

DRAFT FINAL

SITE INSPECTION REPORT

**SITE INSPECTION OF AQUEOUS FILM FORMING FOAM (AFFF) RELEASE AREAS
ENVIRONMENTAL PROGRAMS WORLDWIDE**

**ARNOLD AIR FORCE BASE
MANCHESTER, TENNESSEE**

Project No. RPMO20167118

**Prepared for:
Air Force Civil Engineer Center
Joint Base San Antonio – Lackland, Texas**



Prepared by:



Amec Foster Wheeler Programs, Inc.

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1 **ACRONYMS**

2	AEDC	Arnold Engineering Development Complex
3	AFB	Air Force Base
4	AFCEC	Air Force Civil Engineer Center
5	AFFF	aqueous film forming foam
6	AFTC	Air Force Test Center
7	Amec Foster Wheeler	Amec Foster Wheeler Programs, Inc. and its affiliate Amec Foster 8 Wheeler Environment & Infrastructure Inc. collectively
9		
10	bgs	below ground surface
11	BRAC	Base Realignment and Closure
12		
13	CoC	Chain of Custody
14		
15	DL	detection limit
16	DO	dissolved oxygen
17	DoD	Department of Defense
18		
19	FTA	fire training area
20	FTS	fluorotelomer sulfonate
21		
22	HA	Health Advisory
23	HDPE	high-density polyethylene
24		
25	IDW	investigation-derived waste
26	ISWP	Installation-Specific Work Plan
27		
28	LC-MS/MS	liquid chromatography-tandem mass spectrometry
29		
30	µg/kg	micrograms per kilogram
31	µg/L	micrograms per liter
32		
33	mg/kg	milligrams per kilogram
34		
35	NEtFOSAA	N-Ethyl perfluorooctanesulfonamidoacetic acid
36	NMeFOSAA	N-Methyl perfluorooctanesulfonamidoacetic acid
37		
38	ORP	oxidation-reduction potential
39	OWS	oil/water separator
40		
41	PA	Preliminary Assessment
42	PFAS	per- and polyfluorinated alkyl substances
43	PFBS	perfluorobutanesulfonic acid
44	PFC	perfluorinated compound
45	PFDA	Perfluorodecanoic acid

1	PFDoA	Perfluorododecanoic acid
2	PFHpA	Perfluoroheptanoic acid
3	PFHxA	Perfluorohexanoic acid
4	PFHxS	Perfluorohexane sulfonic acid
5	PFNA	Perfluorononanoic acid
6	PFOA	perfluorooctanoic acid
7	PFOS	perfluorooctane sulfonate
8	PFOSA	Perfluorooctane sulfonamide
9	PFTA or PFTeDA	Perfluorotetradecanoic acid
10	PFTTrDA	Perfluorotridecanoic acid
11	PFUnA	Perfluoroundecanoic acid
12	pH	potential of hydrogen
13	PPE	personal protective equipment
14	PVC	polyvinyl chloride
15		
16	QC	quality control
17	QPP	Quality Program Plan
18		
19	RSL	Regional Screening Level
20		
21	SI	Site Inspection
22	SIR	Site Inspection Report
23	SOP	Standard Operating Procedure
24	S.U.	Standard Unit
25		
26	TDEC	Tennessee Department of Environment & Conservation
27	TOC	total organic carbon
28		
29	U.S.	United States
30	USACE	United States Army Corps of Engineers
31	USAF	United States Air Force
32	USGS	United States Geological Survey
33	USEPA	United States Environmental Protection Agency
34		
35	VOC	volatile organic compound
36		
37	WWII	World War II
38		

EXECUTIVE SUMMARY

1

2 This Site Inspection (SI) Report (SIR) was prepared by Amec Foster Wheeler Programs, Inc., together with
3 our affiliate Amec Foster Wheeler Environment & Infrastructure, Inc., collectively referred to as Amec
4 Foster Wheeler, under Contract No. FA8903-16-D-0027, Task Order 0004, to document the results of SI
5 activities conducted at nine aqueous film forming foam (AFFF) release areas located at Arnold Air Force
6 Base (AFB). The purpose of the SI was to determine, through environmental media sampling, if a release
7 of per- and polyfluorinated alkyl substances (PFAS) has occurred at potential AFFF release areas identified
8 during a Preliminary Assessment (PA) conducted by CH2M HILL (2015), or from the installation scoping
9 visit conducted by Amec Foster Wheeler on 3 and 4 November 2016.

10 The data presented in this SIR were collected and evaluated in accordance with the Final Installation-
11 Specific Work Plan (Amec Foster Wheeler, 2017a) and the General Quality Program Plan (Amec Foster
12 Wheeler, 2017b).

13 PFAS are a class of synthetic organofluorine compounds that possess a chemical structure that gives them
14 unique properties, including thermal stability and the ability to repel both water and oil. These chemical
15 properties make them useful components in a wide variety of consumer and industrial products, including
16 non-stick cookware, food packaging, waterproof clothing, fabric stain protectors, lubricants, paints, and
17 firefighting foams such as AFFF. AFFF concentrate contains fluorocarbon surfactants to meet required
18 performance standards for fire extinguishing agents (Department of Defense Military Specification MIL-F-
19 24385F [SH], Amendment 1, 5 August 1984). The United States Air Force (USAF) began purchasing and
20 using AFFF containing PFAS (perfluorooctanesulfonic acid [PFOS] and/or perfluorooctanoic acid [PFOA])
21 for extinguishing petroleum fires and during firefighting training activities in 1970. AFFF was primarily
22 used on USAF installations at fire training areas (FTAs), but may have also been used, stored or released
23 from hangar fire suppression systems, at firefighting equipment testing and maintenance areas, and
24 during emergency response actions for fuel spills and/or aircraft mishaps.

25 The United States Environmental Protection Agency (USEPA) Office of Water issued lifetime drinking
26 water Health Advisory (HA) values for PFOS and PFOA in May 2016 that replaced the 2009 Provisional HA
27 values. The HA values for PFOS and PFOA are 0.07 micrograms per liter ($\mu\text{g/L}$) for each constituent;
28 however, when these two chemicals co-occur in a drinking water source, a conservative and health-
29 protective approach is recommended that compares the sum of the concentrations (PFOS+PFOA) to the
30 HA value (0.07 $\mu\text{g/L}$). HA values are not to be construed as legally enforceable federal standards and are
31 subject to change as new information becomes available (USEPA, 2016a and 2016b). Although the USEPA
32 has not established HA values for PFAS in soil, the USAF calculated a screening level of 1.26 milligrams per
33 kilogram (mg/kg) for PFOS and PFOA in soil, based on a total hazard quotient (THQ) of 1.0, using the
34 USEPA Regional Screening Level (RSL) calculator ([https://epa-prgs.ornl.gov/cgi-bin/chemicals/
35 csl_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)). This screening value was presented in the Final ISWP (Amec Foster Wheeler, 2017a). In
36 March 2018, the USAF issued revised guidance, *PFAS Site Inspection Objectives and Follow-On Activities*,
37 whereby a new residential screening level for soil and sediment of 0.126 mg/kg was calculated based on
38 a THQ of 0.1 (USAF, 2018).

1 While PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in the
2 SI, USEPA has also derived RSL values for perfluorobutanesulfonic acid (PFBS) for which there is a Tier 2
3 toxicity value (Provisional Peer Review Toxicity Value) (USEPA, 2017a). Based on the Final ISWP (Amec
4 Foster Wheeler, 2017a), concentrations of PFBS detected in groundwater and soil were to be compared
5 to the Tap Water RSL of 400 µg/L and residential RSL of 1,300 mg/kg, respectively. However, as per USAF
6 revised guidance issued subsequent to the ISWP, revised screening levels for PFBS in groundwater of 40
7 µg/L and PFBS in soil of 130 mg/kg were calculated based on a THQ of 0.1 and used for comparison in this
8 SIR (USAF, 2018).

9 Neither the USEPA nor Tennessee Department of Environment and Conservation have issued HA values
10 or promulgated standards for any other PFAS constituents to date.

11 Arnold AFB is located in Coffee and Franklin Counties, Tennessee, between the cities of Manchester,
12 Tullahoma, and Winchester, and encompasses approximately 39,000 acres. The installation consists of
13 three primary areas: 1) Arnold Engineering Development Complex (AEDC) Main Test Area, 2) a Wildlife
14 Management Area operated by the Tennessee Wildlife Resource Agency, and 3) the Tullahoma Training
15 Site that is managed by the Tennessee Army National Guard (United States Army Corps of Engineers
16 [USACE], 2014). The installation also has an airfield that is currently being reactivated and is located west
17 of the AEDC Main Test Area (CH2M HILL, 2015).

18 Arnold AFB originated as Camp Peay in 1926 when the United States (U.S.) Army purchased the land for
19 use as a National Guard summer training camp. Camp Peay originally covered 1,040 acres and was
20 expanded to cover 85,000 acres and was renamed Camp Forrest for the training of U.S. Army infantry,
21 artillery, engineer and signal organizations. After WWII and several periods of inactivity, the land
22 comprising Camp Forrest was transferred to the USAF in 1949 for the construction of the Arnold
23 Engineering Development Center (now AEDC). AEDC is one of three installations which are part of the Air
24 Force Test Center (AFTC), one of six subordinate commands of the Air Force Materiel Command
25 organization and an important national resource. The complex currently operates more than 30
26 aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environmental
27 chambers, arc heaters, ballistic ranges, and other specialized units located in six states (Arnold AFB, 2016).

28 The PA provided findings from research conducted to determine whether and where AFFF, containing
29 PFAS, was stored, handled, used or released at Arnold AFB. Based on the research conducted during the
30 PA, as well as the information collected during an installation scoping visit conducted by Amec Foster
31 Wheeler on 3 and 4 November 2016, the following nine AFFF release areas were recommended for SI:

- 32 • AFFF Release Area 1: FTA No. 1.
- 33 • AFFF Release Area 2: FTA No. 2.
- 34 • AFFF Release Area 3: Fire Station 1 (Building 251).
- 35 • AFFF Release Area 4: Building 892.
- 36 • AFFF Release Area 5: Building 1576 and Tank Dike 21.
- 37 • AFFF Release Area 6: Return Ditch.

- 1 • AFFF Release Area 7: Fire Truck Operational Checks Area.
- 2 • AFFF Release Area 8: Current FTA.
- 3 • AFFF Release Area 9: J-4 Test Cell Groundwater Extraction System.

4 The specific objectives of the SI were as follows:

- 5 • Determine if PFAS are present in soil, groundwater and sediment at AFFF release areas selected
6 for this SI;
- 7 • Determine if PFOS and PFOA concentrations in soil exceed the calculated RSL of 0.126 mg/kg,
8 based on a residential exposure scenario, and if PFBS concentrations in soil exceed the USEPA RSL
9 of 130 mg/kg, based on a residential exposure scenario;
- 10 • Determine if PFOS, PFOA, or sum of PFOS and PFOA concentrations in groundwater exceed the
11 USEPA HA value of 0.07 µg /L, and if PFBS concentrations in groundwater exceed the USEPA Tap
12 Water RSL of 40 µg/L;
- 13 • Determine if concentrations of PFOS or PFOA in sediment exceed the calculated RSL of 0.126
14 mg/kg and if PFBS concentrations exceed the USEPA RSL of 130 mg/kg, based on a residential
15 exposure scenario; and,
- 16 • Identify potential receptor pathways with immediate impacts to human health (i.e., immediate
17 impact to human health is considered consumption of drinking water with PFOS/PFOA above the
18 HA, or PFBS above the RSL).

19 PFAS Analytical Results

20 PFOS and PFOA were detected in surface and subsurface soil at concentrations exceeding the calculated
21 RSL, based on a residential scenario, at AFFF Release Area 4, and were detected below the calculated RSL
22 at AFFF Release Areas 1, 3, 5, 7, and 8. PFBS was detected below the calculated RSL at AFFF Release Area
23 4 and was not detected at AFFF Release Areas 1, 3, 5, 7, and 8. PFOS, PFOA, and/or PFOS+PFOA in the
24 shallow aquifer groundwater exceeded the USEPA HA values at AFFF Release Areas 1 through 5, 7, and 9,
25 while PFOS, PFOA, and PFOS + PFOA in the Manchester aquifer groundwater exceeded the USEPA HA
26 values at AFFF Release Area 8. PFBS was detected below the USEPA Tap Water RSL at AFFF Release Areas
27 1 through 3, 5, and 7 through 9 and was not detected at AFFF Release Area 4. PFOS and/or PFOA were
28 detected in sediment at AFFF Release Areas 5 through 7 at concentrations below the calculated RSL, based
29 on a residential scenario, while PFBS was not detected.

30 Surface and Subsurface Soil Receptors

31 Potential human exposure receptors from PFAS in surface and subsurface soil at AFFF Release Areas 1, 3,
32 4, 5, 7, and 8 include USAF personnel, grounds maintenance workers, utility workers, construction
33 workers, site visitors, and/or trespassers. Based on the SI, potential complete pathways for human
34 exposure to PFAS-impacted surface and subsurface soil through inhalation, ingestion, and/or dermal
35 contact were identified for AFFF Release Areas 4.

1 Groundwater Receptors

2 Potential human exposure receptors from PFAS in groundwater at Arnold AFB include USAF personnel
3 and residents, grounds maintenance workers, utility workers, construction workers that may expose the
4 shallow water table at AFFF Release Areas 1 through 5 and 7 through 9 where PFOS, PFOA, and/or
5 PFOA+PFOA exceeded the USEPA HA value. Human receptors via the ingestion pathway are not present
6 at the installation since PFAS was not detected above the respective screening levels in the AEDC Public
7 Water System or groundwater supply wells located at the golf course and Crockett Cove Recreation Area;
8 however, groundwater receptors (159 water supply wells) were identified within a four-mile distance of
9 Arnold AFB downgradient of AFFF Release Areas 1, 3, 7, and 8.

10 Sediment Receptors

11 Potential exposure receptors include USAF personnel, grounds maintenance workers, utility workers,
12 construction workers, site visitors, and/or trespassers that may come in contact with sediment at or
13 downstream of AFFF Release Areas 5 through 7; however, PFOS and/or PFOA were detected at
14 concentrations below the RSL.

1.0 INTRODUCTION

This Site Inspection (SI) Report (SIR) was prepared by Amec Foster Wheeler Programs, Inc., together with our affiliate Amec Foster Wheeler Environment & Infrastructure, herein collectively referred to as Amec Foster Wheeler, under Contract No. FA8903-16-D-0027, Task Order 0004, to document the results of SI activities conducted at nine aqueous film forming foam (AFFF) release areas located at Arnold Air Force Base (AFB). The purpose of the SI was to determine, through environmental media sampling, if a release of per- and polyfluorinated alkyl substances (PFAS) has occurred at potential AFFF release areas identified during a Preliminary Assessment (PA) conducted by CH2M HILL (2015) or installation scoping visit conducted by Amec Foster Wheeler on 3 and 4 November 2016.

The data presented in this SIR were collected and evaluated in accordance with the Final Installation-Specific Work Plan (ISWP) (Amec Foster Wheeler, 2017a) and the General Quality Program Plan (QPP) (Amec Foster Wheeler, 2017b).

1.1 PER- AND POLY-FLUORINATED ALKYL SUBSTANCES OVERVIEW

PFAS are a class of synthetic organofluorine compounds that possess a chemical structure that gives them unique properties, including thermal stability and the ability to repel both water and oil. These chemical properties make them useful components in a wide variety of consumer and industrial products, including non-stick cookware, food packaging, waterproof clothing, fabric stain protectors, lubricants, paints, and firefighting foams such as AFFF. AFFF concentrate contains fluorocarbon surfactants to meet required performance standards for fire extinguishing agents (Department of Defense [DoD] Military Specification MIL-F-24385F [SH], Amendment 1, 5 August 1984). The United States Air Force (USAF) began purchasing and using AFFF containing PFAS (perfluorooctanesulfonic acid [PFOS] and/or perfluorooctanoic acid [PFOA]) for extinguishing petroleum fires and during firefighting training activities in 1970, as confirmed by the following federal government documents:

- Military Specification for AFFF (MIL-F-24385), formally issued in 1969;
- General Accounting Office determination on sole source award protest to provide AFFF to the Navy in December 1969; and,
- *A History of USAF Fire Protection Training at Chanute Air Force Base, 1964-1976* (Coates, 1977).

AFFF was primarily used on USAF installations at fire training areas (FTAs), but may have also been used, stored or released from hangar fire suppression systems, at firefighting equipment testing and maintenance areas, and during emergency response actions for fuel spills and/or aircraft mishaps.

The United States Environmental Protection Agency (USEPA) Office of Water issued lifetime drinking water Health Advisory (HA) values for PFOS and PFOA in May 2016 that replaced the 2009 Provisional HA values. The HA values for PFOS and PFOA are 0.07 micrograms per liter ($\mu\text{g/L}$) for each constituent; however, when these two chemicals co-occur in a drinking water source, a conservative and health-protective approach is recommended that compares the sum of the concentrations (PFOS + PFOA) to the HA value (0.07 $\mu\text{g/L}$). The HA values are non-regulatory concentrations of drinking water contaminants

1 at or below which adverse health effects are not anticipated to occur over specific exposure durations
2 (e.g., 1 day, 10 days, and a lifetime). They serve as informal technical guidance to assist federal, state,
3 and local officials, and managers of public or community water systems in protecting public health when
4 emergency spills or other contamination situations occur. A HA document provides information on the
5 environmental properties, health effects, analytical methodology, and treatment technologies for
6 removing drinking water contaminants. HA values are not to be construed as legally enforceable federal
7 standards and are subject to change as new information becomes available (USEPA, 2016a and 2016b).

8 The USEPA has not published Regional Screening Levels (RSLs) for PFOS or PFOA for soil or sediment;
9 however; for this project, a residential screening level of 1.26 milligrams per kilogram (mg/kg) for soil and
10 sediment was calculated using the USEPA RSL calculator ([https://epa-prgs.ornl.gov/cgi-
11 bin/chemicals/csl_search](https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)), based on a total hazard quotient (THQ) of 1.0. The toxicity value input for the
12 calculator is the Tier 3 value reference dose of 0.00002 mg/kg per day derived by the USEPA in their
13 Drinking Water HA values for both PFOS and PFOA (USEPA, 2016a and 2016b). In March 2018, the USAF
14 issued revised guidance, *PFAS Site Inspection Objectives and Follow-On Activities*, whereby a new
15 residential screening level for soil and sediment of 0.126 mg/kg was calculated based on a THQ of 0.1
16 (USAF, 2018).

17 While PFOS and PFOA are the focus of the HA and provide specific targets for the USAF to address in the
18 SI, USEPA has also derived RSL values for perfluorobutanesulfonic acid (PFBS) for which there is a Tier 2
19 toxicity value (Provisional Peer Review Toxicity Value) (USEPA, 2017a). Based on the Final ISWP (Amec
20 Foster Wheeler, 2017a), concentrations of PFBS detected in groundwater and soil were to be compared
21 to the USEPA Tap Water RSL of 400 µg/L and residential RSL of 1,300 mg/kg, respectively. However, as
22 per USAF revised guidance issued subsequent to the ISWP, revised screening levels for PFBS in
23 groundwater of 40 µg/L and PFBS in soil of 130 mg/kg were calculated based on a THQ of 0.1, and were
24 used for comparison in this SIR (USAF, 2018).

25 **Table 1.1-1** below presents the screening values for comparing analytical results for PFOS, PFOA, and
26 PFBS. The USEPA and Tennessee Department of Environment and Conservation (TDEC) have not issued
27 HA values or promulgated standards for any other PFAS to date.

1 **Table 1.1-1. Regulatory Screening Values.**

Parameter	Chemical Abstract Number	USEPA Regional Screening Level Table (November 2017) ^a		Calculated RSL for Soils and Sediments ^b (mg/kg)	USEPA Health Advisory for Drinking Water (Surface Water or Groundwater) ^c (µg/L)
		Residential Soil and Sediments (mg/kg)	Tap Water (µg/L)		
PFOS	1763-23-1	NL	NL	0.126	0.07 ^d
PFOA	335-67-1	NL	NL	0.126	
PFBS	375-73-5	130	40	NL	NL

2 **Notes:**

- 3 a USEPA Regional Screening Levels (2017a) [<https://semspub.epa.gov/work/HQ/197027.pdf>].
- 4 b Screening levels, based on residential exposure, calculated using the USEPA Regional Screening Level calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).
- 5 c USEPA, May 2016a. "Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)" and USEPA, May 2016b. "Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)."
- 6 d When both PFOA and PFOS are both present, the combined concentrations of PFOA and PFOS should be compared with the
- 7 0.07 µg/L health advisory level.
- 8 µg/kg - micrograms per kilogram
- 9 µg/L - micrograms per liter
- 10 NL - not listed
- 11 PFBS - perfluorobutanesulfonic acid
- 12 PFOA - perfluorooctanoic acid
- 13 PFOS - perfluorooctanesulfonic acid
- 14 RSL - Regional Screening Level
- 15 USEPA - United States Environmental Protection Agency

14 **1.2 PROJECT OBJECTIVES**

15 In accordance with DoD Instruction 4715.18, "Emerging Contaminants (ECs)" (DoD, 2009), the *Interim AF*

16 *Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base*

17 *Realignment and Closure (BRAC) Installations (USAF, 2012)*, and the *SAF/IE Policy on Perfluorinated*

18 *Compounds of Concern (USAF, 2016)* the USAF will:

- 19 1) Identify locations where there is a reasonable expectation that there may have been a release of
- 20 PFAS (defined below) associated with USAF actions;
- 21 2) Determine if there is unacceptable risk to human health and the environment; and,
- 22 3) Address releases that pose an unacceptable risk, including offsite migration.

23 The primary objectives of this SI were to:

- 24 • Determine if PFAS are present in soil, groundwater and sediment at AFFF release areas selected
- 25 for this SI;
- 26 • Determine if PFOS and PFOA concentrations in soil exceed the calculated RSL of 0.126 mg/kg,
- 27 based on a residential exposure scenario, and if PFBS concentrations in soil exceed the USEPA RSL
- 28 of 130 mg/kg, based on a residential exposure scenario;
- 29 • Determine if PFOS, PFOA, or sum of PFOS and PFOA concentrations in groundwater exceed the
- 30 USEPA HA value of 0.07 µg /L, and if PFBS concentrations in groundwater exceed the USEPA Tap
- 31 Water RSL of 40 µg/L;

- 1 • Determine if concentrations of PFOS or PFOA in sediment exceed the calculated RSL of 0.126
2 mg/kg and if PFBS concentrations exceed the USEPA RSL of 130 mg/kg, based on a residential
3 exposure scenario; and,
- 4 • Identify potential receptor pathways with immediate impacts to human health (i.e., immediate
5 impact to human health is considered consumption of drinking water with PFOS/PFOA above the
6 HA, or PFBS above the RSL).

7 **1.3 PROJECT SCOPE**

8 AFFF release areas were recommended for SI at Arnold AFB based on research conducted during the PA
9 (CH2M HILL, 2015), and from the installation scoping visit conducted by Amec Foster Wheeler on 3 and 4
10 November 2016. The following nine AFFF release areas were included in this SI:

- 11 • AFFF Release Area 1: FTA No. 1.
- 12 • AFFF Release Area 2: FTA No. 2.
- 13 • AFFF Release Area 3: Fire Station 1 (Building 251).
- 14 • AFFF Release Area 4: Building 892.
- 15 • AFFF Release Area 5: Building 1576 and Tank Dike 21.
- 16 • AFFF Release Area 6: Return Ditch.
- 17 • AFFF Release Area 7: Fire Truck Operational Checks Area.
- 18 • AFFF Release Area 8: Current FTA.
- 19 • AFFF Release Area 9: J-4 Test Cell Groundwater Extraction System.

20 Media evaluated included surface and subsurface (vadose zone) soil, groundwater collected from
21 temporary and existing monitoring wells and a groundwater extraction system, and sediment collected
22 from drainage features that receive runoff from select AFFF release areas.

23 This SIR discusses and provides a comparison of the analytical results to screening values for PFOS, PFOA,
24 and PFBS in soil, groundwater, and sediment. The remaining PFAS do not have screening values;
25 therefore, only the results of PFOS, PFOA, and PFBS are discussed in detail and presented in figures.
26 However, all data are presented in the soil, groundwater, and sediment analytical tables.

2.0 AFFF RELEASE AREA BACKGROUND

2.1 SITE LOCATION AND SETTING

Arnold AFB is located in Coffee and Franklin Counties, Tennessee, between the cities of Manchester, Tullahoma, and Winchester, and encompasses approximately 39,000 acres (**Figure 2.1-1**). The installation consists of three primary areas: 1) Arnold Engineering Development Complex (AEDC) Main Test Area, 2) a Wildlife Management Area operated by the Tennessee Wildlife Resource Agency, and 3) the Tullahoma Training Site that is managed by the Tennessee Army National Guard (United States Army Corps of Engineers [USACE], 2014). The installation also has an airfield that is currently being reactivated and is located west of the AEDC Main Test Area (CH2M HILL, 2015).

2.2 SITE HISTORY

Arnold AFB originated as Camp Peay in 1926 when the United States (U.S.) Army purchased the land (1,040 acres) for use as a National Guard summer training camp. As part of the U.S. military buildup to World War II (WWII), the War Department acquired additional lands and began development of a large training center at Camp Peay in October 1940. The expanded training center, covering 85,000 acres, was renamed Camp Forrest in 1941. Camp Forrest ranges and impact areas were used for the training of U.S. Army Ground Forces, including infantry, artillery, and light and heavy armored units, from 1941 to 1944. After WWII and several periods of inactivity, the land comprising Camp Forrest was transferred to the USAF in 1949 for the construction of the Arnold Engineering Development Center (now AEDC). AEDC is one of three installations which are part of the Air Force Test Center (AFTC), one of six subordinate commands of the Air Force Materiel Command organization and an important national resource. Arnold AFB reports through its parent wing to Headquarters Air Force Materiel Command (Bay West, 2011). The installation is the most advanced and largest complex of flight simulation test facilities in the world. The complex currently operates more than 30 aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environmental chambers, arc heaters, ballistic ranges, and other specialized units located in six states (Arnold AFB, 2016).

2.3 PREVIOUS INVESTIGATIONS

CH2M HILL conducted a PA of FTA and non-FTA sites at Arnold AFB to determine locations of potential environmental release of PFAS from AFFF storage or usage areas (CH2M HILL, 2015). Twenty potential AFFF release areas were identified during the PA research. However, the following seven potential AFFF areas were recommended for SI (**Figure 2.3-1**):

- 1) FTA No. 1: This unlined area was used for fire protection training from 1953 to 1983, with fires set in two aboveground steel pans approximately 24 times per year and extinguished with AFFF.
- 2) FTA No. 2: This gravel-covered burn pit was used for fire protection training an average of 21 times per year between 1973 and 1987, where AFFF were used as an extinguishing agent.
- 3) Fire Station 1 (Building 251): Residual AFFF from washing of fire trucks in front of the building may have accumulated in grassy areas on either side of the station driveway.

- 1 4) Building 892: This building houses an AFFF fire suppression system that is tested annually, with
2 small amounts of AFFF discharged outside of the building and four historical AFFF releases
3 documented between 2007 and 2015.
- 4 5) Building 1576: This building houses an AFFF fire suppression system that is tested annually, with
5 small amounts of AFFF discharged outside of the building. A fuel filter fire was extinguished with
6 AFFF at this location in 1995 and the fire suppression system was accidentally activated in 1996.
- 7 6) Return Ditch: This unlined drainage ditch receives stormwater runoff from a large portion of the
8 main industrial area, including potential discharges of AFFF from Buildings 892 and 1576, and Tank
9 Dike 21.
- 10 7) Fire Truck Operational Checks Area: Daily operational checks of AFFF firefighting equipment were
11 conducted on a paved parking area near the airfield that resulted in occasional AFFF discharges.

12 The following three additional areas were also recommended for SI based on information obtained during
13 the installation scoping visit conducted on 3 and 4 November 2016, and subsequent review of historical
14 documents (**Figure 2.3-1**):

- 15 1) Current FTA: A concrete-lined FTA surrounded by grassy fields which replaced FTA No. 2 in the
16 late 1980s and was last used in 1996. AFFF likely was used and may have flowed onto the
17 surrounding gravel and grassy areas.
- 18 2) Tank Dike 21: A concrete-lined dike adjacent to Building 1576 that captures AFFF released during
19 system checks.
- 20 3) J-4 Test Cell Groundwater Extraction System: The J-4 Test Cell is a vertical reinforced concrete
21 shaft that extends approximately 250 feet below ground surface (bgs), penetrating the shallow,
22 Manchester, and Fort Payne aquifers. Periodic dewatering of the J-4 Test Cell induces significant
23 drawdown of the groundwater potentiometric surface beneath the AEDC Main Test Area where
24 PFAS may be present in groundwater.

25 The Building 1576 and Tank Dike 21 areas were combined into a single potential AFFF release area
26 (Building 1576 and Tank Dike 21) since these areas are geographically co-located.

3.0 FIELD ACTIVITIES AND ANALYTICAL PROTOCOL

SI activities were conducted at Arnold AFB from 10 to 21 October 2017 and 14 and 15 November 2017 at the nine AFFF release areas identified by others during the PA (CH2M HILL, 2015) and installation scoping visit conducted by Amec Foster Wheeler (**Figure 2.3-1**). Sample locations were determined following discussions between Amec Foster Wheeler, Arnold AFB, and Air Force Civil Engineer Center (AFCEC) personnel, and were documented in the Final ISWP (Amec Foster Wheeler, 2017a). Media sampled during the SI included surface soil, subsurface soil, groundwater collected from temporary and permanent (existing) monitoring wells and a groundwater extraction system, and sediment collected from drainage features that receive runoff from certain AFFF release areas.

Photographic documentation of the SI activities is provided in **Appendix A** and field documentation is provided in **Appendix B**. Inspection activities were recorded by field personnel on field activity daily logs (**Appendix B-1**), and daily PFAS protocol checklists were completed to ensure PFAS were not introduced by Amec Foster Wheeler employees or subcontractors (**Appendix B-2**). A tailgate safety meeting was conducted each morning prior to beginning work, with the tailgate safety meeting reports provided in **Appendix B-3**.

Soil Boring Advancement and Soil Sample Collection

Seventeen soil borings were advanced by a Tennessee-licensed driller, Saedacco, of Fort Mill, South Carolina for the collection of soil samples and/or temporary monitoring well installation. Soil borings were initially cleared to a depth of five feet (bgs with a hand auger and completed using rotosonic drilling methods. An additional soil boring was advanced with a hand auger for the collection of soil sample. Soil samples were continuously collected from ground surface to below first-encountered groundwater using a hand auger or decontaminated drive casing and core barrel in accordance with Standard Operating Procedure (SOP) AFW-02 (PFAS)–*Soil Sampling*, field-screened with a photoionization detector equipped with a 10.6 electron volt lamp for volatile organic vapors, and logged by a qualified geoscientist in accordance with the Unified Soil Classification System. The resulting soil boring information, photoionization detector readings, lithologic data, soil sample locations, sample ID numbers, date collected, and depths are included on soil boring/monitoring well records provided in **Appendix B-4**. Cross-sections illustrating lithologic data are presented on **Figures 3.0-1 and 3.0-2**.

Samples for laboratory analysis were extracted from the hand auger bucket or core barrel with a decontaminated stainless-steel spoon and transferred directly into laboratory-provided high-density polyethylene (HDPE) containers. Sample containers were sealed, labeled, packed into ice-filled coolers, and delivered under chain-of-custody (CoC) to SGS Accutest in Orlando, Florida for PFAS analysis or CT Laboratories in Baraboo, Wisconsin for physiochemical properties analysis.

Monitoring Well Installation and Development

Sixteen temporary monitoring wells were installed during the SI through a 6-inch outside-diameter sleeve of the drill casing using rotosonic drilling methods. Monitoring well construction was based on observed

1 depth to water at the time of drilling and geologic conditions encountered. All new temporary monitoring
2 wells were constructed in general accordance with the ISWP and SOP AFW-04 (PFAS)-*Monitoring Well*
3 *Installation*, to effectively bracket the water table. The temporary monitoring wells were constructed of
4 two-inch-diameter, Schedule 40 polyvinyl chloride (PVC) casing, a material not known to contain PFAS
5 (USEPA, 2016a and 2016b), and a threaded 10-foot section of 0.010-inch slotted two-inch-diameter
6 Schedule 40 PVC well screen and end cap. The temporary well screens were installed pre-packed with a
7 stainless-steel wire mesh screen containing a 0.25-inch-thick filter pack, or without a pre-pack screen and
8 backfilled with clean 10/25 (#2) silica sand during rod withdrawal to approximately 1 to 2 feet above the
9 well screen. A 2 to 3-foot-thick bentonite transition seal was installed above the sand filter pack and
10 hydrated. Well construction details for the temporary monitoring wells are provided in **Table 3.0-1** and
11 on well construction forms in **Appendix B-5**. Two of the newly installed temporary monitoring wells,
12 MW08001 and MW08003, did not have sufficient groundwater for water level measurements or
13 groundwater sampling after having been installed at approximately 30 feet bgs, and therefore these wells
14 were re-drilled and installed on 19 October 2017 at depths of approximately 50 feet bgs. Monitoring wells
15 MW08001 and MW08003 were then re-assessed on 14 November 2017 and still did not have sufficient
16 groundwater for water level measurements or groundwater sampling.

17 Fourteen new temporary monitoring wells and one existing monitoring well were developed with a
18 peristaltic pump outfitted with disposable HDPE tubing or with a stainless-steel submersible pump
19 outfitted with disposable HDPE tubing, in general accordance with SOP AFW-05, *Monitoring Well*
20 *Development* (Appendix D, General QPP). When sufficient volume was available water quality parameters
21 (pH, specific conductance, temperature, oxidation-reduction potential [ORP], dissolved oxygen [DO], and
22 turbidity) of the development water were measured with water quality meters and recorded on well
23 development logs (**Appendix B-6**). A minimum of three saturated casing volumes of water were purged
24 from each well during development, and continued until the field water quality parameters stabilized.
25 The aforementioned instrumentation was field calibrated and the results included on water quality
26 sampling instrument calibration forms (**Appendix B-7**).

27 **Groundwater Elevations**

28 Depth to water measurements were recorded from 14 temporary and two existing permanent monitoring
29 wells prior to groundwater purging and sampling, and groundwater elevations were calculated relative to
30 top-of-casing elevations surveyed by a professionally licensed Tennessee surveyor, Volunteer Surveying.
31 Depth to groundwater in the October and November 2017 events from monitoring wells installed within
32 the shallow aquifer (exclusive of existing well 232 at AFFF Release Area 8 installed in the Manchester
33 aquifer) ranged from 4.70 to 25.46 feet below top of casing, and the calculated groundwater elevations
34 ranged from 1051.79 to 1077.14 feet above mean sea level (**Table 3.0-2**). The depth to groundwater at
35 well 232 in November 2017 was 64.02 feet below top of casing, and the calculated groundwater elevation
36 was 1027.28 feet above mean sea level. Groundwater flow within the shallow aquifer varies at each AFFF
37 release area based on surface topography and proximity to surface water bodies. Groundwater flow

1 within the underlying Manchester aquifer where one monitoring well sampled is screened (Well 232) is
2 more complex due to the presence of a highly permeable system of chert rubble and solution-enlarged
3 fractures and joints within the upper part of the Fort Payne formation. Additional details on the Site
4 hydrogeologic setting are provided in Section 4.2.1.

5 **Groundwater Sampling**

6 The groundwater sampling program included the collection of groundwater samples for laboratory
7 chemical analysis of PFAS from 14 new temporary monitoring wells and two existing permanent
8 monitoring wells. Monitoring well MW08002 at AFFF Release Area 8 contained only approximately one
9 foot of groundwater that was extremely turbid and, following discussion with AFCEC, it was decided that
10 this sample would not be laboratory analyzed. Samples were collected using low-flow groundwater
11 sampling methods with a peristaltic or stainless-steel submersible pump outfitted with disposable HDPE
12 tubing, or a stainless-steel bailer, in accordance with SOP AFW-03 (PFAS)-*Groundwater Sampling*. The
13 HDPE tubing was connected to a flow-through cell (where used) whereby recovered groundwater was
14 monitored for pH, temperature, specific conductivity, DO, and ORP with a water quality meter, and
15 turbidity with a separate turbidity meter. Groundwater sampling equipment was calibrated prior to use,
16 with the resulting data recorded on water quality sampling instrument calibration forms contained in
17 **Appendix B-7**. Depth to water measurements and field parameters were monitored until groundwater
18 indicator parameters reached stabilization criteria in accordance with SOP AFW-03 (PFAS)-*Groundwater*
19 *Sampling*. The flow-through cell was then removed (when used) and groundwater samples were collected
20 directly into laboratory-provided HDPE containers from the discharge tubing or bailer. The sample
21 containers were sealed, labeled, packed on ice in an insulated cooler, and delivered to SGS Accutest under
22 CoC protocol. Groundwater sampling activities were documented on Groundwater Sampling Records
23 provided in **Appendix B-8**.

24 **Soil Boring Abandonment**

25 The casings and screens from the 16 temporary monitoring wells were removed subsequent to
26 groundwater sampling, steam cleaned, and disposed of in a dumpster at the installation. Thirteen of the
27 16 temporary monitoring well boreholes were abandoned with neat Portland cement via the tremie pipe
28 method on 20 and 21 November 2017, while the remaining three were abandoned on 17 April 2018, as
29 per SOP AFW-06 (PFAS), *Borehole Abandonment*.

30 **Sediment Sampling**

31 Sediment samples were collected to assess the presence or absence of PFAS at drainage canals associated
32 with AFFF Release Area 5 (Building 1576 and Tank Dike 21), AFFF Release Area 6 (Return Ditch), and AFFF
33 Release Area 7 (Fire truck Operational Checks Area). Samples were collected with a decontaminated
34 stainless-steel cup mounted on an extendable pole or manual hand tools and decanted into laboratory-
35 provided containers, in accordance with SOP AFW-07 (PFAS)-*Sediment Sampling*. The sample containers
36 were sealed, labeled, packed on ice in an insulated cooler, and delivered to SGS Accutest under CoC

1 protocol. Sample collection data was documented on sediment/surface water sample collection logs
2 provided in **Appendix B-9**.

3 **Total Sample Counts**

4 The following total sample counts for each media (including field duplicate samples) during SI activities at
5 Arnold AFB are listed below:

- 6 • 26 soil samples (including two duplicate samples) were collected at 12 soil boring locations during
7 the SI;
- 8 • 19 groundwater samples (including three duplicate samples) were collected from 13 temporary
9 monitoring wells, two existing permanent monitoring wells, and from the J-4 Test Cell
10 groundwater influent during the SI; and,
- 11 • Six sediment samples (including one duplicate sample) were collected from drainage canals at
12 three AFFF release areas during the SI.

13 Samples collected during the SI were analyzed for the following 16 PFAS compounds:

- 14 • PFOS;
- 15 • PFOA;
- 16 • PFBS;
- 17 • Perfluoroheptanoic acid (PFHpA);
- 18 • Perfluorohexanesulfonic acid (PFHxS);
- 19 • Perfluorononanoic acid (PFNA);
- 20 • N-Ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA);
- 21 • N-Methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA);
- 22 • Perfluorodecanoic acid (PFDA);
- 23 • Perfluorotetradecanoic acid (PFTA);
- 24 • Perfluorododecanoic acid (PFDoA);
- 25 • Perfluorohexanoic acid (PFHxA);
- 26 • Perfluorotridecanoic acid (PFTrDA);
- 27 • Perfluoroundecanoic acid (PFUnA);
- 28 • 6:2 fluorotelomer sulfonate (FTS); and,
- 29 • 8:2 FTS.

30 Soil, groundwater, and sediment samples were analyzed by SGS Accutest in Orlando, Florida, a DoD
31 Environmental Laboratory Accreditation Program accredited laboratory. Samples were analyzed by
32 Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry (LC-MS/MS).
33 The LC-MS/MS method provides acceptable detection limits to confirm the presence of PFAS listed above.
34 The laboratory analytical reports for the PFAS samples collected during the SI are included in **Appendix C**.

1 Analytical results for PFOS, PFOA, and PFBS are discussed in the following sections, while the analytical
2 results for the remaining PFAS constituents are provided in tables at the conclusion of this SIR.

3 Co-occurrence of PFOS and PFOA (PFOS+PFOA) in aqueous samples was reported using the following
4 guidelines:

- 5 1. If PFOS and PFOA are both detected in concentrations at or above the laboratory detection limit
6 (DL) in groundwater, then the reported concentration for PFOA was added to the reported
7 concentration for PFOS.
- 8 2. If only PFOS or only PFOA is detected at or above the DL in groundwater, then the concentration
9 of the detected analyte only is reported.
- 10 3. If neither PFOA nor PFOS are detected at concentrations at or above the DL, then co-occurrence
11 was reported as *Not Detected*.

12 One composite surface soil sample and one composite subsurface soil sample were also collected at each
13 AFFF release area where soil sampling was conducted and submitted to CT Laboratories in Baraboo,
14 Wisconsin for laboratory analysis of physiochemical properties, including soil pH (USEPA Method 9045B),
15 particle size analysis (ASTM International D422), and total organic carbon (TOC) content (Lloyd Kahn
16 9060A Method). The particle size analysis was subcontracted to Mi-Tech Services, Inc. in Weston,
17 Wisconsin. The laboratory analytical reports for the physiochemical properties samples collected during
18 the SI are included in **Appendix C**.

19 **Data Validation and Usability Assessment**

20 Analytical laboratory data from soil, sediment, and groundwater samples collected and analyzed for PFAS
21 in October and November 2017 were validated by Amec Foster Wheeler in January 2018. During
22 validation Amec Foster Wheeler evaluated a total of 848 data records from field samples and R qualified
23 and rejected 1 result (0.12%) because of low matrix spike (MS) recovery; J or UJ qualified 308 records
24 (36%) as estimated values because of imprecision between laboratory duplicate results, low MS
25 recoveries, low surrogate recoveries, detected analyte concentrations less than the limit of quantification
26 , and/or imprecision between primary and field duplicate results; B qualified 8 results (0.94%) because of
27 detections in the associated equipment blanks; and Q qualified 4 results (0.47%) because of blank
28 detections coupled with additional quality control (QC) exceedances. More than 99% of the data should
29 be considered usable, meeting the QPP-specified 90% completeness goal.

30 During validation Amec Foster Wheeler:

- 31 • R qualified and rejected the non-detected perfluoroundecanoic acid (PFUnA) result from sample
32 ARNLD01-SO-002 because of extremely low matrix spike (MS) recovery. There currently is no
33 applicable screening criteria for PFUnA. Other target analytes were detected in this sample and
34 the rejection is not interpreted to adversely impact overall data usability for this project based on
35 the primary data quality objective of determining the absence or presence of PFAS.

- 1 • J qualified the PFBS and PFOA results from sample ARNLD01-GW-002 and its field duplicate
2 ARNLD-FD-GW-001 as being estimated values because of imprecision between detections in the
3 primary sample and the field duplicate. Both PFBS results were less than half the Regional
4 Screening Level (RSL) of 40 micrograms per liter ($\mu\text{g/L}$) and both PFOA results were orders of
5 magnitude greater than the HA of 0.07 $\mu\text{g/L}$. Imprecision in these analytical results is not
6 interpreted to adversely affect overall data usability.
- 7 • B qualified the detected PFOS results from water samples ARNLD02-GW-003 and
8 ARNLD07-GW-003; and soil samples ARNLD01-SO-001, ARNLD05-SO-001, ARNLD05-SO-002, and
9 ARNLD05-SO-003 because of detections in the associated equipment blanks. Amec Foster
10 Wheeler also Q qualified the detected PFOS results from soil samples ARNLD01-SO-002 and
11 ARNLD01-SO-004 because of detections in the associated equipment blanks coupled with low
12 surrogate and/or MS recoveries. All results qualified because of blank detections were less than
13 the HA of 0.07 $\mu\text{g/L}$ or the screening criteria of 0.126 milligrams per kilogram (mg/kg) and the
14 uncertainty in the analytical results is not interpreted to adversely affect overall data usability.
- 15 • J qualified the detected and UJ qualified the non-detected PFBS results from 12 soil and 2
16 sediment samples, PFOA results from 12 soil and 2 sediment samples, and PFOS results from 11
17 soil and 2 sediment samples as being estimated values because of low matrix spike recoveries,
18 low surrogate recoveries, imprecision between primary and field duplicate results, and/or
19 detected concentrations less than the limit of quantification (LOQ). The PFBS results were multiple
20 orders of magnitude lower than the RSL of 130 mg/kg , the PFOA results were at least an order of
21 magnitude lower than the screening criteria of 0.126 mg/kg , and the PFOA results were less than
22 half the screening criteria of 0.126 mg/kg . The potentially low analytical bias and or analytical
23 uncertainty exhibited by these results is not interpreted to adversely affect overall data usability.
- 24 • J qualified PFBS results from two soil samples, PFOA results from three water and eight soil
25 samples, and PFOS results from two water samples as being estimated values because the
26 detected concentrations were less than the LOQ, which is considered the lowest concentration
27 with known accuracy and precision. These PFBS, PFOA, and PFOS results were less than applicable
28 screening criteria and the uncertainty in analytical results is not interpreted to adversely affect
29 overall data usability.

30 A description of the data validation scope, procedures, observations and actions is presented in the Data
31 Validation Reports provided in **Appendix D**.

32 **Surveying**

33 Soil borings and newly installed temporary monitoring wells sampled as part of the SI were surveyed by a
34 Tennessee Licensed Professional Surveyor (Volunteer Surveying) for horizontal coordinates and
35 groundwater surface and/or top-of-casing elevations (**Table 3.0-1**). Horizontal coordinates were surveyed
36 based on Tennessee State Plane Coordinate System, East Zone, United States Survey Feet, North American

1 Datum of 1983. Groundwater surface and top-of-casing elevations were collected based on North
2 American Vertical Datum of 1988.

3 **Investigation-Derived Waste**

4 Investigation-Derived Waste (IDW) consisted of soil cuttings from soil boring advancement, well
5 development water, groundwater sampling purge water, equipment decontamination water, disposable
6 personal protective equipment (PPE), and other miscellaneous refuse. Used PPE and other miscellaneous
7 refuse was placed in plastic bags and discarded into an on-site sanitary trash container for disposal at a
8 sanitary landfill. Soil and liquid IDW was containerized in Department of Transportation-approved
9 55-gallon steel drums. Composite groundwater grab samples were collected on 15 November 2017 from
10 the 34 drums of liquid IDW generated during the initial SI and on 20 April 2018 from four drums of liquid
11 IDW generated during SI follow-on activities. Composite soil samples were collected on 17 April 2018
12 from the eight drums of soil IDW generated during the SI. The samples were laboratory analyzed by SGS
13 Accutest in Orlando, Florida for laboratory analysis of PFAS and by CT Laboratories in Baraboo, Wisconsin
14 for volatile organic compounds, semi-volatile organic compounds, pesticides, herbicides, and metals,
15 polychlorinated biphenyls, total petroleum hydrocarbons (gasoline range organics and diesel range
16 organics), flashpoint, pH, sulfide, and cyanide, to determine the applicable disposal options (**Appendix C**).
17 IDW transportation/disposal documentation will be provided under separate cover upon determination
18 of the disposal or treatment methodology.

19 A detailed description of sampling locations and results at each AFFF release area is provided in the
20 following sections.

21 **3.1 AFFF RELEASE AREA 1: FTA NO. 1**

22 FTA No. 1 was used for fire protection training of waste oil, propellant, and magnesium chip-fueled fires
23 from 1953 to 1983. The FTA was unlined and consisted of two aboveground steel pans where fires were
24 set. Approximately 24 fire training exercises were conducted each year and typically extinguished with
25 either halon, dry chemicals, and/or AFFF (CH2M HILL, 2015).

26 **3.1.1 Sample Location and Methodologies**

27 **3.1.1.1 Soil Samples**

28 Soil borings MW01001 and SB01003 were advanced on 13 October 2017 at FTA No. 1 within the former
29 FTA where AFFF may have been released (**Figure 3.1-1**). Surface soil samples were collected from soil
30 borings MW01001 and SB01003 at 0.5 to 1 foot bgs, and subsurface soil samples were collected at 17 to
31 19 feet bgs, for PFAS analysis. Composite soil samples were collected from both soil borings at 0 to 1 foot
32 bgs and 17 to 19 feet bgs for TOC, pH, and particle size analysis. Groundwater was encountered at
33 approximately 22 feet bgs during boring advancement.

1 **3.1.1.2 Groundwater Samples**

2 Temporary monitoring wells were installed in soil boring MW01001 and at groundwater sample location
3 MW01002 north of the former FTA on 13 October 2017 to assess PFAS concentrations at and near FTA
4 No. 2 (**Figure 3.1-1**). The temporary monitoring wells were developed on 14 and 15 October 2017,
5 respectively, and sampled on 17 October 2017.

6 **3.1.2 Analytical Results**

7 **3.1.2.1 Soil Results**

8 Two surface soil samples and two subsurface soil samples were collected from borings MW01001 and
9 SB01003 on 13 October 2017. PFAS results are provided in **Table 3.1-1**, illustrated on **Figure 3.1-2**, and
10 summarized below.

11 **MW01001:**

- 12 • PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of
13 0.011 mg/kg (0.5 to 1 foot bgs); however, the analyte was found in an associated blank as well as
14 in the sample.
- 15 • PFOA was detected below the RSL at the two sampling intervals at a maximum concentration of
16 0.01 mg/kg (0 to 0.5 foot bgs).
- 17 • PFBS was not detected at either interval.

18 **SB01003:**

- 19 • PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of
20 0.118 mg/kg (0.5 to 1 foot bgs).
- 21 • PFOA was detected below the RSL at the surface (0.5 to 1 foot) interval at an approximate
22 concentration of 0.00145 mg/kg and was not detected at the subsurface (17 to 19 feet bgs)
23 interval.
- 24 • PFBS was not detected at either interval.

25 The composite TOC concentrations ranged from 287 mg/kg (17 to 19 feet bgs) to 1120 mg/kg (0 to 1 foot
26 bgs), while the composite pH concentrations ranged from 5.39 Standard Units (S.U.) (17 to 19 feet bgs) to
27 6.24 S.U. (0 to 1 foot bgs) (**Table 3.1-2**). The particle size analytical results for the 0 to 1 foot bgs sample
28 was 80.9% fines (silt and clay), 16.0% sand (fine to coarse), and 3.1% gravel (fine), while the 17 to 19 feet
29 bgs sample was 60.0% fines (silt and clay), 20.5% sand (fine to coarse), and 19.5% gravel (fine). The
30 material description during drilling for the 0 to 1 foot bgs sample was a brownish yellow silty sand, while
31 the 17 to 19 feet bgs sample was described as a red sandy fat clay with gravel.

32 **3.1.2.2 Groundwater Results**

33 Three groundwater samples (two normal and one field duplicate) were analyzed for PFAS, with the results
34 provided in **Table 3.1-3**, illustrated in **Figure 3.1-3**, and summarized below.

1 **MW01001:**

- 2 • PFOS was detected above the USEPA HA value at a concentration of 0.647 µg/L.
- 3 • PFOA was detected above the USEPA HA value at a concentration of 0.692 µg/L.
- 4 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 1.339 µg/L.
- 5 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.13 µg/L.

6 **MW01002:**

- 7 • PFOS was detected above the USEPA HA value at a concentration of 159 µg/L in the field duplicate.
- 8 • PFOA was detected above the USEPA HA value at an approximate concentration of 16 µg/L in the
9 field duplicate.
- 10 • PFOS+PFOA was detected above the USEPA HA value at an approximate concentration of 175 µg/L
11 in the field duplicate.
- 12 • PFBS was detected below the USEPA Tap Water RSL at an approximate concentration of 17.6 µg/L.

13 **3.1.3 Conclusions**

14 PFOS and PFOA were detected in soil at AFFF Release Area 1 at concentrations below the USEPA RSLs,
15 while PFBS was not detected. The highest concentrations of PFAS constituents were identified in surface
16 soils at SB01003, located within the former FTA where AFFF may have been released. PFOS, PFOA, and
17 PFOS+PFOA concentrations exceeded the USEPA HA values in both temporary monitoring wells, while
18 PFBS was detected at concentrations below the USEPA Tap Water RSL in both temporary monitoring wells.

19 **3.2 AFFF RELEASE AREA 2: FTA NO. 2**

20 FTA No. 2 was active from 1973 to 1987 and consisted of a gravel-covered burn pit with drains that
21 connected to a small adjacent retention pond. Water, halon, dry chemicals, and AFFF were used to
22 extinguish the fires. Contaminated soils were consolidated and the area was capped and revegetated as
23 part of a land use control in 1993 (CH2M HILL, 2015). Historical documents reviewed indicate that a land
24 use control prohibits disturbance of the soil cap at FTA No. 2, and therefore SI sample locations were
25 placed outside of the capped area. Groundwater was the only media sampled since the sample locations
26 were outside the footprint of the AFFF Release Area.

27 **3.2.1 Sample Location and Methodologies**

28 **3.2.1.1 Groundwater Samples**

29 Three temporary monitoring wells were installed in MW02001 and MW02002 beyond the southern edge
30 of the capped former FTA No. 2 and overflow pond locations, and in MW02003 located west of FTA No. 2
31 beyond Landfill No. 1 (**Figure 3.2-1**). MW02001 was installed on 14 October 2017, while MW02002 and
32 MW02003 were installed on 16 October 2017. The temporary monitoring wells were developed on 15
33 and 17 October 2017, and sampled on 17 and 18 October 2017.

1 **3.2.2 Analytical Results**

2 **3.2.2.1 Groundwater Results**

3 Three groundwater samples were analyzed for PFAS, with the results provided in **Table 3.1-3**, illustrated
4 in **Figure 3.2-2**, and summarized below.

5 **MW02001:**

- 6 • PFOS was detected above the USEPA HA value at a concentration of 2.97 µg/L.
- 7 • PFOA was detected above the USEPA HA value at an approximate concentration of 4.49 µg/L.
- 8 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 7.46 µg/L.
- 9 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.453 µg/L.

10 **MW02002:**

- 11 • PFOS was detected above the USEPA HA value at a concentration of 3.08 µg/L.
- 12 • PFOA was detected above the USEPA HA value at a concentration of 2.61 µg/L.
- 13 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 5.69 µg/L.
- 14 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.605 µg/L.

15 **MW02003:**

- 16 • PFOS was detected below the USEPA HA value at an approximate concentration of 0.0116 µg/L.
- 17 • PFOA was detected below the USEPA HA value at an approximate concentration of 0.00448 µg/L.
- 18 • PFOS+PFOA was below above the USEPA HA value at an approximate concentration of
19 0.01608 µg/L.
- 20 • PFBS was not detected.

21 **3.2.3 Conclusions**

22 PFOS, PFOA, and PFOS+PFOA concentrations exceeded the USEPA HA values in MW02001 and MW02002,
23 and were below the USEPA HA values in MW02003. PFBS was detected at concentrations below the
24 USEPA Tap Water RSL in MW02001 and MW02002, and was not detected in MW02003.

25 **3.3 AFFF RELEASE AREA 3: FIRE STATION 1 (BUILDING 251)**

26 Fire Station 1 houses three fire trucks that carry 35 to 55 gallons of AFFF, and a foam trailer that holds 500
27 gallons of AFFF. AFFF tank resupplying occurs at Fire Station 1. Cleaning of the fire trucks is performed
28 on the concrete driveway in front of the station, and any residual AFFF on the trucks or from potential
29 spills may have migrated to the adjacent grassy areas on either side of the station driveway (CH2M HILL,
30 2015).

1 **3.3.1 Sample Location and Methodologies**

2 **3.3.1.1 Soil Samples**

3 Two soil borings (MW03001 and MW03002) were advanced in the grassy areas east and west of the
4 driveway on 12 October 2017 (**Figure 3.3-1**). Surface soil samples were collected from 0 to 0.5 foot bgs,
5 and subsurface soil samples were collected from 17 to 19 feet bgs, for PFAS analysis. Composite soil
6 samples were also collected from each soil boring from 0 to 1 foot bgs and 17 to 19 feet bgs for TOC, pH,
7 and particle size analysis. Groundwater was encountered at approximately 22 feet bgs during boring
8 advancement.

9 **3.3.1.2 Groundwater Samples**

10 Two temporary monitoring wells were installed in soil borings MW03001 and MW03002 on 12 October
11 2017 to assess PFAS concentrations at Fire Station 1 (Building 251) (**Figure 3.3-1**). The temporary
12 monitoring wells were developed on 13 and 17 October 2017 and sampled on 15 and 18 October 2017.

13 **3.3.2 Analytical Results**

14 **3.3.2.1 Soil Results**

15 Two surface and two subsurface soil samples were collected for PFAS analysis, with the results provided
16 in **Table 3.1-1**, illustrated in **Figure 3.3-2**, and summarized below.

17 **MW03001:**

- 18 • PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of
19 0.0709 mg/kg (0 to 0.5 foot bgs).
- 20 • PFOA was detected below the RSL at the two sampling intervals at a maximum approximate
21 concentration of 0.00392 mg/kg (17 to 19 feet bgs).
- 22 • PFBS was not detected at either interval.

23 **MW03002:**

- 24 • PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of
25 0.0519 mg/kg (0 to 0.5 foot bgs).
- 26 • PFOA was detected below the RSL at the surface interval (0 to 0.5 foot bgs) at an approximate
27 maximum concentration of 0.00204 mg/kg, and was not detected in the subsurface (17 to 19 feet
28 bgs) interval.
- 29 • PFBS was not detected at either interval.

30 The composite TOC concentrations ranged from 868 mg/kg (17 to 19 feet bgs) to 38100 mg/kg (0 to 1 foot
31 bgs), while the composite pH concentrations ranged from 5.53 S.U. (17 to 19 feet bgs) to 6.90 S.U. (0 to
32 1 foot bgs) (**Table 3.1-2**). The particle size analytical results for the 0 to 1 foot bgs sample was 68.7% fines
33 (silt and clay), 30.6% sand (fine to coarse), and 0.7% gravel (fine), while the 17 to 19 feet bgs sample was
34 65.0% fines (silt and clay), 34.5% sand (fine to coarse), and 0.5% gravel (fine). The material description

1 for the 0 to 1 foot bgs sample was a brown silty fine sand with gravel and fines, while the 17 to 19 feet
2 bgs sample was described as a reddish brown sandy clay with silty sand and fines.

3 **3.3.2.2 Groundwater Results**

4 Two groundwater samples were collected for PFAS analysis, with the results provided in **Table 3.1-3**,
5 illustrated in **Figure 3.3-3**, and summarized below.

6 **MW03001:**

- 7 • PFOS was detected above the USEPA HA value at a concentration of 10.5 µg/L.
- 8 • PFOA was detected above the USEPA HA value at a concentration of 2.91 µg/L.
- 9 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 13.41 µg/L.
- 10 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 1.4 µg/L.

11 **MW03002:**

- 12 • PFOS was detected above the USEPA HA value at a concentration of 19.5 µg/L.
- 13 • PFOA was detected above the USEPA HA value at a concentration of 4.03 µg/L.
- 14 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 23.53 µg/L.
- 15 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 2.59.

16 **3.3.3 Conclusions**

17 PFOS and PFOA in soil were detected at concentrations below the USEPA RSLs, while PFBS was not
18 detected. The highest PFOS concentration was in surface soil at MW03001, while the highest PFOA
19 concentration was in subsurface soil at MW03001. PFOS, PFOA, and PFOS+PFOA in groundwater
20 exceeded the USEPA HA values in both monitoring wells, while PFBS was detected at concentrations
21 below the USEPA Tap Water RSL in both wells.

22 **3.4 AFFF RELEASE AREA 4: BUILDING 892**

23 Building 892 (Engine Test Facility valve house) contains a 3% AFFF system with a 500-gallon bladder tank.
24 Four historical AFFF releases were identified, potentially impacting the gravel areas surrounding the
25 building (CH2M HILL, 2015). The proposed soil boring/temporary monitoring well southwest of the
26 building could not be installed due to extensive underground utilities identified in the area.

27 **3.4.1 Sample Location and Methodologies**

28 **3.4.1.1 Soil Samples**

29 One soil boring (SB04001) was advanced along the north side of the building where AFFF was released on
30 19 October 2017 with a hand auger due to extensive overhead and underground piping nearby that
31 inhibited use of a drill rig (**Figure 3.4-1**). A surface soil sample was collected from 0.5 to 1 foot bgs, and a
32 subsurface soil sample was collected from 5 to 6 feet bgs, for PFAS analysis. Groundwater was not
33 encountered during soil boring advancement.

1 **3.4.1.2 Groundwater Samples**

2 One permanent existing monitoring well (834) located approximately 160 feet downgradient (west) of
3 Building 892 was sampled on 19 October 2017 to assess PFAS concentrations downgradient of Building
4 892 (**Figure 3.4-1**).

5 **3.4.2 Analytical Results**

6 **3.4.2.1 Soil Results**

7 One surface and one subsurface soil sample were collected for PFAS analysis, with the results provided in
8 **Table 3.1-1**, illustrated in **Figure 3.4-2**, and summarized below.

9 **SB04002:**

- 10 • PFOS was detected above the RSL at the two sampling intervals at a maximum concentration of
11 1.32 mg/kg (5 to 6 feet bgs).
- 12 • PFOA was detected below the RSL at the two sampling intervals at an approximate maximum
13 concentration of 0.0105 mg/kg (5 to 6 feet bgs).
- 14 • PFBS was detected below the RSL at the two sampling intervals at an approximate maximum
15 concentration of 0.00425 mg/kg (5 to 6 feet bgs).

16 **3.4.2.2 Groundwater Results**

17 One groundwater sample was collected for PFAS analysis, with the results provided in **Table 3.1-3**,
18 illustrated in **Figure 3.4-3**, and summarized below.

19 **Well 834:**

- 20 • PFOS was detected below the USEPA HA value at a concentration of 0.0605 µg/L; however, the
21 analyte was found in an associated blank as well as in the sample.
- 22 • PFOA was detected below the USEPA HA value at a concentration of 0.0601 µg/L.
- 23 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 0.1206 µg/L; however,
24 the analyte was found in an associated blank as well as in the sample.
- 25 • PFBS was not detected.

26 **3.4.3 Conclusions**

27 PFOS in soil was detected at concentrations above the USEPA RSLs in surface and subsurface soil in
28 SB04002, while PFOA and PFBS in soil were detected at concentrations below the USEPA RSLs. PFOS and
29 PFOA in groundwater were detected below the USEPA HA value in monitoring well 834, while PFOS+PFOA
30 in groundwater exceeded the USEPA HA value. PFBS was not detected in groundwater in well 834.

31 **3.5 AFFF RELEASE AREA 5: BUILDING 1576 AND TANK DIKE 21**

32 Building 1576 (Bulk Fuel Farm Foam House) contains an AFFF fire suppression system with a 500-gallon
33 AST. AFFF was discharged to the ground just outside of the building during annual system testing. The

1 building has floor drains that discharge to an oil/water separator (OWS), with flow to a ditch that leads to
2 a nearby retention reservoir to the west.

3 Tank Dike 21 is a concrete lined dike that captures AFFF during system checks and contains a drain that
4 leads to the stormwater drainage system that ultimately discharges to a ditch leading to the nearby
5 retention reservoir to the west (CH2M HILL, 2015).

6 **3.5.1 Sample Location and Methodologies**

7 **3.5.1.1 Soil Samples**

8 One soil boring (MW05001) was advanced within the discharge location west of Building 1576, and one
9 soil boring (MW05002) was advanced near the swale leading from Building 1576 and Tank Dike 21.
10 Surface soil samples were collected from 0 to 1.5 feet bgs, and subsurface soil samples were collected
11 from 12 to 14 feet bgs, for PFAS analysis. Composite soil samples were also collected from each soil boring
12 from 0 to 1.5 feet bgs and 12 to 15 feet bgs for TOC, pH, and particle size analysis. Groundwater was
13 encountered at approximately 14.5 to 16 feet bgs during boring advancement.

14 **3.5.1.2 Groundwater Samples**

15 Three temporary monitoring wells were installed within the discharge location west of Building 1576
16 (MW05001), and downgradient (east) of the tank farm near the swale leading from Building 1576 and
17 Tank Dike 21 (MW05002) on 19 October 2017, to assess PFAS concentrations (**Figure 3.5-1**). The
18 temporary monitoring wells were developed on 19 October 2017 and sampled on 20 October 2017.

19 **3.5.1.3 Sediment Sample**

20 One sediment sample (SD05001) was collected on 11 October 2017 at the drainage ditch outfall from the
21 Tank Dike 21 storm drain system where AFFF may have been discharged during system checks (**Figure 3.5-**
22 **1**).

23 **3.5.2 Analytical Results**

24 **3.5.2.1 Soil Results**

25 Two surface and two subsurface soil samples were collected for PFAS analysis, with the results provided
26 in **Table 3.1-1**, illustrated in **Figure 3.5-2**, and summarized below.

27 **MW05001:**

- 28 • PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of
29 0.00501 mg/kg (1 to 1.5 feet bgs; however, the analyte was found in an associated blank as well
30 as in the sample).
- 31 • PFOA was not detected at either interval.
- 32 • PFBS was not detected at either interval.

1 **MW05002:**

- 2 • PFOS was detected below the RSL in surface soil (0 to 0.5 foot) at a concentration of 0.00174
- 3 mg/kg; however, the analyte was found in an associated blank as well as in the sample, and was
- 4 not detected in subsurface soil (12 to 14 feet bgs).
- 5 • PFOA was not detected at either interval.
- 6 • PFBS was not detected at either interval.

7 The composite TOC concentrations ranged from approximately 120 mg/kg (12 to 15 feet bgs) to 2340
8 mg/kg (0 to 1.5 feet bgs), while the composite pH concentrations ranged from 5.06 S.U. (12 to 15 feet bgs)
9 to 8.09 S.U. (0 to 1.5 feet bgs) (**Table 3.1-2**). The particle size analytical results for the 0 to 1.5 feet bgs
10 sample was 33.6% fines (silt and clay), 41.7% sand (fine to coarse), and 24.7% gravel (fine), while the 12
11 to 15 feet bgs sample was 41.4% fines (silt and clay) and 58.6% sand (fine to coarse). The material
12 description for the 0 to 1.5 feet bgs sample was a brown, silty fine sand with clay, while the 12 to 15 feet
13 bgs sample was described as a brown, silty-clayey sand with fines and gravel.

14 **3.5.2.2 Groundwater Results**

15 Four groundwater samples (three normal and one field duplicate) were collected for PFAS analysis, with
16 the results provided in **Table 3.1-3**, illustrated in **Figure 3.5-3**, and summarized below.

17 **MW05001:**

- 18 • PFOS was detected above the USEPA HA value at a concentration of 2.5 µg/L.
- 19 • PFOA was detected above the USEPA HA value at a concentration of 0.281 µg/L.
- 20 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 2.781 µg/L.
- 21 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.0556 µg/L.

22 **MW05002:**

- 23 • PFOS was detected above the USEPA HA value at a concentration of 5.89 µg/L.
- 24 • PFOA was detected above the USEPA HA value at a concentration of 0.376 µg/L.
- 25 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 6.266 µg/L.
- 26 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.364 µg/L.

27 **MW05003:**

- 28 • PFOS was detected below the USEPA HA value at an approximate concentration of 0.0116 µg/L.
- 29 • PFOA was detected below the USEPA HA value at an approximate concentration of 0.00482 µg/L.
- 30 • PFOS+PFOA was detected below the USEPA HA value at an approximate concentration of 0.02142
- 31 µg/L.
- 32 • PFBS was not detected.

1 **3.5.2.3 Sediment Results**

2 One sediment sample was collected for PFAS analysis, with the results provided in **Table 3.1-4**, illustrated
3 in **Figure 3.5-4**, and summarized below.

4 **SD05001:**

- 5 • PFOS was detected below the USEPA RSL at a concentration of 0.0189 mg/kg.
- 6 • PFOA was not detected.
- 7 • PFBS was not detected.

8 **3.5.3 Conclusions**

9 PFOS in soil was detected at concentrations below the USEPA RSL, while PFOA and PFBS were not
10 detected. The highest concentrations of PFOS was in surface soil at MW05001. PFOS, PFOA, and
11 PFOS+PFOA in groundwater exceeded the USEPA HA values in MW05001 and MW05002, and were
12 detected below the USEPA HA values in MW05003. PFBS was detected at concentrations below the
13 USEPA Tap Water RSL in MW05001 and MW05002, and was not detected in MW05003. PFOS in sediment
14 was detected below the USEPA RSL, while PFOA and PFBS were not detected.

15 **3.6 AFFF RELEASE AREA 6: RETURN DITCH**

16 The Return Ditch receives process water and stormwater from a large portion of the main industrial area,
17 and treated water from the wastewater treatment plant. The ditch is unlined except for a concrete liner
18 at the southwestern end prior to entering the AEDC Retention Reservoir. Multiple outfalls are present
19 along the return ditch; however, the majority of the flow enters the ditch at the northeastern end (CH2M
20 HILL, 2015).

21 **3.6.1 Sample Location and Methodologies**

22 **3.6.1.1 Sediment Samples**

23 Three sediment samples were collected on 11 October 2017 along the Return Ditch: 1) near the
24 northeastern end of the ditch at the main outfall (SD06001); 2) at the midpoint of the ditch where an
25 intermittent outfall enters (SD06002); and 3) near the southwestern end of the ditch (SD06003) (**Figure**
26 **3.6-1**).

27 **3.6.2 Analytical Results**

28 **3.6.2.1 Sediment Results**

29 Three sediment samples (SD06001, SD06002, and SD06003) were collected for PFAS analysis, with the
30 results provided in **Table 3.1-1**, illustrated in **Figure 3.6-2**, and summarized below.

31 **SD06001:**

- 32 • PFOS was detected below the RSL at an approximate concentration of 0.00163 mg/kg.
- 33 • PFOA was not detected.

- 1 • PFBS was not detected.

2 **SD06002:**

- 3 • PFOS was detected below the RSL at an approximate concentration of 0.0012 mg/kg.
- 4 • PFOA was not detected.
- 5 • PFBS was not detected.

6 **SD06003:**

- 7 • PFOS was not detected.
- 8 • PFOA was not detected.
- 9 • PFBS was not detected.

10 **3.6.3 Conclusions**

11 PFOS was detected in sediment at concentrations below the USEPA RSL at SD06001 and SD06002, and
12 was not detected at SD06003. PFOA and PFBS were not detected at any of the sediment sample locations.

13 **3.7 AFFF RELEASE AREA 7: FIRE TRUCK OPERATIONAL CHECKS AREA**

14 Daily AFFF firefighting equipment operational checks were conducted on the parking lot between
15 Buildings 2303 and 2315 when the airfield was operational. Surface water runoff from the parking lot
16 flowed northeast into a grassy area and drainage ditch (CH2M HILL, 2015).

17 **3.7.1 Sample Location and Methodologies**

18 **3.7.1.1 Soil Samples**

19 Three soil borings (MW07001, MW07002, and MW07003) were advanced near the northwest and
20 southeast ends of the ditch and in front of Building 2303 on 18 October 2017 (**Figure 3.7-1**). Surface soil
21 samples were collected from 0 to 1 foot bgs, and subsurface soil samples were collected from 15 to 19
22 feet bgs, for PFAS analysis. Composite soil samples were also collected from each soil boring from 0 to 1
23 foot bgs and 15 to 19 feet bgs for TOC, pH, and particle size analysis. Groundwater was encountered at
24 approximately 21 feet bgs during boring advancement.

25 **3.7.1.2 Groundwater Samples**

26 Three temporary monitoring wells were installed in soil borings MW07001, MW07002, and MW07003 on
27 18 October 2017 to assess PFAS concentrations adjacent to the parking lot where daily AFFF firefighting
28 equipment operational checks were conducted (**Figure 3.7-1**). The temporary monitoring wells were
29 developed on 18 and 19 October 2017, and sampled on 19 and 20 October 2017.

30 **3.7.1.3 Sediment Samples**

31 One sediment (SD07001) sample (SD07001) was collected on 11 October 2017 near the middle of the
32 drainage ditch northeast of the parking lot (**Figure 3.7-1**).

1 **3.7.2 Analytical Results**

2 **3.7.2.1 Soil Results**

3 Three surface and four subsurface (three normal and one field duplicate) soil samples were collected for
4 PFAS analysis, with the results provided in **Table 3.1-1**, illustrated in **Figure 3.7-2**, and summarized below.

5 **MW07001:**

- 6 • PFOS was detected below the RSL at the surface sampling interval (0 to 1 foot bgs) at a
7 concentration of 0.0251 mg/kg, and was not detected at the subsurface sampling interval (15 to
8 17 feet bgs).
- 9 • PFOA was detected below the RSL at the surface sampling interval (0 to 1 foot bgs) at an
10 approximate concentration of 0.0014 mg/kg, and was not detected at the subsurface sampling
11 interval (15 to 17 feet bgs).
- 12 • PFBS was not detected at either interval.

13 **MW07002:**

- 14 • PFOS was detected below the RSL at the surface sampling interval (0 to 1 foot bgs) at an
15 approximate concentration of 0.0137 mg/kg, and was not detected at the subsurface sampling
16 interval (17 to 19 feet bgs).
- 17 • PFOA was not detected at either interval.
- 18 • PFBS was not detected at either interval.

19 **MW07003:**

- 20 • PFOS was detected below the RSL at the surface sampling interval (0 to 1 foot bgs) at a
21 concentration of 0.0106 mg/kg, and was not detected at the subsurface sampling interval (17 to
22 19 feet bgs).
- 23 • PFOA was detected below the RSL at the surface sampling interval (0 to 1 foot bgs) at an
24 approximate concentration of 0.00164 mg/kg, and was not detected at the subsurface sampling
25 interval (17 to 19 feet bgs).
- 26 • PFBS was not detected at either interval.

27 The composite TOC concentrations ranged from 494 mg/kg (15 to 19 feet bgs) to 28400 mg/kg (0 to 1 foot
28 bgs), while the composite pH concentrations ranged from 5.76 S.U. (15 to 19 feet bgs) to 7.58 S.U. (0 to
29 1 foot bgs) (**Table 3.1-2**). The particle size analytical results for the 0 to 1 foot bgs sample was 47.9% fines
30 (silt and clay), 32.3% sand (fine to coarse), and 19.8% gravel (fine), while the 15 to 19 feet bgs sample was
31 60% fines (silt and clay), 22.8% sand (fine to coarse), and 17.2% gravel (fine). The material description for
32 the 0 to 1 foot bgs sample was a reddish brown to yellowish red silty sand with fines, clay, and gravel,
33 while the 15 to 19 feet bgs sample was described as a brownish yellow to red sandy clay with gravel.

1 **3.7.2.2 Groundwater Results**

2 Three groundwater samples were collected for PFAS analysis, with the results provided in **Table 3.1-3**,
3 illustrated in **Figure 3.7-3**, and summarized below.

4 **MW07001:**

- 5 • PFOS was detected above the USEPA HA value at a concentration of 1.02 µg/L.
- 6 • PFOA was detected above the USEPA HA value at a concentration of 0.132 µg/L.
- 7 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 1.152 µg/L.
- 8 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.0468 µg/L.

9 **MW07002:**

- 10 • PFOS was detected above the USEPA HA value at a concentration of 5.36 µg/L.
- 11 • PFOA was detected above the USEPA HA value at a concentration of 0.365 µg/L.
- 12 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 5.725 µg/L.
- 13 • PFBS was detected below the USEPA tap water RSL at a concentration of 0.193 µg/L.

14 **MW07003:**

- 15 • PFOS was detected below the USEPA HA value at a concentration of 0.0439 µg/L; however, the
16 analyte was found in an associated blank as well as in the sample.
- 17 • PFOA was detected below the USEPA HA value at an approximate concentration of 0.0155 µg/L.
- 18 • PFOS+PFOA was detected below the USEPA HA value at an approximate concentration of 0.0594
19 µg/L.
- 20 • PFBS was not detected.

21 **3.7.2.3 Sediment Results**

22 One sediment sample (SD07001) was collected for PFAS analysis, with the results provided in **Table 3.1-1**,
23 illustrated in **Figure 3.7-4**, and summarized below.

24 **SD07001:**

- 25 • PFOS was detected below the RSL at a concentration of 0.0483 mg/kg.
- 26 • PFOA was detected below the RSL at an approximate concentration of 0.000848 mg/kg.
- 27 • PFBS was not detected.

28 **3.7.3 Conclusions**

29 PFOS in soil was detected at concentrations below the USEPA RSLs in all three borings, while PFOA was
30 detected at concentrations below the USEPA RSLs in MW07001 and MW07003, and was not detected in
31 MW07002. PFBS was not detected in any of the borings. The highest PFOS concentration was in surface
32 soil at MW07001, while the highest PFOA concentration was in surface soil at MW07003. PFOS, PFOA,
33 and PFOS+PFOA in groundwater were above the USEPA HA values in MW07001 and MW07002, and below

1 the USEPA HA values in MW07003. PFBS was detected at concentrations below the USEPA Tap Water RSL
2 in MW07001 and MW07002, but was not detected in MW07003. PFOS and PFOA were detected in
3 sediment at concentrations below the USEPA RSL at SD07001, while PFBS was not detected.

4 **3.8 AFFF RELEASE AREA 8: CURRENT FTA**

5 The Current FTA replaced FTA No. 2 in the late 1980s, and was last used in 1996. The FTA consisted of an
6 approximately 60-foot diameter gravel-filled area with a small concrete containment berm. AFFF likely
7 was used at this location and may have been released outside of the containment area (CH2M HILL, 2015).

8 **3.8.1 Sample Location and Methodologies**

9 **3.8.1.1 Soil Samples**

10 Two soil borings (MW08001 and MW08002) were advanced near the north and south edges of the circular
11 gravel area on 17 October 2017 (**Figure 3.8-1**). Surface soil samples were collected from 0 to 0.5 foot bgs,
12 and subsurface soil samples were collected from 17 to 19 feet bgs (MW08001) and 14 to 16 feet bgs
13 (MW08002), for PFAS analysis. Composite soil samples were also collected from each soil boring from 0
14 to 1 foot bgs and 14 to 19 feet bgs for TOC, pH, and particle size analysis. Groundwater was encountered
15 at approximately 19 to 22 feet bgs during boring advancement.

16 **3.8.1.2 Groundwater Samples**

17 One new temporary monitoring well (MW08002) and one existing permanent monitoring well (232) were
18 sampled on 15 November 2017 to assess PFAS concentrations north and south of the circular gravel area
19 (**Figure 3.8-1**). However, monitoring well MW08002 contained only approximately one foot of
20 groundwater that was extremely turbid and, following discussion with AFCEC, it was decided that this
21 sample would not be laboratory analyzed. Temporary monitoring wells MW08001 and MW08003 did not
22 contain sufficient water for sampling, even after drilling deeper and installing these temporary wells at
23 approximately 50 feet bgs (approximately 20 feet deeper than MW08002).

24 **3.8.2 Analytical Results**

25 **3.8.2.1 Soil Results**

26 Two surface and subsurface soil samples were collected for PFAS analysis, with the results provided in
27 **Table 3.1-1**, illustrated in **Figure 3.8-2**, and summarized below.

28 **MW08001:**

- 29 • PFOS was detected below the RSL at the surface sampling interval (0 to 0.5 foot bgs) at a
30 concentration of 0.115 mg/kg, and was not detected at the subsurface sampling interval (17 to 19
31 feet bgs).
- 32 • PFOA was detected below the RSL at the surface sampling interval (0 to 0.5 foot bgs) at an
33 approximate concentration of 0.00112 mg/kg, and was not detected at the subsurface sampling
34 interval (17 to 19 feet bgs).

- 1 • PFBS was not detected at either interval.

2 **MW08002:**

- 3 • PFOS was detected below the RSL at the two sampling intervals at a maximum concentration of
4 0.0613 mg/kg (0 to 0.5 foot bgs).
5 • PFOA was detected below the RSL at the surface (0 to 0.5 foot bgs) sampling interval at an
6 approximate concentration of 0.00107 mg/kg, and was not detected at the subsurface (14 to 16
7 foot bgs) sampling interval.
8 • PFBS was not detected at either interval.

9 The composite TOC concentrations ranged from approximately 171 mg/kg (14 to 19 feet bgs) to 1730
10 mg/kg (0 to 1 foot bgs), while the composite pH concentrations ranged from 5.09 S.U. (0 to 1 foot bgs) to
11 5.34 S.U. (14 to 19 feet bgs) (**Table 3.1-2**). The particle size analytical results for the 0 to 1 foot bgs sample
12 was 69.7% fines (silt and clay), 20.2% sand (fine to coarse), and 10.1% gravel (fine), while the 14 to 19 feet
13 bgs sample was 67.0% fines (silt and clay), 31.4% sand (fine to coarse), and 1.6% gravel (fine). The material
14 description for both the 0 to 1 foot bgs sample and the 14 to 19 feet bgs sample was a dark brown silty
15 sand with fines and gravel.

16 **3.8.2.2 Groundwater Results**

17 Two groundwater samples (one normal and one field duplicate) were collected for PFAS analysis, with the
18 results provided in **Table 3.1-3**, illustrated in **Figure 3.8-3**, and summarized below.

19 **MW 232:**

- 20 • PFOS was detected above the USEPA HA value at a concentration of 1.15 µg/L in the duplicate
21 sample.
22 • PFOA was detected above the USEPA HA value at a concentration of 0.178 µg/L.
23 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 1.327 µg/L in the
24 duplicate sample.
25 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.186 µg/L in the
26 duplicate sample.

27 **3.8.3 Conclusions**

28 PFOS and PFOA in soil were detected at concentrations below the USEPA RSL in both borings, with the
29 highest concentrations in MW08001. PFBS was not detected in any of the borings. PFOS, PFOA, and
30 PFOS+PFOA in groundwater exceeded the USEPA HA values in both monitoring wells, while PFBS was
31 detected at concentrations below the USEPA Tap Water RSL in both of the wells.

32 **3.9 AFFF RELEASE AREA 9: J-4 TEST CELL GROUNDWATER EXTRACTION SYSTEM**

33 Dewatering at the J-4 Test Cell induces significant drawdown on the potentiometric surface beneath the
34 main test area, potentially capturing PFAS-contaminated groundwater in the vicinity of the Test Cell.

1 Therefore, to assess PFAS presence in groundwater at the J-4 Test Cell, Amec Foster Wheeler collected a
2 sample of the influent groundwater at the treatment facility.

