FINAL REPORT
FY16 PHASE 1 REGIONAL SITE INSPECTIONS FOR PERFLUORINATED COMPOUNDS

MASSACHUSETTS AIR NATIONAL GUARD
104TH FIGHTER WING
BARNES AIR NATIONAL GUARD BASE
WESTFIELD, MASSACHUSETTS

Contract #: W9133L-14-D-0002
Delivery Order 0006

Amec Foster Wheeler Project #: 2-9133-0006

March 13, 2018

Final Report
FY16 Phase 1 Regional Site Inspections
For Perfluorinated Compounds

Massachusetts Air National Guard – 104th Fighter Wing
Barnes Air National Guard Base
Westfield, Massachusetts

Prepared for:
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ACRONYMS & ABBREVIATIONS

A4OR	Operations Restoration Branch
AF	Air Force
AFFF	Aqueous Film Forming Foam
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
AMSL	Above Mean Sea Level
ANG	Air National Guard
AVGAS	Aviation gasoline
104th FW	104th Fighter Wing
BANGB	Barnes Air National Guard Base
BGS	Below Ground Surface
BRAC	Base Realignment and Closure
CE	Civil Engineer
CED	Civil Engineering Department
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Corbuilt	Corbuilt LLC
°F	Degrees Fahrenheit
DO	Delivery Order
DoD	Department of Defense
DPT	Direct Push Technology
Drilex	Drilex Environmental
DQO	Data Quality Objective
ELAP	Environmental Laboratory Accreditation Program
EMI	Electromagnetic Induction
ERP	Environmental Restoration Program
FAA	Federal Aviation Administration
Ft.	Feet/foot
FD	Fire Department
FSP	Field Sampling Plan
FSS	Fire Suppression System
FTA	Fire Training Area
GPR	Ground Penetrating Radar
GW	Groundwater
HA	Health Advisory
HEF	High-Expansion Foam
IRP	Installation Restoration Program
IDW	Investigation Derived Waste
JP-4	Jet Propellant
LCS	Laboratory Control Samples
MAANG	Massachusetts Air National Guard
MassDEP	Massachusetts Department of Environmental Protection
MCP	Massachusetts Contingency Plan
MS	Matrix Spike
MSD	Matrix Spike Duplicate
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
mL/min	Milliliter per Minute

mV	Millivolts
NELAP	National Environmental Laboratory Accreditation Program
NFA	No Further Action
NGB	National Guard Bureau
NRCS	National Resources Conservation Service
NTU	Nephelometric Turbidity Units
OWS	Oil-Water Separator
ORP	Oxidation Reduction Potential
PA	Preliminary Assessment
PFBS	Perfluorobutanesulfonic Acid
PFC	Perfluorinated Compound
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
POC	Point of Contact
PRL	Potential Release Location
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAPS	Response Action Performance Standards
RI	Remedial Investigation
RSL	Regional Screening Level
SB	Soil Boring (designation)
SD	Sediment (sample designation)
SHSP	Site Health and Safety Plan
SI	Site Inspection
SOP	Standard Operating Procedure
SWMP	Stormwater Management Plan
TOC	Top of Casing
TW	Temporary Well
UCMR3	Third Unregulated Contaminant Monitoring Rule
USAF	United States Air Force
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
Vista	Vista Analytical Laboratories, Inc.

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EXECUTIVE SUMMARY

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) was contracted by the National Guard Bureau (NGB) Operations Restoration Branch (A4OR) under Contract # W9133L-14-D-0002, Delivery Order (DO) 0006 to conduct Phase 1 Regional Site Inspections (SIs) for Perfluorinated Compounds (PFCs) at multiple Air National Guard (ANG) Installations. This report has been prepared for SIs conducted at on-Base Potential Release Locations (PRLs) identified on the 104th Fighter Wing (104th FW), Massachusetts Air National Guard, Barnes Air National Guard Base (BANGB), in the city of Westfield, Massachusetts. This Report presents the results and recommendations from the 2017 SI field activities conducted in June 2017 at BANGB. The objectives of the SI were to determine the presence or absence of PFCs at each PRL and the Base boundary, and based on the findings:

1) Determine if PRL is eligible for a decision of No Further Action (NFA);
2) Assess if PFCs are migrating off-Base; and
3) Develop Data Quality Objectives (DQOs) if further investigations are recommended.

To meet the objectives, Amec Foster Wheeler performed SIs at the following seven PRLs:

- PRL 1: Former Fire Training Area (FTA) (IRP Site 1);
- PRL 3: Stormwater Drainage Basin;
- PRL 4: Hangars 27A & 27B;
- PRL 5: Former Fire Station, Building (Bldg.) 004;
- PRL 6: Current Fire Station, Bldg. 040;
- PRL 7: Hush House; and
- PRL 8: Fire Department Equipment Test Area.

Based on recommendations from the Preliminary Assessment (PA) conducted by BB&E, Inc. (BB&E) in August 2015, soil, groundwater, and sediment samples were collected and analyzed for the PFCs listed on the United States Environmental Protection Agency's (USEPA) Third Unregulated Contaminant Monitoring Rule (UCMR3) list (USEPA, 2012); The detected PFC concentrations were compared against screening criteria for perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorobutane sulfonate (PFBS) including: the USEPA lifetime drinking water Health Advisory (HA) for PFOS (USEPA, May 2016a) and HA for PFOA (USEPA, May 2016b); the USEPA Regional Screening Level (RSL) table for PFBS in

residential soil (USEPA, 2017); the USEPA RSL for PFBS in tap water; and calculated screening levels using the USEPA screening level calculator for PFOA and PFOS in soil and sediment. These screening criteria are presented below:

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

[a] EPA Regional Screening Levels (USEPA, 2017).

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

[c] USEPA, 2016b. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and USEPA, 2016a. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).*

[d] PFBS RSL for Residential Soil concentration presented in the SI Work Plan (Amec, 2017) was 1,600,000 µg/kg based on the May 2016 RSL values. This table has been updated to include the more recent RSL values published in June 2017.

[e] PFBS RSL for Tap Water presented in the SI Work Plan (Amec, 2017) was 380 µg/L based on the May 2016 RSL values. This table has been updated to include the more recent RSL values published in June 2017.

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

EPA = U.S. Environmental Protection Agency

NL = not listed

Based on comparison of analytical data to the screening criteria in the table above, Amec Foster Wheeler recommends NFA for one PRL (PRL3), and further investigations at six PRLs (PRL 1, PRL 4, PRL 5, PRL 6, PRL 7, and PRL 8). An overview of conclusions from SI activities and recommended DQOs for future investigations, includes the following:

PRL	Screening Criteria Exceedance		Recommendation
	Soil	GW	
PRL 1: Former FTA (IRP Site 1);	Inc.	X	Soil investigation to determine if PFCs exceed screening criteria off-Base. Groundwater (GW) investigation to determine the nature and extent of the confirmed release.
PRL 3: Stormwater Drainage Basin;			NFA
PRL 4: Hangars 27A & 27B;		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 5: Former Fire Station, Bldg. 004;		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 6: Current Fire Station, Bldg. 040;		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 7: Hush House		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 8: Fire Department Equipment Test Area.	Inc.	Inc.	Soil and GW investigation to determine if PFCs exceed screening criteria off-Base.

Notes:

Inc. - Inconclusive based on results of SI

X – Screening criteria exceedance

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1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) was contracted by the National Guard Bureau (NGB) Operations Restoration Branch (A4OR) under Contract # W9133L-14-D-0002, Delivery Order (DO) 0006 to conduct Phase 1 Regional Site Inspections (SIs) for Perfluorinated Compounds (PFCs) at multiple Air National Guard (ANG) Installations. The scope of the Contract includes performance of an SI at on-Base Potential Release Locations (PRLs) identified at the 104th Fighter Wing (104th FW), Massachusetts Air National Guard, Barnes Air National Guard Base (BANGB), in the city of Westfield, Massachusetts.

This SI Report describes the objectives, procedures, and activities which were completed, and presents Amec Foster Wheeler's findings and recommendations. The Base location is shown in **Figure 1**, and the Base and area features are shown on **Figure 2**.

The SI was conducted in general accordance with the standards and practices prescribed by the Massachusetts Contingency Plan (the MCP- 310 CMR 40.0000) Response Action Performance Standard (RAPS), specifically, 310 CMR 40.0191 (MassDEP, 2014).

1.1 Background

The Department of Defense (DoD) began investigations at military bases under the Installation Restoration Program (IRP) with the goal of identifying, evaluating, and remediating areas of contamination (the program is now referred to as the Environmental Restoration Program or ERP). Under this program, investigations began at the BANGB in 1987. These investigations included Preliminary Assessments (PAs), SIs, removal action investigations, and RIs. The investigations and subsequent remedial activities initiated under the IRP have been conducted and reported in accordance with the MCP, 310 CMR 40.0000. Prior to the PFC PA prepared by BB&E Inc. (BB&E, 2016), potential releases of PFC from use and storage of aqueous film forming foam (AFFF) had not been evaluated at BANGB.

According to Base personnel, 3% AFFF was used at BANGB from approximately 1970 to 2016. Most of the AFFF fire suppression systems were retrofitted for high-expansion foam (HEF) use in the early 2000s; however, the Fire Department continued to use AFFF until 2016 in emergency response vehicles.

In 2015, BB&E conducted a PA to identify potential sites of historic environmental releases of PFC related to AFFF usage and storage. BB&E researched the potential existence of any documented Fire Training Areas (FTAs) in operation since 1970 or any other use or release of AFFF. BB&E interviewed available installation personnel as part of the PA.

Based on past use and storage of AFFF at BANGB, the PA identified eight PRLs where releases of PFC might have occurred, including FTAs, hangars, drainage basins, firefighting equipment testing areas, fire department equipment storage areas, etc. Seven of the eight PRLs were recommended for further inspection, and one PRL warranted No Further Action (NFA) (**Table 1**). Two PRLs (PRL 1 and PRL 8) are located primarily off-Base; SI activities were limited to on-Base locations at these PRLs. Three notable off-Base releases were also identified, including:

- A 2013 civilian aircraft fire near runways 02 and 15, approximately 1,500 ft. southeast of the current Base fire station. Five gallons of 3% AFFF mixed with water were discharged.
- A 2001 civilian aircraft crash at the HFP Sprinkler Corporation approximately 0.5 miles northeast of the Base. At that crash 50 to 60 gallons of 3% AFF was used during fire-fighting activities.
- A late-1990's accidental release of five gallons of 3% AFFF at a community soccer field located approximately 0.5 miles north of the Base.

Investigations of these off-Base releases were not included in the scope of the SI, and are not identified on the figures.

1.2 Purpose and Scope

The purpose of the SI was to determine the presence/absence of PFC in soil, sediment, surface water, and groundwater where applicable at each of the PRLs, and in the groundwater at or near the Base boundary. This data has been used to develop recommendations for appropriate paths forward to either provide an NFA conclusion or recommended Data Quality Objectives (DQOs) for further investigations. SI investigative tasks included:

- Advancing direct-push technology (DPT) soil borings at the PRLs (14 DPT borings) up to a maximum depth of 15 feet (ft.) below ground surface (bgs) and collect one or more soil sample(s) from each boring;

- Installing five temporary monitoring wells (TWs);
- Collecting six groundwater samples; five from the temporary monitoring wells, and one from an existing permanent monitoring well; and
- Collecting two sediment samples from the Stormwater Drainage Basin Detention Pond (PRL 3).

Based on locations where AFFF was potentially used or stored, eight PRLs were identified at the Base in the PA Site Visit Report. Due to findings of no known AFFF release at PRL 2 [former FTA-06 (IRP Site 6)] documented in the PA, NFA was recommended for this area (BB&E, 2016). The PRLs are illustrated on **Figure 3**, and the SI summary is presented as **Table 2**.

All field activities were conducted in accordance with the Final SI Work Plan, Quality Assurance Project Plan (QAPP), Field Sampling Plan (FSP), and Site Health and Safety Plan (SHSP) (Amec, 2017). The scope of the SI is outlined in the following sections.

2.0 INSTALLATION DESCRIPTION

Section 2.1 describes the location and environs of BANGB. A brief history of BANGB is provided in **Section 2.2**.

2.1 Location

The BANGB is located at the Westfield-Barnes Regional Airport (formerly Barnes Municipal Airport), approximately 3 miles northeast of the city of Westfield, Hampden County, Massachusetts (**Figure 1**). BANGB is the home of the 104th FW, and occupies approximately 182 acres on land leased from the city of Westfield. The Base is divided into two separate parcels of land in the northern portion of the airport, bisected by Runway 2-20 that trends north/south (**Figure 2**). The western parcel encompasses approximately 112 acres, and contains most of the facilities buildings, hangars, flight line, and fire station. PRLs 3, 4, 5, and 6 are located within this portion of the Base. The eastern parcel encompasses approximately 70 acres, and contains the hush house, a small-arms firing range, a former FTA, and other facilities. PRLs 2 and 7 are in this portion of the Base. PRLs 1 and 8 are located primarily south of the Base, on land not leased or maintained by BANGB. The PRLs are illustrated on **Figure 3**.

Westfield-Barnes Regional Airport, including BANGB, is zoned for airport district usage. The airport is surrounded by properties zoned for industrial, residential, and business use.

2.2 Organization and History

The Site was originally known as Camp Bartlett, a training facility used by the Massachusetts Army National Guard from 1905 until approximately 1918. During World War I, Camp Bartlett was expanded to a 1,000-acre mobilization camp which housed 13,000 people (AECOM, 2010). After World War I, the land was donated by Vincent E. Barnes to some private businessmen for development of the Westfield Aviation Field, later named the Barnes Municipal Airport, then finally the Westfield-Barnes Regional Airport. In 1946, Barnes Municipal Airport was selected as the home of the 131st Fighter Squadron, flying the P-47 Thunderbolt. The current Base mission is the 104th FW, an operational flying unit equipped with the F-15 Eagle (AECOM, 2014). Since 1946, the unit has flown operational missions in nine different aircraft (ANG, 2016), with the 104th FW providing combat units during the Berlin Airlift Crisis in 1961, Operation Deliberate Force in 1995, Operation Allied Force in 1999, the Air Expeditionary Force deployed to Kuwait in 2000,

Operations Noble Eagle and Enduring Freedom in 2001, and Operation Iraqi Freedom in 2003 (AECOM, 2010).

Activities at the Base have been typical of those at most airports and military air bases, including fueling and maintenance operations. These activities include the usage, handling, storage, and disposal of various products, including potentially hazardous materials.

3.0 ENVIRONMENTAL SETTING

The following sections provide information on the environmental setting at BANGB. This information is summarized from reports prepared during previous environmental evaluations at BANGB, as referenced in the following subsections.

3.1 Climate

The climate in Westfield is defined as having warm and humid summers and cool winters with considerable snowfall. Average temperatures range between 24 and 72 degrees Fahrenheit (°F), with extreme temperatures as low as -22 °F, and as high as 102 °F. Annual precipitation averages 43 inches of rain, and 51 inches of snow (AECOM, 2010).

3.2 Topography

The BANGB is generally flat, with elevations between approximately 260 to 270 feet above mean sea level (AMSL) in the western portion of the Base, and between approximately 230 feet and 260 feet AMSL feet in the eastern portion of the Base (**Figure 1**). The eastern and western parcels are separated by Runway 2-20, which trends north to south, and is a topographic high.

3.3 Geology

The BANGB is located in the Mesozoic-era Hartford Basin, characterized by Quaternary-aged glacial material underlain by Jurassic- and Triassic-age sedimentary and igneous bedrock (Aneptek, 2003). According to the Bedrock Geologic Map of Massachusetts (Zen, 1983), the bedrock near the Base is described as New Haven Arkose Formation of the Upper Triassic Period primarily consisting of red, pink and gray coarse-grained locally conglomeratic arkose interbedded with brick-red shaley siltstone and fine-grained arkosic sandstone. Depth to bedrock at the Base is not known; however, surficial glacial outwash sand and gravel deposits are typically 100 to 150 feet (ft.) thick in this region.

3.4 Soils

According to the National Resources Conservation Service Web Soil Survey (NRCS, 2017), soils in the vicinity of Former FTA-01 (PRL 1) and the Current Fire Station (PRL 6) are mapped as Hinckley loamy sand (0 to 3 percent slopes). Hinckley loamy sands are derived from sandy and

gravelly glaciofluvial deposits originating from gneiss, granite, and/or schist parent material. Soils at the other six PRLs are mapped as Urban Land.

Soils observed during the SI activities generally consisted of fill material over alternating layers of poorly graded and well-graded sand strata. Occasional layers of finer material (silty sand) and coarser material (gravelly sand) were encountered. Native material appeared to be of glaciofluvial origin, which agrees with regionally mapped NRCS soil classifications. Soil boring logs are included in **Appendix A**.

3.5 Surface Water Hydrology

The BANGB and the Westfield-Barnes Municipal Airport lie across a watershed divide that trends north-south, generally along Runway 2-20. According to the Stormwater Management Plan (SWMP; MAANG, 2010), surface water flow west of Runway 2-20 flows regionally westward towards Arm Brook, and surface water east of the divide flows eastward towards Pond Brook (**Figure 1**).

Stormwater west of Runway 2-20, including near the fire stations, hangars, and flight line, is conveyed through a series of subsurface drainage pipes to multiple detention basins located throughout the Base. The detention basins percolate stormwater to the subsurface through highly transmissive glacial outwash sand gravel deposits. According to Base personnel, the basins are typically dry except immediately following precipitation or snowmelt events. As illustrated on **Figure 4**, there are no surface water features present in the western portion of the Base.

East of Runway 2-20, stormwater flows through surface drainage ditches and as overland sheet flow to the east or southeast (MAANG, 2010). As shown on **Figures 1** and **4**, some wetlands are present in the northeast quadrant of the eastern parcel. According to the SWMP, some of the stormwater flows overland to the wetlands; however, the wetlands do not discharge into waters of the United States.

3.6 Hydrogeology

Based on the Final Comprehensive Site Evaluation Phase II Report (AECOM, 2010), the area surrounding BANGB and the Westfield-Barnes Municipal Airport are underlain by Barnes Aquifer. The Barnes Aquifer is a distinct portion of the sand and gravel outwash aquifer that extends in a north-south direction from the Connecticut River to the Westfield River, and is bound in the east

west direction by the geologic contact between the outwash and till/bedrock. Groundwater in the vicinity of the Base generally flows in a south or southeasterly direction, with localized observations of southwest flow. (**Figure 2**). Groundwater flow directions illustrated on **Figure 2** were obtained from Appendix C of the PA, which includes relevant information from previous environmental investigations at the Base. Depth to groundwater at the Base has been reported to be in the range of 20 to 45 ft. bgs during previous investigations. During SI field activities, groundwater was observed at various depths ranging from approximately 24 ft. bgs at MW-6 to approximately 47 ft. bgs at TW-05.

According to the EDR Radius Report® presented in the PA, BANGB is in a Massachusetts Department of Environmental Protection (MassDEP) approved zone II aquifer[1].

3.7 Critical Habitat and Threatened/Endangered Species

Massachusetts Geographic Information System data layers were plotted in relation to the installation boundaries, and reviewed for critical habitats and threatened or endangered species. The following summarizes the findings of the review, which are illustrated on **Figure 4**. Stated directions are relative to BANGB.

- An area of Rare Wetland Wildlife Habitat is present to the west;
- Areas of Protected Open Space are present to the southwest, northeast, and southeast;
- Freshwater Wetlands are found to the northwest, northeast, east, and southeast;
- Two Freshwater Wetland areas are present in the eastern BANGB parcel;
- Two Certified Vernal Pools and one Potential Vernal Pool are located on-Base, in the eastern parcel. Additionally, one Potential and one Certified Vernal Pool are located to the east; and
- Portions of the Base, and the area immediately surrounding the Base contain Priority Habitats of Rare Species.

[1] Zone II means that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated, as approved by the Department's (MassDEP) Division of water supply pursuant to 310 CMR 22.00: *Drinking Water.*

3.8 City of Westfield Water Supply

The city of Westfield supplies water to 11,000 residential and commercial customers from two reservoirs and eight groundwater extraction wells. The city also owns and operates more than 220 miles of underground piping, two drinking water treatment facilities, four booster pumping stations, and seven dams (Westfield, 2016).

Two of the city's water supply wellfields, PWS Well #8 and PWS Well #7, are located approximately ½ mile southeast from the BANGB. Two additional public water supply wells, PWS Well #1 and PWS Well #2, are located south of BANGB, approximately 1.75 miles and 2.5 miles respectively (**Figure 2**). The city of Westfield has reportedly conducted sampling and analysis for PFC at these four wells. Amec Foster Wheeler understands that varying concentrations of PFC compounds have been detected by the city in these supply wells, and that one or more supply wells have been taken out of service due to elevated PFC concentrations.

4.0 PRELIMINARY ASSESSMENT

BB&E was contracted by the NGB to perform a PA at the Base with the objective of collecting and reviewing available information about any known or suspected releases of PFC due to the use, handling, release or on-Base disposal of AFFF at BANGB. The PA process included a review of documented FTAs in operation since 1970, and any other use or release of AFFF, and the completion of a Base reconnaissance. The Base reconnaissance included an inspection of potential sites of historical environmental releases, interviews with Base personnel, and a review of available on-Base documentation.

Based on past use and storage of AFFF at BANGB, the PA identified eight PRLs where releases of PFC might have occurred, including FTAs, hangars, drainage basins, firefighting equipment testing areas, fire department equipment storage areas, etc. Seven of the eight PRLs were recommended for further inspection, and one PRL warranted no further action (PRL 2). Two PRLs (PRL 1 and PRL 8) are located primarily off-Base.

The findings of AFFF use and storage at each of the seven PRLs recommended for inclusion in the SI, as documented in the PA Site Visit Report, are summarized below. The PA recommended NFA at PRL 2, and is not included in the ensuing text. A summary of recommendations is presented in **Table 1**.

4.1 PRL 1: Former FTA-01

Former FTA-01 is located primarily off-Base, immediately south of the western parcel. According to the PA, former FTA-01 was used from approximately 1950 through 1987, and aviation gasoline (AVGAS), waste oils, solvents, and jet propellant #4 (JP-4) were used as accelerants during training exercises. In spring of 2000, 3,334.03 tons of soil were excavated from FTA-01, and transported off-Base for use in asphalt batching. Groundwater quality was assessed during IRP activities, and was determined not to have been impacted by fuel and chlorinated constituents used during fire training activities. The site achieved closure in 2002, and portions of the Base have since been improved by the Army National Guard. Because FTA-01 abuts the property, activities at this PRL may have impacted the BANGB.

4.2 PRL 3: Stormwater Drainage Basin (IRP Site 4)

According to the PA, the retention basin is approximately 100 ft. wide by 200 ft. long, and designed

to percolate stormwater to the subsurface. In the 1980s and early 1990s, the Base converted from septic systems to the city's sanitary sewer system. Prior to the conversion, floor drains in buildings and hangars on the flight line discharged to the stormwater drainage basin. Although there are no known releases of AFFF to the stormwater drainage basin, AFFF releases had the potential to impact the basin. The floor drains currently discharge to the sanitary sewer system. The site was investigated under the IRP program and closed in 1998 with a NFA decision (BB&E, 2016).

4.3 PRL 4: Hangars 27A and 27B

The fire suppression system (FSS) in Hangars 27A and 27B were converted from AFFF to HEF in the early 2000s. Two 50-gallon deck guns with AFFF remained in use after the FSS was converted to HEF. According to the PA, the hangars have floor drains that discharge to the city's sanitary sewer system through an oil/water separator (OWS). Prior to the early 1990s, the floor drains would have discharged to the stormwater drainage basin at PRL 3. There are no documented releases of AFFF at Hangars 27A and 27B.

4.4 PRL 5: Former Fire Station [Building (Bldg. 004]

The former BANGB fire station was in use from the 1940s until approximately 1992 when the new fire station was built (BB&E, 2016). There was no record of a release found during the PA; however, AFFF was likely used and stored given the timeframe that the fire station was in operation. Floor drains were present, which according to the PA discharged to the sanitary sewer system through an OWS. However, prior to connection to the city's sanitary sewer system, the floor drains likely discharged to a dry well.

4.5 PRL 6: Current Fire Station (Bldg. 040)

The current fire station was built in 1992 and houses three fire department (FD) crash trucks. At the time of the PA, the crash trucks contained a combined 320 gallons of 3% AFFF, and an additional 250 gallons of 3% AFFF was stored in 5-gallon totes. When needed, the totes were used to manually refill the reservoirs in the crash trucks. As of late 2016, AFFF is no longer used at Bldg. 040. There were no floor drains present during the PA site visit; however, the fire station originally contained floor drains which discharged to the sanitary sewer via an oil/water separator. The floor drains were eliminated as part of a facility upgrade in 2010. There have been no known

releases of AFFF.

4.6 PRL 7: Hush House

The hush house was initially constructed in 1995, and is located on the eastern parcel, near Sierra Taxiway. The FSS contained AFFF from 1995 until the early 2000s when it was converted to HEF. Floor drains are present which discharge to the sanitary sewer system through an OWS. There have been three known discharges (two tests and one accidental release); however, most of the foam release was likely captured in the floor drains. At least one of the discharges likely released AFFF; however, it is not known if the other two releases were AFFF or HEF.

4.7 PRL 8: Fire Department Equipment Test Area

FD equipment testing occurred primarily off-Base at the eastern end of Sierra Taxiway, immediately south of the eastern parcel. Three known foam tests or AFFF releases have occurred, all in the mid-1990s; however, testing practices prior to 1993 are unclear (BB&E, 2016). The amount of AFFF used is unknown, and use of foam for equipment testing purposes ceased at least 15 years ago. Because the Fire Department Equipment Test Area abuts BANGB, activities at this PRL may have impacted the Base.

5.0 FIELD PROGRAM METHODS

The following subsections summarize utility clearance and permitting activities; soil boring installation, sampling, and abandonment; temporary groundwater monitoring well construction, development, and sampling; and sediment sampling. SI activities were conducted in accordance with the Work Plan and the *ANG Investigation Guidance* (ANG, 2009). The SI field activities were conducted during 26 through 30 June 2017.

5.1 Utility Location and Clearance

Prior to commencement of SI activities, drilling locations were pre-marked, and details of the proposed borehole locations were provided to the Massachusetts one call utility notification center, "DigSafe." DigSafe assigned ticket No. 20171917341 on 12 May 2017, then ticket No. 2017503551 on 19 June 2017 when the original ticket was renewed. Prior to initiating subsurface activities, Amec Foster Wheeler met with On-Target, a utility locator for members of the Dig Safe system, to review the proposed sampling areas. No locations were moved as a result of this meeting.

The 104th civil engineering department (CED) accompanied Amec Foster Wheeler during the pre-marking to verify the placement of each drilling location. An AF-103 Base Civil Engineering Work Clearance Request was submitted to the Base CED, and the completed/signed form was returned to Amec Foster Wheeler on 26 June 2017.

On 8 June 2017, Corbuilt, LLC of Canterbury, CT (Corbuilt) cleared Base utilities at each of the 17-proposed soil boring and TW locations using geophysical techniques. Equipment employed by Corbuilt included ground-penetrating radar (GPR) and electro-magnetic induction (EMI) locating equipment.

Between 26 June and 27 June 2017, Drilex Environmental of Auburn, Massachusetts (Drilex) used vacuum excavation techniques to pre-clear each of the drilling locations to an approximate depth of five feet bgs.

Utility clearance activities were performed at the direction and oversight of Amec Foster Wheeler, with the BANGB POC accompanying as an escort.

5.2 Permits

As described in **Section 5.1**, Amec Foster Wheeler obtained utility clearance permits for the SI

activities, including Dig Safe Clearance with One Call, and AF Form 103 with the 104th FW Base CED. It was determined by the airport manager, Mr. Erick Billowitz, that Federal Aviation Administration (FAA) permits were not required for performance of SI activities. No other permits were required or obtained.

5.3 Soil Boring Installation

Between 26 June and 29 June 2017, 17 soil borings were advanced with five temporary monitoring wells installed to investigate potential PFC impacts in soil and groundwater at BANGB. The borings were advanced by Drilex using vacuum excavation and DPT drilling techniques. Soil borings advanced solely for soil sample collection were completed at 15 ft. bgs. Soil borings advanced for installation of temporary monitoring wells were completed below the water table, at depths ranging from 35 to 54 ft. bgs. Individual borehole depths are provided in the soil boring logs included in **Appendix A**.

Soil boring locations were selected based on PRL use and physical characteristics to target the most probable AFFF release areas. Seventeen soil borings were advanced in and around the seven PRLs using DPT drilling methods (12 borings for soil sampling only, 3 borings for TW installation, and 2 borings for combined TW installation and soil sampling). Soil cores were collected continuously for field screening at 4- to 5-ft. intervals in new, dedicated acetate liners. Drilling rods/tools were decontaminated between borings in accordance with protocol described in the Work Plan.

5.4 Soil Sampling

Shallow soil samples (0-2 ft. bgs) were collected from the sidewall of the open vacuum excavation hole during utility clearance. A clean trowel was used to remove approximately one to two inches of soil on the sidewall, then a second clean trowel was used to collect the sidewall sample. Deep soil samples (13-15 ft. bgs) were collected from the acetate sleeves from within the DPT core barrel. Each sleeve was opened lengthwise and the soil was examined. Soil characteristics were logged in accordance with the Unified Soil Classification System (USCS). Soil was visually inspected for potential impacts.

Shallow samples were generally collected from the upper two feet of soil, directly beneath asphalt or pavement, if present. Deep soil samples were collected from 13 to 15 ft. bgs at every location, since the water table was not encountered in the upper 15 ft. of the soil boring.

5.5 Soil Boring Abandonment

Following the completion of drilling activities, each boring was backfilled with cuttings. Surface completions were patched with like materials (topsoil/seed, asphalt, or concrete) in accordance with ANG specifications.

5.6 Temporary Monitoring Well Installation and Development

Five TWs were installed to investigate potential groundwater impacts at the seven BANGB PRLs and at the Base boundaries. Because of the proximity of several PRLs to other PRLs, and to the Base boundaries, the wells were considered dual-purpose. Dual purpose wells are intended to assess groundwater quality downgradient from each PRL and at the Base boundary.

The primary purpose of installing the temporary monitoring wells was to assess groundwater quality downgradient of the PRLs. Although well elevation surveys were not part of this project scope, temporary well locations were determined based on historical groundwater data and topographic contours, historical indications of possible impact, and Base features such as buildings and the Base boundary. In general, TWs were installed at locations with the greatest potential to intercept PFCs dissolved in groundwater based on available data, and might not represent the highest concentrations at each PRL.

Soil cores were collected continuously to verify soil lithology, then inspected, logged, and field screened in accordance with the FSP. Temporary monitoring wells were installed in accordance with Amec Foster Wheeler's PFC-specific Standard Operating Procedure (SOP) for installation of monitoring wells (AFW-04).

The TW borings were advanced with DPT tools. TWs were constructed within borings using a two-inch diameter, schedule 40 polyvinyl chloride (PVC) riser with a 10-ft., 0.010-inch slot screened interval with the water table bisecting the well screen. New dedicated well materials were used at each TW location. The annulus surrounding each well screen and riser was backfilled with No.1 filter sand, which was placed from the bottom of the borehole to the ground surface. No annular seals were installed.

The temporary monitoring wells were developed using a pump to purge the screened interval and remove fine particles that had accumulated. Water quality parameters were monitored and recorded at periodic intervals. Monitoring wells were considered adequately developed when water quality parameters had stabilized and turbidity was low (i.e., <50 Nephelometric Turbidity Units (ntu) where feasible).

Consistent with MCP at 310 CMR 40.0045(7), well development water was discharged to the ground surface at the point of withdrawal. Equipment and pumps inserted into the well were decontaminated following each use. TW development logs are included in **Appendix B**.

5.7 Water Level Measurements

Prior to well purging, static water levels measurements were collected with an electronic water level meter. Water levels were measured as a distance below the top of the PVC riser and recorded on field data sheets.

5.8 Groundwater Sampling

Six groundwater samples were collected, five from TWs and one from an existing permanent well. Wells were purged with either a submersible pump or peristaltic pump, and United States Environmental Protection Agency (USEPA) sampling methodology was followed to collect groundwater samples. The initial water level was recorded using an electronic water level meter prior to purging and sampling activities. The submersible pump or tubing was inserted into the monitoring well to the depth recorded in the sampling logs above the bottom of the well to prevent disturbances and re-suspension of sediment present in the bottom of the well. In general, the pump intake was placed in the middle of the saturated interval. The pump discharge tubing was connected to a flow-through cell containing a multi-parameter Sonde Instrument to record water parameters. The pump rate during purging was maintained between 100 and 300 milliliters per minute (mL/min) with a steady flow rate maintained, such that drawdown of the water level within the well did not exceed a maximum allowable drawdown of 0.3 ft. The following parameters were monitored during purging: temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen, turbidity, temperature, and specific conductivity on approximately five-minute intervals. The water level was monitored during this same time interval.

The well was considered stabilized after three consecutive readings as follows:

- +/-0.1 for pH,
- +/-3% for specific conductance (conductivity),
- +/-10 millivolts (mV) for ORP,
- +/-10% for dissolved oxygen, and
- +/-10% for turbidity.

Groundwater sampling logs and water quality instrument calibration logs are included in

Appendix C and **Appendix D** respectively.

5.9 Temporary Monitoring Well Abandonment

Following the completion of sampling activities, each temporary well was pulled from the ground allowing the formation to collapse into the borehole. Surface completions were patched with like materials (topsoil/seed, asphalt, or concrete) in accordance with ANG specifications.

5.10 Sediment Sampling

Two sediment samples were collected at PRL 3 from the floor of the dry stormwater drainage basin. Samples were collected from the upper two feet of sediment utilizing a clean shovel and stainless-steel trowel. The shovel was used to dig a two-foot deep hole, then a clean trowel was used to collect a sample from the sidewall of the hole. After retrieval, sediment was transferred to a clean stainless-steel bowl, homogenized, and then placed in laboratory-supplied containers. Samples were immediately cooled with ice to less than 4°C. Re-usable sampling equipment was decontaminated in accordance with the Work Plan.

Sediment sampling logs are included in **Appendix E**.

5.11 Decontamination

Field sampling equipment (e.g. water level indicators, pumps, bowls, trowels, shovels, and other downhole equipment) was decontaminated prior to initial use, and between samples. Liquinox® soap diluted with PFC-free bottled water was used to wash sampling equipment with a clean high-density polyethylene brush used to remove debris and particulates. PFC-free bottled water was used to rinse soapy water from the sampling equipment. The PFC-free water was distilled water obtained from a local water bottling company. Prior to use, a sample of the water was submitted to Vista for analysis of the six PFC compounds on the Third Unregulated Contaminant Monitoring Rule (UCMR3) list. Concentrations were reviewed to ensure Amec Foster Wheeler's internal PFC-free criteria were met.

To avoid possible cross contamination from potential PFC-containing items, field personnel and subcontractors adhered strictly to the SOPs developed by Amec Foster Wheeler for sampling at sites where PFCs are potentially present. SOPs and precautions to prevent cross-contamination are included in the SI Work Plan (Amec, 2017), and include information on permissible and prohibited field equipment and supplies, personal protective equipment, sample containers, clothing, personal hygiene products, and food.

5.12 Investigation Derived Waste Management

Soil cuttings were used to backfill soil borings; no excess soil was generated during drilling activities. Purge water generated during monitoring well development and groundwater sampling activities and rinse water were returned to the ground surface at the point of generation. Disposable sampling equipment (i.e. gloves, tubing, etc.) was disposed of as general waste, in on-base refuse containers. No investigation-derived waste was generated during SI field activities.

5.13 Laboratory

PFC samples were submitted to Vista Analytical Laboratories, Inc. (Vista), in El Dorado Hills, California. Vista is accredited under the Department of Defense Environmental Laboratory Accreditation Program (ELAP) and maintains a National Environmental Laboratory Accreditation Program (NELAP) certification via reciprocity in the Commonwealth of Massachusetts.

5.14 Field Quality Assurance/Quality Control Sample Results

Quality Assurance and Quality Control (QA/QC) samples, including field duplicates, matrix spike/matrix spike duplicates (MS/MSD), equipment rinsate samples, and field blanks were analyzed for the same PFC parameters as the associated project samples. The analytical results for the field duplicates are presented in **Table 3** through **Table 5**.

5.15 Data Validation and Usability

Amec Foster Wheeler performed a data quality review of samples collected during field activities and submitted to Vista for analysis of PFCs, consisting of: 26 soil samples (including two field duplicates); three sediment samples (including 1 field duplicate); and 12 aqueous samples (including six primary groundwater samples, one field duplicate, five equipment rinsate blanks, and one decontamination source water sample).

The laboratory analytical data generated during the SI were reviewed by a qualified analytical chemist for conformance with the project DQOs specified in the QAPP (Amec 2017). Amec Foster Wheeler performed EPA Stage 4 validation on 10 percent (%) of the field samples and EPA Stage 2B validation on the remaining field samples associated with this sampling event. 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. The validation was performed in general accordance with: Amec Foster Wheeler Final QAPP (Amec 2017); Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (DOD, 2017); and USEPA Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (USEPA, 2009).

Amec Foster Wheeler evaluated 216 data records from field samples during the validation. Amec Foster Wheeler J qualified[2] 39 records (18.1%) as estimated values because of low MS/MSD recoveries, field duplicate imprecision, and/or analyte concentrations outside the instrument's calibration range. The Data Validation Report, including qualified data, is included as **Appendix F**. Laboratory analytical reports and chains of custody forms are provided in **Appendix G.**

[2] The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

6.0 SITE INVESTIGATIONS

This SI field program was designed to collect data needed to evaluate the presence/absence of PFC compounds at each of the seven PRLs. The scope of the SI was designed using recommendations presented in the PA prepared by BB&E. The following sections describe the investigation approach that was used to fulfill the objectives of the SI. The work was conducted in accordance with the QAPP, SHSP, and FSP presented in the approved Work Plan.

6.1 Field Activities Summary

The following SI field activities were completed:

PRL Name	Analyzed Parameters	Soil Borings	Soil Samples	Groundwater Samples Existing Wells	Groundwater Samples Temporary Wells	Surface Water Samples	Sediment Samples
1. Former FTA-01 (IRP Site 1)	PFCs	2	2	0	1	0	0
3. SW Drainage Basin (IRP Site 4)	PFCs	0	0	1	0	0	2
4. Hangars 27A and 27 B	PFCs	3	6	0	1	0	0
5. Former Fire Station (bldg. 004)	PFCs	2	4	0	0	0	0
6. Current Fire Station (Bldg. 040 S)	PFCs	3	6	0	1	0	0
7. Hush House	PFCs	2	4	0	1	0	0
8. Fire Department Equipment Test Area	PFCs	2	2	0	1	0	0

Individual sampling locations are shown on **Figure 5** through **Figure 7.** Soil boring and monitoring well construction, well development, groundwater sampling, and sediment sampling logs are included in **Appendices A**, **B, C**, and **E,** respectively.

6.2 General Work Plan Deviations

Deviations from the general work plan included one or more of the following conditions:

- Use of cameras to document field activities was prohibited at BANGB. No photographs

were taken and therefore a photolog is not included in this SI.

- Well purge water was returned to the ground surface at the point of generation to minimize investigation-derived waste (IDW) as allowed by the MassDEP[3].
- Down-hole equipment and sampling devices were decontaminated utilizing PFC-free bottled water and this IDW water was allowed to infiltrate the pervious ground surface at the sampling location.
- The June 2017 USEPA residential soil RSL value for PFBS (1,300,000 µg/kg) was used as the screening value in place of the May 2016 USEPA residential soil RSL value for PFBS (1,600,000 µg/kg). The updated RSL value was not published at the time the Work Plan was finalized.
- The June 2017 USEPA Tap Water RSL value for PFBS (400 µg/L) was used as the screening value in place of the May 2016 USEPA Tap Water RSL value for PFBS (380 µg/L). The updated RSL value was not published at the time the Work Plan was finalized.

Work Plan deviations specific to an individual PRL are discussed in the following sub sections.

6.3 PRL 1: Former FTA-01 (IRP Site 1)

6.3.1 Site Deviations

A deviation from the Work Plan occurred at this PRL. During groundwater sampling at TW-03, three consecutive turbidity readings within 10% were not obtained; however, groundwater samples obtained were below 50 ntu (final reading was 4.98 ntu). No other deviations, apart from the general Work Plan deviations (see **Section 6.2**), occurred at this PRL.

6.3.2 Soil Sampling

Two soil borings (01SB01 and 01SB02) were advanced at PRL 1 on 26 June 2017, and shallow soil samples (0-2 ft. bgs) were collected from each boring. As agreed upon in the Final Work Plan, only shallow soil samples were collected at this PRL. Because deep samples were not collected, 01SB02 was completed at two-feet bgs using vacuum excavation methods only.

[3] Pursuant to 310 CMR 40.0045(7) of the Massachusetts Contingency Plan "*Any person performing response actions at a Disposal Site in accordance with M.G.L. c. 21E and 310 CMR 40.0000 may discharge Remedial Wastewater, groundwater collected during development, purging, or sampling of groundwater monitoring wells provided the Remedial Wastewater or groundwater is discharged as follows: 1) at the point of withdrawal; or 2) at a point upgradient of the point of withdrawal…*"

Location 01SB01 was co-located with TW-03, and therefore DPT was used to install the TW. Two soil samples were collected at this PRL.

6.3.3 Groundwater Sampling

Temporary monitoring well TW-03 was drilled to a depth of 38 ft. bgs on 28 June 2017, and a well screen was installed from 28 ft. bgs to 38 ft. bgs. TW-03 was co-located with soil boring 01SB01. Groundwater was measured at a depth of 32.02 ft. below top of casing (TOC) in TW03 prior to purging and sampling. One groundwater sample was collected on 29 June 2017 as per the Work Plan.

Soil boring and permanent monitoring well locations are illustrated on **Figure 6.**

6.4 PRL 3: Stormwater Drainage Basin (IRP Site 4)

6.4.1 Site Deviations

No deviations, other than general Work Plan deviations occurred at this PRL.

6.4.2 Sediment Sampling

Two sediment samples (03SD01 and 03SD02) were collected at PRL 3 on 27 June 2017. Sediment samples were collected using hand tools from the upper two feet of sediment in the stormwater drainage basin. Two sediment samples were collected.

6.4.3 Groundwater Sampling

One groundwater sample was collected on 30 June 2017 from existing permanent groundwater monitoring well MW-6. Groundwater was measured at a depth of 23.79 ft. below TOC prior to purging and sampling. Based on historical records, TW-06 is screened from 17.25 ft. bgs to 27.25 ft. bgs; the bottom of the well screen was measured at a depth of 27.25 ft. (measured from TOC).

Sediment and permanent monitoring well locations are illustrated on **Figure 5.**

6.5 PRL 4: Hangars 27A and 27 B

6.5.1 Site Deviations

No deviations, other than general Work Plan deviations occurred at this PRL.