3 **3.9.1 Sample Location and Methodologies**

4 **3.9.1.1 Groundwater Samples**

5 Influent groundwater at a small weir located near the J-4 Test Cell groundwater treatment facility
6 (INF09001) was sampled on 11 October 2017 to assess PFAS concentrations in extracted groundwater
7 near the J-4 Test Cell (**Figure 3.9-1**).

8 **3.9.2 Analytical Results**

9 **3.9.2.1 Groundwater Results**

10 One grab sample of influent groundwater was collected for PFAS analysis, with the results provided in
11 **Table 3.1-3**, illustrated in **Figure 3.9-2**, and summarized below.

12 **INF09001:**

- 13 • PFOS was detected below the USEPA HA value at a concentration of 0.039 µg/L.
- 14 • PFOA was detected above the USEPA HA value at a concentration of 0.0811 µg/L.
- 15 • PFOS+PFOA was detected above the USEPA HA value at a concentration of 0.1201 µg/L.
- 16 • PFBS was detected below the USEPA Tap Water RSL at a concentration of 0.0196 µg/L.

17 **3.9.3 Conclusions**

18 PFOA and PFOS+PFOA in groundwater were above the USEPA HA values in the extraction system influent,
19 while PFOS in groundwater was below the USEPA HA value. PFBS was detected at concentrations below
20 the USEPA Tap Water RSL in the influent groundwater.

4.0 MIGRATION/EXPOSURE PATHWAYS AND TARGETS

An updated base-wide conceptual site model table is provided as **Table 4.0-1**. The table provides an overview of the facility, physical, release, land use, exposure, and ecological profiles at Arnold AFB. The table has been updated to include information collected during this SI. A more detailed description of source area conditions and exposure pathways is described in the following sections.

4.1 SOIL (SURFACE AND SUBSURFACE) EXPOSURE PATHWAY

4.1.1 Local Geologic Setting

The vicinity around the base contains barren areas that feature karst topography, heavy clay soil, and wetland vegetation (Bay West, 2011). Soils are typically combinations of cherty, silty, and clayey loam consisting of varying proportions of sand, clay, and organic matter (CH2M HILL, 2015). These overlying soils are underlain by materials with increasing chert content from gravel to cobble-size chert and limestone that has weathered from the parent bedrock. The silty and clayed soils with trace to little sand and cobble zone mix transitions to weathered and fractured limestone of the Fort Payne formation.

Basewide geologic cross sections developed from the SI well installation activities are provided in **Figures 3.0-1 and 3.0-2**.

4.1.2 Soil Exposure Pathways and Targets

PFOS was detected in surface and subsurface soil at AFFF Release Area 4 at concentrations above the RSL of 0.126 mg/kg, while PFOA and PFBS detections were below the RSL. PFOS and PFOA were detected in soil at AFFF Release Areas 1, 3, 5, 7, and 8; however, all of the detections were below the RSL of 0.126 mg/kg. None of the AFFF release areas sampled for soil during the SI have a clean cover or permanent impenetrable cover above the impacted soil; however, soils at AFFF Release Area 2 were previously consolidated by others and the area was capped and revegetated as part of a land use control in 1993 (CH2M HILL, 2015). Historical documents reviewed indicate that a land use control prohibits disturbance of the soil cap at FTA No. 2, and therefore these soils were not sampled for PFAS during the SI.

Surface soil at Arnold AFB is potentially accessible by USAF personnel, grounds maintenance workers, utility workers, construction workers, site visitors, and/or trespassers. Subsurface soil is primarily accessible by on-site construction and utility workers involved with excavating, drilling, or any activity that exposes them to subsurface soil. Access to source area soil is not expected to change in the future.

Potential exposure routes for soil include inhalation of impacted surface soil dust particles, and ingestion and dermal contact of contaminants in soil.

4.1.3 Soil Exposure Conclusions

Potential human exposure receptors from PFAS in surface and subsurface soil at AFFF Release Areas 1, 3, 4, 5, 7, and 8 include USAF personnel, grounds maintenance workers, utility workers, construction workers, site visitors, and/or trespassers. PFOS was detected in surface and subsurface soils at AFFF

1 Release Area 4 at concentrations above the calculated RSL, based on a residential exposure scenario,
2 which represents a potential complete receptor pathway for soil.

3 **4.2 GROUNDWATER MIGRATION PATHWAY**

4 **4.2.1 Local Hydrogeologic Setting**

5 The shallow aquifer at Arnold AFB averages approximately 30 feet in thickness and is under unconfined
6 to semi-confined conditions. It may consist of isolated, seasonal perched water tables or be continuous
7 over large areas. Groundwater is typically encountered at 1 to 10 feet bgs. The underlying Manchester
8 aquifer is marked by an increase in chert porous and water-rich rock rubble and ranges from 30 to 90 feet
9 thick (Bay West, 2011). The aquifer transitions to fractured limestone with solution-widened fractures
10 and joints in the upper part of the Fort Payne Formation. The deep, semi-confined Fort Payne aquifer
11 occurs in the less permeable fractured limestone of the Fort Payne Formation and ranges from 10 to 140
12 feet thick (Bay West, 2011; CH2M HILL, 2015).

13 Groundwater flow within the shallow aquifer generally follows the slope of the ground surface topography
14 and is generally towards surface water bodies (CH2M HILL, 2015); however, flow within the semi-confined
15 Manchester aquifer is more complex due to the presence of a highly permeable system of chert rubble
16 and solution-enlarged fractures and joints within the upper part of the Fort Payne Formation. This system
17 influences groundwater movement, creating preferred flow conditions—referred to as troughs—that
18 affect plume migration pathways. Periodic dewatering of the J-4 Test Cell within the Main Test Area
19 induces significant drawdown within the shallow, Manchester, and Fort Payne aquifers beneath the AEDC
20 Main Test Area. The AEDC facility is located along a regional groundwater divide that extends northeast
21 to southwest across the installation (**Figure 4.2-1**).

22 Several groundwater troughs have also been documented in the regional Manchester aquifer
23 potentiometric surface at Arnold AFB from previous site investigations for chlorinated VOCs in
24 groundwater (USGS, 2011). Groundwater troughs were identified in the vicinity of AFFF Release Areas 7
25 and 8, with flow towards the northwest, and near AFFF Release Areas 1 and 3, with flow towards the
26 northeast. AFFF Release Area 2 is located near the regional groundwater divide and groundwater could
27 potentially flow towards either of the aforementioned groundwater troughs. AFFF Release Areas 4 and 5
28 appear to be located within the influence of the J-4 Test Cell and, therefore, groundwater flow near these
29 locations is likely towards the J-4 Test Cell extraction point (**Figure 4.2-1**).

30 Drinking water for Arnold AFB is supplied via the AEDC Public Water System from Woods Reservoir, a
31 4,000-acre, surface impoundment located at the southern end of the installation. Water is pumped from
32 the Primary Pumping Station located on Woods Reservoir to a 56 million gallon elevated Secondary
33 Reservoir located within the industrial area of AEDC. A treatment plant processes up to 2.25 million
34 gallons per day and serves approximately 2,600 people who are primarily day shift workers. Drinking
35 water wells are also located at the installation golf course for this facility, as well as near Woods Reservoir
36 for the Crockett Cove Recreation Area (**Figure 2.1-1**).

1 Influent and effluent streams of the AEDC Public Water System treatment plant were analyzed for PFAS
2 by Arnold AFB in September 2016. A copy of the 2016 PFAS laboratory analytical report is provided in
3 **Appendix E**. The analytical results revealed PFOS concentrations of 0.0039 µg/L in the influent sample
4 (sample ID: Water Treatment Plant Raw) and 0.0035 µg/L in the effluent sample (Water Treatment Plant
5 Treated), which were below the USEPA HA value of 0.07 µg/L (**Appendix E**). PFOA and PFBS were not
6 detected in either sample. The golf course well (Golf Course Well Raw and Golf Course Treated) and the
7 Crockett Cove Recreation Area well (Outdoor Rec Treated) were also sampled for analyses of PFAS by
8 Arnold AFB in September 2016, and PFAS were not detected in either sample.

9 **4.2.2 Groundwater Exposure Pathways and Targets**

10 PFAS, once in groundwater, are highly mobile and will migrate near the same velocity as groundwater due
11 to their high solubility and low partition coefficient value. PFAS are chemically and biologically stable in
12 the environment and resist typical environmental degradation processes. As a result, these chemicals are
13 extremely persistent in the environment, with a half-life greater than 41 years for PFOS and greater than
14 92 years for PFOA (USEPA, 2014). PFBS is generally less toxic and less bioaccumulative in wildlife and
15 humans (USEPA, 2017b).

16 PFOS, PFOA, and/or PFOS+PFOA were detected in shallow aquifer groundwater at AFFF Release Areas 1
17 through 5, 7, and 9 at concentrations exceeding the USEPA HA value of 0.07 µg/L. PFOS, PFOA, and
18 PFOS+PFOA were also detected in existing permanent monitoring well 232, constructed within the
19 Manchester aquifer, at concentrations exceeding the USEPA HA value of 0.07 µg/L. Based on the current
20 PFAS analytical results, AFFF Release Areas 1 through 5 and 7 through 9 are considered as groundwater
21 release areas for pathway analysis.

22 While PFOS, PFOA, and/or PFOS+PFOA exceeded the USEPA HA value during the SI at AFFF Release Areas
23 1 through 5 and 7 through 9, no potential groundwater ingestion receptor pathways with immediate
24 impacts to human health currently exist at Arnold AFB since PFAS was not detected above the HA value
25 in any of the potable water sources at the installation.

26 Groundwater flow from the AFFF release areas varies by location, but shallow groundwater flow generally
27 follows the slope of the ground surface topography, whereas groundwater flow in the Manchester aquifer
28 is within troughs towards the northwest in the vicinity of AFFF Release Areas 7 and 8 and is towards the
29 northeast near AFFF Release Areas 1 and 3 (**Figure 4.2-1**). AFFF Release Area 2 is located near a regional
30 groundwater divide and groundwater could potentially flow towards either of the aforementioned
31 groundwater troughs. AFFF Release Areas 4 and 5 appear to be located within the influence of the J-4
32 Test Cell and therefore, groundwater flow near these locations is likely towards the J-4 Test Cell extraction
33 point. The Manchester aquifer is used as a drinking water source in the vicinity of Arnold AFB, and
34 therefore primary human groundwater targets were identified downgradient from PFAS-impacted AFFF
35 release areas.

1 Amec Foster Wheeler performed a desktop survey of potential private and public water supply wells
2 within a one-mile and four-mile distance of the installation boundary to identify potential receptor
3 pathways and down-stream and/or downgradient receptors. The desktop survey included a review of a
4 list of water supply wells provided by the TDEC Division of Water Resources. A total of 609 private and
5 public water supply wells were identified within a four-mile distance of the installation (**Figure 4.2-2**). Of
6 these 609 wells, 159 are located downgradient of AFFF Release Areas 1, 3, 7, and 8; 129 of which are
7 located downgradient of the groundwater trough to the northwest (**Figure 4.2-3**) and 30 of which are
8 located downgradient of the groundwater trough to the northeast (**Figure 4.2-4**). Of the 159
9 downgradient wells, a total of 110 wells were identified as residential, 87 of which are located
10 downgradient of the groundwater trough to the northwest (**Figure 4.2-3**), and 23 of which are located
11 downgradient of the groundwater trough to the northeast (**Figure 4.2-4**). One municipal supply well was
12 identified downgradient of the groundwater trough to the northwest, approximately 2 miles from the
13 installation boundary. Based on the well depths, most of the residential wells are likely screened within
14 the Manchester aquifer or the underlying Fort Payne aquifer.

15 Based on the SI, potential complete pathways for human exposure to PFAS-impacted groundwater
16 through ingestion were identified within a four-mile distance from Arnold AFB downgradient of AFFF
17 Release Areas 1, 3, 7, and 8. These groundwater targets were further assessed during a follow-on SI, with
18 the results to be presented in a SIR Addendum.

19 **4.2.3 Groundwater Migration Pathway Conclusions**

20 PFOS, PFOA, and/or PFOS + PFOA in groundwater exceeded the USEPA HA value at AFFF Release Areas 1
21 through 5 and 7 through 9. Human receptors via the ingestion pathway are not present at the installation
22 since PFAS was not detected above the respective screening levels in the AEDC Public Water System or
23 groundwater supply wells located at the golf course and Crockett Cove Recreation Area; however,
24 groundwater receptors are present within a four-mile distance of Arnold AFB downgradient of AFFF
25 Release Areas 1, 3, 7, and 8.

26 **4.3 SEDIMENT EXPOSURE PATHWAY**

27 **4.3.1 Sediment Exposure Pathways and Targets**

28 Sediment at Arnold AFB is potentially accessible by on-site workers, site visitors, trespassers, and/or
29 nearby residents. Access to source area sediment is not expected to change in the future. Potential
30 exposure routes for sediment include dermal contact with submerged or exposed sediment during various
31 recreational activities, as well as during maintenance of drainage ditches and canals that contain PFAS-
32 impacted sediment.

33 PFOS was detected in sediment at AFFF Release Areas 5 through 7 and PFOA was detected in sediment at
34 AFFF Release Area 7; however, all the detections were below the calculated RSL of 0.126 mg/kg.

1 **4.3.2 Sediment Exposure Conclusions**

- 2 Potential exposure receptors include on-site workers, visitors, trespassers, and/or nearby residents who
3 may come into contact with sediment at or downstream of AFFF Release Areas 5 through 7; however,
4 PFOS was detected at concentrations below the RSL.

5.0 SUMMARY AND CONCLUSIONS

As stated in Section 1.0 Introduction, the objectives of this study were to:

- Determine if PFAS are present in soil, groundwater and sediment at AFFF release areas selected for SI;
- Determine if PFOS and PFOA concentrations in soil exceed the calculated RSL of 0.126 mg/kg, based on a residential exposure scenario, and if PFBS concentrations in soil exceed the USEPA RSL of 130 mg/kg, based on a residential exposure scenario;
- Determine if PFOS, PFOA, or sum of PFOS and PFOA concentrations in groundwater exceed the USEPA HA value of 0.07 µg /L, and if PFBS concentrations in groundwater exceed the RSL of 40 µg/L;
- Determine if concentrations of PFOS or PFOA in sediment exceed the calculated RSL of 0.126 mg/kg, and if PFBS concentrations exceed the USEPA RSL of 130 mg/kg, based on a residential exposure scenario; and,
- Identify potential receptor pathways with immediate impacts to human health (i.e., immediate impact to human health is considered consumption of drinking water with PFOS/PFOA above the USEPA HA value, or PFBS above the USEPA Tap Water RSL).

Section 3 of this SI detailed the analytical results for PFAS at each AFFF release area included in this SI. In addition, Section 4 includes an assessment of exposure/migration pathways and targets for media impacted with PFAS at all release areas. A summary table (**Table 5.0-1**) is provided below which lists specific exceedances by area and media, fulfilling the objectives of the SI.

Table 5.0-1. Summary of Analytical Results and Screening Level Exceedances.

AFFF Release Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples* / Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
AFFF Release Area 1 FTA No. 1	Surface Soil						Yes	NFRAP
	PFOS	0.118	0.126	mg/kg	2/0	No		
	PFOA	0.01	0.126	mg/kg	2/0	No		
	PFBS	ND	130	mg/kg	2/0	No		NFRAP
	Subsurface Soil							
	PFOS	0.0071	0.126	mg/kg	2/0	No		
	PFOA	0.00108 J	0.126	mg/kg	2/0	No		NFRAP
	PFBS	ND	130	mg/kg	2/0	No		
	Groundwater							
	PFOS	159	0.07	µg/L	2/2	Yes		Follow-on SI
	PFOA	16 J	0.07	µg/L	2/2	Yes		
PFOS+PFOA	175	0.07	µg/L	2/2	Yes			
PFBS	17.6 J	40	µg/L	2/0	No			
AFFF Release Area 2 FTA No. 2	Groundwater						No	Advance Area to RI
	PFOS	3.08	0.07	µg/L	3/2	Yes		
	PFOA	4.49	0.07	µg/L	3/2	Yes		
	PFOS+PFOA	7.46	0.07	µg/L	3/2	Yes		
	PFBS	0.605	40	µg/L	3/0	No		
AFFF Release Area 3 Fire Station 1 (Building 251)	Surface Soil						Yes	NFRAP
	PFOS	0.0709	0.126	mg/kg	2/0	No		
	PFOA	0.00343	0.126	mg/kg	2/0	No		
	PFBS	ND	130	mg/kg	2/0	No		NFRAP
	Subsurface Soil							
	PFOS	0.063 J	0.126	mg/kg	2/0	No		
	PFOA	0.00392 J	0.126	mg/kg	2/0	No		
PFBS	ND	130	mg/kg	2/0	No			

AFFF Release Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples* / Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
	Groundwater						Yes	Follow-on SI
	PFOS	19.5	0.07	µg/L	2/2	Yes		
	PFOA	4.03	0.07	µg/L	2/2	Yes		
	PFOS+PFOA	23.53	0.07	µg/L	2/2	Yes		
	PFBS	2.59	40	µg/L	2/0	No		
AFFF Release Area 4 Building 892	Surface Soil						No	Advance Area to RI
	PFOS	0.583	0.126	mg/kg	1/1	Yes		
	PFOA	0.00813	0.126	mg/kg	1/0	No		
	PFBS	0.00239 J	130	mg/kg	1/0	No		
	Subsurface Soil							Advance Area to RI
	PFOS	1.32	0.126	mg/kg	1/1	Yes		
	PFOA	0.0105 J	0.126	mg/kg	1/0	No		
	PFBS	0.00425 J	130	mg/kg	1/0	No		
	Groundwater							Advance Area to RI
	PFOS	0.0605 B	0.07	µg/L	1/0	No		
	PFOA	0.0601	0.07	µg/L	1/0	No		
	PFOS+PFOA	0.1206	0.07	µg/L	1/1	Yes		
	PFBS	ND	40	µg/L	1/0	No		
AFFF Release Area 5 Building 1576 and Tank Dike 21	Surface Soil						No	NFRAP
	PFOS	0.00501 B	0.126	mg/kg	2/0	No		
	PFOA	ND	0.126	mg/kg	2/0	No		
	PFBS	ND	130	mg/kg	2/0	No		
	Subsurface Soil							NFRAP
	PFOS	0.00393 B	0.126	mg/kg	2/0	No		
	PFOA	ND	0.126	mg/kg	2/0	No		
	PFBS	ND	130	mg/kg	2/0	No		
Groundwater								

AFFF Release Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples* / Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation	
	PFOS	5.89	0.07	µg/L	3/2	Yes	No	Advance Area to RI	
	PFOA	0.376	0.07	µg/L	3/2	Yes			
	PFOS+PFOA	6.266	0.07	µg/L	3/2	Yes			
	PFBS	0.364	40	µg/L	3/0	No			
	Sediment							NFRAP	
	PFOS	0.0189	0.126	mg/kg	1/0	No			
	PFOA	ND	0.126	mg/kg	1/0	No			
	PFBS	ND	130	mg/kg	1/0	No			
AFFF Release Area 6 Return Ditch	Sediment							No	NFRAP
	PFOS	0.00163 J	0.126	mg/kg	3/0	No			
	PFOA	ND	0.126	mg/kg	3/0	No			
	PFBS	ND	130	mg/kg	3/0	No			
AFFF Release Area 7 Fire Truck Operational Checks Area	Surface Soil							Yes	NFRAP
	PFOS	0.0251	0.126	mg/kg	3/0	No			
	PFOA	0.00164 J	0.126	mg/kg	3/0	No			
	PFBS	ND	130	mg/kg	3/0	No	NFRAP		
	Subsurface Soil								
	PFOS	ND	0.126	mg/kg	3/0	No			
	PFOA	ND	0.126	mg/kg	3/0	No	Follow-on SI		
	PFBS	ND	130	mg/kg	3/0	No			
	Groundwater								
	PFOS	5.36	0.07	µg/L	3/2	Yes	Follow-on SI		
	PFOA	0.365	0.07	µg/L	3/2	Yes			
	PFOS+PFOA	5.725	0.07	µg/L	3/2	Yes			
	PFBS	0.193	40	µg/L	3/0	No	NFRAP		
Sediment									
PFOS	0.0483	0.126	mg/kg	1/0	No	NFRAP			

AFFF Release Area	Parameter	Maximum Detected Concentration	Screening Value	Units	Number of Samples* / Number of Exceedances	Exceeds Screening Level	Potentially Complete DW Exposure Pathway	Recommendation
	PFOA	0.000848 J	0.126	mg/kg	1/0	No		
	PFBS	ND	130	mg/kg	1/0	No		
AFFF Release Area 8 Current FTA	Surface Soil							
	PFOS	0.115	0.126	mg/kg	2/0	No	Yes	NFRAP
	PFOA	0.00112 J	0.126	mg/kg	2/0	No		
	PFBS	ND	130	mg/kg	2/0	No		
	Subsurface Soil							
	PFOS	0.0101 J	0.126	mg/kg	2/0	No	Yes	NFRAP
	PFOA	ND	0.126	mg/kg	2/0	No		
	PFBS	ND	130	mg/kg	2/0	No		
	Groundwater							
	PFOS	1.15	0.07	µg/L	1/1	Yes	Yes	Follow-on SI
	PFOA	0.178	0.07	µg/L	1/1	Yes		
	PFOS+PFOA	1.327	0.07	µg/L	1/1	Yes		
PFBS	0.186	40	µg/L	1/0	No			
AFFF Release Area 9 J-4 Test Cell Groundwater Extraction System	Groundwater							
	PFOS	0.039	0.07	µg/L	1/0	No	No	Advance Area to RI
	PFOA	0.0811	0.07	µg/L	1/1	Yes		
	PFOS+PFOA	0.1201	0.07	µg/L	1/1	Yes		
	PFBS	0.0196	40	µg/L	1/0	No		

Notes:

* normal samples (count does not include QC samples)

AFFF – aqueous film forming foam

DW – drinking water

EST - Environmental Solutions & Technologies, Inc.

FTA – Fire Training Area

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample

µg/L - micrograms per liter

mg/kg - milligrams per kilogram J The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample

NFRAP – No Further Remedial Action Planned

ND – not detected

PFBS - perfluorobutanesulfonic acid

PFOA – perfluorooctanoic acid

PFOS - perfluorooctanesulfonic acid

RI – Remedial Investigation

SI – Site Inspection

1 Potential human health pathways were identified and detailed in Section 4 of this SIR. The potential
2 receptors and targets vary by AFFF release area. Media-specific pathways and receptors are discussed
3 below.

4 Surface and Subsurface Soil Receptors

5 Potential human exposure receptors from PFAS in surface and subsurface soil at AFFF Release Areas 1, 3,
6 4, 5, 7, and 8 include USAF personnel, grounds maintenance workers, utility workers, construction
7 workers, site visitors, and/or trespassers. PFOS was detected in surface and subsurface soils at AFFF
8 Release Area 4 at concentrations above the calculated RSL, based on a residential exposure scenario,
9 which represents a potential complete receptor pathway for soil.

10 Groundwater Receptors

11 PFOS, PFOA, and/or PFOS + PFOA in groundwater exceeded the USEPA HA value at AFFF Release Areas 1
12 through 5 and 7 through 9. Human receptors via the ingestion pathway are not present at the installation
13 since PFAS was not detected above the respective screening levels in the AEDC Public Water System or
14 groundwater supply wells located at the golf course and Crockett Cove Recreation Area; however,
15 groundwater receptors are present within a four-mile distance of Arnold AFB downgradient of AFFF
16 Release Areas 1, 3, 7, and 8.

17 Sediment Receptors

18 Potential exposure receptors include on-site workers, visitors, trespassers, and/or nearby residents who
19 may come into contact with sediment at or downstream of AFFF Release Areas 5 through 7; however,
20 PFAS was detected at concentrations below the RSL.

6.0 REFERENCES

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21 *Area (TG028a), Munitions Response Sites, Arnold Air Force Base, Tennessee.* August.
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- 24 USEPA, 2016b. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA).* May.
- 25 USEPA, 2017a. *Regional Screening Levels (RSLs) – Generic Tables (June 2017), Composite Table,* June.
- 26 USEPA, 2017b. *Assessing and Managing Chemicals under TSCA, Per- and Polyfluoroalkyl Substances*
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28 [chemicals-under-tsca/and-polyfluoroalkyl-substances-pfass-under-tsca](https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/and-polyfluoroalkyl-substances-pfass-under-tsca), accessed on 12 April,
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FIGURES

FIGURE ACRONYMS

AFFF	aqueous film forming foam
ft bgs	feet below ground surface
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
PFAS	per- and polyfluorinated alkyl substances
PFBS	perfluorobutanesulfonic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
SB	soil boring
SD	sediment
SW	surface water

FIGURE NOTES

Shaded = Exceeds USEPA Health Advisory Value

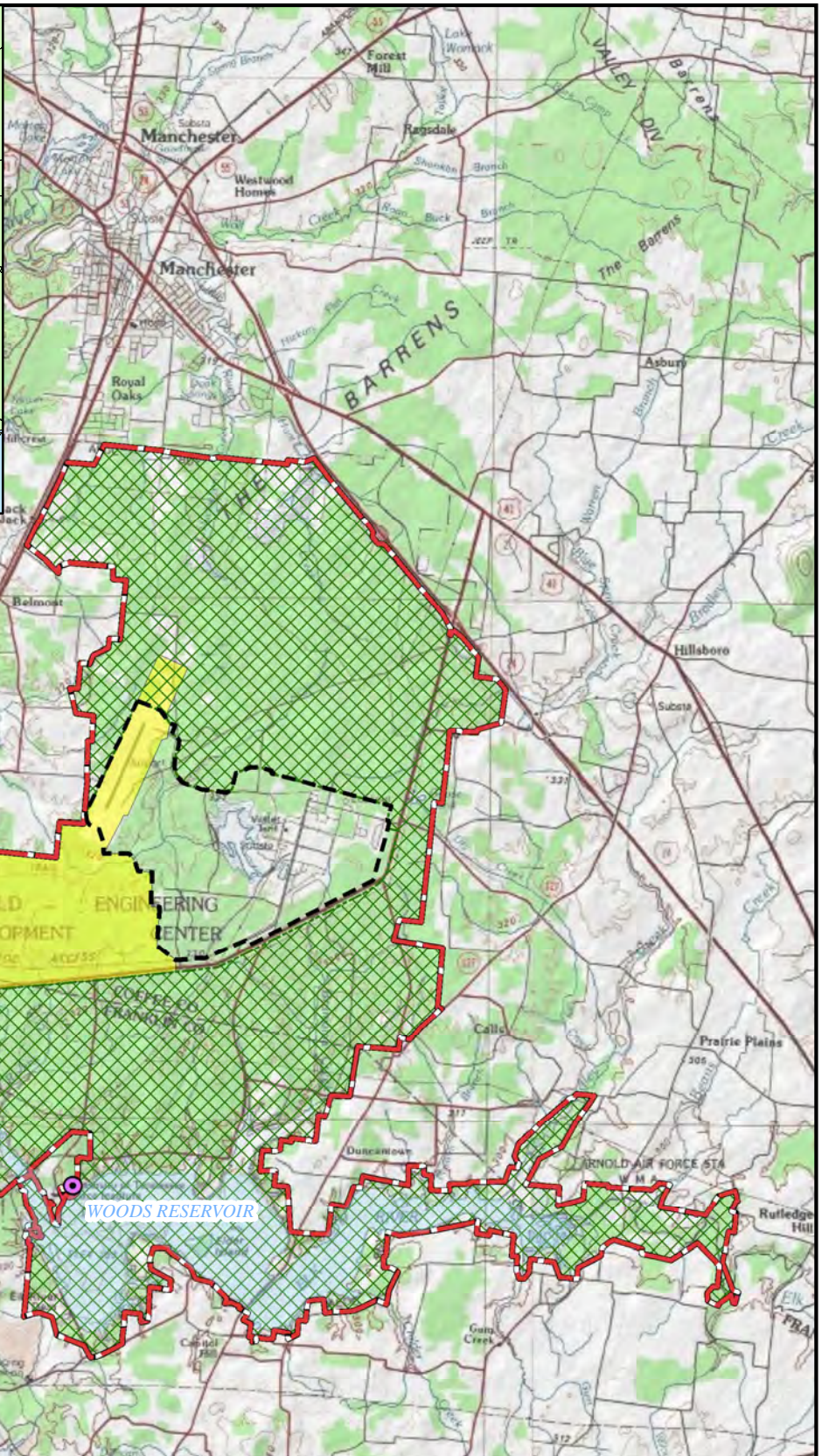
Groundwater elevations in NAVD88 (feet)

^A Higher concentration observed in field duplicate sample

J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample

U = The analyte was analyzed for, but was not detected above the reported limit of detection

UJ = The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample



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Symbol Key

- Arnold Engineering Development Complex
- Arnold AFB Installation Boundary
- AEDC Wildlife Management Area
- Tullahoma Training Site
- Approximate location of Golf Course Well
- Approximate location of Crockett Cove Well

FIGURE 2.1-1
Installation Location Map
Arnold Air Force Base
Manchester, Tennessee



Project: 775303101

By: MV, EMK Date: 5/10/2018

0 1 2 Miles

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Site Inspection of Aqueous
Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

**FIGURE 2.3-1
AFFF Release Areas
Arnold Air Force Base
Manchester, Tennessee**




Site Inspection of Aqueous
Film Forming Foam (AFFF)
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Environmental Programs Worldwide
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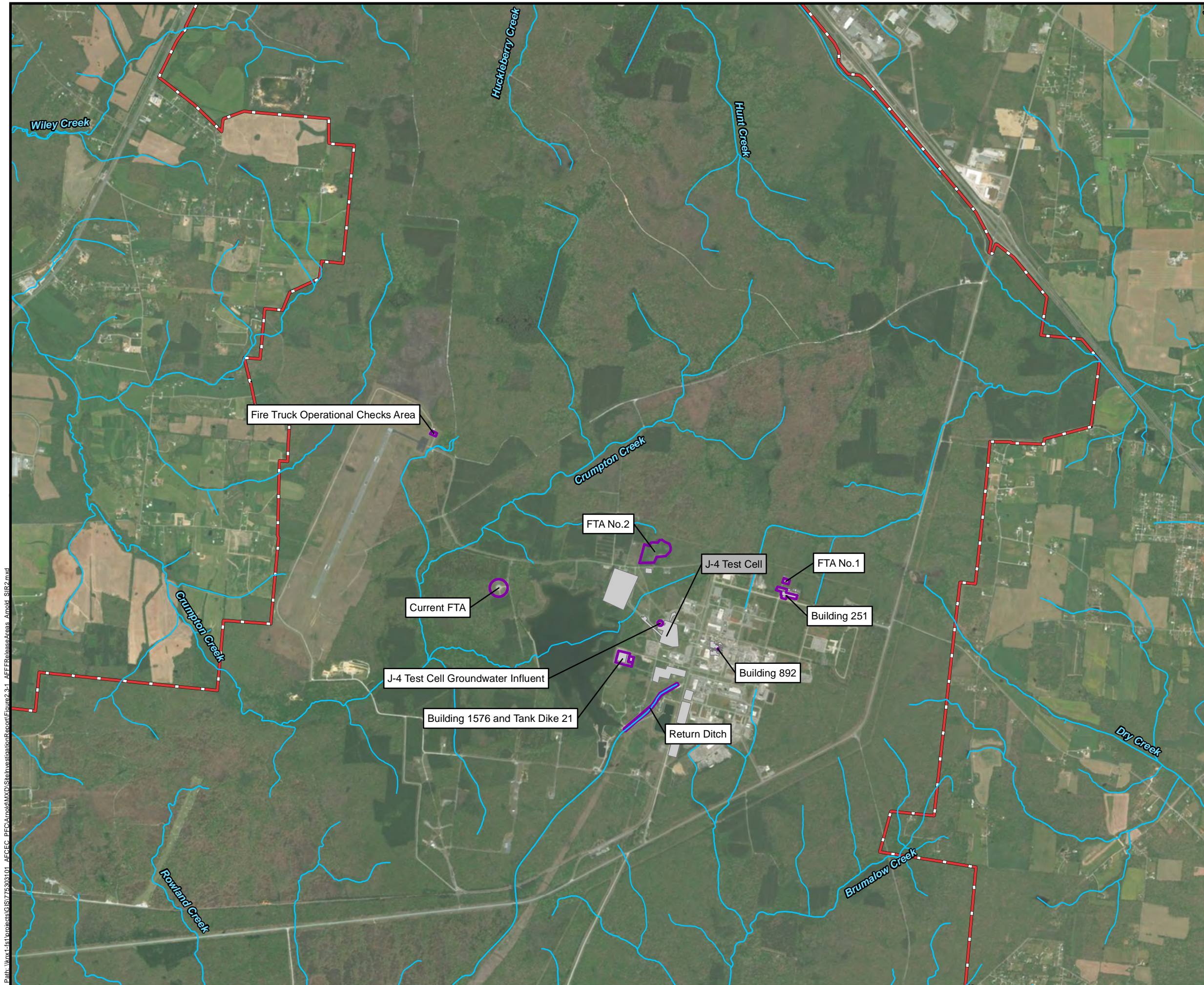
Air Force Civil Engineer Center



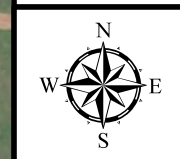
2261 Hughes Ave., Suite 163
JBSA Lackland, TX 78236

Symbol Key

-  Streams
-  AFFF Release
-  Arnold AFB Installation



Path: \\wp1141\projects\GIS\75303101_AFECEC_PFC\Arnold\MXD\SiteInvestigation\Report\Figure2.3-1_AFFFReleaseAreas_Arnold_SIR2.mxd

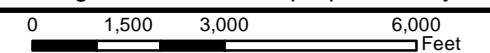


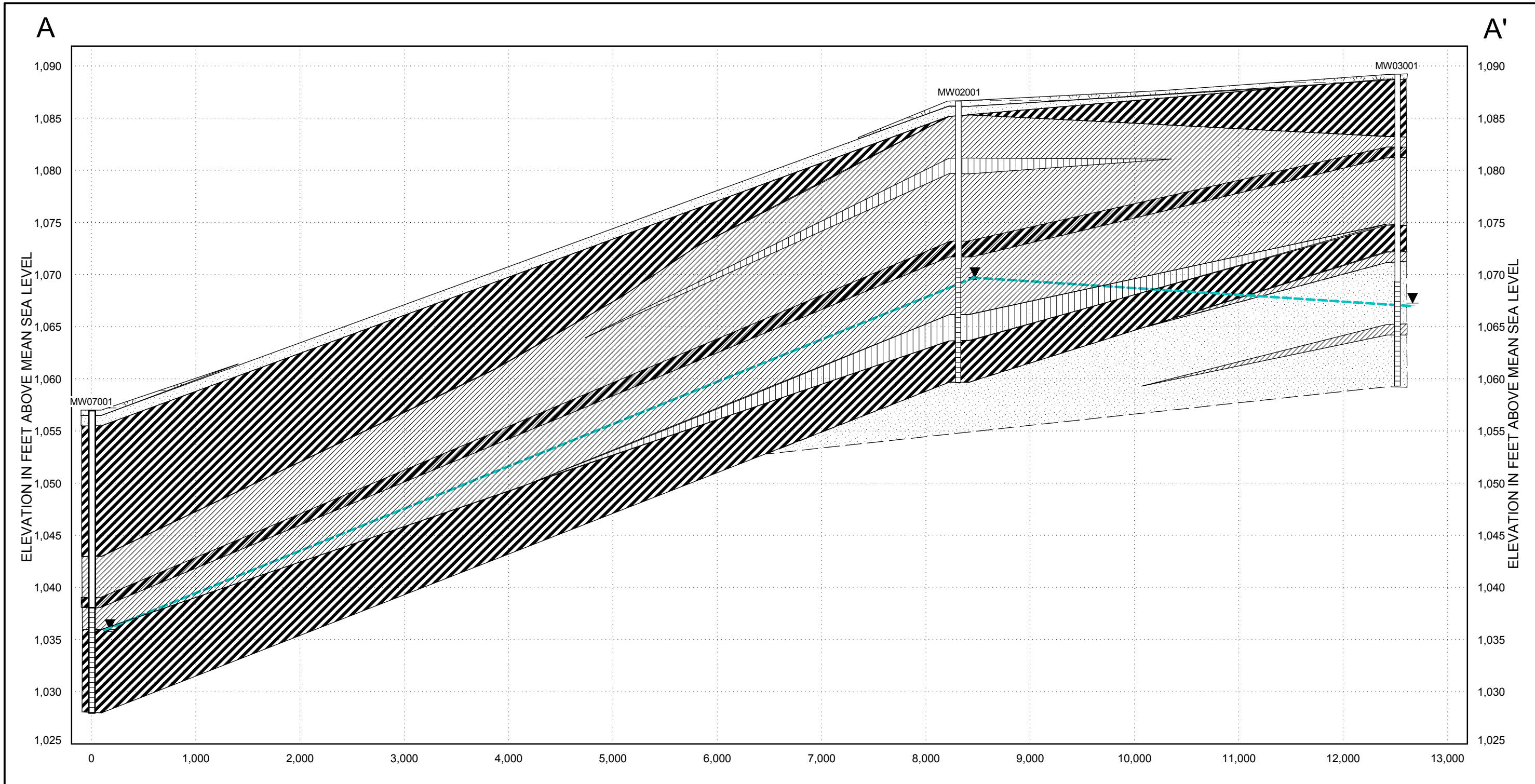
Project: 775303101


By: MV, EMK

Date: 4/26/2018


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 2261 Hughes Ave., Suite 163
 JBSA Lackland, TX 78236
 By: L. Simmons

Project: 775303101
 Date: 04-10-2018

 amec foster wheeler 

Symbol Key

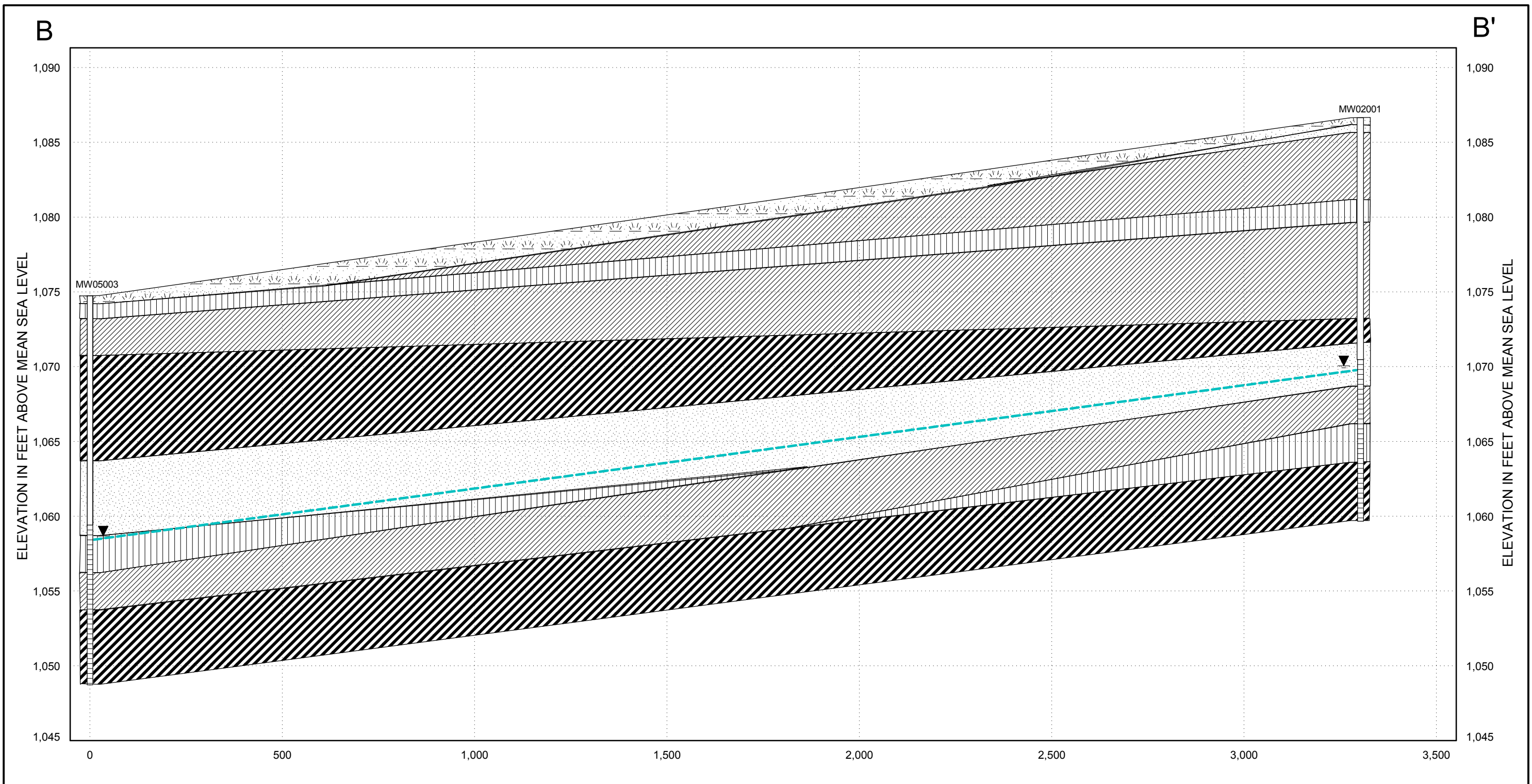
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	Temporary Monitoring Well		Fat Clay (CH)
	Water Level (October, 2017)		Lean Clay (CL)
	Approximate Ground Level		Sands
	Approximate Water Table		Silts
	Inferred Extent		
	Screen		

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FIGURE 3.0-1
Geologic Cross-Section A-A'
Arnold Air Force Base
Manchester, TN

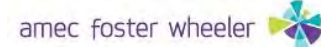
Site Inspection of
 Aqueous Film Forming Foam (AFFF) Release Areas
 Environmental Programs Worldwide
 Site Inspection Report



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2261 Hughes Ave., Suite 163
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By: L. Simmons

Project: 775303101
Date: 04-10-18



Symbol Key

- Monitoring Well
- Temporary Monitoring Well
- Water Level (October, 2017)
- Approximate Ground Level
- Approximate Water Table
- Inferred Extent
- Screen
- Topsoil
- Sands
- Silts
- Fat Clay (CH)
- Lean Clay (CL)









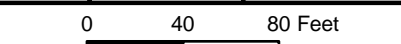
Disclaimer: For general purposes only.



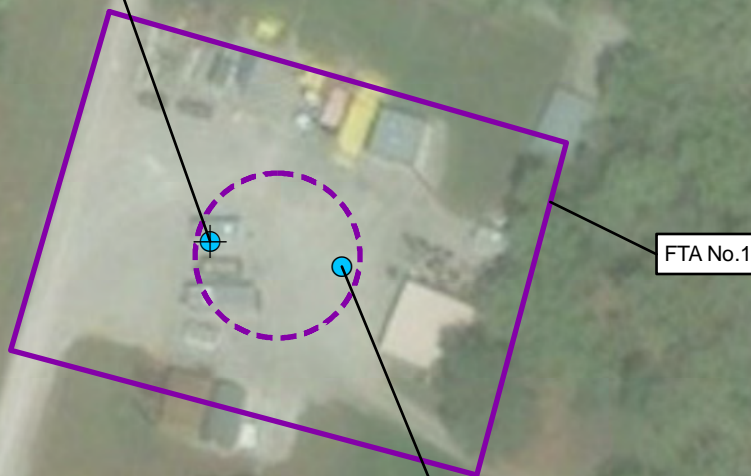
FIGURE 3.0-2
Geologic Cross-Section B-B'
Arnold Air Force Base
Manchester, TN

Site Inspection of
Aqueous Film Forming Foam (AFFF) Release Areas
Environmental Programs Worldwide
Site Inspection Report



Air Force Civil Engineer Center  2261 Hughes Ave., Suite 163 JBSA Lackland, TX 78236		Symbol Key  Temporary Monitoring Well  Soil Boring  Approximate Groundwater Flow Direction  Former FTA  AFFF Release Area  1069.70 October 2017 Groundwater Elevations (ft asml)		FIGURE 3.1-1 Sampling Locations and Groundwater Elevations FTA No. 1 AFFF Release Area 1 Arnold Air Force Base Manchester, Tennessee	
 Project: 775303101 By: MV, EMK Date: 5/10/2018		Disclaimer: For general reference purposes only. This is not a survey product. DO NOT USE to determine, certify, or verify map features, scale and/or other information.		Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community	
		Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide Site Inspection Report			

MW01001				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
13-Oct-17	0.5-1.0	0.0012 U	0.01	0.0010 U
13-Oct-17	17-19	0.00126 J	0.00108 J	0.0013 U



SB01003				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
13-Oct-17	0.5-1.0	0.118	0.00145 J	0.0010 U
13-Oct-17	17-19	0.0071	0.0010 U	0.0010 U

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Symbol Key

- Temporary Monitoring Well
- Soil Boring
- Former FTA
- AFFF Release Area

**FIGURE 3.1-2
PFAS in Soil
FTA No. 1
AFFF Release Area 1
Arnold Air Force Base
Manchester, Tennessee**



Project: 775303101

By: EMK

Date: 5/10/2018

0 40 80 Feet

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MW01002					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOA+PFOS (µg/L)	PFBS (µg/L)
17-Oct-17	20.2-30.2	159	16	175	17.6

MW01001					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOA+PFOS (µg/L)	PFBS (µg/L)
17-Oct-17	20.2-30.2	0.647	0.692	1.339	0.13

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Symbol Key

- Temporary Monitoring Well
- Former FTA
- AFFF Release Area

**FIGURE 3.1-3
PFAS in Groundwater
FTA No. 1
AFFF Release Area 1
Arnold Air Force Base
Manchester, Tennessee**



Project: 775303101

By: EMK

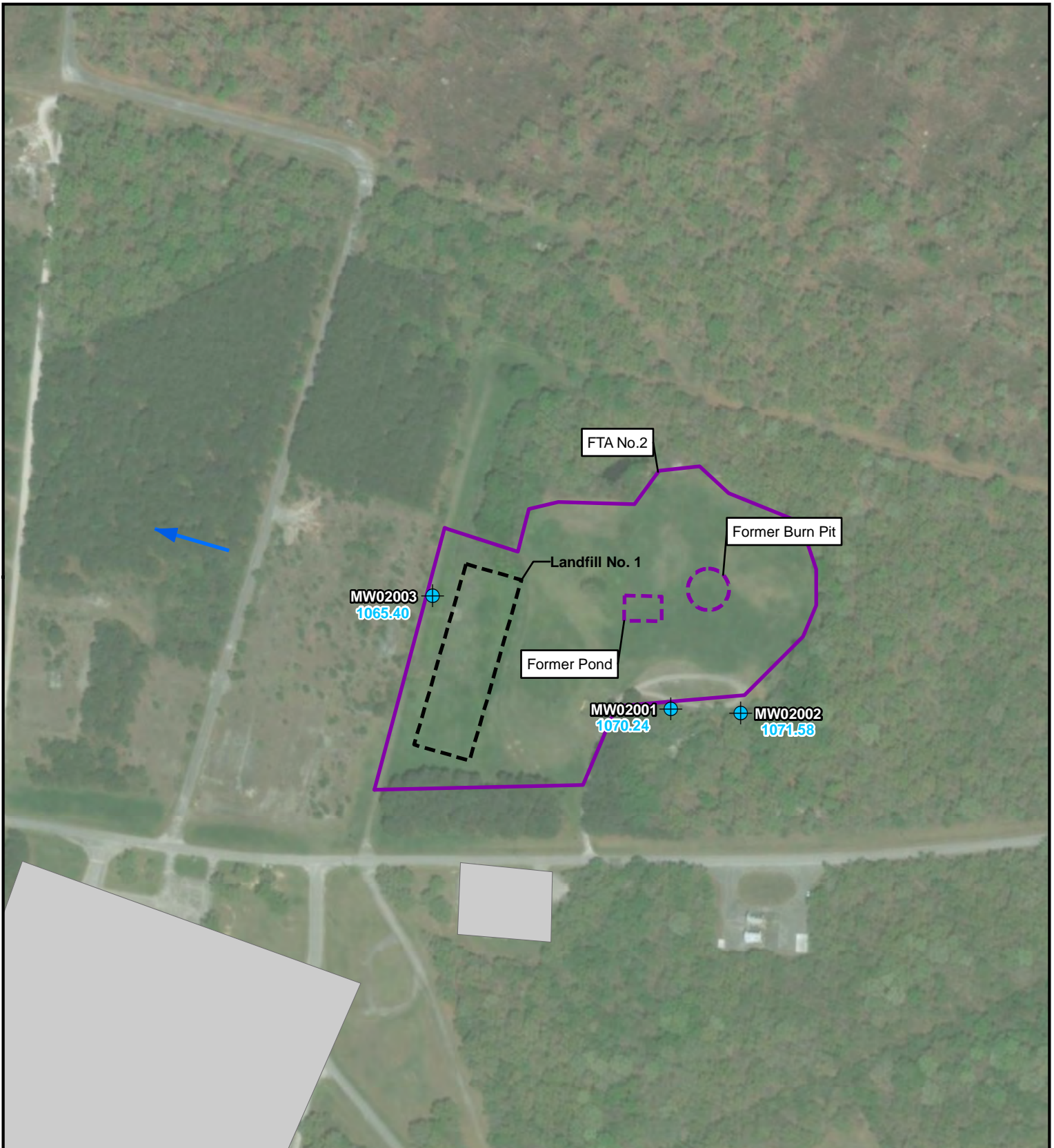
Date: 4/27/2018





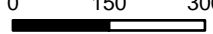
0 40 80 Feet

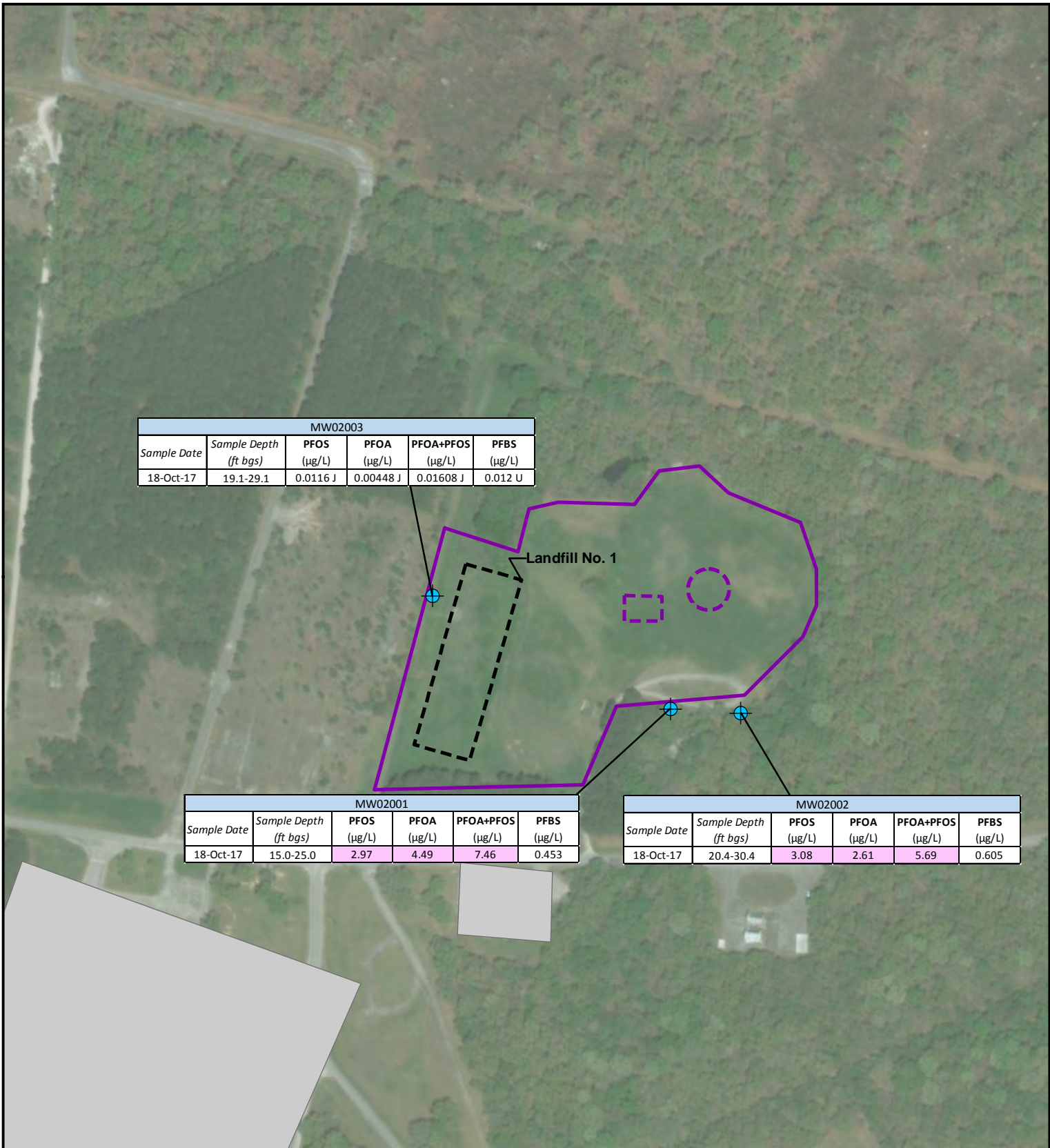
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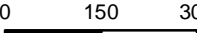
Source: Esri, DigitalGlobe, GeoEye,
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Release Areas
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<p>Air Force Civil Engineer Center  2261 Hughes Ave., Suite 163 JBSA Lackland, TX 78236</p>	<p>Symbol Key</p> <ul style="list-style-type: none">  Temporary Monitoring Well 1065.40 October 2017 Groundwater Elevations (ft asml)  Approximate Groundwater Flow Direction  AFFF Release Area 	<p>FIGURE 3.2-1 Sampling Locations and Groundwater Elevations FTA No. 2 AFFF Release Area 2 Arnold Air Force Base Manchester, Tennessee</p>
<p>Project: 775303101</p> <p>By: EMK Date: 5/10/2018</p> <p>0 150 300 Feet</p> 	<p>Disclaimer: For general reference purposes only. This is not a survey product. DO NOT USE to determine, certify, or verify map features, scale and/or other information.</p> <p>Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community</p>	<p>Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide Site Inspection Report</p>



<p>Air Force Civil Engineer Center  2261 Hughes Ave., Suite 163 JBSA Lackland, TX 78236</p>	<p>Symbol Key</p> <ul style="list-style-type: none">  Temporary Monitoring Well  AFFF Release Area 	<p>FIGURE 3.2-2 PFAS in Groundwater FTA No. 2 AFFF Release Area 2 Arnold Air Force Base Manchester, Tennessee</p>
<p>Project: 775303101 By: EMK Date: 4/27/2018</p> <p>0 150 300 Feet</p> 	<p>Disclaimer: For general reference purposes only. This is not a survey product. DO NOT USE to determine, certify, or verify map features, scale and/or other information.</p> <p>Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community</p>	<p>Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide Site Inspection Report</p>



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Project: 775303101

By: EMK

Date: 5/10/2018

0 50 100 Feet

Symbol Key

-  Temporary Monitoring Well
-  Approximate Groundwater Flow Direction
-  AFFF Release Area

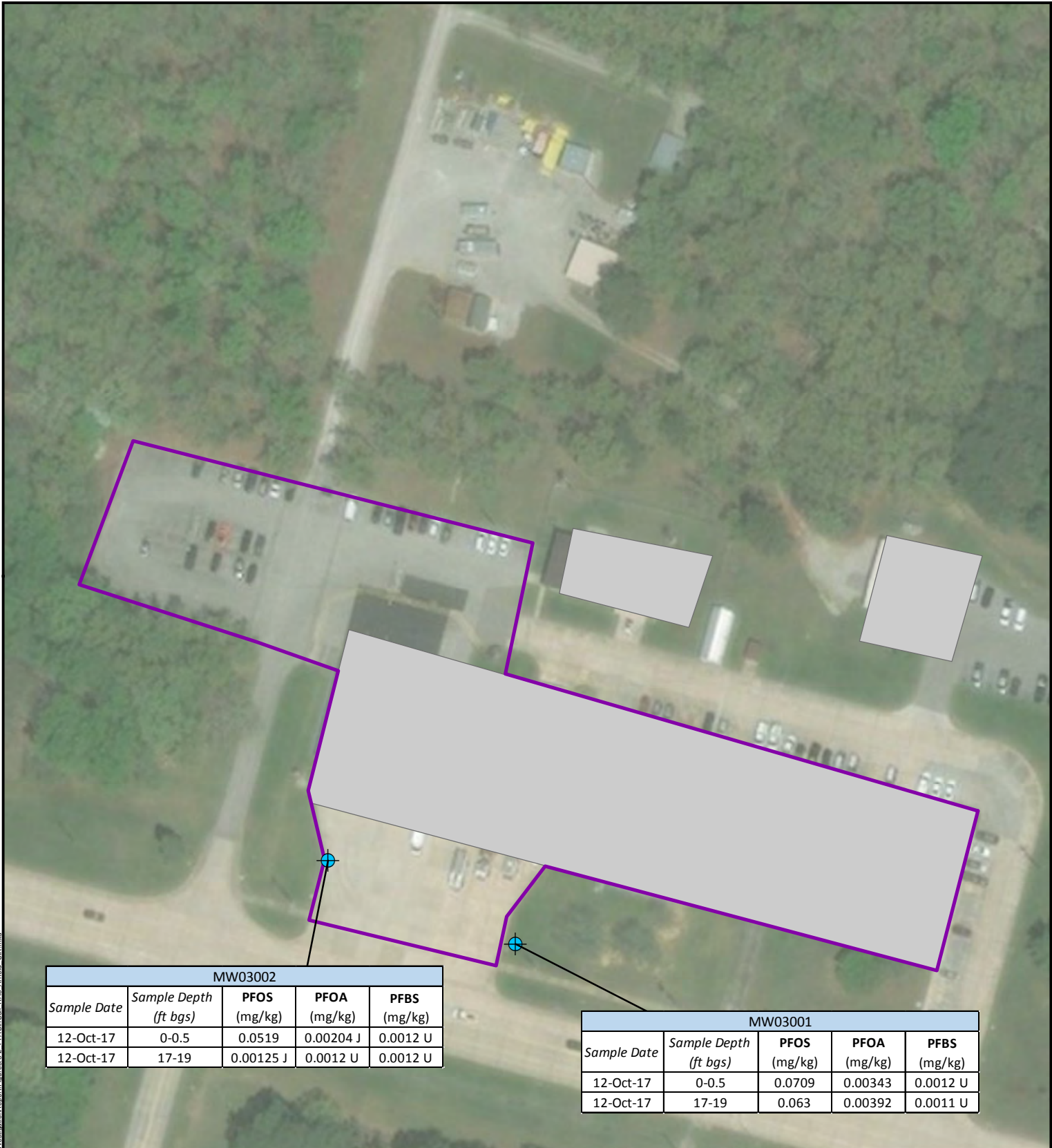
1066.69 October 2017 Groundwater Elevations (ft asml)

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

FIGURE 3.3-1
Sampling Locations and
Groundwater Elevations
Fire Station 1 (Building 251)
AFFF Release Area 3
Arnold Air Force Base
Manchester, Tennessee

Site Inspection of Aqueous
Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report



MW03002				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
12-Oct-17	0-0.5	0.0519	0.00204 J	0.0012 U
12-Oct-17	17-19	0.00125 J	0.0012 U	0.0012 U

MW03001				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
12-Oct-17	0-0.5	0.0709	0.00343	0.0012 U
12-Oct-17	17-19	0.063	0.00392	0.0011 U

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Symbol Key

- Temporary Monitoring Well
- AFFF Release Area

**FIGURE 3.3-2
PFAS in Soil
Fire Station 1 (Building 251)
AFFF Release Area 3
Arnold Air Force Base
Manchester, Tennessee**

Project: 775303101

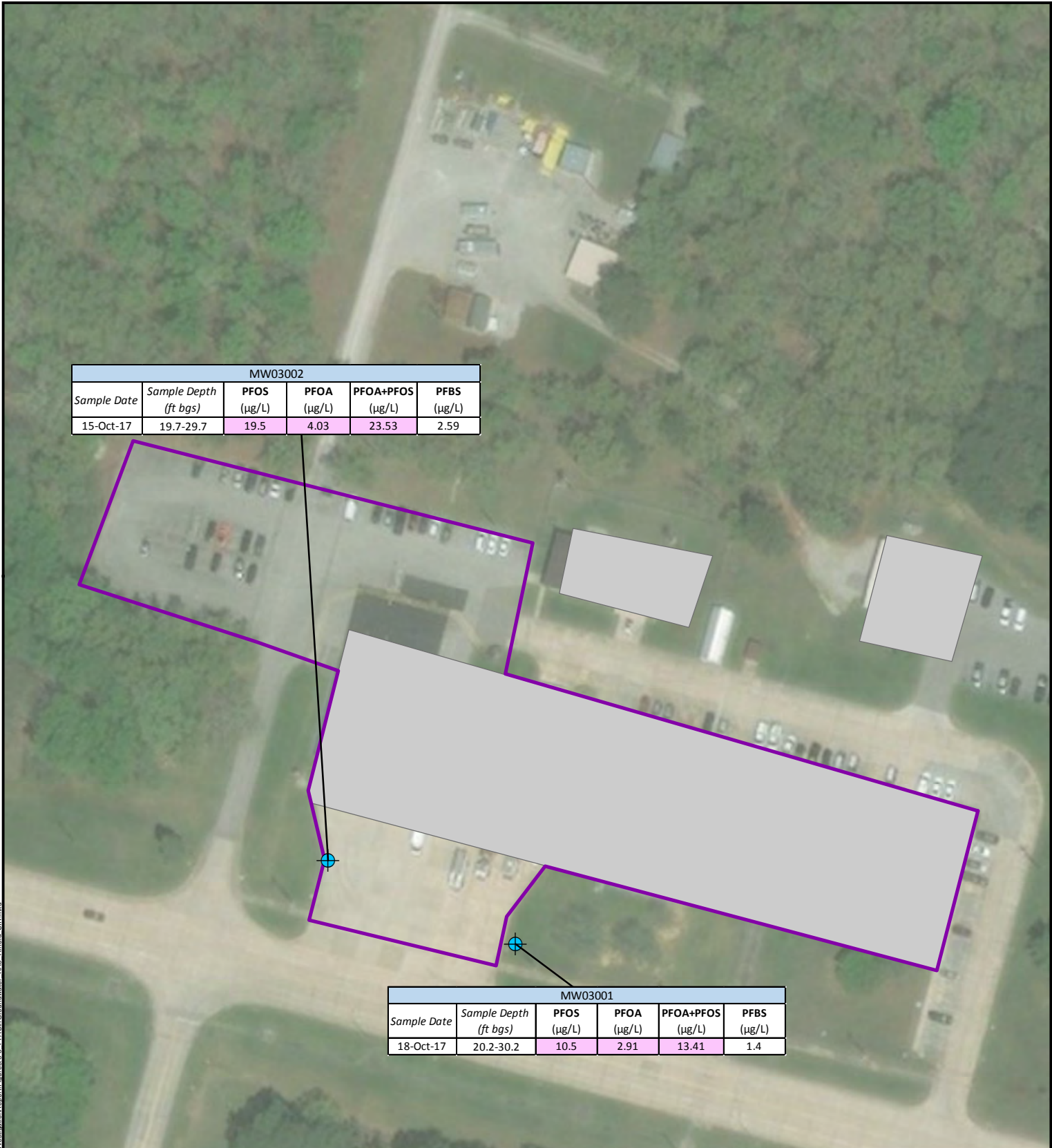
By: EMK Date: 4/27/2018

0 50 100 Feet

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Environmental Programs Worldwide
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MW03002					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOA+PFOS (µg/L)	PFBS (µg/L)
15-Oct-17	19.7-29.7	19.5	4.03	23.53	2.59

MW03001					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOA+PFOS (µg/L)	PFBS (µg/L)
18-Oct-17	20.2-30.2	10.5	2.91	13.41	1.4

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Symbol Key

- Temporary Monitoring Well
- AFFF Release Area

**FIGURE 3.3-3
PFAS in Groundwater
Fire Station 1 (Building 251)
AFFF Release Area 3
Arnold Air Force Base
Manchester, Tennessee**



Project: 775303101

By: EMK

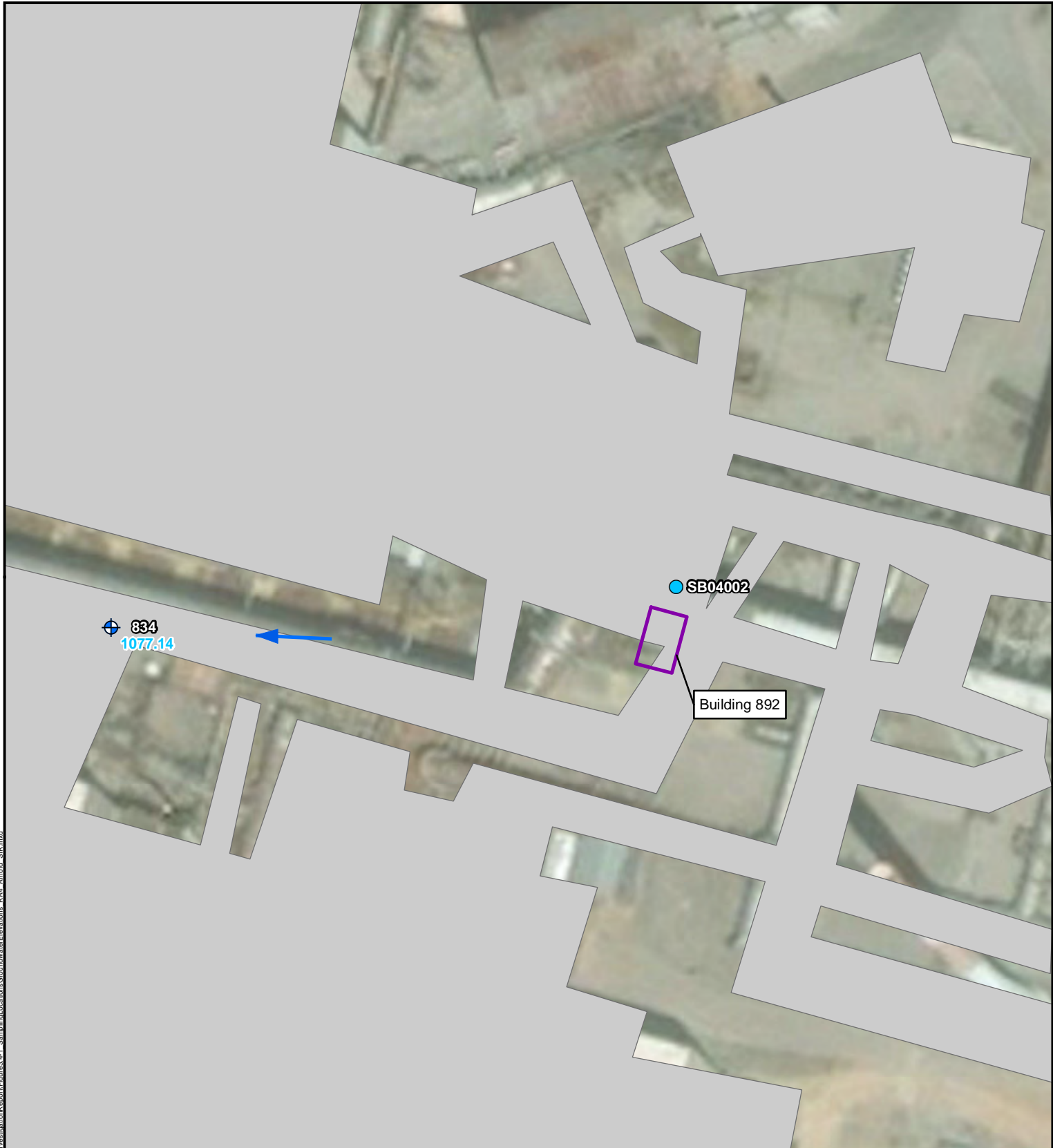
Date: 4/27/2018

0 50 100 Feet

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Project: 775303101

By: EMK

Date: 5/10/2018



0 25 50 Feet

Symbol Key

- Soil Boring
- ⊕ Existing Monitoring Well
- ➔ Approximate Groundwater Flow Direction

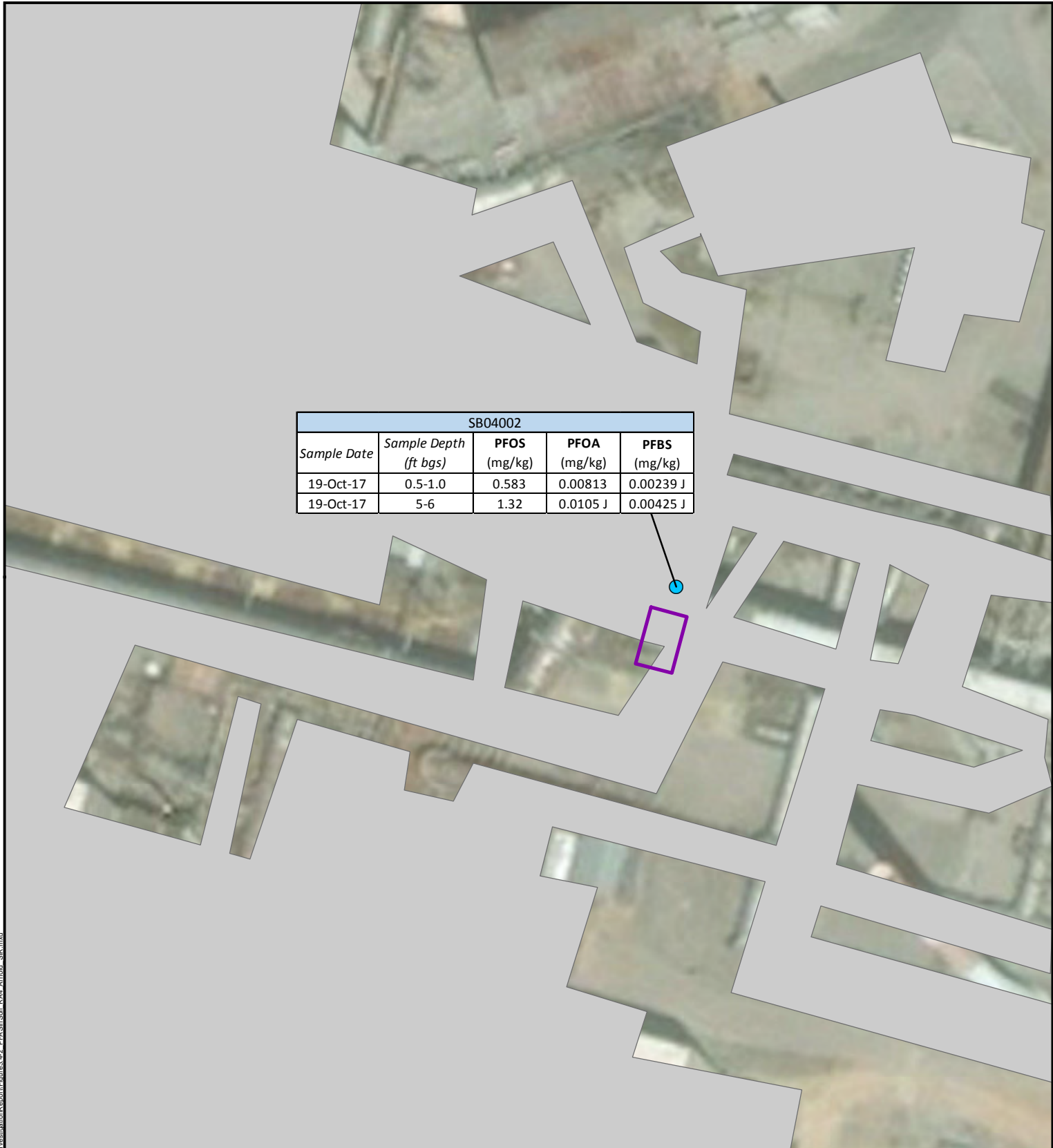
AFFF Release Area
1077.14 October 2017 Groundwater Elevation (ft asml)

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

FIGURE 3.4-1
Sampling Locations and
Groundwater Elevations
Building 892
AFFF Release Area 4
Arnold Air Force Base
Manchester, Tennessee

Site Inspection of Aqueous
Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report



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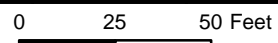
Symbol Key

- Soil Boring
- AFFF Release Area

**FIGURE 3.4-2
PFAS in Soil
Building 892
AFFF Release Area 4
Arnold Air Force Base
Manchester, Tennessee**



Project: 775303101
By: EMK Date: 4/27/2018



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Symbol Key

- Existing Monitoring Well
- AFFF Release Area

**FIGURE 3.4-3
PFAS in Groundwater
Building 892
AFFF Release Area 4
Arnold Air Force Base
Manchester, Tennessee**



Project: 775303101

By: EMK

Date: 4/27/2018

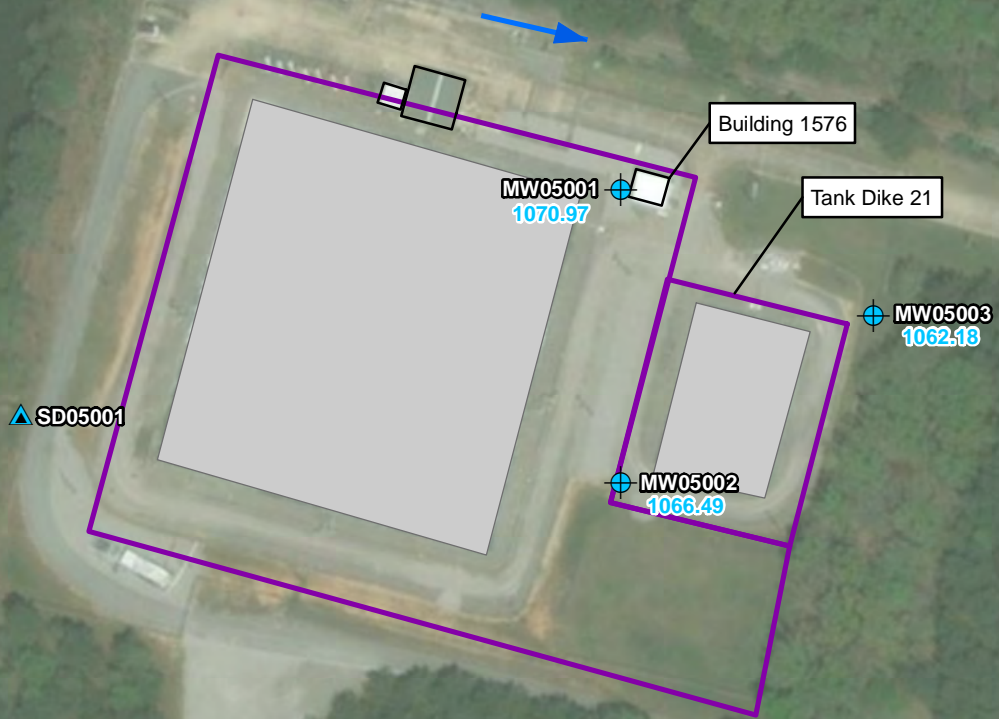
0 25 50 Feet

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**Site Inspection of Aqueous
Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report**

Retention Reservoir



Path: \\arc451\proj\GIS\75303101_AFFFC_EPFCArmedMW05\SiteInvestigationReport\Figure3.5-1_SamplingLocationsGroundwaterElevations_RAS_ArcMap_SIR.mxd

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Project: 775303101

By: EMK

Date: 5/10/2018



0 75 150 Feet

Symbol Key

- Sediment Sample
- Temporary Monitoring Well
- Approximate Groundwater Flow Direction

AFFF Release Area
1062.18 October 2017 Groundwater Elevations (ft asml)

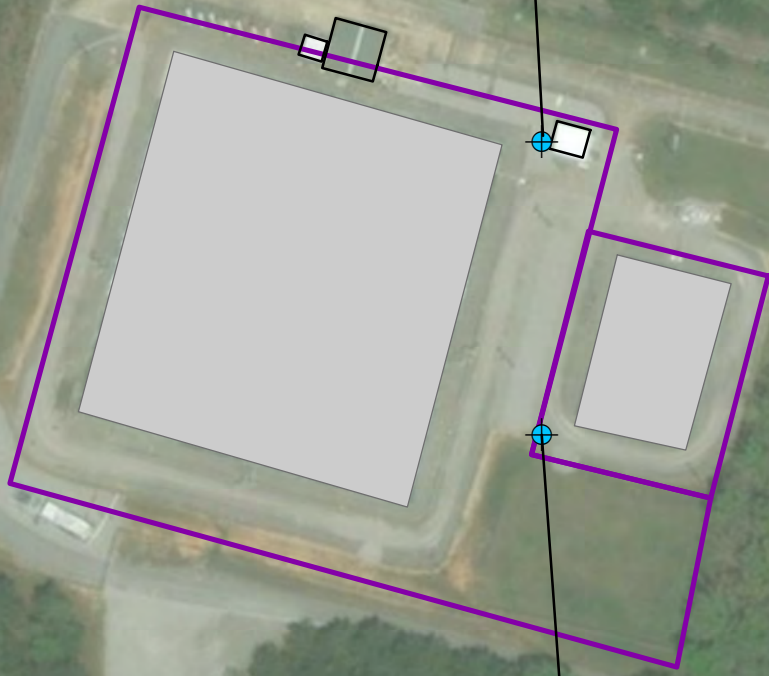
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 3.5-1
Sampling Locations and Groundwater Elevations Building 1576 and Tank Dike 21 AFFF Release Area 5 Arnold Air Force Base Manchester, Tennessee

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Environmental Programs Worldwide Site Inspection Report

MW05001				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
19-Oct-17	1-1.5	0.00501	0.0011 U	0.0011 U
19-Oct-17	12-14	0.00393	0.0013 U	0.0013 U



MW05002				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
19-Oct-17	0-0.5	0.00174 J	0.0012 U	0.0012 U
19-Oct-17	12-14	0.0012 U	0.0012 U	0.0012 U

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Symbol Key



-  Temporary Monitoring Well
-  AFFF Release Area

FIGURE 3.5-2
PFAS in Soil
Building 1576 and Tank Dike 21
AFFF Release Area 5
Arnold Air Force Base
Manchester, Tennessee

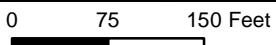
Project: 775303101

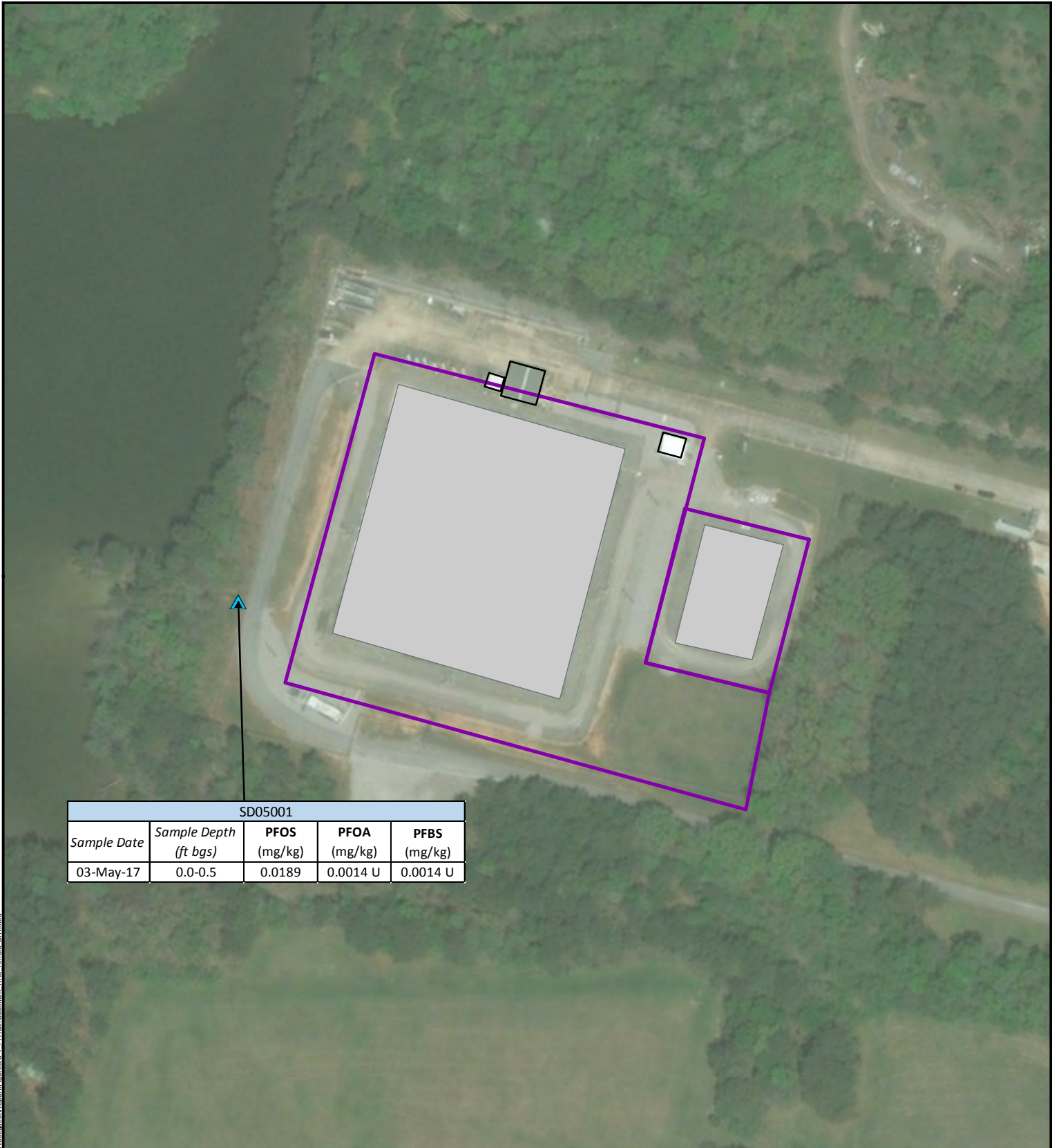
By: EMK Date: 4/27/2018

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Source: Esri, DigitalGlobe, GeoEye,
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Site Inspection of Aqueous
Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report