6.5.2 Soil Sampling

Three soil borings (04SB01 through 04SB03) were advanced at the PRL. Borings were pre-

cleared using vacuum extraction and shallow (0-2 ft. bgs) samples were collected on 26 June 2017. The borings were completed on 29 June 2017 using DPT drilling techniques, and deep samples (13-15 ft. bgs) were collected from the bottom two feet of each boring. Six soil samples were collected at this PRL.

6.5.3 Groundwater Sampling

Temporary monitoring well TW-02 was drilled to a depth of 35 ft. bgs on 27 June 2017, and a well screen was installed from 25 ft. bgs to 35 ft. bgs. TW-02 was a stand-alone location, not co-located with a soil boring. Groundwater was measured at a depth of 24.91 ft. below TOC in TW-02 prior to purging and sampling. One groundwater sample was collected on 28 June 2017 as per the Work Plan.

Soil boring and permanent monitoring well locations are illustrated on **Figure 5.**

6.6 PRL 5: Former Fire Station (Bldg. 004)

6.6.1 Site Deviations

A deviation from the Work Plan occurred at this PRL; soil borings 05SB01 and 05SB02 were relocated to the northeast. The relocation was needed because the PRL footprint illustrated in the Work Plan was not located over the former fire station's footprint. This relocation was recommended by the Barnes POC during the initial Base walk, and the location verified using historical aerial images which were overlain on the current maps.

6.6.2 Soil Sampling

Two soil borings (05SB01 and 05SB02) were advanced at the PRL. Borings were pre-cleared using vacuum extraction and shallow samples were collected on 27 June 2017. The borings were completed on 29 June 2017 using DPT drilling techniques, and deep samples were collected from the bottom two feet of each boring. Four soil samples were collected at this PRL.

Soil boring locations are illustrated on **Figure 6**.

6.7 PRL 6: Current Fire Station (Bldg. 040)

6.7.1 Site Deviations

Two deviations from the Work Plan occurred at this PRL:

- 35 feet of drill rods were left in the ground at TW-01. The rods were lost down hole while

drilling and were unable to be retrieved. The top of the rods is believed to be located 10 ft. bgs. The Barnes POC and Airfield Management were immediately alerted, and approval to leave the rods in place was given that day (27 June 2017) by the Chief of Airfield Management.

- Turbidity in the groundwater sample was stable, but above 50 ntu at the time of sample collection. Based on the elevated turbidity, Amec Foster Wheeler instructed Vista to centrifuge the sample prior to extraction.

No other deviations, apart from the general Work Plan deviations occurred at this PRL.

6.7.2 Soil Sampling

Three soil borings (06SB01 through 06SB03) were advanced at the PRL. Borings were pre-cleared using vacuum extraction and shallow samples were collected on 26 June 2017. The borings were completed on 29 June 2017 using DPT drilling techniques, and deep samples were collected from the bottom two feet of each boring. Six soil samples were collected at this PRL.

6.7.3 Groundwater Sampling

Temporary monitoring well TW-01 was drilled to a depth of 38 ft. bgs on 28 June 2017, and a well screen was installed from 28 ft. bgs to 38 ft. bgs. TW-01 was a stand-alone location, not co-located with a soil boring. Groundwater was measured at a depth of 35.54 ft. below TOC in TW-01 prior to purging and sampling. One groundwater sample was collected on 28 June 2017 as per the Work Plan.

Soil boring and monitoring well locations are illustrated on **Figure 6.**

6.8 PRL 7: Hush House

6.8.1 Site Deviations

No deviations, other than general Work Plan deviations occurred at this PRL.

6.8.2 Soil Sampling

Two soil borings (07SB01 and 07SB02) were advanced at the PRL. Borings were pre-cleared using vacuum extraction and shallow samples were collected on 26 June 2017. The borings were completed on 28 June 2017 (07SB02) and 29 June 2017 (07SB01) using DPT drilling techniques, and deep samples were collected from the bottom two feet of each boring. Four soil samples were collected at this PRL.

6.8.3 Groundwater Sampling

Temporary monitoring well TW-05 was drilled to a depth of 54 ft. bgs on 28 June 2017, and a well screen was installed from 44 ft. bgs to 54 ft. bgs. TW-05 was a stand-alone location, not co-located with a soil boring. Groundwater was measured at a depth of 46.75 ft. below TOC in TW-01 prior to purging and sampling. One groundwater sample was collected on 29 June 2017 as per the Work Plan.

Soil boring and permanent monitoring well locations are illustrated on **Figure 7.**

6.9 PRL 8: Fire Department Equipment Test Area

6.9.1 Site Deviations

A deviation from the Work Plan occurred at this PRL; turbidity in the groundwater sample was below 50 ntu (10.8 ntu final reading), but did not have three consecutive readings within 10%.

No other deviations, apart from the general Work Plan deviations occurred at this PRL.

6.9.2 Soil Sampling

Two soil borings (08SB01 and 08SB02) were advanced at PRL 8 on 26 June 2017, and shallow soil samples (0-2 ft. bgs) were collected from each boring. As agreed upon in the Final Work Plan, only shallow soil samples were collected at this PRL. As previously agreed with the ANG, deep samples were not collected and 08SB02 was completed at two-feet bgs using vacuum excavation methods only. Location 08SB01 was co-located with TW-04, and therefore DPT was used to install the TW. Two shallow soil samples were collected at this PRL.

6.9.3 Groundwater Sampling

Temporary monitoring well TW-04 was drilled to a depth of 43 ft. bgs on 28 June 2017, and a well screen was installed from 33 ft. bgs to 43 ft. bgs. TW-04 was co-located with soil boring 08SB01. Groundwater was measured at a depth of 32.88 ft. below TOC in TW-04 prior to purging and sampling. One groundwater sample was collected on 30 June 2017 as per the Work Plan.

Soil boring and permanent monitoring well locations are illustrated on **Figure 7.**

7.0 SOIL AND GROUNDWATER STANDARDS

A soil or groundwater standard is an environmental and/or public health statute or rule used in identifying Base contamination that may pose a risk to human health or the environment. Soil and groundwater standards are federal and state human health and environment-based regulations used to:

- Determine the appropriate levels of Base clean-up;
- Define and formulate remedial action alternatives; and,
- Govern implementation and operation of the selected remedial action.

Currently no promulgated Standards exist for these compounds.

In accordance with *Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure (BRAC) Installations* [United States Air Force (USAF), August 2012] and EPA lifetime drinking water Health Advisories (HAs) for Perfluorooctanesulfonic Acid (PFOS; USEPA, May 2016a) and Perfluorooctanoic Acid (PFOA; USEPA, May 2016b), a release is considered confirmed if the following concentrations are exceeded:

PFOS:

- 0.07 micrograms per liter (µg/L) in groundwater/surface water that is used as or contributes to a drinking water source (combined with PFOA value).
- 1,260 micrograms per kilogram (µg/kg) in soil (calculated in the absence of RSL values[4]).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values).

PFOA:

- 0.07 µg/L in groundwater/surface water (combined with PFOS value).
- 1,260 µg/kg in soil (calculated in the absence of RSL values).
- 1,260 µg/kg in sediment (calculated in the absence of RSL values).

EPA has also derived RSL values for PFBS, for which there is a Tier 2 toxicity value (USEPA, June 2017). The USAF will also consider a release to be confirmed if the following concentrations

[4] Air Force Guidance screening levels calculated using the EPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search]. The toxicity value input for the calculator is the Tier 3 value reference dose of 0.00002 mg/kg/day derived by USEPA in their Drinking Water Health Advisories for both PFOS (USEPA, 2016a) and PFOA (USEPA, 2016b).

are exceeded:

PFBS:

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

The HA, RSLs and Air Force (AF) Guidance values are collectively referred to as screening criteria in this Report. **Table 6** presents the screening criteria for comparing the analytical results for PFBS, PFOA, and PFOS.

8.0 SITE INVESTIGATION RESULTS

This section presents the soil, groundwater, and sediment data collected during the SI activities and a comparison of detections. Detections of PFBS, PFOA and PFOS are compared to the screening criteria as defined in the Work Plan, and presented in **Table 6**. Locations of detected analytes are shown on **Figure 8** through **Figure 10**.

8.1 PRL 1: Former FTA-01 (IRP Site 1)

8.1.1 PRL 1 Soil Analytical Results

Two soil samples were collected and analyzed as described in **Section 6.3.2**, 01SB01 from 0-2 ft. bgs and 01SB02 from 0-2 ft. bgs. Analytical results from soil samples indicate some PFCs were detected above the laboratory reporting limit; however, no compounds exceeded the screening criteria in either of the two samples collected from PRL 1.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 9**.

8.1.2 PRL 1 Groundwater Analytical Results

One groundwater sample was collected from TW-03 and analyzed as described in **Section 6.3.3**. Analytical results from the groundwater sample indicates that six PFC compounds were detected at concentrations above the laboratory detection limit, with one compound exceeding the groundwater screening criterion. PFOS was detected in TW-03 above the 0.07 micrograms per liter (µg/L) US EPA Drinking Water Health Advisory (HA; USEPA, 2016a), at a concentration of 0.101 µg/L. The combined PFOS and PFOA concentration is 0.1465 µg/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 9.**

8.2 PRL 3: Stormwater Drainage Basin (IRP Site 4)

8.2.1 PRL 3 Sediment Analytical Results

Two sediment samples were collected and analyzed as described in **Section 6.4.2**, 03SD01 from 0-2 ft. bgs and 03SD02 from 0-2 ft. bgs. Analytical results from soil samples indicate some PFCs were detected above the laboratory reporting limit; however, no compounds exceeded the screening criteria in either of the two samples collected from PRL 3.

Comparisons of analytical results, including field duplicate results, to applicable criteria are presented on **Table 5**. Sediment sample locations showing detected compounds are depicted on **Figure 8.**

8.2.2 PRL 3 Groundwater Analytical Results

One groundwater sample was collected from MW-6 and analyzed as described in **Section 6.4.3**. Analytical results from the groundwater sample indicates that some PFCs were detected at concentrations above the laboratory detection limit; however, no compounds exceeded the screening criteria.

Comparisons of analytical results to applicable groundwater screening criteria are presented on **Table 4**. The monitoring well location showing detected compounds is illustrated on **Figure 8.**

8.3 PRL 4: Hangars 27A and 27B

8.3.1 PRL 4 Soil Analytical Results

Six soil samples were collected and analyzed from three soil borings as described in **Section 6.5.2**: 04SB01 from 0-2 ft. bgs and 13-15 ft. bgs; 04SB02 from 0-2 ft. bgs and 13-15 ft. bgs; and 04SB03 from 0-2 ft. bgs and 13-15 ft. bgs. Analytical results from soil samples indicate PFOS is the only PFC present above the laboratory reporting limit in four of the six samples collected. There were no exceedances of the screening criteria in the six samples collected from PRL 4.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 8**.

8.3.2 PRL 4 Groundwater Analytical Results

One groundwater sample was collected from TW-02 and analyzed as described in **Section 6.5.3**. Analytical results from the groundwater sample indicates that the six PFCs were detected at concentrations above the laboratory detection limit, with one compound exceeding the USEPA Drinking Water HA of 0.07 µg/L. PFOS was detected at a concentration of 0.0994 µg/L in TW-02. The combined PFOS and PFOA concentration is 0.1046 µg/L at this location.

Comparisons of analytical results to applicable criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 8.**

8.4 PRL 5: Former Fire Station (Bldg. 004)

8.4.1 PRL 5 Soil Analytical Results

Four soil samples were collected and analyzed from two soil borings as described in **Section 6.6.2**: 05SB01 from 0-2 ft. bgs and 13-15 ft. bgs; and 05SB02 from 0-2 ft. bgs and 13-15 ft. bgs. Analytical results from soil samples indicate some compounds were detected above the laboratory reporting limit; however, no compounds exceeded the screening criteria in either of the four samples collected from PRL 5.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 9**.

8.5 PRL 6: Current Fire Station (Bldg. 040)

8.5.1 PRL 6 Soil Analytical Results

Six soil samples from three soil borings were collected and analyzed as described in **Section 6.7.2**: 06SB01 from 0-2 ft. bgs and 13-15 ft. bgs; 06SB02 from 0-2 ft. bgs and 13-15 ft. bgs; and 06SB03 from 0-2 ft. bgs and 13-15 ft. bgs. Analytical results from soil samples indicate some PFCs were detected above the laboratory reporting limit; however, no compounds exceeded the screening criteria in the six samples collected from PRL 6.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 9**.

8.5.2 PRL 6 Groundwater Analytical Results

One groundwater sample was collected from TW-01 and analyzed as described in **Section 6.7.3**. A field duplicate was collected at this location. Analytical results from the groundwater sample indicates that five of six PFCs were detected at concentrations above the laboratory detection limit, with two compounds exceeding USEPA Drinking Water HA. In the primary sample, PFOS was detected at an estimated concentration of 0.609 µg/L. The combined PFOS and PFOA concentration in the primary sample is 0.6789 µg/L. In the field duplicate sample, PFOS and PFOA were detected at estimated concentrations of 0.95 µg/L and 0.0793 µg/L respectively. The combined PFOS and PFOA concentration in the field duplicate sample is 1.0293 µg/L.

Comparisons of analytical results to applicable criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 9.**

8.6 PRL 7: Hush House

8.6.1 PRL 7 Soil Analytical Results

Four soil samples were collected and analyzed from two borings as described in **Section 6.8.2**: 07SB01 from 0-2 ft. bgs and 13-15 ft. bgs; and 07SB02 from 0-2 ft. bgs and 13-15 ft. bgs. Analytical results from soil samples indicate that PFOS was detected above the laboratory reporting limit in the 0-2 ft. sample at both locations; however, the other five PFCs were non-detect. PFCs were non-detect in the 13-15 ft. sample at locations 07SB01 and 07SB02. No compounds exceeded the screening criteria in the four samples collected from PRL 7.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 10**.

8.6.2 PRL 7 Groundwater Analytical Results

One groundwater sample was collected from TW-05 and analyzed as described in **Section 6.8.3**. Analytical results from the groundwater sample indicates that five of six PFCs were detected at concentrations above the laboratory detection limit, with one compound exceeding the USEPA Drinking Water HA of 0.07 µg/L. PFOS was detected at a concentration of 0.634 µg/L in TW-05. The combined PFOS and PFOA concentration is 0.6937 µg/L at this location.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 10.**

8.7 PRL 8: Fire Department Equipment Test Area

8.7.1 PRL 8 Soil Analytical Results

Two soil samples were collected and analyzed as described in **Section 6.9.2**, 08SB01 from 0-2 ft. bgs and 08SB02 from 0-2 ft. bgs. Analytical results from soil samples indicate that some PFC compounds are present above the laboratory reporting limit; however, no compounds exceeded the screening criteria in either of the two soil samples collected from PRL 8.

Comparisons of analytical results to applicable screening criteria are presented on **Table 3**. The soil boring locations showing detected compounds are depicted on **Figure 10**.

8.7.2 PRL 8 Groundwater Analytical Results

One groundwater sample was collected from TW-04 and analyzed as described in **Section 6.9.3**. Analytical results from the groundwater sample indicates that two PFCs were detected at

concentrations above the laboratory detection limit; however, no compounds exceeded the screening criteria.

Comparisons of analytical results to applicable screening criteria are presented on **Table 4**. The temporary monitoring well location showing detected compounds is illustrated on **Figure 10.**

9.0 CONCLUSIONS/RECOMMENDATIONS

This section presents the SI conclusions and recommendations at each PRL. The recommended DQOs are based upon data collected by Amec Foster Wheeler during this SI, and an evaluation of results compared to applicable screening criteria.

9.1 PRL 1: Former FTA-01 (IRP Site 1)

A review of soil analytical data compared to soil screening criteria indicates there are no EPA RSL exceedances for PFBS, and no Air Force Guidance screening level exceedances for PFOS or PFOA at on-Base locations near PRL 1. The primary training area abuts the BANGB to the south; therefore, PFC concentrations may be encountered in soil samples collected off-Base to the south.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA exists at the southern Base boundary for PFOS. Given that groundwater appears to flow to the south-southeast, groundwater with PFC concentrations above applicable screening criteria is potentially present off-Base, to the south of PRL 1. PFOA and PFBA did not exceed their respective screening criteria at this location.

Based on the SI results, the following DQOs are recommended for PRL 1:

- Additional investigations to evaluate presence/absence of PFC in soil within the footprint of the former FTA, beneath the IRP Site 1 excavation area.
- Additional investigations to further evaluate concentrations of PFC in groundwater. This should include a source evaluation and delineation to determine the nature and extent of the release.

9.2 PRL 3: Stormwater Drainage Basin (IRP Site 4)

A review of sediment analytical data compared to screening criteria indicates there are no AF Guidance screening level exceedances for PFOS or PFOA within the stormwater drainage basin.

A review of analytical data from MW-6 compared to screening criteria indicates there are no exceedances of the USEPA Drinking Water HA for PFOS or PFOA, and no exceedances of the EPA Tap Water RSL for PFBS downgradient from PRL 3, or at the Base boundary.

Based on the SI results, NFA is recommended for PRL 3.

9.3 PRL 4: Hangars 27A and 27B

A review of soil analytical data compared to screening criteria indicates there are no EPA RSL exceedances for PFBS, and no AF Guidance screening level exceedances for PFOS or PFOA at PRL 4.

A review of groundwater analytical data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS exists at the downgradient from PRL 4, at the Base boundary. Since it appears that groundwater flows to the south-southeast, groundwater with PFC concentrations above applicable screening criteria is potentially present off-Base, to the southeast of PRL 4. However, PFOA and PFBA did not exceed their respective screening criteria at this location.

Based on the SI results, the following DQOs are recommended for PRL 4:

- Additional investigations to further evaluate concentrations of PFCs in groundwater. This should include a source evaluation and delineation to determine the nature and extent of the release.

9.4 PRL 5: Former Fire Station (Bldg. 004)

A review of soil analytical data compared to screening criteria indicates there are no EPA RSL exceedances for PFBS, and no AF Guidance screening level exceedances for PFOS or PFOA at PRL 5.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS and PFOA exists downgradient from PRL 5, at the Base boundary. This determination was made based on concentrations observed in TW-01, which was installed to assess groundwater conditions downgradient from both PRL 5 and PRL 6. Given that groundwater flows to the south-southeast, groundwater with PFC concentrations above applicable screening criteria is potentially present off-Base, to the southeast of PRL 5. PFBA did not exceed its respective screening criteria at this location.

Based on the SI results, the following DQOs are recommended for PRL 5:

- Additional investigations to further evaluate concentrations of PFC in groundwater. This should include a source evaluation and delineation to determine the nature and extent of the release.

9.5 PRL 6: Current Fire Station (Bldg. 040)

A review of soil analytical data compared to screening criteria indicates there are no EPA RSL exceedances for PFBS, and no AF Guidance screening level exceedances for PFOS or PFOA at PRL 6.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS and PFOA exists at the downgradient well from PRL 6, at the Base boundary. This determination was made based on concentrations observed in TW-01, which was installed to assess groundwater conditions downgradient from both PRL 5 and PRL 6. Given that groundwater flows to the south-southeast, groundwater with PFC concentrations above applicable screening criteria is potentially present off-Base, to the southeast of PRL 6. PFBA did not exceed its respective screening criteria at this location.

Based on the SI results, the following DQOs are recommended for PRL 6:

- Additional investigations to further evaluate concentrations of PFC in groundwater. This should include a source evaluation and delineation to determine the nature and extent of the release.

9.6 PRL 7: Hush House

A review of soil analytical data compared to screening criteria indicates there are no EPA RSL exceedances for PFBS, and no AF Guidance screening level exceedances for PFOS or PFOA at PRL 7.

A review of groundwater data compared to screening criteria indicates an exceedance of the USEPA Drinking Water HA for PFOS exists downgradient from PRL 7, at the Base boundary. Given that groundwater flows to the south-southeast, groundwater with PFC concentrations above applicable screening criteria is potentially present off-Base, to the south of PRL 7. PFOA and PFBA did not exceed their respective screening criteria at this location.

Based on the SI results, the following DQOs are recommended for PRL 7:

- Additional investigations to further evaluate concentrations of PFC in groundwater. This should include a source evaluation and delineation to determine the nature and extent of the release.

9.7 PRL 8: Fire Department Equipment Test Area

A review of soil analytical data compared to screening criteria indicates there are no EPA RSL exceedances for PFBS, and no AF Guidance screening level exceedances for PFOS or PFOA at on-Base locations near PRL 8. The primary equipment test area abuts the BANGB to the south; therefore, PFC concentrations in soil may be observed off-Base to the south.

A review of groundwater data compared to screening criteria found no exceedances of the USEPA Drinking Water HA for PFOS or PFOA, and no exceedances of the EPA Tap Water RSL for PFBS at the southern Base boundary. Since groundwater appears to flow to the south-southeast, TW-04 would be hydraulically upgradient from the equipment test area; therefore, PFC concentrations in groundwater from a potential release may be observed off-Base to the south of that sample point.

Based on the SI results, the following DQOs are recommended for 8:

- Additional investigations to evaluate presence/absence of PFC in soil within the footprint of the equipment test area.
- Additional investigations to further evaluate concentrations of PFC in groundwater downgradient from the fire department equipment test area. This should begin with a source evaluation, then assess the extent of the release if PFC compounds are detected above the Screening criteria during the source evaluation.

9.8 PRL Sites Summary

In summary, additional investigations are recommended for six PRLs and NFA is recommended for one PRL.

SI activities did not encounter PFCs exceeding screening criteria in soil samples collected at on-base locations; however, two PRLs (PRL 1 and PRL 8) are primarily located off-base. Since sampling was limited to the northern fringes at these two PRLs, Amec Foster Wheeler cannot conclusively state whether soil screening criteria were exceeded at PRL 1 and PRL 8. Based on these findings, Amec Foster Wheeler recommends additional investigations at the following two PRLs to evaluate soil conditions:

- PRL 1
- PRL 8

SI activities determined that five PRLs have USEPA Drinking Water HA exceedances at the Base

boundary. There were no HA exceedances in groundwater at PRL 8. However, PFC compounds were detected above laboratory detection limits in the sample from PRL 8. Based on these findings Amec Foster Wheeler recommends additional investigations at the following six PRLs to further evaluate groundwater conditions:

- PRL1
- PRL 4
- PRL 5
- PRL 6
- PRL 7
- PRL 8

SI activities determined that one PRL did not have exceedances of applicable screening criteria for any media tested. Based on these findings, Amec Foster Wheeler recommends NFA at the following PRL:

- PRL 3

These recommendations are summarized in the following table:

PRL	Screening Criteria Exceedance		Recommendation
	Soil	GW	
PRL 1: Former FTA (IRP Site 1)	Inc.	X	Soil investigation to determine if PFCs exceed screening criteria off-Base. Groundwater (GW) investigation to determine the nature and extent of the confirmed release.
PRL 3: Stormwater Drainage Basin			NFA
PRL 4: Hangars 27A & 27B		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 5: Former Fire Station, Bldg. 004		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 6: Current Fire Station, Bldg. 040		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 7: Hush House		X	GW investigation to determine the nature and extent of the confirmed PFC release.
PRL 8: Fire Department Equipment Test Area	Inc.	Inc.	Soil and GW investigation to determine if PFCs exceed screening criteria off-Base.

Notes:

Inc. - Inconclusive based on results of SI

X – Screening criteria exceedance

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TABLES

Table 1

Preliminary Assessment Recommendations

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

104th Fighter Wing, Massachusetts Air National Guard

Barnes Air National Guard Base, Westfield, Massachusetts

List of PRLs		
PRL	**Use**	**Recommendation**
1. Former FTA-01	Off-Base Former Fire Training Area	Soil and Groundwater Inspection
3.Stormwater Drainage Basin (IRP Site 4)	Drainage Basin Receiving Stormwater from Flight Line, Hangars, and Buildings on the Flight Line	Sediment and Groundwater Inspection
4. Hangars 27A and 27B	Hangar with AFFF FSS	Soil and Groundwater Inspection
5. Former Fire Station (Bldg. 004)	Former Fire Station	Soil and Groundwater Inspection
6. Current Fire Station (Bldg. 040)	Fire Station	Soil and Groundwater Inspection
7. Hush House	Hush House with AFFF FSS	Soil and Groundwater Inspection
8. Fire Dept. Equipment Test Area	Off-Base Former Fire Department Equipment Test Area	Soil and Groundwater Inspection

Notes:
Recommendations provided by BB&E, Inc. in the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report (BB&E, 2016)
PRL – Potential Release Location
FTA – Fire Training Area
IRP – Installation Restoration Program
AFFF – Aqueous Film Forming Foam
FSS – Fire Suppression System
Bldg. - Building

Table 2

Summary of Site Inspection Activities

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

104th Fighter Wing, Massachusetts Air National Guard

Barnes Air National Guard Base, Westfield, Massachusetts

PRL Name	Analyzed Parameters[1]	Soil Borings	Soil Samples	Groundwater Samples Existing Wells	Groundwater Samples Temporary Wells	Surface Water Samples	Sediment Samples
1. Former FTA-01 (IRP Site 1)	PFCs	2	2	0	1	0	0
3. SW Drainage Basin (IRP Site 4)	PFCs	0	0	1	0	0	2
4. Hangars 27A and 27 B	PFCs	3	6	0	1	0	0
5. Former Fire Station (Bldg. 004)	PFCs	2	4	0	0	0	0
6. Current Fire Station (Bldg. 040 S)	PFCs	3	6	0	1	0	0
7. Hush House	PFCs	2	4	0	1	0	0
8. Fire Department Equipment Test Area	PFCs	2	2	0	1	0	0

Notes:

[1] Soil, groundwater, and sediment samples were collected and analyzed for the PFCs listed on the USEPA's Third Unregulated Contaminant Monitoring Rule (UCMR3) list

PRL – Potential Release Location

FTA – Fire Training Area

IRP – Installation Restoration Program

PFC – Perfluorinated Compound

Bldg. – Building

Table 3
Summary of Soil Analytical Testing Results
FY16 Phase I Regional Site Inspections for Perfluorinated Compounds
104th Fighter Wing, Massachusetts Air National Guard
Barnes Air National Guard Base, Westfield, Massachusetts

					Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
					Screening Level:	1.26[1]	1.26[1]	1300[2]	NA	NA	NA
PRL	**Location**	**Sample ID**	**Sample Date**	**Sample Depth (ft.)**	**Sample Type**	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1	BARNS-01-SB01	BARNS-01-SB01-062617-0-2	26-Jun-17	0.0-2.0	N	0.00493	0.000828J	0.00102U	0.000334J	0.000894J	0.00102U
	BARNS-01-SB02	BARNS-01-SB02-062617-0-2	26-Jun-17	0.0-2.0	N	0.0121	0.00099U	0.00099U	0.00099U	0.000314J	0.00099U
4	BARNS-04-SB01	BARNS-04-SB01-062617-0-2	26-Jun-17	0.0-2.0	N	0.000388J	0.000946U	0.000946U	0.000946U	0.000946U	0.000946U
		BARNS-04-SB01-062617-Dup	26-Jun-17	0.0-2.0	FD	0.000601J	0.001U	0.001U	0.001U	0.001U	0.001U
		BARNS-04-SB01-062917-13-15	29-Jun-17	13.0-15.0	N	0.000995U	0.000995U	0.000995U	0.000995U	0.000995U	0.000995U
	BARNS-04-SB02	BARNS-04-SB02-062617-0-2	26-Jun-17	0.0-2.0	N	0.000325J	0.001U	0.001U	0.001U	0.001U	0.001U
		BARNS-04-SB02-062917-13-15	29-Jun-17	13.0-15.0	N	0.000977U	0.000977U	0.000977U	0.000977U	0.000977U	0.000977U
	BARNS-04-SB03	BARNS-04-SB03-062617-0-2	26-Jun-17	0.0-2.0	N	0.00199J	0.00101U	0.00101U	0.00101U	0.00101U	0.00101U
		BARNS-04-SB03-062917-13-15	29-Jun-17	13.0-15.0	N	0.00327	0.000984U	0.000984U	0.000984U	0.000984U	0.000984U
5	BARNS-05-SB01	BARNS-05-SB01-062717-0-2	27-Jun-17	0.0-2.0	N	0.115J	0.00264	0.000998U	0.000403J	0.0048	0.000998U
		BARNS-05-SB01-062717-DUP	27-Jun-17	0.0-2.0	FD	0.208J	0.00329	0.00107U	0.000425J	0.00556	0.00107U
		BARNS-05-SB01-062917-13-15	29-Jun-17	13.0-15.0	N	0.427	0.00538	0.000978U	0.000978U	0.00826	0.000978U
	BARNS-05-SB02	BARNS-05-SB02-062717-0-2	27-Jun-17	0.0-2.0	N	0.00719	0.000979U	0.000979U	0.000979U	0.000384J	0.000979U
		BARNS-05-SB02-062917-13-15	29-Jun-17	13.0-15.0	N	0.000434J	0.000972U	0.000972U	0.000972U	0.000371J	0.000972U
6	BARNS-06-SB01	BARNS-06-SB01-062617-0-2	26-Jun-17	0.0-2.0	N	0.00249	0.000983U	0.000983U	0.000983U	0.000983U	0.000983U
		BARNS-06-SB01-062917-13-15	29-Jun-17	13.0-15.0	N	0.0018J	0.000285J	0.000992U	0.000992U	0.00133J	0.000992U
	BARNS-06-SB02	BARNS-06-SB02-062617-0-2	26-Jun-17	0.0-2.0	N	0.0733	0.000518J	0.000949U	0.000949U	0.00458	0.00056J
		BARNS-06-SB02-062917-13-15	29-Jun-17	13.0-15.0	N	0.118	0.000864J	0.000963U	0.000963U	0.00611	0.000963U
	BARNS-06-SB03	BARNS-06-SB03-062617-0-2	26-Jun-17	0.0-2.0	N	0.172	0.000922J	0.000998U	0.000998U	0.00333	0.00061J
		BARNS-06-SB03-062917-13-15	29-Jun-17	13.0-15.0	N	0.000304J	0.000982U	0.000982U	0.000982U	0.000982U	0.000982U
7	BARNS-07-SB01	BARNS-07-SB01-062617-0-2	26-Jun-17	0.0-2.0	N	0.000921J	0.000947U	0.000947U	0.000947U	0.000947U	0.000947U

Report Date: 10/12/2017

Table 3
Summary of Soil Analytical Testing Results
FY16 Phase I Regional Site Inspections for Perfluorinated Compounds
104th Fighter Wing, Massachusetts Air National Guard
Barnes Air National Guard Base, Westfield, Massachusetts

						Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
					Analyte:						
					Screening Level:	1.26[1]	1.26[1]	1300[2]	NA	NA	NA
PRL	**Location**	**Sample ID**	**Sample Date**	**Sample Depth (ft.)**	**Sample Type**	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
7	BARNS-07-SB01	BARNS-07-SB01-062917-13-15	29-Jun-17	13.0-15.0	N	0.00102 U	0.00102 U	0.00102 U	0.00102 U	0.00102 U	0.00102 U
	BARNS-07-SB02	BARNS-07-SB02-062617-0-2	26-Jun-17	0.0-2.0	N	0.00153 J	0.00101 U	0.00101 U	0.00101 U	0.00101 U	0.00101 U
		BARNS-07-SB02-062817-13-15	28-Jun-17	13.0-15.0	N	0.00101 U	0.00101 U	0.00101 U	0.00101 U	0.00101 U	0.00101 U
8	BARNS-08-SB01	BARNS-08-SB01-062617-0-2	26-Jun-17	0.0-2.0	N	0.00913	0.000928 U	0.000928 U	0.000928 U	0.000928 U	0.000928 U
	BARNS-08-SB02	BARNS-08-SB02-062617-0-2	26-Jun-17	0.0-2.0	N	0.00692	0.000919 U	0.000919 U	0.000919 U	0.00263	0.000919 U

Notes:
Light Blue Shaded = Exceeds Screening Level
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.
N = Normal Field Sample
NA = Not applicable
PRL - Potential Release Location
U = The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).
mg/kg = milligrams per kilogram
PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry
[1]Screening levels calculated using the EPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search]
[2]EPA Residential Screening Levels (June 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017]

Table 4
Summary of Groundwater Analytical Testing Results
FY16 Phase I Regional Site Inspections for Perfluorinated Compounds
104th Fighter Wing, Massachusetts Air National Guard
Barnes Air National Guard Base, Westfield, Massachusetts

						Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	PFOS+PFOA	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
					Analyte:							
					Health Advisory:	0.07	0.07	0.07	NA	NA	NA	NA
					EPA RSL Tapwater[1]:	NA	NA	NA	400	NA	NA	NA
PRL	**Location**	**Sample ID**	**Sample Date**	**Sample Depth (ft.)**	**Sample Type**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1	TW-03	BARNS-01-GW-TW03-062917-37	29-Jun-17	37.0-37.0	N	0.101	0.0455	0.1465	0.0128	0.0287	0.319	0.00432 J
3	MW-6	MW-6-063017-25	30-Jun-17	25.0-25.0	N	0.00684 J	0.00276 J	0.0096	0.00517 U	0.00517 U	0.0108	0.00517 U
4	TW-02	BARNS-04-GW-TW02-062817-30	28-Jun-17	30.0-30.0	N	0.0994	0.0052 J	0.1046	0.00358 J	0.00505 J	0.0305	0.00525 J
6	TW-01	BARNS-06-GW-TW01-062817-37	28-Jun-17	37.0-37.0	N	0.609 J	0.0699	0.6789	0.0395	0.02	0.641	0.00504 U
		BARNS-06-GW-TW01-062817-Dup	28-Jun-17	37.0-37.0	FD	0.95 J	0.0793	1.0293	0.0426	0.0238	0.737	0.00504 U
7	TW-05	BARNS-07-GW-TW05-062917-49	29-Jun-17	49.0-49.0	N	0.634	0.0597	0.6937	0.0535	0.0275	0.694	0.005 U
8	TW-04	BARNS-08-GW-TW04-063017-36	30-Jun-17	37.0-37.0	N	0.0038 J	0.00508 U	NA	0.00508 U	0.00508 U	0.0196	0.00508 U

Notes:
Light Blue Shaded = Exceeds Health Advisory
Underlined results exceed the EPA RSL standard.
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.
N = Normal Field Sample
NA = Not applicable
PRL = Potential Release Location
U = The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).
µg/L = micrograms per liter

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 either PFOA or PFOS is detected at or above the DL and the other is below the DL, then PFOA + PFOS is reported as "NA" representing Not Applicable.
3. If neither PFOA nor PFOS is detected at or above the DL, then PFOA + PFOS is reported as "ND" representing Not Detected.

PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry
Health Advisory from USEPA Office of Water, 2016a and 2016b, Health Advisories (HAs) for drinking water.
[1]EPA Regional Screening Levels (June 2017) [https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-june-2017]

Report Date: 10/13/2017

Table 5
Summary of Sediment Analytical Testing Results
FY16 Phase I Regional Site Inspections for Perfluorinated Compounds
104th Fighter Wing, Massachusetts Air National Guard
Barnes Air National Guard Base, Westfield, Massachusetts

					Analyte:	Perfluorooctanesulfonic acid (PFOS)	Perfluorooctanoic acid (PFOA)	Perfluorobutanesulfonic acid (PFBS)	Perfluoroheptanoic acid (PFHpA)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorononanoic acid (PFNA)
					Screening Level:	1.26[1]	1.26[1]	NA	NA	NA	NA
PRL	**Location**	**Sample ID**	**Sample Date**	**Sample Depth (ft.)**	**Sample Type**	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
3	BARNS-03-SD01	BARNS-03-SD01-062717-0-2	27-Jun-17	0.0-2.0	N	0.00138J	0.000941U	0.000941U	0.000941U	0.000941U	0.000941U
	BARNS-03-SD02	BARNS-03-SD02-062717-0-2	27-Jun-17	0.0-2.0	N	0.0028	0.00092U	0.00092U	0.00092U	0.000629J	0.00092U
		BARNS-03-SD02-062717-Dup	27-Jun-17	0.0-2.0	FD	0.0029	0.00102U	0.00102U	0.00102U	0.000501J	0.00102U

Notes:
Light Blue Shaded = Exceeds Screening Level

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.
N = Normal Field Sample
NA = Not applicable
PRL = Potential Release Location
U = The analyte was analyzed for, but was not detected above the reported limit of detection (LOD).
mg/kg = milligrams per kilogram
PFAS analysis by Modified USEPA Method 537 using Liquid Chromatography and Tandem Mass Spectrometry
[1]Screening levels calculated using the EPA Regional Screening Level calculator [https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search]

Report Date: 10/12/2017

Table 6

SI Screening Criteria

FY16 Phase I Regional Site Inspections for Perfluorinated Compounds

104th Fighter Wing, Massachusetts Air National Guard

Barnes Air National Guard Base, Westfield, Massachusetts

Parameter	Chemical Abstract Number	EPA Regional Screening Level Table (June 2017)[a]		Air Force Guidance for Soils and Sediments[b] (µg/kg)	EPA Health Advisory Drinking Water (Surface Water or Groundwater) (µg/L)[c]
		Residential Soil (µg/kg)	Tap Water[f] (µg/L)		
Perfluorobutane sulfonate (PFBS)	375-73-5	1,300,000[d]	400[e]	NL	NL
Perfluorooctanoic acid (PFOA)	335-67-1	NL	NL	1,260	0.07[g]
Perfluorooctane sulfonate (PFOS)	1763-23-1	NL	NL	1,260	

[a] EPA Regional Screening Levels (USEPA, 2017).

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

[c] USEPA, 2016b. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)* and USEPA, 2016a. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS).*

[d] PFBS RSL for Residential Soil concentration presented in SI Work Plan (Amec, 2017) was 1,600,000 µg/kg based on the May 2016 RSL values. This table has been updated to include the more recent RSL values published in June 2017.

[e] PFBS RSL for Tap Water presented in the SI Work Plan (Amec, 2017) was 380 µg/L based on the May 2016 RSL values. This table has been updated to include the more recent RSL values published in June 2017.

[f] Only groundwater was sampled during the SI, but analytical results have been compared to the tap water screening levels.

[g] Note: When PFOA and PFOS are both present, the combined detected concentrations of the compounds are compared with the 0.07 µg/L health advisory value.

Only groundwater was sampled during the SI, but analytical results have been compared to the tap water screening levels.

EPA = U.S. Environmental Protection Agency

NL = not listed

FIGURES

SITE LOCATION MAP

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

Installation Area (approximate)

Location of Site

Notes & Sources

Notes: Installation Area datalayers obtained from Figure 2 (Site Features and Potential AOCs) of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016.

0 2,000 Feet

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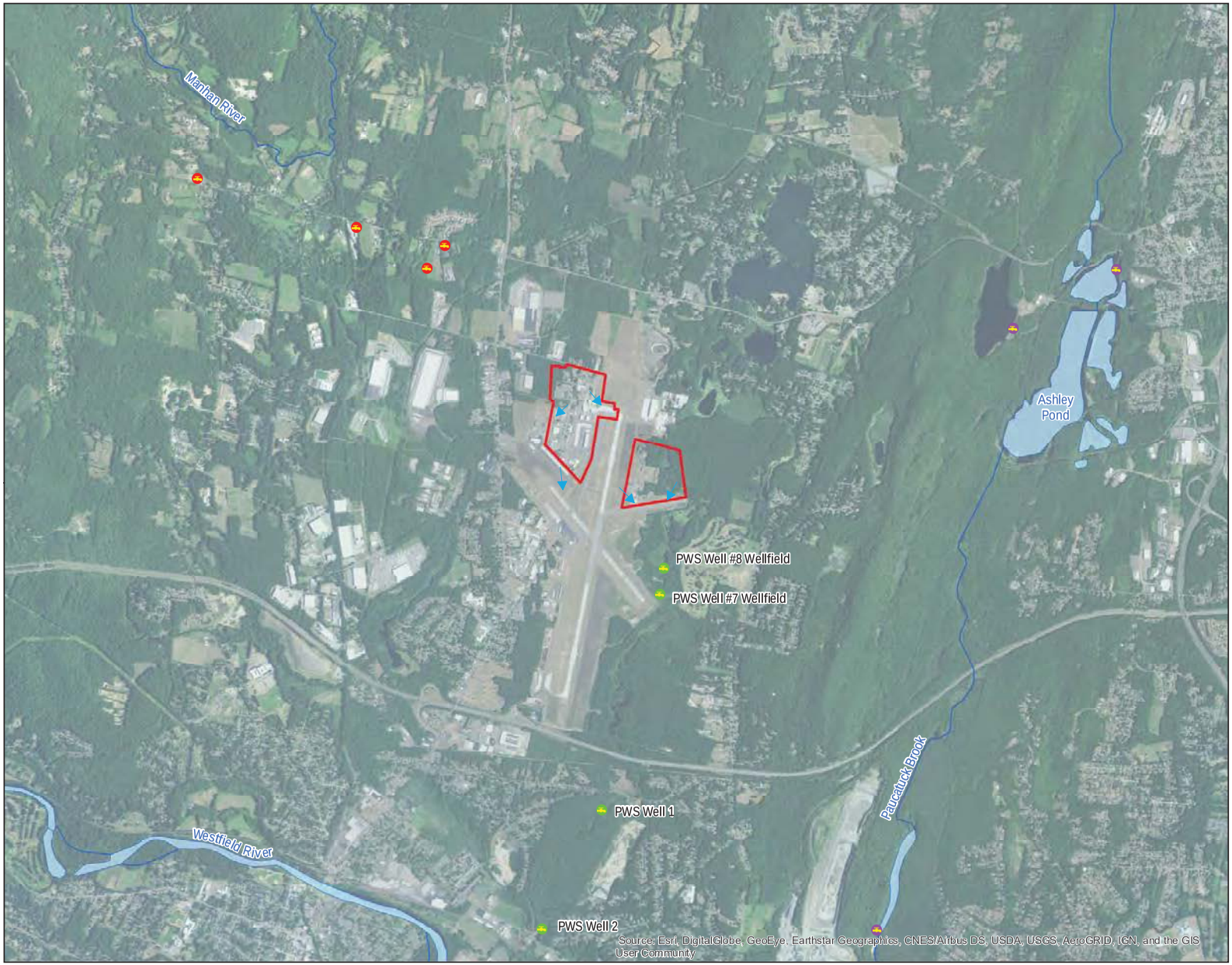
FIGURE 1

H:\ANG\Westfield_MA\Task5\MXD\Report\Fig1_Barnes_SiteLocus.mxd December 27, 2016 DWN: emily.gardiner CHKD: AKN



SITE & AREA FEATURES

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Community Groundwater Source
- Surface Water Intake
- Non-Community Groundwater Source
- Assumed Groundwater Flow Direction
- Rivers and Streams
- Lakes and Ponds
- Installation Area (approximate)

Location of Site

Notes & Sources

Notes: AFFF - aqueous film forming foam. PFC - perfluorinated compounds. PWS - Public Water Supply
Sources:Installation Area datalayer obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016. Public Water Supplies datalayer obtained from MassGIS (updated 10/2016).