SD05001				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
03-May-17	0.0-0.5	0.0189	0.0014 U	0.0014 U

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2261 Hughes Ave., Suite 163
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Symbol Key

- Sediment Sample
- AFFF Release Area

FIGURE 3.5-4
PFAS in Sediment
Building 1576 and Tank Dike 21
AFFF Release Area 5
Arnold Air Force Base
Manchester, Tennessee



Project: 775303101

By: EMK

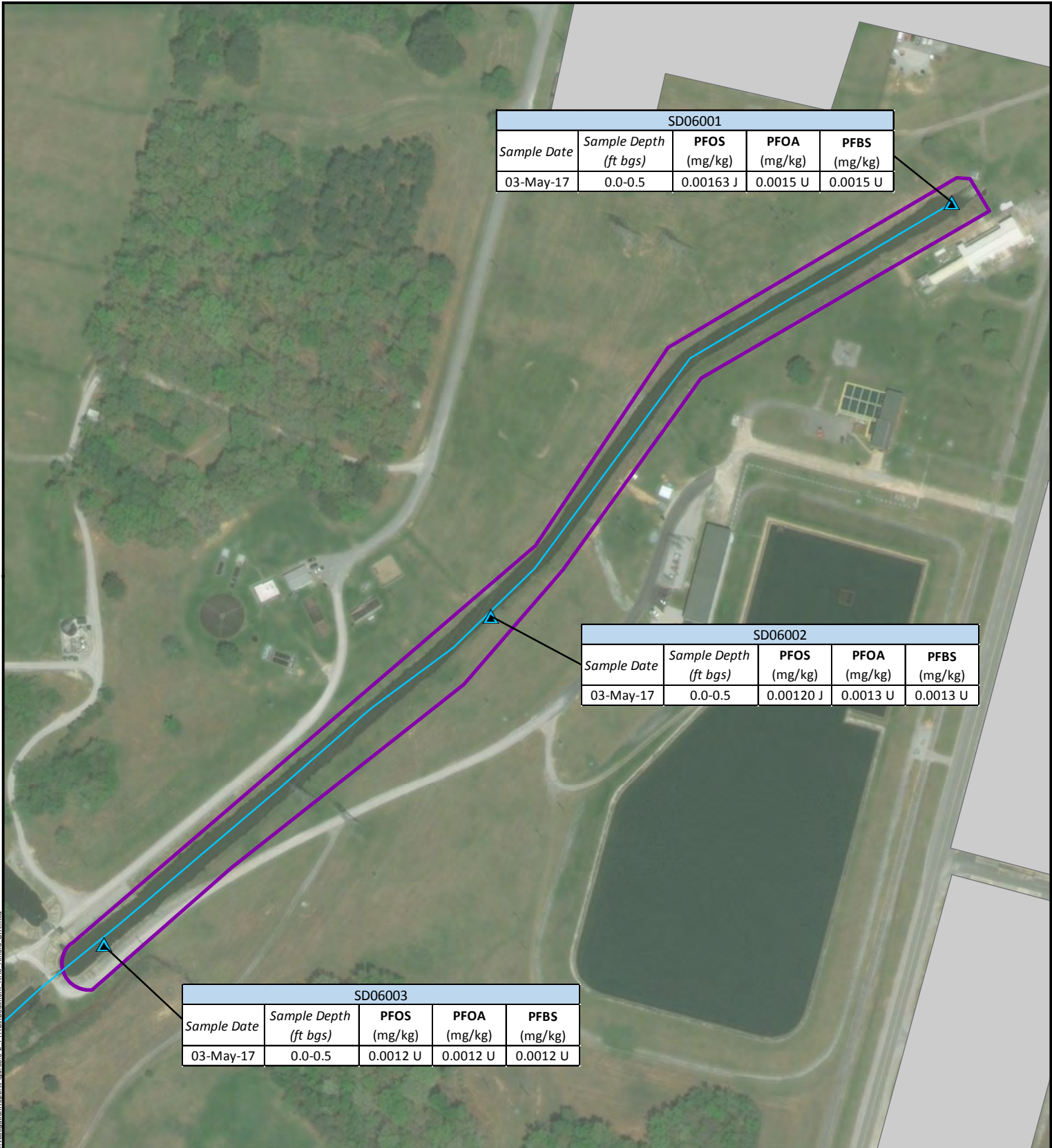
Date: 4/27/2018

0 75 150 Feet


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Source: Esri, DigitalGlobe, GeoEye,
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Site Inspection of Aqueous
Film Forming Foam (AFFF)
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Project: 775303101
 By: EMK Date: 5/10/2018

0 125 250 Feet

Symbol Key

-  Sediment Sample
-  Stream
-  AFFF Release Area

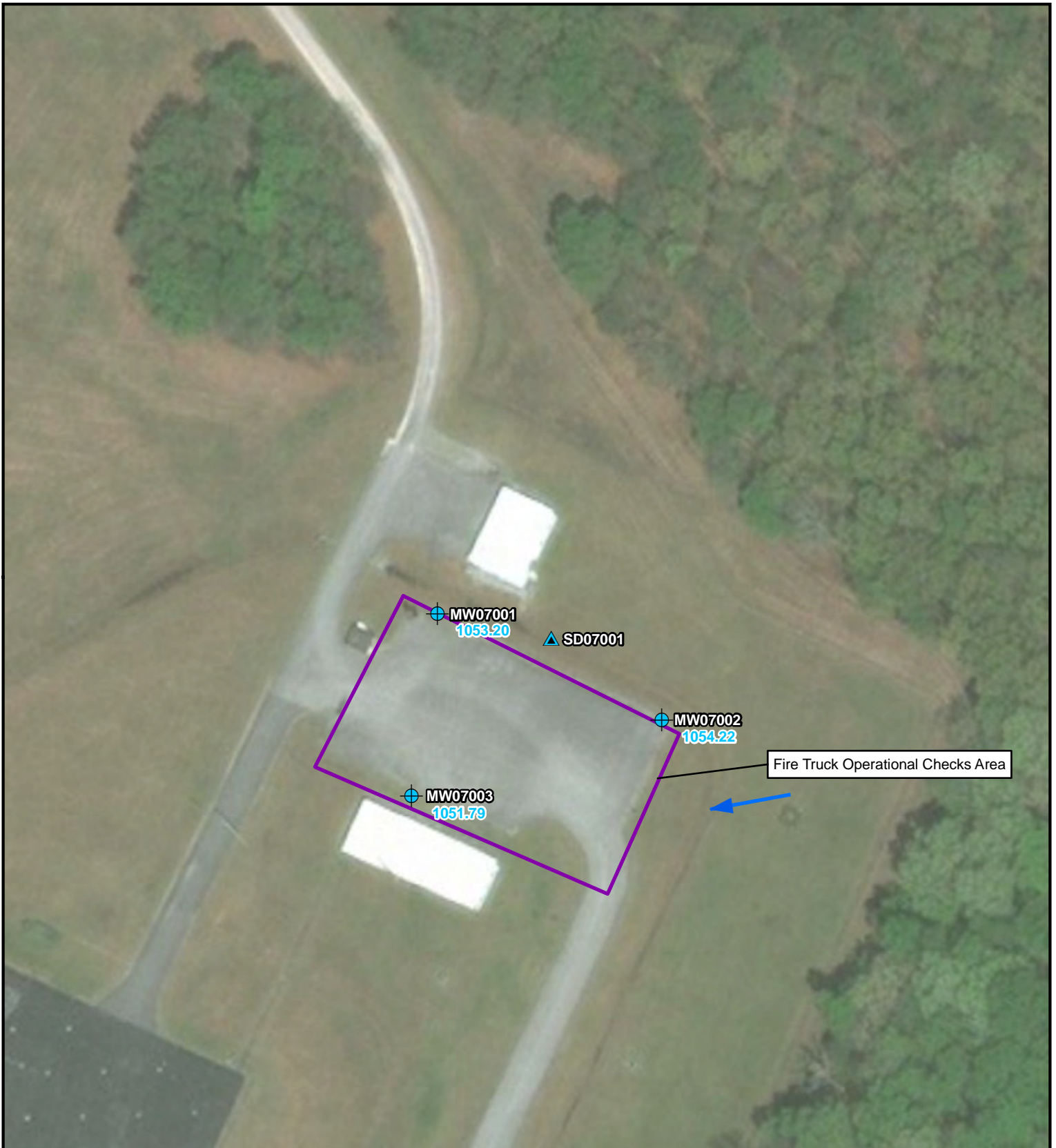
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FIGURE 3.6-2
PFAS in Sediment
Return Ditch
AFFF Release Area 6
Arnold Air Force Base
Manchester, Tennessee

Site Inspection of Aqueous
Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

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Project: 775303101

By: EMK Date: 5/9/2018

0 40 80 Feet

Symbol Key

- Temporary Monitoring Well
- Sediment Sample
- Approximate Groundwater Flow Direction
- AFFF Release Area

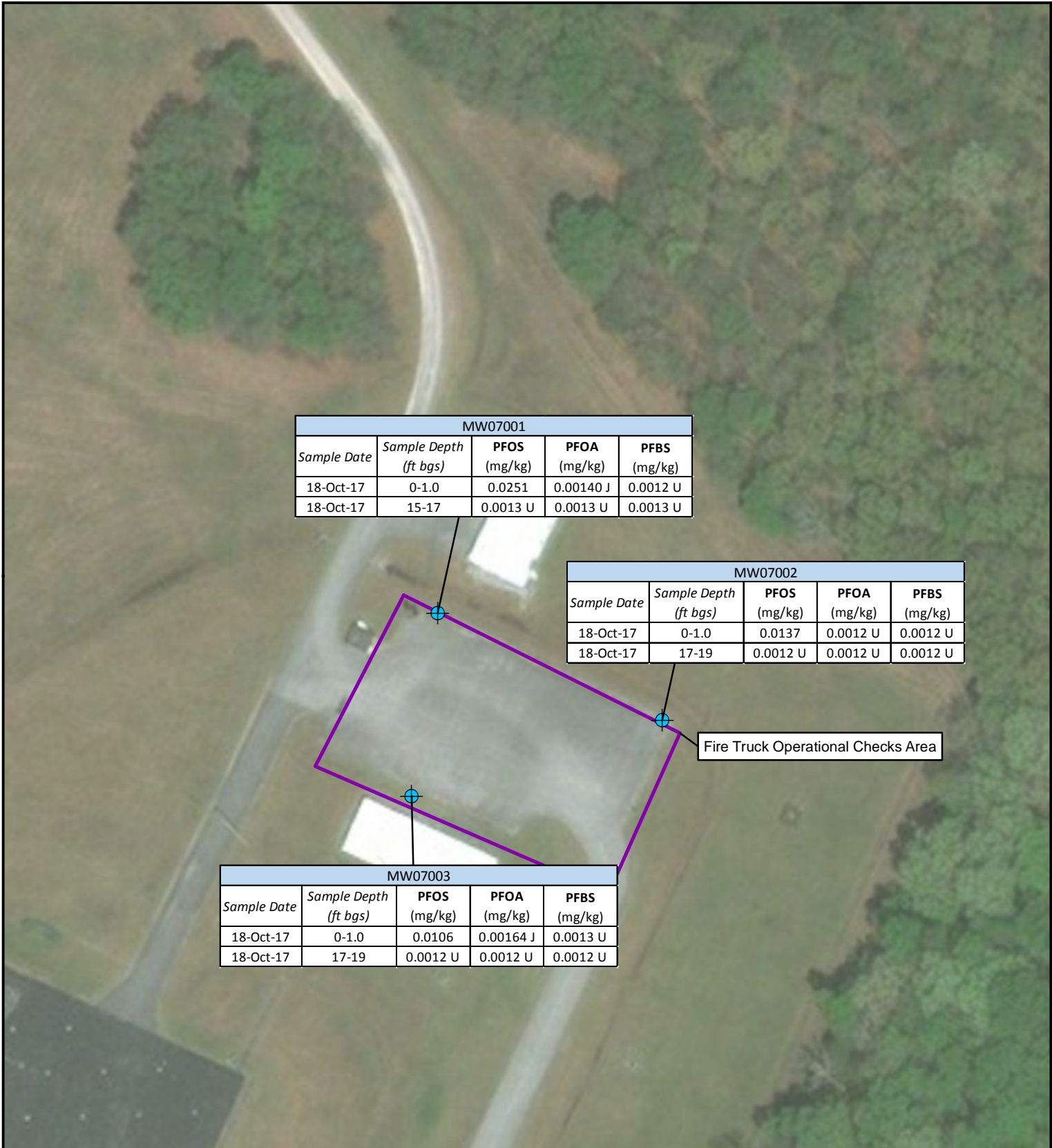
1053.20 October 2017 Groundwater Elevations (ft asml)

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

FIGURE 3.7-1
 Sampling Locations and
 Groundwater Elevations
 Fire Truck Operational Checks Area
 AFFF Release Area 7
 Arnold Air Force Base
 Manchester, Tennessee

**Site Inspection of Aqueous
 Film Forming Foam (AFFF)
 Release Areas**
 Environmental Programs Worldwide
 Site Inspection Report




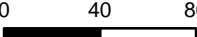


MW07001				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
18-Oct-17	0-1.0	0.0251	0.00140 J	0.0012 U
18-Oct-17	15-17	0.0013 U	0.0013 U	0.0013 U

MW07002				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
18-Oct-17	0-1.0	0.0137	0.0012 U	0.0012 U
18-Oct-17	17-19	0.0012 U	0.0012 U	0.0012 U

Fire Truck Operational Checks Area

MW07003				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
18-Oct-17	0-1.0	0.0106	0.00164 J	0.0013 U
18-Oct-17	17-19	0.0012 U	0.0012 U	0.0012 U

 <p>Air Force Civil Engineer Center 2261 Hughes Ave., Suite 163 JBSA Lackland, TX 78236</p>	<p>Symbol Key</p> <ul style="list-style-type: none">  Temporary Monitoring Well  AFFF Release Area 	<p>FIGURE 3.7-2 PFAS in Soil Fire Truck Operational Checks Area AFFF Release Area 7 Arnold Air Force Base Manchester, Tennessee</p>
	<p>Project: 775303101</p> <p>By: EMK Date: 4/27/2018</p> <p>0 40 80 Feet</p> <p></p>	



MW07001					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOA+PFOS (µg/L)	PFBS (µg/L)
19-Oct-17	19.2-29.2	1.02	0.132	1.152	0.0468

MW07002					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOA+PFOS (µg/L)	PFBS (µg/L)
20-Oct-17	20.0-30.0	5.36	0.365	5.725	0.193

MW07003					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOA+PFOS (µg/L)	PFBS (µg/L)
19-Oct-17	19.8-29.9	0.0439	0.0155 J	0.0594 J	0.012 U

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Symbol Key

- Temporary Monitoring Well
- AFFF Release Area

FIGURE 3.7-3
PFAS in Groundwater
Fire Truck Operational Checks Area
AFFF Release Area 7
Arnold Air Force Base
Manchester, Tennessee



Project: 775303101

By: EMK

Date: 4/27/2018

0 40 80 Feet

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Film Forming Foam (AFFF)
Release Areas
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Site Inspection Report



Air Force Civil Engineer Center



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Symbol Key



-  Sediment Sample
-  AFFF Release Area

FIGURE 3.7-4
PFAS in Sediment
Fire Truck Operational Checks Area
AFFF Release Area 7
Arnold Air Force Base
Manchester, Tennessee



Project: 775303101

By: EMK

Date: 4/27/2018

0 40 80 Feet



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Project: 775303101
 By: EMK Date: 5/11/2018

0 75 150 Feet

Symbol Key

- Temporary Monitoring Well
- Existing Monitoring Well
- Approximate Groundwater Flow Direction
- AFFF Release Area
- 1027.28 November 2017 Groundwater Elevation (ft asml)
- 1063.26 October 2017 Groundwater Elevation (ft asml)
- * - Well screened in deeper Manchester Aquifer
- ** - Insufficient water for measurement

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

FIGURE 3.8-1
Sampling Locations and
Groundwater Elevations
Current FTA
AFFF Release Area 8
Arnold Air Force Base
Manchester, Tennessee

Site Inspection of Aqueous
Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report

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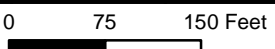


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By: EMK

Date: 5/10/2018



Symbol Key

- Temporary Monitoring Well
- Existing Monitoring Well
- Approximate Groundwater Flow Direction
- AFFF Release Area
- 1027.28 November 2017 Groundwater Elevation (ft asml)
- 1063.26 October 2017 Groundwater Elevation (ft asml)

* - Well screened in deeper Manchester Aquifer

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Source: Esri, DigitalGlobe, GeoEye,
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USDA, USGS, AeroGRID, IGN, and the
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FIGURE 3.8-1
Sampling Locations and
Groundwater Elevations
Current FTA
AFFF Release Area 8
Arnold Air Force Base
Manchester, Tennessee

Site Inspection of Aqueous
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MW08001				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
17-Oct-17	0-0.5	0.115	0.00112 J	0.0011 U
17-Oct-17	17-19	0.0011 U	0.0011 U	0.0011 U





MW08002				
Sample Date	Sample Depth (ft bgs)	PFOS (mg/kg)	PFOA (mg/kg)	PFBS (mg/kg)
17-Oct-17	0-0.5	0.0613	0.00107 J	0.0011 U
17-Oct-17	14-16	0.0101	0.0011 U	0.0011 U

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Symbol Key

-  Temporary Monitoring Well
-  AFFF Release Area

**FIGURE 3.8-2
PFAS in Soil
Current FTA
AFFF Release Area 8
Arnold Air Force Base
Manchester, Tennessee**



Project: 775303101

By: EMK

Date: 4/27/2018


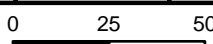
0 75 150 Feet

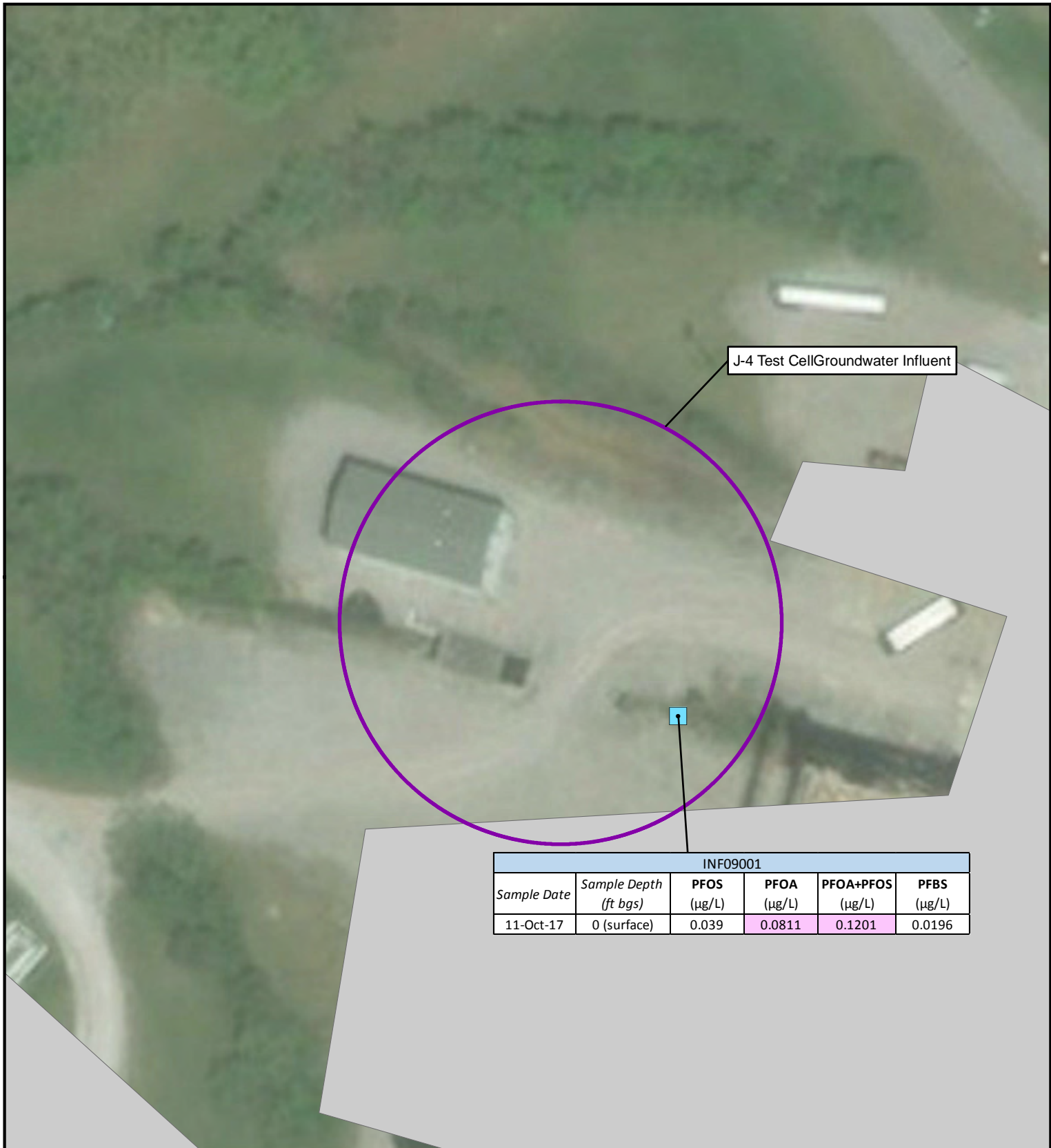
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Film Forming Foam (AFFF)
Release Areas
Environmental Programs Worldwide
Site Inspection Report**



<p>Air Force Civil Engineer Center</p>  <p>2261 Hughes Ave., Suite 163 JBSA Lackland, TX 78236</p>	<p>Symbol Key</p> <ul style="list-style-type: none"> Influent Sample Surface Water Drainage Approximate Groundwater Flow Direction AFFF Release Area 	<p align="center">FIGURE 3.9-1 Sampling Locations J-4 Test Cell Groundwater Extraction System AFFF Release Area 9 Arnold Air Force Base Manchester, Tennessee</p>
<p>Project: 775303101</p> <p>By: EMK Date: 5/9/2018</p> <p>0 25 50 Feet</p> 	<p><small>Disclaimer: For general reference purposes only. This is not a survey product. DO NOT USE to determine, certify, or verify map features, scale and/or other information.</small></p> <p><small>Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community</small></p>	<p align="center">Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas Environmental Programs Worldwide Site Inspection Report</p>



J-4 Test Cell Groundwater Influent

INFO9001					
Sample Date	Sample Depth (ft bgs)	PFOS (µg/L)	PFOA (µg/L)	PFOA+PFOS (µg/L)	PFBS (µg/L)
11-Oct-17	0 (surface)	0.039	0.0811	0.1201	0.0196

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Symbol Key

- Influent Sample
- AFFF Release Area

FIGURE 3.9-2
PFAS in Groundwater
J-4 Test Cell Groundwater
Extraction System
AFFF Release Area 9
Arnold Air Force Base
Manchester, Tennessee



Project: 775303101

By: EMK

Date: 5/9/2018

0 25 50 Feet

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FIGURE 4.2-1
Manchester Aquifer Groundwater Flow
Arnold Air Force Base
Manchester, Tennessee

Site Inspection of Aqueous
 Film Forming Foam (AFFF)
 Release Areas
 Environmental Programs Worldwide
 Site Inspection Report

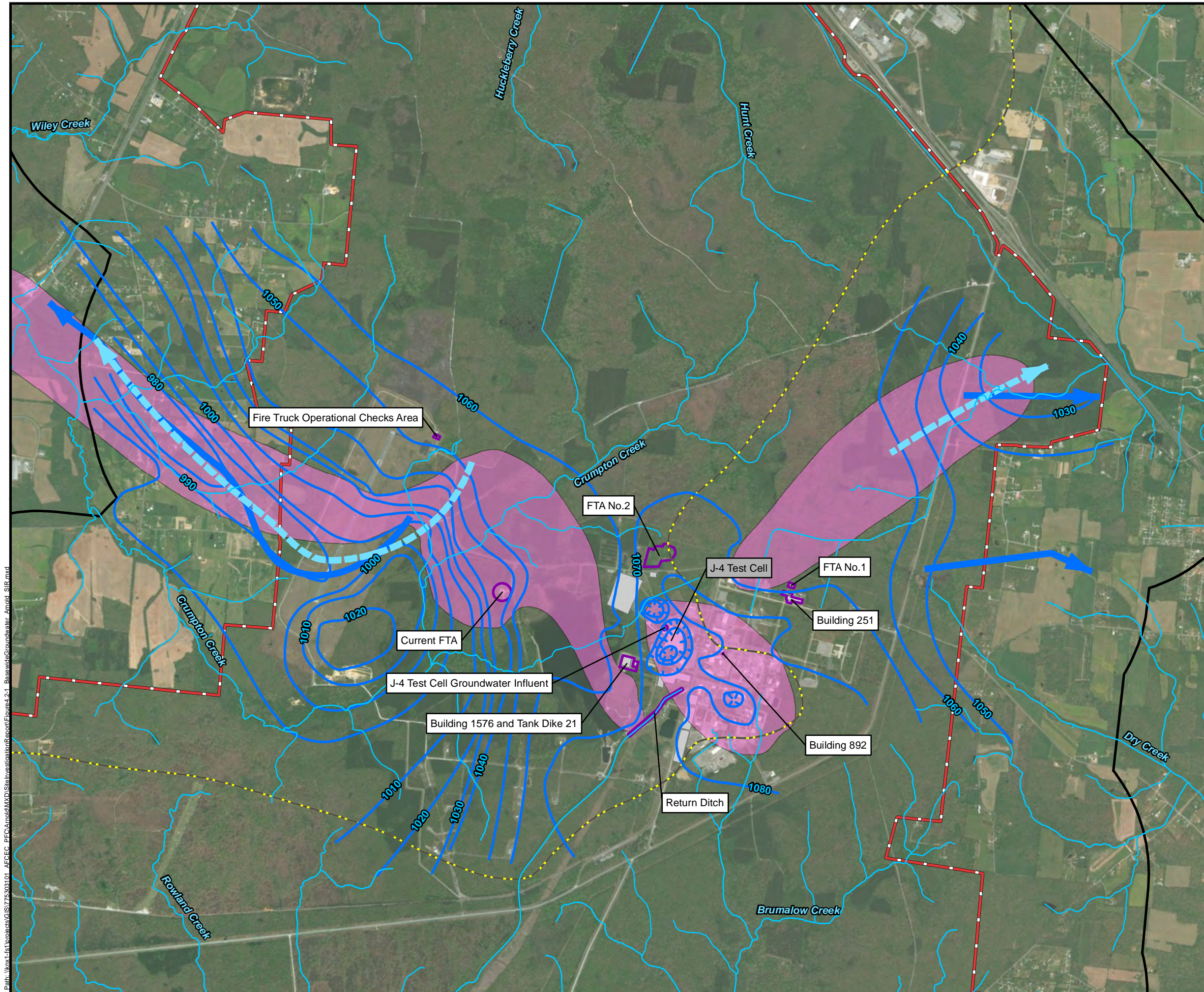
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Symbol Key

- Streams
- Approximate 2016 Groundwater Contours (CH2M, 2016)
- Groundwater Trough (USGS, 2011)
- Interpreted Groundwater Trough (Based on CH2M 2016 Contours)
- Regional Groundwater Divide (USGS, 2011)
- AFFF Release Area
- Arnold AFB Installation Boundary
- Search Area (1-mile from Arnold AFB Installation Boundary)
- Groundwater Chlorinated VOC Contaminant Plume (USGS, 2011)

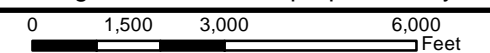


Project: 775303101

By: MV, EMK

Date: 5/17/2018

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FIGURE 4.2-2
Desktop 4-mile Water Well Review Results
(All Wells)
Arnold Air Force Base
Manchester, Tennessee

Site Inspection of Aqueous
 Film Forming Foam (AFFF)
 Release Areas
 Environmental Programs Worldwide
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Air Force Civil Engineer Center



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Symbol Key

- 500 Map Reference Number
- Residential Well
- Municipal Well
- Farm Well; Irrigation Well
- Heat Pump Well
- Industrial Well
- Unknown / Other Well
- Cross-gradient to Upgradient Wells
- Yellow shaded area Potentially impacted groundwater in downgradient direction
- Blue arrow Groundwater Trough (USGS, 2011)
- Light blue arrow Interpreted Groundwater Trough (Based on CH2M 2016 Contours)
- Black dashed line Regional Groundwater Divide (USGS, 2011)
- Pink shaded area Groundwater Chlorinated VOC Contaminant Plume (USGS, 2011)
- Black dashed line Search Area (1-mile from Arnold AFB Installation Boundary)
- Green dashed line Search Area (4-mile from Arnold AFB Installation Boundary)
- Purple shaded area AFFF Release Area
- Red dashed line Arnold AFB Installation Boundary

Well Source: Tennessee Department of Environment and Conservation, Department of Water Resources.

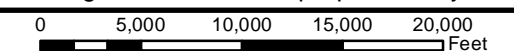


Project: 775303101

By: EMK

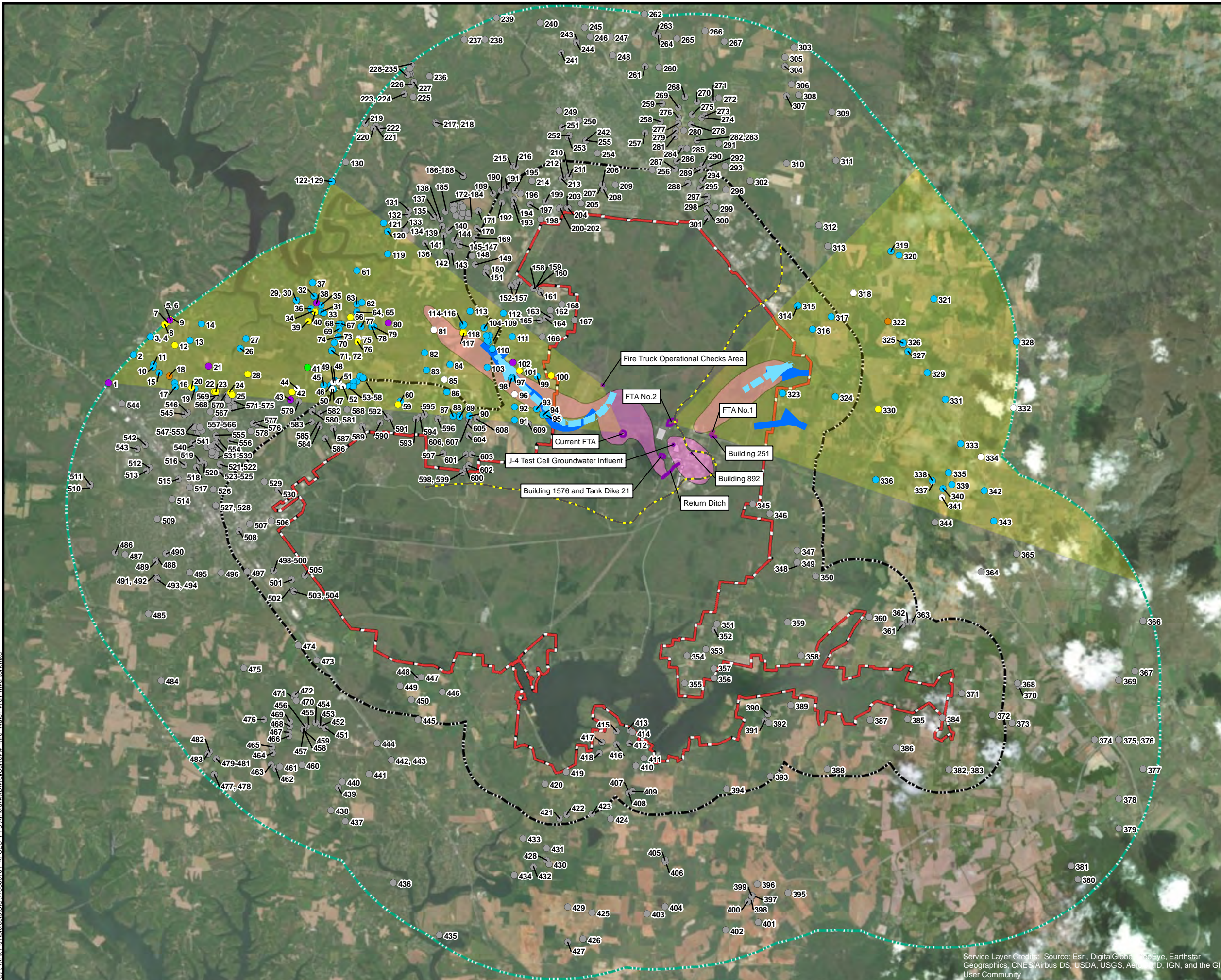
Date: 5/22/2018

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Key to Figure 4.2-2 (Arnold AFB)
 Desktop 4-mile Water Well Review Results (All Wells)
 Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
 Site Inspection Report, Arnold Air Force Base, Tennessee

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
1	20014238	352357	861443	288 FLOWERTOWN RD	GOLDEN, KENT	Heat Pump	126	2001-10-03
2	03100052	352427	861415	Not Provided	BRAZIER W	Residential	107	1963-12-10
3	03100088	352435	861408	Not Provided	HILL E	Residential	78	1964-05-26
4	98003855	352456	861339	398 HICKORY RIDGE	RIGNEY, MARK W	Residential	93	1998-08-28
5	20062567	352500	861328	502 HICKORY RIDGE LN	SCOTT GREGORY CONST	Heat Pump	95	2006-06-19
6	20081908	352500	861329	502 HICKORY RIDGE LN	BARTON, EDDIE	Heat Pump	300	2008-06-14
7	20014233	352458	861332	472 HICKORY RIDGE RD	HALL, JEFF	Irrigation	125	2001-09-26
8	20073797	352449	861329	114 HUNTERS RIDGE RD.	GRANTHAM, MARK	Irrigation	70	2007-09-13
9	20074953	352502	861329	502 HICKORY RIDGE	BARTON, SUZZANNE & EDDIE	Irrigation	195	2007-11-17
10	20121417	352416	861353	1221 RILEY CREEK RD	JONES, RANDY	Residential	111	2012-05-15
11	20074318	352419	861352	1285 RILEY CREEK RD	REED, ALLEN	Residential	112	2007-09-11
12	20033202	352438	861326	664 OVOCA LAKE RD	DAVENPORT, DAVID	Residential	120	2003-09-25
13	03100045	352443	861307	Not Provided	PITTS J	Residential	57	1964-02-06
14	03100046	352500	861253	Not Provided	BRANNON A	Residential	56	1964-02-03
15	03100051	352410	861345	Not Provided	BYRON O	Residential	82	1963-12-28
16	03100238	352400	861326	Not Provided	JOLLY R	Residential	65	1965-12-28
17	03100441	352356	861325	Not Provided	MANN F	Residential	66	1967-11-04
18	20074125	352407	861333	125 PARKWAY RD	STUBBLEFIELD, JAMES	Industrial	140	2007-08-15
19	03100397	352354	861301	Not Provided	LALCOB T	Residential	65	1967-06-06
20	20074957	352355	861305	310 SOMERSET LANE	JOHNSON, CHARLES	Irrigation	65	2007-11-26
21	20022155	352417	861244	2321 OVOCA RD	COLLIER, MARSORIE	Heat Pump	140	2002-06-19
22	20073479	352351	861237	308 SETTERS LANE W	TAYLOR, JAMES	Irrigation	107	2007-08-17
23	20082541	352351	861235	306 SETTERS LANE W	ERIC JONES CONSTRUCTION	Irrigation	104	2008-06-17
24	20074955	352350	861217	105 POINT CIRCLE	ALLERY, PETER	Irrigation	41	2007-11-25
25	20092081	352348	861215	101 POINT CIRCLE	RICHISON, WILLIAM	Irrigation	72	2009-07-28
26	03100013	352435	861205	Not Provided	FISHER H	Residential	96	1963-10-03
27	03100382	352445	861158	Not Provided	CLASON J	Residential	220	1967-04-11
28	20022950	352409	861156	225 LAKE HILLS RD	MARVALL, JEFF	Irrigation	140	2002-08-13
29	03100058	352524	861056	Not Provided	GOLD E	Residential	150	1964-01-03
30	03100383	352524	861056	Not Provided	GOLD E	Residential	120	1967-01-31
31	03100188	352512	861025	Not Provided	CARTER R	Residential	63	1965-04-12
32	03100230	352528	861034	Not Provided	HALL F	Residential	81	1965-09-25
33	03100300	352511	861022	Not Provided	SAIN N	Residential	72	1966-06-20
34	03100375	352513	861035	Not Provided	BAINES C	Residential	72	Not Provided
35	03100186	352519	861025	Not Provided	HARRIS C	Residential	82	1965-02-17
36	03101224	352515	861038	Not Provided	MASSINGILL T.	Residential	71	1974-08-23
37	03101937	352542	861036	Not Provided	DUDLEY CHARLES	Residential	102	1981-08-26
38	20110004	352521	861031	197 BLAZIN ACRES	ROSS, SHAWN	Heat Pump	195	2010-11-03
39	20110005	352503	861041	258 DEAN LANE	DEAN, JEFF	Irrigation	195	2010-11-04
40	20151663	352512	861033	591 J.D. NEIL RD	DEAN, JEFF	Irrigation	150	2015-08-24
41	03108003	352416	861042	Not Provided	CITY TULLAHOMA SHORT	Municipal	0	Not Provided
42	20013622	352351	861101	1156 CARTER BLAKE	QUICK, JOEY	Farm	77	2001-08-18
43	20092282	352343	861103	1038 CARTER BLAKE ROAD	RICE, TOM	Heat Pump	195	2009-08-13
44	TN018608	352355	861055	SHORTSPRINGS	ANDERSON, CHARLES	Not Provided	0	
45	97003555	352358	861022	DUKE HOLLOW	MANGRUM, RUSTY	Residential	126	1997-08-16
46	97004466	352358	861013	DUKE HOLLOW 160	DUKE, LARRY	Residential	118	1997-09-20
47	95003977	352354	861010	CARTER 503	MANGRUM, RUSTY	Residential	89	1995-08-12
48	94001756	352403	861008	CARTER LN 444	FULLER, PATRICIA	Residential	80	1994-05-16
49	TN019984	352401	861010	CARTER 85	DUKE	Not Provided	0	Not Provided
50	TN019985	352354	861012	CARTER 451	UNKNOWN35	Not Provided	0	Not Provided
51	TN019987	352401	861003	CARTER 363	PROSS, CHRIS	Not Provided	0	Not Provided
52	TN019988	352357	860958	CARTER 334	TODD, JAMES	Not Provided	0	Not Provided
53	03100455	352357	860950	Not Provided	GHEN L	Residential	86	1968-01-12
54	03100456	352357	860945	Not Provided	CHEA L	Residential	83	1968-01-02
55	03100340	352402	860941	Not Provided	SMITH J	Residential	77	1966-10-17
56	03100453	352401	860945	Not Provided	HOLDER C	Residential	94	1968-03-01
57	03101809	352407	860937	Not Provided	BOWEN W	Residential	85	1981-06-03
58	20031784	352405	860933	930 SEARS ROEBUCK RD	REEVES, AMOS D	Residential	75	2003-07-08
59	20170271	352338	860850	4304 OLD MANCHESTER HWY	GALLET, BARNEY	Irrigation	70	2016-07-25
60	03100343	352342	860847	Not Provided	DANIEL H	Residential	60	1966-08-01
61	03101805	352554	860941	Not Provided	REYNOLDS S	Residential	180	1981-03-25
62	03101715	352522	860935	Not Provided	DOWNS S	Residential	57	1980-07-14
63	03100002	352520	860941	Not Provided	BAKER W	Residential	93	1963-08-09
64	03100034	352512	860941	Not Provided	GILBERT R	Residential	74	1963-11-07
65	03100337	352512	860941	Not Provided	GILBERT R	Residential	85	1966-11-28
66	03101185	352507	860949	Not Provided	GILBERT E.	Farm	142	1974-03-05
67	03102194	352500	861000	Not Provided	SAIN E, NORMAN	Residential	150	1984-07-13
68	03100068	352500	861003	Not Provided	BOYD T	Residential	64	1964-04-27
69	03100143	352455	861003	Not Provided	BOYD L	Residential	73	1964-10-03
70	03100165	352441	861009	Not Provided	LAWSON D	Residential	80	1964-12-17
71	03100184	352433	861012	Not Provided	GHEA C	Residential	70	1965-01-22
72	03100167	352433	861012	Not Provided	GHEA C	Residential	70	1965-01-12
73	03100301	352447	861004	Not Provided	HARRIS R	Residential	117	1966-03-18
74	03100168	352447	861005	Not Provided	NAZARENE CHURCH	Not Provided	80	1964-10-29
75	03101605	352445	860939	Not Provided	CULBERTSON J	Not Provided	66	1979-06-08
76	03101691	352442	860940	Not Provided	GUINN J	Farm	66	1979-08-18
77	03101714	352457	860936	Not Provided	GRAMMER D	Residential	72	1980-07-15
78	03100124	352457	860923	Not Provided	TARWATER H	Residential	82	1964-08-25
79	03100110	352457	860920	Not Provided	BUCHANAN D	Residential	81	1964-06-11
80	20100060	352501	860902	2276 RUTLEDGE FALLS ROAD	KINSER, DON	Heat Pump	90	2009-11-14
81	03101530	352454	860806	Not Provided	WELBORN D	Not Provided	50	1978-06-27
82	03101265	352431	860817	Not Provided	NEEL D	Residential	70	1975-04-26
83	03101934	352413	860815	Not Provided	NEEL CURRY C.	Residential	74	1981-09-26
84	03101707	352419	860746	Not Provided	MELTON N	Residential	60	1980-07-30
85	03102074	352404	860753	HICKERSON STATI	RUTLEDGE FALLS CH.	Other	83	1983-07-21
86	03101685	352351	860750	Not Provided	FORELL J	Residential	65	1979-08-01
87	03100248	352327	860742	Not Provided	BENNET L	Residential	80	1966-04-12
88	03101532	352328	860734	Not Provided	FERRELL F E	Residential	46	1978-06-21
89	94003828	352326	860734	HAWKERSMITH	LUTTRELL, STEVE	Residential	50	1994-09-17
90	96000594	352327	860722	THACKER RD 104	WHITE, RICK	Residential	72	1996-02-13
91	20040080	352323	860626	2458 HAWKER-SMITH RD.	GIVENS, FRANK	Residential	56	2003-12-09
92	03101710	352336	860626	Not Provided	DUGAN D	Residential	64	1980-03-06
93	94003834	352334	860559	HAWKERSMITH	INGRAM, JIMMY	Residential	143	1994-09-21
94	03100470	352328	860551	Not Provided	BLACKBURN J	Residential	113	1967-06-10
95	94000913	352328	860546	HAWKER SMITH	WEST, BERRY	Residential	140	1994-04-02
96	03101699	352349	860626	Not Provided	SANDERS J	Not Provided	61	1979-07-26
97	20001483	352406	860629	1280 BRANDON TOWN RD	DAVIS, EDWARD	Residential	100	2000-02-16
98	20043641	352405	860630	1326 BRANDONTOWN RD.	NORTON, WENDELL	Residential	88	2004-10-05

**Key to Figure 4.2-2 (Arnold AFB)
 Desktop 4-mile Water Well Review Results (All Wells)
 Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
 Site Inspection Report, Arnold Air Force Base, Tennessee**

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
99	03100451	352407	860558	Not Provided	MYERS J	Residential	100	1968-03-09
100	03101322	352408	860541	Not Provided	CARR R.H.	Farm	45	1975-02-11
101	03101580	352413	860620	Not Provided	MYERS J	Farm	137	1979-04-20
102	20090145	352421	860628	1029 BRANDONTOWN ROAD	SCHERROUSE, PETER	Heat Pump	145	2008-11-18
103	03102017	352416	860700	Not Provided	BLAND SHIRLEY	Residential	95	1982-10-23
104	03101575	352456	860704	Not Provided	JONES L	Residential	62	1979-04-06
105	03101356	352448	860657	Not Provided	MYERS D.C.	Residential	86	1976-06-08
106	03101859	352448	860701	Not Provided	UNKNOWN131	Residential	0	Not Provided
107	03101581	352444	860658	Not Provided	DUNCAN J	Residential	87	1979-04-10
108	03101576	352442	860658	Not Provided	LACKEY B W	Residential	98	1979-04-06
109	03101606	352443	860700	Not Provided	CHRISTMAN J	Residential	100	1979-06-08
110	03102025	352435	860654	Not Provided	MCCULLOUGH ROBERT	Residential	55	1982-09-20
111	03101294	352447	860629	Not Provided	PHILLIPS J.	Residential	128	1976-05-03
112	03102004	352511	860640	Not Provided	GILLIAN	Residential	145	1982-06-20
113	03101793	352513	860721	Not Provided	CROY B	Residential	80	1981-02-20
114	03102709	352500	860730	MT VIEW	HALL, D J	Residential	84	1988-04-23
115	20110279	352458	860730	284 WATERFORD DRIVE	MC GILL, JEFF	Residential	100	2011-02-16
116	20110280	352459	860729	284 WATERFORD DRIVE	MC GILL, JEFF	Residential	85	2011-02-16
117	20120194	352451	860729	WATERFORD FARMS, LOT 2	BOYD, JAY	Irrigation	47	2011-12-02
118	20121151	352451	860730	WATERFORD FARMS, LOT 2	BOYD, JAY	Irrigation	42	2012-05-01
119	20150133	352611	860903	588 VANN LN	VANN, MARK	Residential	180	2014-12-02
120	03100522	352634	860903	Not Provided	ROWLAND B	Residential	59	1968-05-25
121	20015174	352642	860908	172 LEFEVER CT	BRYAN, JAMES	Residential	195	2001-11-17
122	03102144	352730	861000	SUGAR CAMP BOTT	BARNETT, STEVE	Residential	145	1984-03-01
123	03102157	352730	861000	CATHY RIDGE	NOE, DAVID	Residential	82	1984-07-09
124	03102189	352730	861000	LAKE VIEW RD	RHOTEN, ROGER	Residential	145	1985-01-12
125	03102190	352730	861000	LAKE VIEW RD	RHOTEN, ROGER	Residential	50	1985-01-10
126	03102196	352730	861000	WARDS CHAPEL RD	STEPHENS, KENNETH	Residential	125	1984-10-11
127	03102286	352730	861000	BLANTON CHAPEL	DRAKE, ROBERT	Residential	81	1981-11-09
128	03102287	352730	861000	BLANTON CHAPEL	BANKS, W C	Farm	91	1985-11-08
129	03102293	352730	861000	CATHEY RIDGE	BANKS, BRUCE	Residential	89	1985-10-11
130	95003147	352744	860955	SUGAR CAMP RD	GILLEY, SHAN	Residential	220	1995-07-06
131	20042102	352655	860837	597 KNOX PEARSON RD.	JACKSON, JEFF	Farm	84	2004-06-10
132	03101276	352651	860838	Not Provided	PEARSON W.K.	Farm	101	1975-08-13
133	20150252	352635	860842	2430 MT VIEW RD	GAMBLE, RICK	Heat Pump	95	2014-12-27
134	20150253	352635	860841	2430 MT. VIEW RD	GAMBLE, RICK	Heat Pump	57	2014-12-27
135	20031474	352648	860807	515 CLAUDE BOWEN RD	FREEZE, MIKE	Residential	60	2003-05-21
136	20033683	352622	860817	170 CARROLL FARM LN	CARROLL, SEAN	Residential	86	2003-11-15
137	03101524	352650	860803	Not Provided	STEPHENS H	Residential	82	1978-05-12
138	03101523	352646	860758	Not Provided	JACKSON E R	Farm	114	1978-05-16
139	03101969	352639	860756	Not Provided	WISER LEN	Residential	165	1981-11-19
140	03100366	352635	860748	Not Provided	RING J	Residential	95	1966-08-16
141	03101972	352630	860754	Not Provided	CARROLL FLOYD	Residential	100	1981-11-19
142	03101782	352613	860750	Not Provided	LUSK T H	Residential	114	1981-03-31
143	03100403	352612	860744	Not Provided	LUSK T	Not Provided	43	1967-06-30
144	03100452	352625	860741	Not Provided	LEWIS J	Residential	188	1968-03-08
145	03101873	352621	860734	Not Provided	UNKNOWN137	Residential	0	Not Provided
146	03101986	352622	860735	Not Provided	SANDERS EVERETT	Farm	104	1982-04-01
147	03109022	352620	860734	Not Provided	MR. STONER	Residential	103	Not Provided
148	03100503	352609	860719	Not Provided	DAVIS J A	Residential	95	Not Provided
149	20050932	352600	860715	795 BELMONT RD.	LAWHORN, KEVIN	Residential	78	2005-03-08
150	03101772	352557	860701	Not Provided	ELROD D	Residential	71	1980-05-30
151	03101788	352552	860702	Not Provided	WILLIAMS J	Residential	86	1981-05-16
152	03100516	352538	860630	Not Provided	DUGGIN D	Residential	65	1968-03-29
153	03100517	352539	860631	Not Provided	STEELE D	Residential	92	1968-03-22
154	03101331	352538	860631	Not Provided	ELROD E.	Residential	56	1976-12-28
155	03101340	352538	860625	Not Provided	SHASTEEN M.	Farm	68	1976-09-27
156	03101711	352542	860624	Not Provided	TRACTOR SERVICE	Industrial	63	1980-02-14
157	03101246	352543	860620	Not Provided	JEHOVA WITNESS CH	Not Provided	60	1974-12-10
158	03101326	352537	860601	Not Provided	RAY J.	Residential	45	1975-02-13
159	03101351	352536	860601	Not Provided	HUGHTON L.	Residential	95	1976-07-14
160	03101790	352536	860603	Not Provided	RANEY J	Residential	85	1981-05-22
161	03100227	352532	860554	Not Provided	JACKSON W	Residential	89	1965-09-28
162	03101283	352514	860542	Not Provided	SHETTLEWORTH C.	Residential	91	1975-09-10
163	03101282	352507	860542	Not Provided	SHIPLY D.	Residential	102	1975-09-09
164	03101781	352506	860548	Not Provided	LONG T	Residential	63	1981-04-17
165	03101697	352504	860555	Not Provided	SHIPLEY A D	Residential	115	1979-07-24
166	20054354	352447	860552	352 SHIPLEY RD	PRATER, CAIN	Residential	81	2005-11-13
167	03101742	352504	860512	Not Provided	PARSON J	Other	123	1980-08-27
168	03101783	352520	860528	Not Provided	HYATT J	Other	115	1981-03-09
169	03101333	352627	860715	Not Provided	YIELDING S.E.	Residential	101	1976-11-10
170	03101716	352637	860713	Not Provided	CASTEEL V	Farm	59	1980-07-14
171	98002826	352654	860711	148 CAMBRIDGE	HOLT, KEITH	Residential	65	1998-06-30
172	94001685	352648	860724	251 CAMBRIDGE	ELROD, DAVID	Residential	74	1994-05-18
173	98001052	352652	860723	296 CAMBRIDGE LN	SMOTHERMAN,	Residential	67	1998-03-25
174	20043645	352650	860738	189 WEST CAMBRIDGE	RODGERS, BARBARA	Industrial	118	2004-10-11
175	93004874	352653	860733	401 CAMBRIDGE	HOYTS,	Residential	119	1993-11-23
176	94001686	352649	860732	93 W CAMBRIDGE	WILSON, JAMES T	Residential	106	1994-05-19
177	96001620	352650	860739	213 W CAMBRIDGE	BRYAN, JOE	Residential	120	1996-04-13
178	94001917	352652	860730	301 CAMBRIDGE	VANN, MARK	Residential	98	1994-05-28
179	94001684	352700	860743	645 CAMBRIDGE	PARRIS, LARRY	Residential	98	1994-05-18
180	94003844	352701	860733	512 CAMBRIDGE	ROGALLE, GEORGE	Residential	98	1994-09-27
181	95002498	352658	860733	475 CAMBRIDGE LANE	SWANSON, ERIC	Residential	115	1995-05-30
182	95005729	352700	860741	559 CAMBRIDGE	MC GEE, DWIGHT	Residential	102	1995-11-24
183	99002641	352656	860742	219 W CAMBRIDGE	LAYNE, CHRIS	Residential	148	1999-05-30
184	99001096	352658	860730	448 CAMBRIDGE	JERNIGAN, JIMMY	Residential	109	1999-02-28
185	03101525	352654	860752	Not Provided	BRYOM O	Farm	118	1978-05-15
186	03102078	352730	860730	BLANTON CHAPLE	ARMSTRONG, EUGENE	Residential	144	1983-09-10
187	03102159	352730	860730	SUGAR CAMP	WALKER, GREG	Residential	98	1984-08-10
188	03102232	352730	860730	BLANTON CHAPEL	PRESTON, DANIEL T.	Residential	85	1985-07-11
189	03100122	352712	860653	Not Provided	TOLIVER H	Residential	43	1964-08-11
190	03100049	352715	860643	Not Provided	GUY L	Residential	80	1964-01-08
191	03101350	352717	860636	Not Provided	MILLER T.J.	Residential	82	1976-07-20
192	03102254	352703	860642	TALIVER LAKE	SULLIVAN, DR DAVID	Farm	65	1985-02-16
193	03102253	352700	860627	TALIVER LAKE	BLAIR, LEWIS	Residential	48	1985-02-15
194	03101275	352706	860627	Not Provided	HOLLAND E.	Residential	102	1975-08-12
195	97004037	352715	860626	754 TOLIVER LAKE RD	VANDAGRIFF, WAYNE	Residential	150	1997-09-04
196	20060198	352712	860619	153 TOLLIVER LAKE RD	MASINGIL, JAMES	Heat Pump	120	2005-11-14

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 Desktop 4-mile Water Well Review Results (All Wells)
 Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
 Site Inspection Report, Arnold Air Force Base, Tennessee

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
197	95001559	352701	860607	288 TOLIVER LAKE	NORTON, SEAN	Residential	70	1995-04-18
198	Not Provided	352646	860554	HIGHWAY 55	J AND L INSULATION	Not Provided	0	Not Provided
199	03100488	352704	860548	Not Provided	BENNETT C	Industrial	75	1967-04-05
200	03100154	352657	860530	Not Provided	ROGERS D	Residential	64	1964-08-01
201	03100155	352658	860530	Not Provided	ROGERS D	Residential	75	1964-07-01
202	03100333	352657	860531	Not Provided	ROGERS D	Residential	84	1966-08-19
203	03100305	352658	860521	Not Provided	ROGERS B	Commercial	73	1966-03-14
204	03100306	352657	860520	Not Provided	ROGERS B	Not Provided	72	1966-02-15
205	03100009	352702	860504	Not Provided	ROGERS W	Not Provided	73	1963-09-19
206	03100099	352721	860438	Not Provided	ROGERS W	Residential	61	Not Provided
207	03100007	352717	860437	Not Provided	BROHAWN B	Residential	38	1963-09-17
208	03100008	352716	860436	Not Provided	ROGERS D	Residential	66	1963-09-23
209	03100030	352721	860422	Not Provided	LOWERY V	Residential	38	Not Provided
210	20112445	352730	860519	456 HERITAGE PLACE	CLIFFTON HARRIS CONSTRUCTION	Irrigation	76	2011-10-07
211	20120193	352729	860519	456 HERITAGE PLACE	CLIFFTON HARRIS CONST.	Heat Pump	73	2011-12-02
212	03100739	352728	860526	Not Provided	DOW	Industrial	143	Not Provided
213	20121721	352727	860528	1425 MCAURTHUR ST	SWANSON, LEIF	Irrigation	69	2012-07-05
214	03100438	352725	860605	Not Provided	YORK A	Residential	67	1967-10-16
215	03101232	352740	860628	Not Provided	SMITH M.	Residential	67	1974-09-30
216	03101287	352739	860625	Not Provided	JERNIGAN W.	Residential	76	1975-09-29
217	03101865	352824	860804	Not Provided	UNKNOWN132	Other	0	Not Provided
218	03101866	352823	860803	Not Provided	UNKNOWN133	Residential	0	Not Provided
219	03101962	352823	860931	Not Provided	DRIVER JIMMY	Residential	95	1981-11-11
220	03101890	352818	860921	Not Provided	DRIVER J.	Farm	145	1981-08-14
221	03101757	352820	860918	Not Provided	MAYTON A	Residential	140	1980-10-20
222	20021386	352818	860912	441 OLD STAGEOACH RD	MAYTON, DOROTHY	Residential	145	2002-04-25
223	03102456	352853	860843	POWERS BR	GAULT, RONNIE	Residential	265	1987-03-23
224	03102457	352853	860843	POWERS BR RD	GAULT, RONNIE	Residential	97	1987-03-23
225	03100484	352850	860832	Not Provided	CARROLL C	Residential	103	1967-04-22
226	03101195	352902	860834	Not Provided	PARSONS M.	Farm	121	1974-06-08
227	20004985	352905	860831	3760 POWERS BRIDGE RD	BROWN, KYLE	Residential	106	2000-09-16
228	20014157	352922	860834	761 DORSCH RD	SHERRILL, TODD	Residential	72	2001-09-22
229	97003588	352918	860836	4004 POWERS BRIDGE RD	SHELTON, BENNY	Residential	82	1997-08-08
230	03101796	352913	860835	Not Provided	NORRIS G	Residential	120	1981-02-23
231	98002087	352919	860836	4026 POWERS BRIDGE	MIVSHEK, DIANA	Residential	89	1998-05-26
232	20005884	352916	860838	3956 POWERS BRIDGE RD	BROWN, LEROY	Residential	124	2000-12-02
233	96005181	352913	860837	POWERS BRIDGE RD	ST. JOHN, BENJAMIN	Residential	120	1996-11-05
234	97002659	352916	860836	POWERS BRIDGE RD	HOLDER, MARK	Residential	118	1997-06-24
235	99003857	352912	860839	3911 POWERS BRIDGE	SCOTT, ROBERT	Residential	123	1999-07-30
236	20032245	352911	860812	429 DORSCH RD	MOULTRIE, ALLAN	Residential	120	2003-08-08
237	03101990	352948	860729	Not Provided	LEWIS BUTCH	Farm	100	1982-02-23
238	03101881	352948	860703	Not Provided	UNKNOWN141	Residential	0	Not Provided
239	03100493	353010	860649	Not Provided	EATON R	Residential	57	1967-01-09
240	03100549	353005	860555	Not Provided	PUGH T	Residential	39	1969-01-22
241	03102010	352935	860529	Not Provided	CORDER W.	Residential	70	1982-07-12
242	03102084	352806	860458	1404 CLOVER HTS	LOVE, HOLLIS	Heat Pump	74	1983-02-19
243	20130239	352946	860510	115 PARK PLACE	EATONS (HAWK HARDWARE)	Heat Pump	75	2012-12-22
244	20130240	352945	860510	115 PARK PLACE	EATONS (HAWK HARDWARE)	Other	89	2012-12-22
245	03102112	353000	860500	Not Provided	SIMONS, JAMES	Residential	165	1984-04-20
246	03108010	352951	860453	Not Provided	GOODMAN SPRING GS GS	Not Provided	0	Not Provided
247	20011985	352951	860428	290 INTERSTATE DRIVE	DUCK RIVER EQUIPMENT	Commercial	95	2001-05-10
248	03100117	352932	860425	Not Provided	UMBERGER L	Industrial	63	1964-07-10
249	03100141	352836	860531	Not Provided	RYDNES R	Residential	48	1964-09-22
250	03100563	352826	860507	Not Provided	MCCULLOUGH O	Residential	68	Not Provided
251	20014910	352819	860528	913 OAK ST	LOVEDY, RAY	Residential	80	2001-10-25
252	20132589	352811	860519	101 PARK ST	LEWIS, BUTCH	Irrigation	62	2013-10-28
253	20132588	352809	860520	1006 HIGHLAND DR	ROGERS, MARK	Irrigation	62	2013-10-28
254	03101997	352753	860444	Not Provided	LEROY NURSERY	Residential	75	1982-05-13
255	03102071	352806	860458	1404 CLOVER HTS	LOVE, HOLLIS	Heat Pump	7274	1983-02-19
256	20121150	352736	860336	2134 HILLSBORO BLVD	FIRST VISION BANK	Irrigation	67	2012-05-01
257	03100357	352814	860345	Not Provided	BRYAN B	Residential	41	1966-08-01
258	99003828	352825	860326	BUSHY BRANCH RD 9TH AVE	BONNAROO ITCHYCOO PARK	Commercial	85	1999-06-17
259	20111118	352843	860324	BUSHY BRANCH RD	BONNAROO (DEPLOYED RESOURCES)	Commercial	90	2011-05-23
260	03100500	352920	860328	Not Provided	JONES N	Residential	48	Not Provided
261	03100313	352921	860345	Not Provided	CARGILE V	Residential	53	1966-03-28
262	03101834	353014	860346	Not Provided	KEEL S.	Farm	85	1980-10-30
263	03100363	352954	860333	Not Provided	LYNN J	Residential	73	1966-07-09
264	20131674	352952	860329	W LYNN DR CROSSLIN LN	CROSSLIN, RICHARD	Farm	68	2013-07-30
265	03101709	352949	860306	Not Provided	BUCKNER J R	Residential	48	1980-04-07
266	03101932	352957	860231	Not Provided	TOPER WALTER B.	Residential	63	1981-10-19
267	03100149	352946	860207	Not Provided	JONES J	Residential	47	1964-10-18
268	20031882	352850	860256	GROSCHE RD POD 11	BONNAROO (AXIS FESTIVAL)	Not Provided	70	2003-07-04
269	99003827	352839	860304	BUSHY BRANCH RD POD 7	BONNAROO ITCHYCOO PARK	Commercial	85	1999-06-16
270	20031486	352845	860241	BUSHY BRANCH RD POD 10	BONNAROO (AXIS FESTIVAL)	Irrigation	63	2003-05-28
271	20031883	352847	860221	BUSHY BRANCH RD POD 9	BONNAROO (AXIS FESTIVAL)	Irrigation	63	2003-07-06
272	20041883	352849	860214	BRUSHY BRANCH RD. POD 8	BONNAROO AXIS FESTIVAL L L C	Commercial	62	2004-06-25
273	20052367	352831	860231	NEW BUSH LANE POD 2	BONNAROO DEPLOYED RESOURCES	Other	74	2005-06-25
274	99003824	352829	860235	BUSHY BRANCH RD 1ST AVE	BONNAROO ITCHYCOO PARK	Commercial	70	1999-06-07
275	99003826	352832	860247	BUSHY BRANCH RD POD 3	BONNAROO ITCHYCOO PARK	Commercial	75	1999-06-16
276	20071968	352829	860304	GROSCHE LN POD 4	BONNAROO FESTIVAL	Commercial	85	2007-05-29
277	99003823	352823	860304	BUSHY BRANCH RD NORTH CENTERO	BONNAROO ITCHYCOO PARK	Commercial	70	1999-06-07
278	20071969	352822	860248	BRUSHY BRANCH RD VIP AREA	BONNAROO FESTIVAL	Commercial	65	2007-05-29
279	20071967	352816	860307	GROSCHE LN FOUNTAIN WELL	BONNAROO FESTIVAL	Commercial	74	2007-05-29
280	20091066	352816	860257	BUSHY BRANCH ROAD BENNETT BONEYARD	BONNAROO DEPLOYED RESOURCES	Farm	63	2009-05-13
281	99003830	352810	860308	BUSHY BRANCH RD PODS5/6	BONNAROO ITCHYCOO PARK	Commercial	70	1999-06-17
282	99003829	352806	860241	BUSHY BRANCH RD	BONNAROO ITCHYCOO PARK	Commercial	65	1999-06-17
283	99003833	352806	860241	BUSHY BRANCH 800 (WATER WORLD)	BONNAROO ITCHYCOO FESTIVAL	Commercial	65	1999-06-17
284	03100692	352758	860300	Not Provided	USELTON G	Residential	60	Not Provided
285	20041884	352758	860253	BRUSHY BRANCH RD (CATERING RD)	BONNAROO AXIS FESTIVAL L L C	Commercial	50	2004-06-26
286	03101726	352745	860306	Not Provided	HUNT D	Residential	60	1979-08-15
287	TN011169	352737	860308	CAMPGROUND RD	KOA	Not Provided	0	Not Provided
288	03100502	352723	860252	Not Provided	RED HILL CHURCH OF C	Not Provided	55	Not Provided
289	TN025787	352736	860237	384 KIMBERLY	NILES, B. A.	Not Provided	0	Not Provided
290	03100027	352741	860234	Not Provided	SIMMON L	Not Provided	40	Not Provided
291	20022304	352803	860214	BUSHY BRANCH RD (POD 1)	BONNAROO (DAVID POWER)	Irrigation	80	2002-06-28
292	03100012	352740	860225	Not Provided	WEST W	Residential	50	1963-09-25
293	94003796	352740	860206	915 KIMBERLY LANE	MOORE, R D	Residential	48	1994-09-15
294	03100319	352725	860234	Not Provided	GROSCHE J	Residential	50	1966-06-01

Key to Figure 4.2-2 (Arnold AFB)
 Desktop 4-mile Water Well Review Results (All Wells)
 Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
 Site Inspection Report, Arnold Air Force Base, Tennessee

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
295	03100499	352717	860237	Not Provided	POWELL R	Residential	48	Not Provided
296	TN025788	352716	860205	ASBURY	DRIVER, JIMMY	Not Provided	0	Not Provided
297	03100361	352709	860228	Not Provided	CHAMBERS J	Residential	55	Not Provided
298	03100459	352703	860228	Not Provided	SIMMONS L	Industrial	43	1967-07-20
299	03101887	352658	860218	Not Provided	FERRELL B.	Residential	55	1981-08-26
300	03100489	352656	860229	Not Provided	ROGERS W	Residential	40	1967-03-14
301	03100477	352647	860228	Not Provided	LEVINGSTON D	Residential	67	1967-06-07
302	03100310	352725	860135	Not Provided	WELLS C	Residential	51	1966-06-17
303	03100464	352940	860041	Not Provided	CROSSLIN W	Residential	41	1967-07-03
304	20121428	352921	860052	4698 NEW BUSHY BRANCH RD	MID TEN TURF INC.	Irrigation	160	2012-06-11
305	99005592	352930	860052	4698 BUSHY BRANCH	MID TENN TURF INC	Irrigation	165	1999-10-22
306	98003275	352903	860044	BUSHY BRANCH RD	MID TENN TURF	Irrigation	150	1998-08-06
307	03102014	352851	860050	Not Provided	ARMSTRONG HOWARD	Residential	60	1982-08-20
308	03101713	352852	860035	Not Provided	BUCKNER T	Residential	50	1980-08-04
309	03101985	352835	855954	Not Provided	PARKER RANDY	Residential	65	1982-04-22
310	03100198	352743	860050	Not Provided	SIMMONS L	Residential	56	1964-10-08
311	03101813	352746	855949	Not Provided	SMITH A.D.	Residential	65	1980-05-02
312	03101857	352640	860010	Not Provided	UNKNOWN129	Residential	0	Not Provided
313	03101794	352619	855959	DON LASANTER	ROBERTS, LARRY	Residential	63	1981-02-21
314	03100005	352518	860037	Not Provided	BOYER C	Residential	62	1963-09-05
315	03100032	352519	860036	Not Provided	DORIS H	Residential	70	1963-11-04
316	03100026	352455	860018	Not Provided	DUCUS	Residential	38	Not Provided
317	20000922	352508	855955	ADAMS RD	GREEN, DALE	Residential	123	2000-01-30
318	03101288	352532	855927	Not Provided	LASTOR B.	Other	102	1975-09-30
319	03101818	352614	855841	Not Provided	FINNEY N.	Residential	65	1980-08-05
320	03101856	352610	855831	Not Provided	UNKNOWN128	Residential	0	Not Provided
321	03101991	352526	855748	Not Provided	PENNEGAR REX	Residential	115	1982-03-10
322	03100698	352503	855845	Not Provided	FULTS D	Industrial	82	Not Provided
323	03101785	352350	860055	Not Provided	FINNEY G	Residential	86	1981-01-09
324	03101718	352347	855950	Not Provided	MCKELVEY R	Residential	84	1980-05-15
325	03100096	352441	855826	Not Provided	LESTER M	Residential	86	Not Provided
326	03100118	352440	855826	Not Provided	HILLSBORO B CHURCH	Not Provided	78	1964-07-17
327	03101192	352433	855820	Not Provided	MYERS L.B.	Residential	80	1974-06-11
328	03100021	352442	855612	Not Provided	RUST J	Residential	143	1963-11-05
329	03101829	352411	855756	Not Provided	MCCORMICK M.	Residential	87	1980-10-13
330	99003296	352334	855857	214 BAINS RD	MEADOWS, MELVIN	Irrigation	90	1999-07-06
331	03100048	352344	855734	Not Provided	JOHNSON M	Residential	89	1964-01-23
332	03100412	352336	855611	Not Provided	BEANS CREEK CHURCH	Not Provided	33	1967-09-02
333	03102713	352259	855715	HOWARD GREGORY	TOWNSEND, JEFF	Residential	50	1988-05-12
334	Not Provided	352246	855650	10513 HIGHWAY 41	BANKS,	Not Provided	0	Not Provided
335	03102241	352230	855730	PARNE PLAINS ACR	BROWN, JOHNNY	Residential	105	1985-06-08
336	03102009	352223	855900	Not Provided	HARRIS RICHARD	Residential	70	1982-07-12
337	03100025	352221	855750	Not Provided	FULTS	Not Provided	97	1963-11-12
338	03100056	352222	855750	Not Provided	FULTS C	Residential	90	1963-11-12
339	03101995	352218	855726	Not Provided	STARKS FRED	Residential	65	1982-03-18
340	20003573	352214	855737	PRAIRIE PLAINS RD	SHERILL, JAMES	Residential	103	2000-07-05
341	03100024	352205	855738	Not Provided	LONG A	Not Provided	70	Not Provided
342	03101886	352212	855646	Not Provided	UNKNOWN142	Residential	0	Not Provided
343	03101853	352141	855634	Not Provided	UNKNOWN126	Residential	0	Not Provided
344	03101737	352140	855747	Not Provided	GILMORE J	Residential	120	1980-08-22
345	99006274	352158	860132	MARTIN RD	HILL, CHARLES	Residential	76	1999-11-30
346	03100050	352148	860111	Not Provided	DORTON J	Residential	90	1964-01-07
347	03102012	352111	860037	Not Provided	REDMON CHARLES	Residential	70	1982-05-12
348	03101719	352058	860037	Not Provided	FARRIS C C	Residential	73	1980-05-14
349	03109028	352059	860037	Not Provided	FARRIS C C	Residential	90	Not Provided
350	03101817	352045	860014	Not Provided	RANDOLPH B.	Residential	65	1980-07-25
351	05100814	351957	860216	Not Provided	CORTNER G.	Residential	70	1974-07-29
352	04501150	351951	860219	Not Provided	THURMOND R.	Residential	130	1974-06-26
353	05100048	351931	860230	Not Provided	MILLER W	Residential	70	1964-04-11
354	05100830	351925	860253	Not Provided	WHITEHEAD W.	Residential	81	1975-02-12
355	05100848	351857	860256	Not Provided	PERRY H.	Residential	62	1974-05-07
356	TN005463	351902	860220	Not Provided	JAMES, ROBERT	Not Provided	72	Not Provided
357	05101204	351912	860220	DUNCAN LANE	JAMES #1, ROBERT	Residential	104	1983-09-05
358	03101925	351925	860032	Not Provided	WEAVER D	Residential	84	1981-12-29
359	20032218	351959	860049	1868 DEANS SHOP RD	WEAVER, RAY	Farm	86	2003-07-22
360	03101271	352004	855908	Not Provided	HILL R.	Residential	78	1975-06-30
361	20033680	351956	855827	5424 PRARIE PLAINS RD	LAWS, DON	Residential	65	2003-11-13
362	99005587	351959	855821	PRARIE PLAINS RD	LAWS, ROY	Residential	91	1999-10-20
363	03101736	351959	855815	Not Provided	WALDRON R	Residential	78	1980-09-02
364	20000494	352050	855650	818 ALEX MARLOW RD.	COULSON, DON	Residential	125	1999-12-27
365	03100753	352108	855606	Not Provided	MARLOW J	Industrial	205	Not Provided
366	06100065	352000	855330	Not Provided	CLAY G	Other	80	1967-06-08
367	20122523	351909	855340	641 HWY 41	TAYLOR, JANELLE	Residential	100	2012-09-26
368	03102008	351857	855605	Not Provided	BOYETT RAY	Residential	105	1982-06-30
369	06100163	351900	855400	Not Provided	MYERS G	Farm	127	1970-12-02
370	03101807	351854	855603	Not Provided	GIPSON C	Residential	77	1981-04-02
371	03101973	351847	855714	Not Provided	BEAN OWEN	Residential	65	1981-12-23
372	03101984	351825	855636	Not Provided	MARLOW JOE	Residential	85	1982-07-21
373	03100075	351817	855612	Not Provided	SHERILL A	Residential	156	1964-03-27
374	06100159	351800	855430	Not Provided	LLOYD	Industrial	104	Not Provided
375	06100087	351800	855400	Not Provided	KENNEDY & BRYAN OIL	Commercial	70	1968-05-14
376	06100162	351800	855400	Not Provided	REGNEY C	Industrial	104	Not Provided
377	06100372	351730	855330	Not Provided	TYSON FOOD	Residential	135	1978-02-19
378	06100077	351700	855400	Not Provided	EATON P	Farm	67	Not Provided
379	06100404	351630	855400	Not Provided	BROWN S	Farm	182	1980-02-13
380	20080868	351539	855451	CEDAR ROCK DEVELOPMENT	MILLER, SEAN	Residential	200	2008-03-03
381	20080867	351552	855459	CEDAR ROCK DEVELOPMENT	MILLER, SEAN	Residential	600	2008-02-29
382	03102233	351730	855730	HENLY	HINLEY, CLARENCE	Farm	80	1985-07-09
383	03102242	351730	855730	BUCKNER RD	BUCKNER, ALTON	Residential	54	1985-06-07
384	20130513	351822	855738	388 WILDER CHAPEL RD	HILL, JAROD	Irrigation	75	2013-03-14
385	20130512	351821	855821	388 WILDER CHAPEL RD	HILL, JAROD	Irrigation	122	2013-02-21
386	20130514	351752	855835	388 WILDER CHAPEL RD	HILL, JAROD	Irrigation	165	2013-03-02
387	20043871	351820	855907	138 PRAIRIE PLAINS RD.	TRUSSELL, GEORGE	Residential	90	2004-11-15
388	03102708	351730	860000	LANDERS	THURMAN, JAMES D	Residential	74	1988-01-29
389	94002439	351835	860045	FINNEY RD	ROGERS, CLARENCE	Residential	84	1994-07-01
390	20023520	351826	860113	1852 DABBS FORD RD	BARNES, JO ED	Residential	64	2002-09-23
391	20060203	351819	860117	971 SHERRIEL RD.	BURCH, LANNY	Residential	120	2005-11-17
392	20060204	351817	860112	971 SHERRIEL RD.	BURCH, LANNY	Residential	78	2005-11-17

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 Site Inspection Report, Arnold Air Force Base, Tennessee

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
393	05100842	351723	860110	Not Provided	PERRY R.H.	Residential	62	1974-05-29
394	05100845	351710	860204	Not Provided	DAVIS J.A.	Residential	60	1974-08-23
395	05100861	351525	860048	Not Provided	WOODALL L.	Residential	94	1975-04-07
396	95002982	351534	860126	GUM CREEK 483	DUNCAN FARMS	Farm	167	1995-07-13
397	95002981	351522	860132	GUM CREEK	WOODALL, BOBBY	Farm	122	1995-07-10
398	05109063	351517	860135	GUM CREEK	DUNCAN, RUSSELL	Residential	95	Not Provided
399	95004338	351522	860133	GUM CREEK 332	WOODALL, BOBBY	Farm	160	1995-09-06
400	20141053	351516	860138	322 GUM CREEK RD	WOODALL, BOBBY	Farm	120	2014-05-19
401	95004337	351455	860125	WOODALL RD 118	WOODALL, ALDEN	Farm	84	1995-09-27
402	05100111	351447	860205	Not Provided	HOLLAND D	Residential	81	1964-09-24
403	20023702	351504	860342	1191 KNIGHT CHURCH RD	PECK, JOHN M	Irrigation	120	2002-09-16
404	20141052	351511	860320	HOLLAND LN	WOODALL, JUSTIN	Irrigation	122	2014-05-09
405	95004334	351558	860320	KNIGHT CHURCH	STEPHENS, CHARLES	Irrigation	140	1995-09-13
406	95004215	351556	860319	KNIGHT CHURCH	STEPHENS, CHARLS	Irrigation	245	1995-08-31
407	04501156	351707	860404	Not Provided	JONES R.	Residential	135	1974-07-22
408	04501066	351706	860405	Not Provided	WILLIAMS R.	Residential	64	1973-07-17
409	04501067	351708	860400	Not Provided	CRAIG J	Residential	107	1972-09-12
410	05100297	351733	860356	Not Provided	CAPTOL HILL CHURCH C	Not Provided	84	1967-07-21
411	05100057	351741	860346	Not Provided	SYLER T	Municipal	73	1964-04-20
412	05100177	351756	860404	Not Provided	CHAMPION M	Residential	84	1965-10-07
413	05100142	351809	860403	Not Provided	LIGHTFUUT	Residential	84	1965-05-29
414	05100206	351807	860400	Not Provided	LEDFORD H	Residential	63	1966-02-02
415	05100053	351808	860420	Not Provided	MORELAND B	Residential	78	1964-04-24
416	05100054	351755	860420	Not Provided	TUCKER H	Residential	73	1964-04-30
417	05100081	351757	860438	Not Provided	SEALS C	Residential	90	1964-07-22
418	20051843	351746	860441	3886 MORRIS FERRY BRANCH RD.	SEALS, CHARLES	Residential	78	2005-05-19
419	05100004	351727	860522	Not Provided	FINNEY D	Residential	70	1963-08-14
420	TN005574	351715	860548	58 RAY ROAD	EAST TN GAS CO	Not Provided	98	Not Provided
421	05100406	351640	860530	Not Provided	BROWN M	Residential	77	1968-08-27
422	05100319	351644	860521	Not Provided	HALL J	Residential	70	1967-11-08
423	05100331	351645	860450	Not Provided	KELLEY A	Residential	68	1967-12-21
424	05100349	351640	860427	Not Provided	PAYNES CHURCH	Not Provided	92	1968-05-29
425	TN010154	351505	860450	AEDC RD 2701	MORRIS, ROBERT	Not Provided	0	Not Provided
426	05100509	351438	860501	Not Provided	BROWN J	Other	72	1969-10-18
427	05100012	351435	860520	Not Provided	CHILDRESS V	Residential	55	1963-09-09
428	05100300	351558	860546	Not Provided	WHITE T	Not Provided	95	1967-06-12
429	20140585	351511	860520	3354 DECHERD - ESTILL (PEABODY RD)	MORRIS, WYATT	Not Provided	202	2014-04-01
430	20033575	351554	860543	190 STAMEY LN	STAMEY, EDWIN	Residential	95	2003-10-24
431	05100305	351610	860546	Not Provided	COOK C	Residential	108	1967-05-06
432	05100407	351551	860602	Not Provided	NORTHCUTT J	Residential	95	1968-09-27
433	05100403	351620	860615	Not Provided	DURHAM J	Residential	75	1968-07-29
434	05100298	351543	860626	Not Provided	STARNES E	Residential	86	1967-07-18
435	05108004	351442	860758	Not Provided	MUNICIPAL FR Q-15Q15	Municipal	0	Not Provided
436	05100365	351535	860855	Not Provided	LAND J	Residential	100	1968-07-13
437	05100281	351637	860954	Not Provided	BASSCC	Residential	50	1967-01-23
438	05100282	351648	861012	Not Provided	PRICE J	Residential	77	1967-01-28
439	05100268	351711	861003	Not Provided	FAULTNER B	Residential	83	1966-10-26
440	05100267	351717	860958	Not Provided	EULDON C	Residential	84	1966-10-29
441	05100271	351725	860925	Not Provided	PALMANTJN D	Residential	130	1971-10-12
442	05100114	351739	860858	Not Provided	UNKNOWN227	Residential	80	1964-09-11
443	05100115	351739	860858	Not Provided	ELK RIVER UTILITY D	Municipal	81	1964-09-10
444	05100320	351756	860915	Not Provided	RICHEY J	Residential	84	1967-11-03
445	05100843	351820	860825	Not Provided	TOWERY T.	Residential	77	1974-08-01
446	98005253	351848	860755	SPRING CREEK RD	HOLMAN, JERRY	Residential	27	1998-11-01
447	05101225	351903	860821	SPRING CREEK	TINSLEY, CHARLES	Residential	75	1983-06-29
448	05101206	351902	860826	UT FARM	HANES, W.P.	Residential	75	1983-06-29
449	20043313	351854	860847	275 MERCY LANE	HAMBRICK, VIRGIL	Residential	74	2004-09-17
450	04301184	351840	860833	Not Provided	AKINS W	Residential	190	1978-03-27
451	05101009	351811	861019	Not Provided	TUCKER L	Residential	100	1978-09-22
452	05100889	351814	861022	Not Provided	ARNOLD R.	Residential	102	1975-05-30
453	05100094	351814	861025	Not Provided	GROWDEN F	Residential	80	1964-08-13
454	05100156	351817	861031	Not Provided	WOODS B	Residential	94	1965-07-23
455	05100264	351813	861042	Not Provided	SPINER I	Residential	89	1966-11-21
456	05100280	351813	861045	Not Provided	GILLIANN L	Residential	92	1967-01-24
457	05109009	351810	861046	Not Provided	ALBERT FREEMAN	Not Provided	0	Not Provided
458	05109007	351810	861046	Not Provided	ALBERT FREEMAN	Not Provided	0	Not Provided
459	05101025	351809	861046	Not Provided	FREEMAN A	Residential	95	1978-10-06
460	05101019	351734	861048	Not Provided	CARSON H	Residential	61	1979-04-16
461	05100044	351732	861115	Not Provided	LUTTREL H	Residential	26	1964-02-12
462	05100026	351730	861120	Not Provided	HOOVER I	Residential	46	1963-11-16
463	05100849	351734	861126	Not Provided	BRANCH M.	Residential	52	1974-05-08
464	05100824	351746	861124	Not Provided	WEAVER R.	Residential	98	1974-06-26
465	05100812	351752	861125	Not Provided	WEAVER R.	Residential	105	1974-03-22
466	05101208	351803	861104	COOK	HISE, GARY	Residential	102	1983-09-03
467	05100084	351807	861104	Not Provided	MCPERAN J	Residential	102	1964-07-30
468	05100293	351813	861103	Not Provided	HILL J	Residential	98	1967-06-25
469	05101036	351818	861103	Not Provided	CROSSLIN H	Residential	90	1978-11-10
470	05101207	351839	861055	Not Provided	TUCKER, CLAY	Residential	75	1983-04-19
471	05100050	351843	861058	Not Provided	WILSON D	Residential	95	1964-03-28
472	05101051	351845	861056	Not Provided	FREEMAN C	Residential	75	1979-08-24
473	05100326	351920	861030	Not Provided	ROBERTSON W	Residential	60	1967-10-13
474	05100831	351935	861053	Not Provided	MARTIN J.	Commercial	67	1975-02-21
475	05100143	351912	861200	Not Provided	NURSERIES S	Commercial	67	1965-05-24
476	05101209	351820	861135	ROCK CREEK	HODGE, GARY	Residential	350	1983-07-26
477	05101484	351724	861236	HWY 130	JANEY, JOHN	Residential	94	1986-10-30
478	05101484	351724	861236	HWY 130	JANEY, JOHN	Residential	94	1986-10-30
479	95003974	351740	861234	HWY 130	SHASTEEN, JOHNNY	Farm	100	1995-08-08
480	95003975	351740	861234	HWY 130	SHASTEEN, JOHNNY	Farm	115	1995-08-09
481	95003976	351740	861234	HWY 130	SHASTEEN, JOHNNY	Irrigation	84	1995-08-11
482	05101090	351747	861242	Not Provided	HUDDLESTON L M	Residential	72	1980-09-04
483	05101091	351745	861244	Not Provided	PERRY R D	Residential	65	1980-09-05
484	20074603	351859	861342	33 ACORN DR.	FOSTER, JEFF	Irrigation	28	2007-10-25
485	20080311	352006	861358	100 CHESAPEAKE	NUTT, STEPHEN	Irrigation	70	2007-11-23
486	20080332	352108	861439	111 CUMBERLAND TRACE	MCKILL, DALE	Irrigation	78	2007-11-29
487	20121555	352106	861427	100 CUMBERLAND AVE	BARNETT, DEBBIE	Irrigation	100	2012-06-04
488	20090111	352100	861348	206 KAYWOOD LANE	JACKSON, ANDREW	Heat Pump	89	2008-11-14
489	20090112	352059	861349	206 KAYWOOD LANE	JACKSON, ANDREW	Heat Pump	72	2008-11-14
490	03102073	352107	861336	108 HILLCREST D	ABBOTT, EARNEST L.	Other	107	1983-09-08

Key to Figure 4.2-2 (Arnold AFB)
 Desktop 4-mile Water Well Review Results (All Wells)
 Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
 Site Inspection Report, Arnold Air Force Base, Tennessee

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
491	20080074	352043	861348	103 WILLIAMS CT	KOLOGINECZAK, KEN	Heat Pump	90	2007-11-23
492	20080074	352043	861348	103 WILLIAMS CT	KOLOGINECZAK, KEN	Heat Pump	90	2007-11-23
493	20080075	352041	861347	103 WILLIAMS CT	KOLOGINECZAK, KEN	Heat Pump	81	2007-11-23
494	20080075	352041	861347	103 WILLIAMS CT	KOLOGINECZAK, KEN	Heat Pump	81	2007-11-23
495	03101814	352048	861307	Not Provided	SAMER J.	Residential	100	Not Provided
496	03102251	352048	861228	Not Provided	TISWORTH, E L	Residential	175	1985-06-18
497	20082542	352049	861156	1228 SOUTH JACKSON	ESLICK, CRAIG	Irrigation	70	2008-06-17
498	05100107	352050	861123	Not Provided	HILL W	Residential	71	1964-07-12
499	05100117	352050	861123	Not Provided	HILL W	Residential	72	1964-07-14
500	05100118	352050	861123	Not Provided	HILL W	Residential	72	1964-07-09
501	20122216	352041	861101	400 INGLEWOOD	LIVINGSTON, KRystal	Irrigation	60	2012-08-23
502	05100098	352030	861100	Not Provided	TAYLOR J	Residential	72	1964-08-31
503	05100106	352029	861058	Not Provided	JACKSON D	Residential	76	1964-07-07
504	05100116	352029	861058	Not Provided	JACKSON D	Residential	72	1964-08-27
505	05100131	352045	861045	Not Provided	PROPST C	Residential	70	1964-12-23
506	20020683	352140	861126	201 MITCHELL BLVD	HOODRICH LANDING GEAR CORPORATIO	Commercial	92	2002-02-22
507	20051315	352137	861153	500 EAST CARROLL ST.	DOTSON'S FRESH PRODUCE	Irrigation	80	2005-04-21
508	03101953	352130	861206	Not Provided	MORRIS GEORGE L.	Residential	87	1982-06-27
509	TN005454	352142	861347	Not Provided	COX, WAYNE	Not Provided	0	Not Provided
510	20110002	352216	861510	103 CHANDELLE DRIVE	MARKGRAF, KLAUS	Heat Pump	78	2010-11-02
511	20110003	352217	861510	103 CHANDELLE DRIVE	MARKGRAT, KLAUS	Heat Pump	78	2010-11-02
512	03100435	352234	861357	Not Provided	PARISH J	Residential	59	1967-10-20
513	20131665	352231	861401	1377 CEDAR LN	DF CHASE	Irrigation	95	2013-06-26
514	03101748	352202	861329	Not Provided	BOYLES R H	Residential	57	1980-12-24
515	03100014	352223	861321	Not Provided	TENN TRAINING CO	Commercial	88	1963-09-16
516	20051206	352237	861314	1309 NORTH WASHINGTON	L AND H DISTRIBUTING	Irrigation	72	2005-04-08
517	20053488	352214	861307	915 NORTH ATLANTIC ST	TENNESSEE TANNING CO	Irrigation	95	2005-09-17
518	03101738	352235	861259	Not Provided	JERNIGAN R R	Residential	80	1980-09-22
519	20111396	352241	861255	307 LAYNE STREET	ANDERSON, ELLEN	Irrigation	77	2011-06-09
520	03102001	352238	861249	Not Provided	WILKINSON O.B.	Residential	75	1982-06-18
521	20072726	352237	861229	1102 PICKETT	COPELAND, PHIL	Irrigation	72	2007-07-06
522	20073796	352238	861230	404 HOOD DR.	WENDELL, ELIZABETH	Irrigation	70	2007-09-13
523	03102158	352230	861230	LANNON CIRCLE 1	KRAFT, ROGER	Residential	71	1984-07-23
524	03102274	352230	861230	RILEY CREEK	POWELL, CLARA	Residential	52	1985-08-27
525	03102291	352230	861230	COUNTRY CLUB DR	GEORGE, WILLIAM	Heat Pump	81	1985-10-18
526	03101957	352212	861238	Not Provided	HALL JACK E.	Residential	92	1982-07-29
527	20022221	352155	861235	215 NORTH WASHINGTON	SCHEMPP, MARK	Heat Pump	96	2002-06-29
528	20022222	352156	861235	215 NORTH WASHINGTON	SCHEMPP, MARK	Heat Pump	87	2002-06-29
529	03102072	352220	861135	105 BROADRICK	KIRKMAN, GLEN	Other	57	1983-08-18
530	03101844	352212	861118	Not Provided	TULLAHOMA CONCRETE P	Residential	1005	1980-12-30
531	20014588	352256	861236	106 KINGSRIDGE	THOMA, BILL	Irrigation	85	2001-10-15
532	20073480	352246	861235	105 ROYAL COURT	RANDY HAWKERSMITH CONST.	Irrigation	95	2007-08-17
533	20074767	352255	861246	107 LINKSIDE DR	GERWE, RICHARD M	Irrigation	100	2007-10-26
534	20080333	352247	861240	104 ROYAL COURT	EAVES, RAY	Irrigation	97	2007-11-30
535	20080334	352249	861235	101 ROYAL COURT	PHILLIPS, ANTHONY	Irrigation	95	2007-11-30
536	20091423	352254	861231	104 KINGS PLACE	THOMA, BILL	Irrigation	71	2009-05-21
537	20092420	352258	861236	110 KINGSRIDGE	ARTMAN, JAMES	Irrigation	73	2009-08-17
538	20110818	352256	861241	108 LINKSIDE DR	SOBROBI, HEATHER	Irrigation	91	2011-03-24
539	20151771	352250	861240	301 KINGS LANE	MURRAY, DIANNA	Irrigation	77	2015-09-04
540	20071888	352257	861304	100 REGWOOD DR	BENJAMIN, EUGENE	Irrigation	111	2007-05-01
541	20080856	352259	861304	101 RIDGEWOOD DR	PINNER, ROBERT	Irrigation	108	2008-01-30
542	03100086	352257	861402	Not Provided	WINTON Y	Residential	70	1964-05-12
543	20121423	352253	861412	520 AIRPARK DR	ASEND FEDERAL CREDIT UNION	Irrigation	85	2012-05-23
544	20111835	352339	861431	2180 N JACKSON ST	LEVRITT, CHUCK	Commercial	99	2011-07-26
545	03100044	352328	861314	Not Provided	HODGES R	Residential	58	1964-02-10
546	03100814	352330	861310	Not Provided	GLASER L	Residential	76	1970-12-14
547	20010619	352310	861258	SOUTH FAIRWAYS	USSELTON, JIM	Irrigation	72	2001-01-18
548	20010978	352313	861256	CARNOUISTE CT	USSELTON, JIM	Irrigation	71	2001-02-25
549	20011915	352311	861256	1102 LAKE HILL DR	USSELTON, JIM	Irrigation	160	2001-05-04
550	20080312	352315	861303	102 FAIRWAYS BLVD SOUTH	NUTT IRRIGATION	Irrigation	91	2007-12-23
551	20092080	352315	861301	103 FAIRWAYS BLVD SOUTH	ABBOTT, TOMMY	Irrigation	92	2009-07-28
552	20092661	352312	861252	13 DECLAIRMONT CIRCLE	OLIVER, JIM	Irrigation	78	2009-11-05
553	20111414	352315	861255	104 ST ANDREWS PLACE	ROBERTS, DAVE	Irrigation	89	2011-06-22
554	20073481	352302	861233	102 ST. CHARLES	ENNIS, MARY	Irrigation	71	2007-08-18
555	20074956	352307	861235	200 KINGSRIDGE BLVD	SAWYER, SAM	Irrigation	103	2007-11-25
556	20120726	352302	861217	1315 CUNTRY CLUB RD	HELMS, TED D	Residential	72	2012-04-20
557	03100217	352317	861235	Not Provided	SPENCE J.W.	Residential	135	1967-01-20
558	03100229	352323	861236	Not Provided	MILLER A	Residential	75	1965-09-18
559	20074687	352315	861240	216 KNGSRIDGE BLVD	FIGAROLA, TULIO	Irrigation	140	2007-10-12
560	03100315	352316	861233	Not Provided	SHELTON J	Residential	70	1966-03-08
561	03100421	352320	861228	Not Provided	HOMES P	Residential	65	1967-07-29
562	03100422	352320	861231	Not Provided	MANN C	Residential	60	1967-07-26
563	03100256	352316	861225	Not Provided	SANDERS B	Residential	67	1966-07-11
564	03100035	352314	861215	Not Provided	RIDDLING J	Residential	69	1963-11-19
565	03100019	352316	861220	Not Provided	GULFILLIAN D	Residential	63	1963-10-26
566	20073215	352314	861217	1705 COUNTRY CLUB DR.	JENNINGS, DENNIS	Irrigation	54	2007-08-03
567	20072727	352331	861242	405 KINGSRIDGE BLVD	JERMAN, CHARLES	Irrigation	135	2007-07-07
568	03100033	352346	861237	Not Provided	BLACKMAN E	Residential	77	1963-11-02
569	03100428	352349	861234	Not Provided	HAWK G	Residential	61	1967-09-29
570	20091420	352348	861221	217 LAKEWOOD DRIVE	FROST, WALTER	Irrigation	45	2009-05-18
571	03100215	352342	861213	Not Provided	JONES C	Industrial	85	1965-04-02
572	03100245	352343	861220	Not Provided	SOESBE L	Residential	66	1966-02-25
573	03100018	352338	861217	Not Provided	DETZEN J	Residential	78	1963-10-21
574	03100166	352334	861217	Not Provided	USLETON G	Residential	47	1965-01-12
575	03100418	352336	861212	Not Provided	MARSHALL C	Residential	50	1967-07-31
576	20073482	352318	861144	500 ALBERMARLE	GRUBER, TIM	Irrigation	71	2007-08-18
577	20081814	352319	861149	207 ALBERMARLE	BELL, JEREMEY	Irrigation	88	2008-04-22
578	20092019	352311	861152	511 ALBERMAULE DRIVE	JUDGE, LARRY	Irrigation	70	2009-08-06
579	95003418	352341	861053	CARTER BLAKE 956	WALLER, CHARLES	Irrigation	18	1995-08-03
580	96000596	352331	861036	CARTERBLAKE506	SMITH, NATHAN	Residential	90	1996-02-20
581	96005415	352331	861036	CARTER BLAKE RD	SMITH, NATHAN	Residential	125	1996-12-03
582	97002280	352329	861026	ANGLE RD 110-140	WILHOIT TREE SERVICE	Residential	106	1997-06-08
583	03100232	352321	861037	Not Provided	SIMMONS C	Residential	72	1965-08-07
584	20082897	352316	861027	274 CARTER BLAKE ROAD	MOON, HAROLD	Residential	81	2008-07-21
585	03100336	352318	861028	Not Provided	CLARK T	Residential	86	1966-12-13
586	96004526	352304	861020	CARTER BLAKE 360	CLARK, RICHARD	Residential	97	1996-09-25
587	03100338	352314	861010	Not Provided	TAYLOR W	Residential	114	1966-11-05
588	03100031	352333	860953	Not Provided	STONE S	Residential	135	1963-11-06

Key to Figure 4.2-2 (Arnold AFB)
 Desktop 4-mile Water Well Review Results (All Wells)
 Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
 Site Inspection Report, Arnold Air Force Base, Tennessee

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
589	20003572	352316	860934	HWY 55 E	C.F.C. RECYCLING	Other	140	2000-06-30
590	03100504	352320	860912	Not Provided	BRYAN R	Residential	101	Not Provided
591	03100087	352324	860900	Not Provided	DANIAL M	Residential	65	1964-05-29
592	03109001	352326	860904	Not Provided	OLDFIELD LEE	Residential	68	Not Provided
593	20063084	352324	860828	950 HAWKERSMITH RD	HAWKERSMITH, STEVE	Residential	80	2006-06-28
594	03100379	352326	860823	Not Provided	AYERS S	Residential	54	1967-03-20
595	20020923	352328	860817	679 HAWKERSMITH	MONDAY, STORMY	Residential	37	2002-03-29
596	03101789	352324	860801	Not Provided	HAWKER SMITH NURSERY	Farm	62	1981-05-12
597	96001759	352249	860754	THACKER RD	STEMBRIDGE, KEITH	Residential	60	1996-03-15
598	03102171	352230	860730	RUTLEDGE FALLS	THOMAS, INEZ	Residential	85	1984-07-15
599	03102101	352230	860730	SHORT SPRINGS	HARRIS, RAY	Residential	62	1984-07-19
600	03101720	352234	860726	Not Provided	GREGGS A	Residential	45	1979-07-19
601	20060517	352248	860726	830 THACKER RD.	LEWIS HAWKER SMITH NURSERY	Residential	59	2005-12-07
602	20061682	352237	860723	979 THACKER RD	GORE, CLYDE	Residential	51	2006-03-29
603	03101261	352248	860719	Not Provided	THACKER D	Farm	62	1974-09-06
604	95002980	352307	860723	414 THACKER RD	CARTER, TEDDY	Residential	47	1995-06-27
605	98002072	352318	860723	194 THACKER RD	MUSSER, DAISY	Residential	57	1998-06-10
606	95000918	352324	860723	THACKER 234	BALTIMORE, RANDALL	Residential	58	1995-03-13
607	96000787	352324	860722	THACKER 352	HOEFNER, ROD	Residential	53	1996-03-13
608	95002143	352324	860713	HAWKER SMITH 156	HARMON, ANGIE	Residential	68	1995-05-06
609	20032213	352319	860609	2710 HAWKERSMITH RD	INGRAM, JIMMY	Residential	100	2003-07-09

FIGURE 4.2-3
Desktop 4-mile Water Well Review Results
(Downgradient Wells - Northwest
Groundwater Trough)
Arnold Air Force Base
Manchester, Tennessee

Site Inspection of Aqueous
 Film Forming Foam (AFFF)
 Release Areas
 Environmental Programs Worldwide
 Site Inspection Report

Air Force Civil Engineer Center



2261 Hughes Ave., Suite 163
 JBSA Lackland, TX 78236

Symbol Key

- 100 Map Reference Number
- Residential Well
- Municipal Well
- Farm Well; Irrigation Well
- Heat Pump Well
- Industrial Well
- Unknown / Other Well
- Cross-gradient to Upgradient Wells
- Potentially impacted groundwater in downgradient direction
- Approximate 2016 Groundwater Contours (CH2M, 2016) - See Figure 4.2-1
- ▶ Groundwater Trough (USGS, 2011)
- ▶ Interpreted Groundwater Trough (Based on CH2M 2016 Contours)
- Regional Groundwater Divide (USGS, 2011)
- Groundwater Chlorinated VOC Contaminant Plume (USGS, 2011)
- Search Area (1-mile from Arnold AFB Installation Boundary)
- Search Area (4-mile from Arnold AFB Installation Boundary)
- AFFF Release Area
- Arnold AFB Installation Boundary
- + Temporary Monitoring Well
- + Monitoring Well with PFOS, PFOA, PFOS + PFOA, and/or PFBS Groundwater Exceedance
- Influent Sample with PFOS, PFOA, PFOS + PFOA, and/or PFBS Groundwater Exceedance

Well Source: Tennessee Department of Environment and Conservation, Department of Water Resources.

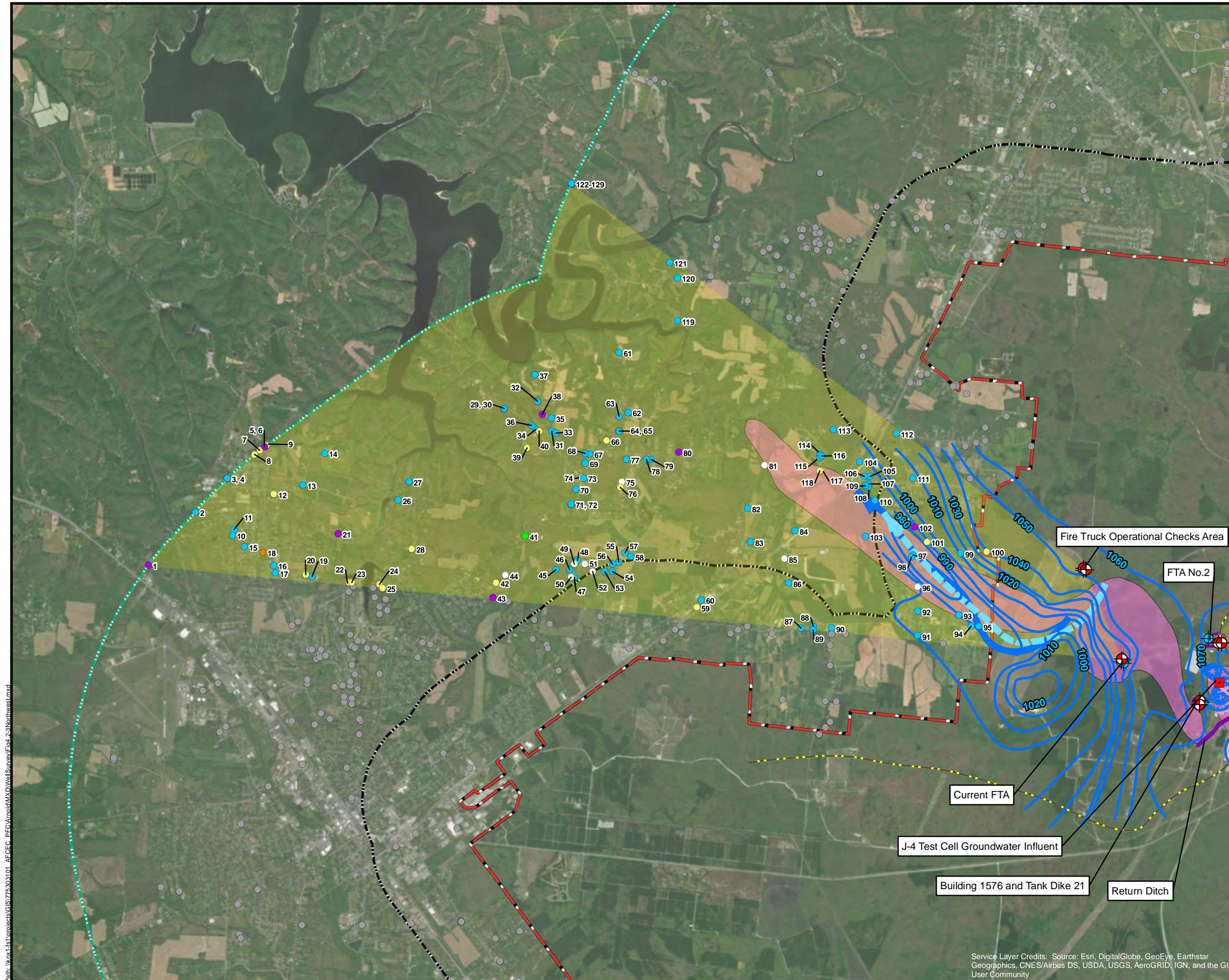
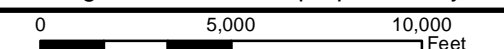


Project: 775303101

By: EMK

Date: 5/22/2018

For general reference purposes only.



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Key to figure 4.2-3 (Arnold AFB)
Desktop 4-mile Water Well Review Results (Downgradient Wells)
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold Air Force Base, Tennessee

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
1	20014238	352357	861443	288 FLOWERTOWN RD	GOLDEN, KENT	Heat Pump	126	2001-10-03
2	03100052	352427	861415	Not Provided	BRAZIER W	Residential	107	1963-12-10
3	03100088	352435	861408	Not Provided	HILL E	Residential	78	1964-05-26
4	98003855	352456	861339	398 HICKORY RIDGE	RIGNEY, MARK W	Residential	93	1998-08-28
5	20062567	352500	861328	502 HICKORY RIDGE LN	SCOTT GREGORY CONST	Heat Pump	95	2006-06-19
6	20081908	352500	861329	502 HICKORY RIDGE LN	BARTON, EDDIE	Heat Pump	300	2008-06-14
7	20014233	352458	861332	472 HICKORY RIDGE RD	HALL, JEFF	Irrigation	125	2001-09-26
8	20073797	352449	861329	114 HUNTERS RIDGE RD.	GRANTHAM, MARK	Irrigation	70	2007-09-13
9	20074953	352502	861329	502 HICKORY RIDGE	BARTON, SUZZANNE & EDDIE	Irrigation	195	2007-11-17
10	20121417	352416	861353	1221 RILEY CREEK RD	JONES, RANDY	Residential	111	2012-05-15
11	20074318	352419	861352	1285 RILEY CREEK RD	REED, ALLEN	Residential	112	2007-09-11
12	20033202	352438	861326	664 OVOCA LAKE RD	DAVENPORT, DAVID	Irrigation	120	2003-09-25
13	03100045	352443	861307	Not Provided	PITTS J	Residential	57	1964-02-06
14	03100046	352500	861253	Not Provided	BRANNON A	Residential	56	1964-02-03
15	03100051	352410	861345	Not Provided	BYRON O	Residential	82	1963-12-28
16	03100238	352400	861326	Not Provided	JOLLY R	Residential	65	1965-12-28
17	03100441	352356	861325	Not Provided	MANN F	Residential	66	1967-11-04
18	20074125	352407	861333	125 PARKWAY RD	STUBBLEFIELD, JAMES	Industrial	140	2007-08-15
19	03100397	352354	861301	Not Provided	LALCOB T	Residential	65	1967-06-06
20	20074957	352355	861305	310 SOMERSET LANE	JOHNSON, CHARLES	Irrigation	65	2007-11-26
21	20022155	352417	861244	2321 OVOCA RD	COLLIER, MARSORIE	Heat Pump	140	2002-06-19
22	20073479	352351	861237	308 SETTERS LANE W	TAYLOR, JAMES	Irrigation	107	2007-08-17
23	20082541	352351	861235	306 SETTERS LANE W	ERIC JONES CONSTRUCTION	Irrigation	104	2008-06-17
24	20074955	352350	861217	105 POINT CIRCLE	ALLERY, PETER	Irrigation	41	2007-11-25
25	20092081	352348	861215	101 POINT CIRCLE	RICHISON, WILLIAM	Irrigation	72	2009-07-28
26	03100013	352435	861205	Not Provided	FISHER H	Residential	96	1963-10-03
27	03100382	352445	861158	Not Provided	CLASON J	Residential	220	1967-04-11
28	20022950	352409	861156	225 LAKE HILLS RD	MARVALL, JEFF	Irrigation	140	2002-08-13
29	03100058	352524	861056	Not Provided	GOLD E	Residential	150	1964-01-03
30	03100383	352524	861056	Not Provided	GOLD E	Residential	120	1967-01-31
31	03100188	352512	861025	Not Provided	CARTER R	Residential	63	1965-04-12
32	03100230	352528	861034	Not Provided	HALL F	Residential	81	1965-09-25
33	03100300	352511	861022	Not Provided	SAIN N	Residential	72	1966-06-20
34	03100375	352513	861035	Not Provided	BAINES C	Residential	72	Not Provided
35	03100186	352519	861025	Not Provided	HARRIS C	Residential	82	1965-02-17
36	03101224	352515	861038	Not Provided	MASSINGILL T.	Residential	71	1974-08-23
37	03101937	352542	861036	Not Provided	DUDLEY CHARLES	Residential	102	1981-08-26
38	20110004	352521	861031	197 BLAZIN ACRES	ROSS, SHAWN	Heat Pump	195	2010-11-03
39	20110005	352503	861041	258 DEAN LANE	DEAN, JEFF	Irrigation	195	2010-11-04
40	20151663	352512	861033	591 J.D. NEIL RD	DEAN, JEFF	Irrigation	150	2015-08-24
41	03108003	352416	861042	Not Provided	CITY TULLAHOMA SHORT	Municipal	0	Not Provided
42	20013622	352351	861101	1156 CARTER BLAKE	QUICK, JOEY	Farm	77	2001-08-18
43	20092282	352343	861103	1038 CARTER BLAKE ROAD	RICE, TOM	Heat Pump	195	2009-08-13
44	TN018608	352355	861055	SHORTSPRINGS	ANDERSON, CHARLES	Other	0	Not Provided
45	97003555	352358	861022	DUKE HOLLOW	MANGRUM, RUSTY	Residential	126	1997-08-16
46	97004466	352358	861013	DUKE HOLLOW 160	DUKE, LARRY	Residential	118	1997-09-20
47	95003977	352354	861010	CARTER 503	MANGRUM, RUSTY	Residential	89	1995-08-12
48	94001756	352403	861008	CARTER LN 444	FULLER, PATRICIA	Residential	80	1994-05-16
49	TN019984	352401	861010	CARTER 85	DUKE	Other	0	Not Provided
50	TN019985	352354	861012	CARTER 451	UNKNOWN35	Other	0	Not Provided
51	TN019987	352401	861003	CARTER 363	PROSS, CHRIS	Other	0	Not Provided
52	TN019988	352357	860958	CARTER 334	TODD, JAMES	Other	0	Not Provided
53	03100455	352357	860950	Not Provided	GHEN L	Residential	86	1968-01-12
54	03100456	352357	860945	Not Provided	CHEA L	Residential	83	1968-01-02
55	03100340	352402	860941	Not Provided	SMITH J	Residential	77	1966-10-17
56	03100453	352401	860945	Not Provided	HOLDER C	Residential	94	1968-03-01
57	03101809	352407	860937	Not Provided	BOWEN W	Residential	85	1981-06-03
58	20031784	352405	860933	930 SEARS ROEBUCK RD	REEVES, AMOS D	Residential	75	2003-07-08
59	20170271	352338	860850	4304 OLD MANCHESTER HWY	GALLETT, BARNEY	Irrigation	70	2016-07-25
60	03100343	352342	860847	Not Provided	DANIEL H	Residential	60	1966-08-01
61	03101805	352554	860941	Not Provided	REYNOLDS S	Residential	180	1981-03-25
62	03101715	352522	860935	Not Provided	DOWNS S	Residential	57	1980-07-14
63	03100002	352520	860941	Not Provided	BAKER W	Residential	93	1963-08-09
64	03100034	352512	860941	Not Provided	GILBERT R	Residential	74	1963-11-07
65	03100337	352512	860941	Not Provided	GILBERT R	Residential	85	1966-11-28
66	03101185	352507	860949	Not Provided	GILBERT E.	Farm	142	1974-03-05
67	03102194	352500	861000	Not Provided	SAIN E, NORMAN	Residential	150	1984-07-13
68	03100068	352500	861003	Not Provided	BOYD T	Residential	64	1964-04-27
69	03100143	352455	861003	Not Provided	BOYD L	Residential	73	1964-10-03
70	03100165	352441	861009	Not Provided	LAWSON D	Residential	80	1964-12-17
71	03100184	352433	861012	Not Provided	GHEA C	Residential	70	1965-01-22
72	03100167	352433	861012	Not Provided	GHEA C	Residential	70	1965-01-12
73	03100301	352447	861004	Not Provided	HARRIS R	Residential	117	1966-03-18
74	03100168	352447	861005	Not Provided	NAZARENE CHURCH	Other	80	1964-10-29
75	03101605	352445	860939	Not Provided	CULBERTSON J	Other	66	1979-06-08

Key to figure 4.2-3 (Arnold AFB)
Desktop 4-mile Water Well Review Results (Downgradient Wells)
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold Air Force Base, Tennessee

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
76	03101691	352442	860940	Not Provided	GUINN J	Farm	66	1979-08-18
77	03101714	352457	860936	Not Provided	GRAMMER D	Residential	72	1980-07-15
78	03100124	352457	860923	Not Provided	TARWATER H	Residential	82	1964-08-25
79	03100110	352457	860920	Not Provided	BUCHANAN D	Residential	81	1964-06-11
80	20100060	352501	860902	2276 RUTLEDGE FALLS ROAD	KINSER, DON	Heat Pump	90	2009-11-14
81	03101530	352454	860806	Not Provided	WELBORN D	Other	50	1978-06-27
82	03101265	352431	860817	Not Provided	NEEL D	Residential	70	1975-04-26
83	03101934	352413	860815	Not Provided	NEEL CURRY C.	Residential	74	1981-09-26
84	03101707	352419	860746	Not Provided	MELTON N	Residential	60	1980-07-30
85	03102074	352404	860753	HICKERSON STATI	RUTLEDGE FALLS CH.	Other	83	1983-07-21
86	03101685	352351	860750	Not Provided	FORELL J	Residential	65	1979-08-01
87	03100248	352327	860742	Not Provided	BENNET L	Residential	80	1966-04-12
88	03101532	352328	860734	Not Provided	FERRELL F E	Residential	46	1978-06-21
89	94003828	352326	860734	HAWKERSMITH	LUTTRELL, STEVE	Residential	50	1994-09-17
90	96000594	352327	860722	THACKER RD 104	WHITE, RICK	Residential	72	1996-02-13
91	20040080	352323	860626	2458 HAWKER-SMITH RD.	GIVENS, FRANK	Residential	56	2003-12-09
92	03101710	352336	860626	Not Provided	DUGAN D	Residential	64	1980-03-06
93	94003834	352334	860559	HAWKERSMITH	INGRAM, JIMMY	Residential	143	1994-09-21
94	03100470	352328	860551	Not Provided	BLACKBURN J	Residential	113	1967-06-10
95	94000913	352328	860546	HAWKER SMITH	WEST, BERRY	Residential	140	1994-04-02
96	03101699	352349	860626	Not Provided	SANDERS J	Other	61	1979-07-26
97	20001483	352406	860629	1280 BRANDON TOWN RD	DAVIS, EDWARD	Residential	100	2000-02-16
98	20043641	352405	860630	1326 BRANDONTOWN RD.	NORTON, WENDELL	Residential	88	2004-10-05
99	03100451	352407	860558	Not Provided	MYERS J	Residential	100	1968-03-09
100	03101322	352408	860541	Not Provided	CARR R.H.	Farm	45	1975-02-11
101	03101580	352413	860620	Not Provided	MYERS J	Farm	137	1979-04-20
102	20090145	352421	860628	1029 BRANDONTOWN ROAD	SCHERROUSE, PETER	Heat Pump	145	2008-11-18
103	03102017	352416	860700	Not Provided	BLAND SHIRLEY	Residential	95	1982-10-23
104	03101575	352456	860704	Not Provided	JONES L	Residential	62	1979-04-06
105	03101356	352448	860657	Not Provided	MYERS D.C.	Residential	86	1976-06-08
106	03101859	352448	860701	Not Provided	UNKNOWN131	Residential	0	Not Provided
107	03101581	352444	860658	Not Provided	DUNCAN J	Residential	87	1979-04-10
108	03101576	352442	860658	Not Provided	LACKEY B W	Residential	98	1979-04-06
109	03101606	352443	860700	Not Provided	CHRISTMAN J	Residential	100	1979-06-08
110	03102025	352435	860654	Not Provided	MCCULLOUGH ROBERT	Residential	55	1982-09-20
111	03101294	352447	860629	Not Provided	PHILLIPS J.	Residential	128	1976-05-03
112	03102004	352511	860640	Not Provided	GILLIAN	Residential	145	1982-06-20
113	03101793	352513	860721	Not Provided	CROY B	Residential	80	1981-02-20
114	03102709	352500	860730	MT VIEW	HALL, D J	Residential	84	1988-04-23
115	20110279	352458	860730	284 WATERFORD DRIVE	MCGILL, JEFF	Residential	100	2011-02-16
116	20110280	352459	860729	284 WATERFORD DRIVE	MCGILL, JEFF	Residential	85	2011-02-16
117	20120194	352451	860729	WATERFORD FARMS, LOT 2	BOYD, JAY	Irrigation	47	2011-12-02
118	20121151	352451	860730	WATERFORD FARMS, LOT 2	BOYD, JAY	Irrigation	42	2012-05-01
119	20150133	352611	860903	588 VANN LN	VANN, MARK	Residential	180	2014-12-02
120	03100522	352634	860903	Not Provided	ROWLAND B	Residential	59	1968-05-25
121	20015174	352642	860908	172 LEFEVER CT	BRYAN, JAMES	Residential	195	2001-11-17
122	03102144	352730	861000	SUGAR CAMP BOTT	BARNETT, STEVE	Residential	145	1984-03-01
123	03102157	352730	861000	CATHY RIDGE	NOE, DAVID	Residential	82	1984-07-09
124	03102189	352730	861000	LAKE VIEW RD	RHOTEN, ROGER	Residential	145	1985-01-12
125	03102190	352730	861000	LAKE VIEW RD	RHOTEN, ROGER	Residential	50	1985-01-10
126	03102196	352730	861000	WARDS CHAPEL RD	STEPHENS, KENNETH	Residential	125	1984-10-11
127	03102286	352730	861000	BLANTON CHAPEL	DRAKE, ROBERT	Residential	81	1981-11-09
128	03102287	352730	861000	BLANTON CHAPEL	BANKS, W C	Farm	91	1985-11-08
129	03102293	352730	861000	CATHEY RIDGE	BANKS, BRUCE	Residential	89	1985-10-11

FIGURE 4.2-4
Desktop 4-mile Water Well Review Results
(Downgradient Wells - Northeast
Groundwater Trough)
Arnold Air Force Base
Manchester, Tennessee

Site Inspection of Aqueous
 Film Forming Foam (AFFF)
 Release Areas
 Environmental Programs Worldwide
 Site Inspection Report

Air Force Civil Engineer Center



2261 Hughes Ave., Suite 163
 JBSA Lackland, TX 78236

Symbol Key

- 330 Map Reference Number
- Residential Well
- Municipal Well
- Farm Well; Irrigation Well
- Heat Pump Well
- Industrial Well
- Unknown / Other Well
- Cross-gradient to Upgradient Wells
- Yellow shaded area Potentially impacted groundwater in downgradient direction
- Blue line Approximate 2016 Groundwater Contours (CH2M, 2016) - See Figure 4.2-1
- Blue arrow Groundwater Trough (USGS, 2011)
- Light blue arrow Interpreted Groundwater Trough (Based on CH2M 2016 Contours)
- Yellow dashed line Regional Groundwater Divide (USGS, 2011)
- Pink shaded area Groundwater Chlorinated VOC Contaminant Plume (USGS, 2011)
- Black dashed line Search Area (1-mile from Arnold AFB Installation Boundary)
- Green dashed line Search Area (4-mile from Arnold AFB Installation Boundary)
- Purple shaded area AFFF Release Area
- Red dashed line Arnold AFB Installation Boundary
- Blue circle with crosshair Temporary Monitoring Well
- Red circle with crosshair Monitoring Well with PFOS, PFOA, PFOS + PFOA, and/or PFBS Groundwater Exceedance
- Red square Influent Sample with PFOS, PFOA, PFOS + PFOA, and/or PFBS Groundwater Exceedance

Well Source: Tennessee Department of Environment and Conservation, Department of Water Resources.

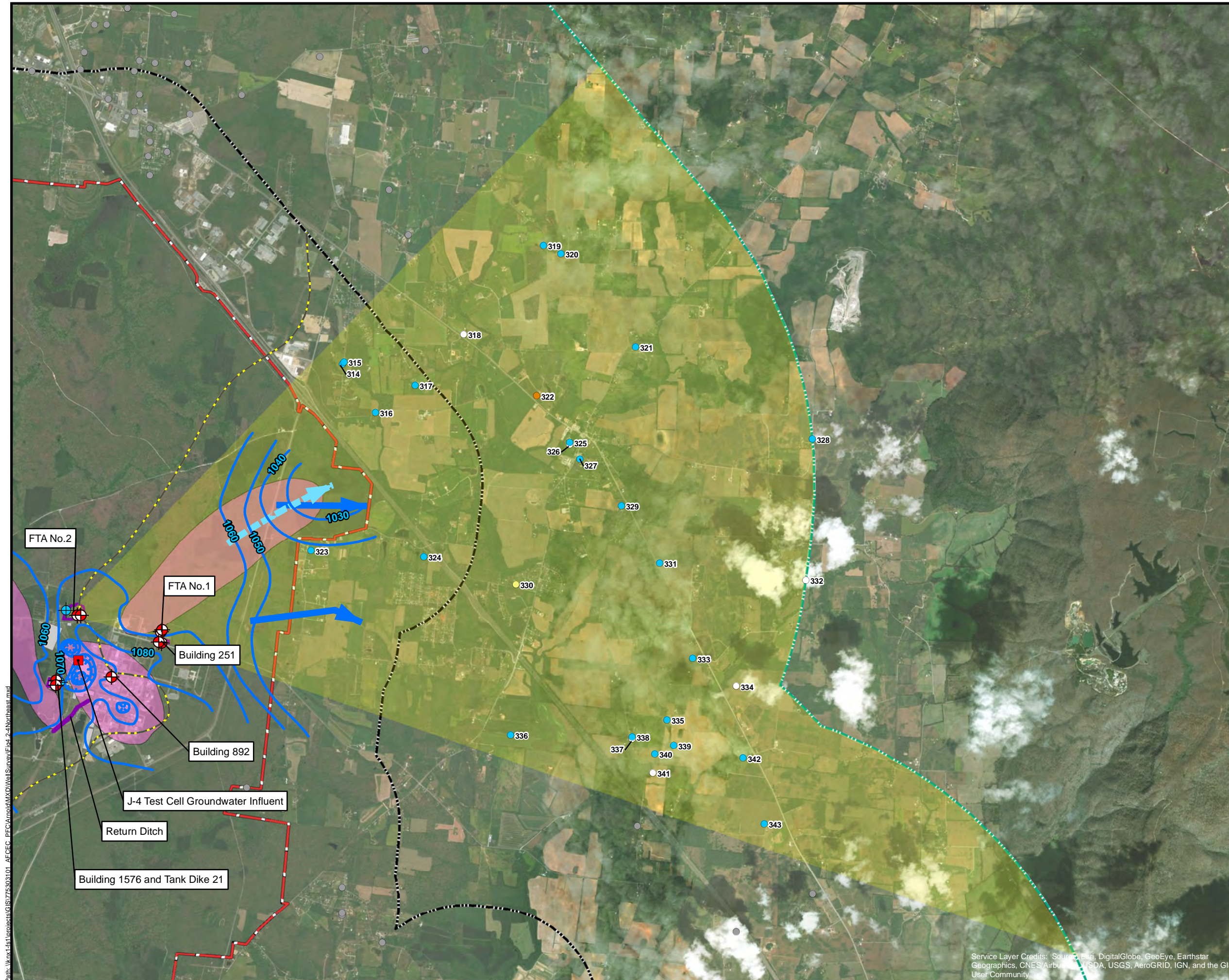
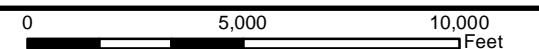


Project: 775303101

By: EMK

Date: 5/22/2018

For general reference purposes only.



Path: \\knox14s1\projects\GIS\775303101_AFCFC_PFOAArnoldMWDWellSurvey\Fig4.2-4Northeast.mxd

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 User Community

Key to Figure 4.2-4 (Arnold AFB)
Desktop 4-mile Water Well Review Results (Downgradient Wells)
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold Air Force Base, Tennessee

Map Reference Number	Well Number	Latitude	Longitude	Address	Owner	Use	Total Depth (feet bgs)	Completion Date
314	03100005	352518	860037	Not Provided	BOYER C	Residential	62	1963-09-05
315	03100032	352519	860036	Not Provided	DORIS H	Residential	70	1963-11-04
316	03100026	352455	860018	Not Provided	DUCUS	Residential	38	Not Provided
317	20000922	352508	855955	ADAMS RD	GREEN, DALE	Residential	123	2000-01-30
318	03101288	352532	855927	Not Provided	LASTOR B.	Other	102	1975-09-30
319	03101818	352614	855841	Not Provided	FINNEY N.	Residential	65	1980-08-05
320	03101856	352610	855831	Not Provided	UNKNOWN128	Residential	0	Not Provided
321	03101991	352526	855748	Not Provided	PENNEGAR REX	Residential	115	1982-03-10
322	03100698	352503	855845	Not Provided	FULTS D	Industrial	82	Not Provided
323	03101785	352350	860055	Not Provided	FINNEY G	Residential	86	1981-01-09
324	03101718	352347	855950	Not Provided	MCKELVEY R	Residential	84	1980-05-15
325	03100096	352441	855826	Not Provided	LESTER M	Residential	86	Not Provided
326	03100118	352440	855826	Not Provided	HILLSBORO B CHURCH	Other	78	1964-07-17
327	03101192	352433	855820	Not Provided	MYERS L.B.	Residential	80	1974-06-11
328	03100021	352442	855612	Not Provided	RUST J	Residential	143	1963-11-05
329	03101829	352411	855756	Not Provided	MCCORMICK M.	Residential	87	1980-10-13
330	99003296	352334	855857	214 BAINS RD	MEADOWS, MELVIN	Irrigation	90	1999-07-06
331	03100048	352344	855734	Not Provided	JOHNSON M	Residential	89	1964-01-23
332	03100412	352336	855611	Not Provided	BEANS CREEK CHURCH	Other	33	1967-09-02
333	03102713	352259	855715	HOWARD GREGORY	TOWNSEND, JEFF	Residential	50	1988-05-12
334	Not Provided	352246	855650	10513 HIGHWAY 41	BANKS,	Other	0	Not Provided
335	03102241	352230	855730	PARNE PLANS ACR	BROWN, JOHNNY	Residential	105	1985-06-08
336	03102009	352223	855900	Not Provided	HARRIS RICHARD	Residential	70	1982-07-12
337	03100025	352221	855750	Not Provided	FULTS	Other	97	1963-11-12
338	03100056	352222	855750	Not Provided	FULTS C	Residential	90	1963-11-12
339	03101995	352218	855726	Not Provided	STARKS FRED	Residential	65	1982-03-18
340	20003573	352214	855737	PRAIRIE PLAINS RD	SHERILL, JAMES	Residential	103	2000-07-05
341	03100024	352205	855738	Not Provided	LONG A	Other	70	Not Provided
342	03101886	352212	855646	Not Provided	UNKNOWN142	Residential	0	Not Provided
343	03101853	352141	855634	Not Provided	UNKNOWN126	Residential	0	Not Provided

TABLES

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Table 3.0-1
Monitoring Well Construction Details
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold AFB, Manchester, Tennessee

AFFF Release Area	Location ID	Installation Date	Well Material	Northing	Easting	TOC Elevation (ft amsl)	Well Depth (ft bgs)	Well Diameter (in)	Screen Length (ft)	Screen Size (in)	Screen Interval (ft bgs)
1	MW01001	10/13/2017	PVC	383383.61	1956783.62	1087.82	30.17	2	10	0.01	20.2-30.2
	MW01002	10/13/2017	PVC	383475.9	1956845.88	1087.21	30.16	2	10	0.01	20.2-30.2
2	MW02001	10/14/2017	PVC	384158.61	1952795	1086.67	25.37	2	10	0.01	15.0-25.0
	MW02002	10/16/2017	PVC	384149.99	1952953.73	1088.03	30.50	2	10	0.01	20.4-30.4
	MW02003	10/16/2017	PVC	384414.48	1952255.27	1090.86	30.50	2	10	0.01	19.1-29.1
3	MW03001	10/17/2017	PVC	382835.77	1956816.76	1089.12	30.50	2	10	0.01	20.2-30.2
	MW03002	10/12/2017	PVC	382898.65	1956675.28	1089.26	30.17	2	10	0.01	19.7-29.7
4	834	10/30/2007	PVC	381237.89	1954641.15	1095.59	40	2	10	0.01	20-40
5	MW05001	10/19/2017	PVC	381054.84	1951782.53	1078.83	28.15	2	7	NA	14.7-24.7
	MW05002	10/19/2017	PVC	380830.97	1951771.41	1074.3	25.15	2	10	0.01	14.7-24.7
	MW05003	10/19/2017	PVC	380961.74	1951968.61	1074.9	25.15	2	NA	NA	14.9-24.9
7	MW07001	10/18/2017	PVC	388192.58	1945505.09	1057.9	30.15	2	10	0.01	19.2-29.2
	MW07002	10/18/2017	PVC	388128.06	1945640.6	1059.14	33.5	2	10	0.01	20.0-21.0
	MW07003	10/18/2017	PVC	388082.2	1945489.32	1060.45	30.15	2	10	0.01	19.8-29.9
8	MW08001	10/19/2017	PVC	383268.84	1947664.6	1094.36	49.25	2	4.5	NA	38.9-48.9
	MW08002	10/17/2017	PVC	383087.97	1947674.43	1092.44	27.5	2	10	NA	17.3-27.3
	MW08003	10/19/2017	PVC	383143.04	1947545.45	1092.79	50.43	2	10	0.01	40.2-50.2
	232	NA	PVC	383278.13	1947579.49	1091.3	81	4	10	NA	71-81

Notes:

AFFF - aqueous film forming foam
amsl - above mean sea level
bgs - below ground surface
ft - feet
in - inches
NA - not available
PVC - Polyvinyl Chloride
TOC - top of casing

Table 3.0-2
Groundwater Elevations
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold AFB, Manchester, Tennessee

AFFF Release Area	Location ID	Well Depth (ft bgs)	TOC Elevation (ft amsl)	Date Measured	Depth to Groundwater (ft btoc)	Groundwater Elevation (ft amsl)
1	MW01001	30.17	1087.82	10/15/2017	21.03	1066.79
	MW01002	30.16	1087.21	10/16/2017	17.51	1069.70
2	MW02001	25.37	1086.67	10/16/2017	16.43	1070.24
	MW02002	30.50	1088.03	10/18/2017	16.45	1071.58
	MW02003	30.50	1090.86	10/18/2017	25.46	1065.40
3	MW03001	30.50	1089.12	10/18/2017	22.00	1067.12
	MW03002	30.17	1089.26	10/15/2017	22.57	1066.69
4	834	40	1095.59	10/19/2017	18.45	1077.14
5	MW05001	28.15	1078.83	10/20/2017	7.86	1070.97
	MW05002	25.15	1074.3	10/20/2017	7.81	1066.49
	MW05003	25.15	1074.9	10/20/2017	12.72	1062.18
7	MW07001	30.15	1057.9	10/19/2017	4.70	1053.20
	MW07002	33.5	1059.14	10/20/2017	4.92	1054.22
	MW07003	30.15	1060.45	10/19/2017	8.66	1051.79
8	MW08001	50.24	1094.36	11/14/2017	49.97	1044.39
	MW08002	30.39	1092.44	11/14/2017	29.18	1063.26
	MW08003	50.42	1092.79	11/14/2017	49.81	1042.98
	232	81	1091.3	11/14/2017	64.02	1027.28

Notes:

AFFF - aqueous film forming foam

amsl - above mean sea level

bgs - below ground surface

btoc - below top of casing

ft - feet

Table 3.1-1
Summary of Soil Analytical Testing Results
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold Air Force Base, Tennessee

Analyte:						Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	6:2 Fluorotelomer sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	N-Ethyl perfluorooctanesulfonamide oacetic acid (NETFOSAA)	N-Methyl perfluorooctanesulfonamide oacetic acid (NMEFOSAA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoA)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTriDA)	Perfluoroundecanoic acid (PFUnA)	
Screening Level:						0.126 ¹	0.126 ¹	130 ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
AFFF Release Area	Location	Sample ID	Sample Date	Sample Depth (ft.)	Sample Type	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
1	MW01001	ARNLD01-SO-001	13-Oct-17	0.5-1.0	N	0.011 B	0.01	0.001 U	0.00591	0.0041 U	0.0041 U	0.0041 U	0.001 U	0.001 U	0.001 U	0.00577 B	0.000578 J	0.001 U	0.001 U	0.001 U	0.001 U	
		ARNLD01-SO-002	13-Oct-17	17.0-19.0	N	0.00126 Q	0.00108 J	0.0013 UJ	0.0051 UJ	0.0051 UJ	0.0051 UJ	0.0051 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.00145 Q	0.000459 J	0.0013 UJ	0.0013 UJ	0.0013 UJ	R
	SB01003	ARNLD01-SO-003	13-Oct-17	0.5-1.0	N	0.118	0.00145 J	0.001 U	0.004 U	0.004 U	0.004 U	0.004 U	0.001 U	0.001 U	0.001 U	0.0051 B	0.00112 J	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
		ARNLD01-SO-004	13-Oct-17	17.0-19.0	N	0.0071 Q	0.001 UJ	0.001 UJ	0.0041 UJ	0.0041 UJ	0.0041 UJ	0.0041 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ	0.00463 Q	0.00076 J	0.001 UJ	0.001 UJ	0.001 UJ	0.001 UJ
3	MW03001	ARNLD03-SO-001	12-Oct-17	0.0-0.5	N	0.0709	0.00343	0.0012 U	0.0047 U	0.0047 U	0.0047 U	0.0047 U	0.00218 J	0.0006 J	0.00208 J	0.00621	0.00253	0.00502	0.0012 U	0.0012 U	0.00305	
		ARNLD03-SO-002	12-Oct-17	17.0-19.0	N	0.063 J	0.00392 J	0.0011 UJ	0.00706 J	0.0045 UJ	0.0045 UJ	0.0045 UJ	0.0011 UJ	0.0011 UJ	0.00104 J	0.0132 J	0.00158 J	0.00168 J	0.0011 UJ	0.0011 UJ	0.0011 UJ	
	MW03002	ARNLD-FD-SO-001	12-Oct-17	17.0-19.0	FD	0.00908 J	0.00101 J	0.0013 UJ	0.0053 UJ	0.0053 UJ	0.0053 UJ	0.0053 UJ	0.0013 UJ	0.0013 UJ	0.00076 J	0.00478 J	0.00135 J	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	
		ARNLD03-SO-003	12-Oct-17	0.0-0.5	N	0.0519	0.00204 J	0.0012 U	0.0047 U	0.0047 U	0.0047 U	0.0047 U	0.00196 J	0.000743 J	0.00148 J	0.00288	0.0011 J	0.00321	0.0012 U	0.0012 U	0.00172 J	
4	SB04002	ARNLD04-SO-001	19-Oct-17	0.5-1.0	N	0.538	0.00813	0.00239 J	0.258	0.0261 J	0.0048 U	0.0048 U	0.0012 U	0.0012 U	0.00184 J	0.0351	0.0225	0.0012 U	0.0012 U	0.0012 U	0.0012 U	
		ARNLD04-SO-002	19-Oct-17	5.0-6.0	N	1.32	0.0105 J	0.00425 J	0.119	0.0236 J	0.1 U	0.1 U	0.0064 U	0.0064 U	0.0064 U	0.0379	0.0241	0.0064 U	0.0064 U	0.0064 U	0.0064 U	
5	MW05001	ARNLD05-SO-001	19-Oct-17	1.0-1.5	N	0.00501 B	0.0011 U	0.0011 U	0.0046 U	0.0046 U	0.0046 U	0.0046 U	0.0011 U	0.0011 U	0.0011 U	0.000646 J	0.0011 U	0.0011 U	0.0011 U	0.0011 U	0.0011 U	
		ARNLD05-SO-002	19-Oct-17	12.0-14.0	N	0.00393 B	0.0013 U	0.0013 U	0.0051 U	0.0051 U	0.0051 U	0.0051 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	
	MW05002	ARNLD05-SO-003	19-Oct-17	0.0-0.5	N	0.00174 B	0.0012 U	0.0012 U	0.0048 U	0.0048 U	0.0048 U	0.0048 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	
		ARNLD05-SO-004	19-Oct-17	12.0-14.0	N	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0049 UJ	0.0049 UJ	0.0049 UJ	0.0049 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ
7	MW07001	ARNLD07-SO-001	18-Oct-17	0.0-1.0	N	0.0251	0.0014 J	0.0012 U	0.0048 U	0.0048 U	0.0048 U	0.0048 U	0.0012 U	0.0012 U	0.00131 J	0.00138 J	0.00185 J	0.00128 J	0.0012 U	0.0012 U	0.0012 U	
		ARNLD07-SO-002	18-Oct-17	15.0-17.0	N	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.005 UJ	0.005 UJ	0.005 UJ	0.005 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	
		ARNLD-FD-SO-002	18-Oct-17	15.0-17.0	FD	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0049 UJ	0.0049 UJ	0.0049 UJ	0.0049 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	
	MW07002	ARNLD07-SO-003	18-Oct-17	0.0-1.0	N	0.0137 J	0.0012 U	0.0012 U	0.0048 U	0.0048 U	0.0048 U	0.0048 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.00101 J	0.0012 U	0.0012 U	0.0012 U	0.0012 U	
		ARNLD07-SO-004	18-Oct-17	17.0-19.0	N	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0049 UJ	0.0049 UJ	0.0049 UJ	0.0049 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	
	MW07003	ARNLD07-SO-005	18-Oct-17	0.0-1.0	N	0.0106	0.00164 J	0.0013 U	0.0052 U	0.0052 UJ	0.0052 UJ	0.0052 UJ	0.0013 UJ	0.0013 UJ	0.000761 J	0.0013 U	0.000835 J	0.000704 J	0.0013 UJ	0.0013 UJ	0.0013 UJ	
ARNLD07-SO-006		18-Oct-17	17.0-19.0	N	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0049 UJ	0.0049 UJ	0.0049 UJ	0.0049 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ	0.0012 UJ		
8	MW08001	ARNLD08-SO-001	17-Oct-17	0.0-0.5	N	0.115	0.00112 J	0.0011 U	0.0044 U	0.0044 U	0.0044 U	0.0044 U	0.00165 J	0.0011 U	0.00116 J	0.0017 J	0.00106 J	0.00366	0.0011 U	0.0011 U	0.0011 U	
		ARNLD08-SO-002	17-Oct-17	17.0-19.0	N	0.0011 UJ	0.0011 UJ	0.0011 UJ	0.0046 UJ	0.0046 UJ	0.0046 UJ	0.0046 UJ	0.0011 UJ	0.0011 UJ	0.0011 UJ	0.0011 UJ	0.00126 J	0.0011 UJ	0.0011 UJ	0.0011 UJ	0.0011 UJ	
	MW08002	ARNLD08-SO-003	17-Oct-17	0.0-0.5	N	0.0613	0.00107 J	0.0011 U	0.0043 U	0.0043 U	0.0043 UJ	0.0043 UJ	0.00178 J	0.0011 U	0.000921 J	0.0019 J	0.00112 J	0.00202 J	0.0011 U	0.0011 U	0.000951 J	
		ARNLD08-SO-004	17-Oct-17	14.0-16.0	N	0.0101 J	0.0011 UJ	0.0011 UJ	0.00379 J	0.00258 J	0.0043 UJ	0.0043 UJ	0.0011 UJ	0.0011 UJ	0.0011 UJ	0.00135 J	0.000694 J	0.0011 UJ	0.0011 UJ	0.0011 UJ	0.0011 UJ	

Notes:
 PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry
¹Screening levels, based on a residential exposure scenario, calculated using the EPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search]
²USEPA Residential Screening Levels (November 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017]
 Highlighted cells indicate concentrations exceeding the Screening Level.
 B = The analyte was found in an associated blank, as well as in the sample.
 FD = Field Duplicate Sample
 ft - feet
 ID = Identification
 J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
 mg/kg - milligrams per kilogram
 N = Normal Field Sample
 NA = Not applicable
 Q = The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.
 R - Result was rejected during data validation. Please see data validation report for more information.
 U = The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).
 UJ = The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Table 3.1-2
Summary of Soil General Chemistry Analytical Testing Results
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold Air Force Base, Tennessee

Analyte:						pH	TOC
AFFF Release Area	Location	Sample ID	Sample Date	Sample Depth (ft)	Sample Type	S. U.	mg/kg
1	ARNLD01-C	ARNLD01-(0-1)	13-Oct-17	0.0-1.0	N	6.24	1120
		ARNLD01-(17-19)	13-Oct-17	17.0-19.0	N	5.39	287
3	ARNLD03-C	ARNLD03-(0-1)	12-Oct-17	0.0-1.0	N	6.90	38100
		ARNLD03-(17-19)	12-Oct-17	17.0-19.0	N	5.53	868
5	ARNLD05-C	ARNLD05-(0-1.5)	19-Oct-17	0.0-1.5	N	8.09	2340
		ARNLD05-(12-15)	19-Oct-17	12.0-15.0	N	5.06	120 J
7	ARNLD07-C	ARNLD07-(0-1)	18-Oct-17	0.0-1.0	N	7.58	28400
		ARNLD07-(15-19)	18-Oct-17	15.0-19.0	N	5.76	494
8	ARNLD08-C	ARNLD08-(0-1)	17-Oct-17	0.0-1.0	N	5.09	1730
		ARNLD08-(14-19)	17-Oct-17	14.0-19.0	N	5.34	171 J

Notes:

AFFF - aqueous film forming foam

ft - feet

ID - identification

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

N - normal field sample

mg/kg - milligrams per kilogram

S.U. - standard units

TOC - Total Organic Carbon

Table 3.1-3
Summary of Groundwater Analytical Testing Results
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold Air Force Base, Tennessee

Analyte:						Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	PFOS+PFOA	Perfluorobutanesulfonic acid (PFBS)	6:2 Fluorotelomer sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	N-Ethyl perfluorooctanesulfonamidoacetic acid (NETFOSAA)	N-Methyl perfluorooctanesulfonamidoacetic acid (NMEFOSAA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoA)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnA)
USEPA Health Advisory:						0.07	0.07	0.07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
USEPA Tap Water RSL¹:						NA	NA	NA	40	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
AFFF Release Area	Location	Sample ID	Sample Date	Sample Depth (ft.)	Sample Type	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1	MW01001	ARNLD01-GW-001	15-Oct-17	20.2-30.2	N	0.647	0.692	1.339	0.13	0.101	0.033 U	0.033 UJ	0.033 UJ	0.012 U	0.12 U	0.0455	0.964	0.295	0.0067 U	0.12 U	0.12 U	0.12 U
	MW01002	ARNLD01-GW-002	16-Oct-17	20.2-30.2	N	122	14.2 J	136.2 J	14.5 J	29.5	3.3 U	3.3 U	3.3 U	1.2 U	1.2 U	4.14	90 J	23.3 J	0.67 U	1.2 U	1.2 U	1.2 U
		ARNLD-FD-GW-001	16-Oct-17	20.2-30.2	FD	159	16 J	175 J	17.6 J	34.5	1.5 U	1.5 U	1.5 U	0.58 U	0.58 U	4.57	132 J	26 J	0.394 J	0.58 U	0.58 U	0.58 U
2	MW02001	ARNLD02-GW-001	17-Oct-17	15.0-25.0	N	2.97	4.49	7.46	0.453	0.873	0.31 U	0.31 U	0.31 U	0.12 U	0.12 U	0.669	16.2	2.98	0.0726 J	0.12 U	0.12 U	0.12 U
	MW02002	ARNLD02-GW-002	18-Oct-17	20.4-30.4	N	3.08	2.61	5.69	0.605	1.45	0.0524	0.033 U	0.033 U	0.012 U	0.012 U	0.393	17	2.82	0.116	0.012 U	0.012 U	0.012 U
	MW02003	ARNLD02-GW-003	18-Oct-17	19.1-29.1	N	0.0116 J	0.00448 J	0.01608	0.012 U	0.033 U	0.033 U	0.033 U	0.033 U	0.012 U	0.012 U	0.012 U	0.0126 J	0.012 U	0.0067 U	0.012 U	0.012 U	0.012 U
3	MW03001	ARNLD03-GW-001	18-Oct-17	20.2-30.2	N	10.5	2.91	13.41	1.4	6.6	0.33 U	0.33 U	0.33 U	0.12 U	0.12 U	1.98	17.8	3.73	0.38	0.12 U	0.12 U	0.12 U
	MW03002	ARNLD03-GW-002	15-Oct-17	19.7-29.7	N	19.5	4.03	23.53	2.59	5.66	0.33 U	0.33 U	0.33 U	0.12 U	0.12 U	1.24	24.1	5.28	0.0733 J	0.12 U	0.12 U	0.12 U
4	834	ARNLD04-GW-002	19-Oct-17	20.0-40.0	N	0.0605 B	0.0601	0.1206 B	0.012 U	0.445	0.0286 J	0.031 U	0.031 U	0.012 U	0.012 U	0.0252	0.0402	0.0936	0.00417 J	0.012 U	0.012 U	0.012 U
5	MW05001	ARNLD05-GW-001	20-Oct-17	14.7-24.7	N	2.5	0.281	2.781	0.0556	1.99	1.9	0.033 U	0.033 U	0.0173	0.012 U	0.318	0.568	0.409	0.0584	0.012 U	0.012 U	0.012 U
	MW05002	ARNLD05-GW-002	20-Oct-17	14.7-24.7	N	5.89	0.376	6.266	0.364	2.47	0.223	0.033 U	0.033 U	0.012 U	0.012 U	0.411	1.85	0.986	0.0285	0.012 U	0.012 U	0.012 U
		ARNLD-FD-GW-002	20-Oct-17	14.7-24.7	FD	5.65	0.348	5.998	0.337	2.25	0.216	0.031 U	0.031 U	0.012 U	0.012 U	0.383	1.71	0.913	0.0265	0.012 U	0.012 U	0.012 U
	MW05003	ARNLD05-GW-003	20-Oct-17	14.9-24.9	N	0.0166 J	0.00482 J	0.02142 J	0.012 U	0.033 U	0.033 U	0.033 U	0.033 U	0.012 U	0.012 U	0.00956 J	0.0116 J	0.0271	0.0067 U	0.012 U	0.012 U	0.012 U
7	MW07001	ARNLD07-GW-001	19-Oct-17	19.2-29.2	N	1.02	0.132	1.152	0.0468	0.349	0.0506	0.031 U	0.031 U	0.012 U	0.012 U	0.219	0.481	0.232	0.0287	0.012 U	0.012 U	0.012 U
	MW07002	ARNLD07-GW-002	20-Oct-17	20.0-30.0	N	5.36	0.365	5.725	0.193	1.03	0.227	0.033 U	0.033 U	0.00853 J	0.012 U	0.611	1.45	0.735	0.0988	0.012 U	0.012 U	0.012 U
	MW07003	ARNLD07-GW-003	19-Oct-17	19.8-29.9	N	0.0439 B	0.0155 J	0.0594 BJ	0.012 U	0.033 U	0.033 U	0.033 U	0.033 U	0.012 U	0.012 U	0.012 U	0.0122 J	0.0122 J	0.00463 J	0.012 U	0.012 U	0.012 U
8	232	ARNLD08-GW-004	15-Nov-17	69.5-79.5	N	1.04	0.178	1.218	0.176	1.88	0.031 UJ	0.031 UJ	0.031 U	0.012 UJ	0.012 U	0.144 J	0.894	0.496	0.00554 J	0.012 U	0.012 U	0.012 U
		ARNLD-FD-GW-003	15-Nov-17	69.5-79.5	FD	1.15	0.177	1.327	0.186	2.05	0.033 UJ	0.033 UJ	0.033 U	0.012 UJ	0.012 U	0.149 J	1.03	0.503	0.00468 J	0.012 U	0.012 U	0.012 U
9	INF09001	ARNLD09-INF-001	11-Oct-17	0.0-0.0	N	0.039	0.0811	0.1201	0.0196	0.033 U	0.033 U	0.033 U	0.033 U	0.012 U	0.012 U	0.0103 J	0.232	0.0723	0.0067 U	0.012 U	0.012 U	0.012 U

Notes:

Purple Shaded - Exceeds USEPA Health Advisory

PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry

¹Health Advisory from USEPA Office of Water, 2016a and 2016b, Health Advisories (HAs) for drinking water.

²USEPA Residential Screening Levels (November 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017]

Highlighted cells indicate concentrations exceeding USEPA Health Advisory

Underlined results indicate concentrations exceeding the USEPA Tap Water RSL

AFFF - aqueous film forming foam

FD - field duplicate sample

ft - feet

ID - identification

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

µg/L - micrograms per liter

N - normal field sample

NA - not applicable

U - The analyte was analyzed for but was not detected above the reporting limit of detection (LOD).

UJ - The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

USEPA - United States Environmental Protection Agency

PFOS+PFOA = Co-occurrence of PFOA and PFOS (PFOA + PFOS) in aqueous samples is reported using the following guidelines

1. If both PFOA and PFOS are detected at or above the detection limit (DL), then the sum of PFOA+ PFOS is reported
2. If only PFOS or only PFOA is detected at or above the DL in groundwater, then the concentration of the detected analyte only is reported
3. If neither PFOA nor PFOS is detected at or above the DL, then PFOA + PFOS is reported as "ND" representing Not Detected

Table 3.1-4
Summary of Sediment Analytical Testing Results
Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold Air Force Base, Tennessee

Analyte:						Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	6:2 Fluorotelomer sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	N-Ethyl perfluorooctanesulfonamido acetic acid (NETFOSAA)	N-Methyl perfluorooctanesulfonamido acetic acid (NMEFOSAA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoA)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnA)
Screening Level:						0.126 ¹	0.126 ¹	130 ²	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
AFFF Release Area	Location	Sample ID	Sample Date	Sample Depth (ft.)	Sample Type	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
5	SD05001	ARNLD05-SD-001	11-Oct-17	0.0-0.5	N	0.0189	0.0014 U	0.0014 U	0.0056 U	0.0056 U	0.0056 U	0.0056 U	0.0014 U	0.0014 U	0.0014 U	0.00107 J	0.000603 J	0.0014 U	0.0014 U	0.0014 U	0.0014 U
6	SD06001	ARNLD06-SD-001	11-Oct-17	0.0-0.5	N	0.00163 J	0.0015 UJ	0.0015 UJ	0.006 UJ	0.006 U	0.006 UJ	0.006 UJ	0.0015 UJ	0.0015 UJ	0.0015 UJ	0.0008 J	0.0015 UJ	0.0015 UJ	0.0015 UJ	0.0015 UJ	0.0015 UJ
	SD06002	ARNLD06-SD-002	11-Oct-17	0.0-0.5	N	0.0012 J	0.0013 UJ	0.0013 UJ	0.0052 UJ	0.0052 U	0.0052 U	0.0052 U	0.0013 U	0.0013 U	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 UJ	0.0013 U	0.0013 U	0.0013 U
		ARNLD-FD-SD-001	11-Oct-17	0.0-0.5	FD	0.0012 U	0.0012 U	0.0012 U	0.0046 U	0.0046 U	0.0046 U	0.0046 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U
SD06003	ARNLD06-SD-003	11-Oct-17	0.0-0.5	N	0.0012 U	0.0012 U	0.0012 U	0.0046 U	0.0046 U	0.0046 U	0.0046 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U	0.0012 U
7	SD07001	ARNLD07-SD-001	11-Oct-17	0.0-0.5	N	0.0483	0.000848 J	0.0013 U	0.0051 U	0.0051 U	0.0051 U	0.0051 U	0.0013 U	0.0013 U	0.0013 U	0.0033	0.000945 J	0.0013 U	0.0013 U	0.0013 U	0.0013 U

Notes:

PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry

¹Screening levels, based on a residential exposure scenario, calculated using the EPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search]

²USEPA Residential Screening Levels (November 2017) [<https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-november-2017>]

Highlighted cells indicate concentrations exceeding the Screening Level.

AFFF - aqueous film forming foam

FD - Field Duplicate Sample

ft - Feet

ID - Identification

J - The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

mg/kg - milligrams per kilogram

N - Normal Field Sample

NA - Not applicable

U - The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).

UJ - The reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

**Table 4.0-1
Conceptual Site Model: Installation-Wide Summary
Site Inspection Report of Aqueous Film Forming Foam (AFFF) Release Areas
Site Inspection Report, Arnold Air Force Base, Tennessee**

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
<p>Installation Description/History:</p> <ul style="list-style-type: none"> • Years of operation: 1926 to the present. • Size: Approximately 39,000 acres. • Location: Coffee and Franklin Counties in south-central, Tennessee, between the cities of Manchester, Tullahoma, and Winchester. • Layout: Comprised of the AEDC Main Test Area near the center portion, a Wildlife Management Area, and the Tullahoma Training Site in the central and western portions (USACE, 2014). An inactive airfield is located west of the AEDC Main Test Area (CH2M Hill, 2015). • History: First established as Camp Peay in 1926 for use as a National Guard summer training camp. Development of a large training center began in 1940, and the facility was renamed Camp Forrest in 1941. Camp Forrest ranges and impact areas were used for the training of Army Ground Forces, including infantry, artillery, and light and heavy armored units from April 1941 through September 1944. The land comprising Camp Forrest was transferred to the USAF for the construction of the AEDC in 1949 (Bay West, 2011). • Current Mission: Develop, test and evaluate weapon, propulsion, aerodynamic and space systems at realistic conditions for the nation through modeling, simulation and ground test facilities. <p>AFFF Use:</p> <ul style="list-style-type: none"> • AFFF containing PFAS was used for firefighting training activities, testing of firefighting equipment, and in fire suppression systems at several installation buildings. • Twenty potential AFFF release areas were identified during the Preliminary Assessment research (CH2M Hill, 2015), with the following seven potential AFFF release areas recommended for SI: <ul style="list-style-type: none"> - FTA No. 1. - FTA No. 2. - Fire Station 1 (Building 251). - Building 892. - Building 1576. - Return Ditch. - Fire Truck Operational Checks Area. • Three additional potential AFFF release areas were also recommended for investigation based on data obtained during the installation scoping visit conducted on 3 and 4 November 2016 and subsequent research: <ul style="list-style-type: none"> - Current FTA. 	<p>Topography:</p> <ul style="list-style-type: none"> • Arnold AFB is located within the Highland Rim Physiographic Province, which is characterized by topography that ranges from flat, poorly drained uplands to sloping escarpments (Bay West, 2011). <p>Vegetation:</p> <ul style="list-style-type: none"> • Vegetation on Arnold AFB is predominantly upland and swamp oak forest consisting of native hardwoods and cultivated pines. • Numerous wetlands occur across the installation, as well as open barrens primarily near the airfield and along power line and railroad rights-of-way (CH2M Hill, 2015). <p>Surface Water:</p> <ul style="list-style-type: none"> • A significant surface water divide extends from the northeastern edge of Arnold AFB to the southwestern edge. Surface water to the north and west of the divide flows into Normandy Lake via Crumpton Creek, while water south and east flows into Woods Reservoir and the ultimately the Elk River. • Portions of Arnold AFB are located within a low-lying, poorly drained, and densely forested area known as the Barrens, in which there are numerous marshes and ponds (Bay West, 2011). <p>Soils:</p> <ul style="list-style-type: none"> • The vicinity around the base contains barren areas, which feature karst topography, heavy clay soil, and wetland vegetation (Bay West, 2011). Soils are typically combinations of cherty, silty, and clayey loam consisting of varying proportions of sand, clay, and organic matter (CH2M Hill, 2015). <p>Geology:</p> <ul style="list-style-type: none"> • Consists of fractured carbonate terrane of Mississippian Age, overlain by a surficial regolith derived from the in-situ weathering of the St. Louis Limestone, the Warsaw limestone, and the Fort Payne formation. • The regolith layer varies in thickness from 10 to 100 feet and primarily contains clayey chert rubble with traces of silt and sand. The Fort Payne formation ranges from 20 to 230 feet in thickness and consists of siliceous limestone with chert nodules and platy chert stringers. At the base of the Fort Payne formation is 20 to 30 feet of fissile, black, carbonaceous shale known as the Chattanooga shale (Bay West, 2011). <p>Hydrogeology:</p> <ul style="list-style-type: none"> • The shallow aquifer is under unconfined to semi-confined conditions and averages approximately 30 feet in thickness. It is typically encountered at 1 to 30 feet below ground surface and is comprised of clay, silts and sands with less than 50 percent chert and rock fragments. The unit may consist of isolated, seasonal perched water tables or may be continuous over large areas (CH2M Hill, 2015) • The Manchester Aquifer is marked by an increase in chert in porous, water-rich rock and soil matrix (rubble zone) and ranges from 30 to 90 feet thick. The aquifer transitions to fractured limestone with solution-widened fractures and joints in the upper part of the Fort Payne Formation (Bay West, 2011). 	<p>Contaminants of Potential Concern:</p> <ul style="list-style-type: none"> • PFAS are the contaminants of potential concern during this investigation. • Chlorinated volatile organic compounds and 1,4-dioxane are historical site contaminants. <p>Media of Potential Concern:</p> <ul style="list-style-type: none"> • Soil, sediment, groundwater, and surface water. <p>Confirmed AFFF Releases:</p> <ul style="list-style-type: none"> • FTA No. 1: This unlined area was used for fire protection training from 1953 to 1983, with fires set in two aboveground steel pans approximately 24 times per year and extinguished with AFFF. PFOS and PFOA were detected above the USEPA HA values in groundwater. • FTA No. 2: This 30-foot diameter, gravel-covered burn pit was used for fire protection training an average of 21 times per year between 1973 and 1987, where AFFF were used as an extinguishing agent. PFOS and PFOA were detected above the USEPA HA values in groundwater. • Fire Station 1 (Building 251): Residual AFFF from washing of fire trucks in front of the building may have accumulated in grassy areas on either side of the station driveway. PFOS and PFOA were detected above the USEPA HA values in groundwater. • Building 892: This building houses an AFFF fire suppression system that is tested annually, with small amounts of AFFF discharged outside of the building and four historical AFFF releases documented between 2007 and 2015. PFOS was detected in subsurface soil above the RSL during the SI, while PFOS + PFOA was detected above the USEPA HA value in groundwater. • Building 1576 and Tank Dike 21: Building 1576 houses an AFFF fire suppression system that is tested annually, with small amounts of AFFF discharged outside of the building. A fuel filter fire was extinguished with AFFF in 1995 and the fire suppression system was accidentally activated in 1996. Tank Dike 21 is a concrete-lined dike adjacent to Building 1576 that captures AFFF released during system checks. PFOS and PFOA were detected above the USEPA HA values in groundwater. 	<p>Current Land Use:</p> <ul style="list-style-type: none"> • Occupied by Arnold AFB. <p>Future Land Use:</p> <ul style="list-style-type: none"> • Land use is not expected to change in the future. <p>Potential Receptors:</p> <ul style="list-style-type: none"> • Potential receptors associated with current and future land use include military personnel and residents, grounds maintenance workers, utility workers, construction workers. 	<p>Potential Ecological Receptors:</p> <ul style="list-style-type: none"> • Inland and aquatic plant species, reptiles, birds, soil invertebrates, and mammals that inhabit or migrate through the installation. <p>Threatened and Endangered Species:</p> <ul style="list-style-type: none"> • A list of 283 endangered species known to inhabit Coffee and/or Franklin Counties were identified in the Preliminary Assessment Report (CH2M Hill, 2015). A portion of the base is dedicated as a wildlife management area.

Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
<ul style="list-style-type: none"> - Tank Dike 21 (co-located with Building 1576 as one AFFF release area) - J-4 Test Cell Groundwater Influent. 	<ul style="list-style-type: none"> • The deep, semi-confined Fort Payne Aquifer occurs in the less permeable fractured limestone of the Fort Payne Formation and ranges from 10 to 140 feet thick (Bay West, 2011). • Groundwater flow within the shallow perched aquifer is generally towards surface water bodies; however, flow within the semi-confined Manchester Aquifer is more complex due to the presence of highly permeable, solution-enlarged fractures (United States Geological Survey [USGS], 1992). • Periodic dewatering of the J-4 Test Cell within the Main Test Area induces significant drawdown of the groundwater potentiometric surface beneath the AEDC Main Test Area. The AEDC facility is along a regional groundwater divide, which runs northeast to southwest. Several troughs are present in the regional potentiometric surface (USGS, 2011). Groundwater near AFFF Release Areas 7 (Fire Truck Operational Checks Area) and 8 (Current FTA) located outside of the J-4 Test Cell influence flows to the west and northwest towards a trough in the potentiometric surface within the Crumpton Creek Basin. Groundwater near AFFF Release Areas 1 (FTA No. 1) and 3 (Fire Station 1 [Building 251]) located outside of the J-4 Test Cell influence to the east and northeast flows towards groundwater troughs that flow generally northeastward. <p>Meteorology:</p> <ul style="list-style-type: none"> • Average annual rainfall is 56 inches/year. • March and May are the wettest months, with October the driest. • Average high temperature of 88 degrees Fahrenheit (°F) occurs in July, while an average low of 26°F occurs in January. 	<ul style="list-style-type: none"> • Return Ditch: This ditch receives process cooling water and stormwater runoff from a large portion of the main industrial area, including potential discharges of AFFF from Buildings 892 and 1576, and Tank Dike 21 and discharges into Woods Reservoir. PFOS, PFOA, and PFBS were below RSLs in sediments collected from this ditch. • Fire Truck Operational Checks Area: Daily operational checks of AFFF firefighting equipment were conducted on a paved parking area near the former airfield that resulted in occasional AFFF discharges. PFOS and PFOA were detected above the USEPA HA values in groundwater. • Current FTA: A concrete-lined FTA surrounded by grassy fields which replaced FTA No. 2 in the late 1980's and was last used in 1996 AFFF likely was used and may have flowed onto the surrounding gravel and grassy areas. PFOS and PFOA were detected above the USEPA HA values in groundwater. • J-4 Test Cell Groundwater Extraction System: The J-4 Test Cell is a vertical reinforced concrete shaft that extends approximately 250 feet below ground surface, penetrating the shallow, intermediate, and deep groundwater aquifers. Periodic dewatering of the J-4 Test Cell induces significant drawdown of the groundwater potentiometric surface beneath the AEDC Main Test Area where PFAS may be present in groundwater. PFOA was detected above the USEPA HA value in groundwater. <p>Primary Release Pathways:</p> <ul style="list-style-type: none"> • Release or application of AFFF to the ground at potential source areas. • Infiltration of PFAS deeper into the soil column over time reaching groundwater in the rubble zone and solution-enlarged fractures/joints system. • AFFF washed into drainage, stormwater, and sewer systems. <p>Secondary Release Pathways:</p> <ul style="list-style-type: none"> • None. 		

Notes:
AEDC – Arnold Engineering Development Complex
AFFF – aqueous film forming foam
AFB – Air Force Base
FTA – fire training area
HA – Health Advisory
PFAS – per- and polyfluorinated alkyl substances

PFBS - Perfluorobutanesulfonic acid
PFOA - perfluorooctanoic acid
PFOS - perfluorooctane sulfonic acid
RSL – Regional Screening Level
SI – Site Inspection

APPENDIX A
PHOTOGRAPH LOGS

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13 October 2017

Photo 1:

AFFF Release Area 1
(FTA No. 1); installation
of MW01001.