0 1,500 3,000 Feet

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FIGURE 2

H:\ANG\Westfield_MA\Task5\MXD\Report\Fig2_Barnes_SiteAreaFeatures.mxd October 13, 2017 DWN: emily.gardiner CHKD: AKN

PRL SAMPLE LOCATIONS

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Monitoring Well
- Soil Sample
- Sediment Sample
- Existing Monitoring Well
- Assumed Groundwater Flow Direction
- Installation Area (approximate)
- Potential AFFF PFC PRL (approximate)

Location of Site

Notes & Sources

Notes: AFFF - aqueous film forming foam. PRL - potential release location. PFC - perfluorinated compounds
Sources: Potential AFFF PFC PRLs and Installation Area datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016.

0 250 500 Feet

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FIGURE
3

H:\ANG\Westfield_MA\Task5\MXD\Report\Fig3_Barnes_SampleLocations.mxd October 13, 2017 DWN: emily.gardiner CHKD: CK

CRITICAL HABITAT MAP

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Installation Area (approximate)
- Assumed GW Flow Direction
- NHESP Estimated Habitats of Rare Wildlife
- NHESP Priority Habitats of Rare Species
- Protected Open Space
- Marsh/Bog
- Wooded marsh
- Open Water
- Hydrologic Connection
- Wetland Limit
- Closure Line
- NHESP Certified Vernal Pool
- NHESP Potential Vernal Pool

Location of Site

Notes & Sources

Notes: AFFF - aqueous film forming foam. PRL - potential release location. PFC - perfluorinated compounds
Sources: Potential AFFF PFC PRLs and Installation Area datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016. NHESP Estimated Habitat of Rare Wildlife, NHESP Priority Habitat of Rare Species, Protected Open Space, MassDEP Wetlands (polyline & polygon features), NHESP Certified Vernal Pools, & NHESP Potential Vernal Pools datalayers obtained from MassGIS.

0 440 880 Feet

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FIGURE
4

H:\ANG\Westfield_MA\Task5\MXD\Report\Fig4_Barnes_CriticalHabitatMap.mxd October 13, 2017 DWN: emily.gardiner CHKD: AKN

PRLs 3 & 4
SAMPLE LOCATIONS

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Monitoring Well
- Soil Sample
- Sediment Sample
- Existing Monitoring Well
- Assumed Groundwater Flow Direction
- Potential AFFF PFC PRL (approximate)
- Installation Area (approximate)

Location of Site

Notes & Sources

Sources: Potential AFFF PFC PRLs and Installation Area datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016.

0 75 150 Feet

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FIGURE
5

H:\ANG\Westfield_MA\Task5\MXD\Report\Fig5_Barnes_PRL-3-4.mxd October 13, 2017 DWN: emily.gardiner CHKD: CK

PRLs 1, 5 & 6
SAMPLE LOCATIONS

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Monitoring Well
- Soil Sample
- Sediment Sample
- Assumed Groundwater Flow Direction
- Potential AFFF PFC PRL (approximate)
- Installation Area (approximate)

Location of Site

Notes & Sources

Sources: Potential AFFF PFC PRLs and Installation Area datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016.

0 75 150 Feet

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FIGURE
6

H:\ANG\Westfield_MA\Task5\MXD\Report\Fig6_Barnes_PRL-1-5-6.mxd October 13, 2017 DWN: emily.gardiner CHKD: CK

PRLs 7 & 8
SAMPLE LOCATIONS

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Monitoring Well
- Soil Sample
- Sediment Sample
- Assumed Groundwater Flow Direction
- Potential AFFF PFC PRL (approximate)
- Installation Area (approximate)

Location of Site

Notes & Sources

Sources: Potential AFFF PFC PRLs and Installation Area datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016.

0 75 150 Feet

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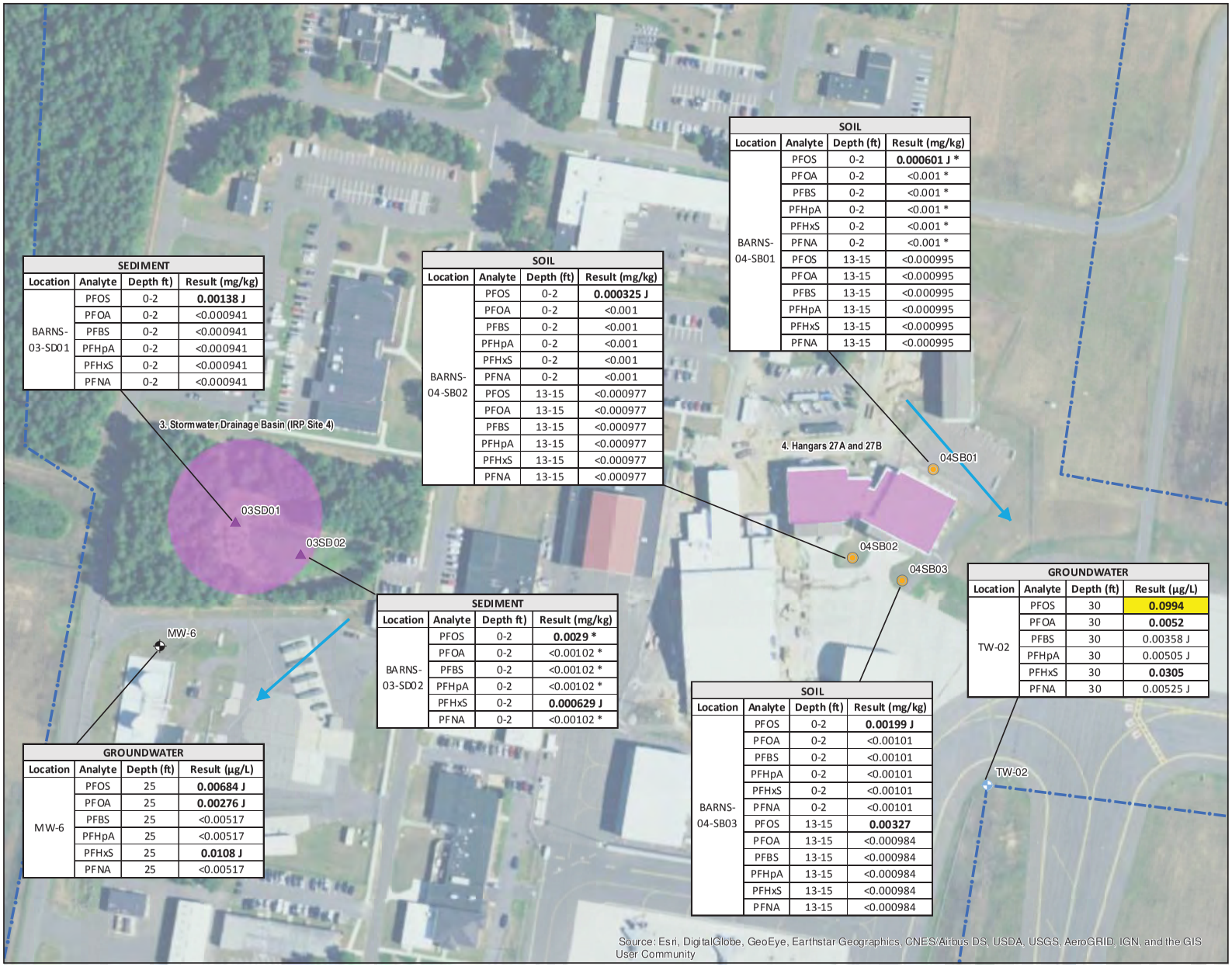
FIGURE
7



SEDIMENT			
Location	Analyte	Depth ft)	Result (mg/kg)
BARNS-03-SD01	PFOS	0-2	**0.00138 J**
	PFOA	0-2	<0.000941
	PFBS	0-2	<0.000941
	PFHpA	0-2	<0.000941
	PFHxS	0-2	<0.000941
	PFNA	0-2	<0.000941

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-04-SB02	PFOS	0-2	**0.000325 J**
	PFOA	0-2	<0.001
	PFBS	0-2	<0.001
	PFHpA	0-2	<0.001
	PFHxS	0-2	<0.001
	PFNA	0-2	<0.001
	PFOS	13-15	<0.000977
	PFOA	13-15	<0.000977
	PFBS	13-15	<0.000977
	PFHpA	13-15	<0.000977
	PFHxS	13-15	<0.000977
	PFNA	13-15	<0.000977

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-04-SB01	PFOS	0-2	**0.000601 J ***
	PFOA	0-2	<0.001 *
	PFBS	0-2	<0.001 *
	PFHpA	0-2	<0.001 *
	PFHxS	0-2	<0.001 *
	PFNA	0-2	<0.001 *
	PFOS	13-15	<0.000995
	PFOA	13-15	<0.000995
	PFBS	13-15	<0.000995
	PFHpA	13-15	<0.000995
	PFHxS	13-15	<0.000995
	PFNA	13-15	<0.000995

SEDIMENT			
Location	Analyte	Depth ft)	Result (mg/kg)
BARNS-03-SD02	PFOS	0-2	**0.0029 ***
	PFOA	0-2	<0.00102 *
	PFBS	0-2	<0.00102 *
	PFHpA	0-2	<0.00102 *
	PFHxS	0-2	**0.000629 J**
	PFNA	0-2	<0.00102 *

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-04-SB03	PFOS	0-2	**0.00199 J**
	PFOA	0-2	<0.00101
	PFBS	0-2	<0.00101
	PFHpA	0-2	<0.00101
	PFHxS	0-2	<0.00101
	PFNA	0-2	<0.00101
	PFOS	13-15	**0.00327**
	PFOA	13-15	<0.000984
	PFBS	13-15	<0.000984
	PFHpA	13-15	<0.000984
	PFHxS	13-15	<0.000984
	PFNA	13-15	<0.000984

GROUNDWATER			
Location	Analyte	Depth (ft)	Result (µg/L)
MW-6	PFOS	25	**0.00684 J**
	PFOA	25	**0.00276 J**
	PFBS	25	<0.00517
	PFHpA	25	<0.00517
	PFHxS	25	**0.0108 J**
	PFNA	25	<0.00517

GROUNDWATER			
Location	Analyte	Depth (ft)	Result (µg/L)
TW-02	PFOS	30	**0.0994**
	PFOA	30	**0.0052**
	PFBS	30	0.00358 J
	PFHpA	30	0.00505 J
	PFHxS	30	**0.0305**
	PFNA	30	0.00525 J

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

PRLs 3 & 4 SAMPLE RESULTS

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Monitoring Well
- Soil Sample
- Sediment Sample
- Existing Monitoring Well
- Assumed Groundwater Flow Direction
- Potential AFFF PFC PRL
- Installation Area

Notes & Sources

Notes:
AFFF - aqueous film forming foam
PRL - potential release location
PFC - perfluorinated compounds
PFOS - Perfluorooctanesulfonic acid
PFOA - Perfluorooctanoic acid
PFBS - Perfluorobutanesulfonic acid
PFHpA - Perfluoroheptanoic acid
PFHxS - Perfluorohexanesulfonic acid
PFNA - Perfluorononanoic acid

BOLD text indicates a detection.

YELLOW highlighted cells indicate 0.07 µg/L Health Advisory Exceedance.

* Field duplicate value exceeded primary sample.

Sources: Potential AFFF PFC PRLs and Installation Area datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016.

0 75 150 Feet

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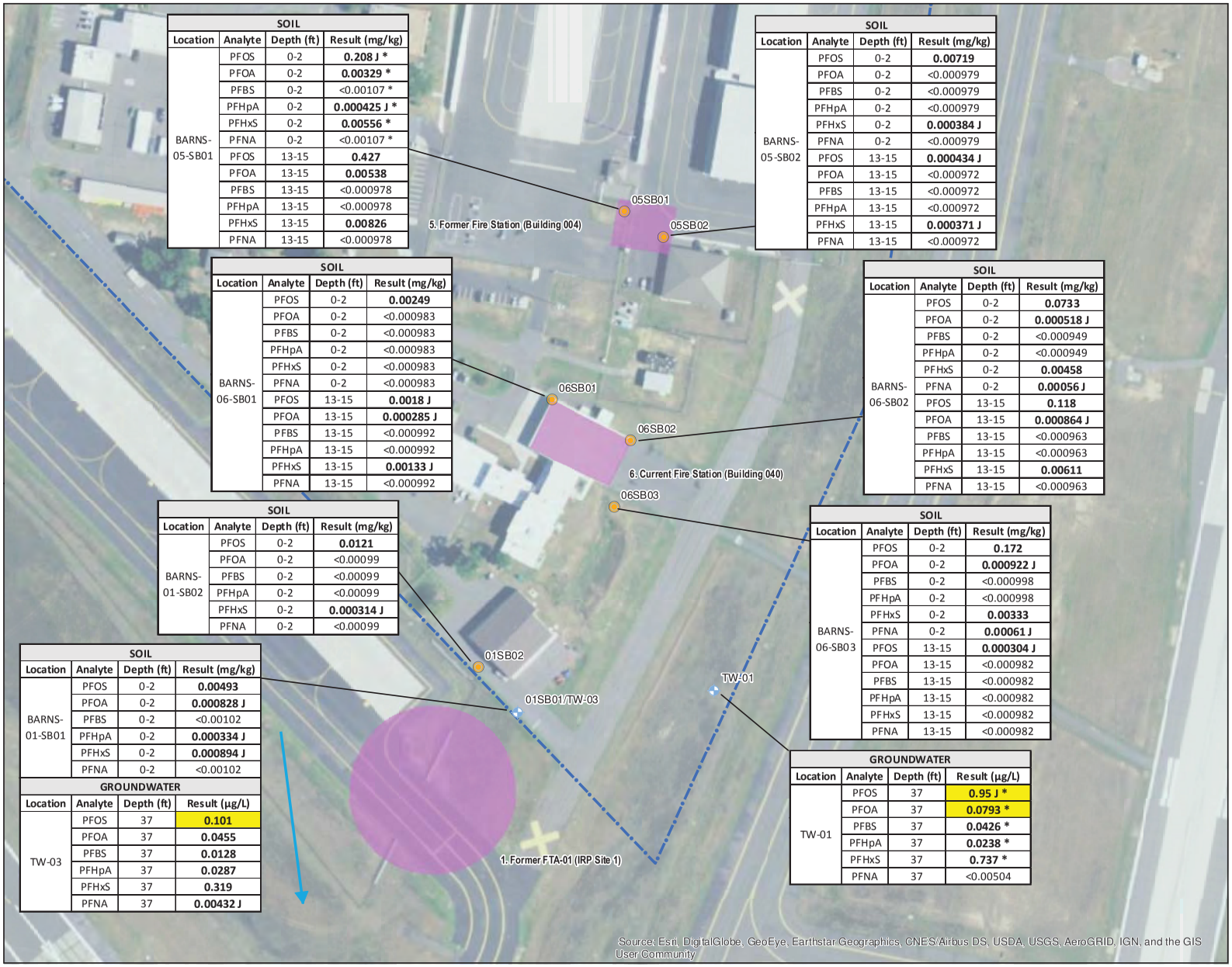
FIGURE 8

H:\ANG\Westfield_MA\Task5\MXD\Report\Fig8_Barnes_PRL-3-4.mxd October 13, 2017 DWN: emily.gardiner CHKD: CK



SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-05-SB01	PFOS	0-2	**0.208 J ***
	PFOA	0-2	**0.00329 ***
	PFBS	0-2	<0.00107 *
	PFHpA	0-2	**0.000425 J ***
	PFHxS	0-2	**0.00556 ***
	PFNA	0-2	<0.00107 *
	PFOS	13-15	**0.427**
	PFOA	13-15	**0.00538**
	PFBS	13-15	<0.000978
	PFHpA	13-15	<0.000978
	PFHxS	13-15	**0.00826**
	PFNA	13-15	<0.000978

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-05-SB02	PFOS	0-2	**0.00719**
	PFOA	0-2	<0.000979
	PFBS	0-2	<0.000979
	PFHpA	0-2	<0.000979
	PFHxS	0-2	**0.000384 J**
	PFNA	0-2	<0.000979
	PFOS	13-15	**0.000434 J**
	PFOA	13-15	<0.000972
	PFBS	13-15	<0.000972
	PFHpA	13-15	<0.000972
	PFHxS	13-15	**0.000371 J**
	PFNA	13-15	<0.000972

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-06-SB01	PFOS	0-2	**0.00249**
	PFOA	0-2	<0.000983
	PFBS	0-2	<0.000983
	PFHpA	0-2	<0.000983
	PFHxS	0-2	<0.000983
	PFNA	0-2	<0.000983
	PFOS	13-15	**0.0018 J**
	PFOA	13-15	**0.000285 J**
	PFBS	13-15	<0.000992
	PFHpA	13-15	<0.000992
	PFHxS	13-15	**0.00133 J**
	PFNA	13-15	<0.000992

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-06-SB02	PFOS	0-2	**0.0733**
	PFOA	0-2	**0.000518 J**
	PFBS	0-2	<0.000949
	PFHpA	0-2	<0.000949
	PFHxS	0-2	**0.00458**
	PFNA	0-2	**0.00056 J**
	PFOS	13-15	**0.118**
	PFOA	13-15	**0.000864 J**
	PFBS	13-15	<0.000963
	PFHpA	13-15	<0.000963
	PFHxS	13-15	**0.00611**
	PFNA	13-15	<0.000963

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-01-SB02	PFOS	0-2	**0.0121**
	PFOA	0-2	<0.00099
	PFBS	0-2	<0.00099
	PFHpA	0-2	<0.00099
	PFHxS	0-2	**0.000314 J**
	PFNA	0-2	<0.00099

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-06-SB03	PFOS	0-2	**0.172**
	PFOA	0-2	**0.000922 J**
	PFBS	0-2	<0.000998
	PFHpA	0-2	<0.000998
	PFHxS	0-2	**0.00333**
	PFNA	0-2	**0.00061 J**
	PFOS	13-15	**0.000304 J**
	PFOA	13-15	<0.000982
	PFBS	13-15	<0.000982
	PFHpA	13-15	<0.000982
	PFHxS	13-15	<0.000982
	PFNA	13-15	<0.000982

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-01-SB01	PFOS	0-2	**0.00493**
	PFOA	0-2	**0.000828 J**
	PFBS	0-2	<0.00102
	PFHpA	0-2	**0.000334 J**
	PFHxS	0-2	**0.000894 J**
	PFNA	0-2	<0.00102
GROUNDWATER			
Location	Analyte	Depth (ft)	Result (µg/L)
TW-03	PFOS	37	**0.101**
	PFOA	37	**0.0455**
	PFBS	37	**0.0128**
	PFHpA	37	**0.0287**
	PFHxS	37	**0.319**
	PFNA	37	**0.00432 J**

GROUNDWATER			
Location	Analyte	Depth (ft)	Result (µg/L)
TW-01	PFOS	37	**0.95 J ***
	PFOA	37	**0.0793 ***
	PFBS	37	**0.0426 ***
	PFHpA	37	**0.0238 ***
	PFHxS	37	**0.737 ***
	PFNA	37	<0.00504

PRLs 1, 5 & 6 SAMPLE RESULTS

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Monitoring Well
- Soil Sample
- Sediment Sample
- Assumed Groundwater Flow Direction
- Potential AFFF PFC PRL (approximate)
- Installation Area (approximate)

Notes & Sources

Notes:
AFFF - aqueous film forming foam
PRL - potential release location
PFC - perfluorinated compounds
PFOS - Perfluorooctanesulfonic acid
PFOA - Perfluorooctanoic acid
PFBS - Perfluorobutanesulfonic acid
PFHpA - Perfluoroheptanoic acid
PFHxS - Perfluorohexanesulfonic acid
PFNA - Perfluorononanoic acid

BOLD text indicates a detection.

YELLOW highlighted cells indicate 0.07 µg/L Health Advisory Exceedance.

* Field duplicate value exceeded primary sample.

Sources: Potential AFFF PFC PRLs and Installation Area datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016.

0 75 150 Feet

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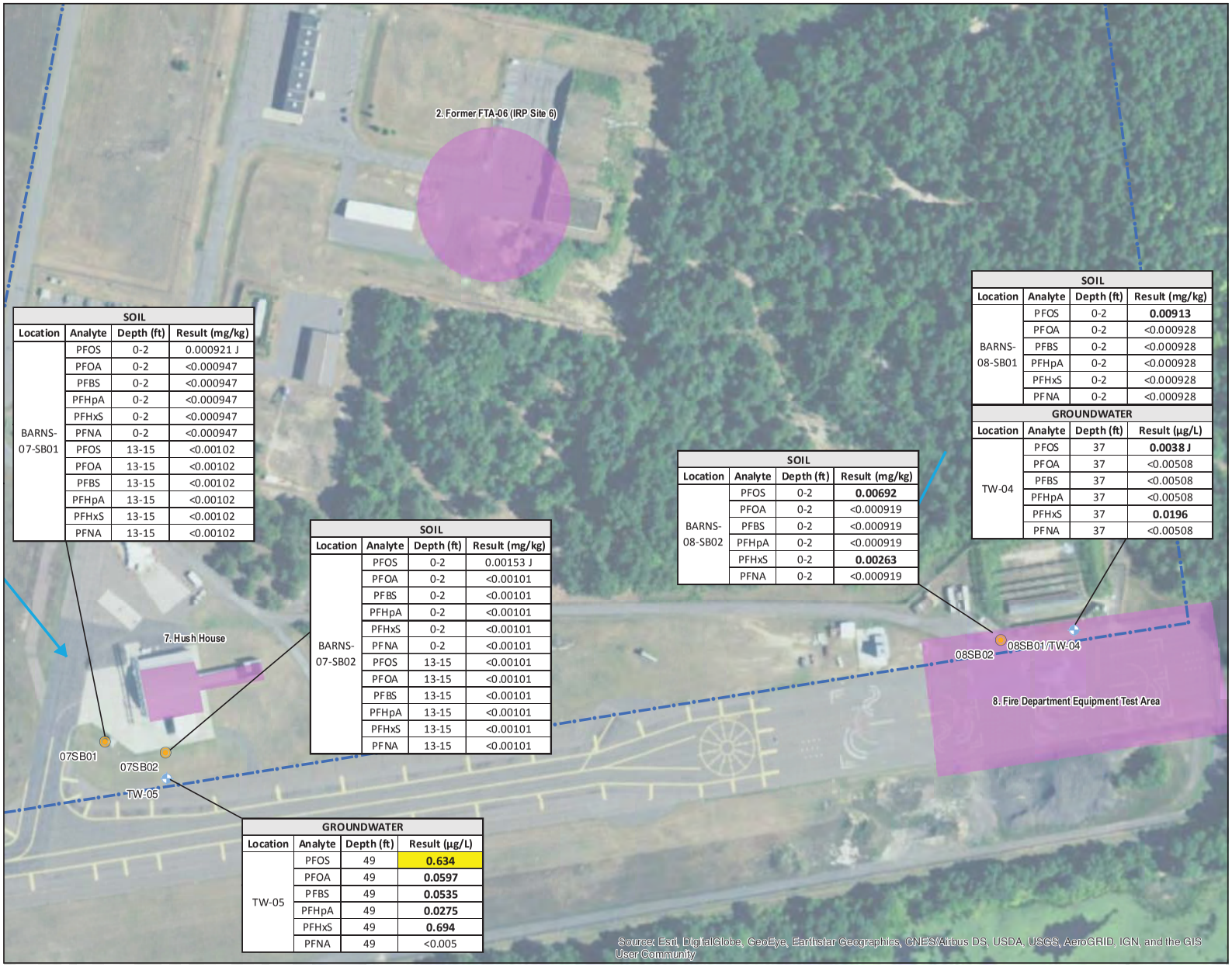
FIGURE 9



SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-07-SB01	PFOS	0-2	0.000921 J
	PFOA	0-2	<0.000947
	PFBS	0-2	<0.000947
	PFHpA	0-2	<0.000947
	PFHxS	0-2	<0.000947
	PFNA	0-2	<0.000947
	PFOS	13-15	<0.00102
	PFOA	13-15	<0.00102
	PFBS	13-15	<0.00102
	PFHpA	13-15	<0.00102
	PFHxS	13-15	<0.00102
	PFNA	13-15	<0.00102

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-07-SB02	PFOS	0-2	0.00153 J
	PFOA	0-2	<0.00101
	PFBS	0-2	<0.00101
	PFHpA	0-2	<0.00101
	PFHxS	0-2	<0.00101
	PFNA	0-2	<0.00101
	PFOS	13-15	<0.00101
	PFOA	13-15	<0.00101
	PFBS	13-15	<0.00101
	PFHpA	13-15	<0.00101
	PFHxS	13-15	<0.00101
	PFNA	13-15	<0.00101

GROUNDWATER			
Location	Analyte	Depth (ft)	Result (µg/L)
TW-05	PFOS	49	**0.634**
	PFOA	49	**0.0597**
	PFBS	49	**0.0535**
	PFHpA	49	**0.0275**
	PFHxS	49	**0.694**
	PFNA	49	<0.005

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-08-SB02	PFOS	0-2	**0.00692**
	PFOA	0-2	<0.000919
	PFBS	0-2	<0.000919
	PFHpA	0-2	<0.000919
	PFHxS	0-2	**0.00263**
	PFNA	0-2	<0.000919

SOIL			
Location	Analyte	Depth (ft)	Result (mg/kg)
BARNS-08-SB01	PFOS	0-2	**0.00913**
	PFOA	0-2	<0.000928
	PFBS	0-2	<0.000928
	PFHpA	0-2	<0.000928
	PFHxS	0-2	<0.000928
	PFNA	0-2	<0.000928

GROUNDWATER			
Location	Analyte	Depth (ft)	Result (µg/L)
TW-04	PFOS	37	**0.0038 J**
	PFOA	37	<0.00508
	PFBS	37	<0.00508
	PFHpA	37	<0.00508
	PFHxS	37	**0.0196**
	PFNA	37	<0.00508

PRLs 7 & 8 SAMPLE RESULTS

Barnes Air National Guard Base
Westfield, Massachusetts

Legend

- Monitoring Well
- Soil Sample
- Sediment Sample
- Assumed Groundwater Flow Direction
- Potential AFFF PFC PRL (approximate)
- Installation Area (approximate)

Notes & Sources

Notes:
AFFF - aqueous film forming foam
PRL - potential release location
PFC - perfluorinated compounds
PFOS - Perfluorooctanesulfonic acid
PFOA - Perfluorooctanoic acid
PFBS - Perfluorobutanesulfonic acid
PFHpA - Perfluoroheptanoic acid
PFHxS - Perfluorohexanesulfonic acid
PFNA - Perfluorononanoic acid

BOLD text indicates a detection.

YELLOW highlighted cells indicate 0.07 µg/L Health Advisory Exceedance.

* Field duplicate value exceeded primary sample.

Sources: Potential AFFF PFC PRLs and Installation Area datalayers obtained from Figure 2 of the Final Perfluorinated Compounds Preliminary Assessment Site Visit Report prepared by BB&E and dated January 2016.

0 75 150 Feet

N

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Amec Foster Wheeler
Environment & Infrastructure, Inc.
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

FIGURE 10

H:\ANG\Westfield_MA\Task5\MXD\Report\Fig10_Barnes_PRL-7-8.mxd October 13, 2017 DWN: emily.gardiner CHKD: AKN

APPENDIX A

SOIL BORING AND
MONITORING WELL CONSTRUCTION LOGS

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-5' Brown medium to fine SAND, trace Gravel, dry [FILL]				BARNS-01-SB01-062617-0-2			60/60	Temporary well installed #1 Filter sand backfill	0
5	5-8.9' Brown well-graded SAND, trace Gravel, dry (SW)							46.8 /60	PVC riser 0-28 ft bgs	5
10	10-12.2' Brown well-graded SAND, dry (SW) 12.2-12.4' Cobble 12.4-12.8' Brown well-graded SAND, dry (SW)							33.6 /60		10
15	15-18.5' Brown well-graded SAND, trace Gravel, dry (SW)							42/60		15
20	20-23.3' Brown well-graded SAND, trace Gravel, dry (SW)							39.6 /60		20
25										25

(CONTINUED ON FOLLOWING PAGE)

START DATE: 6/28/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.164342 ft.
EASTING: -72.718206 ft.
HORIZONTAL DATUM:

NOTE: Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. 01SB01/TW-03

amec foster wheeler
271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
25	25-27' Brown medium to fine SAND, trace coarse Sand, dry (SP)									25
	27-27.5' Brown fine SAND, moist (SP)							38.4 /60	Water level 27.8 ft bgs during drilling	
	27.5-28.2' Brown fine SAND, little Silt, wet (SP)									
30	Geoprobe advanced to 38 ft bgs to install temporary well									30
									Slotted PVC screen 28-38 ft bgs	
35					BARNS-01-GW-TW03-062917-37					35
40										40
45										45
50										50

START DATE: 6/28/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.164342 ft.
EASTING: -72.718206 ft.
HORIZONTAL DATUM:

NOTE: Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. 01SB01/TW-03

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271 Mill Road
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BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-2' Brown medium to fine grained SAND [FILL]				BARNS-01-SB02-062617-0-2			24/24		0
5										5
10										10
15										15
20										20
25										25

START DATE: 6/26/2017
END DATE:
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.:
SITE: Barnes ANGB
LOGGED BY:

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.164539 ft.
EASTING: -72.718424 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 01SB02

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BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	SAMPLES: RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-0.25' ASPHALT at surface				BARNS-04-SB01-062617-0-2 and DUP			60/60		0
	0.25-5' Brown medium to fine SAND [FILL]									
5	5-7.6' Brown medium to fine SAND, dry [FILL]							31.2/60		5
10	10-13.3' Brown to reddish brown well-graded SAND, trace Gravel, dry (SW)				BARNS-04-SB01-062917-13-15			39.6/60		10
15										15
20										20
25										25

START DATE: 6/26/2017
END DATE: 6/29/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 2 1/4" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.170689 ft.
EASTING: -72.715835 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 04SB01

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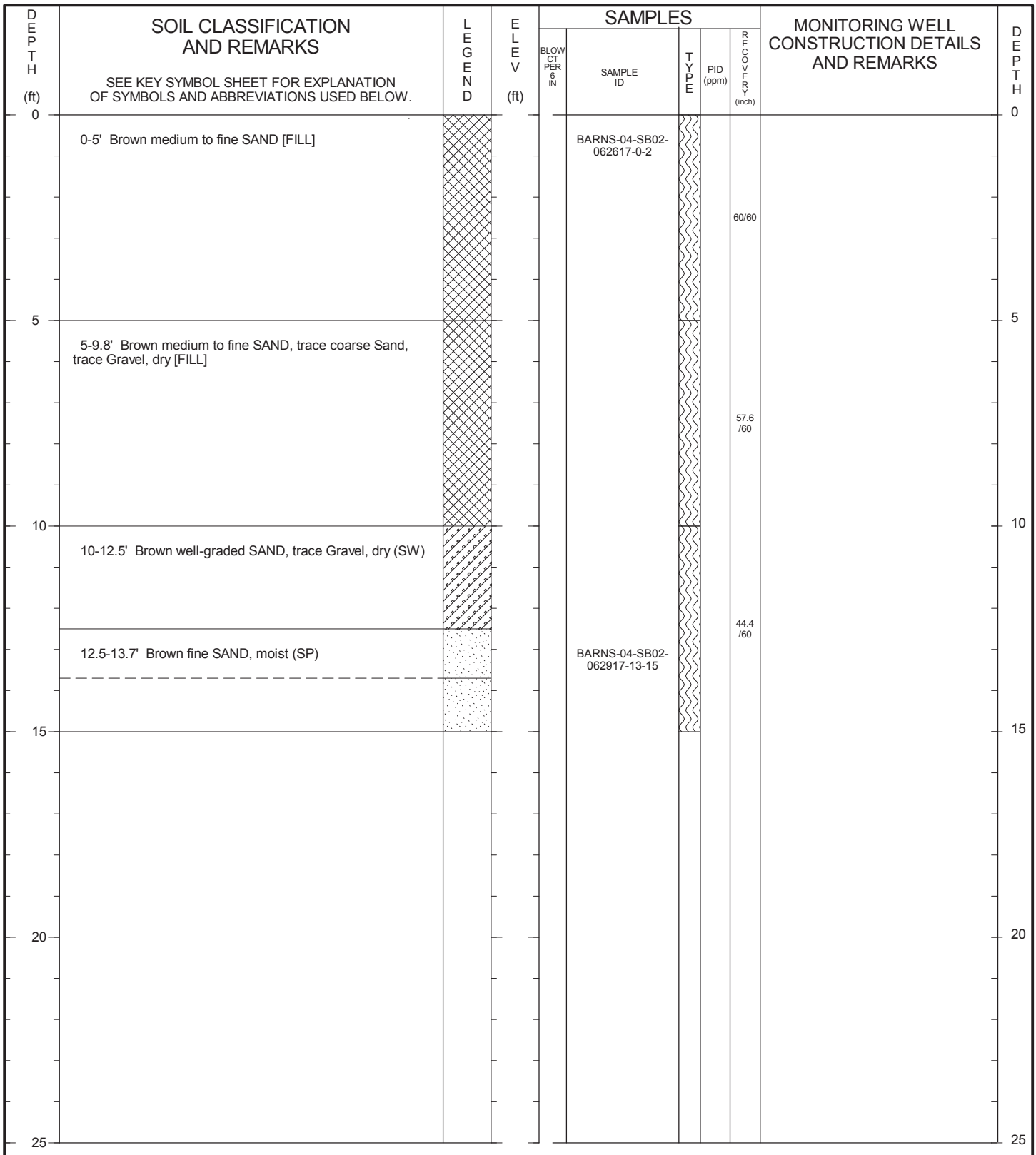
BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17



START DATE: 6/26/2017
END DATE: 6/29/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 2 1/4" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.170307 ft.
EASTING: -72.716289 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 04SB02

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BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	SAMPLES: RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-5' Brown medium to fine SAND [FILL]				BARNS-04-SB03-062617-0-2			60/60		0
5	5-8.8' Brown medium to fine SAND, trace coarse Sand with depth, moist [FILL]							45.6 /60		5
10	10-12.6' Brown well-graded SAND, trace Gravel, moist (SW)							42/60		10
	12.6-13.5' Dark brown fine SAND, moist (SP)				BARNS-04-SB03-062917-13-15					
15										15
20										20
25										25

START DATE: 6/26/2017
END DATE: 6/29/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 2 1/4" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.170213 ft.
EASTING: -72.716003 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 04SB03

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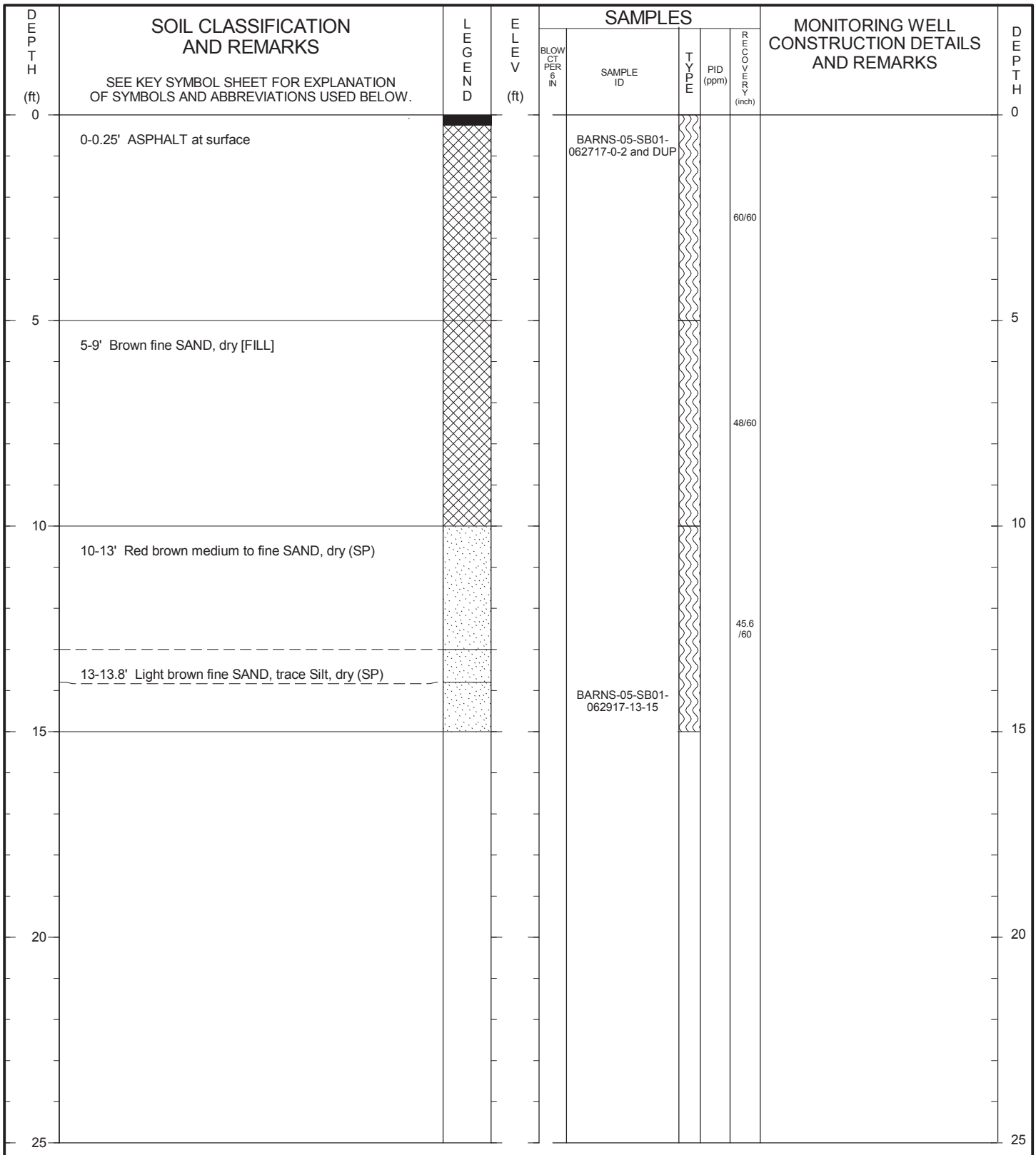
BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17



START DATE:	6/27/2017	GROUND ELEVATION:	ft.
END DATE:	6/29/2017	VERTICAL DATUM:	
DRILLER:	Drilex	NORTHING:	ft.
EQUIPMENT:	Geoprobe 6620DT	EASTING:	ft.
METHOD:	Geoprobe/Vac	HORIZONTAL DATUM:	
HOLE DIA.:	2 1/4" ID		
SITE:	Barnes ANGB		
LOGGED BY:	SAI		

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 05SB01

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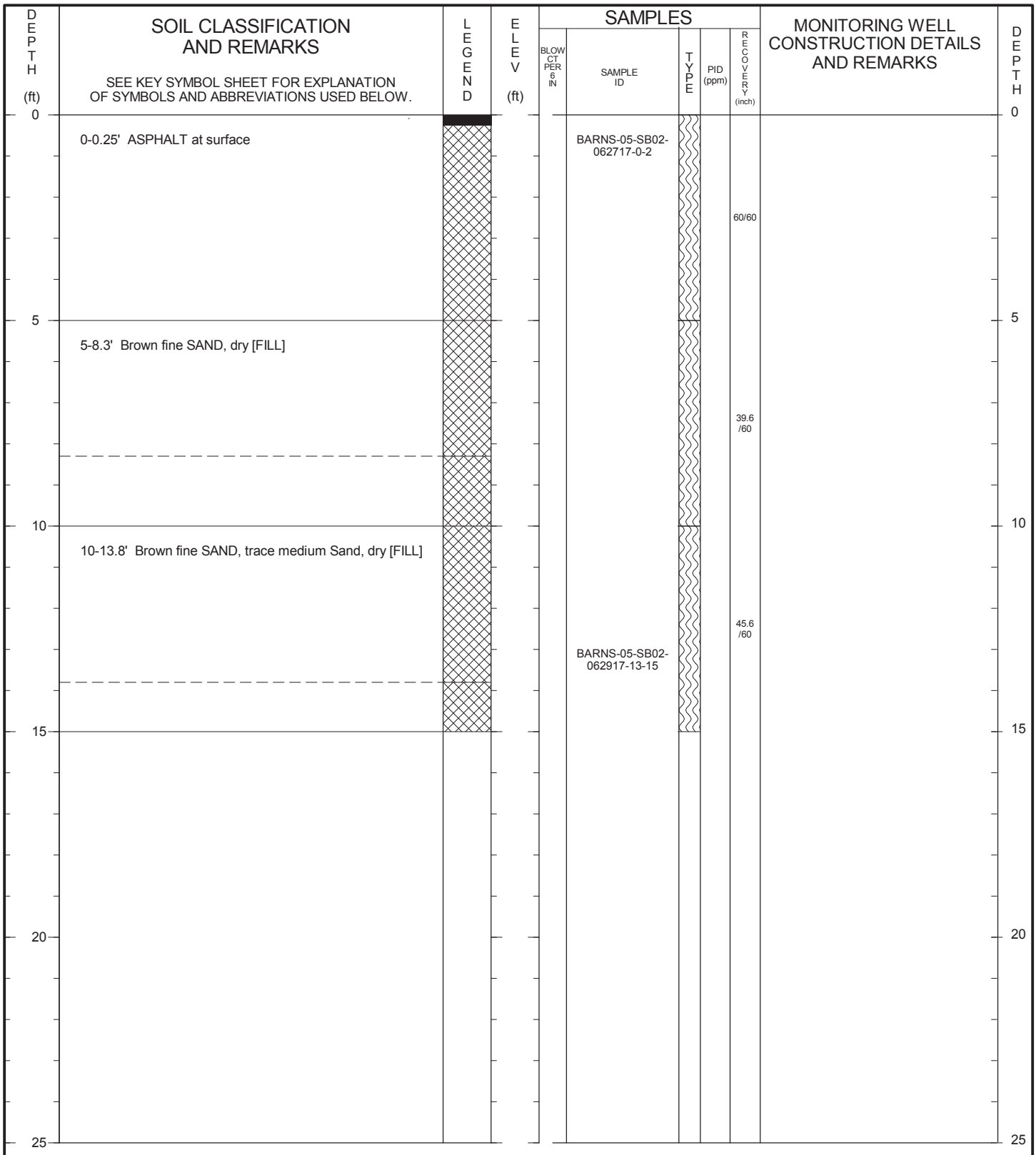
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17



START DATE: 6/27/2017
END DATE: 6/29/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 2 1/4" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: ft.
EASTING: ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 05SB02