Direction of Photo:
North



13 October 2017

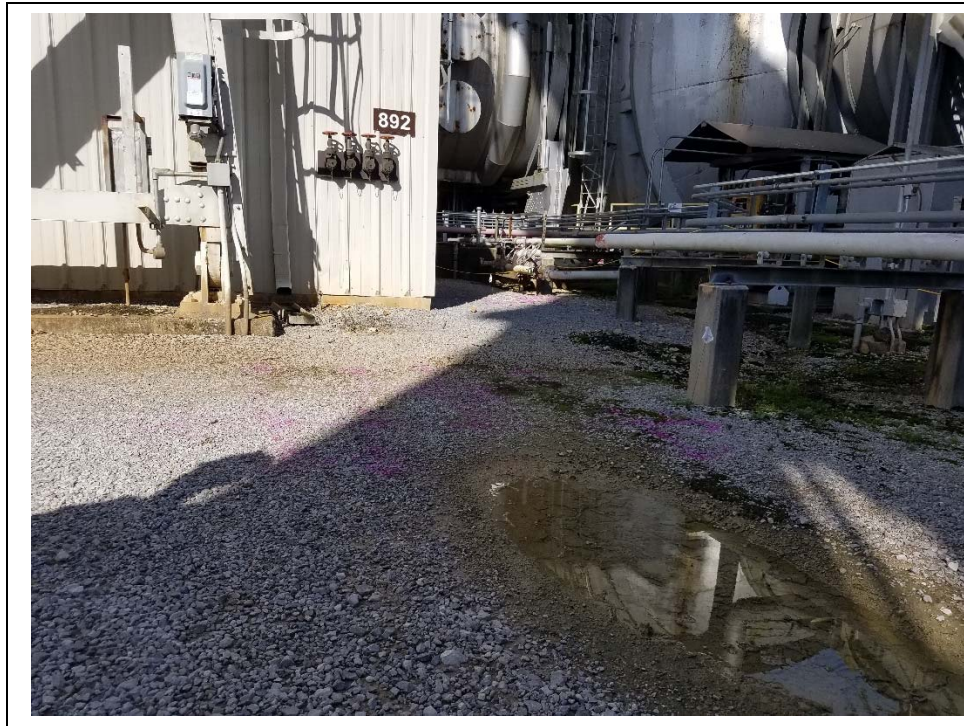
Photo 2:

AFFF Release Area 1
(FTA No. 1); extracted
soil

Direction of Photo:
NA

	<p>16 October 2017</p> <p>Photo 3: AFFF Release Area 2 (FTA No. 2); extracted soil.</p> <p>Direction of Photo: NA</p>
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	<p>12 October 2017</p> <p>Photo 4: AFFF Release Area 3 (Fire Station 1 [Building 251]); installation of MW03002.</p> <p>Direction of Photo: East</p>
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19 October 2017

Photo 5:
AFFF Release Area 4
(Building 892);
extensive utilities within
AFFF release area.

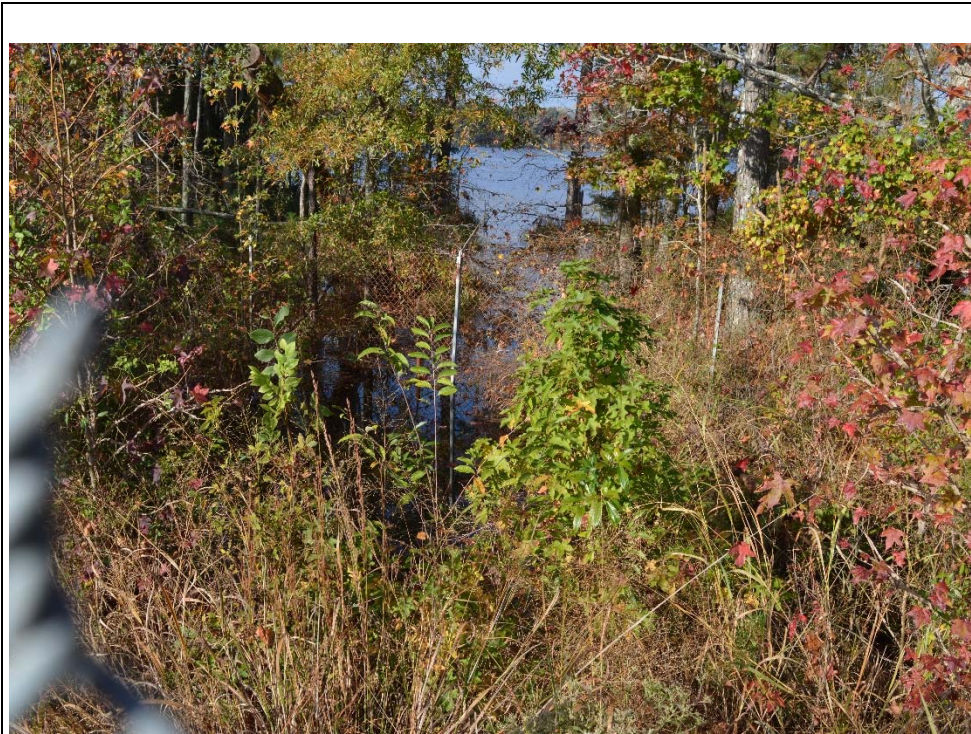
Direction of Photo:
West



19 October 2017

Photo 6:
AFFF Release Area 5
(Building 1576 and Tank
Dike 21); location of
MW05002.

Direction of Photo:
South



11 October 2017

Photo 7:
AFFF Release Area 5
(Building 1576 and Tank
Dike 21); location of
sediment sample
SD05001.

Direction of Photo:
West



11 October 2017

Photo 8:
AFFF Release Area 6
(Return Ditch); view of
ditch.

Direction of Photo:
Southwest



19 October 2017
0914

Photo 9:
AFFF Release Area 8
(Current FTA);
temporary monitoring
well MW08001.

Direction of Photo:
Southeast



15 November 2017

Photo 10:
AFFF Release Area 8
(Current FTA);
groundwater sampling
at MW232.

Direction of Photo:
Northeast



3 May 2017

Photo 11:
AFFF Release Area 9 (J-4
test Cell Groundwater
Extraction System);
location of influent
sample at weir.

Direction of Photo:
East



15 November 2017

Photo 12:
IDW storage.

Direction of Photo:
North

APPENDIX B
FIELD FORMS

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APPENDIX B-1
FIELD ACTIVITY DAILY LOGS

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SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Area 1 and 3
Weather:	Cloudy, light rain, low 80s	Date and Time:	10/10/17 16:42
Technician(s):	Jason Hayes and Noel Garland		

Description of Daily Activities and Events:	
<u>Time</u>	<u>Observation/Comment</u>
06:45	Arrived onsite at visitors center to get badges for all personnel. AmecFW personnel were Joe Deatherage, Jason Hayes, and Noel Garland. SAEDACCO personnel notified AmecFW they still need to fill up water tanks for drilling.
07:40	Visitors center personnel notified AmecFW personnel that badging system is down, notified Denny Timmons about the issue.
08:00	SEADACCO notified AmecFW they are 30 min from Arnold, will notify us when they are close to the gate.
08:30	SEADACCO arrived onsite to get badges.
08:40	Calibrated YSI and Hach for use during development.
09:20	Finished calibration, all readings were within calibration standards.
13:00	All personnel received their badges, mobilized to the staging area. Drillers will have to go through the contractor gate.
13:45	All personnel arrived at staging area. Joe and Jason spoke to personnel from CH2M about where to stage the decon pad, drums, and equipment.
14:15	Drillers left site to go and get the skid steer that was rented for the project.
14:30	Drillers returned to the site and notified AmecFW that no access was available thru the contractor gate after 14:00. Drillers decided to start setting up decon pad.
14:45	Denny Timmons arrived at the staging area. Denny and Joe went and spoke with the fire chief and looked at all the locations.
14:50	Drillers notified AmecFW that they dont have all the equipment to build the decon pad. Drillers left site to go and pickup equipment for set up on 10/11.
15:25	Denny and Joe arrived at staging area. Denny left the site.
15:30	All personnel left site for the day.

List of Samples Collected:	None	Technician Signature:
Deviation from Plans:	None	
Visitors on Site:	Denny Timmons	
Important Telephone Calls / Photos Taken:	None	Technician Name (print): Jason Hayes

QA/QC'd by: Thomas W. Hensel	<i>Thomas W. Hensel</i>	QA/QC Date:	10/30/2017
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SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Area 1 and 3
Weather:	Cloudy, light rain, upper 70s	Date and Time:	10/11/17 20:59
Technician(s):	Jason Hayes and Noel Garland		

Description of Daily Activities and Events:

<u>Time</u>	<u>Observation/Comment</u>
06:40	Arrived onsite with AmecFW personnel Joe Deatherage, Jason Hayes, and Noel Garland.
07:15	Drillers arrived onsite.
07:30	Drillers unloaded skid steer and started setting up decon pad and moving drilling rods.
08:15	Started decontamination of the rig and all associated tooling in constructed decon pad.
09:30	Drillers notified AmecFW there is an issue with the drill rig. A part will need to be bought off base. Driller left to go get the needed part.
10:30	Driller arrived back onsite with part.
12:00	Drillers notified AmecFW that a module is not working on the rig. A part has to be ordered and will arrive 10/12.
13:00	Drillers left site for the day.
13:15	Mobilized to AFFF Area 7. Verified locations for drilling.
13:20	Took sediment sample from SD07001. The sample ID was ARNLD07-SD-001.
13:50	Mobilized to AFFF Area 5.
14:05	Took a sediment sample at SD05001. The sample ID was ARNLD05-SD-001.
14:25	Mobilized to AFFF Area 9.
14:30	Took influent sample from the downstream side of the weir flowing from test cell 4. The sample ID was ARNLD09-INF-001.
15:30	Mobilized to AFFF Area 6.
15:45	Took a sediment sample from SD06001. The sample ID was ARNLD06-SD-001. A MS/MSD was taken at this location.
16:20	Took a sediment sample from SD06002. The sample ID was ARNLD06-SD-002.
16:40	Took a sediment sample from SD06003. The sample ID was ARNLD06-SD-003. A field duplicate was taken at this location. Sample ID ARNLD-FD-SD-001 and sample time was listed as 1645
17:00	All personnel left site for the day.

List of Samples Collected:	None	Technician Signature:
Deviation from Plans:	None	
Visitors on Site:	Denny Timmons	
Important Telephone Calls / Photos Taken:	None	Technician Name (print): Jason Hayes

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	12/13/2017
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SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Area 3
Weather:	Clear, calm, upper 70s	Date and Time:	10/12/17 21:06
Technician(s):	Jason Hayes and Noel Garland		

<u>Time</u>	<u>Observation/Comment</u>
08:00	AmecFW personnel (Joe Deatherage, Jason Hayes, Noel Garland) left hotel to mobilize to site.
08:45	Met onsite at staging area and mobilized to bldg. 892 to look at drilling locations and get water level reading and total depth of MW834, an existing well in AFFF Area 4. Total depth was 39.25, DTW was 18.00. End of the probe was covered in fines from the bottom of the well.
10:00	SAEDACCO arrived onsite to fix the issue with the rig.
10:15	Rig is fixed. Loaded all equipment for mobilization to AFFF Area 3.
10:20	Conducted tailgate safety meeting and completed PFAS protocol checklist.
11:00	Mobilized to AFFF Area 3 and started
11:40	Started hand augering at MW03002.
11:45	Took surface sample at MW03002. The sample ID was ARNLD03-SO-003.
11:55	Took equipment blank from the shoe of the sonic drill rod. The sample ID was ARNLD-EB-001.
12:05	SAEDACCO notified AmecFW there was an issue with the rig again. They will troubleshoot and notify us if the issue is not resolved.
12:50	Rig issues were resolved. Sonic drilling started at MW03002.
13:50	Took subsurface sample at MW03002. The sample ID was ARNLD03-SO-004
13:55	Started running 6" rods to set temp well MW03002. Denny Timmons arrived onsite.
15:30	Completed installation of temp well MW03002. Denny Timmons left site.
15:45	Mobilized to MW03001.
15:50	Took surface sample at MW03001. The sample ID was ARNLD03-SO-001.
16:10	Started drilling after clearing to 5 foot with hand auger.
16:50	Started setting up on MW03002 to start development.
17:00	Started development at MW03002.
17:10	Took subsurface sample at MW03001. The sample ID was ARNLD03-SO-002. A field duplicate was taken with this sample. Sample ID was ARNLD-FD-SO-001 and given a sample time of 1715.
18:00	Completed installation of temp well MW03001. Drillers started cleanup.
18:15	Stopped development at MW03002.
19:15	All personnel left site for the day.

List of Samples Collected:	ARNLD03-SO-003, ARNLD-EB-001, ARNLD03-SO-004, ARNLD03-SO-001, ARNLD03-SO-002
Deviation from Plans:	None
Visitors on Site:	Denny Timmons
Important Telephone Calls / Photos Taken:	None
Technician Signature:	
Technician Name (print):	
Jason Hayes	

QA/QC'd by:	Thomas W. Hensel	QA/QC Date:	12/13/2017

SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Area 1 and 3
Weather:	Clear, calm, upper 70s	Date and Time:	10/13/2017 21:06
Technician(s):	Jason Hayes and Noel Garland		

Description of Daily Activities and Events:	
<u>Time</u>	<u>Observation/Comment</u>
6:30	AmeCFW personnel (Joe Deatherage, Jason Hayes, Noel Garland) left hotel to mobilize to site.
7:20	SAEDACCO arrived onsite to decon augers
8:50	Drill rig shut down at MW01001.
9:30	Started development at MW03002.
11:05	Rig was fixed. Drilling was completed at MW01001.
11:30	Finished development at MW03002.
12:30	Mobilized to MW01002 to start drilling.
13:15	Started hand augering at MW01002
14:35	Completed drilling at MW01002. Well was installed.
15:00	Completed well installation at MW01002.
15:25	Moved to SB01003. Started hand augering to 5 feet.
15:55	Began drilling at SB01003.
16:35	Completed drilling at SB01003.
16:45	Completed well installation at SB01003.
17:30	Started development at MW01001.
18:00	Mobilized to the staging area to decon all equipment.
18:30	Completed development at MW01001.
18:45	All personnel left site for the day.

List of Samples Collected:	ARNLD01-SO-001, ARNLD01-SO-002, ARNLD01-SO-003, ARNLD01-SO-004, ARNLD-EB-002	Technician Signature: Technician Name (print): Jason Hayes
Deviation from Plans:	None	
Visitors on Site:	Denny Timmons	
Important Telephone Calls / Photos Taken:	None	

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	12/13/2017
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SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Areas 1 and 2
Weather:	Clear, calm, upper 70s	Date and Time:	10/14/2017 19:06
Technician(s):	Jason Hayes and Noel Garland		

Description of Daily Activities and Events:

<u>Time</u>	<u>Observation/Comment</u>
7:00	AmecFW personnel (Jason Hayes, Noel Garland) left hotel to mobilize to site.
7:55	Completed hand auger at MW02001. Drill rig would not start.
9:00	Collected equipment blank.
9:20	Drill rig started up again and started drilling at MW02001.
9:30	Started development MW01001
11:00	Finished development at MW01001.
11:05	Completed well installation at MW02001. Started hand augering at MW02002.
11:25	Encountered metal debris at original drilling location, will move the location to the south of the access road.
11:40	Started hand augering at the new drill location at MW02002
12:45	Started drilling at MW02002.
13:00	Reached total depth at MW02002, rig shut down and will not start.
14:50	Drillers notified AmecFW the mechanic will need to come out and arrive on Monday to fix the rig.
15:10	Drillers left site for the day.
15:30	The rest of the personnel left site for the day.

List of Samples Collected:	ARNLD-EB-003	Technician Signature: 
Deviation from Plans:	None	
Visitors on Site:	None	
Important Telephone Calls / Photos Taken:	None	
		Technician Name (print): Jason Hayes

QA/QC'd by:	Thomas W. Hensel 	QA/QC Date:	12/13/2017
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SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Areas 1, 2 and 3
Weather:	Clear, calm, upper 70s	Date and Time:	10/15/2017 17:22
Technician(s):	Jason Hayes and Noel Garland		

Description of Daily Activities and Events:

<u>Time</u>	<u>Observation/Comment</u>
8:00	AmeCFW personnel (Jason Hayes, Noel Garland) left hotel to mobilize to site.
8:40	Started development at MW01002.
10:30	Completed development at MW01002.
12:15	Started development at MW02001
14:00	Completed development at MW02001.
14:15	Started groundwater sampling at MW03002.
15:30	Completed groundwater sampling at MW03002.
16:00	Started groundwater sampling at MW01001.
18:10	Completed groundwater sampling at MW01001.
18:30	All personnel left site for the day.

List of Samples Collected:	ARNLD03-GW-002, ARNLD01-GW-001	Technician Signature:	
Deviation from Plans:	None		
Visitors on Site:	None		
Important Telephone Calls / Photos Taken:	None	Technician Name (print):	
		Jason Hayes	
QA/QC'd by:	Thomas W. Hensel 	QA/QC Date:	12/13/2017

SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Areas 1 and 2
Weather:	Clear, calm, upper 70s	Date and Time:	10/16/2017 20:45
Technician(s):	Jason Hayes and Noel Garland		

Description of Daily Activities and Events:	
<u>Time</u>	<u>Observation/Comment</u>
8:00	AmecFW personnel (Jason Hayes, Noel Garland) left hotel to mobilize to site.
8:10	Got the drilling mechanic on-site to start working on the rig.
9:15	Started groundwater sampling at MW01002.
10:45	Completed well installation MW02002.
11:00	Completed groundwater sampling at MW01002.
11:30	Mobilized drill rig to MW02003.
11:45	Noticed an overhead power line, will move the location to the NNE approx. 50 feet.
11:50	Started to hand auger at MW02003.
12:25	Completed hand auger, drill rig still is not working correctly.
13:25	Started groundwater sampling at MW02001.
13:45	Drill rig was fixed. Mobilized to MW02003.
14:00	Began drilling at MW02003
14:20	Stopped groundwater sampling at MW02001, well was bailed dry. Will set up on well on 11/17 to take sample.
14:45	Started development of MW02002. Well was filled with 5 feet of sediment, well will need to be redrilled.
15:15	Completed drilling at MW02003.
16:15	Completed well installation at MW02003.
17:00	Drill rig mobilized to MW02002 to redrill the location.
18:30	Drilled to depth and stopped work for the day.
19:00	All personnel left site for the day.

List of Samples Collected:	Technician Signature:
ARNLD01-GW-002, ARNLD-FD-GW-001, ARNLD-EB-004	
Deviation from Plans:	Technician Name (print):
None	Jason Hayes
Visitors on Site:	QA/QC'd by:
Denny Timmons	Thomas W. Hensel
Important Telephone Calls / Photos Taken:	QA/QC Date:
None	12/13/2017

SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Areas 2, 3, and 8
Weather:	Clear, calm, lower 70s	Date and Time:	10/17/2017 22:43
Technician(s):	Jason Hayes and Noel Garland		

<u>Time</u>	<u>Observation/Comment</u>
7:30	AmecFW personnel (Jason Hayes, Noel Garland) left hotel to mobilize to site.
7:55	Collected equipment blank.
8:10	Began drilling at MW03001. This location had to be redrilled because of filter pack material found in the well during development.
8:20	Set up to bail sample well MW02001.
8:30	Took groundwater sample at MW02001.
9:30	Completed drilling at MW03001.
9:30	Started development at MW02002.
10:00	Completed well installation at MW03001.
11:20	Mobilized to MW08001 with the drill rig.
11:30	Completed development of MW02002. Mobilized to MW02003.
11:35	Started hand augering at MW08001.
11:50	Had to move locations because of some obstruction. Hand augered new location 5 feet away for MW08001
12:00	Began drilling at new location for MW08001.
13:00	Completed development of MW02003. Mobilized to MW03001.
13:15	Completed drilling at MW08001.
14:00	Pulled well up during removal of rods, pulled well materials and redrilled to depth.
14:50	Completed well installation at MW08001
15:10	Set up to drill MW08002.
15:15	Completed development of MW03001. Mobilized to MW08001.
15:20	Hand augered to 5 feet, started drilling at MW08002.
16:15	Completed well at MW08002. No bentonite will be used going forward for the temp wells.
17:15	Mobilized to MW08003 with the drill rig. Hand augered and started drilling.
17:15	Completed development of MW08001. Mobilized to MW08002.
18:20	Completed well MW08003.
18:45	Completed development of MW08002.
19:00	All personnel left site for the day.

List of Samples Collected:	ARNLD02-GW-001, ARNLD08-SO-001, ARNLD08-SO-002, ARNLD08-SO-003, ARNLD08-SO-004, ARNLD-EB-005	Technician Signature: Technician Name (print): Jason Hayes
Deviation from Plans:	None	
Visitors on Site:	Denny Timmons	
Important Telephone Calls / Photos Taken:	None	

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	12/13/2017
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SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Areas 2, 3, 7, and 8
Weather:	Clear, calm, lower 70s	Date and Time:	10/18/2017 21:57
Technician(s):	Jason Hayes, Noel Garland, Bryan Hansen		

Description of Daily Activities and Events:

<u>Time</u>	<u>Observation/Comment</u>
6:45	AmecFW personnel (Jason Hayes, Noel Garland) left hotel to mobilize to site. Bryan Hansen arrived at the visitors center to get badged.
7:15	Drillers thoroughly decon all tooling to make sure we can complete all the wells in Area 7 today.
9:50	Drillers mobilized to Area 7.
10:00	Began hand augering at MW07003.
10:45	Bryan completed the badging process, started to calibrate YSI.
11:00	Started drilling at MW07003.
11:15	Bryan and Jason mobilized to MW02002 to start setting up for sampling.
12:30	Set up at MW08003 to start development.
12:40	Completed drilling and well installation at MW07003.
13:02	Took groundwater sample at MW02002. A MS/MSD was taken at this location.
13:05	Mobilized to MW07001 with the drill rig. Started hand augering.
13:20	Mobilized to MW02003 for groundwater sampling.
13:30	Started drilling at MW07001.
14:00	Completed development at MW08003. Well had very little water, may not produce water. Notified Joe Deatherage about the well.
14:10	Started development at MW07003.
14:20	Took groundwater sample at MW02003.
14:40	Mobilized to MW08001 for groundwater sampling.
14:50	MW08001 was dry, notified Joe Deatherage of the dry well. Will hold off on doing anything else at this location for now.
15:10	Completed well installation at MW07001.
15:15	MW08002 was pumped dry, notified Joe Deatherage of the dry well. Will take a grab sample tomorrow.
15:25	Mobilized to MW07002. Started hand augering.
15:30	Mobilized to MW03001 for groundwater sampling.
16:30	Took groundwater sample at MW03001.
16:45	Completed well installation at MW07002.
16:50	Jason Hayes left site to drop coolers at FedEx for shipment.
17:00	Started development at MW07001.
18:30	Completed development at MW07001.
19:00	All personnel left site for the day.

List of Samples Collected:	ARNLD02-GW-002, ARNLD02-GW-003, ARNLD03-GW-001, ARNLD07-SO-001, ARNLD07-SO-002, ARNLD07-SO-003, ARNLD07-SO-004, ARNLD07-SO-005, ARNLD07-SO-006, ARNLD-EB-006	Technician Signature: Technician Name (print): Jason Hayes
Deviation from Plans:	None	
Visitors on Site:	Denny Timmons	
Important Telephone Calls / Photos Taken:	None	

QA/QC'd by:	Thomas W. Hensel	QA/QC Date:	12/13/2017
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SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Areas 5, 7, and 8
Weather:	Clear, calm, lower 70s	Date and Time:	10/19/2017 22:57
Technician(s):	Jason Hayes and Noel Garland		

Description of Daily Activities and Events:

<u>Time</u>	<u>Observation/Comment</u>
6:45	AmecFW personnel (Jason Hayes, Noel Garland, Bryan Hansen) left hotel to mobilize to site.
7:40	Mobilize to MW08001, well was still dry. Notified Joe Deatherage of the issue.
7:50	Mobilize to Area 4 to complete the soil boring near the mechanical room door.
7:50	Mobilized to MW08002. A grab sample was taken at this location since it was pumped dry the day prior
8:05	Collected groundwater sample at MW08002.
8:30	Mobilized to the visitors center to get badges extended since they expire on 10/20.
8:30	Mobilized to MW07003 to start groundwater sampling.
9:40	Took groundwater sample at MW07003.
9:45	Completed new badging for drillers, mobilized to MW05002.
9:45	Mobilized to MW07001 to start groundwater sampling
9:50	Started development at MW07002.
10:15	Mobilized to MW05002. Started hand augering.
10:49	Took groundwater sample at MW07001.
11:00	Completed development at MW07002.
11:25	Completed well installation at MW05002.
11:30	MW08003 was dry, notified Joe Deatherage of the dry well. Will hold off on doing anything else at this location for now.
11:50	Mobilized drilling rig to MW05003. Started hand augering.
12:00	Mobilized to the Well 834 to start groundwater sampling
13:12	Took groundwater sample from Well 834
13:30	Completed well installation at MW05003.
13:40	Mobilized to start drilling at MW05001. Started hand augering.
14:00	Started development at MW05002.
14:35	Completed well installation at MW05001.
14:45	Mobilized back to the decon area to decon all tooling to go back to Area8. Joe notified field staff that we need to drill deeper (~50-60 feet) in that area at MW08001 and MW08003.
15:45	Completed development at MW05002.
15:50	Mobilized to MW05003 to start development.
16:00	Mobilized drill rig back to MW08003 to redrill to a lower depth.
16:15	Tagged all the wells in Area 8, all wells were dry prior to redrilling.
16:45	Redrilled MW08003 down to approx. 40 feet.
16:50	Finished development at MW05003, mobilized to MW05001.
17:00	Mobilized drill rig back to MW08001 to redrill to a lower depth.
17:45	Finished development at MW05001.
18:00	Completed installation of well at MW08001. Total depth was approx. 50 feet.
18:20	Started development of MW08001.
19:00	Got pump stuck in the well, will have to develop tomorrow.
19:30	Recovered the pump from the well.
19:40	All personnel left site for the day.

List of Samples Collected:	ARNLD04-SO-001, ARNLD04-SO-002, ARNLD08-GW-002, ARNLD04-GW-002, ARNLD05-SO-001, ARNLD05-SO-002, ARNLD05-SO-003, ARNLD05-SO-004, ARNLD07-GW-001, ARNLD07-GW-003, ARNLD-FD-SO-002, ARNLD-EB-007, ARNLD-FB-001	Technician Signature: 	
Deviation from Plans:	None		
Visitors on Site:	Denny Timmons		
Important Telephone Calls / Photos Taken:	None	Technician Name (print): Jason Hayes	
QA/QC'd by:	Thomas W. Hensel 	QA/QC Date:	12/13/2017



SUMMARY OF DAILY ACTIVITIES

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	AFFF Areas 2, 5, 7, and 8
Weather:	Clear, calm, lower 70s	Date and Time:	10/20/2017 22:27
Technician(s):	Jason Hayes and Noel Garland		

Description of Daily Activities and Events:

<u>Time</u>	<u>Observation/Comment</u>
6:45	AmecFW personnel (Jason Hayes, Noel Garland, Bryan Hansen) left hotel to mobilize to site.
7:00	Mobilized to Area 8 to check on installed wells. MW08003 had no water in it, MW08001 had approximately 10 feet of water in the well.
7:15	Started groundwater sampling at MW07002.
7:50	Spoke with Joe Deatherage about the dry well at MW08003, determined we need to drill down deeper to set the well.
8:40	Completed installation of well at MW08003. Total depth was approx. 50 feet.
8:54	Took groundwater sample at MW07002.
9:00	Bailed the well dry at MW08003, well didn't recover. Notified Joe about the dry well, said to hold off on any other activities at that location.
9:30	Mobilized to MW05002 for groundwater sampling.
9:50	Bailed both MW08003 and MW08001 dry, notified Joe that no recovery was present. Joe said to hold off on any other activities until he decides what needs to be done.
10:20	Drillers mobilized to Area 7 to start removal of well materials and abandoning the well with grout.
10:50	Completed abandonment of all wells at Area 7, mobilized to Area 8 to abandon MW08002.
11:10	Took groundwater sample at MW05002.
11:20	Abandoned the first installed well at MW08001.
12:00	Packed up drill rig, mobilized to Area 5 to complete abandonment at 3 locations.
12:28	Took groundwater sample at MW05003.
12:40	Started groundwater sampling at MW05001.
14:02	Took groundwater sample at MW05001.
14:30	Mobilized to Area 8 to start bailing the existing well in the area per Joe's direction.
15:05	Joe called to stop bailing the existing well, will continue at a later mobilization.
15:10	Mobilized to Area 5 to abandon the 3 wells installed.
15:30	Both Noel and Bryan left site for the day.
16:45	Completed abandonment at Area 5. Mobilized to Area 2 to abandon the 3 wells installed.
17:30	Completed abandonment of MW02003 and MW02001. Will start on abandonment at MW02002 tomorrow.
18:00	The rest of the personnel left site for the day.

List of Samples Collected:	ARNLD05-GW-002, ARNLD-FD-GW-002, ARNLD05-GW-003, ARNLD05-GW-001, ARNLD07-GW-002	Technician Signature:
Deviation from Plans:	None	
Visitors on Site:	None	
Important Telephone Calls / Photos Taken:	None	Technician Name (print): Jason Hayes

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	12/13/2017
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SUMMARY OF DAILY ACTIVITIES

Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027	Task Order: 0004
Installation: ARNLD - Arnold AFB	Investigation Area: All AFFF Areas
Weather: Clear, calm, lower 70s	Date and Time: 10/21/2017 13:32
Technician(s): Jason Hayes	

Description of Daily Activities and Events:

<u>Time</u>	<u>Observation/Comment</u>
7:00	AmeCFW personnel (Jason Hayes) left hotel to mobilize to site.
7:00	Mobilized to Area 2 to abandon MW02002.
8:45	Mobilized to Area 3 to abandon the 2 wells installed.
10:20	Mobilized to Area 1 to abandon the 2 wells installed.
12:15	Completed all abandonment of the wells at Arnold AFB.
12:45	Mobilized back to the decon area, cleaned up all trash and other materials, and loaded up the rest of the equipment for the drillers.
13:30	All personnel left site to travel back home.

List of Samples Collected: None	Technician Signature:
Deviation from Plans: None	
Visitors on Site: None	
Important Telephone Calls / Photos Taken: None	Technician Name (print): Jason Hayes

QA/QC'd by: Thomas W. Hensel		QA/QC Date:	12/13/2017
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SUMMARY OF DAILY ACTIVITIES

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	Current FTA
Weather:	Partly cloudy, 40°F	Date and Time:	11/14/17 18:07
Technician(s):	Miles Watkins, Noel Garland		

Description of Daily Activities and Events:	
<u>Time</u>	<u>Observation/Comment</u>
07:00	Left Knoxville office traveling to Arnold AFB.
10:27	Arrived on site. Observed laydown area.
10:40	Starting Safety Tailgate Checklist and PFAS Protocol Checklist
10:56	Completing Safety Tailgate Checklist and PFAS Protocol Checklist
10:58	Arrived at the Current Fire Training Area to check depth to water on MW08001, MW08002, and MW08003.
10:10	Well total depth and depth to water from TOC respectively are as follows: MW08001: 50.24,49.97; MW08002: 30.39,29.18; MW08003: 50.42,49.81
11:21	Starting calibration of YSI and turbidity meter.
11:59	Finished calibration.
12:35	Collecting tools and taking photographs of AFFF Release Area 9 (J4 Test Cell Weir).
14:12	Attempting to develop MW08001. Not enough water to take parameters. Very high fines. Well was bailed dry.
14:20	Attempting to develop MW08002. Parameters taken (see development log). High fines in water recovered. Well was bailed dry.
14:30	Attempting to develop MW08002. Not enough water to take parameters. Very high fines. Well was bailed dry.
15:18	Starting development on Existing Well 232.
16:33	Development completed on well 232. ~33.5 gallons was removed from the well.
16:45	General site clean up and decon is being completed.
16:53	Decon/Laydown area was locked and access was not achievable today for unloading IDW.
17:11	Leaving project site for equipment run. Work complete on site for the day.

List of Samples Collected:	None		Technician Signature:
Deviation from Plans:	None		
Visitors on Site:	None		
Important Telephone Calls / Photos Taken:	Spoke to Joe Deatherage concerning water in monitoring wells M08001, MW0800, and MW08003. It was requested that the wells be bailed dry and parameters collected if possible. Depth to water in the wells will be checked again tomorrow for recharge.		Technician Name (print):
			Miles Watkins

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	12/13/2017
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APPENDIX B-2

DAILY PFAS PROTOCOL CHECKLISTS

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**ATTACHMENT 1 TO SOP AFW-01
DAILY PFAS PROTOCOL CHECKLIST**



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Weather (temp./precipitation):	Clear, calm, upper 70s
Site/Area Name:	AFFF Area 3	Date and Time:	10/12/17 10:25
Field Manager:	Jason Hayes		

Field Clothing and PPE (as applicable):

- Field crew in compliance with Tables 1 and 2, SOP AFW-01
- Field crew has not used fabric softener on clothing
- Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning
- Field crew has not applied unacceptable sunscreen or insect repellent

Field Equipment:

- No Teflon® containing materials on-site
- All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books on-site other than Rite-in-the-Rain® Products
- No plastic clipboards, binders, or spiral hard cover notebooks on-site
- No adhesives (Post-it® Notes) on-site
- Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- "PFAS-free" water on-site for decontamination of sample equipment
- Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance: <p align="center">None</p>	Signature:
	Name (print): Jason Hayes

QA/QC'd by: Thomas W. Hensel	QA/QC Date: 10/30/2017
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**ATTACHMENT 1 TO SOP AFW-01
DAILY PFAS PROTOCOL CHECKLIST**



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Weather (temp./precipitation):	Clear, calm, upper 70s
Site/Area Name:	AFFF Area 1 and 3	Date and Time:	10/13/17 09:22
Field Manager:	Jason Hayes		

Field Clothing and PPE (as applicable):

- Field crew in compliance with Tables 1 and 2, SOP AFW-01
- Field crew has not used fabric softener on clothing
- Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning
- Field crew has not applied unacceptable sunscreen or insect repellent

Field Equipment:

- No Teflon® containing materials on-site
- All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books on-site other than Rite-in-the-Rain® Products
- No plastic clipboards, binders, or spiral hard cover notebooks on-site
- No adhesives (Post-it® Notes) on-site
- Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- "PFAS-free" water on-site for decontamination of sample equipment
- Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

None

Signature:

Name (print):

Jason Hayes

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	10/30/2017
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**ATTACHMENT 1 TO SOP AFW-01
DAILY PFAS PROTOCOL CHECKLIST**



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Weather (temp./precipitation):	Clear, calm, upper 70s
Site/Area Name:	AFFF Area 1, 2, 3	Date and Time:	10/14/17 07:14
Field Manager:	Jason Hayes		

<p>Field Clothing and PPE (as applicable):</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Field crew in compliance with Tables 1 and 2, SOP AFW-01 <input checked="" type="checkbox"/> Field crew has not used fabric softener on clothing <input checked="" type="checkbox"/> Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning <input checked="" type="checkbox"/> Field crew has not applied unacceptable sunscreen or insect repellent <p>Field Equipment:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> No Teflon® containing materials on-site <input checked="" type="checkbox"/> All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene <input checked="" type="checkbox"/> No waterproof field books on-site other than Rite-in-the-Rain® Products <input checked="" type="checkbox"/> No plastic clipboards, binders, or spiral hard cover notebooks on-site <input checked="" type="checkbox"/> No adhesives (Post-it® Notes) on-site <input checked="" type="checkbox"/> Coolers filled with regular ice only. No chemical (blue) ice packs in possession 	<p>Sample Containers:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE <input checked="" type="checkbox"/> Caps are lined or unlined and made of HDPE or polypropylene <p>Wet Weather (as applicable):</p> <p>For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only</p> <p>Equipment Decontamination:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> "PFAS-free" water on-site for decontamination of sample equipment <input checked="" type="checkbox"/> Alconox and Liquinox to be used as decontamination materials <p>Food Considerations:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area
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If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance: <p align="center">None</p>	Signature:
	Name (print): <p align="center">Jason Hayes</p>

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	10/30/2017
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**ATTACHMENT 1 TO SOP AFW-01
DAILY PFAS PROTOCOL CHECKLIST**



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Weather (temp./precipitation):	Clear, calm, upper 70s
Site/Area Name:	AFFF Area 1, 2, 3, 4, 5, 7, 8	Date and Time:	10/16/2017 7:24
Field Manager:	Jason Hayes		

<p>Field Clothing and PPE (as applicable):</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Field crew in compliance with Tables 1 and 2, SOP AFW-01 <input checked="" type="checkbox"/> Field crew has not used fabric softener on clothing <input checked="" type="checkbox"/> Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning <input checked="" type="checkbox"/> Field crew has not applied unacceptable sunscreen or insect repellent <p>Field Equipment:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> No Teflon® containing materials on-site <input checked="" type="checkbox"/> All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene <input checked="" type="checkbox"/> No waterproof field books on-site other than Rite-in-the-Rain® Products <input checked="" type="checkbox"/> No plastic clipboards, binders, or spiral hard cover notebooks on-site <input checked="" type="checkbox"/> No adhesives (Post-it® Notes) on-site <input checked="" type="checkbox"/> Coolers filled with regular ice only. No chemical (blue) ice packs in possession 	<p>Sample Containers:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE <input checked="" type="checkbox"/> Caps are lined or unlined and made of HDPE or polypropylene <p>Wet Weather (as applicable):</p> <p>For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only</p> <p>Equipment Decontamination:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> "PFAS-free" water on-site for decontamination of sample equipment <input checked="" type="checkbox"/> Alconox and Liquinox to be used as decontamination materials <p>Food Considerations:</p> <p>No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area</p>
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If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance: <p align="center">None</p>	Signature:
	Name (print): <p align="center">Jason Hayes</p>

QA/QC'd by:	Thomas W. Hensel	QA/QC Date:	10/30/2017
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**ATTACHMENT 1 TO SOP AFW-01
DAILY PFAS PROTOCOL CHECKLIST**



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Weather (temp./precipitation):	Clear, calm, upper 70s
Site/Area Name:	AFFF Area 1, 2, 3, 4, 5, 7, 8	Date and Time:	10/17/2017 7:18
Field Manager:	Jason Hayes		

<p>Field Clothing and PPE (as applicable):</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Field crew in compliance with Tables 1 and 2, SOP AFW-01 <input checked="" type="checkbox"/> Field crew has not used fabric softener on clothing <input checked="" type="checkbox"/> Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning <input checked="" type="checkbox"/> Field crew has not applied unacceptable sunscreen or insect repellent <p>Field Equipment:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> No Teflon® containing materials on-site <input checked="" type="checkbox"/> All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene <input checked="" type="checkbox"/> No waterproof field books on-site other than Rite-in-the-Rain® Products <input checked="" type="checkbox"/> No plastic clipboards, binders, or spiral hard cover notebooks on-site <input checked="" type="checkbox"/> No adhesives (Post-it® Notes) on-site <input checked="" type="checkbox"/> Coolers filled with regular ice only. No chemical (blue) ice packs in possession 	<p>Sample Containers:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE <input checked="" type="checkbox"/> Caps are lined or unlined and made of HDPE or polypropylene <p>Wet Weather (as applicable):</p> <p>For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only</p> <p>Equipment Decontamination:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> "PFAS-free" water on-site for decontamination of sample equipment <input checked="" type="checkbox"/> Alconox and Liquinox to be used as decontamination materials <p>Food Considerations:</p> <p>No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area</p>
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If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

<p>Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:</p> <p align="center">None</p>	<p>Signature:</p>
	<p>Name (print):</p> <p align="center">Jason Hayes</p>

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	10/30/2017
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**ATTACHMENT 1 TO SOP AFW-01
DAILY PFAS PROTOCOL CHECKLIST**



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Weather (temp./precipitation):	Clear, calm, upper 70s
Site/Area Name:	AFFF Area 1, 2, 3, 4, 5, 7, 8	Date and Time:	10/19/2017 7:08
Field Manager:	Jason Hayes		

<p>Field Clothing and PPE (as applicable):</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Field crew in compliance with Tables 1 and 2, SOP AFW-01 <input checked="" type="checkbox"/> Field crew has not used fabric softener on clothing <input checked="" type="checkbox"/> Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning <input checked="" type="checkbox"/> Field crew has not applied unacceptable sunscreen or insect repellent <p>Field Equipment:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> No Teflon® containing materials on-site <input checked="" type="checkbox"/> All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene <input checked="" type="checkbox"/> No waterproof field books on-site other than Rite-in-the-Rain® Products <input checked="" type="checkbox"/> No plastic clipboards, binders, or spiral hard cover notebooks on-site <input checked="" type="checkbox"/> No adhesives (Post-it® Notes) on-site <input checked="" type="checkbox"/> Coolers filled with regular ice only. No chemical (blue) ice packs in possession 	<p>Sample Containers:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE <input checked="" type="checkbox"/> Caps are lined or unlined and made of HDPE or polypropylene <p>Wet Weather (as applicable):</p> <p>For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only</p> <p>Equipment Decontamination:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> "PFAS-free" water on-site for decontamination of sample equipment <input checked="" type="checkbox"/> Alconox and Liquinox to be used as decontamination materials <p>Food Considerations:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area
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If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance: <p align="center">None</p>	Signature:
	Name (print): <p align="center">Jason Hayes</p>

QA/QC'd by:	Thomas W. Hensel	QA/QC Date:	10/30/2017
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**ATTACHMENT 1 TO SOP AFW-01
DAILY PFAS PROTOCOL CHECKLIST**



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Weather (temp./precipitation):	Clear, calm, upper 70s
Site/Area Name:	AFFF Area 1, 2, 3, 4, 5, 7, 8	Date and Time:	10/19/2017 7:25
Field Manager:	Jason Hayes		

<p>Field Clothing and PPE (as applicable):</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Field crew in compliance with Tables 1 and 2, SOP AFW-01 <input checked="" type="checkbox"/> Field crew has not used fabric softener on clothing <input checked="" type="checkbox"/> Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning <input checked="" type="checkbox"/> Field crew has not applied unacceptable sunscreen or insect repellent <p>Field Equipment:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> No Teflon® containing materials on-site <input checked="" type="checkbox"/> All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene <input checked="" type="checkbox"/> No waterproof field books on-site other than Rite-in-the-Rain® Products <input checked="" type="checkbox"/> No plastic clipboards, binders, or spiral hard cover notebooks on-site <input checked="" type="checkbox"/> No adhesives (Post-it® Notes) on-site <input checked="" type="checkbox"/> Coolers filled with regular ice only. No chemical (blue) ice packs in possession 	<p>Sample Containers:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE <input checked="" type="checkbox"/> Caps are lined or unlined and made of HDPE or polypropylene <p>Wet Weather (as applicable):</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only <p>Equipment Decontamination:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> "PFAS-free" water on-site for decontamination of sample equipment <input checked="" type="checkbox"/> Alconox and Liquinox to be used as decontamination materials <p>Food Considerations:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area
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If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance: <p align="center">None</p>	Signature:
	Name (print): Jason Hayes

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	10/30/2017
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**ATTACHMENT 1 TO SOP AFW-01
DAILY PFAS PROTOCOL CHECKLIST**



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Weather (temp./precipitation):	Clear, calm, upper 70s
Site/Area Name:	AFFF Area 1, 2, 3, 4, 5, 7, 8	Date and Time:	10/20/2017 7:25
Field Manager:	Jason Hayes		

<p>Field Clothing and PPE (as applicable):</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Field crew in compliance with Tables 1 and 2, SOP AFW-01 <input checked="" type="checkbox"/> Field crew has not used fabric softener on clothing <input checked="" type="checkbox"/> Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning <input checked="" type="checkbox"/> Field crew has not applied unacceptable sunscreen or insect repellent <p>Field Equipment:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> No Teflon® containing materials on-site <input checked="" type="checkbox"/> All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene <input checked="" type="checkbox"/> No waterproof field books on-site other than Rite-in-the-Rain® Products <input checked="" type="checkbox"/> No plastic clipboards, binders, or spiral hard cover notebooks on-site <input checked="" type="checkbox"/> No adhesives (Post-it® Notes) on-site <input checked="" type="checkbox"/> Coolers filled with regular ice only. No chemical (blue) ice packs in possession 	<p>Sample Containers:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE <input checked="" type="checkbox"/> Caps are lined or unlined and made of HDPE or polypropylene <p>Wet Weather (as applicable):</p> <p>For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only</p> <p>Equipment Decontamination:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> "PFAS-free" water on-site for decontamination of sample equipment <input checked="" type="checkbox"/> Alconox and Liquinox to be used as decontamination materials <p>Food Considerations:</p> <p>No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area</p>
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If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

<p>Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:</p> <p align="center">None</p>	<p>Signature:</p>
	<p>Name (print):</p> <p align="center">Jason Hayes</p>

QA/QC'd by:	Thomas W. Hensel	QA/QC Date:	10/30/2017
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SUMMARY OF DAILY ACTIVITIES

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	Current FTA
Weather:	Partly cloudy, 40°F	Date and Time:	11/14/17 18:07
Technician(s):	Miles Watkins, Noel Garland		

Description of Daily Activities and Events:	
<u>Time</u>	<u>Observation/Comment</u>
07:00	Left Knoxville office traveling to Arnold AFB.
10:27	Arrived on site. Observed laydown area.
10:40	Starting Safety Tailgate Checklist and PFAS Protocol Checklist
10:56	Completing Safety Tailgate Checklist and PFAS Protocol Checklist
10:58	Arrived at the Current Fire Training Area to check depth to water on MW08001, MW08002, and MW08003.
10:10	Well total depth and depth to water from TOC respectively are as follows: MW08001: 50.24,49.97; MW08002: 30.39,29.18; MW08003: 50.42,49.81
11:21	Starting calibration of YSI and turbidity meter.
11:59	Finished calibration.
12:35	Collecting tools and taking photographs of AFFF Release Area 9 (J4 Test Cell Weir).
14:12	Attempting to develop MW08001. Not enough water to take parameters. Very high fines. Well was bailed dry.
14:20	Attempting to develop MW08002. Parameters taken (see development log). High fines in water recovered. Well was bailed dry.
14:30	Attempting to develop MW08002. Not enough water to take parameters. Very high fines. Well was bailed dry.
15:18	Starting development on Existing Well 232.
16:33	Development completed on well 232. ~33.5 gallons was removed from the well.
16:45	General site clean up and decon is being completed.
16:53	Decon/Laydown area was locked and access was not achievable today for unloading IDW.
17:11	Leaving project site for equipment run. Work complete on site for the day.

List of Samples Collected:	None		Technician Signature:
Deviation from Plans:	None		
Visitors on Site:	None		
Important Telephone Calls / Photos Taken:	Spoke to Joe Deatherage concerning water in monitoring wells M08001, MW0800, and MW08003. It was requested that the wells be bailed dry and parameters collected if possible. Depth to water in the wells will be checked again tomorrow for recharge.		Technician Name (print):
			Miles Watkins

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	12/13/2017
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SUMMARY OF DAILY ACTIVITIES



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Investigation Area:	Current FTA
Weather:	Cloudy, 40°F	Date and Time:	11/15/17 19:09
Technician(s):	Noel Garland, Miles Watkins		

Description of Daily Activities and Events:

<u>Time</u>	<u>Observation/Comment</u>
07:00	Heading to project site.
07:20	Arrived on site. Collecting liquid IDW samples.
08:20	Collected ARNLD-IDW-AQ-001 samples.
09:03	Collected ARNLD-IDW-AQ-002 samples.
10:30	Depth to water was checked on MW08001 (dry), MW08002 (29.32), and MW08003 (dry).
10:50	Taking Equipment Blank sample ARNLD-EB008 with the stainless-steel bailer.
11:00	Start YSI and turbidity calibration.
11:12	Taking Equipment Blank sample ARNLD-EB009 on the submersible pump.
11:21	Completed calibration.
11:36	Setting up on MW 232 for purge and sampling.
12:49	Collecting sample ARNLD08-GW-004 from MW 232. MS/MSD and ARNLD08-FD-GW-003.
13:17	Collecting sample ARNLD08-GW-002.
14:00	General site clean up was completed and leaving the project site.
18:20	Arrived back at Knoxville office.

List of Samples Collected:	ARNLD-EB-008, ARNLD-EB009, ARNLD08-GW-004 (MS/MSD), ARNLD08-FD-GW-001, ARNLD-IDW-AQ-001, ARNLD-IDW-AQ-002	Technician Signature:
Deviation from Plans:	None	
Visitors on Site:	None	
Important Telephone Calls / Photos Taken:	Joe Deatherage has requested that a sample be collected from MW08002 if possible.	Technician Name (print): Miles Watkins

QA/QC'd by:	Thomas W. Hensel 	QA/QC Date:	12/13/2017
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APPENDIX B-3

TAILGATE SAFETY MEETING REPORTS

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TAILGATE SAFETY MEETING REPORT



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide **Project Number:** 775303101.0004
Contract: FA8903-16-D-0027 **Task Order:** 0004
Installation: ARNLD - Arnold AFB **Date and Time:** 10/12/17 10:40
Field Manager Name: Jason Hayes **Site Health and Safety Officer (HSO):** Jason Hayes
Safety Meeting Type: Initial Kickoff Tailgate Safety Meeting

Order of Business

Topics Discussed (check all that apply):

- Site History/Site Layout
- Scope of Work
- Personnel Responsibilities
- Medical Surveillance Requirements
- Training Requirements
- Safe Work Practices
- Logs, Reports, Recordkeeping
- Sanitation and Illumination
- Air Surveillance Type and Frequency
- Monitoring Instruments and Personal Monitoring
- Action Levels
- Accident Reporting Procedures
- Site Control (visitor access, buddy system, work zones, security, communications)
- Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- Engineering Controls

- PPE Required/PPE Used
- Define PPE Levels, Donning, Doffing Procedures
- Physical Hazards and Controls (e.g., overhead utility lines)
- Decontamination Procedures for Personnel and Equipment
- General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- Hazardous Materials Spill Procedures
- Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- Injury/Illness Reporting Procedures
- Route to Hospital and Medical Care Provider Visit Guidelines
- Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers: Approaching drillers during drilling activities.

Action taken on previous suggestions: Make eye contact before approaching the rig.

Injuries/accidents/personnel changes since previous meeting: NA

Observations of unsafe work practices/conditions that have developed since previous meeting: NA

Location of (or changes in the locations of) evacuation routes/safe refuge areas: Staging Area

Other Safety Topics Discussed: Drilling rig shutoff locations

Additional comments: None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Jason Hayes	AmecFW				
Noel Garland	AmecFW				
Joe Deatherage	AmecFW				
John Eisenman	SAEDACCO				
Stefan Smith	SAEDACCO				
Scott Hunt	SAEDACCO				

Meeting Conducted By (print):	Company and Title	Signature
Jason Hayes	AmecFW - Field Manager	

QA/QC'd by: Thomas W. Hensel **QA/QC Date:** 10/30/2017

TAILGATE SAFETY MEETING REPORT



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date and Time:	10/13/17 09:14
Field Manager Name:	Jason Hayes	Site Health and Safety Officer (HSO):	Jason Hayes
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- Site History/Site Layout
- Scope of Work
- Personnel Responsibilities
- Medical Surveillance Requirements
- Training Requirements
- Safe Work Practices
- Logs, Reports, Recordkeeping
- Sanitation and Illumination
- Air Surveillance Type and Frequency
- Monitoring Instruments and Personal Monitoring
- Action Levels
- Accident Reporting Procedures
- Site Control (visitor access, buddy system, work zones, security, communications)
- Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- Engineering Controls

- PPE Required/PPE Used
- Define PPE Levels, Donning, Doffing Procedures
- Physical Hazards and Controls (e.g., overhead utility lines)
- Decontamination Procedures for Personnel and Equipment
- General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- Hazardous Materials Spill Procedures
- Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- Injury/Illness Reporting Procedures
- Route to Hospital and Medical Care Provider Visit Guidelines
- Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers:	Proper water intake
Action taken on previous suggestions:	Take water breaks as needed
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Staging area
Other Safety Topics Discussed:	Food and drink near the rig
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Jason Hayes	AmecFW				
Joe Deatherage	AmecFW				
Noel Garland	AmecFW				
Scott Hunt	SAEDACCO				
John Eisenman	SAEDACCO				
Stefan Smith	SAEDACCO				

Meeting Conducted By (print):	Company and Title	Signature
Jason Hayes	AmecFW - Field Manager	

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 10/30/2017
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TAILGATE SAFETY MEETING REPORT



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date and Time:	10/14/17 07:07
Field Manager Name:	Jason Hayes	Site Health and Safety Officer (HSO):	Jason Hayes
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- Site History/Site Layout
- Scope of Work
- Personnel Responsibilities
- Medical Surveillance Requirements
- Training Requirements
- Safe Work Practices
- Logs, Reports, Recordkeeping
- Sanitation and Illumination
- Air Surveillance Type and Frequency
- Monitoring Instruments and Personal Monitoring
- Action Levels
- Accident Reporting Procedures
- Site Control (visitor access, buddy system, work zones, security, communications)
- Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- Engineering Controls

- PPE Required/PPE Used
- Define PPE Levels, Donning, Doffing Procedures
- Physical Hazards and Controls (e.g., overhead utility lines)
- Decontamination Procedures for Personnel and Equipment
- General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- Hazardous Materials Spill Procedures
- Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- Injury/Illness Reporting Procedures
- Route to Hospital and Medical Care Provider Visit Guidelines
- Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers:	Watch your step in tall grass
Action taken on previous suggestions:	Look down as you walk
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Staging area
Other Safety Topics Discussed:	Watch for insects and other animals in tall grass
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Jason Hayes	AmecFW				
Noel Garland	AmecFW				
John Eisenman	SAEDACCO				
Scott Hunt	SAEDACCO				
Stefan Smith	SAEDACCO				

Meeting Conducted By (print):	Company and Title	Signature
Jason Hayes	AmecFW - Field Manager	

QA/QC'd by: Thomas W. Hensel QA/QC Date: 10/30/2017

TAILGATE SAFETY MEETING REPORT



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date and Time:	10/15/2017 7:07
Field Manager Name:	Jason Hayes	Site Health and Safety Officer (HSO):	Jason Hayes
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- | | |
|--|--|
| <input checked="" type="checkbox"/> Site History/Site Layout
<input checked="" type="checkbox"/> Scope of Work
<input checked="" type="checkbox"/> Personnel Responsibilities
<input checked="" type="checkbox"/> Medical Surveillance Requirements
<input checked="" type="checkbox"/> Training Requirements
<input checked="" type="checkbox"/> Safe Work Practices
<input checked="" type="checkbox"/> Logs, Reports, Recordkeeping
<input checked="" type="checkbox"/> Sanitation and Illumination
<input checked="" type="checkbox"/> Air Surveillance Type and Frequency
<input checked="" type="checkbox"/> Monitoring Instruments and Personal Monitoring
<input checked="" type="checkbox"/> Action Levels
<input checked="" type="checkbox"/> Accident Reporting Procedures
<input checked="" type="checkbox"/> Site Control (visitor access, buddy system, work zones, security, communications)
<input checked="" type="checkbox"/> Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
<input checked="" type="checkbox"/> Engineering Controls | <input checked="" type="checkbox"/> PPE Required/PPE Used
<input checked="" type="checkbox"/> Define PPE Levels, Donning, Doffing Procedures
<input checked="" type="checkbox"/> Physical Hazards and Controls (e.g., overhead utility lines)
<input checked="" type="checkbox"/> Decontamination Procedures for Personnel and Equipment
<input checked="" type="checkbox"/> General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
<input checked="" type="checkbox"/> Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
<input checked="" type="checkbox"/> Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
<input checked="" type="checkbox"/> Hazardous Materials Spill Procedures
<input checked="" type="checkbox"/> Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
<input checked="" type="checkbox"/> Injury/Illness Reporting Procedures
<input checked="" type="checkbox"/> Route to Hospital and Medical Care Provider Visit Guidelines
<input checked="" type="checkbox"/> Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
<input checked="" type="checkbox"/> Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b) |
|--|--|

Safety suggestions by site workers:	Watch your step in tall grass
Action taken on previous suggestions:	Look down as you walk
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Staging area
Other Safety Topics Discussed:	Watch for insects and other animals in tall grass
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Jason Hayes	AmecFW				
Noel Garland	AmecFW				

Meeting Conducted By (print):	Company and Title	Signature
Jason Hayes	AmecFW - Field Manager	

QA/QC'd by: Thomas W. Hensel	QA/QC Date: 10/30/2017
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TAILGATE SAFETY MEETING REPORT



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date and Time:	10/16/2017 7:34
Field Manager Name:	Jason Hayes	Site Health and Safety Officer (HSO):	Jason Hayes
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- Site History/Site Layout
- Scope of Work
- Personnel Responsibilities
- Medical Surveillance Requirements
- Training Requirements
- Safe Work Practices
- Logs, Reports, Recordkeeping
- Sanitation and Illumination
- Air Surveillance Type and Frequency
- Monitoring Instruments and Personal Monitoring
- Action Levels
- Accident Reporting Procedures
- Site Control (visitor access, buddy system, work zones, security, communications)
- Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- Engineering Controls

- PPE Required/PPE Used
- Define PPE Levels, Donning, Doffing Procedures
- Physical Hazards and Controls (e.g., overhead utility lines)
- Decontamination Procedures for Personnel and Equipment
- General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- Hazardous Materials Spill Procedures
- Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- Injury/Illness Reporting Procedures
- Route to Hospital and Medical Care Provider Visit Guidelines
- Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers:	Lifting properly
Action taken on previous suggestions:	Use your legs during lifting
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Staging area
Other Safety Topics Discussed:	None
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Jason Hayes	AmecFW				
Noel Garland	AmecFW				
John Eisenman	SAEDACCO				
Scott Hunt	SAEDACCO				
Stefan Smith	SAEDACCO				
Christian Minarik	SAEDACCO				

Meeting Conducted By (print):	Company and Title	Signature
Jason Hayes	AmecFW - Field Manager	

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 10/30/2017
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TAILGATE SAFETY MEETING REPORT



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide **Project Number:** 775303101.0004
Contract: FA8903-16-D-0027 **Task Order:** 0004
Installation: ARNLD - Arnold AFB **Date and Time:** 10/17/17 07:34
Field Manager Name: Jason Hayes **Site Health and Safety Officer (HSO):** Jason Hayes
Safety Meeting Type: Regular/Daily Tailgate Safety Meeting

Order of Business

Topics Discussed (check all that apply):

- Site History/Site Layout
- Scope of Work
- Personnel Responsibilities
- Medical Surveillance Requirements
- Training Requirements
- Safe Work Practices
- Logs, Reports, Recordkeeping
- Sanitation and Illumination
- Air Surveillance Type and Frequency
- Monitoring Instruments and Personal Monitoring
- Action Levels
- Accident Reporting Procedures
- Site Control (visitor access, buddy system, work zones, security, communications)
- Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- Engineering Controls

- PPE Required/PPE Used
- Define PPE Levels, Donning, Doffing Procedures
- Physical Hazards and Controls (e.g., overhead utility lines)
- Decontamination Procedures for Personnel and Equipment
- General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- Hazardous Materials Spill Procedures
- Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- Injury/Illness Reporting Procedures
- Route to Hospital and Medical Care Provider Visit Guidelines
- Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers: Pinch points

Action taken on previous suggestions: Watch hands in areas that could cause issues around rig

Injuries/accidents/personnel changes since previous meeting: None

Observations of unsafe work practices/conditions that have developed since previous meeting: None

Location of (or changes in the locations of) evacuation routes/safe refuge areas: Staging area

Other Safety Topics Discussed: None

Additional comments: None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Jason Hayes	AmecFW				
Noel Garland	AmecFW				
John Eisenman	SAEDACCO				
Scott Hunt	SAEDACCO				
Stefan Smith	SAEDACCO				
Christian Minarik	SAEDACCO				

Meeting Conducted By (print):	Company and Title	Signature
Jason Hayes	AmecFW - Field Manager	

QA/QC'd by: Thomas W. Hensel **QA/QC Date:** 10/30/2017

TAILGATE SAFETY MEETING REPORT



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date and Time:	10/18/17 09:07
Field Manager Name:	Jason Hayes	Site Health and Safety Officer (HSO):	Jason Hayes
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Topics Discussed (check all that apply):	Order of Business
<input checked="" type="checkbox"/> Site History/Site Layout	<input checked="" type="checkbox"/> PPE Required/PPE Used
<input checked="" type="checkbox"/> Scope of Work	<input checked="" type="checkbox"/> Define PPE Levels, Donning, Doffing Procedures
<input checked="" type="checkbox"/> Personnel Responsibilities	<input checked="" type="checkbox"/> Physical Hazards and Controls (e.g., overhead utility lines)
<input checked="" type="checkbox"/> Medical Surveillance Requirements	<input checked="" type="checkbox"/> Decontamination Procedures for Personnel and Equipment
<input checked="" type="checkbox"/> Training Requirements	<input checked="" type="checkbox"/> General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
<input checked="" type="checkbox"/> Safe Work Practices	<input checked="" type="checkbox"/> Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
<input checked="" type="checkbox"/> Logs, Reports, Recordkeeping	<input checked="" type="checkbox"/> Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
<input checked="" type="checkbox"/> Sanitation and Illumination	<input checked="" type="checkbox"/> Hazardous Materials Spill Procedures
<input checked="" type="checkbox"/> Air Surveillance Type and Frequency	<input checked="" type="checkbox"/> Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
<input checked="" type="checkbox"/> Monitoring Instruments and Personal Monitoring	<input checked="" type="checkbox"/> Injury/Illness Reporting Procedures
<input checked="" type="checkbox"/> Action Levels	<input checked="" type="checkbox"/> Route to Hospital and Medical Care Provider Visit Guidelines
<input checked="" type="checkbox"/> Accident Reporting Procedures	<input checked="" type="checkbox"/> Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
<input checked="" type="checkbox"/> Site Control (visitor access, buddy system, work zones, security, communications)	<input checked="" type="checkbox"/> Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)
<input checked="" type="checkbox"/> Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences	
<input checked="" type="checkbox"/> Engineering Controls	

Safety suggestions by site workers:	Slips, trips, and falls
Action taken on previous suggestions:	Watch your step
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Staging area
Other Safety Topics Discussed:	Working in secure areas
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Jason Hayes	AmecFW				
Noel Garland	AmecFW				
Bryan Hansen	AmecFW				
John Eisenman	SAEDACCO				
Scott Hunt	SAEDACCO				
Stefan Smith	SAEDACCO				

Meeting Conducted By (print):	Company and Title	Signature
Jason Hayes	AmecFW - Field Manager	

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 10/30/2017
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TAILGATE SAFETY MEETING REPORT



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date and Time:	10/19/17 07:29
Field Manager Name:	Jason Hayes	Site Health and Safety Officer (HSO):	Jason Hayes
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Topics Discussed (check all that apply):	Order of Business
<input checked="" type="checkbox"/> Site History/Site Layout	<input checked="" type="checkbox"/> PPE Required/PPE Used
<input checked="" type="checkbox"/> Scope of Work	<input checked="" type="checkbox"/> Define PPE Levels, Donning, Doffing Procedures
<input checked="" type="checkbox"/> Personnel Responsibilities	<input checked="" type="checkbox"/> Physical Hazards and Controls (e.g., overhead utility lines)
<input checked="" type="checkbox"/> Medical Surveillance Requirements	<input checked="" type="checkbox"/> Decontamination Procedures for Personnel and Equipment
<input checked="" type="checkbox"/> Training Requirements	<input checked="" type="checkbox"/> General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
<input checked="" type="checkbox"/> Safe Work Practices	<input checked="" type="checkbox"/> Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
<input checked="" type="checkbox"/> Logs, Reports, Recordkeeping	<input checked="" type="checkbox"/> Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
<input checked="" type="checkbox"/> Sanitation and Illumination	<input checked="" type="checkbox"/> Hazardous Materials Spill Procedures
<input checked="" type="checkbox"/> Air Surveillance Type and Frequency	<input checked="" type="checkbox"/> Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
<input checked="" type="checkbox"/> Monitoring Instruments and Personal Monitoring	<input checked="" type="checkbox"/> Injury/Illness Reporting Procedures
<input checked="" type="checkbox"/> Action Levels	<input checked="" type="checkbox"/> Route to Hospital and Medical Care Provider Visit Guidelines
<input checked="" type="checkbox"/> Accident Reporting Procedures	<input checked="" type="checkbox"/> Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
<input checked="" type="checkbox"/> Site Control (visitor access, buddy system, work zones, security, communications)	<input checked="" type="checkbox"/> Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)
<input checked="" type="checkbox"/> Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences	
<input checked="" type="checkbox"/> Engineering Controls	

Safety suggestions by site workers:	Lifting techniques
Action taken on previous suggestions:	Using proper lifting with your legs
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Staging area
Other Safety Topics Discussed:	Lifting techniques
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Jason Hayes	AmecFW				
Stefan Smith	SAEDACCO				
Christian Minarik	SAEDACCO				
Noel Garland	AmecFW				
Scott Hunt	SAEDACCO				
John Eisenman	SAEDACCO				
Bryan Hansen	AmecFW				

Meeting Conducted By (print):	Company and Title	Signature
Jason Hayes	AmecFW - Field Manager	

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 10/30/2017
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TAILGATE SAFETY MEETING REPORT



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide **Project Number:** 775303101.0004
Contract: FA8903-16-D-0027 **Task Order:** 0004
Installation: ARNLD - Arnold AFB **Date and Time:** 10/20/2017 7:29
Field Manager Name: Jason Hayes **Site Health and Safety Officer (HSO):** Jason Hayes
Safety Meeting Type: Regular/Daily Tailgate Safety Meeting

Order of Business

Topics Discussed (check all that apply):

- Site History/Site Layout
- Scope of Work
- Personnel Responsibilities
- Medical Surveillance Requirements
- Training Requirements
- Safe Work Practices
- Logs, Reports, Recordkeeping
- Sanitation and Illumination
- Air Surveillance Type and Frequency
- Monitoring Instruments and Personal Monitoring
- Action Levels
- Accident Reporting Procedures
- Site Control (visitor access, buddy system, work zones, security, communications)
- Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
- Engineering Controls

- PPE Required/PPE Used
- Define PPE Levels, Donning, Doffing Procedures
- Physical Hazards and Controls (e.g., overhead utility lines)
- Decontamination Procedures for Personnel and Equipment
- General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
- Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
- Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
- Hazardous Materials Spill Procedures
- Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
- Injury/Illness Reporting Procedures
- Route to Hospital and Medical Care Provider Visit Guidelines
- Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
- Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b)

Safety suggestions by site workers: Pay attention to your tasks

Action taken on previous suggestions: Stay focused on tasks after a lot of consecutive days of work

Injuries/accidents/personnel changes since previous meeting: None

Observations of unsafe work practices/conditions that have developed since previous meeting: None

Location of (or changes in the locations of) evacuation routes/safe refuge areas: Staging area

Other Safety Topics Discussed: None

Additional comments: None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Jason Hayes	AmecFW				
Stefan Smith	SAEDACCO				
Christian Minarik	SAEDACCO				
Noel Garland	AmecFW				
Scott Hunt	SAEDACCO				
John Eisenman	SAEDACCO				
Bryan Hansen	AmecFW				

Meeting Conducted By (print):	Company and Title	Signature
Jason Hayes	AmecFW - Field Manager	

QA/QC'd by: Thomas W. Hensel **QA/QC Date:** 10/30/2017

TAILGATE SAFETY MEETING REPORT



Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date and Time:	11/14/17 10:40
Field Manager Name:	Noel Garland	Site Health and Safety Officer (HSO):	Miles Watkins
Safety Meeting Type:	Regular/Daily Tailgate Safety Meeting		

Order of Business

Topics Discussed (check all that apply):

- | | |
|--|--|
| <input checked="" type="checkbox"/> Site History/Site Layout
<input checked="" type="checkbox"/> Scope of Work
<input checked="" type="checkbox"/> Personnel Responsibilities
<input checked="" type="checkbox"/> Medical Surveillance Requirements
<input checked="" type="checkbox"/> Training Requirements
<input checked="" type="checkbox"/> Safe Work Practices
<input checked="" type="checkbox"/> Logs, Reports, Recordkeeping
<input checked="" type="checkbox"/> Sanitation and Illumination
<input checked="" type="checkbox"/> Air Surveillance Type and Frequency
<input checked="" type="checkbox"/> Monitoring Instruments and Personal Monitoring
<input checked="" type="checkbox"/> Action Levels
<input checked="" type="checkbox"/> Accident Reporting Procedures
<input checked="" type="checkbox"/> Site Control (visitor access, buddy system, work zones, security, communications)
<input checked="" type="checkbox"/> Discussion of previous "near misses" including work crew suggestions to correct work practices to avoid similar occurrences
<input checked="" type="checkbox"/> Engineering Controls | <input checked="" type="checkbox"/> PPE Required/PPE Used
<input checked="" type="checkbox"/> Define PPE Levels, Donning, Doffing Procedures
<input checked="" type="checkbox"/> Physical Hazards and Controls (e.g., overhead utility lines)
<input checked="" type="checkbox"/> Decontamination Procedures for Personnel and Equipment
<input checked="" type="checkbox"/> General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
<input checked="" type="checkbox"/> Site/Regional Emergency Procedures (e.g. earthquake response, typhoon response, etc.)
<input checked="" type="checkbox"/> Medical Emergency Response Procedures (e.g., exposure control precautions, location of first aid kit, etc.)
<input checked="" type="checkbox"/> Hazardous Materials Spill Procedures
<input checked="" type="checkbox"/> Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
<input checked="" type="checkbox"/> Injury/Illness Reporting Procedures
<input checked="" type="checkbox"/> Route to Hospital and Medical Care Provider Visit Guidelines
<input checked="" type="checkbox"/> Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazards and effects)
<input checked="" type="checkbox"/> Review AHAs with all parties engaged in the activity (EM-385 1-1, para 01.A.13.b) |
|--|--|

Safety suggestions by site workers:	Watch for deer while driving.
Action taken on previous suggestions:	None
Injuries/accidents/personnel changes since previous meeting:	None
Observations of unsafe work practices/conditions that have developed since previous meeting:	None
Location of (or changes in the locations of) evacuation routes/safe refuge areas:	Laydown/Decon Area
Other Safety Topics Discussed:	None
Additional comments:	None

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting.

Attendee Name (print)	Company	Signature	Attendee Name (print)	Company	Signature
Noel Garland	AmecFW				
Miles Watkins	AmecFW				

Meeting Conducted By (print):	Company and Title	Signature
Miles Watkins	AmecFW - Technical Professional	

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 12/13/2017
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APPENDIX B-4

SOIL BORING/MONITORING WELL RECORDS

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PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Boring No. SB01003			
BORING LOCATION: N: 383373.19 E: 1956838.53 TN State Plane		ELEVATION AND DATUM: 1088.19 NAVD88			
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/13/17		DATE FINISHED: 10/13/17	
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 20.0		MEASURING POINT:	
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER	FIRST NA	COMPL. NA	24 HRS.
SAMPLING METHOD: Hand Auger		LOGGED BY: N. Garland			
HAMMER WEIGHT: NA		DROP: NA		RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	PID READING (ppm)	REMARKS
	Sample No.	Sample	Blows/6 inches			
				Surface Elevation: 1088.19 NAVD88		
1	ARNLD01-SO-003 (0.5-1)	█		Gravel Fill		PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard
2				SILTY SAND (SM), brownish yellow (10YR 6/6), dry, ~60% sand, ~40% fines		
3				SANDY SILT (ML), yellowish brown (10YR 5/4), dry, ~70% fines, ~30% sand, low plasticity, slow dilatancy, low toughness, low dry strength, soft	1.5	
4				LEAN CLAY (CL), strong brown (7.5YR 5/6), moist, ~80% fines, ~20% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm		
5				SANDY LEAN CLAY (CL), red with mottling (2.5YR 4/8), moist, ~70% fines, ~30% sand, medium plasticity, no dilatancy, medium toughness, high dry strength, hard	2.9	
6						
7					2.5	
8						
9						
10				FAT CLAY (CH), red with mottling (10R 4/6), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm		
11				SANDY LEAN CLAY (CL), strong brown (7.5YR 5/6), moist, ~60% fines, ~30% sand, ~10% gravel, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm		
12				FAT CLAY (CH), gray (2.5Y 5/1), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	3.2	
13				Red with mottling (10R 4/6), moist		
14						

RMRK3

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	PID READING (ppm)	REMARKS
	Sample No.	Sample	Blows/ 6 inches			
15				FAT CLAY (CH): continued	2.9	
16				FAT CLAY with GRAVEL (CH), red (10R 5/6), moist, ~60% fines, ~25% sand, ~15% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm		
17				Chert pieces present		
18				FAT CLAY with SAND (CH), light red with mottling (2.5YR 6/6), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm		
19	ARNLD01-SO-004 (17-19)					
20				Boring terminated at 20' bgs; no temp monitoring well installed.		
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Boring No. SB04002			
BORING LOCATION: N: 381237.89 E: 1954641.15 TN State Plane		ELEVATION AND DATUM: 1092.57 NAVD88			
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/19/17	DATE FINISHED: 10/19/17		
DRILLING METHOD: Hand Auger		TOTAL DEPTH (ft.): 6.0	MEASURING POINT:		
DRILLING EQUIPMENT: Hand Auger		DEPTH TO WATER	FIRST NA	COMPL. NA	24 HRS.
SAMPLING METHOD: Hand Auger		LOGGED BY: N. Garland			
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage		REG. NO. 103318	

DEPTH (feet)	SAMPLES			DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	PID READING (ppm)	REMARKS
	Sample No.	Sample	Blows/ 6 inches			
				Surface Elevation: 1092.57 NAVD88		
1	ARNLD04-SO-001 (0.5-1)			Gravel - Fill	3.8	PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard
2				FAT CLAY with SAND (CH), yellowish red (10YR 5/4), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, soft Wet at 1.5' bgs		
3				SANDY SILT (ML), gray (10YR 6/1), moist, ~70% fines, ~30% sand, nonplastic, no dilatancy, low toughness, low dry strength, firm Wet at 5' bgs		
4				FAT CLAY with SAND (CH), yellowish brown (10YR 5/6), wet, ~80% fines, ~20% sand, high plasticity, slow dilatancy, high toughness, high dry strength, soft		
5	ARNLD04-SO-002 (5-6)					
6				Soil boring terminated at 6' bgs; no temporary monitoring well installed.		
7						
8						
9						
10						
11						
12						
13						
14						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW01001	
BORING LOCATION: N: 383383.61 E: 1956783.62 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1087.7 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/13/17	DATE FINISHED: 10/13/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 30.0	SCREEN INTERVAL (ft.): 20.18 - 30.20
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 22	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/6 Inches			
					Surface Elevation: 1087.7 NAVD88	
1	ARNL001-SO-001-(0.5-1)				Gravel Fill (GRAVEL FILL)	PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard ← No backfill ← 2" PVC casing
2					SILTY SAND (SM), brownish yellow (10YR 6/6), dry, ~60% sand, ~40% fines, nonplastic, no dilatancy	
3				383	SANDY SILT (ML), yellowish brown (10YR 5/4), dry, ~70% fines, ~30% sand, nonplastic, no dilatancy, low toughness, low dry strength, soft	
4					SANDY LEAN CLAY (CL), strong brown (7.5YR 5/6), moist, ~80% fines, ~20% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm	
5				185	Red with mottling (2.5YR 4/8), moist, ~70% fines, ~30% sand, medium plasticity, no dilatancy, medium toughness, high dry strength, hard	
6						
7				33.3		
8						
9						
10					FAT CLAY (CH), red with mottling (10R 4/6), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
11					SANDY LEAN CLAY (CL), strong brown (7.5YR 5/6), moist, ~60% fines, ~30% sand, ~10% gravel, nonplastic, no dilatancy, medium toughness, medium dry strength, firm	
12				32.6		
13					FAT CLAY (CH), gray (2.5Y 5/1), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
14					At 12.4': Red with mottling (10R 4/6), moist, ~90% fines, ~10% sand	
15						

WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					FAT CLAY (CH): continued	No backfill 2" PVC casing
17					SANDY FAT CLAY (CH), red (10R 5/6), moist, ~60% fines, ~25% sand, ~15% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	Bentonite seal
18						
19				27.1	FAT CLAY with SAND (CH), light red with mottling (2.5YR 6/6), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	Filter pack
20						Top of Screen
21						
22				7.1	GRAVELLY FAT CLAY (CH), red with mottling (2.5YR 4/6), moist, ~60% fines, ~30% gravel, ~10% sand, chert present, high plasticity, no dilatancy, high toughness, high dry strength, firm	
23					SANDSTONE (SANDSTONE), wet, Sandstone layer interbedded with clay layers and weathered chert, groundwater encountered	
24						2" PVC Screen, 0.010" factory slot
25					FAT CLAY with SAND (CH), light red (2.5YR 6/6), wet, ~80% fines, ~15% sand, ~5% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
26					SANDY SILT (ML), brownish yellow (10YR 6/8), wet, ~60% fines, ~40% sand, low plasticity, slow dilatancy, low toughness, low dry strength, soft	
27				5.8	FAT CLAY with SAND (CH), light red (2.5YR 6/6), wet, ~80% fines, ~15% sand, ~5% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
28						
29					SANDY SILT (ML), brownish yellow (10YR 6/8), wet, ~60% fines, ~40% sand, low plasticity, slow dilatancy, low toughness, low dry strength, soft	
30					FAT CLAY with SAND (CH), light red with mottling (2.5YR 6/6), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	Bottom of Screen with End Cap
31					Chert seam (29 - 29.8 ft)	
32					SILTY SAND (SM), olive yellow (2.5Y 6/8), wet, ~80% sand, ~20% fines, nonplastic, no dilatancy	
33					Boring terminated at 30' bgs to set temporary monitoring well MW01001.	

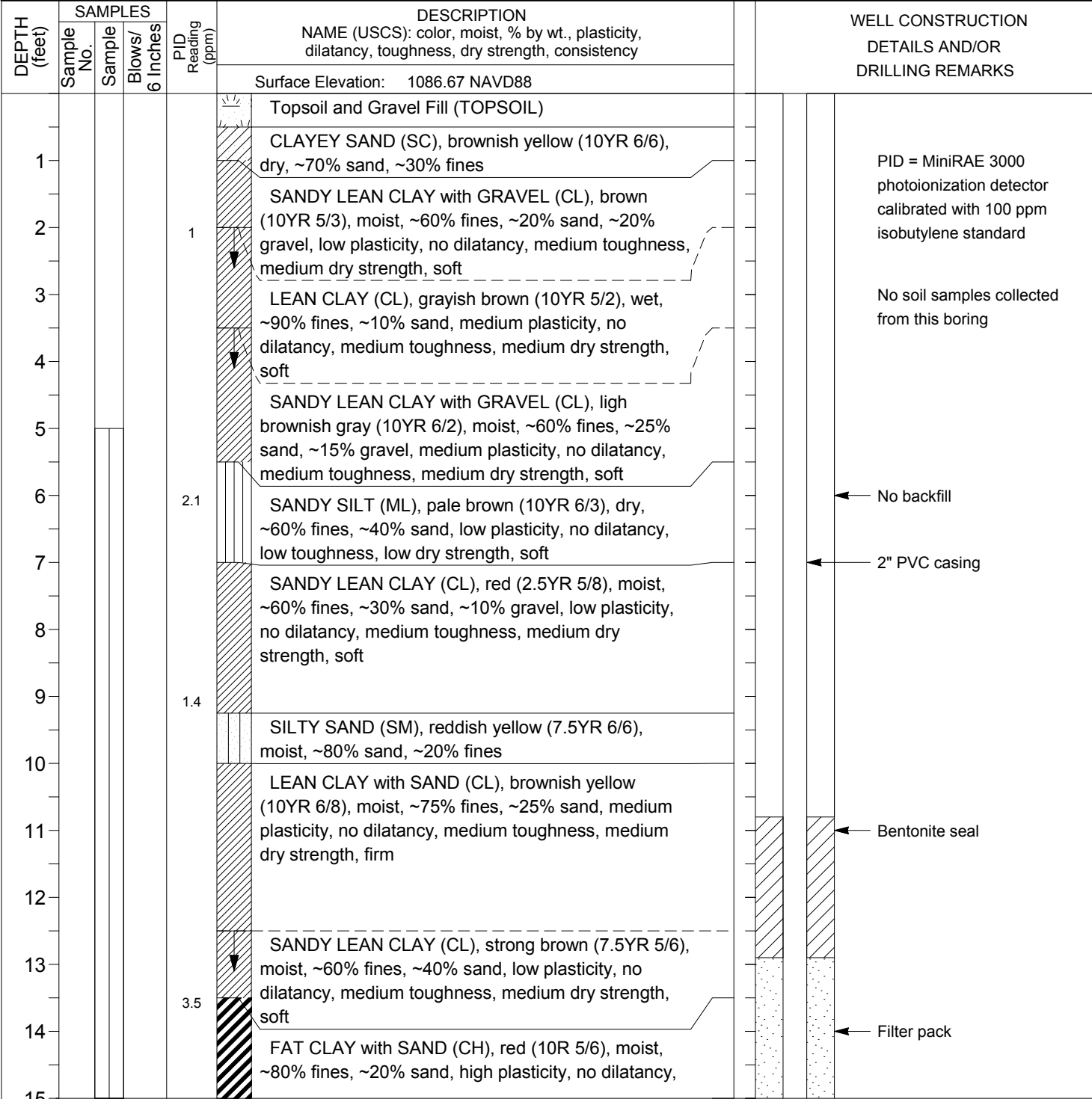
PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW01002	
BORING LOCATION: N: 383475.9 E: 1956845.88 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1087.13 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/13/17	DATE FINISHED: 10/13/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 30.0	SCREEN INTERVAL (ft.): 20.15 - 30.18
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 22	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
					Surface Elevation: 1087.13 NAVD88	
1					Topsoil (TOPSOIL), organics	PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard No soil samples collected from this boring ← No backfill ← 2" PVC casing
2					SANDY SILT (ML), yellowish brown (10YR 5/4), dry, ~60% fines, ~40% sand, nonplastic, no dilatancy, low toughness, low dry strength, soft	
3				1.2	SANDY LEAN CLAY (CL), brown (10YR 5/3), moist, ~80% fines, 20% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, soft	
4					Reddish brown (5YR 5/3), wet, ~60% fines, ~30% sand, ~10% gravel, slow dilatancy	
5				1.5	Red with mottling (10R 5/8), moist, ~70% fines, ~30% sand, no dilatancy, hard	
6						
7				2.2		
8						
9						
10					FAT CLAY (CH), gray with mottling (2.5Y 6/1), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, very high dry strength, firm	
11					Red with mottling (2.5YR 5/6), dry, ~75% fines, ~20% sand, ~5% gravel, high dry strength	
12				2.7	SANDY FAT CLAY (CH), red with mottling (2.5YR 4/6), dry, ~60% fines, ~25% sand, ~15% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
13					Becomes moist	
14						
15						

WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					SANDY FAT CLAY (CH): continued	No backfill
17				2.9	Chert present	2" PVC casing
18					FAT CLAY with SAND (CH), strong brown with mottling (7.5YR 5/6), moist, ~75% fines, ~20% sand, ~5% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	Bentonite seal
19					FAT CLAY (CH), red (10R 5/6), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, medium toughness, high dry strength, hard	Filter pack
20					LEAN CLAY (CL), brownish yellow (10YR 6/8), moist, ~90% fines, ~10% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, soft	Top of Screen
21				1.9	Groundwater encountered at 22' bgs	
22					FAT CLAY with SAND (CH), yellowish brown with mottling (10YR 5/6), wet, ~75% fines, ~15% sand, ~10% gravel, chert present, medium plasticity, no dilatancy, high toughness, high dry strength, firm	2" PVC Screen, 0.010" factory slot
23				3.8		
24					CLAYEY SAND with GRAVEL (SC), yellowish red (5YR 4/6), wet, ~60% sand, ~30% fines, ~10% gravel	
25					POORLY GRADED SAND with SILT (SP-SM), very pale brown (10YR 7/4), wet, ~90% sand, ~10% fines	
26					Boring terminated at 30' bgs to set temporary monitoring well MW01002.	Bottom of Screen with End Cap
27						
28						
29						
30						
31						
32						
33						

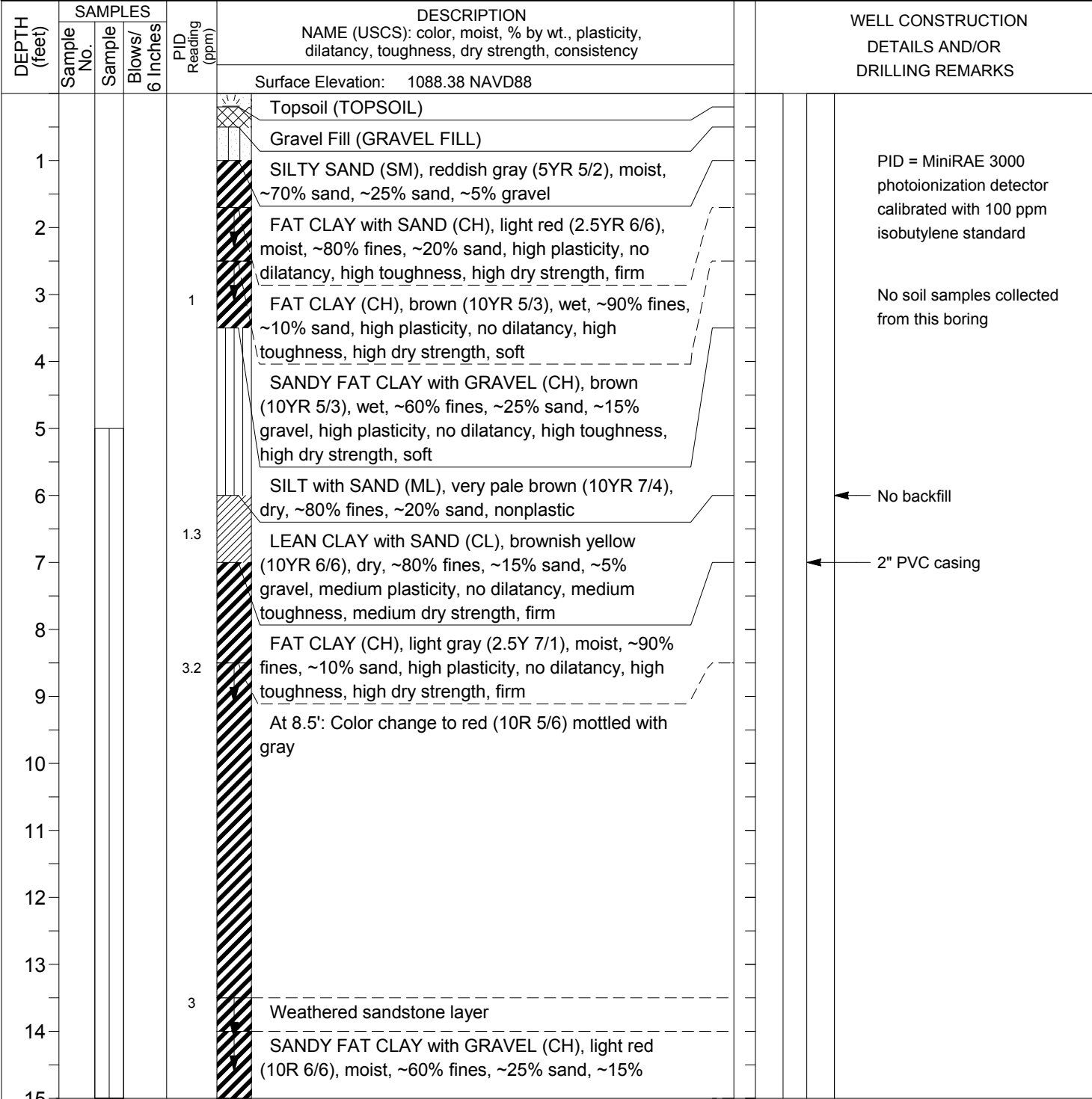
PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW02001	
BORING LOCATION: N: 384158.61 E: 1952795 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1086.67 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/14/17	DATE FINISHED: 10/14/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 27.0	SCREEN INTERVAL (ft.): 15.03 - 25.36
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 17	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318



WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					high toughness, high dry strength, firm CLAYEY SAND with GRAVEL (SC), reddish yellow (7.5YR 6/6), moist, ~60% sand, ~20% gravel, ~20% fines	<p>Top of Screen</p> <p>2" PVC Screen, 0.010" factory slot</p> <p>Filter pack</p> <p>Bottom of Screen with End Cap</p>
17					Groundwater encountered at 17' bgs	
18					LEAN CLAY with GRAVEL (CL), brownish yellow with mottling (10YR 6/6), wet, ~75% fines, ~15% gravel, ~10% sand, medium plasticity, slow dilatancy, medium toughness, medium dry strength, firm	
19				3.9		
20					Weathered chert layer	
21					SILT with SAND (ML), yellow (10YR 7/6), wet, ~85% fines, ~15% sand, nonplastic, slow dilatancy, low toughness, low dry strength, soft	
22						
23					SANDY FAT CLAY with GRAVEL (CH), red (10R 5/8), wet, ~60% fines, ~20% gravel, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
24				3.7		
25						
26						
27					Boring terminated at 27' bgs to set temporary monitoring well MW02001.	
28						
29						
30						
31						
32						
33						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW02002	
BORING LOCATION: N: 384149.99 E: 1952953.73 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1088.38 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/14/17	DATE FINISHED: 10/16/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 30.5	SCREEN INTERVAL (ft.): 20.41 - 30.45
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 17.5	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318



WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					gravel, high plasticity, no dilatancy, medium toughness, medium dry strength, soft	
17					FAT CLAY (CH), red (10R 5/6), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	Bentonite seal
18					LEAN CLAY with SAND (CL), yellow (10YR 7/6), moist, ~75% fines, ~25% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm	Filter pack
19					Groundwater encountered at 17.5' bgs	2" PVC casing
20				4.4	SILTY SAND (SM), pink (5YR 7/3), wet, ~75% sand, ~20% fines, ~5% gravel	
21					Brownish yellow (10YR 6/8), wet, ~80% sand, ~20% fines	Top of Screen
22						
23					FAT CLAY with SAND (CH), light red (2.5YR 6/8), wet, ~75% fines, 20% sand, 5% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
24				3.4	SANDY SILT (ML), brownish yellow (10YR 6/6), wet, ~60% fines, ~40% sand, low plasticity, no dilatancy, low toughness, low dry strength, soft	
25					FAT CLAY with SAND (CH), light red (2.5YR 6/8), wet, ~75% fines, 20% sand, 5% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	2" PVC Screen, 0.010 factory slot
26					SILTY SAND (SM), brownish yellow (10YR 6/6), wet, ~75% sand, ~25% fines	
27						
28					GRAVELLY FAT CLAY (CH), red (2.5YR 5/6), wet, ~70% fines, ~25% gravel, ~5% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
29					SANDY FAT CLAY with GRAVEL (CH), yellowish red (5YR 5/6), wet, ~60% fines, ~25% sand, ~15% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
30						
31					Boring terminated at 30.5' bgs to set temporary monitoring well MW02002.	Bottom of Screen with End Cap
32						
33						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW02003	
BORING LOCATION: N: 384414.48 E: 1952255.27 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1089.89 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/16/17	DATE FINISHED: 10/16/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 30.0	SCREEN INTERVAL (ft.): 19.09 - 29.11
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 18.5	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
					Surface Elevation: 1089.89 NAVD88	
0.5					Gravel Fill (GRAVEL FILL), Dirt	
1						PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard No soil samples collected from this boring ← No backfill ← 2" PVC casing
2					SILTY SAND (SM), brown (10YR 5/3), dry, ~80% sand, ~20% fines, hard	
3				0.9	LEAN CLAY with SAND (CL), yellowish brown (10YR 5/4), moist, ~80% fines, ~20% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm	
4					SANDY FAT CLAY with GRAVEL (CH), reddish brown (5YR 5/3), moist, ~60% fines, ~25% sand, ~15% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
5						
6					FAT CLAY (CH), red (10R 5/6), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, hard	
7						
8						
9						
10				0.9		
11					SANDY SILT (ML), strong brown (7.5YR 5/6), dry, ~70% fines, ~25% sand, ~5% gravel, low plasticity, no dilatancy, low toughness, low dry strength, firm	
12						
13						
14					FAT CLAY with SAND (CH), red, mottled (2.5YR 5/8), dry, ~75% fines, ~25% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
15				2.3		

WELL 10

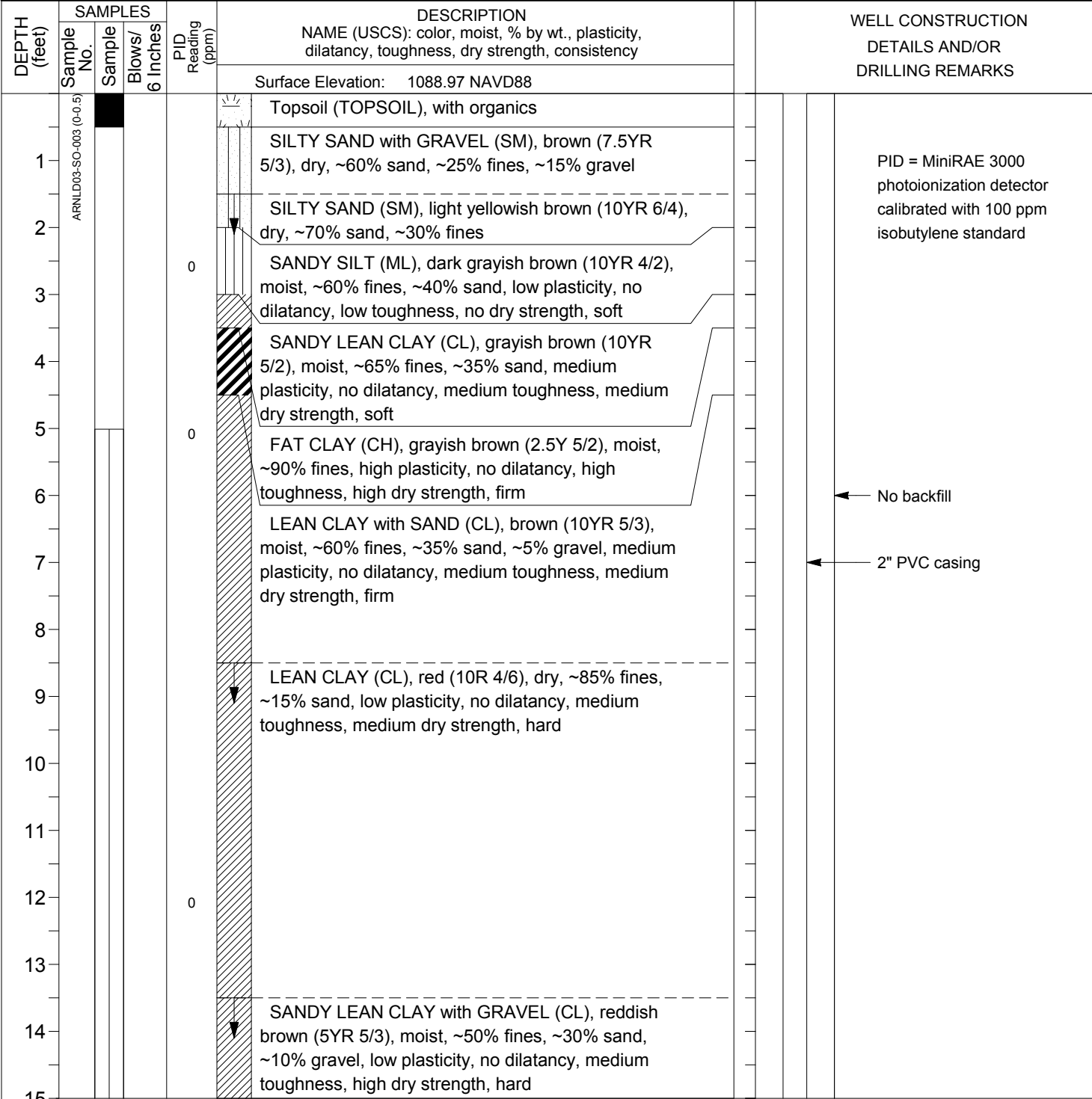
DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					FAT CLAY with SAND (CH): continued	
16					Interbedded sand and gravel layers from 15.6-17.0' bgs	Bentonite seal
17						
18					POORLY GRADED SAND with SILT (SP-SM), reddish yellow (7.5YR 7/6), moist, ~85% sand, ~10% fines, ~5% gravel	Filter pack
19					SILTY SAND (SM), yellow (2.5Y 7/6), wet, ~70% sand, ~25% fines, ~5% gravel	
20				2.6	CLAYEY SAND with GRAVEL (SC), light brown (7.5YR 6/3), wet, ~60% sand, ~25% fines, ~15% gravel	
21					Weathered Sandstone (SANDSTONE)	
22					LEAN CLAY with SAND (CL), reddish yellow (7.5YR 6/8), wet, ~75% fines, ~20% sand, ~5% gravel, medium plasticity, slow dilatancy, medium toughness, medium dry strength, soft	
23						
24						
25					WELL GRADED GRAVEL with SAND (GW), pale brown (10YR 6/3), wet, ~60% gravel, ~35% sand, ~5% fine silt	2" PVC Screen, 0.010" factory slot
26				4	SILTY SAND (SM), reddish yellow (7.5YR 6/6), wet, ~70% sand, ~30% fines	
27					FAT CLAY with SAND (CH), red (10R 5/8), wet, ~80% fines, ~20% sand, high plasticity, slow dilatancy, high toughness, high dry strength, firm	
28				3.3	SILTY SAND with GRAVEL (SM), brownish yellow (10YR 6/6), wet, ~60% sand, ~25% fines, ~15% gravel	
29					SANDY SILT (ML), brownish yellow (10YR 6/6), wet, ~60% fines, ~35% sand, ~5% gravel, low plasticity, slow dilatancy, low toughness, low dry strength, soft	Bottom of Screen with End Cap
30					Boring terminated at 30' bgs to set temporary monitoring well MW02003.	
31						
32						
33						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW03001	
BORING LOCATION: N: 382835.77 E: 1956816.76 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1089.23 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/12/17	DATE FINISHED: 10/12/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 30.0	SCREEN INTERVAL (ft.): 20.16 - 30.16
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 22	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/6 Inches			
					Surface Elevation: 1089.23 NAVD88	
0					Topsoil, black, some organics	
1	ARNLD03-SO-01 (0-0.5)				LEAN CLAY with SAND (CL), strong brown (7.5YR 4/6), dry, ~80% fines, ~20% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm	
2					FAT CLAY with SAND (CH), red (2.5YR 4/6), dry, ~85% fines, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
3					SANDY SILT (ML), grayish brown (10YR 5/2), dry, ~60% fines, ~40% sand, low plasticity, no dilatancy, low toughness, low dry strength, soft	
4					FAT CLAY (CH), light brownish gray (10YR 6/2), wet, ~90% fines, 10% sand, high plasticity, no dilatancy, high toughness, high dry strength, soft	
5					FAT CLAY with SAND (CH), reddish yellow (5YR 6/6), moist, ~75% fines, ~25% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
6					LEAN CLAY (CL), red (10R 5/6), dry, ~85% fines, ~15% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, soft	No backfill
7					SANDY FAT CLAY (CH), light brownish gray (10YR 6/2), moist, ~70% fines, ~20% sand, ~10% gravel, high plasticity, no dilatancy, high toughness, high dry strength, soft	2" PVC casing
8					LEAN CLAY (CL), red (10R 5/6), dry, ~85% fines, ~15% sand, medium plasticity, no dilatancy, mottled with gray, medium toughness, medium dry strength, firm	
9						
10						
11						
12						
13						
14						
15						

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					SANDY LEAN CLAY (CL), reddish brown (5YR 4/3), ~60% fines, ~30% sand, ~10% gravel, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm	No backfill
17				0	FAT CLAY with SAND (CH), brown (10YR 5/3), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	Bentonite seal
18					SANDY LEAN CLAY (CL), reddish brown (2.5YR 5/3), moist, ~60% fines, ~40% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm	
19					POORLY GRADED SAND with SILT (SP-SM), reddish yellow (5YR 6/6), moist, ~90% sand, ~10% fines	2" PVC casing
20					SILTY SAND (SM), very pale brown (10YR 7/3), moist, ~80% sand, ~20% fines	
21					POORLY GRADED SAND with SILT (SP-SM), brownish yellow (10YR 6/6), moist, ~90% sand, ~10% fines	
22					Groundwater encountered at 22' bgs, soft	
23						
24					LEAN CLAY (CL), red (10R 5/6), dry, ~85% fines, ~15% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, soft	Filter pack
25				0	POORLY GRADED SAND with SILT (SP-SM), brownish yellow (10YR 6/6), moist, ~90% sand, ~10% fines	2" PVC Screen, 0.010" factory slot
26					Very pale brown (10YR 7/4), wet, ~85% sand, ~10% fines, ~5% gravel	
27						
28						
29				0		
30					Boring terminated at 30' bgs to set temporary monitoring well MW03001.	Bottom of Screen with End Cap
31						
32						
33						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW03002	
BORING LOCATION: N: 382898.65 E: 1956675.28 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1088.97 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/12/17	DATE FINISHED: 10/12/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 30.0	SCREEN INTERVAL (ft.): 19.71 - 29.71
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 22	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318



WELL 10

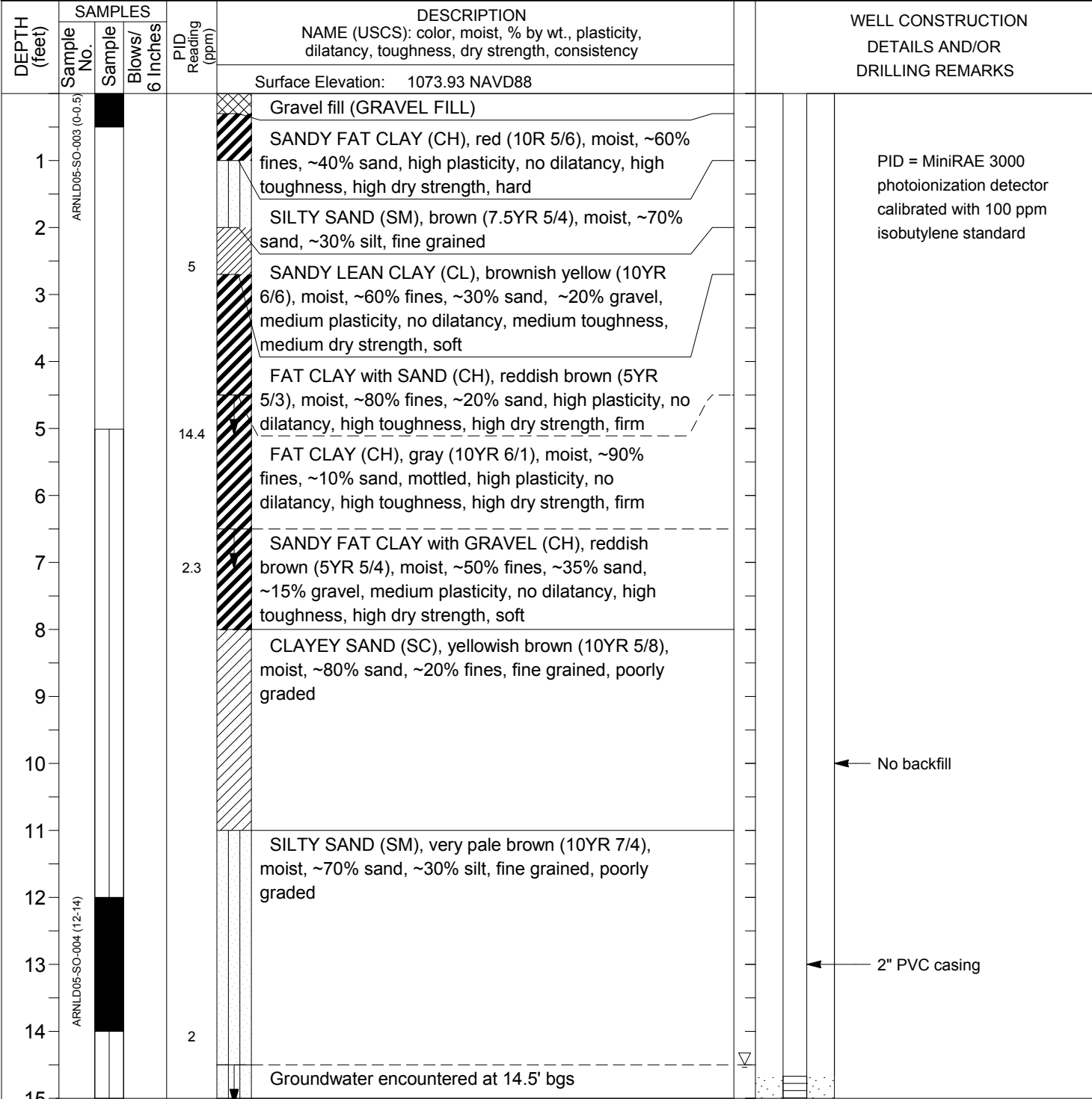
DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
0					SANDY LEAN CLAY with GRAVEL (CL): continued	
16					LEAN CLAY (CL), red (10R 4/6), dry, ~85% fines, ~15% sand, low plasticity, no dilatancy, medium toughness, medium dry strength, hard	
17				0	Sandy silt seam at 16.5' bgs, ~1" thick	Bentonite seal
18					SILTY SAND (SM), light red (2.5YR 6/6), dry, ~70% sand, ~30% fines	
19				0	SANDY SILT (ML), reddish yellow (7.5YR 6/8), moist, ~65% fines, ~35% sand, nonplastic, no dilatancy, low toughness, no dry strength, soft	Filter pack
20						Top of Screen
21					POORLY GRADED SAND with SILT (SP-SM), pale brown (2.5Y 5/2), moist, ~80% sand, ~15% fines, ~5% gravel	
22				0	SILTY SAND (SM), light red (2.5YR 6/6), moist, ~70% sand, ~30% fines	
23					Groundwater encountered at 22' bgs	
24					POORLY GRADED SAND with SILT (SP-SM), light gray (2.5Y 7/2), wet, ~80% sand, ~10% fines, ~10% gravel	
25						2" PVC Screen, 0.010" factory slot
26					SANDY LEAN CLAY (CL), brown (7.5YR 5/4), wet, ~60% fines, ~40% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, soft	
27				0	SANDY SILT (ML), pale brown (10YR 6/3), wet, ~60% fines, ~40% sand, nonplastic, no dilatancy	
28					LEAN CLAY with GRAVEL (CL), light red (10R 6/6), wet, ~75% fines, ~15% gravel, ~10% sand, low plasticity, no dilatancy, medium toughness, medium dry strength, firm	
29					SANDY SILT (ML), yellowish brown (10YR 5/6), wet, ~70% fines, ~30% sand, low plasticity, no dilatancy, low toughness, low dry strength, firm	
30					At 29': Pale brown (10YR 6/3), wet, ~80% fines, ~20% sand, nonplastic, no dilatancy	Bottom of Screen with End Cap
31					Boring terminated at 30' bgs to set temporary monitoring well MW03002.	
32						
33						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW05001	
BORING LOCATION: N: 381054.84 E: 1951782.53 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1078.86 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/19/17	DATE FINISHED: 10/19/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 26.0	SCREEN INTERVAL (ft.): 14.69 - 24.70
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 16	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/6 Inches			
					Surface Elevation: 1078.86 NAVD88	
1	ARNLD05-SO-001 (1-1.5)	█		0.6	Gravel Fill (GRAVEL FILL)	PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard ← No backfill ← 2" PVC casing ← Top of Screen
2					SILTY SAND (SM), dark yellowish brown (10YR 4/4), moist, ~70% sand, ~30% fines, medium grained	
3					SANDY SILT (ML), dark grayish brown (10YR 4/2), moist, ~70% fines, ~20% gravel, nonplastic, no dilatancy, low toughness, low dry strength, soft	
4					FAT CLAY with SAND (CH), brown (10YR 5/3), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
5				0.2	FAT CLAY (CH), gray (10YR 6/1), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
6						
7						
8						
9						
10					CLAYEY SAND (SC), light gray (10YR 7/1), moist, ~70% sand, ~20% clay, ~10% silt, fine grained, poorly graded	
11					SANDY LEAN CLAY (CL), pale brown (10YR 6/3), moist, ~60% fines, ~40% sand, mottled, medium plasticity, no dilatancy, medium toughness, medium dry strength, soft	
12	ARNLD05-SO-002 (12-14)	█				
13						
14				2	FAT CLAY with SAND (CH), gray (10YR 6/1), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
15						

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16				3.4	SANDY LEAN CLAY with GRAVEL (CH), pale brown (10YR 6/3), moist, ~50% fines, ~30% sand, ~20% gravel, high plasticity, no dilatancy, high toughness, high dry strength, soft	<p>2" PVC prepack screen/filter 0.010 factory slot</p> <p>Bottom of Well with End Cap</p>
17					Groundwater encountered at 16' bgs	
18					SANDY SILT (ML), gray (10YR 6/1), wet, ~60% fines, ~30% sand, ~10% gravel, low plasticity, slow dilatancy, low toughness, low dry strength, soft	
19						
20						
21					SANDY FAT CLAY with GRAVEL (CH), very pale brown (10YR 7/3), wet, ~60% fines, ~25% sand, ~15% gravel, high plasticity, slow dilatancy, high toughness, high dry strength, soft	
22						
23						
24						
25						
26					Boring terminated at 26' bgs to set temporary monitoring well MW05001.	
27						
28						
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32						
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PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW05002	
BORING LOCATION: N: 380830.97 E: 1951771.41 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1073.93 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/19/17	DATE FINISHED: 10/19/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 26.0	SCREEN INTERVAL (ft.): 14.67 - 24.67
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 14.5	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318



WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					FAT CLAY (CH), brownish yellow (10YR 6/8), wet, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, soft	<p>2" PVC prepack screen/filter 0.010 factory slot</p> <p>Bottom of Screen with End Cap</p>
17					SILTY SAND (SM), red (10R 5/6), wet, ~70% sand, ~20% silt, ~10% clay, fine grained, poorly graded, slow dilatancy	
18				2.4	At 16': Brownish yellow (10YR 6/8), wet, ~70% sand, ~20% silt, ~10% clay, fine grained, poorly graded	
19					WELL GRADED SAND with GRAVEL (SW), red (10R 5/8), wet, ~60% sand, ~35% gravel, ~5% fine clay, coarse sand, slow dilatancy	
20					LEAN CLAY with SAND (CL), reddish yellow (7.5YR 6/8), wet, ~80% fines, ~20% sand, medium plasticity, slow dilatancy, medium toughness, medium dry strength, soft	
21						
22					GRAVELLY FAT CLAY (CH), red (10R 5/8), wet, ~60% fines, ~30% gravel, ~10% sand, coarse gravel with few cobbles, high plasticity, no dilatancy, high toughness, high dry strength, firm	
23						
24						
25						
26					Boring terminated at 26' bgs to set temporary monitoring well MW05002.	
27						
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PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW05003	
BORING LOCATION: N: 380961.74 E: 1951968.61 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1074.75 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/19/17	DATE FINISHED: 10/19/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 26.0	SCREEN INTERVAL (ft.): 14.90 - 24.90
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 16	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
					Surface Elevation: 1074.75 NAVD88	
0.2					Topsoil (TOPSOIL), black, organics	
1					SANDY SILT (ML), pale brown (10YR 6/3), dry, ~60% fines, ~40% sand, nonplastic, no dilatancy, low toughness, low dry strength, very stiff	PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard No soil samples collected from this boring ← No backfill ← 2" PVC casing
2					SANDY LEAN CLAY (CL), yellowish red (5YR 5/8), moist, ~60% fines, ~40% sand, low plasticity, no dilatancy, medium toughness, medium dry strength, soft	
3						
4						
5				0.4	FAT CLAY with SAND (CH), yellowish brown (10YR 5/6), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, soft	
6						
7					FAT CLAY (CH), light gray (10YR 7/2), moist, ~90% fines, ~10% sand, mottled brown with red, high plasticity, no dilatancy, high toughness, high dry strength, firm	
8						
9						
10				1.3	Gray (10YR 6/1)	
11						
12					CLAYEY SAND (SC), light yellowish brown (10YR 6/4), moist, ~70% sand, ~30% fines, fine grained, poorly sorted	
13						
14					SILTY SAND (SM), very pale brown (10YR 7/3), moist, ~70% sand, ~20% fine silt, ~10% fine clay, fine grained, poorly graded, few gravel	
15						

WELL10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					SILTY SAND (SM): continued	<p>Filter Pack</p> <p>2" PVC prepack screen/filter 0.010 factory slot</p> <p>Bottom of Screen with End Cap</p>
17			1		SANDY SILT (ML), brownish yellow (10YR 6/6), wet, ~60% fines, ~40% sand, nonplastic, slow dilatancy, low toughness, low dry strength, soft	
18						
19					LEAN CLAY with SAND (CL), brownish yellow (10YR 6/6), wet, ~80% fines, ~20% sand, medium plasticity, slow dilatancy, medium toughness, medium dry strength, soft	
20						
21					SANDY FAT CLAY with GRAVEL (CH), red (10R 5/6), wet, ~50% fines, ~30% sand, ~20% gravel, high plasticity, slow dilatancy, high toughness, high dry strength, soft	
22						
23						
24						
25						
26					Boring terminated at 26' bgs to set temporary monitoring well MW05003.	
27						
28						
29						
30						
31						
32						
33						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW07001	
BORING LOCATION: N: 388192.58 E: 1945505.09 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1057.01 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/18/17	DATE FINISHED: 10/18/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 29.0	SCREEN INTERVAL (ft.): 19.21 - 29.22
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 21	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/6 Inches			
					Surface Elevation: 1057.01 NAVD88	
0-1	ARNLD07-SO-001 (0-1)				Topsoil (TOPSOIL), black, with organics	
1-2					WELL GRADED SAND with CLAY (SW-SC), reddish yellow (7.5YR 6/6), moist, ~80% sand, ~10% fines, ~10% gravel, medium grained	
2-3				0	SANDY FAT CLAY (CH), gray (10YR 6/1), moist, ~60% fines, ~35% sand, ~5% gravel, high plasticity, no dilatancy, high toughness, high dry strength, soft	
3-4						
4-5				0.1	FAT CLAY (CH), gray (10YR 6/1), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
5-6					FAT CLAY with SAND (CH), red (10R 4/6), moist, ~80% fines, ~20% sand, mottled, high plasticity, no dilatancy, high toughness, high dry strength, firm	
6-7				0.1		
7-8					Imbedded cobble sized Chert	
8-9						
9-10						No backfill
10-11						
11-12				0.2	FAT CLAY with GRAVEL (CH), reddish brown (5YR 5/4), moist, ~60% fines, ~25% gravel, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength	
12-13						2" PVC casing
13-14						
14-15					SANDY LEAN CLAY with GRAVEL (CL), brownish yellow (10YR 6/6), ~65% fines, ~30% sand, ~15%	

WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS				
	Sample No.	Sample	Blows/ 6 Inches							
16	ARNLD07-SO-002 (15-17)	[Redacted]	[Redacted]	0.2	gravel, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm	No backfill				
17									2" PVC casing	
18										
19									FAT CLAY with SAND (CHS), light brownish gray (10YR 6/2), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	Top of Screen
20									SANDY LEAN CLAY with GRAVEL (CL), brownish yellow (10YR 6/6), ~65% fines, ~30% sand, ~15% gravel, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm	
21										
22								0	SANDY FAT CLAY (CH), light gray (10YR 7/2), wet, ~60% fines, ~40% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
23										2" PVC prepack screen/filter 0.010 factory slot
24									CLAYEY SAND (SC), brownish yellow (10YR 6/6), wet, ~70% sand, ~30% fines, fine grained	
25									SANDY FAT CLAY with GRAVEL (CH), yellowish brown (10YR 5/8), wet, ~55% fines, ~30% sand, ~15% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
26										
27										
28					FAT CLAY (CH), yellowish red (5YR 5/6), wet, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, soft					
29					Boring terminated at 29 ft bgs to set temporary monitoring well MW07001.	Bottom of Screen with End Cap				
30										
31										
32										
33										

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW07002	
BORING LOCATION: N: 388128.06 E: 1945640.6 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1059.04 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/18/17	DATE FINISHED: 10/18/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 30.0	SCREEN INTERVAL (ft.): 19.96 - 29.98
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 21	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/6 Inches			
					Surface Elevation: 1059.04 NAVD88	
0	ARNLD07-SO-003 (0-1)				Gravel (GRAVEL FILL), Large gravel	
0.5					Topsoil (TOPSOIL), black	
1					SANDY SILT (ML), brown (10YR 5/3), dry, ~70% fines, ~30% sand, low plasticity, low toughness, low dry strength, soft	PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard ← 2" PVC casing ← No backfill
2					SANDY FAT CLAY (CH), brownish yellow (10YR 6/6), moist, ~60% fines, ~40% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
3				0.1		
4					Wet at 4 ft bgs	
5				0		
6					FAT CLAY (CH), brown (7.5YR 5/4), moist, ~90% fines, ~10% sand, mottled, high plasticity, no dilatancy, high toughness, high dry strength, firm	
7				1.2		
8						
9					Gray (10YR 6/1), cobble size pieces of chert intermittent	
10						
12				0.1		
13					LEAN CLAY with SAND (CL), brownish yellow (10YR 6/8), moist, ~80% fines, ~20% sand, mottled with cobble pieces of chert, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm	
14						
15						

WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					SANDY FAT CLAY (CH), brownish yellow (10YR 6/6), moist, ~70% fines, ~30% sand, high plasticity, no dilatancy, high toughness, high dry strength, soft	
17	ARNLD07-SO-004 (17-19)				GRAVELLY FAT CLAY with SAND (CH), brownish yellow (10YR 6/8), moist, ~50% fines, ~75% gravel, ~15% sand, coarse gravel with some cobbles, high plasticity, no dilatancy, high toughness, high dry strength, firm	
18						
19				0		
20						Top of Screen
21					CLAYEY SAND with GRAVEL (SC), light brownish gray (10YR 6/2), wet, ~60% sand, ~20% fines, ~20% gravel, medium grained	
22				0.3		
23					SANDY LEAN CLAY with GRAVEL (CL), yellowish brown (10YR 5/8), wet, medium plasticity, slow dilatancy, medium toughness, medium dry strength, firm	
24						2" PVC prepack screen/filter 0.010 factory slot
25						
26						
27						
28						
29						
30					CLAYEY SAND with GRAVEL (SC), light brownish gray (10YR 6/2), wet, ~60% sand, ~20% fines, ~20% gravel, medium grained	Bottom of Screen with End Cap
31					SANDY LEAN CLAY with GRAVEL (SC), yellowish brown (10YR 5/8), wet, medium plasticity, slow dilatancy, medium toughness, medium dry strength, firm	
32					Boring terminated at 30 ft bgs to set temporary monitoring well MW07002	
33						

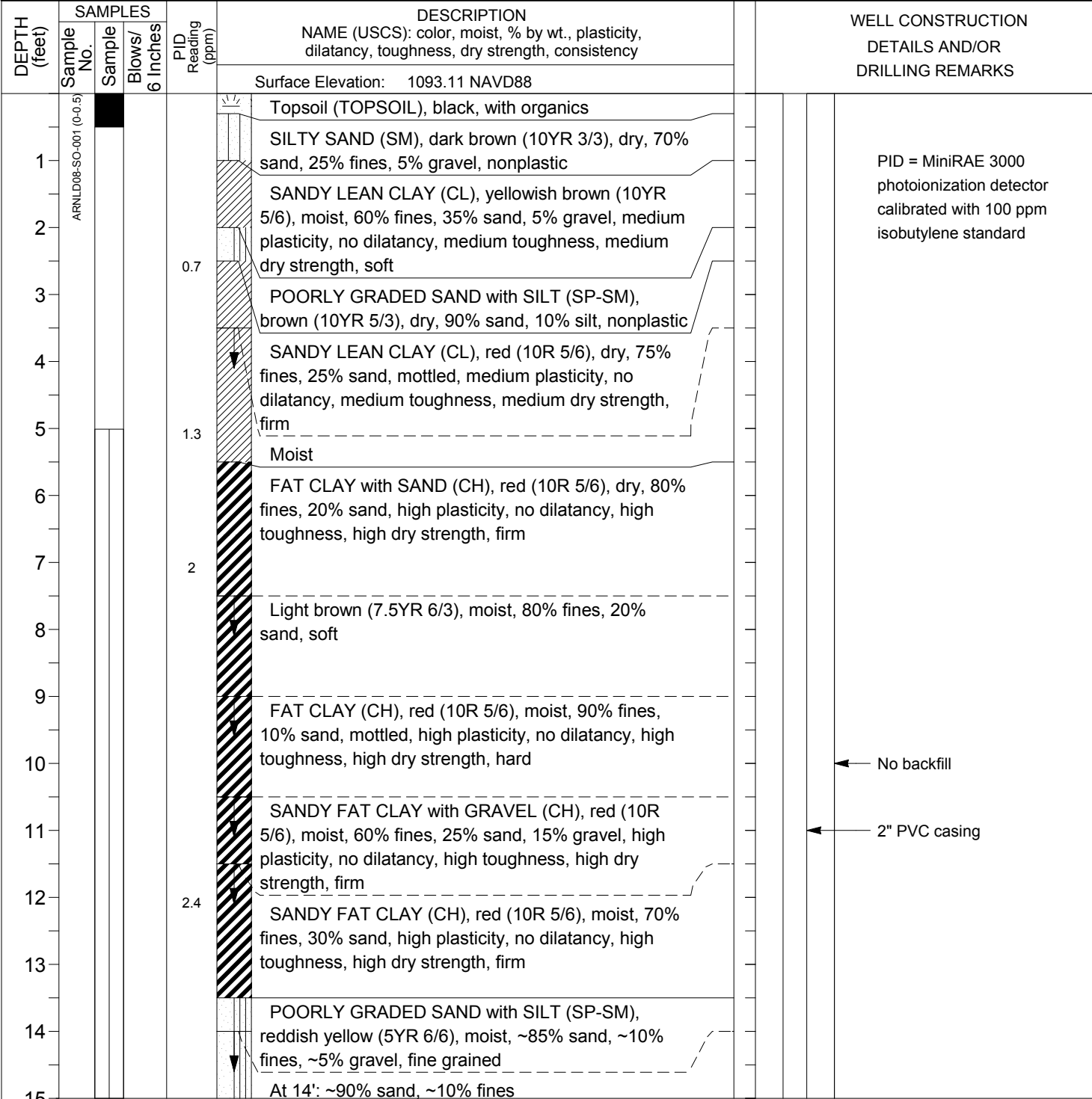
PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW07003	
BORING LOCATION: N: 388082.2 E: 1945489.32 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1060.40 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/18/17	DATE FINISHED: 10/18/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 30.0	SCREEN INTERVAL (ft.): 19.83 - 29.83
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 20.5	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/6 Inches			
					Surface Elevation: 1060.40 NAVD88	
0-1	ARNLD07-SO-005 (0-1)				Topsoil (TOPSOIL), black, organics	
1					Gravel fill (GRAVEL FILL)	
1-2					SANDY FAT CLAY (CH), yellowish red (5YR 4/6), dry, ~60% fines, ~30% sand, ~10% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard ← No backfill ← 2" PVC casing
2-3			0.1	LEAN CLAY with SAND (CL), strong brown (7.5YR 5/8), moist, ~80% fines, ~15% sand, ~5% gravel, medium plasticity, no dilatancy, medium toughness, medium dry strength, firm		
3-4				SANDY SILT with GRAVEL (ML), brown (7.5YR 5/3), moist, ~60% fines, ~30% sand, ~10% gravel, nonplastic, low toughness, low dry strength, firm		
4-5			0.2	ELASTIC SILT (MH), gray (10YR 5/1), dry, ~80% fines, ~20% sand, low plasticity, no dilatancy, medium toughness, medium dry strength, firm		
5-6				SANDY SILT (ML), yellowish brown (10YR 5/6), dry, ~70% fines, ~30% sand, low plasticity, no dilatancy, low toughness, low dry strength, firm		
6-7				SANDY FAT CLAY (CH), red (10R 5/6), dry, ~60% fines, ~40% sand, high plasticity, no dilatancy, high toughness, high dry strength, hard		
7-8			0.4	FAT CLAY with SAND (CH), light red (2.5YR 6/8), moist, ~80% fine, ~20% sand, mottled, high plasticity, no dilatancy, high toughness, high dry strength, firm		
8-9						
9-10						
10-11						
11-12						
12-13						
13-14						
14-15						

WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					FAT CLAY with SAND (CH): continued	No Backfill
17						2" PVC casing
18	ARNLD07-SO-006 (17-19)				WELL GRADED SAND with GRAVEL (SW), yellowish brown (10YR 5/6), ~60% sand, ~25% gravel, ~5% fines, medium grained, cobbles	
19				0.2	SANDY FAT CLAY with GRAVEL (CH), reddish yellow (5YR 6/6), moist, ~55% fines, ~30% sand, ~15% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
20					Chert, dark gray (19-0.3 ft)	Top of Screen
21					FAT CLAY with SAND (CH), gray (10YR 6/1), moist, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
22					WELL GRADED GRAVEL (GW), gray (10YR 6/1), wet, ~90% gravel, ~10% sand, coarse gravel with some cobbles	
23					Wet at 20.5 ft bgs. ~2 ft of return from 19-30 ft bgs.	
24						2" PVC prepack screen/filter 0.010 factory slot
25						
26						
27						
28						
29						
30					Boring terminated at 30 ft to set temporary well MW07003.	Bottom of Screen with End Cap
31						
32						
33						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW08001	
BORING LOCATION: N: 383268.84 E: 1947664.6 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1093.11 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/19/17	DATE FINISHED: 10/19/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 50.0	SCREEN INTERVAL (ft.): 38.91 - 48.91
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 22	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

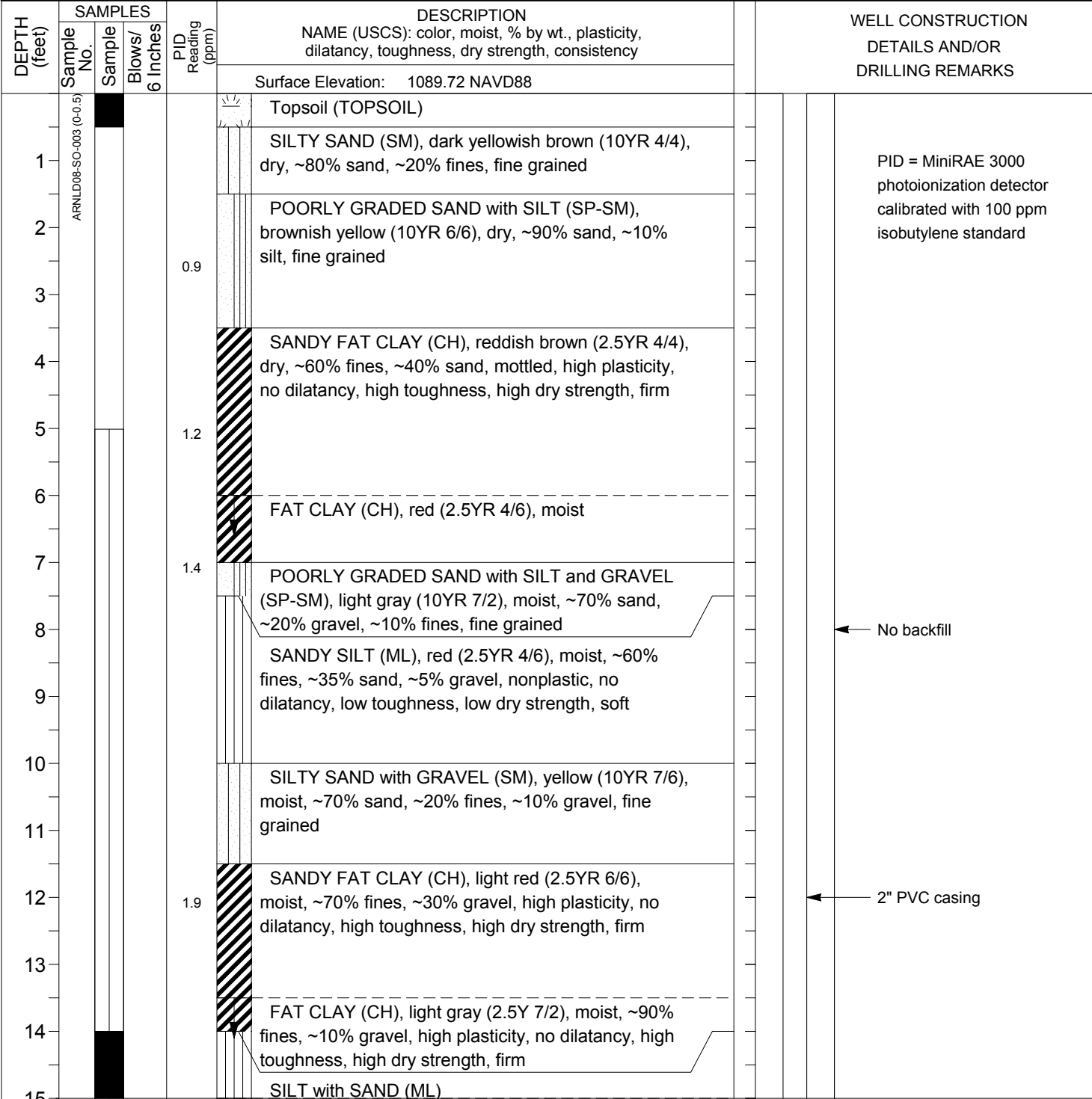


WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16	ARNLD08-SO-002 (17-19)	[REDACTED]	[REDACTED]		POORLY GRADED SAND with SILT (SP-SM): continued	
17					Weathered Sandstone (SANDSTONE), very pale brown (10YR 7/3)	
18					LEAN CLAY with SAND (CL), brownish yellow (10YR 6/6), moist, ~80% fines, ~20% sand, high plasticity, no dilatancy, high toughness, high dry strength	
19				3.2	SANDY SILT (ML), brownish yellow (10YR 6/6), moist, ~60% fines, ~40% sand, nonplastic, no dilatancy, low toughness, low dry strength, soft	
20					SILTY SAND (SM), reddish yellow (5YR 6/8), moist, ~70% sand, ~25% fines, ~5% gravel, fine sand, no dilatancy	
21					SILTY SAND with GRAVEL (SM), yellow (10YR 7/6), moist, ~70% sand, ~15% gravel, ~15% fines, fine grained, no dilatancy	
22				7.4		
23					SANDY FAT CLAY (CH), yellowish red (5YR 4/6), wet, ~60% fines, ~30% sand, ~10% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	← No backfill
24						
25						← 2" PVC casing
26					SILTY SAND with GRAVEL (SM), yellow (10YR 7/6), moist, ~70% sand, ~15% gravel, ~15% fines, fine grained, no dilatancy	
27				2.9		
28					GRAVELLY FAT CLAY (CH), reddish brown (2.5YR 4/3), wet, ~60% fines, ~30% gravel, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
29		Chert, gray				
30		GRAVELLY FAT CLAY (CH), reddish brown (2.5YR 4/3), wet, ~60% fines, ~30% gravel, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm				
31		Only 30% return from 30-40 ft bgs				
32						
33		Weathered Sandstone (SANDSTONE)				

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
34					GRAVELLY FAT CLAY (CH), reddish brown (2.5YR 4/3), wet, ~60% fines, ~30% gravel, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	<p>No backfill</p> <p>Top of Screen</p>
35						
36						
37					SANDY SILT (ML), yellowish brown (10YR 5/4), wet, ~60% fines, ~30% sand, ~10% gravel, low plasticity, slow dilatancy, low toughness, low dry strength, soft	<p>2" PVC prepack screen/filter 0.010 factory slot</p>
38						
39						
40					GRAVELLY FAT CLAY (CH), reddish brown (2.5YR 4/3), wet, ~60% fines, ~30% gravel, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	<p>Bottom of Screen with End Cap</p>
41						
42						
43					Boring terminated at 50 ft bgs to set temporary monitoring well MW08001	
44						
45						
46						
47						
48						
49						
50						
51						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW08002	
BORING LOCATION: N: 383087.97 E: 1947674.43 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1089.72 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/17/17	DATE FINISHED: 10/17/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 27.0	SCREEN INTERVAL (ft.): 17.32 - 27.33
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 19	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318



DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16	ARNLD08-SO-004 (14-16)	[Redacted]	[Redacted]	0.9	SILT with SAND (ML), olive brown (2.5Y 4/4), moist, ~80% fines, ~20% sand, low plasticity, no dilatancy, low toughness, low dry strength, soft	No backfill
17					SANDY LEAN CLAY with GRAVEL (CL), reddish yellow (7.5YR 6/6), moist, ~60% fines, ~20% sand, ~15% gravel, low plasticity, no dilatancy, low toughness, low dry strength, soft	2" PVC casing
18					FAT CLAY with SAND (CH), red (2.5YR 4/6), moist, ~85% fines, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	Top of Screen
19					SILTY SAND with GRAVEL (SM), reddish yellow (5YR 6/8), wet, ~60% sand, ~30% gravel, ~10% fines, medium grained, rapid dilatancy	
20					LEAN CLAY with SAND (CL), yellow (10YR 7/8), wet, ~80% fines, ~20% sand, medium plasticity, slow dilatancy, medium toughness, medium dry strength, soft	
21					SILTY SAND with GRAVEL (SM), reddish yellow (5YR 6/8), wet, ~60% sand, ~30% gravel, ~10% fines, medium grained, rapid dilatancy	
22					LEAN CLAY with SAND (CL), yellow (10YR 7/8), wet, ~80% fines, ~20% sand, medium plasticity, slow dilatancy, medium toughness, medium dry strength, soft	2" PVC prepack screen/filter 0.010 factory slot
23					SILTY SAND with GRAVEL (SM), reddish yellow (5YR 6/8), wet, ~60% sand, ~30% gravel, ~10% fines, medium grained, rapid dilatancy	
24					LEAN CLAY with SAND (CL), yellow (10YR 7/8), wet, ~80% fines, ~20% sand, medium plasticity, slow dilatancy, medium toughness, medium dry strength, soft	
25					SILTY SAND with GRAVEL (SM), reddish yellow (5YR 6/8), wet, ~60% sand, ~30% gravel, ~10% fines, medium grained, rapid dilatancy	
26	GRAVELLY FAT CLAY with SAND (CH), light red (2.5YR 6/6), wet, ~60% fines, ~25% gravel, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm					
27	Boring terminated at 27 ft bgs to set temporary monitoring well MW08002		Bottom of Screen with End Cap			
28						
29						
30						
31						
32						
33						

PROJECT: PFAS Release Area Site Inspection Arnold Air Force Base		Log of Well No. MW08003	
BORING LOCATION: N: 383143.04 E: 1947545.45 TN State Plane		GROUND SURFACE ELEVATION AND DATUM: 1092.87 NAVD88	
DRILLING CONTRACTOR: SAEDACCO Drilling		DATE STARTED: 10/17/17	DATE FINISHED: 10/19/17
DRILLING METHOD: Sonic Rig		TOTAL DEPTH (ft.): 50.0	SCREEN INTERVAL (ft.): 40.20 - 50.22
DRILLING EQUIPMENT: Geoprobe 8140LS		DEPTH TO WATER ATD: 20.5	CASING: 2" dia., Sch. 40 PVC
SAMPLING METHOD: MacroCores		LOGGED BY: N. Garland	
HAMMER WEIGHT: NA	DROP: NA	RESPONSIBLE PROFESSIONAL: J. Deatherage	REG. NO. 103318

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
					Surface Elevation: 1092.87 NAVD88	
1					Topsoil (TOPSOIL), black, some organic	PID = MiniRAE 3000 photoionization detector calibrated with 100 ppm isobutylene standard ← No backfill ← 2" PVC casing
2					SILTY SAND (SM), dark yellowish brown (10YR 4/4), dry, ~80% sand, 20% fines, fine grained	
3			0.3		POORLY GRADED SAND with SILT (SP-SM), brownish yellow (10YR 6/6), dry, ~90% sand, ~10% silt, fine grained	
4					SANDY FAT CLAY (CH), reddish brown (2.5YR 4/4), dry, ~60% fines, ~35% sand, ~5% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
5			0.9			
6					SANDY FAT CLAY with GRAVEL (CH), yellowish red (5YR 5/6), moist, ~55% fines, ~30% sand, ~15% gravel, high plasticity, no dilatancy, high toughness	
7			6.6			
8					SILTY SAND with GRAVEL (SM), reddish brown (2.5YR 5/4), moist, ~60% sand, ~25% fines, ~15% gravel, fine grained	
9					CLAYEY SAND (SC), light gray (10YR 7/2), moist, ~70% sand, ~20% fine clay, ~10% fine silt, fine grained, poorly sorted	
10					SILTY SAND (SM), reddish yellow (7.5YR 6/6), moist, ~80% sand, ~20% fines, fine grained, poorly sorted	
11					LEAN CLAY with SAND (CL), strong brown (7.5YR 5/6), moist, ~80% fines, ~20% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, soft	
12			1.8			
13					CLAYEY SAND (SC), brownish yellow (10YR 6/6), moist, ~80% sand, ~20% fines, fine grained	
14					POORLY GRADED SAND with SILT and GRAVEL (SP-SM), light red (2.5YR 6/6), ~60% sand, ~30% gravel, ~10% fines	
15					SANDSTONE (SANDSTONE), weathered	

WELL 10

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
16					SANDY LEAN CLAY (CL), reddish yellow (7.5YR 6/6), slightly moist, ~70% fines, ~30% sand, medium plasticity, no dilatancy, medium toughness, medium dry strength, soft	
17				2.6	SANDY SILT (ML), brownish yellow (10YR 6/8), moist, ~60% fines, ~40% sand, fine grained	
18					LEAN CLAY with SAND (CL), yellow (10YR 7/6), moist, ~80% fines, ~15% sand, ~5% gravel, medium plasticity, no dilatancy, medium toughness, medium dry strength, soft	
19					CLAYEY SAND with GRAVEL (SC), light red (2.5YR 6/6), moist, ~60% sand, ~25% fines, ~15% gravel, medium grained	
20					At 18.5': Reddish yellow (7.5YR 6/6)	
21					SILT with SAND (ML), brownish yellow (10YR 6/8), wet, ~80% fines, ~20% sand, low plasticity, slow dilatancy, low toughness, low dry strength, soft	
22				2.7	SANDY FAT CLAY with GRAVEL (CH), red (2.5YR 5/6), wet, ~60% fines, ~25% sand, ~15% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
23					FAT CLAY (CH), yellow (10YR 7/6), wet, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
24					GRAVELLY FAT CLAY with SAND (CH), light red (2.5YR 6/6), wet, ~60% fines, ~25% gravel, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
25						← No backfill
26						
27				2.1		
28						
29						
30						← 2" PVC casing
31						
32						
33					WELL GRADED GRAVEL with SAND (GWS), reddish brown (5YR 5/4), wet, ~60% gravel, ~35% sand, ~5% fines, coarse grained	

DEPTH (feet)	SAMPLES			PID Reading (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plasticity, dilatancy, toughness, dry strength, consistency	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ 6 Inches			
34					GRAVELLY FAT CLAY with SAND (CH), light red (2.5YR 6/6), wet, ~60% fines, ~25% gravel, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	No backfill
35					CLAYEY SAND with GRAVEL (SC), reddish yellow (5YR 6/6), wet, ~60% sand, ~20% fines, ~20% gravel, medium grained coarse gravel	
36					FAT CLAY (CH), gray (10YR 6/1), wet, ~90% fines, ~10% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
37					GRAVELLY FAT CLAY with SAND (CH), light red (2.5YR 6/6), wet, ~60% fines, ~25% gravel, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	2" PVC casing
38					GRAVELLY FAT CLAY with SAND (CH), light red (2.5YR 6/6), wet, ~60% fines, ~25% gravel, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
39						
40						
41					WELL GRADED SAND with GRAVEL (SW), light gray (10YR 7/1), wet, ~60% sand, ~35% gravel, ~5% fines, fine grained	Top of Screen
42					SANDY SILT (ML), brownish yellow (10YR 6/6), wet, ~60% fines, ~30% sand, ~10% gravel, low plasticity, slow dilatancy, low toughness, low dry strength, soft	
43					CLAYEY SAND with GRAVEL (SC), very pale brown (10YR 7/4), wet, ~60% sand, ~25% fines, ~15% gravel, fine grained, slow dilatancy	
44					CLAYEY SAND with GRAVEL (SC), very pale brown (10YR 7/4), wet, ~60% sand, ~25% fines, ~15% gravel, fine grained, slow dilatancy	
45					FAT CLAY (CH), gray (10YR 6/1), wet, ~85% fines, ~10% sand, ~5% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	2" PVC prepack screen/filter 0.010 factory slot
46					FAT CLAY (CH), gray (10YR 6/1), wet, ~85% fines, ~10% sand, ~5% gravel, high plasticity, no dilatancy, high toughness, high dry strength, firm	
47					GRAVELLY FAT CLAY with SAND (CH), light red (2.5YR 6/6), wet, ~60% fines, ~25% gravel, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
48					GRAVELLY FAT CLAY with SAND (CH), light red (2.5YR 6/6), wet, ~60% fines, ~25% gravel, ~15% sand, high plasticity, no dilatancy, high toughness, high dry strength, firm	
49						
50					Boring terminate at 50 ft bgs to set temporary monitoring well MW 08003	Bottom of Screen with End Cap
51						

APPENDIX B-5

SCREENED WELL CONSTRUCTION FORMS

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SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
 Release Areas Environmental Programs Worldwide,
 Contract FA8903-16-D-0027 Task Order 0004

Project: _____ Installation: Arnold
 Location ID: MW01001 Well ID: MW01001
 Drilling Subcontractor: SAEDACCO Installation Date: 10/13/2017
 Drilling Personnel: Stefan Smith Project Number: 775303101.0004
 Amec Foster Wheeler Field Representative(s): Noel Garland, Jason Hayes, Joe Deatherage

Measurement Point (riser)
 Elevation (ft msl): 1087.82
 Land Surface Elevation (ft): NA
 Approximate Diameter
 of Borehole (in): 6
 Depth to Water (ft):
 During Drilling: 22
 Date: 10/13/2017
 Post Development: 21.03
 Date: 10/15/2017

Hydro Unit: Unknown Unsaturated Zone
 Aquifer Water Table Aquifer
 Bedrock Aquifer Confining Layer/Aquiclude
 Perched Aquifer Lower/Confined Aquifer

Water added during
 drilling (gal): NA
 Water removed during
 development (gal): NA

Top of Bentonite Seal (ft): 15.7 →
 Top of Filter Pack (ft): 18.1 →
 Top of Screen Interval (ft): 20.18 →
 Bottom of Screened Interval (ft): 30.2 →
 Bottom of Filter Pack (ft): 30.39 →
 Bottom of Borehole (ft): 30.39 →

Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).



Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: PDS
 Type: Chips **Pellets** Slurry
 Installation: 6-in lifts **One Section**
 Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: Southern Products of Silica Co
 Product Name: Filter media
 Size: GP#2
 Installation Type: **Gravity** Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continuous **Factory slot**

Sump/End Cap: NA



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
 Release Areas Environmental Programs Worldwide,
 Contract FA8903-16-D-0027 Task Order 0004

Project: _____ Installation: Arnold
 Location ID: MW02001 Well ID: MW02001
 Drilling Subcontractor: SAEDACCO Installation Date: 10/14/2017
 Drilling Personnel: Stefan Smith/ John Eisenman Project Number: 775303101.0004
 Amec Foster Wheeler Field Representative(s): Noel Garland

Measurement Point (riser)
 Elevation (ft msl): 1086.67
 Land Surface Elevation (ft): NA
 Approximate Diameter
 of Borehole (in): 6
 Depth to Water (ft):
 During Drilling: 17
 Date: 10/14/2017
 Post Development: 16.43
 Date: 10/16/2017

Hydro Unit: Unknown Unsaturated Zone
 Aquifer Water Table Aquifer
 Bedrock Aquifer Confining Layer/Aquiclude
 Perched Aquifer Lower/Confined Aquifer

Water added during
 drilling (gal): NA
 Water removed during
 development (gal): NA

Top of Bentonite Seal (ft): 10.8 →
 Top of Filter Pack (ft): 12.9 →
 Top of Screen Interval (ft): 15.03 →
 Bottom of Screened Interval (ft): 25.03 →
 Bottom of Filter Pack (ft): 25.36 →
 Bottom of Borehole (ft): 27 →

Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).



Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: PDS
 Type: Chips Pellets Slurry
 Installation: 6-in lifts One Section
 Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: Southern Products of Silica Co
 Product Name: Filter media
 Size: GP#2
 Installation Type: **Gravity** Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continous **Factory slot**

Sump/End Cap: 0.33



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
Release Areas Environmental Programs Worldwide,
Contract FA8903-16-D-0027 Task Order 0004

Project: _____ Installation: Arnold

Location ID: MW02003 Well ID: MW02003

Drilling Subcontractor: SAEDACCO Installation Date: 10/16/2017

Drilling Personnel: John Eisenman Project Number: 775303101.0004

Amec Foster Wheeler Field Representative(s): Noel Garland

Measurement Point (riser)
Elevation (ft msl): 1090.86

Land Surface Elevation (ft): NA

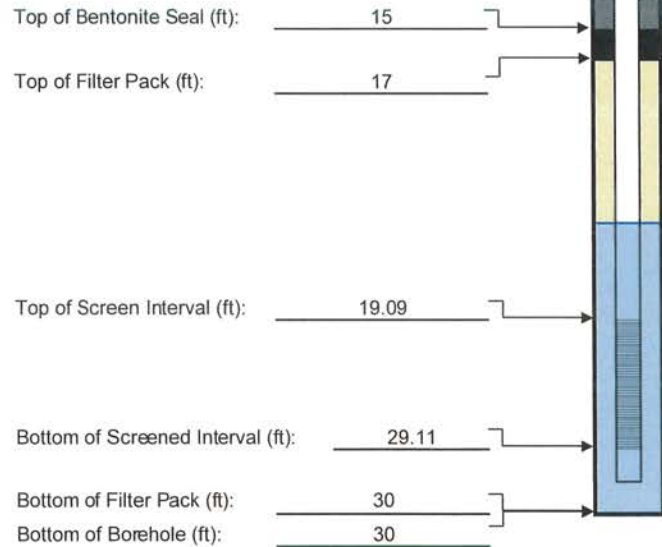
Approximate Diameter of Borehole (in): 6

Depth to Water (ft):
During Drilling: 18.5
Date: 10/16/2017
Post Development: 25.46
Date: 10/18/2017

Hydro Unit: Unknown Unsaturated Zone
Aquifer Water Table Aquifer
Bedrock Aquifer Confining Layer/Aquiclude
Perched Aquifer Lower/Confined Aquifer

Water added during drilling (gal): NA

Water removed during development (gal): NA



Depths and heights are referenced to ground surface unless specified TOC.
All elevations are referenced to MSL (NAVD 88).

Protective Casing:
Type: NA
Dimensions (in): NA
Stickup (ft): NA
Length (ft): NA
Guard Post: NA

Surface Pad:
Dimensions: NA
Type: NA

Annular Seal:
Type: NA
Installation: Gravity Tremie Pumped

Bentonite Seal:
Manufacturer: PDS
Type: Chips **Pellets** Slurry
Installation: 6-in lifts **One Section**
Gravity Tremie Pumped
Hydration time (hrs): _____

Filter Pack Material:
Manufacturer: Southern Products of Silica Co
Product Name: Filter media
Size: GP#2
Installation Type: **Gravity** Tremie
Surging time: None

Well Casing (riser):
Manufacturer: Silver Line Enviro Pure
Type/Material: PVC
Diameter (in): 2

Well Screen:
Manufacturer: Silver Line Enviro Pure
Type/Material: PVC
Diameter (in): 2
Slot Size (in): 0.010
Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.18



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
 Release Areas Environmental Programs Worldwide,
 Contract FA8903-16-D-0027 Task Order 0004

Project: _____	Installation: <u>Arnold</u>
Location ID: <u>MW03001</u>	Well ID: <u>MW03001</u>
Drilling Subcontractor: <u>SAEDACCO</u>	Installation Date: <u>10/17/2017</u>
Drilling Personnel: <u>John Eisenman</u>	Project Number: <u>775303101.0004</u>
Amec Foster Wheeler Field Representative(s): _____	<u>Noel Garland</u>

Measurement Point (riser)
 Elevation (ft msl): 1089.12

Land Surface Elevation (ft): NA

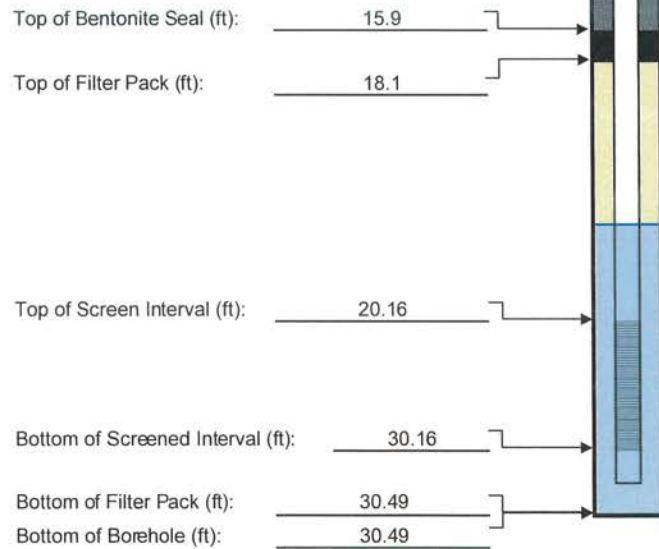
Approximate Diameter
 of Borehole (in): 6

Depth to Water (ft):
 During Drilling: 22
 Date: 10/17/2017
 Post Development: 22
 Date: 10/18/2017

Hydro Unit:	Unknown	Unsaturated Zone
	Aquifer	Water Table Aquifer
	Bedrock Aquifer	Confining Layer/Aquiclude
	Perched Aquifer	Lower/Confined Aquifer

Water added during
 drilling (gal): NA

Water removed during
 development (gal): NA



Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).

Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: PDS
 Type: Chips **Pellets** Slurry
 Installation: 6-in lifts **One Section**
Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: Southern Products of Silica Co
 Product Name: Filter media
 Size: GP#2
 Installation Type: **Gravity** Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.33



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
Release Areas Environmental Programs Worldwide,
Contract FA8903-16-D-0027 Task Order 0004

Project: _____ Installation: Arnold
 Location ID: MW03002 Well ID: MW03002
 Drilling Subcontractor: SAEDACCO Installation Date: 10/12/2017
 Drilling Personnel: Stefan Smith Project Number: 775303101.0004
 Amec Foster Wheeler Field Representative(s): Noel Garland, Jason Hayes, Joe Deatherage

Measurement Point (riser)
 Elevation (ft msl): 1089.26
 Land Surface Elevation (ft): NA
 Approximate Diameter of Borehole (in): 6
 Depth to Water (ft):
 During Drilling: 22
 Date: 10/12/2017
 Post Development: 22.57
 Date: 10/15/2017

Hydro Unit: Unknown Unsaturated Zone
 Aquifer Water Table Aquifer
 Bedrock Aquifer Confining Layer/Aquiclude
 Perched Aquifer Lower/Confined Aquifer

Water added during drilling (gal): NA
 Water removed during development (gal): NA

Top of Bentonite Seal (ft): 15 →
 Top of Filter Pack (ft): 18 →
 Top of Screen Interval (ft): 19.71 →
 Bottom of Screened Interval (ft): 29.71 →
 Bottom of Filter Pack (ft): 30.06 →
 Bottom of Borehole (ft): 30.06 →

Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).



Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: PDS
 Type: Chips **Pellets** Slurry
 Installation: 6-in lifts **One Section**
 Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: Southern Products of Silica Co
 Product Name: Filter media
 Size: GP#2
 Installation Type: **Gravity** Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.35



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
Release Areas Environmental Programs Worldwide,
Contract FA8903-16-D-0027 Task Order 0004

Project: _____ Installation: Arnold
 Location ID: MW05001 Well ID: MW05001
 Drilling Subcontractor: SAEDACCO Installation Date: 10/19/2017
 Drilling Personnel: John Eisenman Project Number: 775303101.0004
 Amec Foster Wheeler Field Representative(s): Noel Garland

Measurement Point (riser)
 Elevation (ft msl): 1078.83
 Land Surface Elevation (ft): NA
 Approximate Diameter
 of Borehole (in): 6
 Depth to Water (ft):
 During Drilling: 16
 Date: 10/19/2017
 Post Development: 7.86
 Date: 10/20/2017

Hydro Unit: Unknown Unsaturated Zone
 Aquifer Water Table Aquifer
 Bedrock Aquifer Confining Layer/Aquiclude
 Perched Aquifer Lower/Confined Aquifer

Water added during
 drilling (gal): NA
 Water removed during
 development (gal): NA

Top of Bentonite Seal (ft): NA
 Top of Filter Pack (ft): NA

Top of Screen Interval (ft): 14.69
 Bottom of Screened Interval (ft): 24.7
 Bottom of Filter Pack (ft): 25
 Bottom of Borehole (ft): 25

Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).



Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: NA
 Type: Chips Pellets Slurry
 Installation: 6-in lifts **One Section**
 Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: NA
 Product Name: NA
 Size: NA
 Installation Type: Gravity Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC Prepack
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.18



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
Release Areas Environmental Programs Worldwide,
Contract FA8903-16-D-0027 Task Order 0004

Project: _____ Installation: Arnold

Location ID: MW05002 Well ID: MW05002

Drilling Subcontractor: SAEDACCO Installation Date: 10/19/2017

Drilling Personnel: John Eisenman Project Number: 775303101.0004

Amec Foster Wheeler Field Representative(s): Noel Garland

Measurement Point (riser)
Elevation (ft msl): 1074.3

Land Surface Elevation (ft): NA

Approximate Diameter
of Borehole (in): 4

Depth to Water (ft):
During Drilling: 14.5
Date: 10/19/2017
Post Development: 8.65
Date: 10/20/2017

Hydro Unit: Unknown Unsaturated Zone
Aquifer Water Table Aquifer
Bedrock Aquifer Confining Layer/Aquiclude
Perched Aquifer Lower/Confined Aquifer

Water added during
drilling (gal): NA

Water removed during
development (gal): NA

Top of Bentonite Seal (ft): NA

Top of Filter Pack (ft): NA

Top of Screen Interval (ft): 14.67

Bottom of Screened Interval (ft): 24.67

Bottom of Filter Pack (ft): 25

Bottom of Borehole (ft): 25

Depths and heights are referenced to ground surface unless specified TOC.
All elevations are referenced to MSL (NAVD 88).



Protective Casing:
Type: NA
Dimensions (in): NA
Stickup (ft): NA
Length (ft): NA
Guard Post: NA

Surface Pad:
Dimensions: NA
Type: NA

Annular Seal:
Type: NA
Installation: Gravity Tremie Pumped

Bentonite Seal:
Manufacturer: NA
Type: Chips Pellets Slurry
Installation: 6-in lifts **One Section**
Gravity Tremie Pumped
Hydration time (hrs): _____

Filter Pack Material:
Manufacturer: NA
Product Name: NA
Size: NA
Installation Type: Gravity Tremie
Surging time: None

Well Casing (riser):
Manufacturer: Silver Line Enviro Pure
Type/Material: PVC
Diameter (in): 2

Well Screen:
Manufacturer: Silver Line Enviro Pure
Type/Material: PVC Prepack
Diameter (in): 2
Slot Size (in): 0.010
Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.19



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
 Release Areas Environmental Programs Worldwide,
 Contract FA8903-16-D-0027 Task Order 0004

Project: _____	Installation: <u>Arnold</u>
Location ID: <u>MW05003</u>	Well ID: <u>MW05003</u>
Drilling Subcontractor: <u>SAEDACCO</u>	Installation Date: <u>10/19/2017</u>
Drilling Personnel: <u>John Eisenman</u>	Project Number: <u>775303101.0004</u>
Amec Foster Wheeler Field Representative(s): _____	<u>Noel Garland</u>

Measurement Point (riser)
 Elevation (ft msl): 1074.9

Land Surface Elevation (ft): NA

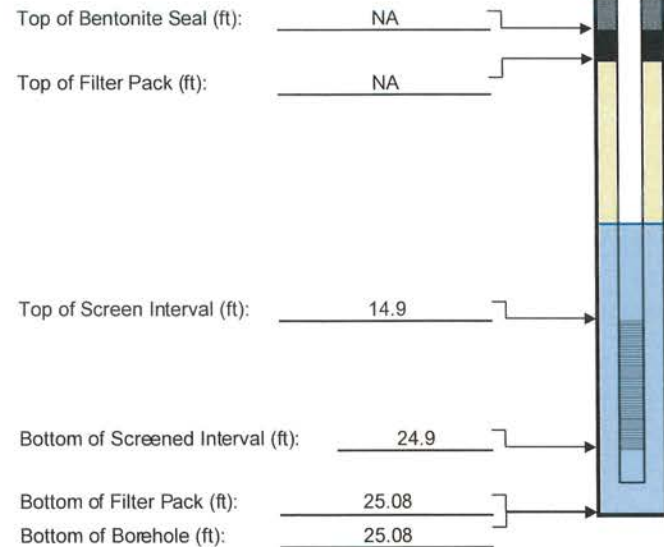
Approximate Diameter of Borehole (in): 4

Depth to Water (ft):
 During Drilling: 16
 Date: 10/19/2017
 Post Development: 7.81
 Date: 10/20/2017

Hydro Unit:	Unknown	Unsaturated Zone
	Aquifer	Water Table Aquifer
	Bedrock Aquifer	Confining Layer/Aquiclude
	Perched Aquifer	Lower/Confined Aquifer

Water added during drilling (gal): NA

Water removed during development (gal): NA



Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).

Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: NA
 Type: Chips Pellets Slurry
 Installation: 6-in lifts **One Section**
 Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: NA
 Product Name: NA
 Size: NA
 Installation Type: Gravity Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC Prepack
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.18



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
Release Areas Environmental Programs Worldwide,
Contract FA8903-16-D-0027 Task Order 0004

Project: _____ Installation: Arnold
 Location ID: MW07001 Well ID: MW07001
 Drilling Subcontractor: SAEDACCO Installation Date: 10/18/2017
 Drilling Personnel: John Eisenman Project Number: 775303101.0004
 Amec Foster Wheeler Field Representative(s): Noel Garland

Measurement Point (riser)
 Elevation (ft msl): 1057.9
 Land Surface Elevation (ft): NA
 Approximate Diameter
 of Borehole (in): 4
 Depth to Water (ft):
 During Drilling: 21
 Date: 10/18/2017
 Post Development: 12.72
 Date: 10/19/2017

Hydro Unit: Unknown Unsaturated Zone
 Aquifer Water Table Aquifer
 Bedrock Aquifer Confining Layer/Aquiclude
 Perched Aquifer Lower/Confined Aquifer

Water added during
 drilling (gal): NA
 Water removed during
 development (gal): NA

Top of Bentonite Seal (ft): NA

Top of Filter Pack (ft): NA

Top of Screen Interval (ft): 19.21

Bottom of Screened Interval (ft): 29.22

Bottom of Filter Pack (ft): 29.4

Bottom of Borehole (ft): 29.4

Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).



Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: NA
 Type: Chips Pellets Slurry
 Installation: 6-in lifts **One Section**
 Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: NA
 Product Name: NA
 Size: NA
 Installation Type: Gravity Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC Prepack
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.18



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
Release Areas Environmental Programs Worldwide,
Contract FA8903-16-D-0027 Task Order 0004

Project: _____	Installation: <u>Arnold</u>
Location ID: <u>MW07002</u>	Well ID: <u>MW07002</u>
Drilling Subcontractor: <u>SAEDACCO</u>	Installation Date: <u>10/18/2017</u>
Drilling Personnel: <u>John Eisenman</u>	Project Number: <u>775303101.0004</u>
Amec Foster Wheeler Field Representative(s): _____	<u>Noel Garland</u>

Measurement Point (riser)
Elevation (ft msl): 1059.14

Land Surface Elevation (ft): NA

Approximate Diameter of Borehole (in): 4

Depth to Water (ft):
During Drilling: 21
Date: 10/18/2017
Post Development: 4.92
Date: 10/20/2017

Hydro Unit:	Unknown	Unsaturated Zone
	Aquifer	Water Table Aquifer
	Bedrock Aquifer	Confining Layer/Aquiclude
	Perched Aquifer	Lower/Confined Aquifer

Water added during drilling (gal): NA

Water removed during development (gal): NA

Top of Bentonite Seal (ft): NA

Top of Filter Pack (ft): NA

Top of Screen Interval (ft): 19.96

Bottom of Screened Interval (ft): 29.98

Bottom of Filter Pack (ft): 30.16

Bottom of Borehole (ft): 30.16

Depths and heights are referenced to ground surface unless specified TOC.
All elevations are referenced to MSL (NAVD 88).



Protective Casing:
Type: NA
Dimensions (in): NA
Stickup (ft): NA
Length (ft): NA
Guard Post: NA

Surface Pad:
Dimensions: NA
Type: NA

Annular Seal:
Type: NA
Installation: Gravity Tremie Pumped

Bentonite Seal:
Manufacturer: NA
Type: Chips Pellets Slurry
Installation: 6-in lifts **One Section**
Gravity Tremie Pumped
Hydration time (hrs): _____

Filter Pack Material:
Manufacturer: NA
Product Name: NA
Size: NA
Installation Type: Gravity Tremie
Surging time: None

Well Casing (riser):
Manufacturer: Silver Line Enviro Pure
Type/Material: PVC
Diameter (in): 2

Well Screen:
Manufacturer: Silver Line Enviro Pure
Type/Material: PVC Prepack
Diameter (in): 2
Slot Size (in): 0.010
Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.18



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
Release Areas Environmental Programs Worldwide,
Contract FA8903-16-D-0027 Task Order 0004

Project: _____ Installation: Arnold
 Location ID: MW07003 Well ID: MW07003
 Drilling Subcontractor: SAEDACCO Installation Date: 10/18/2017
 Drilling Personnel: John Eisenman Project Number: 775303101.0004
 Amec Foster Wheeler Field Representative(s): Noel Garland

Measurement Point (riser)
 Elevation (ft msl): 1060.45
 Land Surface Elevation (ft): NA
 Approximate Diameter
 of Borehole (in): 4
 Depth to Water (ft):
 During Drilling: 20.5
 Date: 10/18/2017
 Post Development: 8.66
 Date: 10/19/2017

Hydro Unit: Unknown Unsaturated Zone
 Aquifer Water Table Aquifer
 Bedrock Aquifer Confining Layer/Aquiclude
 Perched Aquifer Lower/Confined Aquifer

Water added during
 drilling (gal): NA
 Water removed during
 development (gal): NA

Top of Bentonite Seal (ft): NA

Top of Filter Pack (ft): NA

Top of Screen Interval (ft): 19.83

Bottom of Screened Interval (ft): 29.83

Bottom of Filter Pack (ft): 30.02

Bottom of Borehole (ft): 30.02

Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).



Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: NA
 Type: Chips Pellets Slurry
 Installation: 6-in lifts **One Section**
 Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: NA
 Product Name: NA
 Size: NA
 Installation Type: Gravity Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC Prepack
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.19



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
 Release Areas Environmental Programs Worldwide,
 Contract FA8903-16-D-0027 Task Order 0004

Project: _____	Installation: <u>Arnold</u>
Location ID: <u>MW08001</u>	Well ID: <u>MW08001</u>
Drilling Subcontractor: <u>SAEDACCO</u>	Installation Date: <u>10/19/2017</u>
Drilling Personnel: <u>John Eisenman</u>	Project Number: <u>775303101.0004</u>
Amec Foster Wheeler Field Representative(s): _____	<u>Noel Garland</u>

Measurement Point (riser)
 Elevation (ft msl): 1094.36

Land Surface Elevation (ft): NA

Approximate Diameter
 of Borehole (in): 4

Depth to Water (ft):
 During Drilling: 22
 Date: 10/17/2017
 Post Development: Dry
 Date: 11/14/2017

Hydro Unit:	Unknown	Unsaturated Zone
	Aquifer	Water Table Aquifer
	Bedrock Aquifer	Confining Layer/Aquiclude
	Perched Aquifer	Lower/Confined Aquifer

Water added during
 drilling (gal): NA

Water removed during
 development (gal): NA

Top of Bentonite Seal (ft): NA

Top of Filter Pack (ft): NA

Top of Screen Interval (ft): 38.91

Bottom of Screened Interval (ft): 48.91

Bottom of Filter Pack (ft): 49.25

Bottom of Borehole (ft): 50

Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).



Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: NA
 Type: Chips Pellets Slurry
 Installation: 6-in lifts **One Section**
 Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: NA
 Product Name: NA
 Size: NA
 Installation Type: Gravity Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC Prepack
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.34



SCREENED WELL CONSTRUCTION FORM

Site Inspection of Aqueous Film Forming Foam (AFFF)
 Release Areas Environmental Programs Worldwide,
 Contract FA8903-16-D-0027 Task Order 0004

Project: _____ Installation: Arnold
 Location ID: MW08003 Well ID: MW08003
 Drilling Subcontractor: SAEDACCO Installation Date: 10/19/2017
 Drilling Personnel: John Eisenman Project Number: 775303101.0004
 Amec Foster Wheeler Field Representative(s): Noel Garland

Measurement Point (riser)
 Elevation (ft msl): 1092.79
 Land Surface Elevation (ft): NA
 Approximate Diameter
 of Borehole (in): 4
 Depth to Water (ft):
 During Drilling: 20.5
 Date: 10/17/2017
 Post Development: Dry
 Date: 11/14/2017

Hydro Unit: Unknown Unsaturated Zone
 Aquifer Water Table Aquifer
 Bedrock Aquifer Confining Layer/Aquiclude
 Perched Aquifer Lower/Confined Aquifer

Water added during
 drilling (gal): NA
 Water removed during
 development (gal): NA

Top of Bentonite Seal (ft): NA
 Top of Filter Pack (ft): NA
 Top of Screen Interval (ft): 40.2
 Bottom of Screened Interval (ft): 50.22
 Bottom of Filter Pack (ft): 50.43
 Bottom of Borehole (ft): 50.43

Depths and heights are referenced to ground surface unless specified TOC.
 All elevations are referenced to MSL (NAVD 88).