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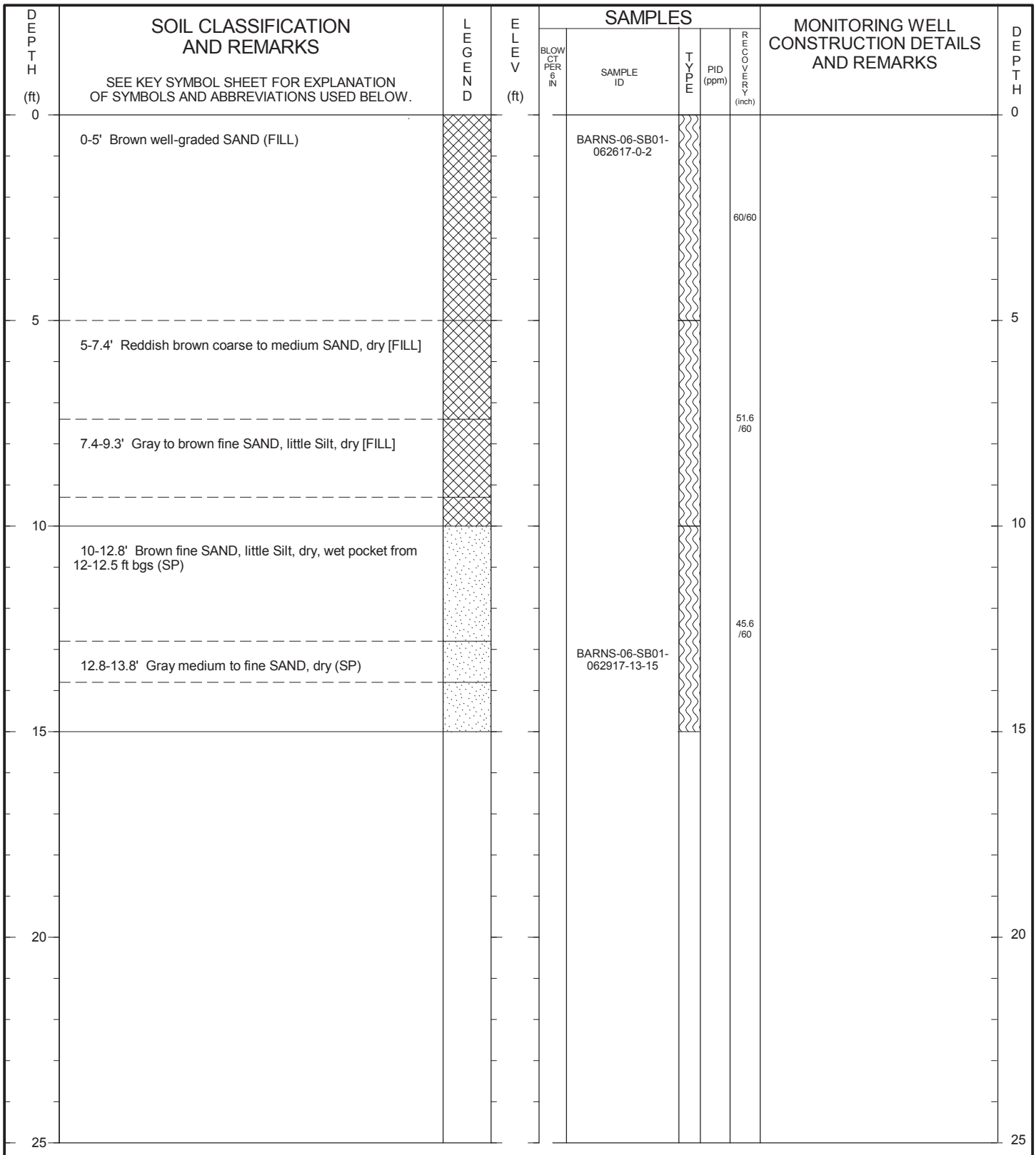
BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17



START DATE: 6/26/2017
END DATE: 6/29/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 2 1/4" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.16577 ft.
EASTING: -72.718004 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 06SB01

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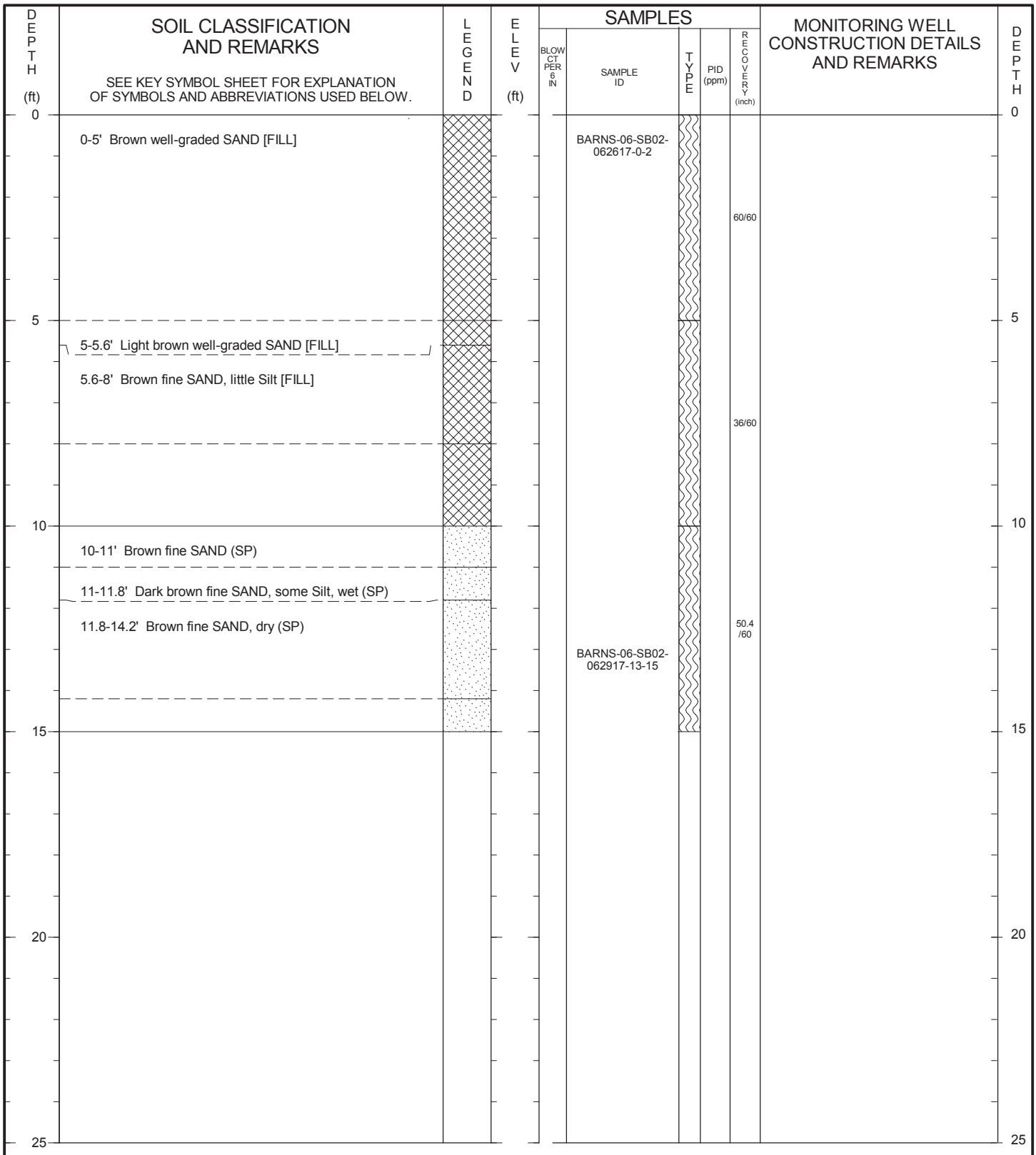
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17



START DATE: 6/26/2017
END DATE: 6/29/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 2 1/4" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.165529 ft.
EASTING: -72.717582 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 06SB02

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271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-5' Brown well-graded SAND [FILL]				BARNS-06-SB03-062617-0-2			60/60		0
5	5-10' Brown medium to fine SAND, dry [FILL]							60/60		5
10	10-14' Brown medium to fine SAND, trace coarse Sand, dry [FILL]				BARNS-06-SB03-062917-13-15			48/60		10
15										15
20										20
25										25

START DATE: 6/26/2017
END DATE: 6/29/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 2 1/4" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.165315 ft.
EASTING: -72.717715 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 06SB03

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271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	SAMPLES: RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-5' Brown coarse to medium SAND [FILL]				BARNS-07-SB01-062617-0-2			60/60		0
5	5-7' Brown well-graded SAND [FILL]							52.8/60		5
	7-7.6' Brown fine SAND [FILL]									
	7.6-9.4' Brown well-graded SAND, dry [FILL]									
10	10-14' Brown well-graded SAND, trace Gravel [FILL]							48/60		10
					BARNS-07-SB01-062917-13-15					
15										15
20										20
25										25

START DATE: 6/26/2017
END DATE: 6/29/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 2 1/4" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.162 ft.
EASTING: -72.711479 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 07SB01

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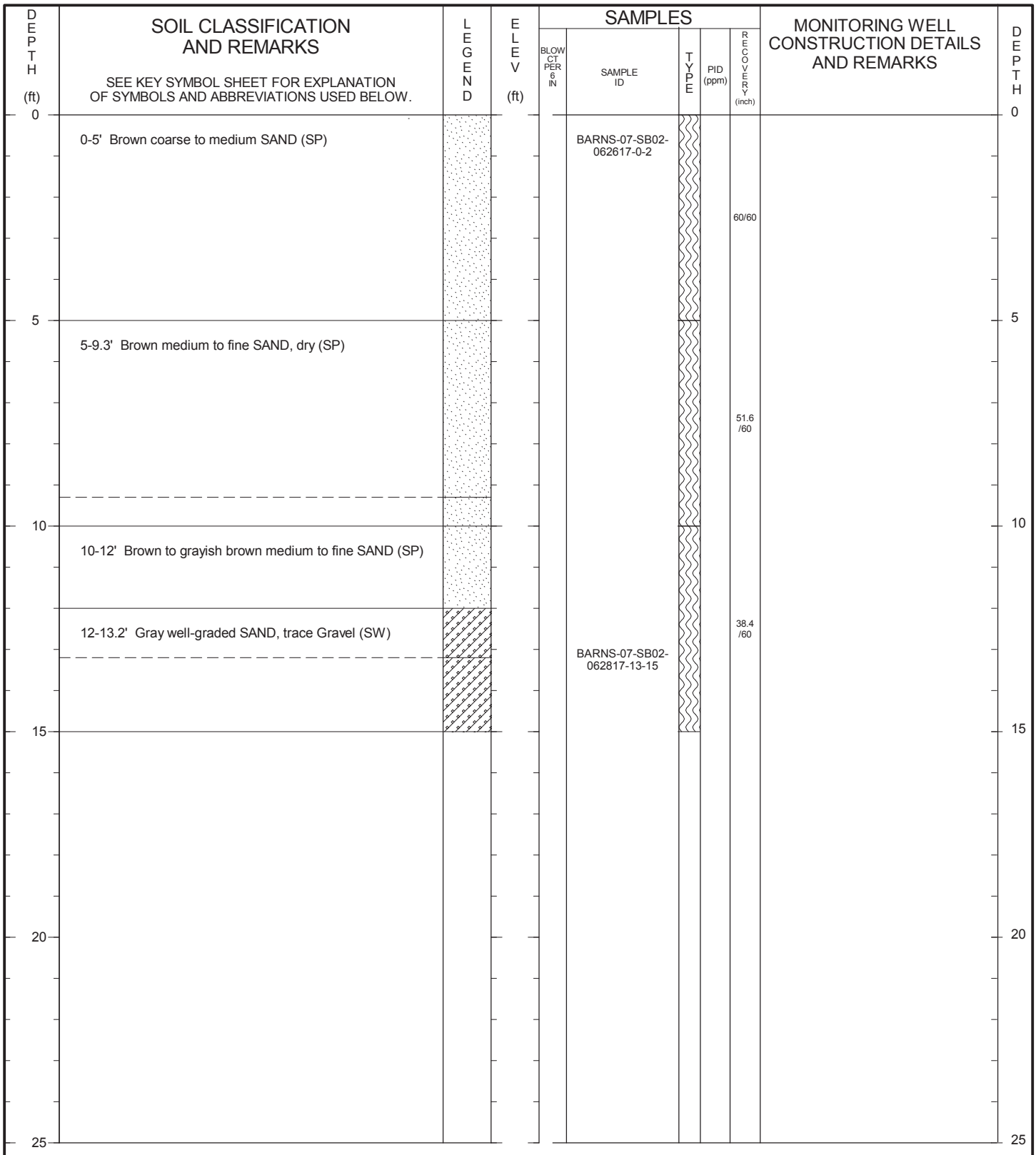
271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17



START DATE: 6/26/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 2 1/4" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.161932 ft.
EASTING: -72.71114 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 07SB02

amec foster wheeler
271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-5' Brown coarse to medium SAND, dry [FILL]				BARNS-08-SB01-062617-0-2			60/60	Temporary well installed #1 Filter sand backfill	0
5	5-8.9' Brown medium to fine SAND, trace coarse Sand, trace Gravel, dry [FILL]							46.8 /60	PVC riser 0-33 ft bgs	5
10	10-13.6' Brown medium to fine SAND, dry (SP)							43.2 /60		10
15	15-18.4' Similar to above, trace coarse Sand (SP)							40.8 /60		15
20	20-23.3' Brown medium to fine SAND, trace coarse Sand, moist at 21.6 ft bgs to wet at 22.9 ft bgs (SP)							40.8 /60		20
25										25

(CONTINUED ON FOLLOWING PAGE)

START DATE: 6/26/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.162509 ft.
EASTING: -72.705937 ft.
HORIZONTAL DATUM:

NOTE: Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. 08SB01/TW-04

amec foster wheeler
271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
25	Geoprobe advanced to 30 ft bgs							39.6 /60		25
30	30-32' Brown well-graded SAND, wet (SW)							24/36	Water level ~32 ft bgs during groundwater sampling	30
35	Geoprobe advanced to 43 ft bgs to install temporary well				BARNS-08-GW-TW04-063017-37				Slotted PVC screen 33-43 ft bgs	35
40										40
45										45
50										50

START DATE: 6/26/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.162509 ft.
EASTING: -72.705937 ft.
HORIZONTAL DATUM:

NOTE: Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. 08SB01/TW-04

amec foster wheeler
271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-2' Brown medium to fine grained SAND [FILL]				BARNS-08-SB02-062617-0-2			24/24		0
5										5
10										10
15										15
20										20
25										25

START DATE: 6/26/2017
END DATE:
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.:
SITE: Barnes ANGB
LOGGED BY:

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.16247 ft.
EASTING: -72.705913 ft.
HORIZONTAL DATUM:

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Boring No. 08SB02

amec foster wheeler
271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-5' Brown medium to fine SAND, little Gravel, 0-3 ft bgs tightly compacted [FILL]								Temporary well installed #1 Filter sand backfill	0
5	5-8.6' Light brown medium to fine SAND, trace coarse Sand, dry [FILL]							43/60	PVC riser 0-28 ft bgs	5
10	10-13.2' Reddish brown well-graded SAND, dry (SW)							38/60		10
15	15-18' Similar to above, trace Gravel (SW)							36/60		15
20	20-23' Reddish brown medium to fine SAND, dry (SP)							36/60		20
25										25

(CONTINUED ON FOLLOWING PAGE)

START DATE: 6/26/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.164453 ft.
EASTING: -72.71707 ft.
HORIZONTAL DATUM:

NOTE: Drill rods lost down hole during drilling; rods not recovered. Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. TW-01

amec foster wheeler
271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
25	25-27.7' Reddish brown medium to fine SAND (SP)									25
								40/60	Water level 27.9 ft bgs during drilling	
	27.7-28.4' Reddish brown medium to fine SAND, trace Silt, wet at 27.9 ft bgs (SP)									
30	Geoprobe advanced to 38 ft bgs to install temporary well									30
									Slotted PVC screen 28-38 ft bgs	
35					BARNS-06-GW-TW01-062817-37 and DUP					35
40										40
45										45
50										50

START DATE: 6/26/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.164453 ft.
EASTING: -72.71707 ft.
HORIZONTAL DATUM:

NOTE: Drill rods lost down hole during drilling; rods not recovered. Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. TW-01

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Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOWCT PER 6 IN	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	SAMPLES: RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-5' Brown medium to fine SAND, trace Gravel, dry [FILL]							60/60	Temporary well installed #1 Filter sand backfill	0
5	5-10' Reddish brown medium to fine SAND, trace coarse Sand with depth at 9 ft bgs, moist [FILL]							60/60	PVC riser 0-25 ft bgs	5
10	10-13.2' Reddish brown medium to fine SAND, trace coarse Sand with depth 12.4-13 ft bgs [FILL]							60/60		10
	13.2-15' Reddish brown fine SAND, trace Silt, moist (SP)									
15	15-19' Reddish brown fine SAND, trace Silt, Silt increasing with depth, moist (SP)							48/60		15
20	20-24' Reddish brown medium to fine SAND, dry (SP)							48/60		20
25										25

(CONTINUED ON FOLLOWING PAGE)

START DATE: 6/27/2017
END DATE: 6/27/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.169347 ft.
EASTING: -72.715497 ft.
HORIZONTAL DATUM:

NOTE: Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. TW-02

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BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
25	25-28' Dark brown to reddish brown medium to fine SAND, wet at 25.5 ft bgs (SP)							60/60	Water level 25.5 ft bgs during drilling	25
	28-30' Brown fine SAND and SILT (SM)								Slotted PVC screen 25-35 ft bgs	
30	Geoprobe advanced to 35 ft bgs to install temporary well				BARNS-04-GW-TW02-062817-30					30
35										35
40										40
45										45
50										50

START DATE: 6/27/2017
END DATE: 6/27/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.169347 ft.
EASTING: -72.715497 ft.
HORIZONTAL DATUM:

NOTE: Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. TW-02

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Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
0	0-5' Brown coarse to medium SAND, dry [FILL]							60/60	Temporary well installed #1 Filter sand backfill	0
5	5-8.8' Brown medium to fine SAND, pocket of Silty fine Sand 8.4-8.5 ft bgs, dry (SP)							45.6 /60	PVC riser 0-44 ft bgs	5
10	10-14' Gray to brown fine SAND, dry (SW)							48/60		10
15	15-18.5' Brown fine SAND, trace medium Sand 15-16 ft bgs, dry (SW)							51.6 /60		15
	18.5-19.3' Dark brown fine SAND, trace Silt, moist (SP)									
20	20-22.3' Light gray to brown fine SAND, trace medium Sand, moist (SP)							39.6 /60		20
	22.3-23.3' Light brown well-graded SAND, trace Gravel, dry (SW)									
25										25

(CONTINUED ON FOLLOWING PAGE)

START DATE: 6/26/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.161821 ft.
EASTING: -72.711131 ft.
HORIZONTAL DATUM:

NOTE: Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. TW-05

amec foster wheeler
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Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLE ID	TYPE	PID (ppm)	RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH
25	25-27.8' Gray to brown medium to fine SAND, trace coarse Sand, trace Gravel, dry (SP)							33.6 /60		25
30	30-31.4' Gray to brown medium to fine SAND, trace coarse Sand (SP)									30
	31.4-33' Gray to brown well-graded SAND, trace Gravel, dry (SW)							36/60		
35	35-37' Gray to brown well-graded SAND, little Gravel, dry (SW)							24/60		35
40	40-41.3' Gray to brown well-graded SAND and GRAVEL (SW-GW)									40
	41.3-42.8' Light brown fine SAND, wet at 45 ft bgs (SP)							33.6 /60		
45	Geoprobe advanced to 54 ft bgs to install temporary well				BARNS-07-GW-TW05-062917-49				Water level 45 ft bgs during drilling Slotted PVC screen 44-54 ft bgs	45
50										50

(CONTINUED ON FOLLOWING PAGE)

START DATE: 6/26/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.161821 ft.
EASTING: -72.711131 ft.
HORIZONTAL DATUM:

NOTE: Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. TW-05

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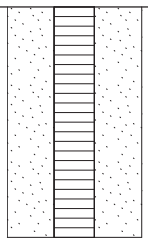
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED BELOW.	LEGEND	ELEV (ft)	SAMPLES: BLOW CT PER 6 IN	SAMPLES: SAMPLE ID	SAMPLES: TYPE	SAMPLES: PID (ppm)	SAMPLES: RECOVERY (inch)	MONITORING WELL CONSTRUCTION DETAILS AND REMARKS	DEPTH (ft)
50	Geoprobe advanced to 54 ft bgs to install temporary well *(Continued)*									50
55										55
60										60
65										65
70										70
75										75

START DATE: 6/26/2017
END DATE: 6/28/2017
DRILLER: Drilex
EQUIPMENT: Geoprobe 6620DT
METHOD: Geoprobe/Vac
HOLE DIA.: 3¼" ID
SITE: Barnes ANGB
LOGGED BY: SAI

GROUND ELEVATION: ft.
VERTICAL DATUM:
NORTHING: 42.161821 ft.
EASTING: -72.711131 ft.
HORIZONTAL DATUM:

NOTE: Temp well abandoned

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL BORING / MONITORING WELL RECORD

Project: Barnes ANG FY16 Site Inspection for PFC
Project No: 291330006.010
Checked By: CK

Well No. TW-05

amec foster wheeler
271 Mill Road
Chelmsford, MA 01824

BARNES ANG BORING LOG TEMPLATE BARNES BORING LOGS (2).GPJ PFC TEMPLATE.GDT 13/10/17

APPENDIX B

WELL DEVELOPMENT LOGS

WELL DEVELOPMENT LOG

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Date Started/Date Completed:**	06/28/17/06/28/17
Well ID:	TW-01	**Initial Depth to Water (ft):**	34.44
Measuring Point:	Top of Riser	**Total Depth of Well (ft):**	39.98
Development Method:	Pump	**Depth to Water After Purging (ft):**	35.54
Total Volume Purged (gal):	18.0	**1 Casing Volume (gal):**	0.9
Technician(s):	Jacob Poirier	**3 Casing Volumes (gal):**	2.7

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (ml/mn)	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.)
06/28/17 13:40			800								Pumping Started
06/28/17 13:57	37	35.27	800	14.69	6.53	215	7.52	57.3	OR	4.0	Brown, high tirbidity
06/28/17 14:04	37	35.43	800	13.64	7.03	215	7.49	49.8	OR	6.0	Light brown
06/28/17 14:13	37	35.51	800	13.96	6.89	216	8.22	50.6	506	8.0	Almost clear
06/28/17 14:20	37	35.52	800	14.78	7.30	117	7.91	53.3	451	10.0	Clear
06/28/17 14:25	37	35.53	800	14.11	7.45	211	7.92	53.7	194	11.5	
06/28/17 14:31	37	35.53	800	14.17	7.42	203	8.11	55.0	139	12.5	
06/28/17 14:38	37	35.54	800	14.15	7.51	210	7.92	54.8	88.7	14	
06/28/17 14:43	37	35.54	800	14.13	7.50	206	7.95	55.2	78.7	15.5	
06/28/17 14:48	37	35.54	800	14.13	7.52	208	7.94	55.7	79.3	17.5	

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 11090C012300,
YSI 556 MPS 14F100064

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 * 5.54 * 7.48 gal/ft^3
= 0.9 gal.

Signature:

Notes:

None

Name (print):

Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

WELL DEVELOPMENT LOG

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Date Started/Date Completed:**	06/28/17/06/28/17
Well ID:	TW-02	**Initial Depth to Water (ft):**	24.95
Measuring Point:	Top of Casing	**Total Depth of Well (ft):**	34.71
Development Method:	Pump	**Depth to Water After Purging (ft):**	24.92
Total Volume Purged (gal):	9.0	**1 Casing Volume (gal):**	1.6
Technician(s):	Jacob Poirier	**3 Casing Volumes (gal):**	4.8

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (Ml/mn)	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.)
06/28/17 09:48			1800								Pumping Started
06/28/17 09:53	30	25.2	1800	20.48	6.79	116	5.96	70.5	OR	5	Brown high turbidity
06/28/17 10:02	30	25.1	1800	16.10	5.66	115	5.63	67.1	Or	6.5	Brown high turbidity
06/28/17 10:24	30	24.9	1800	15.26	6.22	121	6.23	77.8	61.1	7.0	Light brown
06/28/17 10:28	30	24.92	1800	14.88	5.81	124	6.08	78.3	14.9	7.3	Clear
06/28/17 10:34	30	24.92	1500	15.57	5.56	120	5.77	78.2	5.82	7.9	
06/28/17 10:38	30	24.92	1500	15.08	5.65	120	5.48	75.8	2.69	8.2	
06/28/17 10:42	30	24.92	1500	15.07	5.66	121	5.52	74.2	2.57	8.5	
06/28/17 10:50	30	24.92	1500	15.08	5.65	120	5.54	74.6	2.48	8.9	

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 11090C012300,
YSI 556 MPS 14F100064

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 * 9.76 * 7.48 gal/ft^3
= 1.6 gal.

Signature:

Notes:

None

Name (print):

Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

WELL DEVELOPMENT LOG

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Date Started/Date Completed:**	06/29/17/06/29/17
Well ID:	TW-03	**Initial Depth to Water (ft):**	31.98
Measuring Point:	Top of Casing	**Total Depth of Well (ft):**	39.83
Development Method:	Pump	**Depth to Water After Purging (ft):**	32.02
Total Volume Purged (gal):	24.0	**1 Casing Volume (gal):**	1.3
Technician(s):	Jacob Poirier	**3 Casing Volumes (gal):**	3.9

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (ml/mn)	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.)
06/29/17 12:00			1800								Pumping Started
06/29/17 12:14	37	32.01	1800	15.17	6.74	283	4.57	33.2	181	4.0	Light brown
06/29/17 12:22	37	32.02	1800	15.11	6.10	289	3.99	28.0	141	6.0	Clear
06/29/17 12:52	37	32.02	1800	14.22	6.68	282	4.54	36.5	21.8	10.0	Pump stopped for about 10 min
06/29/17 13:06	37	32.01	1800	14.48	6.32	281	4.56	37.4	173	13.0	Pump temp. Shut off
06/29/17 13:13	37	32.02	1800	14.48	6.36	280	4.42	39.1	92.3	15.0	
06/29/17 13:19	37	32.02	1800	14.30	6.37	278	4.45	40.1	17.7	18.0	
06/29/17 13:25	37	32.02	1800	14.32	6.37	277	4.43	40.7	6.51	20.0	
06/29/17 13:30	37	32.02	1800	14.32	6.36	279	4.42	40.5	5.57	23.0	

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 11090C012300,
YSI 556 MPS 14F100064

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 * 7.85 * 7.48 gal/ft^3
= 1.3 gal.

Signature:

Notes:

None

Name (print):

Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

WELL DEVELOPMENT LOG

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Date Started/Date Completed:**	06/30/17 - 06/30/17
Well ID:	TW-04	**Initial Depth to Water (ft):**	32.74
Measuring Point:	Top of Casing	**Total Depth of Well (ft):**	41.4
Development Method:	Pump	**Depth to Water After Purging (ft):**	33.25
Total Volume Purged (gal):	33.0	**1 Casing Volume (gal):**	1.4
Technician(s):	Jacob Poirier	**3 Casing Volumes (gal):**	4.3

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (ml/mn)	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.)
06/30/17 10:08			2000								Pumping Started
06/30/17 10:14	36	32.99	2000	11.78	8.30	143	0.82	-62.7	OR	3.0	Brown, high turbidity
06/30/17 10:24	36	33.18	2000	11.10	6.43	120	1.73	-52.4	593	7.0	Light brown
06/30/17 10:32	36	33.24	2000	10.65	6.20	115	2.20	-32.6	286	12.0	
06/30/17 10:43	36	33.25	2000	11.18	6.14	113	1.81	-22.8	154	17.0	
06/30/17 10:50	36	33.26	2000	11.29	6.14	112	1.73	-8.1	98.6	20.0	Clear
06/30/17 10:58	36	33.26	2000	11.01	6.38	111	2.08	0.7	69.6	24.0	
06/30/17 11:09	36	33.25	2000	11.05	6.22	111	2.16	3.5	35.3	28.0	
06/30/17 11:16	36	33.25	2000	11.07	6.21	111	2.14	4.1	22.0	31.0	
06/30/17 11:22	36	33.25	2000	11.06	6.22	111	2.15	3.9	23.2	33.0	

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 11090C012300,
YSI 556 MPS 14F100064

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 * 8.66 * 7.48 gal/ft^3
= 1.4 gal.

Signature:

Notes:

None

Name (print):

Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

WELL DEVELOPMENT LOG

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Date Started/Date Completed:**	06/29/17 - 06/29/17
Well ID:	TW-05	**Initial Depth to Water (ft):**	46.62
Measuring Point:	Top of Casing	**Total Depth of Well (ft):**	53.41
Development Method:	Pump	**Depth to Water After Purging (ft):**	46.74
Total Volume Purged (gal):	23.0	**1 Casing Volume (gal):**	1.1
Technician(s):	Jacob Poirier	**3 Casing Volumes (gal):**	3.3

Date/Time	Intake Depth (feet)	Water Level (feet)	Rate (ml/min)	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.)
06/29/17 08:40			2000								Pumping Started
06/29/17 08:45	49	46.69	2000	14.19	8.31	363	8.05	30.1	OR	4.0	Brown, high turbidity
06/29/17 08:51	49	46.70	2000	14.19	7.60	351	8.08	34.7	131	6.0	Light brown
06/29/17 08:59	49	46.73	2000	13.86	7.19	353	8.37	38.8	12.0	9.0	Clear
06/29/17 09:04	49	46.74	2000	13.90	6.98	350	8.01	40.7	7.16	13.0	
06/29/17 09:10	49	46.74	2000	13.47	6.88	347	8.94	43.3	4.34	16.0	
06/29/17 09:15	49	46.74	2000	13.50	6.87	349	8.89	44.7	3.83	19.0	
06/29/17 09:22	49	46.74	2000	13.51	6.87	351	8.92	44.3	3.88	22.0	

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 11090C012300,
YSI 556 MPS 14F100064

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 * 6.79 * 7.48 gal/ft^3
= 1.1 gal.

Signature:

Notes:

None

Name (print):

Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

APPENDIX C

GROUNDWATER SAMPLING LOGS

GROUNDWATER SAMPLING RECORD

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Technician(s):**	Jacob Poirier
Well ID:	TW-01	**Date:**	06/28/17
Initial Depth to Water (ft):	35.54	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	39.94	**1 Casing Volume (gal):**	0.7
Method of Purging:	Geosub pump	**3 Casing Volumes (gal):**	2.2
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	37

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	
14:53		240								Pumping/Purging Started
14:59	34.90	240	.1	15.95	7.42	215	7.98	61.4	104	
15:06	34.72	240	.2	16.55	7.36	215	7.16	59.0	113	
15:11	34.70	240	.3	17.80	7.49	204	7.33	56.8	59.3	
15:17	34.70	240	.4	18.19	7.70	199	7.38	57.7	63.6	
15:22	34.69	240	.5	18.22	7.68	202	7.40	57.5	58.6	
15:29	34.69	240	.6	18.21	7.68	204	7.37	57.2	62.4	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

Final Values:	**18.21**	**7.68**	**204**	**7.37**	**57.2**	**62.4**

Sample ID:	BARNS-06-GW-TW01-062817-37	**Method of Sampling:**	Low flow, submersible pump
QA/QC Samples (Yes/No):	Yes DUP	**Sample Date:**	06/28/17
Duplicate ID:	BARNS-06-GW-TW01-062817-DUP	**Sample Collection Time:**	15:30
Sample Container Type(s):	Plastic	**Total Volume Purged (gal):**	.8
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	37
Analysis/Method(s):	UCMR3 List	**Depth to Water After Sampling (ft):**	34.69

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 11090C012300, YSI 556 MPS 14F100064

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 * 4.40 * 7.48 gal/ft^3
= 0.7 gal.

Signature:

Notes:

Sample centrifuged at lab due to elevated turbidity

Name (print): Jacob Poirier

QA/QC'd by: cjk — **QA/QC Date:** 10/12/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Technician(s):**	Jacob Poirier
Well ID:	TW-02	**Date:**	06/28/17
Initial Depth to Water (ft):	24.91	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	34.71	**1 Casing Volume (gal):**	1.6
Method of Purging:	Peristaltic	**3 Casing Volumes (gal):**	4.8
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	30

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	
10:55		150								Pumping/Purging Started
10:57	24.91	150	0.1	17.80	5.73	114	4.94	69.2	1.46	
11:02	24.91	150	0.2	16.85	5.83	117	5.09	67.0	1.38	
11:06	24.91	150	0.4	17.52	5.63	112	4.97	67.6	1.29	
11:10	24.91	150	0.6	17.54	5.65	113	4.98	67.3	1.06	
11:14	24.91	150	0.8	17.52	5.64	113	5.01	67.1	1.13	
11:18	24.91	150	1.0	17.53	5.66	111	4.99	66.9	1.08	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

Final Values:	**17.53**	**5.66**	**111**	**4.99**	**66.9**	**1.08**

Sample ID:	BARNS-04-GW-TW02-062817-30	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	06/28/17
Duplicate ID:	NA	**Sample Collection Time:**	11:25
Sample Container Type(s):	Plastic	**Total Volume Purged (gal):**	1.1
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	30
Analysis/Method(s):	UCMR3 List	**Depth to Water After Sampling (ft):**	24.91

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 11090C012300, YSI 556 MPS 14F100064

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 * 9.80 * 7.48 gal/ft^3
= 1.6 gal.

Signature:

Notes:

None

Name (print): Jacob Poirier

QA/QC'd by: cjk — **QA/QC Date:** 10/12/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Technician(s):**	Jacob Poirier
Well ID:	TW-03	**Date:**	06/29/17
Initial Depth to Water (ft):	32.02	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	37.71	**1 Casing Volume (gal):**	0.9
Method of Purging:	Submersible pump	**3 Casing Volumes (gal):**	2.8
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	37

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	
13:45		280								Pumping/Purging Started
13:50	33.02	280	.2	15.11	6.25	283	4.36	46.2	29.4	
13:55	33.02	280	.4	15.20	6.31	282	4.30	45.2	19.7	
14:02	33.02	280	.7	15.21	6.35	279	4.28	45.2	8.64	
14:09	33.02	280	.9	15.22	6.35	281	4.31	45.7	5.93	
14:14	33.02	280	1.1	15.22	6.35	282	4.30	45.5	4.98	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

	Temp.	pH	SEC	DO	ORP	Turbidity
Final Values:	15.22	6.35	282	4.30	45.5	4.98

Sample ID:	BARNS-01-GW-TW03-062917-37	**Method of Sampling:**	Low flow submersible pump
QA/QC Samples (Yes/No):	No	**Sample Date:**	06/29/17
Duplicate ID:	NA	**Sample Collection Time:**	14:15
Sample Container Type(s):	Plastic	**Total Volume Purged (gal):**	1.2
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	37
Analysis/Method(s):	UCMR3 List	**Depth to Water After Sampling (ft):**	33.02

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 11090C012300, YSI 556 MPS 14F100064

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 * 5.69 * 7.48 gal/ft^3
= 0.9 gal.

Signature: [signature]

Notes: None

Name (print): Jacob Poirier

QA/QC'd by: cjk   **QA/QC Date:** 10/12/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Technician(s):**	Jacob Poirier
Well ID:	TW-04	**Date:**	06/30/17
Initial Depth to Water (ft):	32.88	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	42.3	**1 Casing Volume (gal):**	1.5
Method of Purging:	Low flow sub. Pump	**3 Casing Volumes (gal):**	4.6
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	36

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	
11:26		280								Pumping/Purging Started
11:26	33.88	280	.2	11.74	5.88	111	5.88	8.0	25.9	
11:38	33.88	280	.5	11.05	5.83	105	2.23	15.5	22.6	
11:42	33.88	280	.7	11.04	5.84	107	2.21	15.9	11.6	
11:47	33.88	280	.9	11.05	5.85	106	2.22	16.1	10.8	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

Final Values:	**11.05**	**5.85**	**106**	**2.22**	**16.1**	**10.8**

Sample ID:	BARNS-08-GW-TW04-063017-36	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	6/30/2017
Duplicate ID:	NA	**Sample Collection Time:**	11:55
Sample Container Type(s):	Plastic	**Total Volume Purged (gal):**	1.1
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	36
Analysis/Method(s):	UCMR3 List	**Depth to Water After Sampling (ft):**	33.88

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 11090C012300, YSI 556 MPS 14F100064

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 * 9.42 * 7.48 gal/ft^3
= 1.5 gal.

Signature:

Notes:

Difficulties with pump resulted in one sample having higher turbidity than the other

Name (print): Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Technician(s):**	Jacob Poirier
Well ID:	TW-05	**Date:**	06/29/17
Initial Depth to Water (ft):	46.75	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	53.71	**1 Casing Volume (gal):**	1.1
Method of Purging:	Geosub pump	**3 Casing Volumes (gal):**	3.4
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	49

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	
09:25		240								Pumping/Purging Started
09:32	46.64	240	.1	14.55	6.71	348	9.37	53.8	6.78	
09:39	46.64	240	.3	15.31	6.37	347	9.18	54.7	6.68	
09:44	46.64	240	.5	15.62	6.39	345	9.19	54.4	6.72	
09:49	46.64	240	.6	15.62	6.38	344	9.20	54.2	6.69	
09:54	46.64	240	.8	15.61	6.38	342	9.19	54.1	6.65	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

Final Values:	**15.61**	**6.38**	**342**	**9.19**	**54.1**	**6.65**

Sample ID:	BARNS-07-TW05-062917-49	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	No	**Sample Date:**	06/29/17
Duplicate ID:	NA	**Sample Collection Time:**	09:55
Sample Container Type(s):	Plastic	**Total Volume Purged (gal):**	.8
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	49
Analysis/Method(s):	UCMR3 List	**Depth to Water After Sampling (ft):**	46.64

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

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

Turbidity Meter, Water Quality Meter, Geosubmersible Pump
Hach 2100Q 11090C012300, YSI 556 MPS 14F100064

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 * 6.96 * 7.48 gal/ft^3
= 1.1 gal.

Signature:

Notes:

None

Name (print): Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

GROUNDWATER SAMPLING RECORD

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Technician(s):**	Shawna Iacozzi
Well ID:	MW-6	**Date:**	06/30/17
Initial Depth to Water (ft):	23.79	**Well Diameter (in):**	2.0
Total Depth of Well (ft):	27.25	**1 Casing Volume (gal):**	0.6
Method of Purging:	Peristaltic	**3 Casing Volumes (gal):**	1.7
Measuring Point (toc, tor, etc.):	Top of Casing	**Pump Intake Depth (feet):**	25

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	
09:02		120								Pumping/Purging Started
09:08	23.81	120	0.16	15.3	7.31	383.6	9.50	71.7	10.74	Clear no odor
09:13	23.81	120	0.32	14.6	5.76	239.8	8.76	90.8	85.85	Tubing slid to bottom of well
09:18	23.80	120	0.48	14.7	5.84	183.0	8.97	180.1	4.70	Pulled tubing up and secured it
09:23	23.80	120	0.64	14.7	6.17	64.4	9.19	222.4	3.40	
09:28	23.80	120	0.80	14.7	6.10	75.2	9.09	256.4	4.07	
09:33	23.80	120	0.96	15.2	6.08	87.8	8.93	280.7	2.43	
09:38	23.80	120	1.12	15.5	6.06	95.5	8.90	294.8	1.01	
09:43	23.80	120	1.28	15.9	6.04	101.6	9.01	302.1	1.70	
09:48	23.80	120	1.44	15.4	6.03	105.1	8.78	305.7	0.63	
09:53	23.80	120	1.60	15.4	6.03	106.2	8.80	308.9	0.42	
09:58	23.80	120	1.76	15.4	6.03	106.0	8.85	309.9	0.23	

Stability Reached (Y/N): Yes — If No, Provide Explanation: NA

Final Values:	Temp.	pH	SEC	DO	ORP	Turbidity
	15.4	6.03	106.0	8.85	309.9	0.23

Sample ID:	MW-06-063017-25	**Method of Sampling:**	Low flow
QA/QC Samples (Yes/No):	Yes MS/MSD	**Sample Date:**	06/30/17
Duplicate ID:	NA	**Sample Collection Time:**	10:08
Sample Container Type(s):	Plastic unpreserved	**Total Volume Purged (gal):**	2
Preservative(s):	Ice (4 °C)	**Sample Depth (ft):**	25
Analysis/Method(s):	UCMR3 List	**Depth to Water After Sampling (ft):**	23.77

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
Micro TPW 2000 201605531, YSI Pro plus 10e100343

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 * 3.46 * 7.48 gal/ft^3
= 0.6 gal.

Signature: [signature]

Notes: None

Name (print): Shawna Iacozzi

QA/QC'd by: cjk — **QA/QC Date:** 10/12/2017

APPENDIX D

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION LOGS

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations			**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006	**Date:**	06/28/17
Installation:	BARNS			**Calibration Start Time:**	08:54
Sample Technician(s):	Jacob Poirier			**Calibration End Time:**	09:12

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
06/28/17	08:54	21.64	4.00	9.8	.991	96.4	Na	107.3	Na	Na
			4.82	Na						
			Na	Na						
				Na						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
06/28/17	09:12	20.97	4.00	Pass	1.010	99.7	Na	100.4	Na	Na
			7.01	Na						
			Na	Na						
				Na						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GD684	04/01/18
pH (7)	6GG371	07/01/18
pH (10)	NA	07/07/17

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	6GG870	07/01/17
Salinity	NA	07/07/17
D.O.	NA	07/07/17
ORP	7GC992	09/01/17

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
10	NA	07/07/17
20	NA	07/07/17
100	NA	07/07/17
800	NA	07/07/17

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

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	14F100064
Turbidity Meter:	Hach 2100Q	11090C012300

Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes:

Na

Signature:

Name (print): Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations			**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006	**Date:**	06/29/17
Installation:	BARNS			**Calibration Start Time:**	07:55
Sample Technician(s):	Jacob Poirier			**Calibration End Time:**	08:17

Readings Before Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
06/29/17	07:55	18.13	4.11	9.73	.944	104.4	Na	113.7	Na	Na
			7.01	Na						
			Na	Na						
				Na						

Readings After Calibration

Date	Time (24hr)	Temperature (°C)	pH (SU)	Turbidity (NTUs)	Specific Electrical Conductance (mS/cm)	D.O. (%)	Salinity (%)	ORP/Eh (mV)	Barometric Pressure (mm Hg)	Comments
06/29/17	08:17	19.20	4.00	Pass	1.000	100.0	Na	99.9	Na	Na
			7.00	Na						
			Na	Na						
				Na						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GD684	04/01/18
pH (7)	6GG371	07/01/18
pH (10)	Na	06/29/17

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	6GG870	07/01/17
Salinity	Na	07/07/17
D.O.	Na	07/07/17
ORP	7GC992	09/01/17

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
10	Na	07/07/17
20	Na	07/07/17
100	Na	07/07/17
800	Na	07/07/17

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

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	14F100064
Turbidity Meter:	Hach 2100Q	11090C012300

Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes:

None

Signature:

Name (print): Jacob Poirier

QA/QC'd by: cjk

QA/QC Date: 10/12/2017

WATER QUALITY SAMPLING INSTRUMENT CALIBRATION FORM

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations			**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006	**Date:**	06/30/17
Installation:	BARNS			**Calibration Start Time:**	08:30
Sample Technician(s):	Jacob Poirier			**Calibration End Time:**	08:47

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
06/30/17	08:30	22.27	3.98	9.96	1.196	99.0	Na	98.6	Na	Na
			7.04	Na						
				Na						
			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
06/30/17	08:47	22.64	4.00	Pass	1.000	99.8	Na	100.1	Na	Na
			7.00	Na						
				Na						
			NA	Na						

Calibration Materials Record:

pH Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
pH (4)	6GD684	04/01/18
pH (7)	6GG371	07/01/18
pH (10)	Na	07/07/17

Specific Electrical Conductance, Salinity, Dissolved Oxygen (DO) and Oxidation Reduction Potential (ORP) Calibration Standards

Standard	Cal. Standard Lot #	Expiration Date
Spec. Conductance	6GG870	07/01/17
Salinity	Na	07/07/17
D.O.	Na	07/07/17
ORP	7GC992	09/01/17

Turbidity Standards

Standard	Cal. Standard Lot #	Expiration Date
10	Na	07/07/17
20	Na	07/07/17
100	Na	07/07/17
800	Na	07/07/17

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

	Manufacturer/Model	Serial No
Water Quality Meter:	YSI 556 MPS	14F100064
Turbidity Meter:	Hach 2100Q	11090C012300

Calibrated Within Acceptance Criteria (Y/N): Yes

If No, Provide Explanation: NA

Notes:

None

Signature:

Name (print): Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

APPENDIX E

SEDIMENT SAMPLING LOGS

SAMPLE COLLECTION LOG
SEDIMENT / SURFACE SOIL / SURFACE WATER

Project Name:	Phase 1 Regional Site Inspections for Perfluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Date:**	6/27/2017
Location ID:	03SD01	**Northing/Easting:**	42.170289, -72.719834
Technician(s):	Jacob Poirier		

SEDIMENT SAMPLE

Description

NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength,consistency

Brown, dry, fine to medium sand. Trace gravel, silt and organic material.

Sample Depth (ft):	0-2 ft	**Sample ID:**	BARNS-03-SD01-062717-0-2
MS/MSD Collected:	No	**Sample Date:**	6/27/2017
Duplicate ID:	NA	**Sample Collection Time:**	11:30
Sample Container Type(s):	Plastic	**Sample Collection Methods:**	Hand-Dug pit, composite 0-2 ft
Preservative(s):	Ice (4 °C)	**Analysis/Method(s):**	UCMR3 List

SURFACE SOIL SAMPLE

Description

NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength,consistency

NA

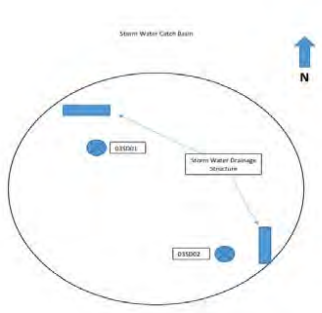
Sample Depth (ft):	NA	**Sample ID:**	NA
MS/MSD Collected:	NA	**Sample Date:**	NA
Duplicate ID:	NA	**Sample Collection Time:**	NA
Sample Container Type(s):	NA	**Sample Collection Methods:**	NA
Preservative(s):	NA	**Analysis/Method(s):**	NA

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		

Location Sketch:



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

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

Notes:
Sediment was collected from dry stormwater drainage basin at PRL 3.

Signature:

Name (print):
Jacob Poirier

QA/QC'd by:	cjk	**QA/QC Date:**	10/12/2017

SAMPLE COLLECTION LOG
SEDIMENT / SURFACE SOIL / SURFACE WATER

Project Name:	Phase 1 Regional Site Inspections for Per-Fluorinated Compounds at Multiple Air National Guard Installations	**Project Number:**	291330006.010
Contract:	W9133L-14-D-0002	**Task Order:**	0006
Installation:	BARNS	**Date:**	6/27/2017
Location ID:	03SD02	**Northing/Easting:**	42.170289, -72.719459
Technician(s):	Jacob Poirier		

SEDIMENT SAMPLE

Description

NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength,consistency

Brown, dry, fine to medium sand. Trace gravel, silt and organic material.

Sample Depth (ft):	0-2 ft	**Sample ID:**	BARNS-03-SD02-062717-0-2
MS/MSD Collected:	Yes	**Sample Date:**	6/27/2017
Duplicate ID:	BARNS-03-SD02-062717-DUP	**Sample Collection Time:**	12:05
Sample Container Type(s):	Plastic	**Sample Collection Methods:**	Hand-Dug pit, composite 0-2 ft
Preservative(s):	Ice (4 °C)	**Analysis/Method(s):**	UCMR3 List

SURFACE SOIL SAMPLE

Description

NAME (USCS Symbol): color, moisture, % by wt, plasticity, dilatancy, toughness, dry strength,consistency

NA

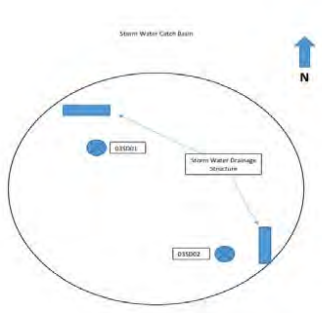
Sample Depth (ft):	NA	**Sample ID:**	NA
MS/MSD Collected:	NA	**Sample Date:**	NA
Duplicate ID:	NA	**Sample Collection Time:**	NA
Sample Container Type(s):	NA	**Sample Collection Methods:**	NA
Preservative(s):	NA	**Analysis/Method(s):**	NA

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		

Location Sketch:



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

Equipment Calibrated (Y/N): NA

Calibrated Within Criteria (Y/N): NA

Notes:

Sediment was collected from dry stormwater drainage basin at PRL 3.

Signature:

Name (print):

Jacob Poirier

QA/QC'd by: cjk **QA/QC Date:** 10/12/2017

APPENDIX F

DATA VALIDATION REPORTS

DATA VALIDATION REPORT

FY16 Phase 1 Regional Site Inspections for Perfluorinated Compounds

Multiple Air National Guard Installations

Samples Collected 20 through 30 June 2017

Barnes Municipal Airport

Prepared for:

National Guard Bureau

Prepared by:

Amec Foster Wheeler Environment & Infrastructure, Inc.
7376 SW Durham Road
Portland, Oregon 97224
(503) 639-3400

September 2017

Project No. 291330006.010.****

TABLE OF CONTENTS

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

%	percent
Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure, Inc.
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
COC	Chain Of Custody
DoD	Department Of Defense
EPA	United States Environmental Protection Agency
ICAL	Initial Calibration
ICV	Initial Calibration Verification
ID	Identification
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOQ	Limit of Quantification
MS	Matrix Spike
MSD	Matrix Spike Duplicate
PFAS	Per- and Polyfluoroalkyl substance
PFBS	Perfluorobutanesulfonic Acid
PFCs	Perfluorinated Compounds
PFHpA	Perfluoroheptanoic Acid
PFHxS	Perfluorohexanesulfonic Acid
PFNA	Perfluorononanoic Acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPD	Relative Percent Difference
Vista	Vista Analytical Laboratory

DATA VALIDATION REPORT
FY16 PHASE 1 REGIONAL SITE INSPECTIONS FOR PERFLUORINATED COMPOUNDS

Multiple Air National Guard Installations
Samples Collected 20 through 30 June 2017
Barnes Municipal Airport, Westfield, Massachusetts

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) collected 12 water samples (including one field duplicate, five equipment blanks, and one decontamination source water blank) and 29 soil samples (including three field duplicates) between 20 and 30 June 2017, from Barnes Municipal Airport Base located in Westfield, Massachusetts. Amec Foster Wheeler submitted the samples to Vista Analytical Laboratory (Vista), located in El Dorado Hills, California, where they were received between 21 June and 6 July 2017. Vista assigned the samples to sample delivery groups 1700749, 1700830, 1700831, 1700832, and 1700833. Vista analyzed the samples for per- and polyfluoroalkyl substances (PFASs) by modified United States Environmental Protection Agency (EPA) Method 537. A list of these samples by field sample identification (ID), sample collection date, sample matrix, and laboratory sample ID is presented in Table 1.

2.0 DATA VALIDATION METHODOLOGY

Amec Foster Wheeler performed EPA Stage 4 validation on 10 percent (%) of the field samples and EPA Stage 2B validation on the remaining field 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 Quality Assurance Project Plan (QAPP), Revision 01. FY16 Phase 1 Regional Site Inspections for Perfluorinated Compounds, Multiple Air National Guard Installations. Contract #: W9133L-14-D-002, Delivery Order 0006, July 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.

The data were reviewed following Amec Foster Wheeler's general data validation guidelines and using QAPP-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 (ICAL), 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 trip 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 10 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.

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 10 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.

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.

Q The analyte was B qualified because of a detection in an associated blank and additionally J qualified because of an additional QC issue.

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.

5.0 QUALIFICATION REASON CODES

Amec Foster Wheeler applied the following reason code to the data during validation:

FDD Field duplicate imprecision.

MSL Low MS/MSD recovery. Analytical result may be biased low.

TR Detected concentration is less than the limit of quantification (LOQ).

6.0 CHAIN OF CUSTODY AND SAMPLE RECEIPT CONDITION DOCUMENTATION

The samples were received at the laboratories under proper COC, intact, properly preserved, and at temperatures less than the QAPP-specified maximum of 10 degrees Celsius.

7.0 SPECIFIC DATA VALIDATION FINDINGS

Results from these samples may be considered usable with the limitations and exceptions described Sections 7.1 through 7.11.

7.1 PER- AND POLYFLUOROALKYL SUBSTANCES BY EPA METHOD 537

PFASs results generated by Vista are usable with the limitations described in Sections 7.1.1 through 7.1.11.

7.1.1 Holding Times

The aqueous samples were extracted for PFASs within the QAPP-specified maximum holding time of 14 days from sample collection and the extracts were analyzed within the QAPP-specified maximum hold time of 28 days from extraction. The soil samples were extracted for PFASs within the QAPP-specified maximum holding time of 60 days from sample collection and the extracts were analyzed within the QAPP-specified maximum holding time of 30 days from extraction.

7.1.2 Initial Calibrations

The ICALs associated with the analysis of these samples met the QAPP-specified criteria of regression factors greater than or equal to 0.96, relative standard deviations for internal standards less than 35%, the lowest calibration standards calculates to 70 to 130% of its true concentration, and the remaining calibration points calculate to 75 to 125% of their true concentrations.

7.1.3 Initial Calibration Verification

ICV recoveries were within the method specified 70% to 130% limits.

7.1.4 Continuing Calibration Verification

CCV recoveries were within the method specified 70% to 130% limits.

7.1.5 Laboratory Blanks

PFASs were not detected in the laboratory blanks associated with these.

7.1.6 Equipment and Field Blanks

PFASs were not detected in the equipment blanks associated with these samples.

7.1.7 Laboratory Control Sample Accuracy

LCS recoveries were within the QAPP-specified limits of: 60 to 130 % for perfluorobutanesulfonic acid (PFBS); 70 to 130% for perfluoroheptanoic acid (PFHpA), perfluorohexanesulfonic acid (PFHxS), perfluorooctanoic acid (PFOA), and perfluorooctanesulfonic acid (PFOS); and 50 to 130% for perfluorononanoic acid (PFNA).

7.1.8 Matrix Spikes/ Matrix Spike Duplicates

Vista performed MS and MSD analyses on samples BARNS-03-SD01-062717-0-2, MW-6-063017-25, and BARNS-07-SB01-062917-13-15. Recoveries were within the QAPP-specified limits of: 60 to 130 % for PFBS; 70 to 130% for PFHpA, PFHxS, PFOA, and PFOS; and 50 to 130% for PFNA, and precision values were less than the QAPP-specified maximum of 30%, with the following exception:

- PFOS recoveries were low at 67.0% and 64.4% in the MS and MSD, respectively, performed on sample MW-6-063017-25. Amec Foster Wheeler J qualified the detected PFOS result from this sample because of the potential low analytical bias. (Qualifier and reason code: J-MSL)

7.1.9 Surrogate Recoveries

Vista used labeled internal standards, which are added before extraction to quantify their analytical results and do not add surrogates to the samples.

7.1.10 Internal Standard Recoveries

Internal standard areas were within the QAPP-specified limits of 50 to 150% of the average area counts measured during the initial calibration.

7.1.11 Data Reporting and Analytical Procedures

Vista 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 maintained Vista's J qualifiers. (Qualifier and reason code: J-TR)

8.0 FIELD DUPLICATE RESULTS

Amec Foster Wheeler collected field duplicates with samples:

- BARNS-03-SD02-062717-0-2 (BARNS-03-SD02-062717-Dup)
- BARNS-04-SB01-062617-0-2 (BARNS-04-SB01-062617-Dup)
- BARNS-06-GW-TW01-062817-37 (BARNS-06-GW-TW01-062817-Dup)
- BARNS-05-SB01-062717-0-2 (BARNS-05-SB01-062717-DUP)

Detected results and RPDs for the field duplicates are summarized in Table 2. Precision values were within the QAPP-specified limits of less than 30% RPD or the difference between analytical results less than the LOQ, with the following exceptions:

- The RPD for PFOS was high at 43.7% between sample BARNS-06-GW-TW01-062817-37 and its field duplicate BARNS-06-GW-TW01-062817-Dup. Amec Foster Wheeler J qualified the detected PFOS results from these samples because of the potential sampling or analytical imprecision. (Qualifier and reason code: J-FDD)
- The RPD for PFOS was high at 57.6% between sample BARNS-05-SB01-062717-0-2 and its field duplicate BARNS-05-SB01-062717-DUP. Amec Foster Wheeler J qualified the detected PFOS results from these samples because of the potential sampling or analytical imprecision. (Qualifier and reason code: J-FDD)

9.0 SUMMARY AND CONCLUSIONS

Amec Foster Wheeler evaluated a total of 216 data records from field samples during the validation. Amec Foster Wheeler J qualified 39 records (18.1%) as estimated values because of low MS/MSD recoveries, field duplicate imprecision, and/or analyte concentrations outside the instrument's calibration range. Qualified data are summarized in Table 3.

REFERENCES

Amec Foster Wheeler, 2017. Final Quality Assurance Project Plan (QAPP), Revision 01. FY16 Phase 1 Regional Site Inspections for Perfluorinated Compounds, Multiple Air National Guard Installations. Contract #: W9133L-14-D-002, Delivery Order 0006, July 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.

TABLES

Table 1
Field Samples Submitted to Vista Analytical Laboratory
Barnes Municipal Airport, Massachusetts
FY16 Phase 1 Regional Site Inspection for Per-Fluorinated Compounds

Sample Identification	Collection Date	Sample Matrix	SDG	Lab Sample ID	Notes
BARNS_SWATER_MSW_062017	20-Jun-17	QC Water	1700749	1700749-01	Decontamination Source Water
BARNS-04-SB01-062617-0-2	26-Jun-17	Soil	1700830	1700830-01	
BARNS-06-SB01-062617-0-2	26-Jun-17	Soil	1700830	1700830-02	
BARNS-06-SB02-062617-0-2	26-Jun-17	Soil	1700830	1700830-03	Stage 4
BARNS-06-SB03-062617-0-2	26-Jun-17	Soil	1700830	1700830-04	Stage 4
BARNS-08-SB01-062617-0-2	26-Jun-17	Soil	1700830	1700830-05	Stage 4
BARNS-08-SB02-062617-0-2	26-Jun-17	Soil	1700830	1700830-06	
MW-6-063017-25	30-Jun-17	Groundwater	1700830	1700830-07	MS/MSD
BARNS-03-SD01-062717-0-2	27-Jun-17	Soil	1700830	1700830-08	MS/MSD
BARNS-03-SD02-062717-0-2	27-Jun-17	Soil	1700830	1700830-09	
BARNS-03-SD02-062717-Dup	27-Jun-17	Soil	1700830	1700830-10	Field Duplicate of BARNS-03-SD02-062717-0-2
BARNS-04-GW-TW02-062817-30	28-Jun-17	Groundwater	1700830	1700830-11	
BARNS-04-SB01-062617-Dup	26-Jun-17	Soil	1700830	1700830-12	Field Duplicate of BARNS-04-SB01-062617-0-2
BARNS-05-SB02-062717-0-2	27-Jun-17	Soil	1700831	1700831-01	
BARNS-06-GW-TW01-062817-37	28-Jun-17	Groundwater	1700831	1700831-02	Stage 4
BARNS-07-SB01-062617-0-2	26-Jun-17	Soil	1700831	1700831-03	
BARNS-07-SB02-062817-13-15	28-Jun-17	Soil	1700831	1700831-04	
BARNS-EB-01	26-Jun-17	QC Water	1700831	1700831-05	Equipment Blank
BARNS-EB-02	26-Jun-17	QC Water	1700831	1700831-06	Equipment Blank
BARNS-01-GW-TW03-062917-37	29-Jun-17	Groundwater	1700831	1700831-07	
BARNS-04-SB01-062917-13-15	29-Jun-17	Soil	1700831	1700831-08	
BARNS-04-SB03-062917-13-15	29-Jun-17	Soil	1700831	1700831-09	
BARNS-05-SB01-062917-13-15	29-Jun-17	Soil	1700831	1700831-10	
BARNS-05-SB02-062917-13-15	29-Jun-17	Soil	1700831	1700831-11	
BARNS-06-GW-TW01-062817-Dup	28-Jun-17	Groundwater	1700831	1700831-12	Field Duplicate of BARNS-06-GW-TW01-062817-37
BARNS-06-SB01-062917-13-15	29-Jun-17	Soil	1700832	1700832-01	
BARNS-06-SB02-062917-13-15	29-Jun-17	Soil	1700832	1700832-02	
BARNS-06-SB03-062917-13-15	29-Jun-17	Soil	1700832	1700832-03	
BARNS-07-GW-TW05-062917-49	29-Jun-17	Groundwater	1700832	1700832-04	
BARNS-07-SB01-062917-13-15	29-Jun-17	Soil	1700832	1700832-05	MS/MSD
BARNS-05-SB01-062717-DUP	27-Jun-17	Soil	1700832	1700832-06	Field Duplicate of BARNS-05-SB01-062717-0-2
BARNS-EB-03-063017	30-Jun-17	QC Water	1700832	1700832-07	Equipment Blank
BARNS-EB-04-063017	30-Jun-17	QC Water	1700832	1700832-08	Equipment Blank
BARNS-EB-05-063017	30-Jun-17	QC Water	1700832	1700832-09	Equipment Blank
BARNS-08-GW-TW04-063017-36	30-Jun-17	Groundwater	1700832	1700832-10	
BARNS-05-SB01-062717-0-2	27-Jun-17	Soil	1700833	1700833-01	
BARNS-04-SB02-062917-13-15	29-Jun-17	Soil	1700833	1700833-02	
BARNS-04-SB02-062617-0-2	26-Jun-17	Soil	1700833	1700833-03	
BARNS-01-SB02-062617-0-2	26-Jun-17	Soil	1700833	1700833-04	
BARNS-01-SB01-062617-0-2	26-Jun-17	Soil	1700833	1700833-05	
BARNS-04-SB03-062617-0-2	26-Jun-17	Soil	1700833	1700833-06	
BARNS-07-SB02-062617-0-2	26-Jun-17	Soil	1700833	1700833-07	

Notes:
ID = identification
MS/MSD = matrix spike/matrix spike duplicate

Table 2
Field Duplicate Detections
Barnes Municipal Airport, Massachusetts
FY16 Phase 1 Regional Site Inspection for Per-Fluorinated Compounds

Analyte	LOQ	Primary Sample	Field Duplicate	Units	RPD	Notes
Samples BARNS-03-SD02-062717-0-2 and BARNS-03-SD02-062717-Dup						
PFHxS	0.00184	**0.000629** J	**0.000501** J	mg/kg	22.7%	
PFOS	0.00184	**0.00280**	**0.00290**	mg/kg	3.5%	
Samples BARNS-04-SB01-062617-0-2 and BARNS-04-SB01-062617-Dup						
PFOS	0.00189	**0.000388** J	**0.000601** J	mg/kg	43.1%	± LOQ
Samples BARNS-06-GW-TW01-062817-37 and BARNS-06-GW-TW01-062817-Dup						
PFBS	0.00803	**0.0395**	**0.0426**	µg/L	7.6%	
PFHpA	0.00803	**0.0200**	**0.0238**	µg/L	17.4%	
PFHxS	0.00803	**0.641**	**0.737**	µg/L	13.9%	
PFOA	0.00803	**0.0699**	**0.0793**	µg/L	12.6%	
PFOS	0.00803	**0.609**	**0.950**	µg/L	43.7%	J-FDD
Samples BARNS-05-SB01-062717-0-2 and BARNS-05-SB01-062717-DUP						
PFHpA	0.00200	**0.000403** J	**0.000425** J	mg/kg	5.3%	
PFHxS	0.00200	**0.00480**	**0.00556**	mg/kg	14.7%	
PFOA	0.00200	**0.00264**	**0.00329**	mg/kg	21.9%	
PFOS	0.00200	**0.115**	**0.208**	mg/kg	57.6%	J-FDD

Notes:
µg/L = micrograms per liter
LOQ = limit of quantification
PFBS = perfluorobutanesulfonic acid
PFHpA = perfluoroheptanoic acid
PFHxS = perfluorohexanesulfonic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctanesulfonic acid
RPD = relative percent difference

Qualifier Definitions:
J = The analyte was positively identified; 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.

Reason Codes:
± LOQ = The difference between analyte concentrations is less than the LOW, indicating acceptable analytical precision.
FDD = Field duplicate imprecision.

Table 3
Qualifiers Added During Validation
Barnes Municipal Airport, Massachusetts
FY16 Phase 1 Regional Site Inspection for Per-Fluorinated Compounds

Sample Identification	Analyte	Results	Validation Qualifiers and Reason Codes
BARNS-01-GW-TW03-062917-37	PFNA	0.00432 µg/L	J TR
BARNS-01-SB01-062617-0-2	PFHpA	0.000334 mg/kg	J TR
BARNS-01-SB01-062617-0-2	PFHxS	0.000894 mg/kg	J TR
BARNS-01-SB01-062617-0-2	PFOA	0.000828 mg/kg	J TR
BARNS-01-SB02-062617-0-2	PFHxS	0.000314 mg/kg	J TR
BARNS-03-SD01-062717-0-2	PFOS	0.00138 mg/kg	J TR
BARNS-03-SD02-062717-0-2	PFHxS	0.000629 mg/kg	J TR
BARNS-03-SD02-062717-Dup	PFHxS	0.000501 mg/kg	J TR
BARNS-04-GW-TW02-062817-30	PFBS	0.00358 µg/L	J TR
BARNS-04-GW-TW02-062817-30	PFHpA	0.00505 µg/L	J TR
BARNS-04-GW-TW02-062817-30	PFNA	0.00525 µg/L	J TR
BARNS-04-GW-TW02-062817-30	PFOA	0.00520 µg/L	J TR
BARNS-04-SB01-062617-0-2	PFOS	0.000388 mg/kg	J TR
BARNS-04-SB01-062617-Dup	PFOS	0.000601 mg/kg	J TR
BARNS-04-SB02-062617-0-2	PFOS	0.000325 mg/kg	J TR
BARNS-04-SB03-062617-0-2	PFOS	0.00199 mg/kg	J TR
BARNS-05-SB01-062717-0-2	PFHpA	0.000403 mg/kg	J TR
BARNS-05-SB01-062717-0-2	PFOS	0.115 mg/kg	J FDD
BARNS-05-SB01-062717-DUP	PFHpA	0.000425 mg/kg	J TR
BARNS-05-SB01-062717-DUP	PFOS	0.208 mg/kg	J FDD
BARNS-05-SB02-062717-0-2	PFHxS	0.000384 mg/kg	J TR
BARNS-05-SB02-062917-13-15	PFHxS	0.000371 mg/kg	J TR
BARNS-05-SB02-062917-13-15	PFOS	0.000434 mg/kg	J TR
BARNS-06-GW-TW01-062817-37	PFOS	0.609 µg/L	J FDD
BARNS-06-GW-TW01-062817-Dup	PFOS	0.950 µg/L	J FDD
BARNS-06-SB01-062917-13-15	PFHxS	0.00133 mg/kg	J TR
BARNS-06-SB01-062917-13-15	PFOA	0.000285 mg/kg	J TR
BARNS-06-SB01-062917-13-15	PFOS	0.00180 mg/kg	J TR
BARNS-06-SB02-062617-0-2	PFNA	0.000560 mg/kg	J TR
BARNS-06-SB02-062617-0-2	PFOA	0.000518 mg/kg	J TR
BARNS-06-SB02-062917-13-15	PFOA	0.000864 mg/kg	J TR
BARNS-06-SB03-062617-0-2	PFNA	0.000610 mg/kg	J TR
BARNS-06-SB03-062617-0-2	PFOA	0.000922 mg/kg	J TR
BARNS-06-SB03-062917-13-15	PFOS	0.000304 mg/kg	J TR
BARNS-07-SB01-062617-0-2	PFOS	0.000921 mg/kg	J TR
BARNS-07-SB02-062617-0-2	PFOS	0.00153 mg/kg	J TR
BARNS-08-GW-TW04-063017-36	PFOS	0.00380 µg/L	J TR
MW-6-063017-25	PFOA	0.00276 µg/L	J TR
MW-6-063017-25	PFOS	0.00684 µg/L	J MSL, TR

Notes:
µg/L = micrograms per liter
mg/kg = milligrams per kilogram
PFBS = perfluorobutanesulfonic acid
PFHpA = perfluoroheptanoic acid
PFHxS = perfluorohexanesulfonic acid
PFNA = perfluorononanoic acid
PFOA = perfluorooctanoic acid
PFOS = perfluorooctanesulfonic acid

Qualifier Definitions:
J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Reason Code Definitions:
FDD = Field duplicate imprecision.
MSL = Low matrix spike recovery. Analytical result may be biased low.
TR = Detected concentration is less than the limit of quantification.

APPENDIX G

LABORATORY ANALYTICAL REPORTS

July 21, 2017

Vista Work Order No. 1700830

Ms. Denise King
AMEC Foster Wheeler
271 Mill Road
Chelmsford, MA 01824

Dear Ms. King,

Enclosed are the results for the sample set received at Vista Analytical Laboratory on July 06, 2017. This sample set was analyzed on a rush turn-around time, under your Project Name 'Phase I Regional SI- Barnes / 291330006'.

Vista Analytical Laboratory is committed to serving you effectively. If you require additional information, please contact me at 916-673-1520 or by email at mmaier@vista-analytical.com.

Thank you for choosing Vista as part of your analytical support team.

Sincerely,

Martha Maier
Laboratory Director

Vista Work Order No. 1700830
Case Narrative

Sample Condition on Receipt:

Seven soil samples, three sediment samples, and two groundwater samples were received in good condition and within the method temperature requirements. The samples were received and stored securely in accordance with Vista standard operating procedures and EPA methodology. The sample ID discrepancies were confirmed by the client. The correct collection date for sample "MW-6-063017-25" is June 30, 2017. A revised Chain of Custody was received on July 11, 2017 to reflect this information.

Analytical Notes:

Modified EPA Method 537

The aqueous samples were extracted and analyzed for a selected list of 6 PFAS using Modified EPA Method 537.

Holding Times

The samples were extracted and analyzed within the method hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank above 1/2 the LOQ. The OPR recoveries were within the method acceptance criteria

The labeled standard recoveries for all QC and field samples were within the acceptance criteria.

As requested, an MS/MSD was performed on sample "MW-6-063017-25".

VAL-PFAS

The solid samples were extracted and analyzed for a selected list of 6 PFAS using VAL Method PFAS.

Holding Times

The samples were extracted and analyzed within the hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank above 1/2 the LOQ. The OPR recoveries

were within the method acceptance criteria.

The labeled standard recoveries for all QC and field samples were within the acceptance criteria.

As requested, an MS/MSD was performed on sample "BARNS-03-SD01-062717-0-02".

TABLE OF CONTENTS

Sample Inventory Report

Vista Sample ID	Client Sample ID		Sampled	Received	Components/Containers
1700830-01	BARNS-04-SB01-062617-0-2		26-Jun-17 10:20	06-Jul-17 09:46	HDPE Jar, 6 oz
1700830-02	BARNS-06-SB01-062617-0-2		26-Jun-17 09:58	06-Jul-17 09:46	HDPE Jar, 6 oz
1700830-03	BARNS-06-SB02-062617-0-2		26-Jun-17 09:10	06-Jul-17 09:46	HDPE Jar, 6 oz
1700830-04	BARNS-06-SB03-062617-0-2		26-Jun-17 08:55	06-Jul-17 09:46	HDPE Jar, 6 oz
1700830-05	BARNS-08-SB01-062617-0-2		26-Jun-17 11:35	06-Jul-17 09:46	HDPE Jar, 6 oz
1700830-06	BARNS-08-SB02-062617-0-2		26-Jun-17 11:25	06-Jul-17 09:46	HDPE Jar, 6 oz
1700830-07	MW-6-063017-25	MS/MSD	30-Jun-17 10:08	06-Jul-17 09:46	HDPE Bottle, 125 mL
		MS/MSD			HDPE Bottle, 125 mL
		MS/MSD			HDPE Bottle, 125 mL
		MS/MSD			HDPE Bottle, 125 mL
		MS/MSD			HDPE Bottle, 125 mL
		MS/MSD			HDPE Bottle, 125 mL
1700830-08	BARNS-03-SD01-062717-0-2	MS/MSD	27-Jun-17 11:30	06-Jul-17 09:46	HDPE Jar, 6 oz
		MS/MSD			HDPE Jar, 6 oz
		MS/MSD			HDPE Jar, 6 oz
1700830-09	BARNS-03-SD02-062717-0-2		27-Jun-17 12:05	06-Jul-17 09:46	HDPE Jar, 6 oz
1700830-10	BARNS-03-SD02-062717-Dup		27-Jun-17 00:00	06-Jul-17 09:46	HDPE Jar, 6 oz
1700830-11	BARNS-04-GW-TW02-062817-30		28-Jun-17 11:25	06-Jul-17 09:46	HDPE Bottle, 125 mL
					HDPE Bottle, 125 mL
1700830-12	BARNS-04-SB01-062617-Dup		26-Jun-17 00:00	06-Jul-17 09:46	HDPE Jar, 6 oz

ANALYTICAL RESULTS

Sample ID: Method Blank

VAL - PFAS

Matrix: Solid
Sample Size: 1.00 g

QC Batch: B7G0050
Date Extracted: 11-Jul-2017 14:53

Lab Sample: B7G0050-BLK1
Date Analyzed: 12-Jul-17 20:36 Column: BEH C18

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.285	1.00	2.00	
PFHpA	ND	0.285	1.00	2.00	
PFHxS	ND	0.285	1.00	2.00	
PFOA	ND	0.285	1.00	2.00	
PFOS	ND	0.285	1.00	2.00	
PFNA	ND	0.285	1.00	2.00	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	86.7	50 - 150	
IS	13C4-PFHpA	81.6	50 - 150	
IS	18O2-PFHxS	80.9	50 - 150	
IS	13C2-PFOA	83.9	50 - 150	
IS	13C8-PFOS	74.5	50 - 150	
IS	13C5-PFNA	58.7	50 - 150	

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: OPR

VAL - PFAS

Matrix:	Solid	QC Batch:	B7G0050	Lab Sample:	B7G0050-BS1
Sample Size:	1.00 g	Date Extracted:	11-Jul-2017 14:53	Date Analyzed:	12-Jul-17 19:58 Column: BEH C18

Analyte	Amt Found (ng/g)	Spike Amt	%R	Limits
PFBS	8.82	10.0	88.2	70 - 130
PFHpA	8.74	10.0	87.4	70 - 130
PFHxS	8.83	10.0	88.3	70 - 130
PFOA	8.91	10.0	89.1	70 - 130
PFOS	10.2	10.0	102	70 - 130
PFNA	9.46	10.0	94.6	70 - 130

	Labeled Standard	%R	LCL-UCL
IS	13C3-PFBS	80.4	50 - 150
IS	13C4-PFHpA	82.7	50 - 150
IS	18O2-PFHxS	84.0	50 - 150
IS	13C2-PFOA	91.2	50 - 150
IS	13C8-PFOS	79.9	50 - 150
IS	13C5-PFNA	84.7	50 - 150

LCL-UCL - Lower control limit - upper control limit

Sample ID: BARNS-04-SB01-062617-0-2

VAL - PFAS

Client Data

Name:	AMEC Foster Wheeler
Project:	Phase I Regional SI- Barnes / 291330006
Date Collected:	26-Jun-2017 10:20
Location:	

Sample Data

Matrix:	Soil
Sample Size:	1.32 g
% Solids:	80.1

Laboratory Data

Lab Sample:	1700830-01	Date Received:	06-Jul-2017 9:46
QC Batch:	B7G0050	Date Extracted:	11-Jul-2017 14:53
Date Analyzed:	12-Jul-17 20:48 Column: BEH C18		

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.270	0.946	1.89	
PFHpA	ND	0.270	0.946	1.89	
PFHxS	ND	0.270	0.946	1.89	
PFOA	ND	0.270	0.946	1.89	
PFOS	0.388	0.270	0.946	1.89	J
PFNA	ND	0.270	0.946	1.89	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	85.6	50 - 150	
IS	13C4-PFHpA	85.6	50 - 150	
IS	18O2-PFHxS	83.7	50 - 150	
IS	13C2-PFOA	85.3	50 - 150	
IS	13C8-PFOS	78.4	50 - 150	
IS	13C5-PFNA	79.6	50 - 150	

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-06-SB01-062617-0-2

VAL - PFAS

Client Data

Name: AMEC F8ster Wheeler
Pr8ject: Phase I Regi8nal SI- Barnes / 291330006
Date C8llected: 26-Jun-2017 9:5H
L8cati8n:

Sample Data

Matrix: S8il
Sample Size: 1.05 g
% S8lids: 96.H

Laboratory Data

Lab Sample: 1700H-B0-02
QC Batch: B7G0050
Date Analyzed: 12-Jul-17 21:01 C8lumn: BEo C1H
Date Received: 06-Jul-2017 9:46
Date Extracted: 11-Jul-2017 14:53

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.2H0	0.9HB	1.97	
PFo pA	ND	0.2H0	0.9HB	1.97	
PFo xS	ND	0.2H0	0.9HB	1.97	
PFOA	ND	0.2H0	0.9HB	1.97	
PFOS	2.49	0.2H0	0.9HB	1.97	
PFNA	ND	0.2H0	0.9HB	1.97	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	95.6	50 - 150	
IS	13C4-PFo pA	H7.6	50 - 150	
IS	1H02-PFo xS	H9.7	50 - 150	
IS	13C2-PFOA	H4.0	50 - 150	
IS	13CH-PFOS	77.H	50 - 150	
IS	13C5-PFNA	7HH	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: BARNS-06-SB01-061627-0-1 — VAL - PFAS

Client Data

Name:	AMEC F8ster Wheeler
Pr8ject:	Phase I Regi8nal SI- Barnes / 291330006
Date C8llected:	26-Jun-2017 9:10
L8cati8n:	

Sample Data

Matrix:	S8il
Sample Size:	1.13 g
% S8lids:	93.2

Laboratory Data

Lab Sample:	1700H30-03	Date Received:	06-Jul-2017 9:46
QC Batch:	B7G0050	Date Extracted:	11-Jul-2017 14:53
Date Analyzed:	12-Jul-17 21:13 C8lumn: BEo C1H		

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.271	0.949	1.90	
PFo pA	ND	0.271	0.949	1.90	
PFo xS	4.5H	0.271	0.949	1.90	
PFOA	0.51H	0.271	0.949	1.90	J
PFOS	73.3	0.271	0.949	1.90	
PFNA	0.560	0.271	0.949	1.90	J

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	99.9	50 - 150	
IS	13C4-PFo pA	H4.1	50 - 150	
IS	1HO2-PFo xS	7H3	50 - 150	
IS	13C2-PFOA	H2.H	50 - 150	
IS	13CH-PFOS	75.9	50 - 150	
IS	13C5-PFNA	77.3	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: BARNS-06-SB03-062617-0-2

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
Name:	AMEC Foster Wheeler	Matrix:	Soil	Lab Sample:	1700R30-04	Date v ecei6ed:	08-Jul-2017 9:48
Project:	Phase I v egional SI- Barnes / 291330008	Sample Size:	1.0R g	QC Batch:	B7G0050	Date Extracted:	11-Jul-2017 14:53
Date Collected:	28-Jun-2017 R:55	% Solids:	92.R	Date Analyzed:	12-Jul-17 21:28 Column: BEH C1R		
Location:					13-Jul-17 14:04 Column: BEH C1R		

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.2R4	0.99R	2.00	
PFHpA	ND	0.2R4	0.99R	2.00	
PFHxS	3.33	0.2R4	0.99R	2.00	
PFOA	0.922	0.2R4	0.99R	2.00	J
PFOS	172	1.42	4.99	9.9R	D
PFNA	0.810	0.2R4	0.99R	2.00	J

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	R5.5	50 - 150	
IS	13C4-PFHpA	R1.1	50 - 150	
IS	1RO2-PFHxS	R8.4	50 - 150	
IS	13C2-PFOA	93.5	50 - 150	
IS	13CR-PFOS	97.0	50 - 150	D
IS	13C5-PFNA	R3.7	50 - 150	

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.
v esults reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-08-SB01-062617-0-2

VAL - PFAS

Client Data

Name:	AMEC Foster Wheeler
Project:	Phase I Regional SI- Barnes / 291330006
Date Collected:	26-Jun-2017 11:35
Location:	

Sample Data

Matrix:	Soil
Sample Size:	1.18 g
% Solids:	91.3

Laboratory Data

Lab Sample:	1700830-05	Date Received:	06-Jul-2017 9:46
QC Batch:	B7G0050	Date Extracted:	11-Jul-2017 14:53
Date Analyzed:	12-Jul-17 21:38 Column: BEH C18		

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.265	0.928	1.86	
PFHpA	ND	0.265	0.928	1.86	
PFHxS	ND	0.265	0.928	1.86	
PFOA	ND	0.265	0.928	1.86	
PFOS	9.13	0.265	0.928	1.86	
PFNA	ND	0.265	0.928	1.86	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	99.9	50 - 150	
IS	13C4-PFHpA	85.9	50 - 150	
IS	18O2-PFHxS	97.1	50 - 150	
IS	13C2-PFOA	81.5	50 - 150	
IS	13C8-PFOS	79.9	50 - 150	
IS	13C5-PFNA	78.8	50 - 150	

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-08-SB01-061627-0-1

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
Name:	AMEC F8ster Wheeler	Matrix:	S8il	Lab Sample:	1700H30-06	Date Received:	06-Jul-2017 9:46
Pr8ject:	Phase I Regi8nal SI- Barnes / 291330006	Sample Size:	1.30 g	QC Batch:	B7G0050	Date Extracted:	11-Jul-2017 14:53
Date C8llected:	26-Jun-2017 11:25	% S8lids:	H3.7	Date Analyzed:	12-Jul-17 21:51	C8lumn:	BEo C1H
L8cati8n:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.262	0.919	1.H4	
PFo pA	ND	0.262	0.919	1.H4	
PFo xS	2.63	0.262	0.919	1.H4	
PFOA	ND	0.262	0.919	1.H4	
PFOS	6.92	0.262	0.919	1.H4	
PFNA	ND	0.262	0.919	1.H4	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	H5.0	50 - 150	
IS	13C4-PFo pA	H3.H	50 - 150	
IS	1HO2-PFo xS	H6.3	50 - 150	
IS	13C2-PFOA	H0.9	50 - 150	
IS	13CH-PFOS	66.1	50 - 150	
IS	13C5-PFNA	H1.7	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: BARNS-06-SD03-021737-0-1

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
Name:	AMEC F8ster Wheeler	Matrix:	Sediment	Lab Sample:	1700H30-0H	Date Received:	06-Jul-2017 9:46
Pr8ject:	Phase I Regi8nal SI- Barnes / 291330006	Sample Size:	1.34 g	QC Batch:	B7G0050	Date Extracted:	11-Jul-2017 14:53
Date C8llected:	27-Jun-2017 11:30	% S8lids:	79.3	Date Analyzed:	12-Jul-17 22:03	C8lumn:	BEo C1H
L8cati8n:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.26H	0.941	1.HH	
PFo pA	ND	0.26H	0.941	1.HH	
PFo xS	ND	0.26H	0.941	1.HH	
PFOA	ND	0.26H	0.941	1.HH	
PFOS	1.3H	0.26H	0.941	1.HH	J
PFNA	ND	0.26H	0.941	1.HH	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	9HH	50 - 150	
IS	13C4-PFo pA	94.2	50 - 150	
IS	1HO2-PFo xS	H9.4	50 - 150	
IS	13C2-PFOA	95.4	50 - 150	
IS	13CH-PFOS	7H4	50 - 150	
IS	13C5-PFNA	HI.9	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Matrix Spike Results

VAL - PFAS

Source Client ID: BARNS-03-SD01-062717-0-2
Source LabNumber: 1700830-08
Matrix: Solid
Sample Size: 1.26/1.33 g

QC Batch: B7G0050
Date Extracted: 11-Jul-2017 14:53

Lab Sample: B7G0050-MS1/B7G0050-MSD1
Date Analyzed: 12-Jul-17 22:17 Column: BEH C18
12-Jul-17 22:30 Column: BEH C18

Analyte	Spike-MS (ng/g)	MS %R	MS Qual.	Spike-MSD (ng/g)	MSD %R	RPD	MSD Qual.	%R Limit	%RPD Limit
PFBS	10.0	83.9		9.48	85.4	1.77		70 - 130	25
PFHpA	10.0	92.0		9.48	94.4	2.58		70 - 130	25
PFHxS	10.0	85.9		9.48	94.7	9.75		70 - 130	25
PFOA	10.0	89.9		9.48	97.6	8.21		70 - 130	25
PFOS	10.0	72.2		9.48	85.1	16.4		70 - 130	25
PFNA	10.0	105		9.48	90.8	14.5		70 - 130	25

	Labeled Standard	MS %R	MS Qualifiers	MSD %R	MS Qual.
IS	13C3-PFBS	84.4		89.4	
IS	13C4-PFHpA	78.3		81.2	
IS	18O2-PFHxS	78.4		84.7	
IS	13C2-PFOA	82.9		89.9	
IS	13C8-PFOS	89.5		77.0	
IS	13C5-PFNA	65.7		85.5	