Protective Casing:
 Type: NA
 Dimensions (in): NA
 Stickup (ft): NA
 Length (ft): NA
 Guard Post: NA

Surface Pad:
 Dimensions: NA
 Type: NA

Annular Seal:
 Type: NA
 Installation: Gravity Tremie Pumped

Bentonite Seal:
 Manufacturer: NA
 Type: Chips Pellets Slurry
 Installation: 6-in lifts **One Section**
 Gravity Tremie Pumped
 Hydration time (hrs): _____

Filter Pack Material:
 Manufacturer: NA
 Product Name: NA
 Size: NA
 Installation Type: Gravity Tremie
 Surging time: None

Well Casing (riser):
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC
 Diameter (in): 2

Well Screen:
 Manufacturer: Silver Line Enviro Pure
 Type/Material: PVC Prepack
 Diameter (in): 2
 Slot Size (in): 0.010
 Slot Type: Continuous **Factory slot**

Sump/End Cap: 0.21

APPENDIX B-6
WELL DEVELOPMENT LOGS

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WELL DEVELOPMENT LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date Started/Date Completed:	10/12/17 / 10/13/17
Well ID:	MW03002	Initial Depth to Water (ft):	14.49
Measuring Point:	Top of Riser	Total Depth of Well (ft):	30.17
Development Method:	Pumped	Depth to Water After Purging (ft):	Pumped well dry
Total Volume Purged (gal):	8.5	1 Casing Volume (gal):	2.6
Technician(s):	Jason Hayes and Noel Garland	3 Casing Volumes (gal):	7.7

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/12/17 17:07			2.5								Pumping Started
10/12/17 17:09	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/12/17 17:27	30	23.40	NR	NR	NR	NR	NR	NR	NR	2.5	Started pump again
10/12/17 17:28	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/12/17 17:39	30	24.32	NR	NR	NR	NR	NR	NR	NR	3.5	Started pump again
10/12/17 17:40	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/12/17 18:00	30	26.23	NR	NR	NR	NR	NR	NR	NR	4	Started pump again
10/12/17 18:00	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/12/17 18:15	30	27.2	NR	NR	NR	NR	NR	NR	NR	4.5	Started pump again
10/12/17 18:15	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/13/17 09:40	30	23.02	NR	NR	NR	NR	NR	NR	NR	5.5	Started pump after 12+ hrs
10/13/17 09:41	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/13/17 10:00	30	26.45	NR	NR	NR	NR	NR	NR	NR	6.5	Started pump again
10/13/17 10:00	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/13/17 10:10	30	26.51	NR	NR	NR	NR	NR	NR	NR	7.0	Started pump again
10/13/17 10:11	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/13/17 10:22	30	27.22	NR	NR	NR	NR	NR	NR	NR	7.5	Started pump again
10/13/17 10:22	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/13/17 10:38	30	27.18	NR	NR	NR	NR	NR	NR	NR	8.0	Started pump again
10/13/17 10:39	30	Dry	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/13/17 11:35	30	26.40	NR	NR	NR	NR	NR	NR	NR	8.5	Started pump again
10/13/17 11:36	30	Dry	NR	NR	NR	NR	NR	NR	NR	8.5	Pumped well dry

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes
Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

Calculations:
Saturated well casing volume: $V = \Pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$
 $V = \text{Volume (gal/ft)}$
 $\Pi = 3.14$
 $R = \text{well radius (ft)} = (\text{well diameter (in)/12 (in/ft)})/2$
 $H = \text{height of water column (ft)}$

$V = \Pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$
 $= \Pi \cdot (2.0 \text{ (in)/12 (in/ft)})^2 \cdot 2 \cdot 15.68 \cdot 7.48 \text{ gal/ft}^3$
 $= 2.6 \text{ gal.}$

Signature:

Notes:
Pumped well dry 10 times over a 2 day period. Groundwater was clearing up, minimal sediment was present in the flow.
Development was considered complete even with no water parameters taken.

Name (print):
Jason Hayes

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* **QA/QC Date:** 10/30/2017




WELL DEVELOPMENT LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date Started/Date Completed:	10/13/17 / 10/14/17
Well ID:	MW01001	Initial Depth to Water (ft):	15.56
Measuring Point:	Top of Riser	Total Depth of Well (ft):	30.17
Development Method:	Pumped	Depth to Water After Purging (ft):	Dry
Total Volume Purged (gal):	8.5	1 Casing Volume (gal):	2.4
Technician(s):	Jason Hayes and Noel Garland	3 Casing Volumes (gal):	7.2

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/13/17 17:41			2.5								Pumping Started
10/13/17 17:42	30	Dry	NR	NR	NR	NR	NR	NR	NR	2.5	Pumped well dry
10/13/17 17:51	30	22.54	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/13/17 17:52	30	Dry	NR	NR	NR	NR	NR	NR	NR	4.0	Pumped well dry
10/13/17 18:13	30	23.49	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/13/17 18:14	30	Dry	NR	NR	NR	NR	NR	NR	NR	5.0	Pumped well dry
10/13/17 18:29	30	24.51	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/13/17 18:30	30	Dry	NR	NR	NR	NR	NR	NR	NR	6.0	Pumped well dry
10/14/17 09:36	30	22.19	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/14/17 09:38	30	Dry	NR	NR	NR	NR	NR	NR	NR	7.0	Pumped well dry
10/14/17 09:56	30	24.55	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/14/17 09:56	30	Dry	NR	NR	NR	NR	NR	NR	NR	7.5	Pumped well dry
10/14/17 10:24	30	24.17	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/14/17 10:25	30	Dry	NR	NR	NR	NR	NR	NR	NR	8.0	Pumped well dry
10/14/17 10:46	30	24.58	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/14/17 10:46	30	Dry	NR	NR	NR	NR	NR	NR	NR	8.5	Pumped well dry

Instruments (Manufacturer, Model, and Serial No.):
Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes
Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
Hach 2100Q 11030C007945, YSI 556 MPS 14K100941

Calculations: Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$ V = Volume (gal/ft) $\pi = 3.14$ R = well radius (ft) = (well diameter (in)/12 (in/ft))/2 H = height of water column (ft) $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$ $= \pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 14.61 * 7.48 \text{ gal/ft}^3$ $= 2.4 \text{ gal.}$	Signature: 
Notes: Well was pumped dry 8 times. Groundwater was clearing up, minimal sediment was present in the flow. Development was considered complete even with no water parameters taken.	Name (print): Jason Hayes

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* QA/QC Date: 10/30/2017



WELL DEVELOPMENT LOG

Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide Project Number: 775303101.0004

Contract: FA8903-16-D-0027 Task Order: 0004

Installation: ARNLD - Arnold AFB Date Started/Date Completed: 10/17/17 / 10/17/17

Well ID: MW02002 Initial Depth to Water (ft): 15.08

Measuring Point: Top of Riser Total Depth of Well (ft): 30.34

Development Method: Pumped Depth to Water After Purging (ft): Dry

Total Volume Purged (gal): 33 1 Casing Volume (gal): 2.5

Technician(s): Jason Hayes and Noel Garland 3 Casing Volumes (gal): 7.5

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/17/17 09:39			Bailed first, then 2 gpm								Pumping Started
10/17/17 09:44	30	24.56	NR	NR	NR	NR	NR	NR	NR	3	Started pump
10/17/17 09:47	30	Dry	NR	NR	NR	NR	NR	NR	NR	8	Pumped well dry
10/17/17 10:04	30	23.34	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/17/17 10:04	30	Dry	NR	NR	NR	NR	NR	NR	NR	12	Pumped well dry
10/17/17 10:19	30	22.03	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/17/17 10:21	30	Dry	NR	NR	NR	NR	NR	NR	NR	17	Pumped well dry
10/17/17 10:30	30	23.17	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/17/17 10:32	30	Dry	NR	NR	NR	NR	NR	NR	NR	22	Pumped well dry
10/17/17 10:42	30	21.12	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/17/17 10:44	30	Dry	NR	NR	NR	NR	NR	NR	NR	26	Pumped well dry
10/17/17 10:54	30	22.25	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/17/17 10:56	30	Dry	NR	NR	NR	NR	NR	NR	NR	30	Pumped well dry
10/17/17 11:08	30	21.74	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/17/17 11:10	30	Dry	NR	NR	NR	NR	NR	NR	NR	33	Pumped well dry

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

Calculations:

Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$

V = Volume (gal/ft)
 $\pi = 3.14$
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2
H = height of water column (ft)

$V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$
 $= \pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 15.26 * 7.48 \text{ gal/ft}^3$
 $= 2.5 \text{ gal.}$

Signature:

Notes:

Pumped well dry 7 times. Groundwater was clearing up, minimal sediment was present in the flow. Development was considered complete even with no water parameters taken.

Name (print): Jason Hayes

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* QA/QC Date: 10/30/2017



WELL DEVELOPMENT LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date Started/Date Completed:	10/18/17 / 10/18/17
Well ID:	MW07001	Initial Depth to Water (ft):	0
Measuring Point:	Top of Riser	Total Depth of Well (ft):	30.17
Development Method:	PUMPED	Depth to Water After Purging (ft):	Dry
Total Volume Purged (gal):	33	1 Casing Volume (gal):	5.0
Technician(s):	Jason Hayes and Noel Garland	3 Casing Volumes (gal):	14.9

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/18/2017 17:12			Bailed first 3 gallons, 2.5 gpm pumping rate								Pumping Started
10/18/2017 17:18	Varied	14.45	NR	NR	NR	NR	NR	NR	NR	3.0	Started pump
10/18/2017 17:20	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	8.0	Pumped well dry
10/18/2017 17:24	Varied	20.71	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 17:25	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	10.5	Pumped well dry
10/18/2017 17:31	Varied	24.32	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 17:32	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	13.0	Pumped well dry
10/18/2017 17:45	Varied	26.04	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 17:46	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	15.5	Pumped well dry
10/18/2017 17:56	Varied	24.95	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 17:56	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	18.0	Pumped well dry
10/18/2017 18:08	Varied	24.52	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 18:08	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	20.5	Pumped well dry
10/18/2017 18:13	Varied	25.43	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 18:13	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	23.0	Pumped well dry
10/18/2017 18:23	Varied	26.75	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 18:24	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	25.5	Pumped well dry
10/18/2017 18:37	Varied	26.13	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 18:37	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	28.0	Pumped well dry
10/18/2017 18:43	Varied	27.00	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 18:43	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	30.5	Pumped well dry
10/18/2017 18:48	Varied	27.26	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/2017 18:49	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	33.0	Pumped well dry

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

<p>Calculations:</p> <p>Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$</p> <p>V = Volume (gal/ft) $\pi = 3.14$ R = well radius (ft) = (well diameter (in)/12 (in/ft))/2 H = height of water column (ft)</p> <p style="text-align: right; margin-right: 20px;"> $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$ $= \pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 30.37 * 7.48 \text{ gal/ft}^3$ $= 5.0 \text{ gal.}$ </p>	<p>Signature:</p>
<p>Notes:</p> <p style="text-align: center; font-size: small;">Water at top of riser (drilling fluid), pumped well dry 11 times. Groundwater was clearing up, minimal sediment was present in the flow. Development was considered complete even with no water parameters taken.</p>	<p>Name (print):</p> <p style="text-align: center;">Jason Hayes</p>

QA/QC'd by: Thomas W. Hensel **QA/QC Date:** 12/13/2017



WELL DEVELOPMENT LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date Started/Date Completed:	10/18/17 / 10/18/17
Well ID:	MW07003	Initial Depth to Water (ft):	0
Measuring Point:	Top of Riser	Total Depth of Well (ft):	30.37
Development Method:	PUMPED	Depth to Water After Purging (ft):	Dry
Total Volume Purged (gal):	15	1 Casing Volume (gal):	5.0
Technician(s):	Jason Hayes and Noel Garland	3 Casing Volumes (gal):	14.9

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/18/17 14:12			Bailed first 3 gallons, 2 gpm pumping rate								Pumping Started
10/18/17 14:18	Varied	14.45	NR	NR	NR	NR	NR	NR	NR	3	Started pump
10/18/17 14:20	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	5	Pumped well dry
10/18/17 14:34	Varied	20.71	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 14:35	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	6	Pumped well dry
10/18/17 14:51	Varied	24.32	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 14:52	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	7	Pumped well dry
10/18/17 15:01	Varied	26.04	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 15:02	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	8	Pumped well dry
10/18/17 15:16	Varied	24.95	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 15:16	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	9	Pumped well dry
10/18/17 15:38	Varied	24.52	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 15:38	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	10	Pumped well dry
10/18/17 15:53	Varied	25.43	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 15:53	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	11	Pumped well dry
10/18/17 16:03	Varied	26.75	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 16:04	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	12	Pumped well dry
10/18/17 16:17	Varied	26.13	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 16:17	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	13	Pumped well dry
10/18/17 16:33	Varied	27.00	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 16:33	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	14	Pumped well dry
10/18/17 16:48	Varied	27.26	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 16:49	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	15	Pumped well dry

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

Calculations:

Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$

V = Volume (gal/ft)
 π = 3.14
 R = well radius (ft) = (well diameter (in)/12 (in/ft))/2
 H = height of water column (ft)

$V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$
 $= \pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 30.37 * 7.48 \text{ gal/ft}^3$
 $= 5.0 \text{ gal.}$

Signature:

Notes:

Water at top of riser (drilling fluid), pumped well dry 11 times. Groundwater was clearing up, minimal sediment was present in the flow. Development was considered complete even with no water parameters taken.

Name (print):

Jason Hayes

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* **QA/QC Date:** 12/13/2017



WELL DEVELOPMENT LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date Started/Date Completed:	10/18/17 / 10/18/17
Well ID:	MW08003	Initial Depth to Water (ft):	26.61
Measuring Point:	Top of Riser	Total Depth of Well (ft):	30.37
Development Method:	PUMPED	Depth to Water After Purging (ft):	Dry
Total Volume Purged (gal):	2.5	1 Casing Volume (gal):	0.6
Technician(s):	Jason Hayes and Noel Garland	3 Casing Volumes (gal):	1.8

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/18/17 12:52			Bailed 1 gallon, 2 gpm pumping								Pumping Started
10/18/17 12:53	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	1	Pumped well dry
10/18/17 13:11	Varied	27.45	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 13:12	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	1.5	Pumped well dry
10/18/17 13:29	Varied	27.74	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 13:29	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	2	Pumped well dry
10/18/17 13:48	Varied	Below top of pump	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/18/17 13:48	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	2.5	Pumped well dry

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes
 Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
 Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

Calculations: Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$ $V = \text{Volume (gal/ft)}$ $\pi = 3.14$ $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$ $H = \text{height of water column (ft)}$	Signature:
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Notes: Pumped well dry 4 times. After last purge, well did not recover more than 1 feet in 30 min. Development was considered complete even with no water parameters taken.	Name (print): Jason Hayes
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QA/QC'd by: Thomas W. Hensel	QA/QC Date: 10/30/2017
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WELL DEVELOPMENT LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date Started/Date Completed:	10/19/17 / 10/19/17
Well ID:	MW05001	Initial Depth to Water (ft):	5.8
Measuring Point:	Top of Riser	Total Depth of Well (ft):	28.17
Development Method:	PUMPED	Depth to Water After Purging (ft):	Dry
Total Volume Purged (gal):	13	1 Casing Volume (gal):	3.7
Technician(s):	Jason Hayes and Noel Garland	3 Casing Volumes (gal):	11.0

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
10/19/17 16:53			Bailed 3 gallons, pumped 2 gpm flow rate									Pumping Started
10/19/17 17:00	Varied	7.45	NR	NR	NR	NR	NR	NR	NR	3	Started pump	
10/19/17 17:02	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	7	Pumped well dry	
10/19/17 17:11	Varied	8.45	NR	NR	NR	NR	NR	NR	NR		Started pump again	
10/19/17 17:12	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	9	Pumped well dry	
10/19/17 17:21	Varied	10.45	NR	NR	NR	NR	NR	NR	NR		Started pump again	
10/19/17 17:22	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	11	Pumped well dry	
10/19/17 17:30	Varied	14.42	NR	NR	NR	NR	NR	NR	NR		Started pump again	
10/19/17 17:31	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	13	Pumped well dry	

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes
 Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
 Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

Calculations:
Saturated well casing volume: $V = \Pi(R^2)H = 7.48 \text{ gal/ft}^3$
 V = Volume (gal/ft)
 $\Pi = 3.14$
 R = well radius (ft) = (well diameter (in)/12 (in/ft))/2
 H = height of water column (ft)

$$V = \Pi(R^2)H = 7.48 \text{ gal/ft}^3$$

$$= \Pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 22.37 * 7.48 \text{ gal/ft}^3$$

$$= 3.7 \text{ gal.}$$

Signature:

Notes:
 Pumped well dry 4 times. Groundwater was clearing up, minimal sediment was present in the flow. Development was considered complete even with no water parameters taken.

Name (print):
 Jason Hayes

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* **QA/QC Date:** 10/30/2017



WELL DEVELOPMENT LOG

Project Name: Site Inspection of AFFF Release Areas
Environmental Programs Worldwide
Project Number: 775303101.0004
Contract: FA8903-16-D-0027
Task Order: 0004
Installation: ARNLD - Arnold AFB
Date Started/Date Completed: 10/19/17 / 10/19/17
Well ID: MW05002
Initial Depth to Water (ft): 6.03
Measuring Point: Top of Riser
Total Depth of Well (ft): 25.0
Development Method: PUMPED
Depth to Water After Purging (ft): Dry
Total Volume Purged (gal): 11
1 Casing Volume (gal): 3.1
Technician(s): Jason Hayes and Noel Garland
3 Casing Volumes (gal): 9.3

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/19/17 14:10			Bailed first 3 gallons, then 2 gpm flow rate								Pumping Started
10/19/17 14:20	Varied	7.57	NR	NR	NR	NR	NR	NR	NR	3	Started pump
10/19/17 14:22	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	5	Pumped well dry
10/19/17 14:49	Varied	14.53	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/19/17 14:50	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	7	Pumped well dry
10/19/17 15:04	Varied	17.95	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/19/17 15:04	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	8	Pumped well dry
10/19/17 15:13	Varied	19.93	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/19/17 15:13	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	9	Pumped well dry
10/19/17 15:22	Varied	17.65	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/19/17 15:22	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	10	Pumped well dry
10/19/17 15:28	Varied	17.41	NR	NR	NR	NR	NR	NR	NR		Started pump again
10/19/17 15:28	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	11	Pumped well dry

Instruments (Manufacturer, Model, and Serial No.):
Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

Calculations:
Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$
 $V =$ Volume (gal/ft)
 $\pi = 3.14$
 $R =$ well radius (ft) = (well diameter (in)/12 (in/ft))/2
 $H =$ height of water column (ft)
$$V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$$
$$= \pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 18.97 * 7.48 \text{ gal/ft}^3$$
$$= 3.1 \text{ gal.}$$

Signature:

Notes: Pumped well dry 6 times. Groundwater was clearing up, minimal sediment was present in the flow.
Development was considered complete even with no water parameters taken.

Name (print):
Jason Hayes

QA/QC'd by: Thomas W. Hensel **QA/QC Date:** 10/30/2017



WELL DEVELOPMENT LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date Started/Date Completed:	10/19/17 / 10/19/17
Well ID:	MW05003	Initial Depth to Water (ft):	7.3
Measuring Point:	Top of Riser	Total Depth of Well (ft):	25.37
Development Method:	PUMPED	Depth to Water After Purging (ft):	Dry
Total Volume Purged (gal):	26	1 Casing Volume (gal):	3.0
Technician(s):	Jason Hayes and Noel Garland	3 Casing Volumes (gal):	8.9

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)	
10/19/17 15:30			Bailed 3 gallons, pumped 2 gpm flow rate									Pumping Started
10/19/17 15:44	Varied	8.76	NR	NR	NR	NR	NR	NR	NR	3	Started pump	
10/19/17 15:45	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	6	Pumped well dry	
10/19/17 16:05	Varied	9.45	NR	NR	NR	NR	NR	NR	NR		Started pump again	
10/19/17 16:10	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	16	Pumped well dry	
10/19/17 16:21	Varied	13.45	NR	NR	NR	NR	NR	NR	NR		Started pump again	
10/19/17 16:23	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	20	Pumped well dry	
10/19/17 16:30	Varied	12.34	NR	NR	NR	NR	NR	NR	NR		Started pump again	
10/19/17 16:31	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	22	Pumped well dry	
10/19/17 16:33	Varied	14.34	NR	NR	NR	NR	NR	NR	NR		Started pump again	
10/19/17 16:34	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	24	Pumped well dry	
10/19/17 16:45	Varied	13.98	NR	NR	NR	NR	NR	NR	NR		Started pump again	
10/19/17 16:46	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	26	Pumped well dry	

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

Calculations:

Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$

V = Volume (gal/ft)
 $\pi = 3.14$
 R = well radius (ft) = (well diameter (in)/12 (in/ft))/2
 H = height of water column (ft)

$V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$
 $= \pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 18.07 * 7.48 \text{ gal/ft}^3$
 $= 3.0 \text{ gal.}$

Signature:

Notes:

Pumped well dry 6 times. Groundwater was clearing up, minimal sediment was present in the flow. Development was considered complete even with no water parameters taken.

Name (print):

Jason Hayes

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* **QA/QC Date:** 10/30/2017



WELL DEVELOPMENT LOG

Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027	Task Order: 0004
Installation: ARNLD - Arnold AFB	Date Started/Date Completed: 10/19/17 / 10/19/17
Well ID: MW07002	Initial Depth to Water (ft): 4.03
Measuring Point: Top of Riser	Total Depth of Well (ft): 33.15
Development Method: PUMPED	Depth to Water After Purging (ft): Dry
Total Volume Purged (gal): 35	1 Casing Volume (gal): 4.8
Technician(s): Jason Hayes and Noel Garland	3 Casing Volumes (gal): 14.3

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
10/19/17 09:45			Bailed first 4 gallons, then 2 gpm pumping rate								
10/19/17 09:50	Varied	10.45	NR	NR	NR	NR	NR	NR	NR	4	Pumping Started
10/19/17 10:03	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	25	Started pump
10/19/17 10:16	Varied	27.46	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/19/17 10:16	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	27	Started pump again
10/19/17 10:25	Varied	26.33	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/19/17 10:25	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	29	Started pump again
10/19/17 10:35	Varied	25.76	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/19/17 10:35	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	31	Started pump again
10/19/17 10:47	Varied	26.03	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/19/17 10:47	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	33	Started pump again
10/19/17 10:55	Varied	27.67	NR	NR	NR	NR	NR	NR	NR		Pumped well dry
10/19/17 10:55	Varied	Dry	NR	NR	NR	NR	NR	NR	NR	35	Started pump again

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes
 Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
 Hach 2100Q 11030C007945, YSI Pro Plus 14K100941


Calculations:

Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$

V = Volume (gal/ft)
 π = 3.14
 R = well radius (ft) = (well diameter (in)/12 (in/ft))/2
 H = height of water column (ft)

$V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$
 $= \pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 29.12 * 7.48 \text{ gal/ft}^3$
 $= 4.8 \text{ gal.}$

Signature:



Notes:

Pumped well dry 6 times. Groundwater was clearing up, minimal sediment was present in the flow.
 Development was considered complete even with no water parameters taken.

Name (print):

Jason Hayes

QA/QC'd by: Thomas W. Hensel  **QA/QC Date:** 12/13/2017



WELL DEVELOPMENT LOG

Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027	Task Order: 0004
Installation: ARNLD - Arnold AFB	Date Started/Date Completed: 11/14/17 / 11/14/17
Well ID: MW08002	Initial Depth to Water (ft): 29.18
Measuring Point: Top of Riser	Total Depth of Well (ft): 30.39
Development Method: PUMPED	Depth to Water After Purging (ft): 30.39 (Dry)
Total Volume Purged (gal): 0.20	1 Casing Volume (gal): 0.2
Technician(s): Noel Garland, Miles Watkins	3 Casing Volumes (gal): 0.6

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
11/14/17 14:25			NA								Pumping Started
11/14/17 14:30	30	29.18	NA	20.12	6.47	0.186	5.70	58.9	>1000	0.10	Brown, high fines, purged dry

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter
 Hach 2100Q 09F100833, YSI 556 MPS 11090C012139

<p>Calculations:</p> <p>Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$</p> <p>$V$ = Volume (gal/ft) π = 3.14 R = well radius (ft) = (well diameter (in)/12 (in/ft))/2 H = height of water column (ft)</p> <div style="text-align: right; font-size: small;"> $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$ $= \pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 1.21 * 7.48 \text{ gal/ft}^3$ $= 0.2 \text{ gal.}$ </div>	<p>Signature:</p> <div style="text-align: center;"> </div>
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<p>Notes:</p> <p style="text-align: center; font-size: small; color: blue;">Well was bailed dry with stainless-steel bailer.</p>	<p>Name (print):</p> <p style="text-align: center;">Miles Watkins</p>
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QA/QC'd by: Thomas W. Hensel		QA/QC Date:	12/13/2017
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WELL DEVELOPMENT LOG

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date Started/Date Completed:	11/14/17 / 11/14/17
Well ID:	MW 232	Initial Depth to Water (ft):	64.02
Measuring Point:	Top of Riser	Total Depth of Well (ft):	79.81
Development Method:	PUMPED	Depth to Water After Purging (ft):	64.02
Total Volume Purged (gal):	33.5	1 Casing Volume (gal):	10.4
Technician(s):	Miles Watkins, Noel Garland	3 Casing Volumes (gal):	31.1

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (gpm)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Cum. Volume (gal.)	Comments/Observations During Purging (color, sediment, etc.)
11/14/17 15:18			0.20								Pumping Started
11/14/17 15:23	75.00	64.31	0.20	16.76	5.67	0.081	6.14	120.2	35.1	1.0	Clear
11/14/17 15:28	75.00	64.20	0.20	17.01	5.68	0.089	4.67	95.2	28.9	2.0	Clear
11/14/17 15:33	75.00	64.47	0.50	16.63	5.61	0.093	4.33	104.8	19.7	4.5	Clear
11/14/17 15:38	75.00	64.47	0.50	16.58	5.69	0.098	4.11	104.0	18.8	7.0	Clear
11/14/17 15:43	70.00	64.49	0.50	16.60	5.43	0.064	4.90	116.2	12.5	9.5	Clear
11/14/17 15:48	70.00	64.50	0.50	16.61	5.55	0.081	4.50	117.1	12.4	12.0	Clear
11/14/17 15:53	66.00	64.51	0.50	16.67	5.16	0.051	5.29	132.1	33.3	14.5	Clear
11/14/17 15:58	66.00	64.51	0.50	16.69	5.51	0.078	4.60	126.1	19.3	17.0	Clear
11/14/17 16:03	78.00	65.50	0.50	16.32	5.73	0.123	3.37	123.9	216	19.5	Cloudy
11/14/17 16:08	78.00	65.50	0.50	16.32	5.93	0.134	3.09	115.5	66.1	21.0	Cloudy
11/14/17 16:13	78.00	65.50	0.50	16.19	5.93	0.135	3.06	115.8	23.4	23.5	Clear
11/14/17 16:16	78.00	65.50	0.50	16.13	5.96	0.134	3.07	115.1	12.9	26.0	Clear
11/14/17 16:23	78.00	65.50	0.50	16.14	5.97	0.133	3.09	114.7	7.10	28.5	Clear
11/14/17 16:28	78.00	65.50	0.50	16.14	5.97	0.131	3.10	115.2	5.03	31.0	Clear
11/14/17 16:33	78.00	65.50	0.50	16.09	5.96	0.128	3.19	116.6	3.40	33.5	Clear

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes
 Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
 Hach 2100Q 09F100833, YSI 556 MPS 11090C012139

<p>Calculations:</p> <p>Saturated well casing volume: $V = \pi(R^2)H \times 7.48 \text{ gal/ft}^3$</p> <p>V = Volume (gal/ft) $\pi = 3.14$ R = well radius (ft) = (well diameter (in)/12 (in/ft))/2 H = height of water column (ft)</p> <p style="text-align: center;"> $V = \pi(R^2)H \times 7.48 \text{ gal/ft}^3$ $= \pi * (4.0 \text{ (in)/12 (in/ft)})^2 * 15.79 * 7.48 \text{ gal/ft}^3$ $= 10.4 \text{ gal.}$ </p>	<p>Signature:</p> <div style="text-align: center;">  Miles Watkins </div>
<p>Notes:</p> <p style="text-align: center;">None</p>	<p>Name (print):</p> <p style="text-align: center;">Miles Watkins</p>

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* **QA/QC Date:** 12/13/2017

APPENDIX B-7

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORMS

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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004	Date: 10/12/17
Installation: ARNLD - Arnold AFB	Calibration Start Time: 08:36
Sample Technician(s): Jason Hayes and Noel Garland	Calibration End Time: 09:30

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/12/17	08:36	NA	3.97	NA	0.966	NA	NA	109.7	NA	None
			7.06	NA						
				NA						
			10.16	NA						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/12/17	09:32	NA	4.00	9.91	1.001	10.14	NA	100.0	NA	None
			7.03	20.3						
				98.8						
			10.09	800						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/31/18	Spec. Conductance	7GH673	08/30/18	10	A6354	03/30/18
pH (7)	7GG600	07/31/19	Salinity	NA	10/12/17	20	A6354	03/30/18
pH (10)	6GG873	07/31/18	D.O.	NA	10/12/17	100	A6350	03/30/18
			ORP	7GH705	02/28/18	800	A7045	03/30/18

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;">Manufacturer/Model</th> <th style="width: 70%;">Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI Pro Plus</td> <td>14K100941</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>11030C007945</td> </tr> </table> Calibrated Within Acceptance Criteria (Y/N): Yes If No, Provide Explanation: NA	Manufacturer/Model	Serial No	Water Quality Meter: YSI Pro Plus	14K100941	Turbidity Meter: Hach 2100Q	11030C007945	Notes: None	Signature: Name (print): Jason Hayes
Manufacturer/Model	Serial No							
Water Quality Meter: YSI Pro Plus	14K100941							
Turbidity Meter: Hach 2100Q	11030C007945							

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 10/30/2017
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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004	Date: 10/13/2017
Installation: ARNLD - Arnold AFB	Calibration Start Time: 08:39
Sample Technician(s): Jason Hayes and Noel Garland	Calibration End Time: 09:16

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/13/2017	08:39	NA	3.92	NA	0.982	NA	NA	121.3	NA	None
			7.13	NA						
				NA						
			9.78	NA						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/13/2017	09:15	NA	4.00	10.2	1.000	8.73	NA	100.4	99.6	None
			7.00	19.8						
				101						
			9.98	800						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/31/18	Spec. Conductance	7GH673	08/30/18	10	A6354	03/30/18
pH (7)	7GG600	07/31/19	Salinity	NA	10/13/17	20	A6354	03/30/18
pH (10)	6GG873	07/31/18	D.O.	NA	10/13/17	100	A6350	03/30/18
			ORP	7GH705	02/28/18	800	A7045	03/30/18

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%;"> <tr> <th style="width: 30%;">Manufacturer/Model</th> <th style="width: 70%;">Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI 556 MPS</td> <td>15D100992</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>11030C007945</td> </tr> </table> Calibrated Within Acceptance Criteria (Y/N): Yes If No, Provide Explanation: NA	Manufacturer/Model	Serial No	Water Quality Meter: YSI 556 MPS	15D100992	Turbidity Meter: Hach 2100Q	11030C007945	Notes: None	Signature: Name (print): Jason Hayes
Manufacturer/Model	Serial No							
Water Quality Meter: YSI 556 MPS	15D100992							
Turbidity Meter: Hach 2100Q	11030C007945							

QA/QC'd by: Thomas W. Hensel	<i>Thomas W. Hensel</i>	QA/QC Date: 10/30/2017
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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004	Date: 10/15/17
Installation: ARNLD - Arnold AFB	Calibration Start Time: 08:24
Sample Technician(s): Jason Hayes and Noel Garland	Calibration End Time: 08:44

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/15/17	08:24	NA	4.02	NA	0.997	NA	NA	97.6	NA	None
			7.03	NA						
				NA						
			10.01	NA						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/15/17	08:44	NA	4.00	9.92	1.000	9.12	NA	100.1	NA	None
			7.03	19.9						
				100						
			10.04	799						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/31/18	Spec. Conductance	7GH673	08/30/18	10	A6354	03/30/18
pH (7)	7GG600	07/31/19	Salinity	NA	10/15/17	20	A6354	03/30/18
pH (10)	6GG873	07/31/18	D.O.	NA	10/15/17	100	A6350	03/30/18
			ORP	7GH705	02/28/18	800	A7045	03/30/18

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;">Manufacturer/Model</th> <th style="width: 70%;">Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI Pro Plus</td> <td>14K100941</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>11030C007945</td> </tr> <tr> <td>Calibrated Within Acceptance Criteria (Y/N):</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td>If No, Provide Explanation:</td> <td style="text-align: center;">NA</td> </tr> </table>	Manufacturer/Model	Serial No	Water Quality Meter: YSI Pro Plus	14K100941	Turbidity Meter: Hach 2100Q	11030C007945	Calibrated Within Acceptance Criteria (Y/N):	Yes	If No, Provide Explanation:	NA	Notes: <div style="text-align: center; padding: 10px;">None</div>	Signature: Name (print): Jason Hayes
Manufacturer/Model	Serial No											
Water Quality Meter: YSI Pro Plus	14K100941											
Turbidity Meter: Hach 2100Q	11030C007945											
Calibrated Within Acceptance Criteria (Y/N):	Yes											
If No, Provide Explanation:	NA											

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 10/30/2017
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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004	Date: 10/16/2017
Installation: ARNLD - Arnold AFB	Calibration Start Time: 08:24
Sample Technician(s): Jason Hayes and Noel Garland	Calibration End Time: 08:44

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/15/17	08:24	NA	4.03	NA	0.997	NA	NA	97.6	NA	None
			7.03	NA						
			10.02	NA						
				NA						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/15/17	08:44	NA	4.00	9.92	1.000	9.12	NA	100.1	NA	None
			7.03	19.9						
			10.04	100						
				799						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/31/18	Spec. Conductance	7GH673	08/30/18	10	A6354	03/30/18
pH (7)	7GG600	07/31/19	Salinity	NA	10/16/2017	20	A6354	03/30/18
pH (10)	6GG873	07/31/18	D.O.	NA	10/16/2017	100	A6350	03/30/18
			ORP	7GH705	02/28/18	800	A7045	03/30/18

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%;"> <tr> <th style="width: 30%;">Manufacturer/Model</th> <th>Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI Pro Plus</td> <td>14K100941</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>11030C007945</td> </tr> <tr> <td>Calibrated Within Acceptance Criteria (Y/N):</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td>If No, Provide Explanation:</td> <td style="text-align: center;">NA</td> </tr> </table>	Manufacturer/Model	Serial No	Water Quality Meter: YSI Pro Plus	14K100941	Turbidity Meter: Hach 2100Q	11030C007945	Calibrated Within Acceptance Criteria (Y/N):	Yes	If No, Provide Explanation:	NA	Notes: <div style="text-align: center; padding: 10px;">None</div>	Signature: Name (print): Jason Hayes
Manufacturer/Model	Serial No											
Water Quality Meter: YSI Pro Plus	14K100941											
Turbidity Meter: Hach 2100Q	11030C007945											
Calibrated Within Acceptance Criteria (Y/N):	Yes											
If No, Provide Explanation:	NA											

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 10/30/2017
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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004	Date: 10/17/2017
Installation: ARNLD - Arnold AFB	Calibration Start Time: 08:00
Sample Technician(s): Noel Garland	Calibration End Time: 08:34

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/16/17	08:04	13.0	3.99	9.61	1.004	11.23	NA	103.4	738.3	None
			7.04	20.3						
				101						
			10.11	808						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/16/17	08:51	13.0	4.00	9.59	1.001	11.23	NA	100.1	738.3	None
			7.05	20.1						
				99.9						
			10.15	798						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/16/18	Spec. Conductance	7GH673	08/16/18	10	A6354	03/16/18
pH (7)	7GG600	07/16/19	Salinity	NA	10/17/2017	20	A6354	03/16/18
pH (10)	6GG873	07/16/18	D.O.	NA	10/17/2017	100	A6350	03/16/18
			ORP	7GH705	02/16/18	800	A7045	05/16/18

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;">Manufacturer/Model</th> <th style="width: 70%;">Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI Pro Plus</td> <td>14K100941</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>11030C007945</td> </tr> <tr> <td>Calibrated Within Acceptance Criteria (Y/N):</td> <td>Yes</td> </tr> <tr> <td>If No, Provide Explanation:</td> <td>NA</td> </tr> </table>	Manufacturer/Model	Serial No	Water Quality Meter: YSI Pro Plus	14K100941	Turbidity Meter: Hach 2100Q	11030C007945	Calibrated Within Acceptance Criteria (Y/N):	Yes	If No, Provide Explanation:	NA	Notes: <div style="text-align: center; padding: 10px;">None</div>	Signature: <div style="text-align: center; font-size: 2em; font-family: cursive;"> </div> Name (print): Noel Garland
Manufacturer/Model	Serial No											
Water Quality Meter: YSI Pro Plus	14K100941											
Turbidity Meter: Hach 2100Q	11030C007945											
Calibrated Within Acceptance Criteria (Y/N):	Yes											
If No, Provide Explanation:	NA											

QA/QC'd by: Thomas W. Hensel	<i>Thomas W. Hensel</i>	QA/QC Date: 10/30/2017
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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004	Date: 10/18/2017
Installation: ARNLD - Arnold AFB	Calibration Start Time: 08:24
Sample Technician(s): Jason Hayes and Noel Garland	Calibration End Time: 08:44

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/15/17	08:24	NA	4.03	NA	0.997	NA	NA	97.6	NA	None
			7.03	NA						
			10.02	NA						
				NA						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/15/17	08:44	NA	4.00	9.97	1.000	9.23	NA	100.1	NA	None
			7.03	20.2						
			10.04	99.8						
				799						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/31/18	Spec. Conductance	7GH673	08/30/18	10	A6354	03/30/18
pH (7)	7GG600	07/31/19	Salinity	NA	10/18/2017	20	A6354	03/30/18
pH (10)	6GG873	07/31/18	D.O.	NA	10/18/2017	100	A6350	03/30/18
			ORP	7GH705	02/28/18	800	A7045	03/30/18

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%;"> <tr> <th style="text-align: left;">Manufacturer/Model</th> <th style="text-align: left;">Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI Pro Plus</td> <td>14K100941</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>11030C007945</td> </tr> </table> Calibrated Within Acceptance Criteria (Y/N): Yes If No, Provide Explanation: NA	Manufacturer/Model	Serial No	Water Quality Meter: YSI Pro Plus	14K100941	Turbidity Meter: Hach 2100Q	11030C007945	Notes: None	Signature: Name (print): Jason Hayes
Manufacturer/Model	Serial No							
Water Quality Meter: YSI Pro Plus	14K100941							
Turbidity Meter: Hach 2100Q	11030C007945							

QA/QC'd by: Thomas W. Hensel 	QA/QC Date: 10/30/2017
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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004	Date: 10/19/2017
Installation: ARNLD - Arnold AFB	Calibration Start Time: 10:44
Sample Technician(s): Bryan Hansen	Calibration End Time: 11:29

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/18/17	10:45	14.16	3.43	NA	1.079	129.2	NA	146.3	742.0	None
			6.97	18.8						
			95.3	748						
			10.10	748						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/18/17	11:03	14.16	4.00	10.2	1.002	98.1	NA	97.2	742.0	None
			7.00	19.5						
			99.9	816						
			10.01	816						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/31/18	Spec. Conductance	7GH673	08/31/18	10	A6354	03/31/18
pH (7)	7GG600	07/31/19	Salinity	NA	10/19/2017	20	A6354	03/30/18
pH (10)	6GG873	07/18/17	D.O.	NA	10/19/2017	100	A6350	03/31/18
			ORP	7GH705	02/18/18	800	A6349	03/31/18

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%;"> <tr> <th style="text-align: left;">Manufacturer/Model</th> <th style="text-align: left;">Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI 556 MPS</td> <td>15D100992</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>13080C027788</td> </tr> </table> Calibrated Within Acceptance Criteria (Y/N): Yes If No, Provide Explanation: NA	Manufacturer/Model	Serial No	Water Quality Meter: YSI 556 MPS	15D100992	Turbidity Meter: Hach 2100Q	13080C027788	Notes: None	Signature: Name (print): Bryan Hansen
Manufacturer/Model	Serial No							
Water Quality Meter: YSI 556 MPS	15D100992							
Turbidity Meter: Hach 2100Q	13080C027788							

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 10/30/2017
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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027	Task Order: 0004
Installation: ARNLD - Arnold AFB	Date: 10/19/17
Sample Technician(s): Bryan Hansen	Calibration Start Time: 08:31
	Calibration End Time: 09:04

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/19/17	08:31	11.96	4.06	NA	0.816	12.21	NA	129.2	742.7	None
			6.96	21.5						
			9.93	100						
			9.93	768						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
10/19/17	09:04	11.96	4.00	9.62	1.001	9.86	NA	99.8	742.7	None
			7.00	18.8						
			10.00	99.7						
			10.00	849						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/31/18	Spec. Conductance	7GH673	08/31/18	10	A6354	03/31/18
pH (7)	7GG600	07/31/19	Salinity	NA	10/19/17	20	A6354	03/30/18
pH (10)	6GG873	07/18/17	D.O.	NA	10/19/17	100	A6350	03/31/18
			ORP	7GH705	02/18/18	800	A6349	03/31/18

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;">Manufacturer/Model</th> <th style="width: 70%;">Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI 556 MPS</td> <td>15D100992</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>13080C02778</td> </tr> </table> Calibrated Within Acceptance Criteria (Y/N): Yes If No, Provide Explanation: NA	Manufacturer/Model	Serial No	Water Quality Meter: YSI 556 MPS	15D100992	Turbidity Meter: Hach 2100Q	13080C02778	Notes: None	Signature: Name (print): Bryan Hansen
Manufacturer/Model	Serial No							
Water Quality Meter: YSI 556 MPS	15D100992							
Turbidity Meter: Hach 2100Q	13080C02778							

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 10/30/2017
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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004	Date: 11/14/17
Installation: ARNLD - Arnold AFB	Calibration Start Time: 11:21
Sample Technician(s): Noel Garland, Miles Watkins	Calibration End Time: 11:59

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
11/14/17	11:21	NA	3.85	NA	0.971	NA	NA	110.8	NA	None
			7.09	NA						
			9.90	NA						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
11/14/17	11:59	NA	4.00	10.9	1.000	NA	NA	100	NA	None
			7.00	19.2						
			9.98	97.2						
				800						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/31/18	Spec. Conductance	7GJ520	10/31/18	10	A7037	02/28/19
pH (7)	7GG600	07/31/19	Salinity	NA	11/14/17	20	A7053	05/31/18
pH (10)	6GG873	07/31/18	D.O.	NA	11/14/17	100	A6229	08/31/18
			ORP	7GJ521	04/30/18	800	A7062	03/31/19

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;">Manufacturer/Model</th> <th style="width: 70%;">Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI 556 MPS</td> <td>09F100833</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>11090C012139</td> </tr> <tr> <td>Calibrated Within Acceptance Criteria (Y/N):</td> <td>Yes</td> </tr> <tr> <td>If No, Provide Explanation:</td> <td>NA</td> </tr> </table>	Manufacturer/Model	Serial No	Water Quality Meter: YSI 556 MPS	09F100833	Turbidity Meter: Hach 2100Q	11090C012139	Calibrated Within Acceptance Criteria (Y/N):	Yes	If No, Provide Explanation:	NA	Notes: <p style="text-align: center;">None</p>	Signature: Name (print): Miles Watkins
Manufacturer/Model	Serial No											
Water Quality Meter: YSI 556 MPS	09F100833											
Turbidity Meter: Hach 2100Q	11090C012139											
Calibrated Within Acceptance Criteria (Y/N):	Yes											
If No, Provide Explanation:	NA											

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 12/13/2017
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WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM



Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004	Date: 11/15/17
Installation: ARNLD - Arnold AFB	Calibration Start Time: 11:00
Sample Technician(s): Noel Garland	Calibration End Time: 11:21

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
11/15/17	11:00	NA	4.02	10.3	0.940	NA	NA	115.4	NA	None
			6.98	20.9						
				101						
			9.99	803						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (mg/L)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
11/15/17	11:20	NA	4.00	NA	1.000	NA	NA	99.9	NA	None
			7.00	NA						
				NA						
			10.00	NA						

Calibration Materials Record:

pH Calibration Standards			Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards			Turbidity Standards		
Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date	Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GG869	07/31/18	Spec. Conductance	7GJ520	10/31/18	10	A7037	02/28/19
pH (7)	7GG600	07/31/19	Salinity	NA	11/15/17	20	A7053	05/31/18
pH (10)	6GG873	07/31/18	D.O.	NA	11/15/17	100	A6229	08/31/18
			ORP	7GJ521	04/30/18	800	A7062	03/31/19

Instruments (Manufacturer, Model, and Serial No.): <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;">Manufacturer/Model</th> <th style="width: 70%;">Serial No</th> </tr> <tr> <td>Water Quality Meter: YSI 556 MPS</td> <td>09F100833</td> </tr> <tr> <td>Turbidity Meter: Hach 2100Q</td> <td>11090C012139</td> </tr> </table> Calibrated Within Acceptance Criteria (Y/N): Yes If No, Provide Explanation: NA	Manufacturer/Model	Serial No	Water Quality Meter: YSI 556 MPS	09F100833	Turbidity Meter: Hach 2100Q	11090C012139	Notes: None	Signature: Name (print): Noel garland
Manufacturer/Model	Serial No							
Water Quality Meter: YSI 556 MPS	09F100833							
Turbidity Meter: Hach 2100Q	11090C012139							

QA/QC'd by: Thomas W. Hensel		QA/QC Date: 12/13/2017
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APPENDIX B-8

GROUNDWATER SAMPLING LOGS

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GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Jason Hayes and Noel Garland
Well ID:	MW03002	Date:	10/15/17
Initial Depth to Water (ft):	22.57	Well Diameter (in):	2.0
Total Depth of Well (ft):	30.17	1 Casing Volume (gal):	1.2
Method of Purging:	Peristaltic Pump	3 Casing Volumes (gal):	3.7
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	29

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (liters)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
14:15		100								Pumping/Purging Started
14:25	23.74	100	1	22.2	5.88	0.197	4.26	3.1	28.5	Clear
14:35	24.66	100	2	22.1	5.89	0.212	3.37	-6.5	92.2	Slightly cloudy
14:45	25.79	100	3	21.0	6.10	0.231	5.52	-93.7	52.5	Cloudy
14:55	27.11	100	4	20.9	6.04	0.222	5.41	-78.8	230	Cloudy
15:00	27.50	100	4.5	21.3	6.07	0.228	5.20	-93.5	266	Cloudy
15:05	27.91	100	5.0	21.2	6.11	0.237	4.94	-107.8	419	Cloudy
15:10	28.26	100	5.5	21.1	6.12	0.241	4.89	-110.3	413	Cloudy
15:15	28.83	100	6.0	21.3	6.13	0.243	4.91	-115.7	404	Cloudy
15:20	28.95	100	6.5	21.4	6.16	0.248	4.87	-117.8	414	Cloudy
15:25	29.03	100	7.0	21.4	6.17	0.245	4.85	-121.2	422	Cloudy

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values:	21.4	6.17	0.245	4.85	-121.2	422
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Sample ID:	ARNLD03-GW-002	Method of Sampling:	Grab
QA/QC Samples (Yes/No):	No	Sample Date:	10/15/17
Duplicate ID:	NA	Sample Collection Time:	15:25
Sample Container Type(s):	2 x 125 mL HDPE	Total Volume Purged (gal):	1.85 gallons, 7 liters
Preservative(s):	Ice (4 °C)	Sample Depth (ft):	29
Analysis/Method(s):	PFAS (EPA 537-modified)	Depth to Water After Sampling (ft):	29.14

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes
 Turbidity Meter, Water Quality Meter, Water Level Meter, Peristaltic Pump
 Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

Calculations: Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$ $V = \text{Volume (gal/ft)}$ $\pi = 3.14$ $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$ $H = \text{height of water column (ft)}$	Signature:
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Notes: Tubing was placed at 29 feet to keep constant purge pump rate while the well was drawing down to almost dry.	Name (print): Jason Hayes
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QA/QC'd by: Thomas W. Hensel **QA/QC Date:** 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Jason Hayes and Noel Garland
Well ID:	MW01001	Date:	10/15/17
Initial Depth to Water (ft):	21.03	Well Diameter (in):	2.0
Total Depth of Well (ft):	30.17	1 Casing Volume (gal):	1.5
Method of Purging:	Peristaltic Pump	3 Casing Volumes (gal):	4.5
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	29

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (liters)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
16:09		100								Pumping/Purging Started
16:19	21.92	100	1	20.1	5.42	0.059	4.48	-0.5	127	Slightly cloudy
16:29	22.79	100	2	20.2	5.32	0.056	3.55	42.7	97.3	Slightly cloudy
16:39	23.28	100	3	20.2	5.28	0.059	3.06	51.0	799	Cloudy
16:49	23.87	100	4	20.1	5.24	0.056	3.13	49.9	Over 1000	Very cloudy
16:59	24.25	100	5	20.0	5.19	0.054	3.00	47.4	Over 1000	Very cloudy
17:04	24.58	100	5.5	19.8	5.16	0.053	2.79	44.7	Over 1000	Very cloudy
17:09	24.83	100	6	19.7	5.13	0.053	2.71	40.6	Over 1000	Very cloudy
17:14	25.10	100	6.5	20.0	5.12	0.051	2.46	32.5	Over 1000	Very cloudy
17:19	25.41	100	7	19.9	5.13	0.051	2.18	25.4	Over 1000	Very cloudy
17:24	25.58	100	7.5	19.8	5.11	0.050	2.41	21.3	Over 1000	Very cloudy
17:29	25.82	100	8	19.8	5.10	0.049	2.43	19.4	Over 1000	Very cloudy
17:34	26.01	100	8.5	19.8	5.04	0.050	2.37	5.5	Over 1000	Very cloudy
17:39	26.22	100	9	19.8	5.08	0.050	2.42	0.3	Over 1000	Very cloudy
17:44	26.44	100	9.5	19.6	5.06	0.049	2.26	-6.0	Over 1000	Very cloudy
17:49	26.75	100	10	19.6	5.02	0.049	2.16	-8.7	Over 1000	Very cloudy
17:54	26.83	100	10.5	19.6	5.02	0.048	2.19	-10.0	Over 1000	Very cloudy
17:59	26.98	100	11	19.6	5.04	0.048	2.18	-9.7	Over 1000	Very cloudy

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values:	19.6	5.04	0.048	2.18	-9.7	Over 1000
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Sample ID: ARNLD01-GW-001	Method of Sampling: Grab
QA/QC Samples (Yes/No): No	Sample Date: 10/15/2017
Duplicate ID: NA	Sample Collection Time: 17:59
Sample Container Type(s): 2 x 125 mL HDPE	Total Volume Purged (gal): 11 liters, 2.9 gallons
Preservative(s): Ice (4 °C)	Sample Depth (ft): 29
Analysis/Method(s): PFAS (EPA 537-modified)	Depth to Water After Sampling (ft): 26.98

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, Peristaltic Pump
 Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

<p>Calculations:</p> <p>Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$</p> <p>$V = \text{Volume (gal/ft)}$ $\pi = 3.14$ $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$ $H = \text{height of water column (ft)}$</p> <p style="text-align: right;">$V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$ $= \pi * (2.0 \text{ (in)}/12 \text{ (in/ft)})^2 * 2 * 9.14 * 7.48 \text{ gal/ft}^3$ $= 1.5 \text{ gal.}$</p>	<p>Signature:</p>
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Notes: <div style="text-align: center;">None</div>	Name (print): Jason Hayes
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QA/QC'd by: Thomas W. Hensel **QA/QC Date:** 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Noel Garland and Jason Hayes
Well ID:	MW01002	Date:	10/16/17
Initial Depth to Water (ft):	17.51	Well Diameter (in):	2.0
Total Depth of Well (ft):	30.16	1 Casing Volume (gal):	2.1
Method of Purging:	Peristaltic pump	3 Casing Volumes (gal):	6.2
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	26

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (liters)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
09:15		100								Pumping/Purging Started
09:20	18.40	150	0.75	18.2	5.04	0.040	2.17	-22.9	13.4	
09:25	18.97	150	1.5	18.3	4.85	0.040	1.61	-41.4	10.9	
09:30	19.46	150	2.25	18.4	4.93	0.044	1.82	-54.2	12.0	
09:35	19.82	150	3	18.5	4.90	0.042	1.76	-55.1	9.58	
09:40	20.11	150	3.75	18.4	4.90	0.042	1.83	-52.9	7.71	
09:45	20.24	150	4.5	18.4	4.87	0.040	1.77	-51.4	6.70	
09:50	20.38	150	5.25	18.4	4.89	0.041	1.67	-53.4	5.57	
09:55	20.52	150	6	18.4	4.86	0.040	1.65	-49.7	5.11	
10:00	20.63	150	6.75	18.5	4.84	0.040	1.63	-47.4	3.94	
10:05	20.68	150	7.5	18.5	4.80	0.039	1.60	-45.6	4.12	
10:15	20.71	150	8.25	18.6	4.82	0.039	1.60	-44.1	3.84	
10:20	20.77	150	9	18.6	4.84	0.040	1.58	-46.8	2.42	
10:25	20.82	150	9.75	18.7	4.84	0.041	1.61	-48.2	2.35	
10:30	20.89	150	10.5	18.6	4.83	0.040	1.63	-45.5	1.68	
10:35	20.93	150	11.25	18.6	4.83	0.041	1.61	-47.3	2.39	
10:40	20.92	150	12	18.7	4.83	0.040	1.63	-49.5	1.70	
10:45	20.93	150	12.75	18.7	4.80	0.039	1.64	-48.5	1.41	
10:50	20.91	150	13.5	18.7	4.78	0.039	1.62	-45.6	1.61	
10:55	20.93	150	14.25	18.7	4.78	0.039	1.63	-49.7	1.30	
11:00	20.94	150	15	18.8	4.77	0.039	1.62	-48.2	0.96	

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values:	18.8	4.77	0.039	1.62	-48.2	0.96
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Sample ID:	ARNLD01-GW-002	Method of Sampling:	Grab
QA/QC Samples (Yes/No):	Yes, DUP	Sample Date:	10/16/17
Duplicate ID:	ARNLD-FD-GW-001	Sample Collection Time:	11:00
Sample Container Type(s):	2 x 125 mL HDPE	Total Volume Purged (gal):	15 liters, 4 gallons
Preservative(s):	Ice (4 °C)	Sample Depth (ft):	26
Analysis/Method(s):	PFAS (EPA 537-modified)	Depth to Water After Sampling (ft):	20.78

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, Peristaltic Pump
 Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

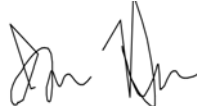
Calculations:

Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$

$V = \text{Volume (gal/ft)}$
 $\pi = 3.14$
 $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$
 $H = \text{height of water column (ft)}$

$V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$
 $= \pi * (2.0 \text{ (in)}/12 \text{ (in/ft)})^2 * 2 * 12.65 * 7.48 \text{ gal/ft}^3$
 $= 2.1 \text{ gal.}$

Signature:



Notes:

None

Name (print):

Jason Hayes

QA/QC'd by: Thomas W. Hensel  **QA/QC Date:** 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Jason Hayes and Noel Garland
Well ID:	MW02001	Date:	10/16/17
Initial Depth to Water (ft):	16.43	Well Diameter (in):	2.0
Total Depth of Well (ft):	25.37	1 Casing Volume (gal):	1.5
Method of Purging:	Peristaltic Pump	3 Casing Volumes (gal):	4.4
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	24

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (liters)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
13:25		100								Pumping/Purging Started
13:30	18.34	100	0.5	16.6	6.48	0.660	5.64	-168.9	22.0	Clear
13:35	18.97	100	1	16.6	6.55	0.660	5.72	-164.9	23.5	Clear
13:40	19.78	100	1.5	16.7	6.61	0.664	5.93	-155.5	147	Slightly cloudy
13:45	20.52	100	2.0	16.7	6.61	0.668	5.82	-159.9	246	Cloudy
13:50	21.46	100	2.5	16.7	6.61	0.671	5.42	-171.5	413	Cloudy
13:55	22.56	100	3	16.7	6.61	0.689	5.05	-173.5	409	Cloudy
14:00	23.41	100	3.5	16.7	6.63	0.694	4.82	-171.9	406	Cloudy
14:05	23.65	100	4.0	16.6	6.57	0.710	4.57	-189.2	310	Cloudy
14:10	24.20	100	4.5	16.6	6.56	0.725	3.89	-185.8	281	Cloudy
14:15	24.56	100	5.0	16.7	6.55	0.734	3.54	-204.4	378	Cloudy
14:17	Dry		5.2							Pumped well dry - Allow to recharge
08:23	15.41	100	5.5	15.6	6.65	0.637	6.26	-176.4	46.2	Started pump on 10/17

Stability Reached (Y/N): No If No, Provide Explanation: No - Well was pumped dry, will sample on 10/17

Final Values:	15.6	6.65	0.637	6.26	-176.4	46.2
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Sample ID:	ARNLD02-GW-001	Method of Sampling:	Grab
QA/QC Samples (Yes/No):	No	Sample Date:	10/17/17
Duplicate ID:	NA	Sample Collection Time:	08:35
Sample Container Type(s):	2 x 125 mL HDPE	Total Volume Purged (gal):	5.2 liters, 1.4 gallons
Preservative(s):	Ice (4 °C)	Sample Depth (ft):	24
Analysis/Method(s):	PFAS (EPA 537-modified)	Depth to Water After Sampling (ft):	16.45

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter, Water Level Meter, Peristaltic Pump
Hach 2100Q 11030C007945, YSI Pro Plus 14K100941

Calculations:

Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$

$V = \text{Volume (gal/ft)}$
 $\pi = 3.14$
 $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$
 $H = \text{height of water column (ft)}$

$V = \pi * (2.0 \text{ (in)}/12 \text{ (in/ft)})^2 * 2 * 8.94 * 7.48 \text{ gal/ft}^3$
 $= 1.5 \text{ gal.}$

Signature:



Notes:

Well was pumped dry on 10/16, recharged overnight, sample was taken on 10/17

Name (print):

Jason Hayes

QA/QC'd by: Thomas W. Hensel  **QA/QC Date:** 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Bryan Hansen
Well ID:	MW02002	Date:	10/18/17
Initial Depth to Water (ft):	16.45	Well Diameter (in):	2.0
Total Depth of Well (ft):	30.5	1 Casing Volume (gal):	2.3
Method of Purging:	Low flow - peristaltic pump	3 Casing Volumes (gal):	6.9
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	25.00

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
11:47		100								Pumping/Purging Started
11:54	17.02	100	0.00	16.79	5.49	0.313	5.01	-31.2	240	
11:59	17.32	100	0.13	16.70	5.47	0.309	4.57	-28.3	380	
12:04	17.51	100	0.26	16.75	5.31	0.300	4.58	-17.7	649	
12:09	17.61	100	0.39	16.77	5.32	0.291	4.47	-17.0	698	
12:14	17.66	100	0.42	16.73	5.34	0.294	4.51	-16.9	677	
12:19	17.70	100	0.55	16.75	5.31	0.292	4.44	-16.3	530	
12:24	17.76	100	0.68	16.86	5.28	0.240	3.83	-17.9	103	
12:29	17.80	100	0.71	16.92	5.24	0.235	3.54	-16.8	95.0	
12:34	17.85	100	0.84	16.90	5.24	0.235	3.72	-15.8	60.3	
12:39	17.86	100	0.97	16.84	5.26	0.236	3.66	-15.0	30.4	
12:44	17.88	100	1.10	16.90	5.24	0.235	3.72	-15.8	15.2	
12:49	17.92	100	1.23	16.86	5.22	0.229	3.40	-16.0	9.54	
12:54	17.96	100	1.36	16.79	5.28	0.231	3.57	-15.8	10.3	
12:58	18.01	100	1.49	16.83	5.24	0.236	3.49	-15.6	10.0	


Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values:	16.83	5.24	0.236	3.49	-15.6	10.0
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Sample ID:	ARNLD02-GW-002	Method of Sampling:	Grab
QA/QC Samples (Yes/No):	Yes, MS/MSD	Sample Date:	10/18/17
Duplicate ID:	NA	Sample Collection Time:	13:10
Sample Container Type(s):	2 x 125 mL HDPE	Total Volume Purged (gal):	1.6
Preservative(s):	Ice (4 °C)	Sample Depth (ft):	25.00
Analysis/Method(s):	PFAS (EPA 537-modified)	Depth to Water After Sampling (ft):	18.17

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Water Quality Meter, YSI 556 MPS 15D100992

Calculations: Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$ $V = \text{Volume (gal/ft)}$ $\pi = 3.14$ $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$ $H = \text{height of water column (ft)}$	Signature: 
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Notes: <p style="text-align: center;">None</p>	Name (print): <p style="text-align: center;">Bryan Hansen</p>
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QA/QC'd by: Thomas W. Hensel 	QA/QC Date: 11/7/2017
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GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Bryan Hansen
Well ID:	MW02003	Date:	10/18/17
Initial Depth to Water (ft):	25.46	Well Diameter (in):	2.0
Total Depth of Well (ft):	30.5	1 Casing Volume (gal):	0.8
Method of Purging:	Low Flow - Peristaltic Pump	3 Casing Volumes (gal):	2.5
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	28.00

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
13:40		100								Pumping/Purging Started
13:48	25.75	100	0.00	19.14	5.91	0.310	4.76	-17.6	23.5	
13:53	25.92	100	0.13	19.18	5.94	0.319	4.76	-19.1	22.5	
13:58	26.09	100	0.26	19.20	5.95	0.318	4.73	-20.4	14.4	
14:03	26.31	100	0.39	19.05	5.95	0.316	4.58	-22.0	5.91	
14:08	26.40	100	0.52	18.81	5.96	0.317	4.40	-24.0	4.91	
14:13	26.51	100	0.65	19.20	5.96	0.317	4.23	-25.7	4.21	
14:18	26.67	100	0.78	19.13	5.96	0.320	4.18	-26.0	4.90	

Stability Reached (Y/N): Yes If No, Provide Explanation NA


Final Values:	19.13	5.96	0.320	4.18	-26.0	4.90
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Sample ID:	ARNLD02-GW-003	Method of Sampling:	Grab
QA/QC Samples (Yes/No):	No	Sample Date:	10/18/17
Duplicate ID:	NA	Sample Collection Time:	14:20
Sample Container Type(s):	2 x 125 mL HDPE	Total Volume Purged (gal):	0.85
Preservative(s):	Ice (4 °C)	Sample Depth (ft):	28.00
Analysis/Method(s):	PFAS (EPA 537-modified)	Depth to Water After Sampling (ft):	26.75

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Water Quality Meter, YSI 556 MPS 15D100992

Calculations:	Signature:
<p>Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$</p> <p>$V = \text{Volume (gal/ft)}$ $\pi = 3.14$ $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$ $H = \text{height of water column (ft)}$</p> <p style="text-align: center;"> $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$ $= \pi * (2.0 \text{ (in)}/12 \text{ (in/ft)})^2 * 2 * 5.04 * 7.48 \text{ gal/ft}^3$ $= 0.8 \text{ gal.}$ </p>	
Notes:	Name (print):
None	Bryan Hansen

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* QA/QC Date: 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Bryan Hansen
Well ID:	MW03001	Date:	10/18/17
Initial Depth to Water (ft):	22.0	Well Diameter (in):	2.0
Total Depth of Well (ft):	30.5	1 Casing Volume (gal):	1.4
Method of Purging:	Low Flow - Peristaltic Pump	3 Casing Volumes (gal):	4.2
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	25.00

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
16:10		100								Pumping/Purging Started
16:15	23.91	100	0.13	19.91	5.43	0.116	4.08	-8.3	199	
16:20	23.11	100	0.26	19.95	5.45	0.116	4.08	-8.8	209	
16:25	23.30	100	0.39	19.70	5.44	0.115	3.71	-9.4	208	

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values: 19.70 5.44 0.115 3.71 -9.4 208

Sample ID:	ARNLD03-GW-001	Method of Sampling:	Grab
QA/QC Samples (Yes/No):	No	Sample Date:	10/18/17
Duplicate ID:	NA	Sample Collection Time:	16:30
Sample Container Type(s):	2 x 125 mL HDPE	Total Volume Purged (gal):	0.50
Preservative(s):	Ice (4 °C)	Sample Depth (ft):	25.00
Analysis/Method(s):	PFAS (EPA 537-modified)	Depth to Water After Sampling (ft):	24.75

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter,
 Hach 2100Q 13080C027788, YSI 556 MPS 15D100992

Calculations: Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$ $V = \text{Volume (gal/ft)}$ $\pi = 3.14$ $R = \text{well radius (ft) = (well diameter (in)/12 (in/ft))/2}$ $H = \text{height of water column (ft)}$ $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$ $= \pi * (2.0 (in)/12 (in/ft))^2 * 8.50 * 7.48 \text{ gal/ft}^3$ $= 1.4 \text{ gal.}$	Signature:
Notes: <div style="text-align: center; font-size: small;">None</div>	Name (print): Bryan Hansen

QA/QC'd by: Thomas W. Hensel		QA/QC Date:	11/7/2017
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GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Bryan Hansen
Well ID:	MW08002	Date:	10/18/17
Initial Depth to Water (ft):	28.28	Well Diameter (in):	2.0
Total Depth of Well (ft):	30.15	1 Casing Volume (gal):	0.3
Method of Purging:	Low Flow - Peristaltic Pump	3 Casing Volumes (gal):	0.9
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	29.00

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
15:18		100								Pumping/Purging Started
15:29	29.90	100	0.26	20.31	5.96	0.092	5.81	-24.7	956	Purged dry

Stability Reached (Y/N):	No	If No, Provide Explanation	No - Purged dry
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Final Values:	20.31	5.96	0.092	5.81	-24.7	956
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Sample ID:	Not Sampled	Method of Sampling:	NA
QA/QC Samples (Yes/No):	No	Sample Date:	NA
Duplicate ID:	NA	Sample Collection Time:	NA
Sample Container Type(s):	NA	Total Volume Purged (gal):	0.26
Preservative(s):	NA	Sample Depth (ft):	29.00
Analysis/Method(s):	NA	Depth to Water After Sampling (ft):	Dry

Instruments (Manufacturer, Model, and Serial No.):	
Equipment Calibrated (Y/N):	Yes
Calibrated Within Criteria (Y/N):	Yes
Turbidity Meter, Water Quality Meter, Hach 2100Q 13080C027788, YSI 556 MPS 15D100992	

<p>Calculations:</p> <p>Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$</p> <p>V=Volume (gal/ft) $\pi = 3.14$ R = well radius (ft) = (well diameter (in)/12 (in/ft))/2 H = height of water column (ft)</p> <p style="text-align: right; font-size: small;"> $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$ $= \pi \cdot (2.0 \text{ (in)/12 (in/ft)})^2 \cdot 1.87 \cdot 7.48 \text{ gal/ft}^3$ $= 0.3 \text{ gal.}$ </p> <p>Notes:</p> <p style="text-align: center; color: blue;">Purged dry, not sampled.</p>	<p>Signature:</p> <div style="font-family: cursive; font-size: 2em; text-align: center;">Bryan Hansen</div> <hr/> <p>Name (print):</p> <p style="text-align: center;">Bryan Hansen</p>
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QA/QC'd by: Thomas W. Hensel	<i>Thomas W. Hensel</i>	QA/QC Date:	11/7/2017
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GROUNDWATER SAMPLING RECORD

Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide Project Number: 775303101.0004
Contract: FA8903-16-D-0027 Task Order: 0004
Installation: ARNLD - Arnold AFB Technician(s): Bryan Hansen
Well ID: MW07001 Date: 10/19/17
Initial Depth to Water (ft): 12.72 Well Diameter (in): 2.0
Total Depth of Well (ft): 30.15 1 Casing Volume (gal): 2.9
Method of Purging: Low Flow - Peristaltic Pump 3 Casing Volumes (gal): 8.6
Measuring Point (toc, tor, etc.): Top of Riser Pump Intake Depth (feet): 25.00

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
10:05		100								Pumping/Purging Started
10:11	13.13	100	0.13	19.20	5.11	0.041	2.17	-70.5	156	
10:16	13.32	100	0.26	19.31	5.07	0.042	2.07	-64.0	210	
10:21	13.55	100	0.39	19.25	5.07	0.042	2.09	-59.7	227	
10:26	13.71	100	0.52	19.21	5.06	0.041	2.14	-56.2	104	
10:31	13.95	100	0.65	19.41	5.06	0.041	2.16	-52.1	95.0	
10:36	14.09	100	0.78	19.22	5.07	0.040	2.14	-47.0	65.1	
10:41	14.30	100	0.91	19.38	5.05	0.040	2.18	-42.6	59.2	
10:46	14.50	100	1.04	19.29	5.04	0.040	2.15	-39.9	54.3	

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values: 19.29 5.04 0.040 2.15 -39.9 54.3

Sample ID: ARNLD07-GW-001 Method of Sampling: Grab
QA/QC Samples (Yes/No): No Sample Date: 10/19/17
Duplicate ID: NA Sample Collection Time: 10:49
Sample Container Type(s): 2 x 125 mL HDPE Total Volume Purged (gal): 1.10
Preservative(s): Ice (4 °C) Sample Depth (ft): 25.00
Analysis/Method(s): PFAS (EPA 537-modified) Depth to Water After Sampling (ft): 14.65

Instruments (Manufacturer, Model, and Serial No.):
Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter,
Hach 2100Q 13080C027788, YSI 556 MPS 15D100992

Calculations:
Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$
 $V = \text{Volume (gal/ft)}$
 $\pi = 3.14$
 $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$
 $H = \text{height of water column (ft)}$
 $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$
 $= \pi * (2.0 \text{ (in)}/12 \text{ (in/ft)})^2 * 2 * 17.43 * 7.48 \text{ gal/ft}^3$
 $= 2.9 \text{ gal.}$

Signature:

Notes:
None

Name (print):
Bryan Hansen

QA/QC'd by: Thomas W. Hensel QA/QC Date: 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide
Project Number: 775303101.0004
Contract: FA8903-16-D-0027
Installation: ARNLD - Arnold AFB
Well ID: MW07003
Initial Depth to Water (ft): 8.66
Total Depth of Well (ft): 30.15
Method of Purging: Low Flow - Peristaltic Pump
Measuring Point (toc, tor, etc.): Top of Riser
Task Order: 0004
Technician(s): Bryan Hansen
Date: 10/19/17
Well Diameter (in): 2.0
1 Casing Volume (gal): 3.5
3 Casing Volumes (gal): 10.6
Pump Intake Depth (feet): 25.00

Table with 10 columns: Time, Water Level (feet), Flow Rate (mL/min), Cum. Volume (gal.), Temp. (°C), pH (SU), Specific Electrical Conductance (mS/cm), DO (mg/L), ORP (mV), Turbidity (NTU), and Comments/Observations During Purging (color, sediment, odor, etc.). Includes data for 09:10 to 09:34 and stabilization criteria.

Stability Reached (Y/N): Yes. If No, Provide Explanation: NA

Final Values: 19.87, 5.72, 0.210, 0.85, -162.4, 38.8
Sample ID: ARNLD07-GW-003
Method of Sampling: Grab
QA/QC Samples (Yes/No): No
Sample Date: 10/19/17
Duplicate ID: NA
Sample Collection Time: 09:40
Sample Container Type(s): 2 x 125 mL HDPE
Total Volume Purged (gal): 0.70
Preservative(s): Ice (4 °C)
Sample Depth (ft): 25.00
Analysis/Method(s): PFAS (EPA 537-modified)
Depth to Water After Sampling (ft): 16.65

Instruments (Manufacturer, Model, and Serial No.): Turbidity Meter, Water Quality Meter, Hach 2100Q 13080C027788, YSI 556 MPS 15D100992
Equipment Calibrated (Y/N): Yes
Calibrated Within Criteria (Y/N): Yes

Calculations: Saturated well casing volume: V= π(R^2)H*7.48 gal/ft^3
V=Volume (gal/ft)
π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2
H = height of water column (ft)
V = π(R^2)H*7.48 gal/ft^3
= π * (2.0 (in)/12 (in/ft))^2 * 21.49 * 7.48 gal/ft^3
= 3.5 gal.
Signature: [Handwritten Signature]

Notes: None
Name (print): Bryan Hansen

QA/QC'd by: Thomas W. Hensel [Handwritten Signature]
QA/QC Date: 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027	Task Order: 0004
Installation: ARNLD - Arnold AFB	Technician(s): Bryan Hansen
Well ID: MW05001	Date: 10/20/17
Initial Depth to Water (ft): 7.86	Well Diameter (in): 2.0
Total Depth of Well (ft): 28.15	1 Casing Volume (gal): 3.3
Method of Purging: Low Flow - Peristaltic Pump	3 Casing Volumes (gal): 10.0
Measuring Point (toc, tor, etc.): Top of Riser	Pump Intake Depth (feet): 23.00

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
12:57		400								Pumping/Purging Started
13:00	13.05	400	0.26	21.77	6.38	0.342	2.03	17.3	153	
13:05	13.97	200	0.52	22.77	6.39	0.352	1.97	2.9	526	
13:10	14.02	200	0.78	22.87	6.41	0.350	1.98	-3.1	656	
13:15	14.70	200	1.04	22.65	6.43	0.342	1.93	-9.5	OR	OR-Out of Range
13:20	14.51	200	1.30	22.46	6.45	0.320	1.82	-16.4	776	
13:25	14.71	300	1.69	22.24	6.51	0.306	1.80	-17.0	714	
13:30	15.42	300	2.08	22.01	6.50	0.290	1.66	-18.1	598	
13:35	16.14	300	2.47	22.38	6.52	0.268	1.46	-17.1	415	
13:40	16.28	250	2.80	22.30	6.55	0.286	1.55	-18.5	313	
13:45	16.45	250	3.13	22.21	6.50	0.288	1.63	-18.0	306	
13:50	17.15	250	3.46	22.37	6.57	0.289	1.56	-21.5	430	
13:55	17.61	250	3.79	22.19	6.54	0.292	1.54	-22.4	435	
14:00	17.83	250	4.12	22.19	6.55	0.288	1.47	-22.1	465	

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values:	22.19	6.55	0.288	1.47	-22.1	465
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Sample ID: ARNLD05-GW-001 QA/QC Samples (Yes/No): No Duplicate ID: NA Sample Container Type(s): 2 x 125 mL HDPE Preservative(s): Ice (4 °C) Analysis/Method(s): PFAS (EPA 537-modified)	Method of Sampling: Grab Sample Date: 10/20/17 Sample Collection Time: 14:02 Total Volume Purged (gal): 4.30 Sample Depth (ft): 23.00 Depth to Water After Sampling (ft): 17.71
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Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter,
Hach 2100Q 13080C027788, YSI 556 MPS 15D100992

Calculations: Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$ $V = \text{Volume (gal/ft)}$ $\pi = 3.14$ $R = \text{well radius (ft) = (well diameter (in)/12 (in/ft))/2}$ $H = \text{height of water column (ft)}$ $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$ $= \pi * (2.0 \text{ (in)/12 (in/ft)})^2 * 20.29 * 7.48 \text{ gal/ft}^3$ $= 3.3 \text{ gal.}$	Signature:
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Notes: <div style="text-align: center; font-size: small;">None</div>	Name (print): <div style="text-align: center;">Bryan Hansen</div>
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QA/QC'd by: Thomas W. Hensel	QA/QC Date: 11/7/2017
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GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Bryan Hansen
Well ID:	MW05002	Date:	10/20/17
Initial Depth to Water (ft):	8.65	Well Diameter (in):	2.0
Total Depth of Well (ft):	25.15	1 Casing Volume (gal):	2.7
Method of Purging:	Low Flow - Peristaltic Pump	3 Casing Volumes (gal):	8.1
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	20.00

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
10:00		300								Pumping/Purging Started
10:05	10.90	300	0.39	20.61	6.39	0.322	1.51	-97.0	30.0	
10:10	11.05	300	0.78	20.49	6.15	0.274	1.12	-98.6	16.5	
10:15	11.25	300	1.17	20.37	6.13	0.291	0.86	-105.0	18.1	
10:20	11.61	300	1.56	20.55	6.11	0.180	0.79	-111.5	12.5	
10:25	11.72	300	2.95	20.42	5.69	0.148	0.66	-89.6	5.57	
10:30	11.84	300	2.34	20.40	5.62	0.155	0.61	-84.9	6.22	
10:35	11.91	300	2.73	20.35	5.88	0.232	0.57	-99.9	14.9	
10:40	12.00	300	3.12	20.29	5.90	0.231	0.59	-104.3	14.3	Clear, no odor
10:45	12.02	300	3.41	20.44	5.86	0.229	0.50	-106.4	89.5	
10:50	12.03	300	3.80	20.35	5.87	0.225	0.47	-108.2	87.4	
10:55	12.05	300	4.19	20.44	5.89	0.228	0.46	-111.4	16.3	
11:00	12.07	300	4.58	20.44	5.91	0.230	0.50	-112.5	15.7	
11:05	12.07	300	4.97	20.39	5.87	0.231	0.47	-111.1	15.3	

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values:	20.39	5.87	0.231	0.47	-111.1	15.3
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Sample ID:	ARNLD05-GW-002	Method of Sampling:	Grab
QA/QC Samples (Yes/No):	Yes, DUP	Sample Date:	10/20/17
Duplicate ID:	ARNLD-FD-GW-002	Sample Collection Time:	11:10
Sample Container Type(s):	2 x 125 mL HDPE	Total Volume Purged (gal):	5.25
Preservative(s):	Ice (4 °C)	Sample Depth (ft):	20.00
Analysis/Method(s):	PFAS (EPA 537-modified)	Depth to Water After Sampling (ft):	12.07

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Turbidity Meter, Water Quality Meter,
 Hach 2100Q 13080C027788, YSI 556 MPS 15D100992

Calculations:

Saturated well casing volume: $V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$

$V = \text{Volume (gal/ft)}$
 $\pi = 3.14$
 $R = \text{well radius (ft)} = (\text{well diameter (in)} / 12 \text{ (in/ft)}) / 2$
 $H = \text{height of water column (ft)}$

$V = \pi(R^2)H * 7.48 \text{ gal/ft}^3$
 $= \pi * (2.0 \text{ (in)} / 12 \text{ (in/ft)})^2 * 2 * 16.50 * 7.48 \text{ gal/ft}^3$
 $= 2.7 \text{ gal.}$

Signature:



Notes:

None

Name (print):

Bryan Hansen

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* **QA/QC Date:** 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide
Project Number: 775303101.0004
Contract: FA8903-16-D-0027
Installation: ARNLD - Arnold AFB
Well ID: MW05003
Initial Depth to Water (ft): 7.81
Total Depth of Well (ft): 25.15
Method of Purging: Low Flow - Peristaltic Pump
Measuring Point (toc, tor, etc.): Top of Riser
Task Order: 0004
Technician(s): Bryan Hansen
Date: 10/20/17
Well Diameter (in): 2.0
1 Casing Volume (gal): 2.8
3 Casing Volumes (gal): 8.5
Pump Intake Depth (feet): 20.00

Table with 10 columns: Time, Water Level (feet), Flow Rate (mL/min), Cum. Volume (gal.), Temp. (°C), pH (SU), Specific Electrical Conductance (mS/cm), DO (mg/L), ORP (mV), Turbidity (NTU), and Comments/Observations During Purging (color, sediment, odor, etc.).