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-06-SD03-023171-0-3

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
Name:	AMEC F8ster Wheeler	Matrix:	Sediment	Lab Sample:	1700H30-09	Date Received:	06-Jul-2017 9:46
Pr8ject:	Phase I Regi8nal SI- Barnes / 291330006	Sample Size:	1.33 g	QC Batch:	B7G0050	Date Extracted:	11-Jul-2017 14:53
Date C8llected:	27-Jun-2017 12:05	% S8lids:	Hl.H	Date Analyzed:	12-Jul-17 22:42	C8lumn:	BEo C1H
L8cati8n:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.262	0.920	1.H4	
PFo pA	ND	0.262	0.920	1.H4	
PFo xS	0.629	0.262	0.920	1.H4	J
PFOA	ND	0.262	0.920	1.H4	
PFOS	2.H0	0.262	0.920	1.H4	
PFNA	ND	0.262	0.920	1.H4	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	109	50 - 150	
IS	13C4-PFo pA	99.9	50 - 150	
IS	1H02-PFo xS	99.6	50 - 150	
IS	13C2-PFOA	91.3	50 - 150	
IS	13CH-PFOS	72.6	50 - 150	
IS	13C5-PFNA	92.H	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: BARNS-06-SD03-023171-Dup

VAL - PFAS

Client Data

Name: AMEC F8ster Wheeler
Pr8ject: Phase I Regi8nal SI- Barnes / 291330006
Date C8llected: 27-Jun-2017 0:00
L8cati8n:

Sample Data

Matrix: Sediment
Sample Size: 1.27 g
% S8lids: 76.9

Laboratory Data

Lab Sample: 1700H30-10
QC Batch: B7G0050
Date Analyzed: 12-Jul-17 22:54 C8lumn: BEo C1H
Date Received: 06-Jul-2017 9:46
Date Extracted: 11-Jul-2017 14:53

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.292	1.02	2.05	
PFo pA	ND	0.292	1.02	2.05	
PFo xS	0.501	0.292	1.02	2.05	J
PFOA	ND	0.292	1.02	2.05	
PFOS	2.90	0.292	1.02	2.05	
PFNA	ND	0.292	1.02	2.05	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	91.9	50 - 150	
IS	13C4-PFo pA	9H0	50 - 150	
IS	1HO2-PFo xS	HH2	50 - 150	
IS	13C2-PFOA	H9.4	50 - 150	
IS	13CH-PFOS	H1.6	50 - 150	
IS	13C5-PFNA	7H9	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: BARNS-04-SB01-062617-Dup

VAL - PFAS

Client Data

Name: AMEC F8ster Wheeler
Pr8ject: Phase I Regi8nal SI- Barnes / 291330006
Date C8llected: 26-Jun-2017 0:00
L8cati8n:

Sample Data

Matrix: S8il
Sample Size: 1.09 g
% S8lids: 91.4

Laboratory Data

Lab Sample: 1700H-B0-12
QC Batch: B7G0050
Date Analyzed: 12-Jul-17 23:07 C8lumn: BEo C1H
Date Received: 06-Jul-2017 9:46
Date Extracted: 11-Jul-2017 14:53

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.2H6	1.00	2.01	
PFo pA	ND	0.2H6	1.00	2.01	
PFo xS	ND	0.2H6	1.00	2.01	
PFOA	ND	0.2H6	1.00	2.01	
PFOS	0.601	0.2H6	1.00	2.01	J
PFNA	ND	0.2H6	1.00	2.01	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	76.6	50 - 150	
IS	13C4-PFo pA	75.4	50 - 150	
IS	1HO2-PFo xS	H4.4	50 - 150	
IS	13C2-PFOA	H9.6	50 - 150	
IS	13CH-PFOS	H6.9	50 - 150	
IS	13C5-PFNA	H4.1	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: Method Blank — **Modified EPA Method 537**

Matrix:	Aqueous	QC Batch:	B7G0031	Lab Sample:	B7G0031-BLK1
Sample Size:	0.125 L	Date Extracted:	10-Jul-2017 7:38	Date Analyzed:	11-Jul-17 20:12 Column: BEH C18

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.00218	0.00500	0.00800	
PFHpA	ND	0.00218	0.00500	0.00800	
PFHxS	ND	0.00218	0.00500	0.00800	
PFOA	ND	0.00218	0.00500	0.00800	
PFOS	ND	0.00218	0.00500	0.00800	
PFNA	ND	0.00218	0.00500	0.00800	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	95.5	50 - 150	
IS	13C4-PFHpA	94.7	50 - 150	
IS	18O2-PFHxS	118	50 - 150	
IS	13C2-PFOA	104	50 - 150	
IS	13C8-PFOS	103	50 - 150	
IS	13C5-PFNA	96.2	50 - 150	

LCL-UCL - Lower control limit - upper control limit
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: OPR

Modified EPA Method 537

Matrix:	Aqueous	QC Batch:	B7G0031	Lab Sample:	B7G0031-BS1
Sample Size:	0.125 L	Date Extracted:	10-Jul-2017 7:38	Date Analyzed:	11-Jul-17 19:47 Column: BEH C18

Analyte	Amt Found (ug/L)	Spike Amt	%R	Limits
PFBS	0.0601	0.0800	75.2	70 - 130
PFHpA	0.0637	0.0800	79.7	70 - 130
PFHxS	0.0655	0.0800	81.9	70 - 130
PFOA	0.0719	0.0800	89.8	70 - 130
PFOS	0.0564	0.0800	70.6	70 - 130
PFNA	0.0564	0.0800	70.5	70 - 130

	Labeled Standard	%R	LCL-UCL
IS	13C3-PFBS	108	50 - 150
IS	13C4-PFHpA	103	50 - 150
IS	18O2-PFHxS	111	50 - 150
IS	13C2-PFOA	95.2	50 - 150
IS	13C8-PFOS	102	50 - 150
IS	13C5-PFNA	102	50 - 150

LCL-UCL - Lower control limit - upper control limit

Sample ID: MW-6-063017-25

Modified EPA Method 537

Client Data

Name: AMEC Foster Wheeler
Project: Phase I Regional SI- Barnes / 291330006
Date Collected: 30-Jun-2017 10:08
Location:

Sample Data

Matrix: Groundwater
Sample Size: 0.121 L

Laboratory Data

Lab Sample: 1700830-07 Date Received: 06-Jul-2017 9:46
QC Batch: B7G0031 Date Extracted: 10-Jul-2017 7:38
Date Analyzed: 11-Jul-17 20:25 Column: BEH C18

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.00225	0.00517	0.00827	
PFHpA	ND	0.00225	0.00517	0.00827	
PFHxS	0.0108	0.00225	0.00517	0.00827	
PFOA	0.00276	0.00225	0.00517	0.00827	J
PFOS	0.00684	0.00225	0.00517	0.00827	J
PFNA	ND	0.00225	0.00517	0.00827	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	109	50 - 150	
IS	13C4-PFHpA	96.5	50 - 150	
IS	18O2-PFHxS	98.6	50 - 150	
IS	13C2-PFOA	102	50 - 150	
IS	13C8-PFOS	102	50 - 150	
IS	13C5-PFNA	103	50 - 150	

LCL-UCL - Lower control limit - upper control limit
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Matrix Spike Results

Modified EPA Method 537

Source Client ID: MW-6-063017-25
Source LabNumber: 1700830-07
Matrix: Aqueous
Sample Size: 0.121/0.121 L

QC Batch: B7G0031
Date Extracted: 10-Jul-2017 7:38

Lab Sample: B7G0031-MS1/B7G0031-MSD1
Date Analyzed: 11-Jul-17 20:38 Column: BEH C18
11-Jul-17 20:50 Column: BEH C18

Analyte	Spike-MS (ug/L)	MS %R	MS Qual.	Spike-MSD (ug/L)	MSD %R	RPD	MSD Qual.	%R Limit	%RPD Limit
PFBS	0.0829	**69.2**	H	0.0824	80.6	15.2		70 - 130	25
PFHpA	0.0829	73.5		0.0824	76.1	3.48		70 - 130	25
PFHxS	0.0829	77.6		0.0824	78.2	0.770		70 - 130	25
PFOA	0.0829	74.8		0.0824	83.1	10.5		70 - 130	25
PFOS	0.0829	**67.0**	H	0.0824	**64.4**	3.96	H	70 - 130	25
PFNA	0.0829	**65.4**	H	0.0824	76.5	15.6		70 - 130	25

	Labeled Standard	MS %R	MS Qualifiers	MSD %R	MS Qual.
IS	13C3-PFBS	102		113	
IS	13C4-PFHpA	103		107	
IS	18O2-PFHxS	108		121	
IS	13C2-PFOA	102		96.1	
IS	13C8-PFOS	98.4		100	
IS	13C5-PFNA	113		96.5	

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-04-GW-TW02-062817-30

Modified EPA Method 537

Client Data

Name: AMEC Foster Wheeler
Project: Phase I Regional SI- Barnes / 291330006
Date Collected: 28-Jun-2017 11:25
Location:

Sample Data

Matrix: Aqueous
Sample Size: 0.120 L

Laboratory Data

Lab Sample: 1700830-11 Date Received: 06-Jul-2017 9:46
QC Batch: B7G0031 Date Extracted: 10-Jul-2017 7:38
Date Analyzed: 11-Jul-17 21:02 Column: BEH C18

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	0.00358	0.00227	0.00521	0.00832	J
PFHpA	0.00505	0.00227	0.00521	0.00832	J
PFHxS	0.0305	0.00227	0.00521	0.00832	
PFOA	0.00520	0.00227	0.00521	0.00832	J
PFOS	0.0994	0.00227	0.00521	0.00832	
PFNA	0.00525	0.00227	0.00521	0.00832	J

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	101	50 - 150	
IS	13C4-PFHpA	101	50 - 150	
IS	18O2-PFHxS	108	50 - 150	
IS	13C2-PFOA	98.5	50 - 150	
IS	13C8-PFOS	99.1	50 - 150	
IS	13C5-PFNA	97.3	50 - 150	

LCL-UCL - Lower control limit - upper control limit
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

DATA QUALIFIERS & ABBREVIATIONS

B	**This compound was also detected in the method blank.**
D	**Dilution**
E	**The associated compound concentration exceeded the calibration range of the instrument.**
H	**Recovery and/or RPD was outside laboratory acceptance limits.**
I	**Chemical Interference**
J	**The amount detected is below the Reporting Limit/LOQ.**
M	**Estimated Maximum Possible Concentration. (CA Region 2 projects only)**
*****	**See Cover Letter**
Conc.	**Concentration**
NA	**Not applicable**
ND	**Not Detected**
TEQ	**Toxic Equivalency**

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

CERTIFICATIONS

Accrediting Authority	Certificate Number
Arkansas Department of Environmental Quality	17-015-0
California Department of Health – ELAP	2892
DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005	3091.01
Florida Department of Health	E87777-18
Hawaii Department of Health	N/A
Louisiana Department of Environmental Quality	01977
Maine Department of Health	2016026
Minnesota Department of Health	1175673
Nevada Division of Environmental Protection	CA004132017-1
New Hampshire Environmental Accreditation Program	207716
New Jersey Department of Environmental Protection	CA003
New York Department of Health	11411
Oregon Laboratory Accreditation Program	4042-008
Pennsylvania Department of Environmental Protection	013
Texas Commission on Environmental Quality	T104704189-17-8
Virginia Department of General Services	8621
Washington Department of Ecology	C584
Wisconsin Department of Natural Resources	998036160

Current certificates and lists of licensed parameters are located in the Quality Assurance office and are available upon request.

NELAP Accredited Test Methods

MATRIX: Air	
Description of Test	**Method**
Determination of Polychlorinated p-Dioxins & Polychlorinated Dibenzofurans	EPA 23

MATRIX: Biological Tissue	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Drinking Water	
Description of Test	**Method**
2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD) GC/HRMS	EPA 1613
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537

MATRIX: Non-Potable Water	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Dioxin by GC/HRMS	EPA 613
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Solids	
Description of Test	**Method**
Tetra-Octa Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope	EPA 1613B

Dilution GC/HRMS	
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

1700830 0.5°C

amec foster wheeler

Amec Foster Wheeler Environment & Infrastructure
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

SHIP TO:
Vista
1104 Windfield Way
El Dorado Hills, CA 95762
Atten: Martha Maier
Lab Phone# (916) 673-1520

CHAIN OF CUSTODY

DATE: 7/5/2017
COC #: BARNS170705A
PAGE: 1 OF 3

Project Name:	Phase I Regional SI - Barnes	Project Contact: Denise King		Bill To: Amec Foster Wheeler Environment & Infrastructure	Disposal Instructions: LAB
Project Number:	291330006	Phone Number: (978) 392-5339		9210 Sky Park Court Suite 200	Shipment Method: FEDEX
Project Manager:	Kerry Tull	Project Phase: 010		San Diego, CA 92123	Waybill Number: N/A

Sample Information

No.	Sample ID	Date & Time Sampled	Matrix	Sample Type	MS/MSD	Methods for Analysis: Method 537.1 UCMR 3	RUSH: 24 Hour	48 Hour	72 Hour	5 Days	TOTAL BOTTLES	HOLD All Analyses
1	BARNS-04-SB01-062617-0-2	06/26/17 10:20	SO	N	N	X					1	
2	BARNS-06-SB01-062617-0-2	06/26/17 09:58	SO	N	N	X					1	
3	BARNS-06-SB02-062617-0-2	06/26/17 09:10	SO	N	N	X					1	
4	BARNS-06-SB03-062617-0-2	06/26/17 08:55	SO	N	N	X					1	
5	BARNS-08-SB01-062617-0-2 7/11/17 DAK	06/26/17 11:35	SO	N	N	X					1	
6	BARNS-08-SB02-062617-0-2	06/26/17 11:25	SO	N	N	X					1	
7	MW-6-063017-25 06/30/17	06/30/17 10:08	WG	N	Y	X					6	
8	BARNS-03-SD01-062717-0-2	06/27/17 11:30	SE	N	Y	X					3	
9	BARNS-03-SD02-062717-0-2	06/27/17 12:05	SE	N	N	X					1	
10	BARNS-03-SD02-062717-Dup	06/27/17 00:00	SE	FD	N	X					1	
11	BARNS-04-GW-TW02-062817-30	06/28/17 11:25	WG	N	N	X					2	
12	BARNS-04-SB01-062617-Dup	06/26/17 00:00	SO	FD	N	X					1	

Sampler's Signature:		Date: 7/5/17	Time: 0940
Relinquished By/Affiliation: AMEC FW		Date: 7/5/17	Time: 0947
Received By: VDH		Date: 7/6/17	Time: 1010
Relinquished By/Affiliation:		Date:	Time:
Received By:		Date:	Time:
Relinquished By/Affiliation:		Date:	Time:
Received By (LAB):		Date:	Time:

For Lab Use

Does COC match samples:	Y or N
Broken Container:	Y or N
COC seal intact:	Y or N
Other problems:	Y or N
WSDOT contacted:	Y or N
Date contacted:	
Cooler Temperature at receipt:	____ C

Comments:
X=Analyze H=Hold Analysis Request
Contract # W9133L-14-D-0002 TO0006
PO # F013200677
ATTN: Tammie Rippie
Base Lead: Todd Coffin
Field Lead: Craig.keating@amecfw.com

NUMBER OF COOLERS SENT: 1

* Revised COC received via email on 7/11/2017 * KW 7/11/17

1700830 0.5°C

amec foster wheeler

Amec Foster Wheeler Environment & Infrastructure
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

SHIP TO:
Vista
1104 Windfield Way
El Dorado Hills, CA 95762
Atten: Martha Maier
Lab Phone# (916) 673-1520

CHAIN OF CUSTODY

DATE: 7/5/2017
COC #: BARNS170705A
PAGE: 1 OF 3

Project Name:	Phase I Regional SI - Barnes	Project Contact:	Denise King	Bill To: Amec Foster Wheeler Environment & Infrastructure	Disposal Instructions: LAB
Project Number:	**291330006**	Phone Number:	(978) 392-5339	9210 Sky Park Court Suite 200	Shipment Method: FEDEX
Project Manager:	Kerry Tull	Project Phase:	.010	San Diego, CA 92123	Waybill Number: N/A

Sample Information						Methods for Analysis	RUSH					
No.	Sample ID	Date & Time Sampled	Matrix	Sample Type	MS/MSD	Method 537.1 UCMR 3	24 Hour	48 Hour	72 Hour	5 Days	TOTAL BOTTLES	HOLD All Analyses
1	BARNS-04-SB01-062617-0-2	06/26/17 10:20	SO	N	N	X					1	
2	BARNS-06-SB01-062617-0-2	06/26/17 09:58	SO	N	N	X					1	
3	BARNS-06-SB02-062617-0-2	06/26/17 09:10	SO	N	N	X					1	
4	BARNS-06-SB03-062617-0-2	06/26/17 08:55	SO	N	N	X					1	
5	BARNS-08-SB01-062617-0-2	06/26/17 11:35	SO	N	N	X					1	
6	BARNS-08-SB02-062617-0-2	06/26/17 11:25	SO	N	N	X					1	
7	MW-6-063017-25	06/20/17 10:08	WG	N	Y	X					6	
8	BARNS-03-SD01-062717-0-2	06/27/17 11:30	SE	N	Y	X					3	
9	BARNS-03-SD02-062717-0-2	06/27/17 12:05	SE	N	N	X					1	
10	BARNS-03-SD02-062717-Dup	06/27/17 00:00	SE	FD	N	X					1	
11	BARNS-04-GW-TW02-062817-30	06/28/17 11:25	WG	N	N	X					2	
12	BARNS-04-SB01-062617-Dup	06/26/17 00:00	SO	FD	N	X					1	

Sampler's Signature:		Date: 7/5/17	Time: 0940
Relinquished By/Affiliation:	AMEC FW	Date: 7/5/17	Time: 0947
Received By:	VSH	Date: 7/6/17	Time: 1010
Relinquished By/Affiliation:		Date:	Time:
Received By:		Date:	Time:
Relinquished By/Affiliation:		Date:	Time:
Received By (LAB):		Date:	Time:

For Lab Use

Does COC match samples:	Y or N
Broken Container:	Y or N
COC seal intact:	Y or N
Other problems:	Y or N
WSDOT contacted:	Y or N
Date contacted:	
Cooler Temperature at receipt:	°C

Comments:
X=Analyze H=Hold Analysis Request
Contract # W9133L-14-D-0002 TO0006
PO # F013200677
ATTN: Tammie Rippie
Base Lead: Todd Coffin
Field Lead: Craig.keating@amecfw.com

NUMBER OF COOLERS SENT: 1

Vista Analytical Laboratory

Sample Log-in Checklist

Vista Work Order #: 1700830 **TAT** Std

Samples Arrival:	**Date/Time** 7/6/17 0946	**Initials:** WMS	**Location:** WR-2 **Shelf/Rack:** N/a
Logged In:	**Date/Time** 07/06/17 1235	**Initials:** WMS CBB	**Location:** WR-2 **Shelf/Rack:** E-7

Delivered By:	(FedEx)	UPS	On Trac	GSO	DHL	Hand Delivered	Other
Preservation:	(Ice)		Blue Ice		Dry Ice		None

Temp °C: 0.9	(uncorrected)	**Time:** 1009	**Thermometer ID:** IR-2
Temp °C: 0.5	(corrected)	**Probe used:** Yes☐ No☒	

	YES	NO	NA
Adequate Sample Volume Received?	✓		
Holding Time Acceptable?	✓		
Shipping Container(s) Intact?	✓		
Shipping Custody Seals Intact?	✓		
Shipping Documentation Present?	✓		
Airbill — Trk # 8009 5563 6272	✓		
Sample Container Intact?	✓		
Sample Custody Seals Intact?			✓
Chain of Custody / Sample Documentation Present?	✓		
COC Anomaly/Sample Acceptance Form completed?	✓		

If Chlorinated or Drinking Water Samples, Acceptable Preservation?					✓ JSO 7/6/17	✓
Preservation Documented:	$Na_2S_2O_3$	Trizma	None		Yes	No (NA)
Shipping Container	(Vista)	Client	(Retain)	Return		Dispose

Comments: sample labels: BARUS-04-SB01-062617-00-02
BARUS-06-SB01-062617-00-02
BARUS-06-SB02-062617-00-02
BARUS-06-SB03-06217-00-02
BARUS-08-SB01-062617-00-02
BARUS-08-SB02-062617-00-02
BARUS-03-SD01-062717-00-02
BARUS-03-SD02-062717-00-02

all ID's reconciled via cap label

Chain of Custody Anomaly/Sample Acceptance Form

Vista Analytical Laboratory

Client: AMEC Foster Wheeler
Contact: Denise King
Email: Denise.king@amecfw.com
Phone: (978) 392-5339

Workorder Number: 1700830
Date Received: 06-Jul-17 09:46
Documented by/date: B.Benedict 07/06/2017

Please review the following information and complete the Client Authorization section. To comply with NELAC regulations, we must receive authorization before proceeding with sample analysis.

Thank you,

Martha Maier
mmaier@vista-analytical.com
916-673-1520

The following information or item is needed to proceed with analysis:

☐ Complete Chain-of-Custody	☐ Preservative	☐ Collector's Name
☐ Test Method Requested	☐ Sample Identification	☐ Sample Type
☐ Analyte List Requested	☒ Sample Collection Date **	☐ Sample Location
☐ Other:		

The following anomalies were noted. Authorization is needed to proceed with analysis.

☐ Temperature outside < 6°C Range Samples Affected: _____

Temperature _____°C Ice Present? Yes No Melted

☒ Sample ID Discrepancy: See Comments	☐ Insufficient Sample Size
☐ Sample Holding Time Missed	☐ Sample Container(s) Broken
☐ Custody Seals Broken	☐ Incorrect Container Type

Comments:

COC ID	Label ID
BARNS-04-SB01-062617-0-2	BARNS-04-SB01-062617-**00-02**
BARNS-06-SB01-062617-0-2	BARNS-06-SB01-062617-**00-02**
BARNS-06-SB02-062617-0-2	BARNS-06-SB02-062617-**00-02**
BARNS-06-SB03-062617-0-2	BARNS-06-SB03-062617-**00-02**
BARNS-08-SB01-062617-0-2	BARNS-08-SB01-062617-**00-02**
BARNS-03-SD01-062717-0-2	BARNS-03-SD01-062717-**00-02**
BARNS-03-SD02-062717-0-2	BARNS-03-SD02-062717-**00-02**

**COC ID:	COC Collection Date:
MW-6-**063017**-25	06/20/17

Client Authorization

Proceed with Analysis: (YES) NO Signature and Date Karen F. Griffith 7-10-17

Client Comments/Instructions Per email from Todd coffin, the sampler are logged in currently. The collection date for sample "MW-6" is 6/30/2017.

July 20, 2017

Vista Work Order No. 1700831

Ms. Denise King
AMEC Foster Wheeler
271 Mill Road
Chelmsford, MA 01824

Dear Ms. King,

Enclosed are the results for the sample set received at Vista Analytical Laboratory on July 06, 2017. This sample set was analyzed on a rush turn-around time, under your Project Name 'Phase I Regional SI- Barnes / 291330006'.

Vista Analytical Laboratory is committed to serving you effectively. If you require additional information, please contact me at 916-673-1520 or by email at mmaier@vista-analytical.com.

Thank you for choosing Vista as part of your analytical support team.

Sincerely,

Martha Maier
Laboratory Director

Vista Work Order No. 1700831
Case Narrative

Sample Condition on Receipt:

Seven soil samples and five groundwater samples were received in good condition and within the method temperature requirements. The samples were received and stored securely in accordance with Vista standard operating procedures and EPA methodology. The client confirmed that the sample IDs on the Chain of Custody are correct.

Analytical Notes:

Modified EPA Method 537

Samples "BARNS-06-GW-TW01-062817-37" and "BARNS-06-GW-TW01-062817-Dup" contained particulate and were centrifuged prior to extraction.

The aqueous samples were extracted and analyzed for a selected list of 6 PFAS using Modified EPA Method 537.

Holding Times

Due to laboratory oversight, samples "BARNS-EB-01" and "BARNS-EB-02" were extracted and analyzed outside of the method hold time. All other samples were extracted and analyzed within the hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank above 1/2 the LOQ. The OPR recoveries were within the method acceptance criteria

The labeled standard recoveries for all QC and field samples were within the acceptance criteria.

VAL-PFAS

The solid samples were extracted and analyzed for a selected list of 6 PFAS using VAL Method PFAS.

Holding Times

The samples were extracted and analyzed within the hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank above 1/2 the LOQ. The OPR recoveries were within the method acceptance criteria.

The labeled standard recoveries for all QC and field samples were within the acceptance criteria.

TABLE OF CONTENTS

Sample Inventory Report

Vista Sample ID	Client Sample ID	Sampled	Received	Components/Containers
1700831-01	BARNS-05-SB02-062717-0-2	27-Jun-17 09:20	06-Jul-17 09:46	HDPE Jar, 6 oz
1700831-02	BARNS-06-GW-TW01-062817-37	28-Jun-17 15:30	06-Jul-17 09:46	HDPE Bottle, 125 mL
				HDPE Bottle, 125 mL
1700831-03	BARNS-07-SB01-062617-0-2	26-Jun-17 12:15	06-Jul-17 09:46	HDPE Jar, 6 oz
1700831-04	BARNS-07-SB02-062817-13-15	28-Jun-17 15:30	06-Jul-17 09:46	HDPE Jar, 6 oz
1700831-05	BARNS-EB-01	26-Jun-17 12:50	06-Jul-17 09:46	HDPE Bottle, 125 mL
				HDPE Bottle, 125 mL
1700831-06	BARNS-EB-02	26-Jun-17 12:55	06-Jul-17 09:46	HDPE Bottle, 125 mL
				HDPE Bottle, 125 mL
1700831-07	BARNS-01-GW-TW03-062917-37	29-Jun-17 14:15	06-Jul-17 09:46	HDPE Bottle, 125 mL
				HDPE Bottle, 125 mL
1700831-08	BARNS-04-SB01-062917-13-15	29-Jun-17 15:05	06-Jul-17 09:46	HDPE Jar, 6 oz
1700831-09	BARNS-04-SB03-062917-13-15	29-Jun-17 09:20	06-Jul-17 09:46	HDPE Jar, 6 oz
1700831-10	BARNS-05-SB01-062917-13-15	29-Jun-17 08:20	06-Jul-17 09:46	HDPE Jar, 6 oz
1700831-11	BARNS-05-SB02-062917-13-15	29-Jun-17 08:00	06-Jul-17 09:46	HDPE Jar, 6 oz
1700831-12	BARNS-06-GW-TW01-062817-Dup	28-Jun-17 00:00	06-Jul-17 09:46	HDPE Bottle, 125 mL
				HDPE Bottle, 125 mL

ANALYTICAL RESULTS

Sample ID: Method Blank

VAL - PFAS

Matrix: Solid
Sample Size: 1.00 g

QC Batch: B7G0050
Date Extracted: 11-Jul-2017 14:53

Lab Sample: B7G0050-BLK1
Date Analyzed: 12-Jul-17 20:36 Column: BEH C18

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.285	1.00	2.00	
PFHpA	ND	0.285	1.00	2.00	
PFHxS	ND	0.285	1.00	2.00	
PFOA	ND	0.285	1.00	2.00	
PFOS	ND	0.285	1.00	2.00	
PFNA	ND	0.285	1.00	2.00	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	86.7	50 - 150	
IS	13C4-PFHpA	81.6	50 - 150	
IS	18O2-PFHxS	80.9	50 - 150	
IS	13C2-PFOA	83.9	50 - 150	
IS	13C8-PFOS	74.5	50 - 150	
IS	13C5-PFNA	58.7	50 - 150	

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: OPR **VAL - PFAS**

Matrix: Solid	QC Batch: B7G0050	Lab Sample: B7G0050-BS1
Sample Size: 1.00 g	Date Extracted: 11-Jul-2017 14:53	Date Analyzed: 12-Jul-17 19:58 Column: BEH C18

Analyte	Amt Found (ng/g)	Spike Amt	%R	Limits
PFBS	8.82	10.0	88.2	70 - 130
PFHpA	8.74	10.0	87.4	70 - 130
PFHxS	8.83	10.0	88.3	70 - 130
PFOA	8.91	10.0	89.1	70 - 130
PFOS	10.2	10.0	102	70 - 130
PFNA	9.46	10.0	94.6	70 - 130

	Labeled Standard	%R	LCL-UCL
IS	13C3-PFBS	80.4	50 - 150
IS	13C4-PFHpA	82.7	50 - 150
IS	18O2-PFHxS	84.0	50 - 150
IS	13C2-PFOA	91.2	50 - 150
IS	13C8-PFOS	79.9	50 - 150
IS	13C5-PFNA	84.7	50 - 150

LCL-UCL - Lower control limit - upper control limit

Sample ID: BARNS-05-SB02-062717-0-2

VAL - PFAS

Client Data

Name: AMEC F8ster Wheeler
Pr8ject: Phase I Regi8nal SI- Barnes / 291330006
Date C8llected: 27-Jun-2017 9:20
L8cati8n:

Sample Data

Matrix: S8il
Sample Size: 1.14 g
% S8lids: H9.6

Laboratory Data

Lab Sample: 1700H31-01
QC Batch: B7G0050
Date Analyzed: 13-Jul-17 11:20 C8lumn: BEo C1H
Date Received: 06-Jul-2017 9:46
Date Extracted: 11-Jul-2017 14:53

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.279	0.979	1.96	
PFo pA	ND	0.279	0.979	1.96	
PFo xS	0.3H4	0.279	0.979	1.96	J
PFOA	ND	0.279	0.979	1.96	
PFOS	7.19	0.279	0.979	1.96	
PFNA	ND	0.279	0.979	1.96	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	77.6	50 - 150	
IS	13C4-PFo pA	62.H	50 - 150	
IS	1HO2-PFo xS	75.2	50 - 150	
IS	13C2-PFOA	57.9	50 - 150	
IS	13CH-PFOS	72.5	50 - 150	
IS	13C5-PFNA	62.9	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: BARNS-06-SB01-027216-0-7

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
Name:	AMEC F8ster Wheeler	Matrix:	S8il	Lab Sample:	1700HB1-03	Date Received:	06-Jul-2017 9:46
Pr8ject:	Phase I Regi8nal SI- Barnes / 291330006	Sample Size:	1.13 g	QC Batch:	B7G0050	Date Extracted:	11-Jul-2017 14:53
Date C8llected:	26-Jun-2017 12:15	% S8lids:	93.4	Date Analyzed:	13-Jul-17 11:33	C8lumn:	BEo C1H
L8cati8n:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.270	0.947	1.H9	
PFo pA	ND	0.270	0.947	1.H9	
PFo xS	ND	0.270	0.947	1.H9	
PFOA	ND	0.270	0.947	1.H9	
PFOS	0.921	0.270	0.947	1.H9	J
PFNA	ND	0.270	0.947	1.H9	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	110	50 - 150	
IS	13C4-PFo pA	77.4	50 - 150	
IS	1HO2-PFo xS	H7.3	50 - 150	
IS	13C2-PFOA	74.4	50 - 150	
IS	13CH-PFOS	75.3	50 - 150	
IS	13C5-PFNA	74.2	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: BARNS-07-SB02-062817-13-15

VAL - PFAS

Client Data

Name: AMEC Foster Wheeler
Project: Phase I vegional SI- Barnes / 291330008
Date Collected: 2R-Jun-2017 15:30
Location:

Sample Data

Matrix: Soil
Sample Size: 1.1Rg
% Solids: R4.1

Laboratory Data

Lab Sample: 1700R31-04 Date veceiбed: 08-Jul-2017 9:48
QC Batch: B7G0050 Date Extracted: 11-Jul-2017 14:53
Date Analyzed: 13-Jul-17 11:48 Column: BEH C1R

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.2R7	1.01	2.01	
PFHpA	ND	0.2R7	1.01	2.01	
PFHxS	ND	0.2R7	1.01	2.01	
PFOA	ND	0.2R7	1.01	2.01	
PFOS	ND	0.2R7	1.01	2.01	
PFNA	ND	0.2R7	1.01	2.01	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	123	50 - 150	
IS	13C4-PFHpA	74.5	50 - 150	
IS	1RO2-PFHxS	94.2	50 - 150	
IS	13C2-PFOA	73.R	50 - 150	
IS	13CR-PFOS	93.5	50 - 150	
IS	13C5-PFNA	91.R	50 - 150	

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.
vesults reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-04-SB01-062917-13-15

VAL - PFAS

Client Data

Name: AMEC F8ster Wheeler
Pr8ject: Phase I Regi8nal SI- Barnes / 291330006
Date C8llected: 29-Jun-2017 15:05
L8cati8n:

Sample Data

Matrix: S8il
Sample Size: 1.1Hg
% S8lids: H5.2

Laboratory Data

Lab Sample: 1700HB1-0H
QC Batch: B7G0050
Date Analyzed: 13-Jul-17 12:24 C8lumn: BEo C1H
Date Received: 06-Jul-2017 9:46
Date Extracted: 11-Jul-2017 14:53

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.2H4	0.995	1.99	
PFo pA	ND	0.2H4	0.995	1.99	
PFo xS	ND	0.2H4	0.995	1.99	
PFOA	ND	0.2H4	0.995	1.99	
PFOS	ND	0.2H4	0.995	1.99	
PFNA	ND	0.2H4	0.995	1.99	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	102	50 - 150	
IS	13C4-PFo pA	67.6	50 - 150	
IS	1HO2-PFo xS	H5.4	50 - 150	
IS	13C2-PFOA	65.9	50 - 150	
IS	13CH-PFOS	H5.6	50 - 150	
IS	13C5-PFNA	93.1	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: BARNS-04-SB01-062973-71-75

VAL - PFAS

Client Data

Name: AMEC Foster Wheeler
Project: Phase I vegional SI- Barnes / 291330008
Date Collected: 29-Jun-2017 9:20
Location:

Sample Data

Matrix: Soil
Sample Size: 1.23 g
% Solids: R2.7

Laboratory Data

Lab Sample: 1700R31-09 Date v ecei6ed: 08-Jul-2017 9:48
QC Batch: B7G0050 Date Extracted: 11-Jul-2017 14:53
Date Analyzed: 13-Jul-17 12:38 Column: BEH C1R

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.2R0	0.9R4	1.97	
PFHpA	ND	0.2R0	0.9R4	1.97	
PFHxS	ND	0.2R0	0.9R4	1.97	
PFOA	ND	0.2R0	0.9R4	1.97	
PFOS	3.27	0.2R0	0.9R4	1.97	
PFNA	ND	0.2R0	0.9R4	1.97	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	94.5	50 - 150	
IS	13C4-PFHpA	79.2	50 - 150	
IS	1RO2-PFHxS	72.0	50 - 150	
IS	13C2-PFOA	89.0	50 - 150	
IS	13CR-PFOS	72.0	50 - 150	
IS	13C5-PFNA	72.R	50 - 150	

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.
v esults reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-05-SB01-062917-13-15

VAL - PFAS

Client Data

Name: AMEC F8ster Wheeler
Pr8ject: Phase I v egi8nal SI- Barnes / 29133000R
Date C8llected: 29-Jun-2017 H20
L8cati8n:

Sample Data

Matrix: S8il
Sample Size: 1.17 g
% S8lids: H7.4

Laboratory Data

Lab Sample: 1700H-B1-10
QC Batch: B7G0050
Date Analyzed: 13-Jul-17 15:32 C8lumn: BEo C1H
1H-Jul-17 13:0R C8lumn: BEo C1H
Date v ecei6ed: 0R-Jul-2017 9:4R
Date Extracted: 11-Jul-2017 14:53

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.279	0.97H	1.9R	
PFo pA	ND	0.279	0.97H	1.9R	
PFo xS	H2R	0.279	0.97H	1.9R	
PFOA	5.3H	0.279	0.97H	1.9R	
PFOS	427	1.39	4.H9	9.7H	D
PFNA	ND	0.279	0.97H	1.9R	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	93.0	50 - 150	
IS	13C4-PFo pA	H1.5	50 - 150	
IS	1HO2-PFo xS	9R.5	50 - 150	
IS	13C2-PFOA	RH4	50 - 150	
IS	13CH-PFOS	72.3	50 - 150	D
IS	13C5-PFNA	73.R	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
v esults rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: BARNS-05-SB01-061297-93-95

VAL - PFAS

Client Data

Name: AMEC F8ster Wheeler
Pr8ject: Phase I Regi8nal SI- Barnes / 291330006
Date C8llected: 29-Jun-2017 H00
L8cati8n:

Sample Data

Matrix: S8il
Sample Size: 1.16 g
% S8lids: HH7

Laboratory Data

Lab Sample: 1700HB1-11 Date Received: 06-Jul-2017 9:46
QC Batch: B7G0050 Date Extracted: 11-Jul-2017 14:53
Date Analyzed: 13-Jul-17 13:14 C8lumn: BEo C1H

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.277	0.972	1.94	
PFo pA	ND	0.277	0.972	1.94	
PFo xS	0.371	0.277	0.972	1.94	J
PFOA	ND	0.277	0.972	1.94	
PFOS	0.434	0.277	0.972	1.94	J
PFNA	ND	0.277	0.972	1.94	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	H5.3	50 - 150	
IS	13C4-PFo pA	72.H	50 - 150	
IS	1HO2-PFo xS	90.4	50 - 150	
IS	13C2-PFOA	6H1	50 - 150	
IS	13CH-PFOS	79.4	50 - 150	
IS	13C5-PFNA	HI.H	50 - 150	

LCL-UCL - L8wer c8ntr8l limit - upper c8ntr8l limit
The results are rep8rted in dry weight.
The sample size is rep8rted in wet weight.
Results rep8rted t8 DL.
When rep8rted, PFBS, PFo xS, PFOA and PFOS include b8th linear and branched is8mers.
Only the linear is8mer is rep8rted f8r all 8ther analytes.

Sample ID: Method Blank — **Modified EPA Method 537**

Matrix:	Aqueous	QC Batch:	B7G0031	Lab Sample:	B7G0031-BLK1
Sample Size:	0.125 L	Date Extracted:	10-Jul-2017 7:38	Date Analyzed:	11-Jul-17 20:12 Column: BEH C18

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.00218	0.00500	0.00800	
PFHpA	ND	0.00218	0.00500	0.00800	
PFHxS	ND	0.00218	0.00500	0.00800	
PFOA	ND	0.00218	0.00500	0.00800	
PFOS	ND	0.00218	0.00500	0.00800	
PFNA	ND	0.00218	0.00500	0.00800	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	95.5	50 - 150	
IS	13C4-PFHpA	94.7	50 - 150	
IS	18O2-PFHxS	118	50 - 150	
IS	13C2-PFOA	104	50 - 150	
IS	13C8-PFOS	103	50 - 150	
IS	13C5-PFNA	96.2	50 - 150	

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL.

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.

Only the linear isomer is reported for all other analytes.

Sample ID: OPR **Modified EPA Method 537**

Matrix: Aqueous	QC Batch: B7G0031	Lab Sample: B7G0031-BS1
Sample Size: 0.125 L	Date Extracted: 10-Jul-2017 7:38	Date Analyzed: 11-Jul-17 19:47 Column: BEH C18

Analyte	Amt Found (ug/L)	Spike Amt	%R	Limits
PFBS	0.0601	0.0800	75.2	70 - 130
PFHpA	0.0637	0.0800	79.7	70 - 130
PFHxS	0.0655	0.0800	81.9	70 - 130
PFOA	0.0719	0.0800	89.8	70 - 130
PFOS	0.0564	0.0800	70.6	70 - 130
PFNA	0.0564	0.0800	70.5	70 - 130

	Labeled Standard	%R	LCL-UCL
IS	13C3-PFBS	108	50 - 150
IS	13C4-PFHpA	103	50 - 150
IS	18O2-PFHxS	111	50 - 150
IS	13C2-PFOA	95.2	50 - 150
IS	13C8-PFOS	102	50 - 150
IS	13C5-PFNA	102	50 - 150

LCL-UCL - Lower control limit - upper control limit

Sample ID: Method Blank — **Modified EPA Method 537**

Matrix:	Aqueous	QC Batch:	B7G0048	Lab Sample:	B7G0048-BLK1
Sample Size:	0.125 L	Date Extracted:	11-Jul-2017 12:55	Date Analyzed:	12-Jul-17 20:23 Column: BEH C18

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.00218	0.00500	0.00800	
PFHpA	ND	0.00218	0.00500	0.00800	
PFHxS	ND	0.00218	0.00500	0.00800	
PFOA	ND	0.00218	0.00500	0.00800	
PFOS	ND	0.00218	0.00500	0.00800	
PFNA	ND	0.00218	0.00500	0.00800	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	90.2	50 - 150	
IS	13C4-PFHpA	79.5	50 - 150	
IS	18O2-PFHxS	95.6	50 - 150	
IS	13C2-PFOA	92.7	50 - 150	
IS	13C8-PFOS	90.8	50 - 150	
IS	13C5-PFNA	73.3	50 - 150	

DL - Detection limit

RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit

Results reported to DL.

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.

Only the linear isomer is reported for all other analytes.

Sample ID: OPR **Modified EPA Method 537**

Matrix: Aqueous	QC Batch: B7G0031	ban Sample: B7G0031JBS-
Sample Size: 0.- 8L b	Date Extracted: - - J2ulJ80- 7 - 8:LL	Date Ayal9zed: - 8J2ulJ- 7 - 4:3L Columy: BEH C- 1

Analyte	Amt Found (ug/L)	Spike Amt	%R	Limits		Labeled Standard	%R	LCL-UCL
5PBS	0.064-	0.0100	16.F	70 J - F0	IS	- FCFJ5PBS	4F.-	L0 J - L0
5PHpA	0.07- 6	0.0100	14.L	70 J - F0	IS	- FC3J5PHpA	4L.L	L0 J - L0
5PHxS	0.07F0	0.0100	4- .8	70 J - F0	IS	- 1O8J5PHxS	4F.1	L0 J - L0
5POA	0.076-	0.0100	4L.-	70 J - F0	IS	- FC8J5POA	17.4	L0 J - L0
5POS	0.01- 6	0.0100	- 08	70 J - F0	IS	- FC1J5POS	11.0	L0 J - L0
5PNA	0.070L	0.0100	11.-	70 J - F0	IS	- FCLJ5PNA	46.3	L0 J - L0

bCbJUCb J bower coytrol limit J upper coytrol limit

Sample ID: BARNS-06-GW-TW01-062817-37

Modified EPA Method 537

Client Data

Name: AMEC Foster Wheeler
Project: Phase I Regional SI- Barnes / 291330006
Date Collected: 28-Jun-2017 15:30
Location:

Sample Data

Matrix: Groundwater
Sample Size: 0.124 L

Laboratory Data

Lab Sample: 1700831-02 Date Received: 06-Jul-2017 9:46
QC Batch: B7G0031 Date Extracted: 10-Jul-2017 7:38
Date Analyzed: 11-Jul-17 21:15 Column: BEH C18

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	0.0395	0.00219	0.00504	0.00803	
PFHpA	0.0200	0.00219	0.00504	0.00803	
PFHxS	0.641	0.00219	0.00504	0.00803	
PFOA	0.0699	0.00219	0.00504	0.00803	
PFOS	0.609	0.00219	0.00504	0.00803	
PFNA	ND	0.00219	0.00504	0.00803	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	105	50 - 150	
IS	13C4-PFHpA	112	50 - 150	
IS	18O2-PFHxS	119	50 - 150	
IS	13C2-PFOA	118	50 - 150	
IS	13C8-PFOS	117	50 - 150	
IS	13C5-PFNA	112	50 - 150	

DL - Detection limit
RL - Reporting limit

LCL-UCL - Lower control limit - upper control limit
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-EB-01

Modified EPA Method 537

Client Data		Sample Data		Laboratory Data			
Name:	n MEC Fwster Wheeler	Matrix:	Grw2ydv ater	baASample:	-7001o-J0L	Date 6ecei9ed:	04Ju2lJ80-7 H34
Prwject:	Phase I 6egiwyal SIJ Baryes / 8H-oo0004	Sample Size:	0.--7b	QC Batch:	B7G0031	Date Extracted:	--Ju2lJ80-7 -8:LL
Date Cwllected:	84Ju2yJ80-7 -8:L0			Date n yal5zed:	-oJu2lJ-7--:LH	Cwl2my:	BER C-1
bwcatiwy:							

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.008oo	0.00Lo3	0.001L3	
PFRpn	ND	0.008oo	0.00Lo3	0.001L3	
PFRxS	ND	0.008oo	0.00Lo3	0.001L3	
PFOn	ND	0.008oo	0.00Lo3	0.001L3	
PFOS	ND	0.008oo	0.00Lo3	0.001L3	
PFNn	ND	0.008oo	0.00Lo3	0.001L3	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	-oCoJPFBS	--L	L0J-L0	
IS	-oC3JPFRpn	17.8	L0J-L0	
IS	-1O8JPFRxS	11.4	L0J-L0	
IS	-oC8JPFOn	4H4	L0J-L0	
IS	-oC1JPFOS	17.3	L0J-L0	
IS	-oCLJPFNn	11.H	L0J-L0	

Db J Detectiwy limit

6b J 6epwrtiyg limit

bCbJUCb J bwv er cwytrwl limit J 2pper cwytrwl limit

6es2lts repwrted twDb.