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values: 19.81, 4.73, 0.034, 1.20, 38.6, 25.8

Sample ID: ARNLD05-GW-003
QA/QC Samples (Yes/No): No
Duplicate ID: NA
Sample Container Type(s): 2 x 125 mL HDPE
Preservative(s): Ice (4 °C)
Analysis/Method(s): PFAS (EPA 537-modified)
Method of Sampling: Grab
Sample Date: 10/20/17
Sample Collection Time: 12:28
Total Volume Purged (gal): 5.5
Sample Depth (ft): 20.00
Depth to Water After Sampling (ft): 9.70

Instruments (Manufacturer, Model, and Serial No.):
Equipment Calibrated (Y/N): Yes
Calibrated Within Criteria (Y/N): Yes
Turbidity Meter, Water Quality Meter, Hach 2100Q 13080C027788, YSI 556 MPS 15D100992

Calculations:
Saturated well casing volume: V= π(R^2)H*7.48 gal/ft^3
V=Volume (gal/ft)
π = 3.14
R = well radius (ft) = (well diameter (in)/12 (in/ft))/2
H = height of water column (ft)
V= π(R^2)H*7.48 gal/ft^3
= π * (2.0 (in)/12 (in/ft))/2^2 * 17.34 * 7.48 gal/ft^3
= 2.8 gal.
Signature: Bryan Hansen

Notes: None
Name (print): Bryan Hansen

QA/QC'd by: Thomas W. Hensel
QA/QC Date: 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name: Site Inspection of AFF Release Areas Environmental Programs Worldwide Project Number: 775303101.0004

Contract: FA8903-16-D-0027 Task Order: 0004

Installation: ARNLD - Arnold AFB Technician(s): Bryan Hansen

Well ID: MW07002 Date: 10/20/17

Initial Depth to Water (ft): 4.92 Well Diameter (in): 2.0

Total Depth of Well (ft): 33.5 1 Casing Volume (gal): 4.7

Method of Purging: Low Flow - Peristaltic Pump 3 Casing Volumes (gal): 14.1

Measuring Point (toc, tor, etc.): Top of Riser Pump Intake Depth (feet): 25.00

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
08:05		200								Pumping/Purging Started
08:11	5.00	200	0.26	16.77	7.54	0.128	6.89	-26.8	180	
08:16	5.15	200	0.52	16.49	6.60	0.121	5.01	-55.4	139	
08:21	5.28	300	0.91	17.27	6.29	0.118	4.05	-63.9	77.1	
08:26	5.45	300	1.30	17.23	6.09	0.116	3.60	-65.0	57.5	
08:30	5.59	300	1.39	17.24	5.99	0.116	3.39	-63.6	43.5	
08:35	5.69	300	1.78	17.22	5.94	0.115	3.23	-63.4	43.1	
08:40	5.91	300	2.17	17.28	5.89	0.116	3.07	-63.2	28.0	
08:45	6.12	300	2.56	17.47	5.90	0.117	2.99	-61.9	25.9	
08:50	6.30	300	2.95	17.41	5.88	0.118	2.95	-60.6	24.4	

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values:	17.41	5.88	0.118	2.95	-60.6	24.4
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Sample ID: ARNLD07-GW-002 Method of Sampling: Grab

QA/QC Samples (Yes/No): No Sample Date: 10/20/17

Duplicate ID: NA Sample Collection Time: 08:54

Sample Container Type(s): 2 x 125 mL HDPE Total Volume Purged (gal): 3.25

Preservative(s): Ice (4 °C) Sample Depth (ft): 25.00

Analysis/Method(s): PFAS (EPA 537-modified) Depth to Water After Sampling (ft): 6.59

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes

Water Quality Meter, YSI 556 MPS 15D100992

Calculations:

Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$

$V = \text{Volume (gal/ft)}$
 $\pi = 3.14$
 $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$
 $H = \text{height of water column (ft)}$

$V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$
 $= \pi * (2.0 \text{ (in)}/12 \text{ (in/ft)})^2 * 28.58 * 7.48 \text{ gal/ft}^3$
 $= 4.7 \text{ gal.}$

Signature:

Notes:

None

Name (print): Bryan Hansen

QA/QC'd by: Thomas W. Hensel *Thomas W. Hensel* QA/QC Date: 11/7/2017



GROUNDWATER SAMPLING RECORD

Project Name:	Site Inspection of AFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Technician(s):	Noel Garland, Miles Watkins
Well ID:	MW08002	Date:	11/15/17
Initial Depth to Water (ft):	29.32	Well Diameter (in):	2.0
Total Depth of Well (ft):	30.39	1 Casing Volume (gal):	0.2
Method of Purging:	Bailed	3 Casing Volumes (gal):	0.5
Measuring Point (toc, tor, etc.):	Top of Riser	Pump Intake Depth (feet):	NA (Bailed)

Time	Water Level (feet)	Flow Rate (mL/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
13:16		0.0								Pumping/Purging Started
13:17	NA	NA	0.17	NA	NA	NA	NA	NA	NA	Brown, extremely turbid, high fines

Stability Reached (Y/N): No If No, Provide Explanation No - Bailed dry without parameters being taken

Final Values:	NA	NA	NA	NA	NA	NA
Sample ID:	ARNLD08-GW-002			Method of Sampling:	Grab	
QA/QC Samples (Yes/No):	No			Sample Date:	11/15/17	
Duplicate ID:	NA			Sample Collection Time:	13:17	
Sample Container Type(s):	2 x 125 mL HDPE			Total Volume Purged (gal):	0.17	
Preservative(s):	Ice (4 °C)			Sample Depth (ft):	NA	
Analysis/Method(s):	PFAS (EPA 537-modified) + FTS List			Depth to Water After Sampling (ft):	30.39 (dry)	

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes
 Water Level Meter

Calculations:
 Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$
 $V = \text{Volume (gal/ft)}$
 $\pi = 3.14$
 $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$
 $H = \text{height of water column (ft)}$
 $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$
 $= \pi * (2.0 \text{ (in)}/12 \text{ (in/ft)})^2 * 2 * 1.07 * 7.48 \text{ gal/ft}^3$
 $= 0.2 \text{ gal.}$

Signature:

Notes:
 Well was bailed dry on two separate purges over the course of 2.5 hours to obtain approximately 225 mL of groundwater. Insufficient volume to collect field parameters.

Name (print):
 Miles Watkins

QA/QC'd by: Thomas W. Hensel **QA/QC Date:** 12/13/2017



GROUNDWATER SAMPLING RECORD

Project Name: Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number: 775303101.0004
Contract: FA8903-16-D-0027	Task Order: 0004
Installation: ARNLD - Arnold AFB	Technician(s): Noel Garland, Miles Watkins
Well ID: MW 232	Date: 11/15/17
Initial Depth to Water (ft): 64.03	Well Diameter (in): 4.0
Total Depth of Well (ft): 79.81	1 Casing Volume (gal): 10.4
Method of Purging: Pumping	3 Casing Volumes (gal): 31.1
Measuring Point (toc, tor, etc.): Top of Riser	Pump Intake Depth (feet): 75.00

Time	Water Level (feet)	Flow Rate (gal/min)	Cum. Volume (gal.)	Temp. (°C)	pH (SU)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, odor, etc.)
Stabilization Criteria				±0.5°C	±0.1	±3%	±10%	±10%	±10% and <10 NTU	
11:43										Pumping/Purging Started
11:48	64.51	0.5	2.5	16.03	6.72	0.106	5.82	69.4	8.02	Clear
11:53	64.55	0.5	5.0	16.09	6.12	0.115	4.38	70.9	9.01	Clear
11:58	64.56	0.5	7.5	16.08	5.96	0.117	4.02	72.4	10.4	Clear
12:03	64.59	0.5	10.0	16.16	5.89	0.121	3.79	75.3	9.09	Clear
12:08	64.59	0.5	12.5	16.09	5.88	0.122	3.73	76.7	8.10	Clear
12:13	64.58	0.5	15.0	16.14	5.88	0.125	3.62	78.3	6.11	Clear
12:18	64.58	0.5	17.5	16.27	5.89	0.125	3.60	79.8	4.43	Clear
12:23	64.58	0.5	20.0	16.08	5.88	0.126	3.58	82.3	2.87	Clear
12:28	64.58	0.5	22.5	16.05	5.88	0.128	3.50	83.3	2.02	Clear
11:33	64.58	0.5	25.0	16.15	5.88	0.129	3.46	83.5	1.84	Clear
12:38	64.58	0.5	27.5	16.11	5.89	0.130	3.42	84.4	1.47	Clear
12:43	64.58	0.5	30.0	16.08	5.89	0.131	3.41	85.0	1.08	Clear
12:48	64.58	0.5	32.2	16.03	5.89	0.131	3.38	84.9	1.48	Clear

Stability Reached (Y/N): Yes If No, Provide Explanation NA

Final Values:	16.03	5.89	0.131	3.38	84.9	1.48
----------------------	-------	------	-------	------	------	------

Sample ID: ARNLD08-GW-004	Method of Sampling: Grab
QA/QC Samples (Yes/No): Yes, DUP, MS/MSD	Sample Date: 11/15/17
Duplicate ID: ARNLD-FD-GW-003	Sample Collection Time: 12:49
Sample Container Type(s): 2 x 125 mL HDPE	Total Volume Purged (gal): 33.0
Preservative(s): Ice (4 °C)	Sample Depth (ft): 75.00
Analysis/Method(s): PFAS (EPA 537-modified) + FTS List	Depth to Water After Sampling (ft): 64.6

Instruments (Manufacturer, Model, and Serial No.):
 Equipment Calibrated (Y/N): Yes Calibrated Within Criteria (Y/N): Yes
 Turbidity Meter, Water Quality Meter, Water Level Meter, Geosubmersible Pump
 Hach 2100Q 11090C012139, YSI 556 MPS 09F100833

Calculations: Saturated well casing volume: $V = \pi(R^2)H \cdot 7.48 \text{ gal/ft}^3$ $V = \text{Volume (gal/ft)}$ $\pi = 3.14$ $R = \text{well radius (ft)} = (\text{well diameter (in)}/12 \text{ (in/ft)})/2$ $H = \text{height of water column (ft)}$ $V = \pi(4.0 \text{ (in)}/12 \text{ (in/ft)})/2^2 \cdot 15.78 \cdot 7.48 \text{ gal/ft}^3$ $= 10.4 \text{ gal.}$	Signature:
---	---------------------------

Notes: None	Name (print): Miles Watkins
---------------------------	---

QA/QC'd by: Thomas W. Hensel **QA/QC Date:** 12/13/2017

APPENDIX B-9

SEDIMENT/SURFACE WATER SAMPLE COLLECTION LOGS

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SAMPLE COLLECTION LOG

SEDIMENT / SURFACE SOIL / SURFACE WATER

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date:	10/11/17
Location ID:	SD05001	Northing/Easting:	NA / NA
Technician(s):	Jason Hayes, Noel Garland		

SEDIMENT SAMPLE

Description	
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency	
Silt (ML), 10YR 5/3, brown, wet, 80% fines, 15% gravel, 5% sand, low plastic, slow dilatancy, low toughness, no dry strength, very soft consistency	
Sample Depth (ft):	0 - 0.5
MS/MSD Collected:	No
Duplicate ID:	NA
Sample Container Type(s):	4 oz. HDPE
Preservative(s):	Ice (4 °C)
Sample ID:	ARNLD05-SD-001
Sample Date:	10/11/17
Sample Collection Time:	14:05
Sample Collection Methods:	Grab
Analysis/Method(s):	PFAS (EPA 537-Modified)

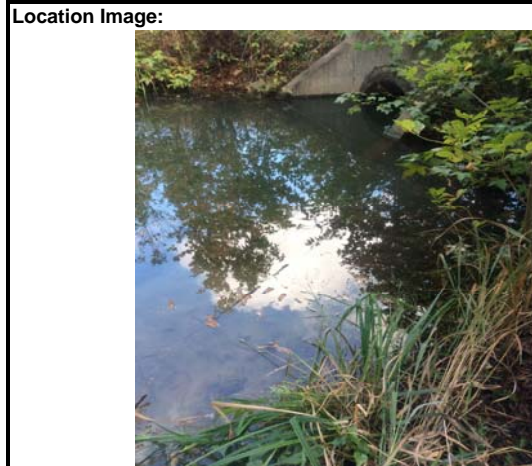
SURFACE SOIL SAMPLE

Description	
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency	
NA	
Sample Depth (ft):	NA
MS/MSD Collected:	NA
Duplicate ID:	NA
Sample Container Type(s):	NA
Preservative(s):	NA
Sample ID:	NA
Sample Date:	NA
Sample Collection Time:	NA
Sample Collection Methods:	NA
Analysis/Method(s):	NA

SURFACE WATER SAMPLE

Time	Intake Depth (in)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, etc.)
NA	NA	NA	NA	NA	NA	NA	NA	NA

Sample Depth (ft):	NA	Sample Date:	NA
Sample ID:	NA	Sample Collection Time:	NA
MS/MSD Collected:	NA	Sample Collection Methods:	NA
Duplicate ID:	NA	Surface Water Depth (ft):	NA
Sample Container Type(s):	NA	Water Body and Water Quality Characteristics:	NA
Preservative(s):	NA		
Analysis/Method(s):	NA		



Caption: Sample SD05001, facing east, approximately 15 ft west of security fence

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N):	NA
Calibrated Within Criteria (Y/N):	NA
Manual Hand Tools	

Notes:	Signature:
None	
	Name (print):
	Jason Hayes

QA/QC'd by:	Thomas W. Hensel		QA/QC Date:	10/30/2017
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SAMPLE COLLECTION LOG

SEDIMENT / SURFACE SOIL / SURFACE WATER

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date:	10/11/17
Location ID:	SD06001	Northing/Easting:	NA / NA
Technician(s):	Noel Garland, Jason Hayes		

SEDIMENT SAMPLE

Description			
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency			
Silty sand (SM), 2.5 Y 6/4 light yellowish brown, wet, 70% sand, 25% fines and 5% gravel, non plastic, slow dilatancy			
Sample Depth (ft):	0 - 0.5	Sample ID:	ARNLD06-SD-001
MS/MSD Collected:	Yes	Sample Date:	10/11/17
Duplicate ID:	NA	Sample Collection Time:	15:45
Sample Container Type(s):	4 oz. HDPE	Sample Collection Methods:	Grab
Preservative(s):	Ice (4 °C)	Analysis/Method(s):	PFAS (EPA 537-Modified)

SURFACE SOIL SAMPLE

Description			
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency			
NA			
Sample Depth (ft):	NA	Sample ID:	NA
MS/MSD Collected:	NA	Sample Date:	NA
Duplicate ID:	NA	Sample Collection Time:	NA
Sample Container Type(s):	NA	Sample Collection Methods:	NA
Preservative(s):	NA	Analysis/Method(s):	NA

SURFACE WATER SAMPLE

Time	Intake Depth (in)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, etc.)
NA	NA	NA	NA	NA	NA	NA	NA	NA

Sample Depth (ft):	NA	Sample Date:	NA
Sample ID:	NA	Sample Collection Time:	NA
MS/MSD Collected:	NA	Sample Collection Methods:	NA
Duplicate ID:	NA	Surface Water Depth (ft):	NA
Sample Container Type(s):	NA	Water Body and Water Quality Characteristics:	
Preservative(s):	NA	NA	
Analysis/Method(s):	NA		



Caption: Sample SD06001, facing east.

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): NA

Calibrated Within Criteria (Y/N): NA

Plastic Sampling Cup

Notes:

None

Signature:

Name (print):
Jason Hayes

QA/QC'd by:	Thomas W. Hensel <i>Thomas W. Hensel</i>	QA/QC Date:	10/30/2017
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SAMPLE COLLECTION LOG

SEDIMENT / SURFACE SOIL / SURFACE WATER

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date:	10/11/17
Location ID:	SD06002	Northing/Easting:	NA / NA
Technician(s):	Noel Garland, Jason Hayes		

SEDIMENT SAMPLE

Description			
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency			
Silty sand with gravel (SM), 2.5 Y 5/4 light olive brown, wet, 50% sand, 30 % fines, and 20% gravel, non plastic, rapid dilatancy			
Sample Depth (ft):	0 - 0.5	Sample ID:	ARNLD06-SD-002
MS/MSD Collected:	No	Sample Date:	10/11/17
Duplicate ID:	NA	Sample Collection Time:	16:20
Sample Container Type(s):	4 oz. HDPE	Sample Collection Methods:	Grab
Preservative(s):	Ice (4 °C)	Analysis/Method(s):	PFAS (EPA 537-Modified)

SURFACE SOIL SAMPLE

Description			
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency			
NA			
Sample Depth (ft):	NA	Sample ID:	NA
MS/MSD Collected:	NA	Sample Date:	NA
Duplicate ID:	NA	Sample Collection Time:	NA
Sample Container Type(s):	NA	Sample Collection Methods:	NA
Preservative(s):	NA	Analysis/Method(s):	NA

SURFACE WATER SAMPLE

Time	Intake Depth (in)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, etc.)
NA	NA	NA	NA	NA	NA	NA	NA	NA

Sample Depth (ft):	NA	Sample Date:	NA
Sample ID:	NA	Sample Collection Time:	NA
MS/MSD Collected:	NA	Sample Collection Methods:	NA
Duplicate ID:	NA	Surface Water Depth (ft):	NA
Sample Container Type(s):	NA	Water Body and Water Quality Characteristics:	
Preservative(s):	NA	NA	
Analysis/Method(s):	NA		



Caption: Sample SD06002. Located near the center of the return ditch.

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N):	NA
Calibrated Within Criteria (Y/N):	NA

Other(s): No tools used. Grab with gloved hand

Notes:	Signature:
None	
	Name (print):
	Jason Hayes

QA/QC'd by:	Thomas W. Hensel	QA/QC Date:	10/30/2017
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SAMPLE COLLECTION LOG

SEDIMENT / SURFACE SOIL / SURFACE WATER

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date:	10/11/17
Location ID:	SD06003	Northing/Easting:	NA / NA
Technician(s):	Noel Garland, Jason Hayes		

SEDIMENT SAMPLE

Description			
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency			
Sandy lean clay (CL), 10YR 5/3 Brown, 60% fines 35 % sand and 5% gravel, wet, medium plastic, no dilatancy, medium toughness, medium dry strength, firm consistency			
Sample Depth (ft):	0 - 0.5	Sample ID:	ARNLD06-SD-003
MS/MSD Collected:	No	Sample Date:	10/11/17
Duplicate ID:	ARNLD-FD-SD-001	Sample Collection Time:	16:40
Sample Container Type(s):	4 oz. HDPE	Sample Collection Methods:	Grab
Preservative(s):	Ice (4 °C)	Analysis/Method(s):	PFAS (EPA 537-Modified)

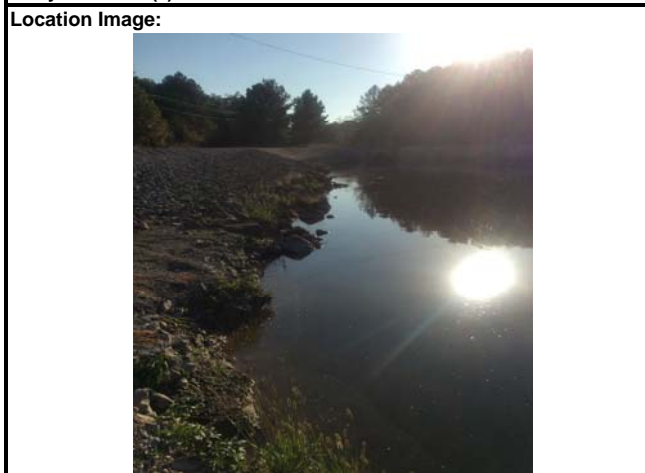
SURFACE SOIL SAMPLE

Description			
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency			
NA			
Sample Depth (ft):	NA	Sample ID:	NA
MS/MSD Collected:	NA	Sample Date:	NA
Duplicate ID:	NA	Sample Collection Time:	NA
Sample Container Type(s):	NA	Sample Collection Methods:	NA
Preservative(s):	NA	Analysis/Method(s):	NA

SURFACE WATER SAMPLE

Time	Intake Depth (in)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, etc.)
NA	NA	NA	NA	NA	NA	NA	NA	NA

Sample Depth (ft):	NA	Sample Date:	NA
Sample ID:	NA	Sample Collection Time:	NA
MS/MSD Collected:	NA	Sample Collection Methods:	NA
Duplicate ID:	NA	Surface Water Depth (ft):	NA
Sample Container Type(s):	NA	Water Body and Water Quality Characteristics:	
Preservative(s):	NA	NA	
Analysis/Method(s):	NA		



Caption: Sample SD06003. Located on western end of return ditch.

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N):	NA
Calibrated Within Criteria (Y/N):	NA

Other(s): No tools used for sample collection. Collected with gloved hand.

Notes:	Signature:
None	
	Name (print): Jason Hayes

QA/QC'd by:	Thomas W. Hensel	QA/QC Date:	10/30/2017
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SAMPLE COLLECTION LOG

SEDIMENT / SURFACE SOIL / SURFACE WATER

Project Name:	Site Inspection of AFFF Release Areas Environmental Programs Worldwide	Project Number:	775303101.0004
Contract:	FA8903-16-D-0027	Task Order:	0004
Installation:	ARNLD - Arnold AFB	Date:	10/11/17
Location ID:	SD07001	Northing/Easting:	NA / NA
Technician(s):	Jason Hayes, Noel Garland		

SEDIMENT SAMPLE

Description	
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency	
Lean clay with gravel (CL), 10YR 5/2 grayish brown, wet, 60% fines, 25% gravel, and 15% sand, medium plastic, no dilatancy, medium toughness, medium dry strength, soft consistency	
Sample Depth (ft):	0 - 0.5
MS/MSD Collected:	No
Duplicate ID:	NA
Sample Container Type(s):	4 oz. HDPE
Preservative(s):	Ice (4 °C)
Sample ID:	ARNLD07-SD-001
Sample Date:	10/11/17
Sample Collection Time:	13:20
Sample Collection Methods:	Grab
Analysis/Method(s):	PFAS (EPA 537-Modified)

SURFACE SOIL SAMPLE

Description	
NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength, consistency	
NA	
Sample Depth (ft):	NA
MS/MSD Collected:	NA
Duplicate ID:	NA
Sample Container Type(s):	NA
Preservative(s):	NA
Sample ID:	NA
Sample Date:	NA
Sample Collection Time:	NA
Sample Collection Methods:	NA
Analysis/Method(s):	NA

SURFACE WATER SAMPLE

Time	Intake Depth (in)	Temp. (°C)	pH (units)	Specific Electrical Conductance (mS/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Comments/Observations During Purging (color, sediment, etc.)	
NA	NA	NA	NA	NA	NA	NA	NA	NA	
Sample Depth (ft):	NA	Sample Date:	NA	Sample ID:	NA	Sample Collection Time:	NA	MS/MSD Collected:	NA
Duplicate ID:	NA	Sample Collection Methods:	NA	Surface Water Depth (ft):	NA	Water Body and Water Quality Characteristics:	NA	Preservative(s):	NA
Analysis/Method(s):	NA								



Caption: SD07001, facing NE, approximately 40 ft SSE of building 2315

Instruments (Manufacturer, Model, and Serial No.):

Equipment Calibrated (Y/N): NA

Calibrated Within Criteria (Y/N): NA

Manual Hand Tools

Notes:

None

Signature:

Name (print):

Jason Hayes

QA/QC'd by:	Thomas W. Hensel	<i>Thomas W. Hensel</i>	QA/QC Date:	10/30/2017
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APPENDIX C

LABORATORY ANALYTICAL REPORTS

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APPENDIX D
DATA VALIDATION REPORT

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DATA VALIDATION REPORT
SITE INSPECTION OF AQUEOUS FILM FORMING FOAM (AFFF) RELEASE AREAS
ENVIRONMENTAL PROGRAMS WORLDWIDE
ARNOLD AIR FORCE BASE

Samples Collected Between 11 October and 15 November 2017

Prepared for:
Air Force Civil Engineer Center
Joint Base San Antonio – Lackland, Texas



Prepared by:



Contract FA8903-16-D-0027

Task Order 0004

January 2018

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Table 2	Field Duplicate Detections
Table 3	Qualifiers Added During Validation

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ACRONYMS AND ABBREVIATIONS

%	Percent
µg/L	Micrograms Per Liter
6:2 FTS	6:2 Fluorotelomer Sulfonate
8:2 FTS	8:2 Fluorotelomer Sulfonate
AFFF	Aqueous Film Forming Foam
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
COC	Chain Of Custody
DL	Detection Limit
DoD	Department Of Defense
EPA	United States Environmental Protection Agency
EtFOSAA	Ethylperfluorooctane Sulfonamidoacetic Acid
ICAL	Initial Calibrations
ICV	Initial Calibration Verification
ID	Identification
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOQ	Limit Of Quantification
MeFOSAA	Methylperfluorooctane Sulfonamidoacetic Acid
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PFASs	Per- And Polyfluoroalkyl Substances
PFBS	Perfluorobutanesulfonic Acid
PFDA	Perfluorodecanoic Acid
PFDoA	Perfluorododecanoic Acid
PFHpA	Perfluoroheptanoic Acid
PFHxA	Perfluorohexanoic Acid

PFHxS	Perfluorohexanesulfonic Acid
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PFTeDA	Perfluorotetradecanoic Acid
PFTrDA	Perfluorotridecanoic Acid
PFUnA	Perfluoroundecanoic Acid
QC	Quality Control
QPP	Quality Program Plan
RPD	Relative Percent Difference
SGS	SGS Accutest

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) collected 26 soil samples (including 2 field duplicates), 6 sediment samples (including 1 field duplicate), and 31 water samples (including 3 field duplicates, 7 equipment blanks, and 1 field blank) between 11 October and 15 November 2017, from Arnold Force Base, located in Tullahoma, Tennessee. Amec Foster Wheeler submitted the samples to SGS Accutest (SGS), located in Orlando, Florida, where they were received on 19 and 24 October and 17 November 2017. SGS assigned the samples to sample delivery groups FA48568, FA48687, and FA49465, and analyzed the samples for per- and polyfluoroalkyl substances (PFASs) by Modified United States Environmental Protection Agency (EPA) Method 537, using the modifications to EPA Method 537 specified in the laboratory's analytical standard operating procedure MS014.3. A list of these samples by field sample identification (ID), sample collection date, sample matrix, and laboratory sample ID is presented in Table 1.

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2.0 DATA VALIDATION METHODOLOGY

Amec Foster Wheeler performed EPA Stage 4 validation on 10 percent (%) of the samples and EPA Stage 2B validation on the remaining samples associated with this sampling event as indicated on Table 1. The Stage 4 validation includes review of the quality control (QC) results in the laboratory's analytical report and reported on QC summary forms as well as recalculation checks and review of the instrument raw data outputs. The Stage 2B validation includes review of the QC results in the laboratory's analytical report and reported on QC summary forms with no review of the associated raw data. Data from equipment and field blanks did not undergo validation because results from these samples are only used to assess data usability for field samples. This data validation has been performed in general accordance with:

- Amec Foster Wheeler, 2017. Final (Revision 1), Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas, Environmental Programs Worldwide, Quality Program Plan (QPP), Contract FA8903-16-D-0027, Task Order 0004, December 2017.
- Department of Defense (DoD), 2013. DoD Quality Systems Manual for Environmental Laboratories, Version 5.0. July 2013.
- EPA, 2009. Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry, Version 1.1, September 2009. EPA Document #: EPA/600/R-08/092.
- EPA, 2014. EPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, EPA/540-R-014-002.

The CLP guideline was written specifically for the CLP, and has been modified for the purposes of this data review where it differs from method-specific, QPP-specified, and laboratory-specified QC requirements.

The laboratory's certified analytical report and supporting documentation were reviewed to assess the following:

- Data package and electronic data deliverable completeness;
- Laboratory case narrative review;
- Chain of custody (COC) compliance;
- Holding time compliance;
- QC sample frequency;
- Initial calibration, initial calibration verification (ICV), and continuing calibration verification (CCV) compliance with method-specified criteria;
- Presence or absence of laboratory contamination as demonstrated by laboratory blanks;

- Accuracy and bias as demonstrated by recovery of surrogate spikes, laboratory control sample (LCS), and matrix spike (MS) samples;
- Internal standard recoveries;
- Analytical precision as relative percent difference (RPD) of analyte concentration between laboratory duplicates or MS/MS duplicate (MSD);
- Sampling and analytical precision as RPD of analyte concentration between field duplicates;
- Assessment of field contamination as demonstrated by field and equipment blanks;
- Insofar as possible, the degree of conformance to method requirements and good laboratory practices.

In general, it is important to recognize that no analytical data are guaranteed to be correct, even if all QC audits are passed. Strict QC serves to increase confidence in data, but any reported value may potentially contain error.

3.0 EXPLANATION OF DATA QUALITY INDICATORS

Summary explanations of the specific data quality indicators reviewed during this data quality review are presented below.

3.1 LABORATORY CONTROL SAMPLE RECOVERIES

LCSs and LCS duplicates (LCSDs) are aliquots of analyte-free matrices that are spiked with the analytes of interest for an analytical method, or a representative subset of those analytes. The spiked matrix is then processed through the same analytical procedures as the samples they accompany. LCS recovery is an indication of a laboratory's ability to successfully perform an analytical method in an interference-free matrix.

3.2 MATRIX SPIKE RECOVERIES

MSs and MSDs are prepared by adding known amounts of the analytes of interest for an analytical method, or a representative subset of those analytes, to an aliquot of sample. The spiked sample is then processed through the same extraction, concentration, cleanup, and analytical procedures as the unspiked samples in an analytical batch.

MS recovery and precision are an indication of a laboratory's ability to successfully recover an analyte in the matrix of a specific sample or closely related sample matrices. It is important not to apply MS results for any specific sample to other samples without understanding how the sample matrices are related.

3.3 BLANK CONCENTRATIONS

Blank samples are aliquots of analyte free matrix that are used as negative controls to verify that the sample collection, storage, preparation, and analysis system does not produce false positive results.

Equipment blanks are prepared by passing analyte-free water through or over sample collection equipment and collecting the water in sample containers. Equipment blanks are analyzed for the analytical suite required for the project. Equipment blanks are used to monitor for possible sample contamination during the sample collection process and serve as a check on the effectiveness of field decontamination procedures.

Field blanks are prepared by pouring an aliquot of analyte-free water into a sample container in the field. Field blanks are analyzed for the analytical suite required for the project. Field blanks are used to monitor for possible sample contamination originating from the water used for equipment decontamination.

Laboratory, equipment, and field blanks are processed by the laboratory using exactly the same procedures as the field samples. Target analytes should not be found in laboratory blanks.

When target analytes are detected in blanks, analyte concentrations in the associated samples less than ten times the concentration detected in the blank will be B qualified.

3.4 LABORATORY AND FIELD DUPLICATES

Laboratory and field duplicate analysis verifies acceptable method precision by the laboratory at the time of preparation and analysis and/or sampling precision at the time of collection.

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4.0 DEFINITIONS OF QUALIFIERS THAT MAY BE USED DURING DATA VALIDATION

- B** The analyte was detected in the sample and an associated blank and the concentration detected in the sample was less than ten times the concentration detected in the blank.
- U** The analyte was analyzed for, but was not detected.
- J** The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- Q** The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.
- UJ** The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- R** The sample result is rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

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5.0 QUALIFICATION REASON CODES

Amec Foster Wheeler applied the following reason code to the data during validation:

- EBG The analyte was detected in an equipment blank at a concentration greater than the limit of quantification (LOQ) and the concentration detected in the sample is less than ten times the concentration detected in the blank.
- EBL The analyte was detected in an equipment blank at a concentration less than the LOQ and the concentration detected in the sample is less than ten times the concentration detected in the blank.
- EXC There were two results for the analysis and this result should be excluded from the data set.
- FDD Imprecision between field duplicate results.
- LDD Imprecision between laboratory duplicate results.
- MSL Low MS recovery. Result may be biased low.
- SGL Low surrogate recovery. Result may be biased low.
- TR Detected concentration is less than the LOQ.

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6.0 CHAIN OF CUSTODY AND SAMPLE RECEIPT CONDITION DOCUMENTATION

The samples were received at the laboratory under proper COC, intact, properly preserved, and at temperatures less than the QPP-specified maximum of 10 degrees Celsius.

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7.0 SPECIFIC DATA VALIDATION FINDINGS

Results from these samples may be considered usable with the limitations and exceptions described Sections 7.1 through 8.0.

7.1 PER- AND POLYFLUOROALKYL SUBSTANCES BY EPA METHOD 537

PFAS results generated by SGS are usable with the limitations described in Sections 7.1.1 through 7.1.10.

7.1.1 Holding Times

The aqueous samples were extracted for PFASs within the QPP-specified maximum holding time of 14 days from sample collection and the extracts were analyzed within the QPP-specified maximum hold time of 28 days from extraction. The solid samples were extracted for PFASs within the method-recommended maximum holding time of 60 days from sample collection and the extracts were analyzed within the method-recommended 30 days from extraction.

7.1.2 Initial Calibrations

The Initial Calibrations (ICALs) associated with the analysis of these samples met the QPP-specified criteria of correlation coefficients greater than 0.99 and the calibration standards calculating to 75 to 125% of its true concentrations.

7.1.3 Initial Calibration Verification

ICV recoveries were within the QPP-specified 75% to 125% limits.

7.1.4 Continuing Calibration Verification

CCV recoveries were within the QPP specified 75% to 125% limits, with the following exceptions:

- Perfluorooctanesulfonic acid (PFOS) and 6:2 fluorotelomer sulfonate (6:2 FTS) recoveries were high at 175% and 131%, respectively, in the CCV associated with the undiluted analysis of sample ARNLD-FD-GW-002. PFOS and 6:2 FTS results were not reported from the undiluted analysis and data usability is not adversely affected by the potentially high analytical bias.

7.1.5 Laboratory Blanks

PFASs were not detected in the laboratory blanks associated with these samples.

7.1.6 Field and Equipment Blanks

PFASs were not detected in the field and equipment blanks associated with these samples, with the following exceptions:

- Perfluorohexanesulfonic acid (PFHxS) and PFOS were detected at concentrations of 0.0204 micrograms per liter ($\mu\text{g/L}$) and 0.0262 $\mu\text{g/L}$, respectively, in equipment blank ARNLD-EB-002, associated with samples ARNLD01-SO-001, ARNLD01-SO-002, ARNLD01-SO-003, and ARNLD01-SO-004. Data limitations are summarized below.

- Amec Foster Wheeler B qualified the detected PFHxS and PFOS results from samples ARNLD01-SO-001, ARNLD01-SO-002, and ARNLD01-SO-004 because the concentrations detected in the samples were less than ten times the concentrations detected in the blank. (Qualifier and reason code: B-EBG)
- Amec Foster Wheeler B qualified the detected PFHxS result from sample ARNLD01-SO-003 because the concentration detected in the sample was less than ten times the concentration detected in the blank. (Qualifier and reason code: B-EBG)
- The PFOS concentration detected in sample ARNLD01-SO-003 was more than ten times the concentration detected in the blank and data usability is not adversely affected by the blank detection.
- PFHxS and PFOS were detected at concentrations of 0.0123 µg/L and 0.0149 µg/L, respectively, in equipment blank ARNLD-EB-003. There were no field samples collected on the same day as this blank and Amec Foster Wheeler did not qualify data based on these blank detections.
- PFOS was detected at a concentration of 0.00652 µg/L in equipment blank ARNLD-EB-007, associated with samples ARNLD04-GW-002, ARNLD04-SO-001, ARNLD04-SO-002, ARNLD05-SO-001, ARNLD05-SO-002, ARNLD05-SO-003, ARNLD05-SO-004, ARNLD07-GW-001, ARNLD07-GW-003, and ARNLD-FD-SO-002. Data limitations are summarized below.
 - Amec Foster Wheeler B qualified the detected PFOS results from samples ARNLD04-GW-002, ARNLD05-SO-001, ARNLD05-SO-002, ARNLD05-SO-003, and ARNLD07-GW-003 because the concentrations detected in the samples were less than ten times the concentration detected in the blank. (Qualifier and reason code: B-EBL)
 - PFOS either was not detected in the remaining samples, or was detected at concentrations greater than ten times the concentration detected in the blank and data usability is not adversely affected.
- Perfluorobutanesulfonic acid (PFBS) and PFOS were detected at concentrations of 0.0162 µg/L and 0.00914 µg/L, respectively, in equipment blank ARNLD-EB-008, associated with samples ARNLD08-GW-004 and ARNLD-FD-GW-003. PFBS and PFOS concentrations detected in the associated samples were greater than ten times the concentrations detected in the blank and data usability is not adversely affected.

7.1.7 Laboratory Control Sample Accuracy

LCS recoveries were within QPP-specified 70 to 130% limits.

7.1.8 Matrix Spikes/ Matrix Spike Duplicates

SGS performed MS and/or MSD analyses on samples ARNLD01-SO-002, ARNLD02-GW-002, ARNLD06-SD-001, ARNLD07-SO-003, ARNLD08-GW-004, and ARNLD09-INF-001. Recoveries were within the QPP-specified 70

to 130% limits and RPDs between MS and MSD results were less than the QPP-specified maximum of 30%, with the following exceptions:

- All recoveries were low in the MS and MSD performed on sample ARNLD01-SO-002. Additionally, perfluoroundecanoic acid (PFUnA) was not recovered from the MSD. Data limitations are summarized below.
 - Amec Foster Wheeler R qualified and rejected the non-detected PFUnA result from sample ARNLD01-SO-002 because the analyte could not be recovered from the MSD. (Qualifier and reason code: R-MSL)
 - The PFHxS and PFOS results from sample ARNLD01-SO-002 were previously B qualified because of detections in the associated equipment blank and it is not possible to apply combined qualifiers for this project. Amec Foster Wheeler Q qualified the PFHxS and PFOS results from this sample to indicate that the results should be both B qualified because of the blank detections and J qualified because of the low MS recoveries. (Qualifier and reason code Q-MSL)
 - Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected remaining analytes in sample ARNLD01-SO-002 because of potentially low analytical bias. (Qualifiers and reason code: J/UJ-MSL)
- The MS and MSD performed on sample ARNLD02-GW-002 were analyzed at 1:100 dilutions due to high target analyte concentrations in the unspiked native sample. The high dilutions reduced the spike concentrations to levels that were not detectable and Amec Foster Wheeler did not evaluate MS or MSD recoveries for this spiked sample.
- Perfluorohexanoic acid (PFHxA, 66%-MS), perfluoroheptanoic acid (PFHpA, 66%-MS), perfluorooctanoic acid (PFOA, 67%-MS), perfluorononanoic acid (PFNA, 69%-MS), perfluorodecanoic acid (PFDA, 68%-MS), PFUnA (66% and 66%), perfluorododecanoic acid (PFDoA, 67% and 68%), perfluorotridecanoic acid (PFTTrDA, 61% and 54%), perfluorotetradecanoic acid (PFTeDA, 55% and 36%), PFBS (66%-MS), PFOS (58%-MS), methylperfluorooctane sulfonamidoacetic acid (MeFOSAA, 66%-MS), ethylperfluorooctane sulfonamidoacetic acid (EtFOSAA, 66%-MS), and 6:2 FTS (68%-MS) recoveries were low in the MS and/or MSD performed on sample ARNLD06-SD-001. Additionally, the RPD between MS and MSD results for PFTeDA was high at 37%. Data limitations are summarized below.
 - Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnA, PFDoA, PFTeDA, PFTTrDA, PFBS, PFOS, MeFOSAA, EtFOSAA, and 6:2 FTS result from sample ARNLD06-SD-001 because of potentially low analytical bias. (Qualifiers and reason code: J/UJ-MSL)
 - PFTeDA was not detected in the unspiked native sample and data usability is not adversely affected by the potential analytical imprecision.

- PFNA (68%-MSD), PFDA (67% and 65%), PFTrDA (68%-MSD), PFOS (58% and 63%), MeFOSAA (55% and 53%), and EtFOSAA (58% and 57%) recoveries were low in the MS and/or MSD performed on sample ARNLD07-SO-003. Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected PFNA, PFDA, PFTrDA, PFOS, MeFOSAA, and EtFOSAA results from sample ARNLD07-SO-003 because of potentially low analytical bias. (Qualifiers and reason code: J/UJ-MSL)
- PFHxA (-14% and -27%), PFHpA (54% and 51%), PFOA (57% and 49%), PFDA (67%-MS), PFBS (68% and 64%), PFOS (26%-MSD), EtFOSAA (69%-MSD), 6:2 FTS (59% and -20%), and 8:2 fluorotelomer sulfonate (8:2 FTS, 69%-MS) recoveries were low in the MS and/or MSD performed on sample ARNLD08-GW-004. Data limitations are summarized below.
 - Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected PFHpA, PFDA, EtFOSAA, and 8:2 FTS results from sample ARNLD08-GW-004 and its field duplicate ARNLD-FD-GW-003 because of potentially low analytical bias. (Qualifiers and reason code: J/UJ-MSL)
 - PFHxA, PFOA, PFBS, PFOS, and 6:2 FTS concentrations detected in the unspiked native sample were more than the spike concentrations and it is not possible to assess data usability for these analytes based on MS recoveries.

7.1.9 Laboratory Duplicate

SGS performed a duplicate analysis on sample ARNLD01-GW-002. RPDs between primary and duplicate results were less than 30% or differences between primary and duplicate results were less than the LOQ, with the following exceptions:

- RPDs between primary and duplicate results were high for PFHxA (39%), PFOA (35%), and PFBS (39%) in the duplicate analysis of sample ARNLD01-GW-002. Amec Foster Wheeler J qualified the detected PFHxA, PFOA, and PFBS results from sample ARNLD01-GW-002 and its field duplicate ARNLD-FD-GW-001 because of potential analytical imprecision. (Qualifier and reason code: J-LDD)

7.1.10 Surrogate Recoveries

Surrogate recoveries were within the QPP-specified 70 to 130% limits for field samples analyzed at dilutions up to five-fold, with the following exceptions:

- Recovery of the surrogate compound $^{13}\text{C}_2$ -PFDA was high at 131% in equipment blank ARNLD-EB-006 and recoveries of the surrogate compounds $^{13}\text{C}_2$ -PFHxA and $^{13}\text{C}_2$ -PFDA were high at 132% and 147%, respectively, in equipment blank ARNLD-EB-008. Amec Foster Wheeler does not qualify data from equipment blanks and no results from field samples were qualified based on these high surrogate recoveries.
- Recoveries of the surrogate compound d5-EtFOSAA were less than the QPP-specified minimum of 70%, but within laboratory-specified limits in samples ARNLD01-GW-001, ARNLD07-SO-003, and

- ARNLD08-SO-003. Amec Foster Wheeler UJ qualified the non-detected MeFOSAA and EtFOSAA results from these samples because of potentially low analytical bias. (Qualifier and reason code: UJ-SGL)
- Recoveries of all three surrogate compounds were low in samples ARNLD01-SO-002 and ARNLD01-SO-004. The low surrogate recoveries were confirmed by the analysis of a MS and MSD performed on sample ARNLD01-SO-002 and re-extraction and reanalysis of sample ARNLD01-SO-004. Data limitations are summarized below.
 - The PFHxS and PFOS results from these samples were previously B qualified because of blank detections and it is not possible to apply combined qualifiers for this project. Amec Foster Wheeler Q qualified the PFHxS and PFOS results because of the low surrogate recovery combined with the blank detections. (Qualifier and reason code: Q-SGL)
 - The PFUnA result from sample ARNLD01-SO-002 was previously rejected because of extremely low MS recovery and further qualification is not warranted.
 - Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected results for the remaining analytes in these samples because of the low surrogate recoveries. (Qualifiers and reason codes: J/UJ-SGL)
 - Recoveries of all three surrogate compounds were low in samples ARNLD03-SO-002, ARNLD-FD-SO-001, ARNLD05-SO-004, ARNLD07-SO-002, ARNLD-FD-SO-002, ARNLD07-SO-004, ARNLD07-SO-006, ARNLD08-SO-002, and ARNLD08-SO-004. SGS re-extracted and reanalyzed the samples and surrogate recoveries remained low. Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected PFAS results from these samples because of potentially low analytical bias. (Qualifiers and reason code: J/UJ-SGL)
 - Recoveries of all 3 surrogate compounds were less than the QPP-specified minimum of 70%, but within laboratory-specified limits in sample ARNLD03-SO-004. Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected PFAS results from this sample because of potentially low analytical bias. (Qualifiers and reason code: J/UJ-SGL)
 - Recovery of the surrogate compound d5-EtFOSAA was low at 39% in the 1:5 dilution of sample ARNLD04-SO-002. MeFOSAA and EtFOSAA were not reported from the 1:5 dilution and data usability is not adversely affected by the low surrogate recovery.
 - Recovery of the surrogate compound ¹³C₂-PFHxA was low at 69% in sample ARNLD06-SD-002. Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, and 6:2 FTS results from sample ARNLD06-SD-002 due to potentially low analytical bias. (Qualifiers and reason code J/UJ-SGL)

- Recoveries of the surrogate compounds $^{13}\text{C}_2$ -PFDA and d5-EtFOSAA were both lower than the QAPP-specified minimum of 70%, but within laboratory-specified limits, at 69%, in sample ARNLD07-SO-005. Amec Foster Wheeler J qualified the detected and UJ qualified the non-detected PFNA, PFDA, PFUnA, PFDaA, PFTrDA, PFTeDA, MeFOSAA, EtFOSAA, and 8:2 FTS results from sample ARNLD07-SO-005 because of potentially low analytical bias. (Qualifiers and reason code: J/UJ-SGL)
- Surrogates were not recovered from the 1:10 dilutions performed on samples ARNLD05-GW-001, ARNLD05-GW-002, ARNLD07-GW-001, ARNLD07-GW-002, and ARNLDL-FD-GW-002; the 1:20 dilution performed on sample ARNLD04-SO-002; the 1:100 dilutions performed on samples ARNLD01-GW-002, ARNLD02-GW-002, and ARNLD03-GW-001; and the 1:250 dilution performed on sample ARNLD01-GW-002. The high dilutions reduced surrogate concentrations below detectable limits and it is not possible to assess data usability for these analyses based on surrogate recoveries.

7.1.11 Internal Standard Recoveries

Internal standard areas were within the QPP-specified limits of 50 to 150% of the average area counts measured during the initial calibration.

7.1.12 Data Reporting and Analytical Procedures

SGS J qualified analytes with concentrations between the detection limit (DL) and the LOQ. Amec Foster Wheeler agrees that these results are quantitatively uncertain and has J qualified these results. (Qualifier and reason code: J-TR)

SGS calibrates their instrument using both linear and branched isomers, when available, but the solution used for calibration verification and spiking contains linear isomers only. The analytical software is unable to correctly auto-integrate analytes when peaks for both linear and branched isomers are present, so the calibration standards, CCVs, and samples containing both linear and branched isomers require manual integration.

SGS reported two PFHxS results for sample ARNLD02-GW-002, a non-detect result, with a limit of detection of 0.012 $\mu\text{g}/\text{L}$ and a detection of 17.0 $\mu\text{g}/\text{L}$. Amec Foster Wheeler chose to report the detection of 17.0 $\mu\text{g}/\text{L}$ because it is highly likely that the concentration was high enough that the peak shifted outside of the analyte's retention time window in the undiluted analysis. Amec Foster Wheeler R qualified the non-detected PFHxS result from this sample to indicate that the detected result should be reported and this rejection does not affect overall data usability. (Qualifier and reason code: R-EXC)

8.0 FIELD DUPLICATE RESULTS

Amec Foster Wheeler collected a field duplicate with samples ARNLD01-GW-002 (ARNLD-FD-GW-001), ARNLD05-GW-002 (ARNLD-FD-GW-002), ARNLD08-GW-004 (ARNLD-FD-GW-003), ARNLD06-SD-003 (ARNLD-FD-SD-001), ARNLD03-SO-002 (ARNLD-FD-SO-001), and ARNLD07-SO-002 (ARNLD-FD-SO-002). Detected results and RPDs for the field duplicate are summarized in Table 2. Precision values were within the QPP-specified limits of less than 30% RPD or the difference between analytical results less than the LOQ, with the following exceptions:

- The RPD between PFHxS results from sample ARNLD01-GW-002 and its field duplicate ARNLD-FD-GW-001 was high at 38%. Amec Foster Wheeler J qualified the detected PFHxS results from samples ARNLD01-GW-002 and ARNLD-FD-GW-001 because of potential sampling or analytical imprecision. (Qualifier and reason code: J-FDD)
- RPDs between PFOA (118%), PFHxS (94%), and PFOS (150%) results from sample ARNLD03-SO-002 and its field duplicate ARNLD-FD-SO-001 were high. Amec Foster Wheeler J qualified the detected PFOA, PFHxS, and PFOS results from samples ARNLD03-SO-002 and ARNLD-FD-SO-001 because of potential sampling or analytical imprecision. (Qualifier and reason code: J-FDD)

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9.0 SUMMARY AND CONCLUSIONS

Amec Foster Wheeler evaluated a total of 848 data records from field samples during the validation. Amec Foster Wheeler R qualified and rejected 1 result (0.12%) because of low MS recovery; J or UJ qualified 308 records (36%) as estimated values because of imprecision between laboratory duplicate results, low MS recoveries, low surrogate recoveries, analyte concentrations between the DL and the LOQ, and/or field duplicate imprecision; B qualified 8 results (0.94%) because of detections in the associated equipment blanks; and Q qualified 4 results (0.47%) because of blank detections coupled with additional QC exceedances.

More than 99% of the data should be considered usable, meeting the QPP-specified 90% completeness goal. Qualified data are summarized in Table 3.

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REFERENCES

- Amec Foster Wheeler, 2017. Final (Revision 1), Site Inspection of Aqueous Film Forming Foam (AFFF) Release Areas, Environmental Programs Worldwide, Quality Program Plan (QPP), Contract FA8903-16-D-0027, Task Order 0004, December 2017.
- Department of Defense (DOD), 2017. DoD Quality Systems Manual for Environmental Laboratories, Version 5.1. January 2017.
- EPA, 2009. Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS), Version 1.1, September 2009. EPA Document #: EPA/600/R-08/092.
- EPA, 2014. EPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review, EPA/540-R-014-002.

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TABLES

APPENDIX E

2016 PFAS ANALYTICAL REPORT

LABORATORY REPORT

If you have any questions concerning this report, please do not hesitate to call us at (800) 332-4345 or (574) 233-4777.

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STATE CERTIFICATION LIST

State	Certification	State	Certification
Alabama	40700	Montana	CERT0026
Alaska	IN00035	Nebraska	E87775
Arizona	AZ0432	Nevada	IN00035
Arkansas	IN00035	New Hampshire*	2124
California	2920	New Mexico	IN00035
Colorado	IN035	New Jersey*	IN598
Colorado Radiochemistry	IN035	New York*	11398
Connecticut	PH-0132	North Carolina	18700
Delaware	IN035	North Dakota	R-035
Florida*	E87775	Ohio	87775
Georgia	929	Oklahoma	D9508
Hawaii	IN035	Oregon (Primary AB)*	4074-001
Idaho	IN00035/E87775	Pennsylvania*	68-00466
Illinois*	200001	Puerto Rico	IN00035
Illinois Microbiology	200001	Rhode Island	LAO00343
Indiana Chemistry	C-71-01	South Carolina	95005
Indiana Microbiology	M-76-07	South Dakota	IN00035
Iowa	098	Tennessee	TN02973
Kansas*	E-10233	Texas*	T104704187-15-8
Kentucky	90056	Texas/TCEQ	TX207
Louisiana*	LA160002	Utah*	IN00035
Maine	IN00035	Vermont	VT-8775
Maryland	209	Virginia*	460275
Massachusetts	M-IN035	Washington	C837
Michigan	9926	West Virginia	9927 C
Minnesota*	018-999-338	Wisconsin	999766900
Mississippi	IN035	Wyoming	IN035
Missouri	880		

*NELAP/TNI Recognized Accreditation Bodies

110 South Hill Street
 South Bend, IN 46617
 Tel: (574) 233-4777
 Fax: (574) 233-8207
 1 800 332 4345

Laboratory Report

Client: Wright-Patterson/USAFSAM OE Lab - IH
 Attn: Hollie Hoffman
 2510 Fifth Street
 South Bldg 20840, Rm W327.20
 Wright-Patterson AFB, OH 45433

Report: 371229
 Call Number: 16DW040
 Base Code: 0410Z
 Site ID: Not Supplied

PWS ID: Not Supplied

Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3531565	Outdoor Rec Treated	537	08/23/16 09:56	Client	08/25/16 08:30

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Kelly Trott at (574) 233-4777.

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Kelly Trott Analytical Services Manager

Authorized Signature

Title

Date

Base Code: 0410Z

Page 1 of 2

Base Name: Arnold AFB

Site ID: Not Supplied

Base Number: Outdoor Rec Treated

LIMS Number: W1609031-01A

UL Methods									
PARAMETER	CAS#	Method	MRL†	Result	Reg Limit	Units	Flag	Preparation Date	Analyzed Date
Perfluorobutanesulfonic acid	375-73-5	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:43
Perfluoroheptanoic acid	375-85-9	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:43
Perfluorohexanesulfonic acid	355-46-4	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:43
Perfluorononanoic acid	375-95-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:43
Perfluorooctane sulfonate	1763-23-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:43
Perfluorooctanoic acid	335-67-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:43

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!



Eaton Analytical

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South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Wright-Patterson/USAFSAM OE Lab - IH
Attn: Hollie Hoffman
2510 Fifth Street
South Bldg 20840, Rm W327.20
Wright-Patterson AFB, OH 45433

Report: 371229
Call Number: 16DW040
Base Code: 0410Z
Site ID: Not Supplied

PWS ID: TN0004408

Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3531567	Water Treatment Plant Treated	537	08/23/16 09:07	Client	08/25/16 08:30

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Kelly Trott at (574) 233-4777.

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Kelly Trott Analytical Services Manager

09/23/2016

Authorized Signature

Title

Date

Base Code: 0410Z

Page 1 of 2

Base Name: Arnold AFB

UL Methods									
PARAMETER	CAS#	Method	MRL†	Result	Reg Limit	Units	Flag	Preparation Date	Analyzed Date
Perfluorobutanesulfonic acid	375-73-5	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:10
Perfluoroheptanoic acid	375-85-9	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:10
Perfluorohexanesulfonic acid	355-46-4	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:10
Perfluorononanoic acid	375-95-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:10
Perfluorooctane sulfonate	1763-23-1	537	2.0	3.5	---	ng/L	---	09/02/16 08:09	09/03/16 12:10
Perfluorooctanoic acid	335-67-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:10

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

110 South Hill Street
 South Bend, IN 46617
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Laboratory Report

Client: Wright-Patterson/USAFSAM OE Lab - IH
 Attn: Hollie Hoffman
 2510 Fifth Street
 South Bldg 20840, Rm W327.20
 Wright-Patterson AFB, OH 45433

Report: 371229
 Call Number: 16DW040
 Base Code: 0410Z
 Site ID: Not Supplied

PWS ID: TN0004408

Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3531568	Water Treatment Plant Treated	537	08/23/16 09:07	Client	08/25/16 08:30

Report Summary

Note: The sample submitted for Method 537 analysis was extracted outside the fourteen day hold time.

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Kelly Trott at (574) 233-4777.

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Kelly Trott Analytical Services Manager

09/23/2016

Authorized Signature

Title

Date

Base Code: 0410Z

Page 1 of 2

Base Name: Arnold AFB

Site ID: Not Supplied

Base Number: Water Treatment Plant Treated FTB

LIMS Number: W1609031-04A

UL Methods									
PARAMETER	CAS#	Method	MRL†	Result	Reg Limit	Units	Flag	Preparation Date	Analyzed Date
Perfluorobutanesulfonic acid	375-73-5	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:02
Perfluoroheptanoic acid	375-85-9	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:02
Perfluorohexanesulfonic acid	355-46-4	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:02
Perfluorononanoic acid	375-95-1	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:02
Perfluorooctane sulfonate	1763-23-1	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:02
Perfluorooctanoic acid	335-67-1	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:02

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!



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1 800 332 4345

Laboratory Report

Client: Wright-Patterson/USAFSAM OE Lab - IH
Attn: Hollie Hoffman
2510 Fifth Street
South Bldg 20840, Rm W327.20
Wright-Patterson AFB, OH 45433

Report: 371229
Call Number: 16DW040
Base Code: 0410Z
Site ID: Not Supplied

PWS ID: TN0004409

Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3531569	Golf Course Well Raw	537	08/23/16 09:35	Client	08/25/16 08:30

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Kelly Trott at (574) 233-4777.

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Kelly Trott Analytical Services Manager

Authorized Signature

Title

09/23/2016

Date

Base Code: 0410Z

Page 1 of 2

Base Name: Arnold AFB

Site ID: Not Supplied

Base Number: Golf course Well Raw

LIMS Number: W1609031-05A

UL Methods									
PARAMETER	CAS#	Method	MRL†	Result	Reg Limit	Units	Flag	Preparation Date	Analyzed Date
Perfluorobutanesulfonic acid	375-73-5	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:26
Perfluoroheptanoic acid	375-85-9	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:26
Perfluorohexanesulfonic acid	355-46-4	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:26
Perfluorononanoic acid	375-95-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:26
Perfluorooctane sulfonate	1763-23-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:26
Perfluorooctanoic acid	335-67-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 12:26

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!



Eaton Analytical

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South Bend, IN 46617
Tel: (574) 233-4777
Fax: (574) 233-8207
1 800 332 4345

Laboratory Report

Client: Wright-Patterson/USAFSAM OE Lab - IH
Attn: Hollie Hoffman
2510 Fifth Street
South Bldg 20840, Rm W327.20
Wright-Patterson AFB, OH 45433

Report: 371229
Call Number: 16DW040
Base Code: 0410Z
Site ID: Not Supplied

PWS ID: TN0004408

Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3531571	Water Treatment Plant Raw	537	08/23/16 09:09	Client	08/25/16 08:30

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Kelly Trott at (574) 233-4777.

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Title

09/23/2016

Date

Base Code: 0410Z

Page 1 of 2

Base Name: Arnold AFB

Site ID: Not Supplied

Base Number: Water Treatment Plant Raw

LIMS Number: W1609031-07A

UL Methods									
PARAMETER	CAS#	Method	MRL†	Result	Reg Limit	Units	Flag	Preparation Date	Analyzed Date
Perfluorobutanesulfonic acid	375-73-5	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:39
Perfluoroheptanoic acid	375-85-9	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:39
Perfluorohexanesulfonic acid	355-46-4	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:39
Perfluorononanoic acid	375-95-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:39
Perfluorooctane sulfonate	1763-23-1	537	2.0	3.9	---	ng/L	---	09/02/16 08:09	09/03/16 21:39
Perfluorooctanoic acid	335-67-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:39

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

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 Fax: (574) 233-8207
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Laboratory Report

Client: Wright-Patterson/USAFSAM OE Lab - IH
 Attn: Hollie Hoffman
 2510 Fifth Street
 South Bldg 20840, Rm W327.20
 Wright-Patterson AFB, OH 45433

Report: 371229
 Call Number: 16DW040
 Base Code: 0410Z
 Site ID: Not Supplied

PWS ID: TN0004408

Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3531572	Water Treatment Plant Raw FTB	537	08/23/16 09:09	Client	08/25/16 08:30

Report Summary

Note: The sample submitted for Method 537 analysis was extracted outside the fourteen day hold time.

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Kelly Trott at (574) 233-4777.

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09/23/2016

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Title

Date

Base Code: 0410Z

Page 1 of 2

Base Name: Arnold AFB

Site ID: Not Supplied

Base Number: Water Treatment Plant Raw FTB

LIMS Number: W1609031-08A

UL Methods									
PARAMETER	CAS#	Method	MRL†	Result	Reg Limit	Units	Flag	Preparation Date	Analyzed Date
Perfluorobutanesulfonic acid	375-73-5	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:18
Perfluoroheptanoic acid	375-85-9	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:18
Perfluorohexanesulfonic acid	355-46-4	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:18
Perfluorononanoic acid	375-95-1	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:18
Perfluorooctane sulfonate	1763-23-1	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:18
Perfluorooctanoic acid	335-67-1	537	2.0	< 2.0	---	ng/L	---	09/13/16 08:13	09/14/16 03:18

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!



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Laboratory Report

Client: Wright-Patterson/USAFSAM OE Lab - IH
Attn: Hollie Hoffman
2510 Fifth Street
South Bldg 20840, Rm W327.20
Wright-Patterson AFB, OH 45433

Report: 371229
Call Number: 16DW040
Base Code: 0410Z
Site ID: Not Supplied

PWS ID: TN0004409

Sample Information					
EEA ID #	Client ID	Method	Collected Date / Time	Collected By:	Received Date / Time
3531573	Golf Course Treated	537	08/23/16 09:31	Client	08/25/16 08:30

Report Summary

Detailed quantitative results are presented on the following pages. The results presented relate only to the samples provided for analysis.

We appreciate the opportunity to provide you with this analysis. If you have any questions concerning this report, please do not hesitate to call Kelly Trott at (574) 233-4777.

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Kelly Trott Analytical Services Manager

Authorized Signature

Title

09/23/2016

Date

Base Code: 0410Z

Page 1 of 2

Base Name: Arnold AFB

Site ID: Not Supplied

Base Number: Golf Course Treated

LIMS Number: W1609031-019

UL Methods									
PARAMETER	CAS#	Method	MRL†	Result	Reg Limit	Units	Flag	Preparation Date	Analyzed Date
Perfluorobutanesulfonic acid	375-73-5	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:56
Perfluoroheptanoic acid	375-85-9	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:56
Perfluorohexanesulfonic acid	355-46-4	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:56
Perfluorononanoic acid	375-95-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:56
Perfluorooctane sulfonate	1763-23-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:56
Perfluorooctanoic acid	335-67-1	537	2.0	< 2.0	---	ng/L	---	09/02/16 08:09	09/03/16 21:56

† EEA has demonstrated it can achieve these report limits in reagent water, but can not document them in all sample matrices.

Reg Limit Type:	MCL	SMCL	AL
Symbol:	*	^	!

Lab Definitions

Continuing Calibration Check Standard (CCC) / Continuing Calibration Verification (CCV) / Initial Calibration Verification Standard (ICV) / Initial Performance Check (IPC) - is a standard containing one or more of the target analytes that is prepared from the same standards used to calibrate the instrument. This standard is used to verify the calibration curve at the beginning of each analytical sequence, and may also be analyzed throughout and at the end of the sequence. The concentration of continuing standards may be varied, when prescribed by the reference method, so that the range of the calibration curve is verified on a regular basis. CCL, CCM, and CCH are the CCC standards at low, mid, and high concentration levels, respectively.

Internal Standards (IS) - are pure compounds with properties similar to the analytes of interest, which are added to field samples or extracts, calibration standards, and quality control standards at a known concentration. They are used to measure the relative responses of the analytes of interest and surrogates in the sample, calibration standard or quality control standard.

Laboratory Duplicate (LD) - is a field sample aliquot taken from the same sample container in the laboratory and analyzed separately using identical procedures. Analysis of laboratory duplicates provides a measure of the precision of the laboratory procedures.

Laboratory Fortified Blank (LFB) / Laboratory Control Sample (LCS) - is an aliquot of reagent water to which known concentrations of the analytes of interest are added. The LFB is analyzed exactly the same as the field samples. LFBs are used to determine whether the method is in control. FBL, FBM, and FBH are the LFB samples at low, mid, and high concentration levels, respectively.

Laboratory Method Blank (LMB) / Laboratory Reagent Blank (LRB) - is a sample of reagent water included in the sample batch analyzed in the same way as the associated field samples. The LMB is used to determine if method analytes or other background contamination have been introduced during the preparation or analytical procedure. The LMB is analyzed exactly the same as the field samples.

Laboratory Trip Blank (LTB) / Field Reagent Blank (FRB) - is a sample of laboratory reagent water placed in a sample container in the laboratory and treated as a field sample, including storage, preservation, and all analytical procedures. The FRB/LTB container follows the collection bottles to and from the collection site, but the FRB/LTB is not opened at any time during the trip. The FRB/LTB is primarily a travel blank used to verify that the samples were not contaminated during shipment.

Matrix Spike Duplicate Sample (MSD) / Laboratory Fortified Sample Matrix Duplicate (LFSMD) - is a sample aliquot taken from the same field sample source as the Matrix Spike Sample to which known quantities of the analytes of interest are added in the laboratory. The MSD is analyzed exactly the same as the field samples. Analysis of the MSD provides a measure of the precision of the laboratory procedures in a specific matrix. SDL, SDM, and SDH / LFSMDL, LFSMDM, and LFSMDH are the MSD or LFSMD at low, mid, and high concentration levels, respectively.

Matrix Spike Sample (MS) / Laboratory Fortified Sample Matrix (LFSM) - is a sample aliquot taken from field sample source to which known quantities of the analytes of interest are added in the laboratory. The MS is analyzed exactly the same as the field samples. The purpose is to demonstrate recovery of the analytes from a sample matrix to determine if the specific matrix contributes bias to the analytical results. MSL, MSM, and MSH / LFSML, LFSMM, and LFSMH are the MS or LFSM at low, mid, and high concentration levels, respectively.

Quality Control Standard (QCS) / Second Source Calibration Verification (SSCV) - is a solution containing known concentrations of the analytes of interest prepared from a source different from the source of the calibration standards. The solution is obtained from a second manufacturer or lot if the lot can be demonstrated by the manufacturer as prepared independently from other lots. The QCS sample is analyzed using the same procedures as field samples. The QCS is used as a check on the calibration standards used in the method on a routine basis.

Reporting Limit Check (RLC) / Initial Calibration Check Standard (ICCS) - is a procedural standard that is analyzed each day to evaluate instrument performance at or below the minimum reporting limit (MRL).

Surrogate Standard (SS) / Surrogate Analyte (SUR) - is a pure compound with properties similar to the analytes of interest, which is highly unlikely to be found in any field sample, that is added to the field samples, calibration standards, blanks and quality control standards before sample preparation. The SS is used to evaluate the efficiency of the sample preparation process.



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Batch # 371229

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CHAIN OF CUSTODY RECORD

Page 1 of 1

REPORT TO: Joshua Syggs, TSS1, TSS2-56
225 von Karman, ArnoldAFB 37389
 BILL TO:

Shaded area for EEA use only

LAB Number	COLLECTION		SAMPLER (Signature)	COMPLIANCE MONITORING	Yes	No	POPULATION SERVED	PWS ID #	STATE (sample origin)	PROJECT NAME	CHLORINATED		# OF CONTAINERS	MATRIX CODE	TURNAROUND TIME
	DATE	TIME									AM	PM			
1	23 Aug 16	0956	<i>[Signature]</i>	OUTDOOR	11		NA		DM	Treated	X		1	SW	
2	23 Aug 16	0956	<i>[Signature]</i>	OUTDOOR	11		NA		DM	F-TB	X		1	SW	
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															

RELINQUISHED BY: (Signature) *[Signature]* DATE 8/25/16 TIME 4:50 AM | PM

RECEIVED BY: (Signature) *[Signature]* DATE 8/25/16 TIME 0830 AM | PM

RELINQUISHED BY: (Signature) *[Signature]* DATE 8/25/16 TIME 0830 AM | PM

RECEIVED FOR LABORATORY BY: *[Signature]*

LAB COMMENTS: LAB COMMENTS

CONDITIONS UPON RECEIPT (check one):
 Ice/Wet/Blue Ambient 5.8 °C Upon Receipt N/A

MATRIX CODES:
 DW-DRINKING WATER
 RW-REAGENT WATER
 GW-GROUND WATER
 EW-EXPOSURE WATER
 SW-SURFACE WATER
 PW-POOL WATER
 WW-WASTE WATER

TURN-AROUND TIME (TAT) - SURCHARGES
 SW = Standard Written: (15 working days) 0%
 RV = Rush Verbal: (5 working days) 50%
 RW = Rush Written: (5 working days) 75%

STAT* = Less than 48 hours
 IV* = Immediate Verbal: (3 working days) 100%
 IW* = Immediate Written: (3 working days) 125%
 SP* = Weekend, Holiday CALL
 STAT* = Less than 48 hours CALL

• Please call, expedited service not available for all testing

Sample analysis will be provided according to the standard EEA Water Services Terms, which are available upon request. Any other terms proposed by Customer are deemed material alterations and are rejected unless expressly agreed to in writing by EEA.

06-LO-F0435 Issue 5.0 Effective Date: 2016-01-20



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Order # 303627
Batch # 1

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CHAIN OF CUSTODY RECORD

Page 1 of 1

REPORT TO: Joshua Suggs, TSD-56
225 Von Karman Dr, Arnold, MO, 63010
 BILL TO: 225 Von Karman Dr, Arnold, MO, 63010

Shaded area for EEA use only

LAB Number	COLLECTION		SAMPLER (Signature)	COMPLIANCE MONITORING	Yes	No	PWS ID #	STATE (sample origin)	PROJECT NAME	PO#	# OF CONTAINERS	MATRIX CODE	TURNAROUND TIME
	DATE	TIME											
1	23 Aug 16	0907	<i>[Signature]</i>	Yes			TN0004408	TN			1	DW SW	
2	23 Aug 16	0907	<i>[Signature]</i>	Yes							1	NA SW	
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME	LAB COMMENTS
<i>[Signature]</i>	24 Aug 16	9:00 AM	<i>[Signature]</i>	8/25/16	4:30 PM	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME	
			<i>[Signature]</i>	8/25/16	08:30 AM	
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED FOR LABORATORY BY:	DATE	TIME	CONDITIONS UPON RECEIPT (check one):
			<i>[Signature]</i>	8/25/16	08:30 AM	Ice: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Ambient: <u>5.8</u> °C Upon Receipt: <u>N/A</u>

MATRIX CODES:
 DW-DRINKING WATER
 RW-REAGENT WATER
 GW-GROUND WATER
 EW-EXPOSURE WATER
 SW-SURFACE WATER
 PW-POOL WATER
 WW-WASTE WATER

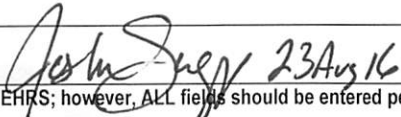
TURN-AROUND TIME (TAT) - SURCHARGES
 SW = Standard Written: (15 working days) 0%
 RV = Rush Verbal: (5 working days) 50%
 RW = Rush Written: (5 working days) 75%

IV* = Immediate Verbal: (3 working days) 100%
IW* = Immediate Written: (3 working days) 125%
SP* = Weekend, Holiday CALL
STAT* = Less than 48 hours CALL

*** Please call, expedited service not available for all testing**

Sample analysis will be provided according to the standard EEA Water Services Terms, which are available upon request. Any other terms proposed by Customer are deemed material alterations and are rejected unless expressly agreed to in writing by EEA.

06-LO-F0435 Issue 5.0 Effective Date: 2016-01-20

GENERAL INFORMATION			
SAMPLING DATE: 23 August 2016		INSTALLATION/GSU/LOCATION (D): Arnold AFB/ Tullahoma Tn	
PERSONNEL INFORMATION			
SAMPLER NAME(S)		TSgt Joshua Suggs	
SAMPLING POINT			
BUILDING/SITE (D)	Water Treatment Plant	SAMPLING POINT (D) (i.e. "Sampling Point Spigot")	Lab Faucet
SAMPLE ID (D)	0000GM17	FIELD BLANK SAMPLE ID (D)	000GM18
GPS COORDINATES OF SAMPLING POINT (To 6 decimals)	Lat: 35.376368	Long: -86.051380	
CE WELL DESCRIPTOR (i.e. Bldg #, Well #)	Bldg 1504		
WATER SYSTEM INFORMATION			
Water System Name (D)	Arnold AFB Main Base		
PWSID (D)	TN0004408		
Water System Classification (D)	NTNCWS		
WELL OPERATING CONDITIONS OF WATER SYSTEM FOR SAMPLING EVENT			
DATE/TIME (when well pump was turned on day of sampling)	WELL NUMBER (list wells associated with PWS distribution system)	WELL PUMP ON DURING SAMPLING (Y/N)	WELL PUMP OFF DURING SAMPLING (Y/N)
NOTES			
COMPLETED BY: (Include Date)		REVIEWED BY: (Include Date)	
 23 Aug 16			

(D) – data required in DOEHS; however, ALL fields should be entered per this sheet



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CHAIN OF CUSTODY RECORD

Page 1 of 1

REPORT TO: Joshua Suggs, T547, TSD-56
 BILL TO: 225 Von Karman Dr, Acedd APB, To 37089

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LAB Number	COLLECTION		SAMPLER (Signature)	COMPLIANCE MONITORING	Yes	No	PWS ID #	STATE (sample origin)		PROJECT NAME	PO#	# OF CONTAINERS	MATRIX CODE	TURNAROUND TIME
	DATE	TIME						POPULATION SERVED	SOURCE WATER					
1	3/31/16	0935	<i>Joshua Suggs</i>	Yes			TN0004409	TN		Raw		1	DW SW	
2	3/31/16	0935	<i>Joshua Suggs</i>	Yes						FTB		1	NA SW	
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														

RELINQUISHED BY: (Signature) *Joshua Suggs* TIME 9:00 AM DATE 3/31/16

RECEIVED BY: (Signature) *Amber Gunn* TIME 9:50 AM DATE 3-31-16

RELINQUISHED BY: (Signature) _____ TIME _____ DATE _____

RECEIVED BY: (Signature) *Amber* TIME 12:30 PM DATE 3/31/16

RECEIVED FOR LABORATORY BY: _____ TIME _____ DATE _____

LAB COMMENTS: *all melted. NOT temperature dm 8/25/16*

CONDITIONS UPON RECEIPT (check one):
 Iced Wet Blue Ambient °C Upon Receipt _____ N/A

MATRIX CODES:
 DW-DRINKING WATER
 RW-REAGENT WATER
 GW-GROUND WATER
 EW-EXPOSURE WATER
 SW-SURFACE WATER
 PW-POOL WATER
 WW-WASTE WATER

TURN-AROUND TIME (TAT) - SURCHARGES
 SW = Standard Written: (15 working days) 0%
 RV = Rush Verbal: (5 working days) 50%
 RW = Rush Written: (5 working days) 75%

IV* = Immediate Verbal: (3 working days) 100%
W* = Immediate Written: (3 working days) 125%
SP* = Weekend, Holiday CALL
STAT* = Less than 48 hours CALL

* Please call, expedited service not available for all testing

Sample analysis will be provided according to the standard EEA/Water Services Terms, which are available upon request. Any other terms proposed by Customer are deemed material alterations and are rejected unless expressly agree to in writing by EEA.

06-LO-F0435 Issue 5.0 Effective Date: 2016-01-20

GENERAL INFORMATION			
SAMPLING DATE: 23 August 2016		INSTALLATION/GSU/LOCATION (D): Arnold AFB/ Tullahoma Tn	
PERSONNEL INFORMATION			
SAMPLER NAME(S)		TSgt Joshua Suggs	
SAMPLING POINT			
BUILDING/SITE (D)	Golf Course Well	SAMPLING POINT (D) (i.e. "Sampling Point Spigot")	Raw Water Spigot
SAMPLE ID (D)	0000GM1N	FIELD BLANK SAMPLE ID (D)	0000GM1O
GPS COORDINATES OF SAMPLING POINT (To 6 decimals)	Lat: 35.354267		Long: -86.171446
CE WELL DESCRIPTOR (i.e. Bldg #, Well #)	Golf Course Well		
WATER SYSTEM INFORMATION			
Water System Name (D)	Arnold AFB Main Base		
PWSID (D)	TN0004409		
Water System Classification (D)	NTNCWS		
WELL OPERATING CONDITIONS OF WATER SYSTEM FOR SAMPLING EVENT			
DATE/TIME (when well pump was turned on day of sampling)	WELL NUMBER (list wells associated with PWS distribution system)	WELL PUMP ON DURING SAMPLING (Y/N)	WELL PUMP OFF DURING SAMPLING (Y/N)
23 Aug 16/0600	Well 001	Y	N
NOTES			
COMPLETED BY: (Include Date)	<i>Joshua Suggs</i> 23 Aug 16		REVIEWED BY: (Include Date)

(D) – data required in DOEPRS; however, ALL fields should be entered per this sheet



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CHAIN OF CUSTODY RECORD

Page 1 of 1

REPORT TO: Joshua Suggs, Tst, TSD-56
225 Van Korman Dr. Arnold AFB, Tx 77888

BILL TO: _____

LAB Number	COLLECTION		SAMPLER (Signature)	COMPLIANCE MONITORING	SAMPLING SITE	TEST NAME	POPULATION SERVED	STATE (sample origin)	PROJECT NAME	CHLORINATED		# OF CONTAINERS	MATRIX CODE	TURNAROUND TIME
	DATE	TIME								YES	NO			
1	23 Aug 16	0909	<i>[Signature]</i>	No	Water Treatment Plant Raw	EPA 537	TN		RAW		X	1	DW SW	
2	23 Aug 16	0909	<i>[Signature]</i>	No	11	EPA 537			FTB		X	1	NA SW	
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														

RELINQUISHED BY: (Signature) *[Signature]* DATE 24 Aug 16 TIME 9:40 AM | PM

RECEIVED BY: (Signature) *[Signature]* DATE 8/24/16 TIME 9:10 AM | PM

RELINQUISHED BY: (Signature) *[Signature]* DATE 8/25/16 TIME 08:30 AM | PM

RECEIVED FOR LABORATORY BY: *[Signature]* DATE 8/25/16 TIME 08:30 AM | PM

LAB COMMENTS: _____

CONDITIONS UPON RECEIPT (check one): Ambient 2.4 °C Upon Receipt _____ N/A

MATRIX CODES:
 DW-DRINKING WATER
 RW-REAGENT WATER
 GW-GROUND WATER
 EW-EXPOSURE WATER
 SW-SURFACE WATER
 PW-POOL WATER
 WW-WASTE WATER

TURN-AROUND TIME (TAT) - SURCHARGES
 SW = Standard Written: (15 working days) 0%
 RV = Rush Verbal: (5 working days) 50%
 RW = Rush Written: (5 working days) 75%

IV = Immediate Verbal: (3 working days) 100%
IW = Immediate Written: (3 working days) 125%
SP = Weekend, Holiday CALL
STAT = Less than 48 hours CALL

* Please call, expedited service not available for all testing

06-LO-F0435 Issue 5.0 Effective Date: 2016-01-20

Sample analysis will be provided according to the standard EEA Water Services Terms, which are available upon request. Any other terms proposed by Customer are deemed material alterations and are rejected unless expressly agree to in writing by EEA.

GENERAL INFORMATION			
SAMPLING DATE: 23 August 2016		INSTALLATION/GSU/LOCATION (D): Arnold AFB/ Tullahoma Tn	
PERSONNEL INFORMATION			
SAMPLER NAME(S)		TSgt Joshua Suggs	
SAMPLING POINT			
BUILDING/SITE (D)	Water Treatment Plant Raw	SAMPLING POINT (D) (i.e. "Sampling Point Spigot")	Raw Water Spigot
SAMPLE ID (D)	0000GM1J	FIELD BLANK SAMPLE ID (D)	0000GM1K
GPS COORDINATES OF SAMPLING POINT (To 6 decimals)		Lat: 35.376368 Long: -86.051380	
CE WELL DESCRIPTOR (i.e. Bldg #, Well #)		Bldg 1504	
WATER SYSTEM INFORMATION			
Water System Name (D)		Arnold AFB Main Base	
PWSID (D)		TN0004408	
Water System Classification (D)		NTNCWS	
WELL OPERATING CONDITIONS OF WATER SYSTEM FOR SAMPLING EVENT			
DATE/TIME (when well pump was turned on day of sampling)	WELL NUMBER (list wells associated with PWS distribution system)	WELL PUMP ON DURING SAMPLING (Y/N)	WELL PUMP OFF DURING SAMPLING (Y/N)
NOTES			
COMPLETED BY: (Include Date)		REVIEWED BY: (Include Date)	
Joshua Suggs 23 Aug 16			

(D) – data required in DOEHRIS; however, ALL fields should be entered per this sheet

GENERAL INFORMATION			
SAMPLING DATE: 23 August 2016		INSTALLATION/GSU/LOCATION (D): Arnold AFB/ Tullahoma Tn	
PERSONNEL INFORMATION			
SAMPLER NAME(S)		TSgt Joshua Suggs	
SAMPLING POINT			
BUILDING/SITE (D)	Golf Course	SAMPLING POINT (D) (i.e. "Sampling Point Spigot")	Water Spigot
SAMPLE ID (D)	0000GM1D	FIELD BLANK SAMPLE ID (D)	0000GM1E
GPS COORDINATES OF SAMPLING POINT (To 6 decimals)	Lat: 35.354267		Long: -86.171446
CE WELL DESCRIPTOR (i.e. Bldg #, Well #)	Golf Course Well		
WATER SYSTEM INFORMATION			
Water System Name (D)	Arnold AFB Main Base		
PWSID (D)	TN0004408		
Water System Classification (D)	NTNCWS		
WELL OPERATING CONDITIONS OF WATER SYSTEM FOR SAMPLING EVENT			
DATE/TIME (when well pump was turned on day of sampling)	WELL NUMBER (list wells associated with PWS distribution system)	WELL PUMP ON DURING SAMPLING (Y/N)	WELL PUMP OFF DURING SAMPLING (Y/N)
23 Aug 2016/0600	Well 001	Y	N
NOTES			
COMPLETED BY: (Include Date)	<i>Joshua Suggs 23 Aug 16</i>		REVIEWED BY: (Include Date)

(D) – data required in DOEHRs; however, ALL fields should be entered per this sheet

REQUISITION AND INVOICE/SHIPPING DOCUMENT

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0246), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PLEASE DO NOT RETURN YOUR FORM TO THIS ADDRESS. RETURN COMPLETED FORM TO THE ADDRESS IN ITEM 2.

1. FROM: (Include ZIP Code)
 Arnold Medical Aid Station
 225 VonKarmen Road
 Arnold AFB TN 37389 POC: TSgt Suggs

2. TO: (Include ZIP Code)
 6. REQUISITION NUMBER
 FB2804-6237-0007
 8. PRIORITY

3. SHIP TO - MARK FOR
 EUROFINS EATON ANALYTICAL
 110 S HILL ST
 SOUTH BEND, IN 46617-2702

10. SIGNATURE
 SPADEMAN, BEVERLY A. 1232 Dept. of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0246), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302
 554033

11a. VOUCHER NUMBER & DATE (YYYYMMDD)
 16-1566
 8-24-16 LC

12. DATE SHIPPED (YYYYMMDD)
 20160824

13. MODE OF SHIPMENT
 FDEX AM

14. BILL OF LADING NUMBER
 188,734

15. AIR MOVEMENT DESIGNATOR OR PORT REFERENCE NO.

4. APPROPRIATIONS DATA
 Transportation Account Code (TAC)

ITEM NO. (a)	FEDERAL STOCK NUMBER, DESCRIPTION, AND CODING OF MATERIEL AND/OR SERVICES (b)	UNIT OF ISSUE (c)	QUANTITY REQUESTED (d)	SUPPLY ACTION (e)	TYPE CON-TAINER (f)	CON-TAINER NOS. (g)	UNIT PRICE (h)	TOTAL COST (i)	AMOUNT
1	WATER SAMPLE 5 coolers								

16. TRANSPORTATION VIA MATS OR MISTS CHARGEABLE TO									
ISSUED BY	TOTAL CON-TAINERS	TYPE CON-TAINER	DESCRIPTION	TOTAL WEIGHT	TOTAL CUBE	DATE (YYYYMMDD)	BY	SHEET TOTAL	GRAND TOTAL
Signature								0.00	
CHECKED BY									
PACKED BY									
TOTAL									

REQUISITION AND INVOICE/SHIPPING DOCUMENT (Continuation Sheet)

Form Approved
OMB No. 0704-0246
Expires Feb 28, 2006

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden, to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0246), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

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ITEM NO.	FEDERAL STOCK NUMBER, DESCRIPTION, AND CODING OF MATERIEL AND/OR SERVICES	UNIT OF ISSUE	QUANTITY REQUESTED	SUPPLY ACTION	TYPE CONTAINER	CON-TAINER NOS.	UNIT PRICE	TOTAL COST	6. REQUISITION NUMBER		11a. VOUCHER NUMBER AND DATE		b. VOUCHER NUMBER AND DATE	
									NO. OF SHEETS	NO. OF SHEETS	NO. OF SHEETS	NO. OF SHEETS	NO. OF SHEETS	NO. OF SHEETS
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)						
									SHEET TOTAL				0.00	