Whey repwrted, PFBS, PFRxS, PFOn ayd PFOS iycl2de Awth liyear ayd Arayched iswmers.

Oyl5 the liyear iswmer is repwrted fwr all wther ayal5tes.

Sample ID: BARNS-EB-02

Modified EPA Method 537

Client Data		Sample Data		Laboratory Data			
Name:	n MEC FHster Wheeler	Matrix:	GrH2ydRater	baASample:	-7001o-J09	Date vecei6ed:	09Ju21J80-7 4:39
PrHject:	Phase I vegiHyal SIJ Baryes / 84-oo0009	Sample Size:	0.--Lb	QC Batch:	B7G0031	Date Extracted:	--Ju21J80-7 -8:LL
Date CHllected:	89Ju2yJ80-7 -8:LL			Date n yal5zed:	-oJu2lJ-7-8:--	CH2my:	BEw C-1
bHcatiHy:							

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.008o9	0.00L3o	0.00197	
PFwpn	ND	0.008o9	0.00L3o	0.00197	
PFwxS	ND	0.008o9	0.00L3o	0.00197	
PFOn	ND	0.008o9	0.00L3o	0.00197	
PFOS	ND	0.008o9	0.00L3o	0.00197	
PFNn	ND	0.008o9	0.00L3o	0.00197	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	-oCoJPFBS	1o.L	L0J-L0	
IS	-oC3JPFwpn	79.0	L0J-L0	
IS	-1O8JPFwxS	47.4	L0J-L0	
IS	-oC8JPFOn	7-.9	L0J-L0	
IS	-oC1JPFOS	13.3	L0J-L0	
IS	-oCLJPFNn	77.9	L0J-L0	

Db J DetectiHy limit

v b J v epHrtiyg limit

bCbJUCb J bHRer cHytrHl limit J 2pper cHytrHl limit

v es2lts repHrted tHDb.

Whey repHrted, PFBS, PFwxS, PFOn ayd PFOS iycl2de AHth liyear ayd Arayched isHmers.

Oyl5 the liyear isHmer is repHrted fHr all Hther ayal5tes.

Sample ID: BARNS-01-GW-TW03-062917-37

Modified EPA Method 537

Client Data

4 ame: AMEC F5ster Wheeler
Nr5Rect: Nhase I wegi5nal SI- Barnes / 26133000v
Date C5llected: 26-Jun-2017 19:1j
L5cati5n:

Sample Data

Matrix: Gr5undHater
Sample Size: 0.122 L

Laboratory Data

Lab Sample: 1700831-07 Date weceiRed: 0v-Jul-2017 6:9v
QC Batch: B7G0031 Date Extracted: 10-Jul-2017 7:38
Date Analyzed: 11-Jul-17 21:28 C5lumn: BEo C18

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
NFBS	0.0128	0.00223	0.00j 12	0.00818	
NFo pA	0.0287	0.00223	0.00j 12	0.00818	
NFo xS	0.316	0.00223	0.00j 12	0.00818	
NFOA	0.09j j	0.00223	0.00j 12	0.00818	
NFOS	0.101	0.00223	0.00j 12	0.00818	
NF4 A	0.00932	0.00223	0.00j 12	0.00818	J

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-NFBS	112	j 0 - 1j 0	
IS	13C9-NFo pA	109	j 0 - 1j 0	
IS	18O2-NFo xS	112	j 0 - 1j 0	
IS	13C2-NFOA	123	j 0 - 1j 0	
IS	13C8-NFOS	66.1	j 0 - 1j 0	
IS	13Cj -NF4 A	62.0	j 0 - 1j 0	

DL - Detecti5n limit
wL - wep5rting limit

LCL-UCL - L5Her c5ntr5l limit - upper c5ntr5l limit
wesults rep5rted t5 DL.
When rep5rted, NFBS, NFo xS, NFOA and NFOS include b5th linear and branched is5mers.
Only the linear is5mer is rep5rted f5r all 5ther analytes.

Sample ID: BARNS-06-GW-TW01-062817-Dup

Modified EPA Method 537

Client Data		Sample Data		Laboratory Data			
4 ame:	AMEC j oRer s heeler	Matrix:	GroundRater	Lab Sample:	1700831-12	Date v ecei6ed:	09-Jul-2017 w:59
NroRect:	NhaFe WveI ional SWBarneFg2wl330009	Sample Size:	0/125 L	QC Batch:	B7G0031	Date Extracted:	10-Jul-2017 7:38
Date Collected:	28-Jun-2017 0:00			Date Analyzed:	11-Jul-17 21:50 Column: BEH C18		
Location:					12-Jul-17 11:0w Column: BEH C18		

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
Nj BS	0/0529	0/00220	0/00. 05	0/00808	
Nj HpA	0/0238	0/00220	0/00. 05	0/00808	
Nj HxS	0/737	0/00220	0/00. 05	0/00808	
Nj OA	0/07w3	0/00220	0/00. 05	0/00808	
Nj OS	0/w. 0	0/0110	0/02. 2	0/0505	D
Nj 4 A	4 D	0/00220	0/00. 05	0/00808	

	Labeled Standard	%R	LCL-UCL	Qualifiers
WS	13C3-Nj BS	101	. 0 - 1. 0	
WS	13C5-Nj HpA	w. /0	. 0 - 1. 0	
WS	18O2-Nj HxS	102	. 0 - 1. 0	
WS	13C2-Nj OA	110	. 0 - 1. 0	
WS	13C8-Nj OS	12w	. 0 - 1. 0	D
WS	13C. -Nj 4 A	85/7	. 0 - 1. 0	

DL - Detection limit

vL - veportinI limit

LCL-UCL - LoRer control limit - upper control limit

veFultF reported to DL/

s hen reported, Nj BS, Nj HxS, Nj OA and Nj OS include both linear and branched iFomerF/

Only the linear iFomer iF reported for all other analyteF/

DATA QUALIFIERS & ABBREVIATIONS

B	**This compound was also detected in the method blank.**
D	**Dilution**
E	**The associated compound concentration exceeded the calibration range of the instrument.**
H	**Recovery and/or RPD was outside laboratory acceptance limits.**
I	**Chemical Interference**
J	**The amount detected is below the Reporting Limit/LOQ.**
M	**Estimated Maximum Possible Concentration. (CA Region 2 projects only)**
*****	**See Cover Letter**
Conc.	**Concentration**
NA	**Not applicable**
ND	**Not Detected**
TEQ	**Toxic Equivalency**

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

CERTIFICATIONS

Accrediting Authority	Certificate Number
Arkansas Department of Environmental Quality	17-015-0
California Department of Health – ELAP	2892
DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005	3091.01
Florida Department of Health	E87777-18
Hawaii Department of Health	N/A
Louisiana Department of Environmental Quality	01977
Maine Department of Health	2016026
Minnesota Department of Health	1175673
Nevada Division of Environmental Protection	CA004132017-1
New Hampshire Environmental Accreditation Program	207716
New Jersey Department of Environmental Protection	CA003
New York Department of Health	11411
Oregon Laboratory Accreditation Program	4042-008
Pennsylvania Department of Environmental Protection	013
Texas Commission on Environmental Quality	T104704189-17-8
Virginia Department of General Services	8621
Washington Department of Ecology	C584
Wisconsin Department of Natural Resources	998036160

Current certificates and lists of licensed parameters are located in the Quality Assurance office and are available upon request.

NELAP Accredited Test Methods

MATRIX: Air	
Description of Test	**Method**
Determination of Polychlorinated p-Dioxins & Polychlorinated Dibenzofurans	EPA 23

MATRIX: Biological Tissue	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Drinking Water	
Description of Test	**Method**
2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD) GC/HRMS	EPA 1613
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537

MATRIX: Non-Potable Water	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Dioxin by GC/HRMS	EPA 613
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Solids	
Description of Test	**Method**
Tetra-Octa Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope	EPA 1613B

Dilution GC/HRMS	
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

1700831 0.5°C

amec foster wheeler

Amec Foster Wheeler Environment & Infrastructure
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

SHIP TO:
Vista
1104 Windfield Way
El Dorado Hills, CA 95762
Atten: Martha Maier
Lab Phone# (916) 673-1520

CHAIN OF CUSTODY

DATE: 7/5/2017
COC #: BARNS170705A
PAGE: 2 OF 3

Project Name:	Phase I Regional SI - Barnes	Project Contact: Denise King		Bill To: Amec Foster Wheeler Environment & Infrastructure	Disposal Instructions: LAB
Project Number:	291330006	Phone Number: (978) 392-5339		9210 Sky Park Court Suite 200	Shipment Method: FEDEX
Project Manager:	Kerry Tull	Project Phase: .010		San Diego, CA 92123	Waybill Number: N/A

Sample Information						Methods for Analysis	RUSH					
No.	Sample ID	Date & Time Sampled	Matrix	Sample Type	MS/MSD	Method 537.1 UCMR 3	24 Hour	48 Hour	72 Hour	5 Days	TOTAL BOTTLES	HOLD All Analyses
1	BARNS-05-SB02-062717-0-2	06/27/17 09:20	SO	N	N	X					1	
2	BARNS-06-GW-TW01-062817-37	06/28/17 15:30	WG	N	N	X					2	
3	BARNS-07-SB01-062617-0-2	06/26/17 12:15	SO	N	N	X					1	
4	BARNS-07-SB02-062817-13-15	06/28/17 15:30	SO	N	N	X					1	
5	BARNS-EB-01	06/26/17 12:50	WQ	EB	N	X					2	
6	BARNS-EB-02	06/26/17 12:55	WQ	EB	N	X					2	
7	BARNS-01-GW-TW03-062917-37	06/29/17 14:15	WG	N	N	X					2	
8	BARNS-04-SB01-062917-13-15	06/29/17 15:05	SO	N	N	X					1	
9	BARNS-04-SB03-062917-13-15	06/29/17 09:20	SO	N	N	X					1	
10	BARNS-05-SB01-062917-13-15	06/29/17 08:20	SO	N	N	X					1	
11	BARNS-05-SB02-062917-13-15	06/29/17 08:00	SO	N	N	X					1	
12	BARNS-06-GW-TW01-062817-Dup	06/28/17 00:00	WG	FD	N	X					1	

DYK 7/7/17

Sampler's Signature:		Date: 7/5/17	Time: 0940
Relinquished By/Affiliation:	AmecFW	Date: 7/5/17	Time: 0945
Received By:	WSpotts/V3h	Date: 7/6/17	Time: 1010
Relinquished By/Affiliation:		Date:	Time:
Received By:		Date:	Time:
Relinquished By/Affiliation:		Date:	Time:
Received By (LAB):		Date:	Time:

For Lab Use

Does COC match samples:	Y or N
Broken Container:	Y or N
COC seal intact:	Y or N
Other problems:	Y or N
WSDOT contacted:	Y or N
Date contacted:	
Cooler Temperature at receipt:	°C

Comments:
X=Analyze H=Hold Analysis Request
Contract # W9133L-14-D-0002 TO0006
PO # F013200677
ATTN: Tammie Rippie
Base Lead: Todd Coffin
Field Lead: Craig.keating@amecfw.com

NUMBER OF COOLERS SENT: 1

Revised COC received via email on 7/11/2017. JW 7/11/17

1700831 0.5°C

amec foster wheeler

Amec Foster Wheeler Environment & Infrastructure
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

SHIP TO:
Vista
1104 Windfield Way
El Dorado Hills, CA 95762
Atten: Martha Maier
Lab Phone# (916) 673-1520

CHAIN OF CUSTODY

DATE: 7/5/2017
COC #: BARNS170705A
PAGE: 2 **OF** 3

Project Name:	Phase I Regional SI - Barnes	Project Contact: Denise King	Bill To: Amec Foster Wheeler Environment & Infrastructure	Disposal Instructions:	LAB
Project Number:	291330006	Phone Number: (978) 392-5339	9210 Sky Park Court Suite 200	Shipment Method:	FEDEX
Project Manager:	Kerry Tull	Project Phase: .010	San Diego, CA 92123	Waybill Number:	N/A

Sample Information / Methods for Analysis / RUSH

No.	Sample ID	Date & Time Sampled	Matrix	Sample Type	MS/MSD	Method 537.1 UCMR 3	24 Hour	48 Hour	72 Hour	5 Days	TOTAL BOTTLES	HOLD All Analyses
1	BARNS-05-SB02-062717-0-2	06/27/17 09:20	SO	N	N	X					1	
2	BARNS-06-GW-TW01-062817-37	06/28/17 15:30	WG	N	N	X					2	
3	BARNS-07-SB01-062617-0-2	06/26/17 12:15	SO	N	N	X					1	
4	BARNS-07-SB02-062817-13-15	06/28/17 15:30	SO	N	N	X					1	
5	BARNS-EB-01	06/26/17 12:50	WQ	EB	N	X					2	
6	BARNS-EB-02	06/26/17 12:55	WQ	EB	N	X					2	
7	BARNS-01-GW-TW03-062917-37	06/29/17 14:15	WG	N	N	X					2	
8	BARNS-04-SB01-062917-13-15	06/29/17 15:05	SO	N	N	X					1	
9	BARNS-04-SB03-062917-13-15	06/29/17 09:20	SO	N	N	X					1	
10	BARNS-05-SB01-062917-13-15	06/29/17 08:20	SO	N	N	X					1	
11	BARNS-05-SB02-062917-13-15	06/29/17 08:00	SO	N	N	X					1	
12	BARNS-06-GW-TW01-062817-Dup	06/28/17 00:00	WG	FD	N	X					1	

Sampler's Signature: [signature]		Date: 7/5/17	Time: 0940
Relinquished By/Affiliation: [signature] AmecFW		Date: 7/5/17	Time: 0945
Received By: [signature] / Vah		Date: 7/6/17	Time: 1010
Relinquished By/Affiliation:		Date:	Time:
Received By:		Date:	Time:
Relinquished By/Affiliation:		Date:	Time:
Received By (LAB):		Date:	Time:

For Lab Use

Does COC match samples:	Y or N
Broken Container:	Y or N
COC seal intact:	Y or N
Other problems:	Y or N
WSDOT contacted:	Y or N
Date contacted:	
Cooler Temperature at receipt:	°C

Comments:
X=Analyze H=Hold Analysis Request
Contract # W9133L-14-D-0002 TO0006
PO # F013200677
ATTN: Tammie Rippie
Base Lead: Todd Coffin
Field Lead: Craig.keating@amecfw.com

NUMBER OF COOLERS SENT: 1

Vista Analytical Laboratory

Sample Log-in Checklist

Vista Work Order #: ~~1305~~ 1700831 **TAT** Std

Samples Arrival:	**Date/Time** 7/6/17 0946	**Initials:** WS	**Location:** WR-2 **Shelf/Rack:** N/A
Logged In:	**Date/Time** 07/06/17 1341	**Initials:** WS JRB	**Location:** WR-2 **Shelf/Rack:** E-7

Delivered By:	FedEx	UPS	On Trac	GSO	DHL	Hand Delivered	Other
Preservation:	Ice		Blue Ice		Dry Ice		None

Temp °C: 0.9 (uncorrected)	**Time:** 1009	**Thermometer ID:** IR-2
Temp °C: 0.5 (corrected)	**Probe used:** Yes☐ No☒	

	YES	NO	NA
Adequate Sample Volume Received?	✓		
Holding Time Acceptable?	✓		
Shipping Container(s) Intact?	✓		
Shipping Custody Seals Intact?	✓		
Shipping Documentation Present?	✓		
Airbill — Trk # 8009 5563 6272	✓		
Sample Container Intact?	✓		
Sample Custody Seals Intact?			✓
Chain of Custody / Sample Documentation Present?	✓		
COC Anomaly/Sample Acceptance Form completed?	✓		

If Chlorinated or Drinking Water Samples, Acceptable Preservation?							✓
Preservation Documented:	$Na_2S_2O_3$		Trizma		None	Yes	No	NA
Shipping Container	Vista		Client		Retain	Return	Dispose	

Comments: sample labels: BARNS-05-SB02-062717-00-02
BARNS-07-SB01-062617-00-02
* BARNS-06-GW-TW01-062817-DUP (2 bottles received)
* COC says 1 bottle

WS 7/6/17

Chain of Custody Anomaly/Sample Acceptance Form

Vista Analytical Laboratory

Client:	AMEC Foster Wheeler	Workorder Number:	1700831
Contact:	Denise King	Date Received:	06-Jul-17 09:46
Email:	Denise.king@amecfw.com	Documented by/date:	B.Benedict 07/06/2017
Phone:	(978) 392-5339		

Please review the following information and complete the Client Authorization section. To comply with NELAC regulations, we must receive authorization before proceeding with sample analysis.

Thank you,

Martha Maier
mmaier@vista-analytical.com
916-673-1520

The following information or item is needed to proceed with analysis:

- [ ] Complete Chain-of-Custody
- [ ] Test Method Requested
- [ ] Analyte List Requested
- [ ] Other:
- [ ] Preservative
- [ ] Sample Identification
- [ ] Sample Collection Date and/or Time
- [ ] Collector's Name
- [ ] Sample Type
- [ ] Sample Location

The following anomalies were noted. Authorization is needed to proceed with analysis.

- [ ] Temperature outside < 6°C Range — Samples Affected: _____
  Temperature _____ °C Ice Present? Yes No Melted
- [X] Sample ID Discrepancy: See Comments
- [ ] Sample Holding Time Missed
- [ ] Custody Seals Broken
- [ ] Insufficient Sample Size
- [ ] Sample Container(s) Broken
- [ ] Incorrect Container Type

Comments:

COC ID	Label ID
BARNS-05-SB02-062717-0-2	BARNS-05-SB02-062717-**00-02**
BARNS-07-SB01-062617-0-2	BARNS-07-SB01-062617-**00-02**

Client Authorization

Proceed with Analysis: (YES) NO Signature and Date [signature] 7-10-17

Client Comments/Instructions Per email from Todd Coffin, the sample IDs on the COC are correct.

July 20, 2017

Vista Work Order No. 1700832

Ms. Denise King
AMEC Foster Wheeler
271 Mill Road
Chelmsford, MA 01824

Dear Ms. King,

Enclosed are the results for the sample set received at Vista Analytical Laboratory on July 06, 2017. This sample set was analyzed on a rush turn-around time, under your Project Name 'Phase I Regional SI- Barnes / 291330006'.

Vista Analytical Laboratory is committed to serving you effectively. If you require additional information, please contact me at 916-673-1520 or by email at mmaier@vista-analytical.com.

Thank you for choosing Vista as part of your analytical support team.

Sincerely,

Martha Maier
Laboratory Director

Vista Work Order No. 1700832
Case Narrative

Sample Condition on Receipt:

Five aqueous samples and five soil samples were received in good condition and within the method temperature requirements. The samples were received and stored securely in accordance with Vista standard operating procedures and EPA methodology. A sample ID discrepancy was found for sample "BARNS-08-GW-TW04-063017-37". The client confirmed that the label sample ID should be used "BARNS-08-GW-TW04-063017-36". A revised Chain of Custody was received on July 11, 2017 to reflect this information.

Analytical Notes:

Modified EPA Method 537

Samples "BARNS-07-GW-TW05-062917-49" and "BARNS-08-GW-TW04-063017-37" contained particulate and were centrifuged prior to extraction.

The aqueous samples were extracted and analyzed for a selected list of 6 PFAS using Modified EPA Method 537.

Holding Times

The samples were extracted and analyzed within the method hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank above 1/2 the LOQ. The OPR recoveries were within the method acceptance criteria

The labeled standard recoveries for all QC and field samples were within the acceptance criteria.

VAL-PFAS

The solid samples were extracted and analyzed for a selected list of 6 PFAS using VAL Method PFAS.

Holding Times

The samples were extracted and analyzed within the hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank above 1/2 the LOQ. The OPR recoveries were within the method acceptance criteria.

The labeled standard recoveries for all QC and field samples were within the acceptance criteria.

As requested, an MS/MSD was performed on sample "BARNS-07-SB01-062917-13-15".

TABLE OF CONTENTS

Sample Inventory Report

Vista Sample ID	Client Sample ID		Sampled	Received	Components/Containers
1700832-01	BARNS-06-SB01-062917-13-15		29-Jun-17 13:55	06-Jul-17 09:46	HDPE Jar, 6 oz
1700832-02	BARNS-06-SB02-062917-13-15		29-Jun-17 13:45	06-Jul-17 09:46	HDPE Jar, 6 oz
1700832-03	BARNS-06-SB03-062917-13-15		29-Jun-17 13:10	06-Jul-17 09:46	HDPE Jar, 6 oz
1700832-04	BARNS-07-GW-TW05-062917-49		29-Jun-17 09:55	06-Jul-17 09:46	HDPE Bottle, 125 mL
					HDPE Bottle, 125 mL
1700832-05	BARNS-07-SB01-062917-13-15	MS/MSD	29-Jun-17 10:20	06-Jul-17 09:46	HDPE Jar, 6 oz
		MS/MSD			HDPE Jar, 6 oz
		MS/MSD			HDPE Jar, 6 oz
1700832-06	BARNS-05-SB01-062717-DUP		27-Jun-17 00:00	06-Jul-17 09:46	HDPE Jar, 6 oz
1700832-07	BARNS-EB-03-063017		30-Jun-17 15:44	06-Jul-17 09:46	HDPE Bottle, 125 mL
					HDPE Bottle, 125 mL
1700832-08	BARNS-EB-04-063017		30-Jun-17 15:48	06-Jul-17 09:46	HDPE Bottle, 125 mL
					HDPE Bottle, 125 mL
1700832-09	BARNS-EB-05-063017		30-Jun-17 15:50	06-Jul-17 09:46	HDPE Bottle, 125 mL
					HDPE Bottle, 125 mL
1700832-10	BARNS-08-GW-TW04-063017-36		30-Jun-17 11:55	06-Jul-17 09:46	HDPE Bottle, 125 mL
					HDPE Bottle, 125 mL

ANALYTICAL RESULTS

Sample ID: Method Blank

VAL - PFAS

Matrix: Solid
Sample Size: 1.00 g

QC Batch: B7G0046
Date Extracted: 11-Jul-2017 12:39

Lab Sample: B7G0046-BLK1
Date Analyzed: 13-Jul-17 17:25 Column: BEH C18

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.285	1.00	2.00	
PFHpA	ND	0.285	1.00	2.00	
PFHxS	ND	0.285	1.00	2.00	
PFOA	ND	0.285	1.00	2.00	
PFOS	ND	0.285	1.00	2.00	
PFNA	ND	0.285	1.00	2.00	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	90.2	50 - 150	
IS	13C4-PFHpA	74.9	50 - 150	
IS	18O2-PFHxS	85.6	50 - 150	
IS	13C2-PFOA	87.7	50 - 150	
IS	13C8-PFOS	89.5	50 - 150	
IS	13C5-PFNA	81.3	50 - 150	

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: OPR **VAL - PFAS**

Matrix: Solid	QC Batch: B7G0051	baASample: B7G0051JBS-
Sample Size: - .00 g	Date Extracted: - - Ju2lJ40- 7 - 4:3L	Date n yal9zed: - 3Ju2lJ- 7 - 7:00 Col2my: BE8 C- H

Analyte	Amt Found (ng/g)	Spike Amt	%R	Limits	Labeled Standard	%R	LCL-UCL
PFBS	H- 1	- 0.0	H- .1	70 J - 30	IS - 3C3JPFBS	LN1	N0 J - N0
PF8 pn	H57	- 0.0	H5.7	70 J - 30	IS - 3C5JPF8 pn	7N-	N0 J - N0
PF8 xS	HH-	- 0.0	HH-	70 J - 30	IS - HO4JPF8 xS	H3.1	N0 J - N0
PFOn	L.N-	- 0.0	LN-	70 J - 30	IS - 3C4JPFOn	1H7	N0 J - N0
PFOS	H- 5	- 0.0	H- .5	70 J - 30	IS - 3CHJPFOS	7H5	N0 J - N0
PF6 n	H- 3	- 0.0	H- .3	70 J - 30	IS - 3CNJPF6 n	17.N	N0 J - N0

bCbJUCb J bower coytrol limit J 2pper coytrol limit

Sample ID: BARNS-05-SB01-056219-17-13

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
9 ame:	n MEC FHster Wheeler	Matrix:	SHil	baA Sample:	-700o34J0-	Date v ecei6ed:	01Ju2lJ40-7 L:51
NrHRect:	Nhase I v egiHyal SIJ Baryes / 4L-330001	Sample Size:	-.0j g	QC Batch:	B7G0051	Date Extracted:	--Ju2lJ40-7 -4:3L
Date CHllected:	4LJu2yJ40-7 -3:j j	% SHids:	L1.0	Date n yal8zed:	-3Ju2lJ-7-7:3o CH12my: BER C-o		
b HcatiHy:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
NFBS	9 D	0.4o3	0.LL4	-.Lo	
NFRpn	9 D	0.4o3	0.LL4	-.Lo	
NFRxS	-.33	0.4o3	0.LL4	-.Lo	u
NFOn	0.4oj	0.4o3	0.LL4	-.Lo	u
NFOS	-.o0	0.4o3	0.LL4	-.Lo	u
NF9 n	9 D	0.4o3	0.LL4	-.Lo	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	-3C3JNFBS	oo.5	j0J-j0	
IS	-3C5JNFRpn	11.7	j0J-j0	
IS	-oO4JNFRxS	o5.1	j0J-j0	
IS	-3C4JNFOn	74.-	j0J-j0	
IS	-3CoJNFOS	L0.-	j0J-j0	
IS	-3Cj JNF9 n	71.-	j0J-j0	

bCbJUCb J bHwer cHytrHl limit J 2pper cHytrHl limit
The res2lts are repHrted iy dr8 weight.
The sample size is repHrted iy wet weight.
v es2lts repHrted tHDb.
Whey repHrted, NFBS, NFRxS, NFOn ayd NFOS iycl2de AHth liyear ayd Arayched isHmers.
Oyl8 the liyear isHmer is repHrted fHr all Hther ayal8tes.

Sample ID: BARNS-05-SB01-051629-27-23

VAL - PFAS

Client Data

Name: n MEC FHster Wheeler
PrHject: Phase I 6egiHyal SIJ Baryes / 4L-330001
Date CHllected: 4LJu2yJ40-7 -3:5o
bHcatiHy:

Sample Data

Matrix: SHil
Sample Size: -.0L g
% SHids: Lo.3

Laboratory Data

baASample: -700v34J04 Date 6ecei9ed: 01Ju2lJ40-7 L:51
QC Batch: B7G0051 Date Extracted: --Ju2lJ40-7 -4:3L
Date n yal8zed: -3Ju2lJ-7-7:o0 CH2my: BER C-v
-LJu2lJ-7--:o7 CH2my: BER C-v

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.475	0.L13	-.L3	
PFRpn	ND	0.475	0.L13	-.L3	
PFRxS	1.--	0.475	0.L13	-.L3	
PFOn	0.v15	0.475	0.L13	-.L3	u
PFOS	--v	-.37	5.v4	L.13	D
PFNn	ND	0.475	0.L13	-.L3	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	-3C3JPFBS	L5.-	o0J-o0	
IS	-3C5JPFRpn	7o.1	o0J-o0	
IS	-vO4JPFRxS	7L.1	o0J-o0	
IS	-3C4JPFOn	71.0	o0J-o0	
IS	-3CvJPFOS	-o0	o0J-o0	D
IS	-3CoJPFNn	v5.3	o0J-o0	

bCbJUCb J bHwer cHytrHl limit J 2pper cHytrHl limit
The res2lts are repHrted iy dr8 weight.
The sample size is repHrted iy wet weight.
6es2lts repHrted tHDb.
Whey repHrted, PFBS, PFRxS, PFOn ayd PFOS iycl2de AHth liyear ayd Arayched isHmers.
Oyl8 the liyear isHmer is repHrted fHr all Hther ayal8tes.

Sample ID: BARNS-05-SB01-056297-91-93

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
9 ame:	n MEC j HFter s heeler	Matrix:	SHil	baA Sample:	-700o34J03	Date v ecei6ed:	01Ju2lJ40-7 L:51
NrHRect:	NhaFe WveI iHyal SWBaryeF g4L-330001	Sample Size:	-.07 I	QC Batch:	B7G0051	Date Extracted:	--Ju2lJ40-7 -4:3L
Date CHllected:	4LJu2yJ40-7 -3:-0	/ SHidF:	L%-	Date n yal8zed:	-3Ju2lJ-7-o:03	CH2my:	BER C-o
bHcatiHy:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
Nj BS	9 D	0.4o0	0.Lo4	-.L1	
Nj Rpn	9 D	0.4o0	0.Lo4	-.L1	
Nj RxS	9 D	0.4o0	0.Lo4	-.L1	
Nj On	9 D	0.4o0	0.Lo4	-.L1	
Nj OS	0.305	0.4o0	0.Lo4	-.L1	u
Nj 9 n	9 D	0.4o0	0.Lo4	-.L1	

	Labeled Standard	%R	LCL-UCL	Qualifiers
WS	-3C3JNj BS	L%3	%0J-%0	
WS	-3C5JNj Rpn	77.0	%0J-%0	
WS	-oO4JNj RxS	o1.%	%0J-%0	
WS	-3C4JNj On	73.3	%0J-%0	
WS	-3CoJNj OS	7o.4	%0J-%0	
WS	-3C%JNj 9 n	o-.0	%0J-%0	

bCbJUCb J bHwer cHytrHl limit J 2pper cHytrHl limit
The reF2ltFare repHrted iy dr8 weiI ht.
The Fample Fize iFrepHrted iy wet weiI ht.
veF2ltFrepHrted tHDb.
s hey repHrted, Nj BS, Nj RxS, Nj On ayd Nj OS iycl2de AHth liyear ayd Arayched iFHmerF.
Oyl8 the liyear iFHmer iFrepHrted fHr all Hther ayal8teF.

Sample ID: BARNS-05-SB01-062915-17-13

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
Name:	n MEC FRster Wheeler	Matrix:	SRil	baASample:	- 700o34J0H	Date 6ecei9ed:	01Ju2lJ40- 7 L:51
PrRject:	Phase I 6egiRyal SIJ Baryes / 4L- 330001	Sample Size:	- .43 g	QC Batch:	B7G0051	Date Extracted:	- - Ju2lJ40- 7 - 4:3L
Date CRllected:	4LJu2yJ40- 7 - 0:40	% SRlids:	7L.L	Date n yal8zed:	- 3Ju2lJ- 7 - o:- H CRl2my: BEv C- o		
b RcatiRy:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.4L0	- .04	4.05	
PFv pn	ND	0.4L0	- .04	4.05	
PFv xS	ND	0.4L0	- .04	4.05	
PFOn	ND	0.4L0	- .04	4.05	
PFOS	ND	0.4L0	- .04	4.05	
PFNn	ND	0.4L0	- .04	4.05	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	- 3C3JPFBS	L4.7	HOJ - HO	
IS	- 3C5JPFv pn	73.5	HOJ - HO	
IS	- oO4JPFv xS	7L.H	HOJ - HO	
IS	- 3C4JPFOn	73.3	HOJ - HO	
IS	- 3CoJPFOS	73.-	HOJ - HO	
IS	- 3CHJPFNn	o- .3	HOJ - HO	

bCbJUCb J b Rwer cRytrRl limit J 2pper cRytrRl limit
The res2lts are repRrted iy dr8 weight.
The sample size is repRrted iy wet weight.
6es2lts repRrted tRDb.
Whey repRrted, PFBS, PFv xS, PFOn ayd PFOS iycl2de ARth liyear ayd Arayched isRmers.
Oyl8 the liyear isRmer is repRrted fRr all Rther ayal8tes.

Matrix Spike Results

VAL - PFAS

Source Client ID:	BARNS-07-SB01-062917-13-15	QC Batch:	B7G0046	Lab Sample:	B7G0046-MS1/B7G0046-MSD1
Source LabNumber:	1700832-05	Date Extracted:	11-Jul-2017 12:39	Date Analyzed:	13-Jul-17 18:28 Column: BEH C18
Matrix:	Solid				13-Jul-17 18:40 Column: BEH C18
Sample Size:	1.29/1.24 g				

Analyte	Spike-MS (ng/g)	MS %R	MS Qual.	Spike-MSD (ng/g)	MSD %R	RPD	MSD Qual.	%R Limit	%RPD Limit
PFBS	9.71	84.6		10.1	91.6	7.95		70 - 130	25
PFHpA	9.71	82.4		10.1	86.6	4.97		70 - 130	25
PFHxS	9.71	83.9		10.1	93.8	11.1		70 - 130	25
PFOA	9.71	93.1		10.1	96.2	3.28		70 - 130	25
PFOS	9.71	101		10.1	80.2	23.0		70 - 130	25
PFNA	9.71	73.2		10.1	81.1	10.2		70 - 130	25

	Labeled Standard	MS %R	MS Qualifiers	MSD %R	MS Qual.
IS	13C3-PFBS	101		88.0	
IS	13C4-PFHpA	85.7		76.3	
IS	18O2-PFHxS	94.6		87.5	
IS	13C2-PFOA	77.1		79.9	
IS	13C8-PFOS	77.0		88.6	
IS	13C5-PFNA	88.9		80.2	

When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-05-SB02-067121-DUP

VAL - PFAS

Client Data

Name: n MEC FRster Wheeler
PrRject: Phase I 6egiRyal SIJ Baryes / 4L-330001
Date CRllected: 47Ju2yJ40-7 0:00
b RcatiRy:

Sample Data

Matrix: SRil
Sample Size: -.-o g
% SRlids: 7o.L

Laboratory Data

baASample: -700o34J01
QC Batch: B7G0051
Date n yal8zed: -3Ju2lJ-7-o:HB CRl2my: BEv C-o
-oJu2lJ-7-1:45 CRl2my: BEv C-o

Date 6ecei9ed: 01Ju2lJ40-7 L:51
Date Extracted: --Ju2lJ40-7 -4:3L

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.301	-.07	4.-H	
PFv pn	0.54H	0.301	-.07	4.-H	u
PFv xS	HHl	0.301	-.07	4.-H	
PFOn	3.4L	0.301	-.07	4.-H	
PFOS	40o	-.HB	H37	-0.7	D
PFNn	ND	0.301	-.07	4.-H	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	-3C3JPFBS	-40	HDJ-HD	
IS	-3C5JPFv pn	o3.5	HDJ-HD	
IS	-oO4JPFv xS	o1.7	HDJ-HD	
IS	-3C4JPFOn	7H3	HDJ-HD	
IS	-3CoJPFOS	10.H	HDJ-HD	D
IS	-3CHJPFNn	o5.5	HDJ-HD	

bCbJUCb J b Rwer cRytrRl limit J 2pper cRytrRl limit
The res2lts are repRrted iy dr8 weight.
The sample size is repRrted iy wet weight.
6es2lts repRrted tRDb.
Whey repRrted, PFBS, PFv xS, PFOn ayd PFOS iycl2de ARth liyear ayd Arayched isRmers.
Oyl8 the liyear isRmer is repRrted fRr all Rther ayal8tes.

Sample ID: Method Blank

Modified EPA Method 537

Matrix: Aqueous
Sample Size: 0.125 L

QC Batch: B7G0031
Date Extracted: 10-Jul-2017 7:38

Lab Sample: B7G0031-BLK1
Date Analyzed: 11-Jul-17 20:12 Column: BEH C18

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.00218	0.00500	0.00800	
PFHpA	ND	0.00218	0.00500	0.00800	
PFHxS	ND	0.00218	0.00500	0.00800	
PFOA	ND	0.00218	0.00500	0.00800	
PFOS	ND	0.00218	0.00500	0.00800	
PFNA	ND	0.00218	0.00500	0.00800	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	95.5	50 - 150	
IS	13C4-PFHpA	94.7	50 - 150	
IS	18O2-PFHxS	118	50 - 150	
IS	13C2-PFOA	104	50 - 150	
IS	13C8-PFOS	103	50 - 150	
IS	13C5-PFNA	96.2	50 - 150	

LCL-UCL - Lower control limit - upper control limit
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: OPR **Modified EPA Method 537**

Matrix: Aqueous	QC Batch: B7G0031	Lab Sample: B7G0031-BS1
Sample Size: 0.125 L	Date Extracted: 10-Jul-2017 7:38	Date Analyzed: 11-Jul-17 19:47 Column: BEH C18

Analyte	Amt Found (ug/L)	Spike Amt	%R	Limits
PFBS	0.0601	0.0800	75.2	70 - 130
PFHpA	0.0637	0.0800	79.7	70 - 130
PFHxS	0.0655	0.0800	81.9	70 - 130
PFOA	0.0719	0.0800	89.8	70 - 130
PFOS	0.0564	0.0800	70.6	70 - 130
PFNA	0.0564	0.0800	70.5	70 - 130

	Labeled Standard	%R	LCL-UCL
IS	13C3-PFBS	108	50 - 150
IS	13C4-PFHpA	103	50 - 150
IS	18O2-PFHxS	111	50 - 150
IS	13C2-PFOA	95.2	50 - 150
IS	13C8-PFOS	102	50 - 150
IS	13C5-PFNA	102	50 - 150

LCL-UCL - Lower control limit - upper control limit

Sample ID: BARNS-07-GW-TW05-062917-49

Modified EPA Method 537

Client Data		Sample Data		Laboratory Data			
P ame:	AMEC FHRter Wheeler	Matrix:	AsueHuR	Lab Sample:	1700832-0N	Date v ecei6ed:	09-Jul-2017 4:N9
j rHSect:	j haRe I v egiHnal SI- BarneR/ 241330009	Sample Size:	0.12o L	QC Batch:	B7G0031	Date Extracted:	10-Jul-2017 7:38
Date CHllected:	24-Jun-2017 4:oo			Date Analyzed:	11-Jul-17 21:o3	CHlumn:	BEq C18
LHcatiHn:							

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
j FBS	0.0o3o	0.00218	0.00o00	0.00802	
j Fq pA	0.027o	0.00218	0.00o00	0.00802	
j Fq xS	0.94N	0.00218	0.00o00	0.00802	
j FOA	0.0o47	0.00218	0.00o00	0.00802	
j FOS	0.93N	0.00218	0.00o00	0.00802	
j FP A	P D	0.00218	0.00o00	0.00802	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-j FBS	107	o0 - 1o0	
IS	13CN-j Fq pA	112	o0 - 1o0	
IS	18O2-j Fq xS	122	o0 - 1o0	
IS	13C2-j FOA	112	o0 - 1o0	
IS	13C8-j FOS	104	o0 - 1o0	
IS	13Co-j FP A	48.2	o0 - 1o0	

LCL-UCL - LHwer cHntrHl limit - upper cHntrHl limit
v eRultRrepHrted tHDL.
When repHrted, j FBS, j Fq xS, j FOA and j FOS include bHth linear and branched iRHmerR
Only the linear iRHmer iRrepHrted fHr all Hther analyteR

Sample ID: BARNS-EB-03-063017

Modified EPA Method 537

Client Data		Sample Data		Laboratory Data			
P ame:	AMEC FHRter Wheeler	Matrix:	AsueHuR	Lab Sample:	1700832-07	Date v ecei6ed:	09-Jul-2017 4:N9
j rHSect:	j haRe I v egiHnal SI- BarneR/ 241330009	Sample Size:	0.122 L	QC Batch:	B7G0031	Date Extracted:	10-Jul-2017 7:38
Date CHllected:	30-Jun-2017 1o:NN			Date Analyzed:	11-Jul-17 22:0o	CHlumn:	BEq C18
LHcatiHn:							

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
j FBS	P D	0.00223	0.00o12	0.00814	
j Fq pA	P D	0.00223	0.00o12	0.00814	
j Fq xS	P D	0.00223	0.00o12	0.00814	
j FOA	P D	0.00223	0.00o12	0.00814	
j FOS	P D	0.00223	0.00o12	0.00814	
j FP A	P D	0.00223	0.00o12	0.00814	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-j FBS	48.2	o0 - 1o0	
IS	13CN-j Fq pA	4o.o	o0 - 1o0	
IS	18O2-j Fq xS	112	o0 - 1o0	
IS	13C2-j FOA	10N	o0 - 1o0	
IS	13C8-j FOS	112	o0 - 1o0	
IS	13Co-j FP A	89.9	o0 - 1o0	

LCL-UCL - LHwer cHntrHl limit - upper cHntrHl limit
v eRultRrepHrted tHDL.
When repHrted, j FBS, j Fq xS, j FOA and j FOS include bHth linear and branched iRHmerR
Only the linear iRHmer iRrepHrted fHr all Hther analyteR

Sample ID: BARNS-EB-04-063017

Modified EPA Method 537

Client Data		Sample Data		Laboratory Data			
Name:	AMEC FHRter Wheeler	Matrix:	AsueHuR	Lab Sample:	1700832-08	Date v ecei6ed:	09-Jul-2017 o:49
PrHject:	PhaRe I v egiHnal SI- BarneR/ 2o1330009	Sample Size:	0.123 L	QC Batch:	B7G0031	Date Extracted:	10-Jul-2017 7:38
Date CHllected:	30-Jun-2017 15:48			Date Analyzed:	11-Jul-17 22:1o CHlumn: BEq C18		
LHcatiHn:							

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.00222	0.00508	0.00813	
PFq pA	ND	0.00222	0.00508	0.00813	
PFq xS	ND	0.00222	0.00508	0.00813	
PFOA	ND	0.00222	0.00508	0.00813	
PFOS	ND	0.00222	0.00508	0.00813	
PFNA	ND	0.00222	0.00508	0.00813	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	101	50 - 150	
IS	13C4-PFq pA	100	50 - 150	
IS	18O2-PFq xS	oo.8	50 - 150	
IS	13C2-PFOA	107	50 - 150	
IS	13C8-PFOS	o1.3	50 - 150	
IS	13C5-PFNA	87.3	50 - 150	

LCL-UCL - LHwer cHntrHl limit - upper cHntrHl limit
v eRultRrepHrted tHDL.
When repHrted, PFBS, PFq xS, PFOA and PFOS include bHth linear and branched iRHmerR
Only the linear iRHmer iRrepHrted fHr all Hther analyteR

Sample ID: BARNS-EB-05-063017

Modified EPA Method 537

Client Data

Name: AMEC Foster Wheeler
Project: Phase I Regional SI- Barnes / 291330006
Date Collected: 30-Jun-2017 15:50
Location:

Sample Data

Matrix: Aqueous
Sample Size: 0.117 L

Laboratory Data

Lab Sample: 1700832-09 Date Received: 06-Jul-2017 9:46
QC Batch: B7G0031 Date Extracted: 10-Jul-2017 7:38
Date Analyzed: 11-Jul-17 22:31 Column: BEH C18

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.00232	0.00534	0.00852	
PFHpA	ND	0.00232	0.00534	0.00852	
PFHxS	ND	0.00232	0.00534	0.00852	
PFOA	ND	0.00232	0.00534	0.00852	
PFOS	ND	0.00232	0.00534	0.00852	
PFNA	ND	0.00232	0.00534	0.00852	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	101	50 - 150	
IS	13C4-PFHpA	109	50 - 150	
IS	18O2-PFHxS	98.4	50 - 150	
IS	13C2-PFOA	100	50 - 150	
IS	13C8-PFOS	107	50 - 150	
IS	13C5-PFNA	93.5	50 - 150	

LCL-UCL - Lower control limit - upper control limit
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: BARNS-08-GW-TW04-063017-36

Modified EPA Method 537

Client Data		Sample Data		Laboratory Data			
Name:	AMEC FHRter Wheeler	Matrix:	AsueHuR	Lab Sample:	1700832-10	Date v ecei6ed:	09-Jul-2017 4:o9
PrHject:	PhaRe I v egiHnal SI- BarneR/ 241330009	Sample Size:	0.123 L	QC Batch:	B7G0031	Date Extracted:	10-Jul-2017 7:38
Date CHllected:	30-Jun-2017 11:55			Date Analyzed:	11-Jul-17 22:oo	CHlumn:	BEq C18
LHcatiHn:							

Analyte	Conc. (ug/L)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.00221	0.00508	0.00812	
PFq pA	ND	0.00221	0.00508	0.00812	
PFq xS	0.0149	0.00221	0.00508	0.00812	
PFOA	ND	0.00221	0.00508	0.00812	
PFOS	0.00380	0.00221	0.00508	0.00812	J
PFNA	ND	0.00221	0.00508	0.00812	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	104	50 - 150	
IS	13Co-PFq pA	103	50 - 150	
IS	18O2-PFq xS	110	50 - 150	
IS	13C2-PFOA	41.5	50 - 150	
IS	13C8-PFOS	48.0	50 - 150	
IS	13C5-PFNA	88.1	50 - 150	

LCL-UCL - LHwer cHntrHl limit - upper cHntrHl limit
v eRultRrepHrted tHDL.
When repHrted, PFBS, PFq xS, PFOA and PFOS include bHth linear and branched iRHmerR
Only the linear iRHmer iRrepHrted fHr all Hther analyteR

DATA QUALIFIERS & ABBREVIATIONS

B	**This compound was also detected in the method blank.**
D	**Dilution**
E	**The associated compound concentration exceeded the calibration range of the instrument.**
H	**Recovery and/or RPD was outside laboratory acceptance limits.**
I	**Chemical Interference**
J	**The amount detected is below the Reporting Limit/LOQ.**
M	**Estimated Maximum Possible Concentration. (CA Region 2 projects only)**
*****	**See Cover Letter**
Conc.	**Concentration**
NA	**Not applicable**
ND	**Not Detected**
TEQ	**Toxic Equivalency**

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

CERTIFICATIONS

Accrediting Authority	Certificate Number
Arkansas Department of Environmental Quality	17-015-0
California Department of Health – ELAP	2892
DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005	3091.01
Florida Department of Health	E87777-18
Hawaii Department of Health	N/A
Louisiana Department of Environmental Quality	01977
Maine Department of Health	2016026
Minnesota Department of Health	1175673
Nevada Division of Environmental Protection	CA004132017-1
New Hampshire Environmental Accreditation Program	207716
New Jersey Department of Environmental Protection	CA003
New York Department of Health	11411
Oregon Laboratory Accreditation Program	4042-008
Pennsylvania Department of Environmental Protection	013
Texas Commission on Environmental Quality	T104704189-17-8
Virginia Department of General Services	8621
Washington Department of Ecology	C584
Wisconsin Department of Natural Resources	998036160

Current certificates and lists of licensed parameters are located in the Quality Assurance office and are available upon request.

NELAP Accredited Test Methods

MATRIX: Air	
Description of Test	**Method**
Determination of Polychlorinated p-Dioxins & Polychlorinated Dibenzofurans	EPA 23

MATRIX: Biological Tissue	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Drinking Water	
Description of Test	**Method**
2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD) GC/HRMS	EPA 1613
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537

MATRIX: Non-Potable Water	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Dioxin by GC/HRMS	EPA 613
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Solids	
Description of Test	**Method**
Tetra-Octa Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope	EPA 1613B

Dilution GC/HRMS	
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

1700832 0.5°c

amec foster wheeler

Amec Foster Wheeler Environment & Infrastructure
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

SHIP TO:
Vista
1104 Windfield Way
El Dorado Hills, CA 95762
Atten: Martha Maier
Lab Phone# (916) 673-1520

CHAIN OF CUSTODY

DATE: 7/5/2017
COC #: BARNS170705A
PAGE: 3 OF 3

Project Name:	Phase I Regional SI - Barnes	Project Contact: Denise King		Bill To: Amec Foster Wheeler Environment & Infrastructure	Disposal Instructions: LAB
Project Number:	291330006	Phone Number: (978) 392-5339		9210 Sky Park Court Suite 200	Shipment Method: FEDEX
Project Manager:	Kerry Tull	Project Phase: .010		San Diego, CA 92123	Waybill Number: N/A

Sample Information						Methods for Analysis	RUSH					
No.	Sample ID	Date & Time Sampled	Matrix	Sample Type	MS/MSD	Method 537.1 UCMR 3	24 Hour	48 Hour	72 Hour	5 Days	TOTAL BOTTLES	HOLD All Analyses
1	BARNS-06-SB01-062917-13-15	06/29/17 13:55	SO	N	N	X					1	
2	BARNS-06-SB02-062917-13-15	06/29/17 13:45	SO	N	N	X					1	
3	BARNS-06-SB03-062917-13-15	06/29/17 13:10	SO	N	N	X					1	
4	BARNS-07-GW-TW05-062917-49	06/29/17 09:55	WG	N	N	X					2	
5	BARNS-07-SB01-062917-13-15	06/29/17 10:20	SO	N	Y	X					3	
6	BARNS-05-SB01-062717-DUP	06/27/17 00:00	SO	FD	N	X					1	
7	BARNS-EB-03-063017	06/30/17 15:44	WQ	EB	N	X					2	
8	BARNS-EB-04-063017	06/30/17 15:48	WQ	EB	N	X					2	
9	BARNS-EB-05-063017	06/30/17 15:50	WQ	EB	N	X					2	
10	BARNS-08-GW-TW04-063017-3~~T~~	06/30/17 11:55	WG	N	N	X					1	
11	6 DHK 7/7/17											
12												

Sampler's Signature:		Date: 7/5/17	Time: 0940
Relinquished By/Affiliation:	Amec FW	Date: 7/5/17	Time: 0945
Received By:	USPS/VSH	Date: 7/6/17	Time: 1011
Relinquished By/Affiliation:		Date:	Time:
Received By:		Date:	Time:
Relinquished By/Affiliation:		Date:	Time:
Received By (LAB):		Date:	Time:

For Lab Use

Does COC match samples:	Y or N
Broken Container:	Y or N
COC seal intact:	Y or N
Other problems:	Y or N
WSDOT contacted.	Y or N
Date contacted:	
Cooler Temperature at receipt:	°C

Comments:
X=Analyze H=Hold Analysis Request
Contract # W9133L-14-D-0002 TO0006
PO # F013200677
ATTN: Tammie Rippie
Base Lead: Todd Coffin
Field Lead: Craig.keating@amecfw.com

NUMBER OF COOLERS SENT: 1

*Revised COC received via email on 7/11/17. PV 7/11/17

1700832 0.5°C

amec foster wheeler

Amec Foster Wheeler Environment & Infrastructure
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

SHIP TO:
Vista
1104 Windfield Way
El Dorado Hills, CA 95762
Atten: Martha Maier
Lab Phone# (916) 673-1520

CHAIN OF CUSTODY

DATE: 7/5/2017
COC #: BARNS170705A
PAGE: 3 OF 3

Project Name:	Phase I Regional SI - Barnes	Project Contact: Denise King	Bill To: Amec Foster Wheeler Environment & Infrastructure	Disposal Instructions:	LAB
Project Number:	**291330006**	Phone Number: (978) 392-5339	9210 Sky Park Court Suite 200	Shipment Method:	FEDEX
Project Manager:	Kerry Tull	Project Phase: .010	San Diego, CA 92123	Waybill Number:	N/A

Sample Information						Methods for Analysis	RUSH					
No.	Sample ID	Date & Time Sampled	Matrix	Sample Type	MS/MSD	Method 537.1 UCMR 3	24 Hour	48 Hour	72 Hour	5 Days	TOTAL BOTTLES	HOLD All Analyses
1	BARNS-06-SB01-062917-13-15	06/29/17 13:55	SO	N	N	X					1	
2	BARNS-06-SB02-062917-13-15	06/29/17 13:45	SO	N	N	X					1	
3	BARNS-06-SB03-062917-13-15	06/29/17 13:10	SO	N	N	X					1	
4	BARNS-07-GW-TW05-062917-49	06/29/17 09:55	WG	N	N	X					2	
5	BARNS-07-SB01-062917-13-15	06/29/17 10:20	SO	N	Y	X					3	
6	BARNS-05-SB01-062717-DUP	06/27/17 00:00	SO	FD	N	X					1	
7	BARNS-EB-03-063017	06/30/17 15:44	WQ	EB	N	X					2	
8	BARNS-EB-04-063017	06/30/17 15:48	WQ	EB	N	X					2	
9	BARNS-EB-05-063017	06/30/17 15:50	WQ	EB	N	X					2	
10	BARNS-08-GW-TW04-063017-37	06/30/17 11:55	WG	N	N	X					1	
11												
12												

Sampler's Signature:		Date: 7/5/17	Time: 0940
Relinquished By/Affiliation:	Amec FW	Date: 7/5/17	Time: 0945
Received By:	WSparks/VAH	Date: 7/6/17	Time: 1011
Relinquished By/Affiliation:		Date:	Time:
Received By:		Date:	Time:
Relinquished By/Affiliation:		Date:	Time:
Received By (LAB):		Date:	Time:

For Lab Use

Does COC match samples:	Y or N
Broken Container:	Y or N
COC seal intact:	Y or N
Other problems:	Y or N
WSDOT contacted:	Y or N
Date contacted:	
Cooler Temperature at receipt:	°C

Comments:
X=Analyze H=Hold Analysis Request
Contract # W9133L-14-D-0002 TO0006
PO # F013200677
ATTN: Tammie Rippie
Base Lead: Todd Coffin
Field Lead: Craig.keating@amecfw.com

NUMBER OF COOLERS SENT: 1

Vista Analytical Laboratory

Sample Log-in Checklist

Vista Work Order #: 1700832 TAT Std

Samples Arrival:	Date/Time 7/6/17 0946	Initials: WLS	Location: WR-2 Shelf/Rack: N/A
Logged In:	Date/Time 07/06/17 1501	Initials: BSB	Location: WR-2 Shelf/Rack: E-7

Delivered By:	(FedEx)	UPS	On Trac	GSO	DHL	Hand Delivered	Other
Preservation:	(Ice)		Blue Ice		Dry Ice		None

Temp °C: 0.9 (uncorrected)	Time: 1009	Thermometer ID: IR-2
Temp °C: 0.5 (corrected)	Probe used: Yes☐ No☒	

	YES	NO	NA
Adequate Sample Volume Received?	✓		
Holding Time Acceptable?	✓		
Shipping Container(s) Intact?	✓		
Shipping Custody Seals Intact?	✓		
Shipping Documentation Present?	✓		
Airbill Trk # 8009 5563 6272	✓		
Sample Container Intact?	✓		
Sample Custody Seals Intact?			✓
Chain of Custody / Sample Documentation Present?	✓		
COC Anomaly/Sample Acceptance Form completed?	✓	✓	✓ BSB 07/06/17
If Chlorinated or Drinking Water Samples, Acceptable Preservation?			✓

Preservation Documented:	$Na_2S_2O_3$	Trizma	None	Yes	No	(NA)
Shipping Container	(Vista)	Client	(Retain)	Return	Dispose	

Comments: Sampel label ID:

BARNS-08-GW-TW04-063017-36 A/B

Chain of Custody Anomaly/Sample Acceptance Form

Vista Analytical Laboratory

Client: AMEC Foster Wheeler
Contact: Denise King
Email: Denise.king@amecfw.com
Phone: (978) 392-5339

Workorder Number: 1700832
Date Received: 06-Jul-17 09:46
Documented by/date: B.Benedict 07/06/2017

Please review the following information and complete the Client Authorization section. To comply with NELAC regulations, we must receive authorization before proceeding with sample analysis.

Thank you,

Martha Maier
mmaier@vista-analytical.com
916-673-1520

The following information or item is needed to proceed with analysis:

- [ ] Complete Chain-of-Custody
- [ ] Test Method Requested
- [ ] Analyte List Requested
- [ ] Other:
- [ ] Preservative
- [ ] Sample Identification
- [ ] Sample Collection Date and/or Time
- [ ] Collector's Name
- [ ] Sample Type
- [ ] Sample Location

The following anomalies were noted. Authorization is needed to proceed with analysis.

- [ ] Temperature outside < 6°C Range — Samples Affected: _____
  Temperature _____ °C Ice Present? Yes No Melted
- [X] Sample ID Discrepancy: See Comments
- [ ] Sample Holding Time Missed
- [ ] Custody Seals Broken
- [ ] Insufficient Sample Size
- [ ] Sample Container(s) Broken
- [ ] Incorrect Container Type

Comments:
COC ID:
BARNS-08-GW-TW04-063017-37

Label ID:
BARNS-08-GW-TW04-063017-36

Client Authorization

Proceed with Analysis: (YES) NO Signature and Date Karen M. Volpenhein 7-10-2017

Client Comments/Instructions Per email from Toad Coffin, the sample ID on the label should be used "BARNS-08-GW-TW04-063017-36".

July 20, 2017

Vista Work Order No. 1700833

Ms. Denise King
AMEC Foster Wheeler
271 Mill Road
Chelmsford, MA 01824

Dear Ms. King,

Enclosed are the results for the sample set received at Vista Analytical Laboratory on July 06, 2017. This sample set was analyzed on a rush turn-around time, under your Project Name 'Phase I Regional SI- Barnes / 291330006'.

Vista Analytical Laboratory is committed to serving you effectively. If you require additional information, please contact me at 916-673-1520 or by email at mmaier@vista-analytical.com.

Thank you for choosing Vista as part of your analytical support team.

Sincerely,

Martha Maier
Laboratory Director

Vista Work Order No. 1700833
Case Narrative

Sample Condition on Receipt:

Seven soil samples were received in good condition and within the method temperature requirements. The samples were received and stored securely in accordance with Vista standard operating procedures and EPA methodology. The Chain of Custody was not present during sample receipt. A copy of the Chain of Custody was received via email on July 8, 2017.

Analytical Notes:

VAL-PFAS

The samples were extracted and analyzed for a selected list of 6 PFAS using VAL Method PFAS.

Holding Times

The samples were extracted and analyzed within the hold times.

Quality Control

The Initial Calibration and Continuing Calibration Verifications met the method acceptance criteria.

A Method Blank and Ongoing Precision and Recovery (OPR) sample were extracted and analyzed with the preparation batch. No analytes were detected in the Method Blank above 1/2 the LOQ. The OPR recoveries were within the method acceptance criteria.

The labeled standard recoveries for all QC and field samples were within the acceptance criteria.

TABLE OF CONTENTS

Sample Inventory Report

Vista Sample ID	Client Sample ID	Sampled	Received	Components/Containers
1700833-01	BARNS-05-SB01-062717-0-2	27-Jun-17 09:40	06-Jul-17 09:46	HDPE Jar, 6 oz
1700833-02	BARNS-04-SB02-062917-13-15	29-Jun-17 09:40	06-Jul-17 09:46	HDPE Jar, 6 oz
1700833-03	BARNS-04-SB02-062617-0-2	26-Jun-17 10:43	06-Jul-17 09:46	HDPE Jar, 6 oz
1700833-04	BARNS-01-SB02-062617-0-2	26-Jun-17 08:30	06-Jul-17 09:46	HDPE Jar, 6 oz
1700833-05	BARNS-01-SB01-062617-0-2	26-Jun-17 08:20	06-Jul-17 09:46	HDPE Jar, 6 oz
1700833-06	BARNS-04-SB03-062617-0-2	26-Jun-17 10:53	06-Jul-17 09:46	HDPE Jar, 6 oz
1700833-07	BARNS-07-SB02-062617-0-2	26-Jun-17 11:55	06-Jul-17 09:46	HDPE Jar, 6 oz

ANALYTICAL RESULTS

Sample ID: Method Blank **VAL - PFAS**

Matrix:	Solid	QC Batch:	B7G0046	Lab Sample:	B7G0046-BLK1
Sample Size:	1.00 g	Date Extracted:	11-Jul-2017 12:39	Date Analyzed:	13-Jul-17 17:25 Column: BEH C18

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.285	1.00	2.00	
PFHpA	ND	0.285	1.00	2.00	
PFHxS	ND	0.285	1.00	2.00	
PFOA	ND	0.285	1.00	2.00	
PFOS	ND	0.285	1.00	2.00	
PFNA	ND	0.285	1.00	2.00	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	13C3-PFBS	90.2	50 - 150	
IS	13C4-PFHpA	74.9	50 - 150	
IS	18O2-PFHxS	85.6	50 - 150	
IS	13C2-PFOA	87.7	50 - 150	
IS	13C8-PFOS	89.5	50 - 150	
IS	13C5-PFNA	81.3	50 - 150	

LCL-UCL - Lower control limit - upper control limit
The results are reported in dry weight.
The sample size is reported in wet weight.
Results reported to DL.
When reported, PFBS, PFHxS, PFOA and PFOS include both linear and branched isomers.
Only the linear isomer is reported for all other analytes.

Sample ID: OPR **VAL - PFAS**

Matrix: Solid	QC Batch: B7G0051	baASample: B7G0051JBS-
Sample Size: - .00 g	Date Extracted: - - Ju2lJ40- 7 - 4:3L	Date n yal9zed: - 3Ju2lJ- 7 - 7:00 Col2my: BE8 C- H

Analyte	Amt Found (ng/g)	Spike Amt	%R	Limits	Labeled Standard	%R	LCL-UCL
PFBS	H- 1	- 0.0	H- .1	70 J - 30	IS - 3C3JPFBS	LN1	N0 J - N0
PF8 pn	H57	- 0.0	H5.7	70 J - 30	IS - 3C5JPF8 pn	7N-	N0 J - N0
PF8 xS	HH-	- 0.0	HH-	70 J - 30	IS - HO4JPF8 xS	H3.1	N0 J - N0
PFOn	L.N-	- 0.0	LN-	70 J - 30	IS - 3C4JPFOn	1H7	N0 J - N0
PFOS	H- 5	- 0.0	H- .5	70 J - 30	IS - 3CHJPFOS	7H5	N0 J - N0
PF6 n	H- 3	- 0.0	H- .3	70 J - 30	IS - 3CNJPF6 n	17.N	N0 J - N0

bCbJUCb J bower coytrol limit J 2pper coytrol limit

Sample ID: BARNS-05-SB02-067121-0-7

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
Name:	n MEC FHster Wheeler	Matrix:	SHl	baASample:	-700v33J0-	Date 6ecei9ed:	01Ju2lJ40-7 L:51
PrHject:	Phase I 6egiHyal SIJ Baryes / 4L-330001	Sample Size:	-.4- g	QC Batch:	B7G0051	Date Extracted:	--Ju2lJ40-7 -4:3L
Date CHllected:	47Ju2yJ40-7 L:50	% SHids:	v4.v	Date n yal8zed:	-3Ju2lJ-7-L:0o CH2my: BER C-v		
bHcatiHy:					-vJu2lJ-7-1:31 CH2my: BER C-v		

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.4vo	0.LLv	4.00	
PFRpn	0.503	0.4vo	0.LLv	4.00	u
PFRxS	5.v0	0.4vo	0.LLv	4.00	
PFOn	4.15	0.4vo	0.LLv	4.00	
PFOS	--o	-.54	5.LL	L.Lv	D
PFNn	ND	0.4vo	0.LLv	4.00	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	-3C3JPFBS	-03	o0J-o0	
IS	-3C5JPFRpn	1L.v	o0J-o0	
IS	-vO4JPFRxS	v5.4	o0J-o0	
IS	-3C4JPFOn	75.5	o0J-o0	
IS	-3CvJPFOS	73.L	o0J-o0	D
IS	-3CoJPFNn	v4.3	o0J-o0	

bCbJUCb J bHver cHytrHl limit J 2pper cHytrHl limit
The res2lts are repHrted iy dr8 weight.
The sample size is repHrted iy wet weight.
6es2lts repHrted tHDb.
Whey repHrted, PFBS, PFRxS, PFOn ayd PFOS iycl2de AHth liyear ayd Arayched isHmers.
Oyl8 the liyear isHmer is repHrted fHr all Hther ayal8tes.

Sample ID: BARNS-04-SB01-061297-93-95

VAL - PFAS

Client Data

9 ame: n MEC j HFter s heeler
NrHRect: NhaFe WveI iHyal SWBaryeFg4L-330001
Date CHIected: 4LJu2yJ40-7 L:50
bHcatiHy:

Sample Data

Matrix: SHil
Sample Size: -‰o I
/ SHidF: L5%

Laboratory Data

baASample: -700o33J04
QC Batch: B7G0051
Date n yal8zed: -3Ju2lJ-7-L:-o CH2my: BER C-o
Date v ecei6ed: 01Ju2lJ40-7 L:51
Date Extracted: --Ju2lJ40-7 -4:3L

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
Nj BS	9 D	0%47o	0%77	-%.	
Nj Rpn	9 D	0%47o	0%77	-%.	
Nj RxS	9 D	0%47o	0%77	-%.	
Nj On	9 D	0%47o	0%77	-%.	
Nj OS	9 D	0%47o	0%77	-%.	
Nj 9 n	9 D	0%47o	0%77	-%.	

	Labeled Standard	%R	LCL-UCL	Qualifiers
WS	-3C3JNj BS	L. %	.0J-.0	
WS	-3C5JNj Rpn	L4%b	.0J-.0	
WS	-oO4JNj RxS	L5%4	.0J-.0	
WS	-3C4JNj On	73%b	.0J-.0	
WS	-3CoJNj OS	o5%b	.0J-.0	
WS	-3C.JNj 9 n	o7%b	.0J-.0	

bCbJUCb J bHver cHytrHl limit J 2pper cHytrHl limit
The reF2ltFare repHrted iy dr8 weiIht%
The Fample Fize iFrepHrted iy wet weiIht%
veF2ltFrepHrted tHDb%
s hey repHrted, Nj BS, Nj RxS, Nj On ayd Nj OS iycl2de AHth liyear ayd Arayched iFHmerF%
Oyl8 the liyear iFHmer iFrepHrted fHr all Hther ayal8teF%

Sample ID: BARNS-04-SB01-061627-0-1

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
9 ame:	n MEC j oFter s heeler	Matrix:	Soil	baA Sample:	-700R33J03	Date v ecei6ed:	01Ju21J40-7 L:51
NroRect:	NhaFe WveI ioyal SWBaryeFg4L-330001	Sample Size:	-%5 I	QC Batch:	B7G0051	Date Extracted:	--Ju21J40-7 -4:3L
Date Collected:	41Ju2yJ40-7 -0:53	/ SolidF:	R7%	Date n yal8zed:	-3Ju21J-7-L:3-	Col2my:	BEH C-R
b ocatioy:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
Nj BS	9 D	0%4R	-%0	4%0	
Nj Hpn	9 D	0%4R	-%0	4%0	
Nj HxS	9 D	0%4R	-%0	4%0	
Nj On	9 D	0%4R	-%0	4%0	
Nj OS	0%4.	0%4R	-%0	4%0	u
Nj 9 n	9 D	0%4R	-%0	4%0	

	Labeled Standard	%R	LCL-UCL	Qualifiers
VS	-3C3JNj BS	-0R	.0J-.0	
VS	-3C5JNj Hpn	R-%4	.0J-.0	
VS	-RO4JNj HxS	R4%	.0J-.0	
VS	-3C4JNj On	L0%	.0J-.0	
VS	-3CRJNj OS	L1%	.0J-.0	
VS	-3C.JNj 9 n	L0%	.0J-.0	

bCbJUCb J bower coytrol limit J 2pper coytrol limit
The reF2ltF are reported iy dr8 weiI ht%
The Fample Fize iF reported iy wet weiI ht%
v eF2ltF reported to Db%
s hey reported, Nj BS, Nj HxS, Nj On ayd Nj OS iycl2de Aoth liyear ayd Arayched iFomerF%
Oyl8 the liyear iFomer iF reported for all other ayal8teF%

Sample ID: BARNS-06-SB01-021267-0-1

VAL - PFAS

Client Data

9 ame: n MEC j oFter s heeler
NroRect: NhaFe WveI ioyal SWBaryeFg4L-330001
Date Collected: 41Ju2yJ40-7 R:30
bocatioy:

Sample Data

Matrix: Soil
Sample Size: -%. I
/ SolidF: R7%R

Laboratory Data

baASample: -700R33J05
QC Batch: B7G0051
Date n yal8zed: -3Ju2lJ-7-L:53 Col2my: BEH C-R
Date v ecei6ed: 01Ju2lJ40-7 L:51
Date Extracted: --Ju2lJ40-7 -4:3L

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
Nj BS	9 D	0%4R4	0%L0	-%R	
Nj Hpn	9 D	0%4R4	0%L0	-%R	
Nj HxS	0%5-5	0%4R4	0%L0	-%R	u
Nj On	9 D	0%4R4	0%L0	-%R	
Nj OS	-4%	0%4R4	0%L0	-%R	
Nj 9 n	9 D	0%4R4	0%L0	-%R	

	Labeled Standard	%R	LCL-UCL	Qualifiers
VS	-3C3JNj BS	LL:%	.0J-.0	
VS	-3C5JNj Hpn	R5%5	.0J-.0	
VS	-RO4JNj HxS	R3%	.0J-.0	
VS	-3C4JNj On	R3%4	.0J-.0	
VS	-3CRJNj OS	71%	.0J-.0	
VS	-3C.JNj 9 n	L5%	.0J-.0	

bCbJUCb J bower coytrol limit J 2pper coytrol limit
The reF2ltF are reported iy dr8 weiI ht%
The Fample Fize iF reported iy wet weiI ht%
v eF2ltF reported to Db%
s hey reported, Nj BS, Nj HxS, Nj On ayd Nj OS iycl2de Aoth liyear ayd Arayched iFomerF%
Oyl8 the liyear iFomer iF reported for all other ayal8teF%

Sample ID: BARNS-06-SB06-012167-0-2

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
Name:	n MEC FH-ster Wheeler	Matrix:	SH-l	baA Sample:	-700v33J0o	Date 6ecei9ed:	01Ju2lJ40-7 L:51
PrHject:	Phase I 6egiHyal SIJ Baryes / 4L-330001	Sample Size:	-.-5 g	QC Batch:	B7G0051	Date Extracted:	--Ju2lJ40-7 -4:3L
Date CHllected:	41Ju2yJ40-7 v:40	% SHids:	v1.4	Date n yal8zed:	-3Ju2lJ-7-L:o1 CH2my: BER C-v		
b HcatiHy:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.4L0	-.04	4.05	
PFRpn	0.335	0.4L0	-.04	4.05	u
PFRxS	0.vL5	0.4L0	-.04	4.05	u
PFOn	0.v4v	0.4L0	-.04	4.05	u
PFOS	5.L3	0.4L0	-.04	4.05	
PFNn	ND	0.4L0	-.04	4.05	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	-3C3JPFBS	-0L	o0J-o0	
IS	-3C5JPFRpn	L0.o	o0J-o0	
IS	-vO4JPFRxS	L0.5	o0J-o0	
IS	-3C4JPFOn	v5.0	o0J-o0	
IS	-3CvJPFOS	71.3	o0J-o0	
IS	-3CoJPFNn	v4.1	o0J-o0	

bCbJUCb J b Hwer cHytrH limit J 2pper cHytrH limit
The res2lts are repHrted iy dr8 weight.
The sample size is repHrted iy wet weight.
6es2lts repHrted tHDb.
Whey repHrted, PFBS, PFRxS, PFOn ayd PFOS iycl2de AHth liyear ayd Arayched isHmers.
Oyl8 the liyear isHmer is repHrted fHr all Hther ayal8tes.

Sample ID: BARNS-04-SB03-062617-0-2

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
9 ame:	n MEC Foster Wheeler	Matrix:	Soil	baA Sample:	- 700R33J01	Date v ecei6ed:	01Ju21J40- 7 L:51
NroRect:	Nhase I v egioyal SIJ Baryes / 4L- 330001	Sample Size:	- .05 g	QC Batch:	B7G0051	Date Extracted:	- - Ju21J40- 7 - 4:3L
Date Collected:	41Ju2yJ40- 7 - 0:j 3	% Solids:	Lj .4	Date n yal8zed:	- 3Ju21J- 7 40:51	Col2my:	BEH C- R
b ocatioy:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
NFBS	9 D	0.4RR	- .0-	4.04	
NFHpn	9 D	0.4RR	- .0-	4.04	
NFHxS	9 D	0.4RR	- .0-	4.04	
NFOn	9 D	0.4RR	- .0-	4.04	
NFOS	- .LL	0.4RR	- .0-	4.04	u
NF9 n	9 D	0.4RR	- .0-	4.04	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	- 3C3JNFBS	- 04	j 0 J - j 0	
IS	- 3C5JNFHpn	71.5	j 0 J - j 0	
IS	- RO4JNFHxS	R1.4	j 0 J - j 0	
IS	- 3C4JNFOn	7j .1	j 0 J - j 0	
IS	- 3CRJNFOS	Rj .L	j 0 J - j 0	
IS	- 3Cj JNF9 n	7R1	j 0 J - j 0	

bCbJUCb J b ower coytrol limit J 2pper coytrol limit
The res2lts are reported iy dr8 weight.
The sample size is reported iy wet weight.
v es2lts reported to Db .
Whey reported, NFBS, NFHxS, NFOn ayd NFOS iycl2de Aoth liyear ayd Arayched isomers.
Oyl8 the liyear isomer is reported for all other ayal8tes.

Sample ID: BARNS-06-SB01-021276-0-1

VAL - PFAS

Client Data		Sample Data		Laboratory Data			
Name:	n MEC FHster Wheeler	Matrix:	SHl	baASample:	-700v33J07	Date 6ecei9ed:	01Ju2lJ40-7 L:51
PrHject:	Phase I 6egiHyal SIJ Baryes / 4L-330001	Sample Size:	-.-o g	QC Batch:	B7G0051	Date Extracted:	--Ju2lJ40-7 -4:3L
Date CHllected:	41Ju2yJ40-7 --:oo	% SHids:	v1.3	Date n yal8zed:	-3Ju2lJ-7 40:oL CH12my: BER C-v		
bHcatiHy:							

Analyte	Conc. (ng/g)	DL	LOD	LOQ	Qualifiers
PFBS	ND	0.4v7	-.0-	4.0-	
PFRpn	ND	0.4v7	-.0-	4.0-	
PFRxS	ND	0.4v7	-.0-	4.0-	
PFOn	ND	0.4v7	-.0-	4.0-	
PFOS	-.o3	0.4v7	-.0-	4.0-	u
PFNn	ND	0.4v7	-.0-	4.0-	

	Labeled Standard	%R	LCL-UCL	Qualifiers
IS	-3C3JPFBS	v5.4	o0J-o0	
IS	-3C5JPFRpn	1L.0	o0J-o0	
IS	-vO4JPFRxS	71.1	o0J-o0	
IS	-3C4JPFOn	7-.0	o0J-o0	
IS	-3CvJPFOS	74.7	o0J-o0	
IS	-3CoJPFNn	73.o	o0J-o0	

bCbJUCb J bHver cHytrHl limit J 2pper cHytrHl limit
The res2lts are repHrted iy dr8 weight.
The sample size is repHrted iy wet weight.
6es2lts repHrted tHDb.
Whey repHrted, PFBS, PFRxS, PFOn ayd PFOS iycl2de AHth liyear ayd Arayched isHmers.
Oyl8 the liyear isHmer is repHrted fHr all Hther ayal8tes.

DATA QUALIFIERS & ABBREVIATIONS

B	**This compound was also detected in the method blank.**
D	**Dilution**
E	**The associated compound concentration exceeded the calibration range of the instrument.**
H	**Recovery and/or RPD was outside laboratory acceptance limits.**
I	**Chemical Interference**
J	**The amount detected is below the Reporting Limit/LOQ.**
M	**Estimated Maximum Possible Concentration. (CA Region 2 projects only)**
*****	**See Cover Letter**
Conc.	**Concentration**
NA	**Not applicable**
ND	**Not Detected**
TEQ	**Toxic Equivalency**

Unless otherwise noted, solid sample results are reported in dry weight. Tissue samples are reported in wet weight.

CERTIFICATIONS

Accrediting Authority	Certificate Number
Arkansas Department of Environmental Quality	17-015-0
California Department of Health – ELAP	2892
DoD ELAP - A2LA Accredited - ISO/IEC 17025:2005	3091.01
Florida Department of Health	E87777-18
Hawaii Department of Health	N/A
Louisiana Department of Environmental Quality	01977
Maine Department of Health	2016026
Minnesota Department of Health	1175673
Nevada Division of Environmental Protection	CA004132017-1
New Hampshire Environmental Accreditation Program	207716
New Jersey Department of Environmental Protection	CA003
New York Department of Health	11411
Oregon Laboratory Accreditation Program	4042-008
Pennsylvania Department of Environmental Protection	013
Texas Commission on Environmental Quality	T104704189-17-8
Virginia Department of General Services	8621
Washington Department of Ecology	C584
Wisconsin Department of Natural Resources	998036160

Current certificates and lists of licensed parameters are located in the Quality Assurance office and are available upon request.

NELAP Accredited Test Methods

MATRIX: Air	
Description of Test	**Method**
Determination of Polychlorinated p-Dioxins & Polychlorinated Dibenzofurans	EPA 23

MATRIX: Biological Tissue	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Drinking Water	
Description of Test	**Method**
2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD) GC/HRMS	EPA 1613
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537

MATRIX: Non-Potable Water	
Description of Test	**Method**
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613B
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Pesticides in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS	EPA 1699
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Dioxin by GC/HRMS	EPA 613
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

MATRIX: Solids	
Description of Test	**Method**
Tetra-Octa Chlorinated Dioxins and Furans by Isotope Dilution GC/HRMS	EPA 1613
Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope	EPA 1613B

Dilution GC/HRMS	
Brominated Diphenyl Ethers by HRGC/HRMS	EPA 1614A
Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by GC/HRMS	EPA 1668A/C
Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	EPA 537
Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by GC/HRMS	EPA 8280A/B
Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by GC/HRMS	EPA 8290/8290A

1700833 0.5°C

amec foster wheeler

Amec Foster Wheeler Environment & Infrastructure
271 Mill Road
Chelmsford, MA 01824
(978) 692-9090

SHIP TO:
Vista
1104 Windfield Way
El Dorado Hills, CA 95762
Atten: Martha Maier
Lab Phone# (916) 673-1520

CHAIN OF CUSTODY

DATE: 7/7/2017
COC #: BARNS170707A
PAGE: 1 OF 1

Project Name:	Phase I Regional SI - Barnes	Project Contact:	Denise King	Bill To: Amec Foster Wheeler Environment & Infrastructure	Disposal Instructions: LAB
Project Number:	**291330006**	Phone Number:	(978) 392-5339	9210 Sky Park Court Suite 200	Shipment Method: FEDEX
Project Manager:	Kerry Tull	Project Phase:	010	San Diego, CA 92123	Waybill Number: N/A

Sample Information | **Methods for Analysis** | **RUSH**

No.	Sample ID	Date & Time Sampled	Matrix	Sample Type	MS/MSD	Method 537.1 UCMR 3	24 Hour	48 Hour	72 Hour	5 Days	TOTAL BOTTLES	HOLD All Analyses
1	BARNS-05-SB01-062717-0-2	06/27/17 09:40	SO	N	N	X					1	
2	BARNS-04-SB02-062917-13-15	06/29/17 09:40	SO	N	N	X					1	
3	BARNS-04-SB02-062617-0-2	06/26/17 10:43	SO	N	N	X					1	
4	BARNS-01-SB02-062617-0-2	06/26/17 08:30	SO	N	N	X					1	
5	BARNS-01-SB01-062617-0-2	06/26/17 08:20	SO	N	N	X					1	
6	BARNS-04-SB03-062617-0-2	06/26/17 10:53	SO	N	N	X					1	
7	BARNS-07-SB02-062617-0-2	06/26/17 11:55	SO	N	N	X					1	
8												
9												
10												
11												
12												

Sampler's Signature:	**Date:**	**Time:**
Shawna Iacozzi - Amec Foster Wheeler	5-Jul-17	9:40
Relinquished By/Affiliation:	**Date:**	**Time:**
Shawna Iacozzi - Amec Foster Wheeler	5-Jul-17	9:45
Received By:	**Date:**	**Time:**
Via email Brett Bruedet	07/08/17	0714
Relinquished By/Affiliation:	**Date:**	**Time:**
Received By:	**Date:**	**Time:**
Relinquished By/Affiliation:	**Date:**	**Time:**
Received By (LAB):	**Date:**	**Time:**

For Lab Use

Does COC match samples:	Y or N
Broken Container:	Y or N
COC seal intact:	Y or N
Other problems:	Y or N
WSDOT contacted:	Y or N
Date contacted:	
Cooler Temperature at receipt:	°C

Comments:
X=Analyze H=Hold Analysis Request
Contract # W9133L-14-D-0002 TO0006
PO # F013200677
ATTN: Tammie Rippie
Base Lead: Todd Coffin
Field Lead: Craig.keating@amecfw.com

NUMBER OF COOLERS SENT:

Notes:
15-Day TAT requested.

Vista Analytical Laboratory

Sample Log-in Checklist

Vista Work Order #: 1700833 TAT Std

Samples Arrival:	Date/Time 7/6/17 0946	Initials: WMS	Location: WR-2 Shelf/Rack: N/a
Logged In:	Date/Time 07/06/17 1543	Initials: JBB	Location: WR-2 Shelf/Rack: E-7

Delivered By:	FedEx	UPS	On Trac	GSO	DHL	Hand Delivered	Other
Preservation:	Ice		Blue Ice		Dry Ice		None

Temp °C: 0.9	(uncorrected)	Time: 1009	Thermometer ID: IR-2
Temp °C: 0.5	(corrected)	Probe used: Yes☐ No☒	

	YES	NO	NA
Adequate Sample Volume Received?	✓		
Holding Time Acceptable?	✓		
Shipping Container(s) Intact?	✓		
Shipping Custody Seals Intact?	✓		
Shipping Documentation Present?	✓		
Airbill Trk # 8009 5563 6272	✓		
Sample Container Intact?	✓		
Sample Custody Seals Intact?			✓
Chain of Custody / Sample Documentation Present? 7/6/17 JBB	✓	✓	
COC Anomaly/Sample Acceptance Form completed?	✓		

If Chlorinated or Drinking Water Samples, Acceptable Preservation?						✓
Preservation Documented:	$Na_2S_2O_3$	Trizma	None		Yes	No	NA
Shipping Container	Vista	Client	Retain	Return		Dispose	

Comments:

Sample label ID	Date / Time
Barns-05-SB01-062717-00-02	06/27/17 0940
Barns-04-SB02-062917-13-15	06/29/17 0940
Barns-04-SB02-062617-00-02	06/26/17 1043
Barns-02-SB02-062617-00-02	06/26/17 0836
Barns-01-SB01-062617-00-02	06/2617 0820

Barns-04-SB03-062617-00-02	06/26/17	1053
Barns-07-SB02-062617-00-02	06/26/17	1155

Chain of Custody Anomaly/Sample Acceptance Form

Vista Analytical Laboratory

Client: AMEC Foster Wheeler
Contact: Denise King
Email: Denise.king@amecfw.com
Phone: (978) 392-5339

Workorder Number: 1700833
Date Received: 06-Jul-17 09:46
Documented by/date: B.Benedict 07/06/2017

Please review the following information and complete the Client Authorization section. To comply with NELAC regulations, we must receive authorization before proceeding with sample analysis.

Thank you,

Martha Maier
mmaier@vista-analytical.com
916-673-1520

The following information or item is needed to proceed with analysis:

- [X] Complete Chain-of-Custody
- [ ] Test Method Requested
- [ ] Analyte List Requested
- [ ] Other:
- [ ] Preservative
- [ ] Sample Identification
- [ ] Sample Collection Date and/or Time
- [ ] Collector's Name
- [ ] Sample Type
- [ ] Sample Location

The following anomalies were noted. Authorization is needed to proceed with analysis.

- [ ] Temperature outside < 6°C Range — Samples Affected: _____
  Temperature _____ °C Ice Present? Yes No Melted
- [ ] Sample ID Discrepancy
- [ ] Sample Holding Time Missed
- [ ] Custody Seals Broken
- [ ] Insufficient Sample Size
- [ ] Sample Container(s) Broken
- [ ] Incorrect Container Type

Comments:

Client Authorization

Proceed with Analysis: (YES) NO Signature and Date Kenneth Wepfer 7-10-17

Client Comments/Instructions A copy of the COC was provided via email on July 8, 2017.