Final

Perfluorinated Compound Investigation Status Report

Site 8, AT008, Fire Department Training Area 2 (NHDES Site No. 100330508) Former Pease Air Force Base Portsmouth, New Hampshire

Prepared for Air Force Civil Engineer Center
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Contract No. FA8903-09-D-8580, Task Order No. 0010
Project No. 143279
Revision 0
September 2016

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Performance-Based Remediation
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Perfluorinated Compound Investigation Status Report Certification, September 2016

I certify under penalty of law that this *Perfluorinated Compound Investigation Status Report, Site 8, AT008, Fire Department Training Area 2 (NHDES Site No. 100330508), Former Pease Air Force Base, Portsmouth, New Hampshire, Revision 0* was reviewed and prepared under the direct supervision of a professional geologist licensed in the state of New Hampshire as described herein and pursuant to the New Hampshire Department of Environmental Services Code of Administrative Rules, Chapter Env-Or 600, Contaminated Site Management, Section Env-Or 606.18(b). I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

09/13/2016

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Acronyms and Abbreviations

<	less than
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
2-D	two-dimensional
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film forming foam
AMEC	AMEC Environment & Infrastructure
amsl	above mean sea level
ATV	acoustic televiewer
bgs	below ground surface
CAS	Chemical Abstracts Service
CB&I	CB&I Federal Services LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSM	conceptual site model
DOD	U.S. Department of Defense
E. coli	*Escherichia coli*
EPA	U.S. Environmental Protection Agency
FDTA	Fire Department Training Area
gpm	gallons per minute
GT	glacial till
GWTS	groundwater treatment system
ID	inside diameter
IWQPP	Installation-Wide Quality Program Plan
JP-4	jet propulsion fuel No. 4
lb	pound
LNAPL	light nonaqueous phase liquid
LOQ	limit of quantitation
LS	lower sand
LTM	long-term monitoring
MCS	marine clay silt
MDL	method detection limit
NEBC	New England Boring Contractors
NGS	Northeast Geophysical Services
NHAGQS	New Hampshire Ambient Groundwater Quality Standards
NHDES	New Hampshire Department of Environmental Services
NTU	nephelometric turbidity units
OD	outside diameter
PDA	Pease Development Authority
PFC	perfluorinated compound
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate

Acronyms and Abbreviations (continued)

PHA	Provisional Health Advisory
Quality Systems Manual	*Quality Systems Manual for Environmental Laboratories, Version 5.0*
Shaw	Shaw Environmental & Infrastructure, Inc.
SVE	soil vapor extraction
U.S.	United States
US	upper sand
USGS	U.S. Geological Survey
VOC	volatile organic compound
WERC	Worldwide Environmental Restoration and Construction
Weston	Roy F. Weston, Inc.
Work Plan	Site 8 PFC Investigation Work Plan

1.0 INTRODUCTION

The Air Force Civil Engineer Center (AFCEC) has awarded CB&I Federal Services LLC (CB&I) a Performance-Based Task Order for firm fixed-price environmental restoration activities at the former Pease Air Force Base (AFB) in Portsmouth, New Hampshire (**Figure 1**) that is being conducted under the Worldwide Environmental Restoration and Construction (WERC) Contract No. FA8903-09-D-8580, Task Order No. 0010. Under the WERC contract, the AFCEC has requested that CB&I perform an investigation to delineate off-site migration of perfluorinated compounds (PFCs) at Site 8, AT008, Fire Department Training Area (FDTA) 2 (**Figures 1** and **2**). The work objectives conform to the *Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations* (United States [U.S.] Air Force, 2012).

On August 3, 2015, the U.S. Environmental Protection Agency (EPA) issued an Administrative Order under the Safe Drinking Water Act (Docket No. SDWA-01-2015-0061) that institutes requirements related to Site 8 PFC contamination and associated off-site and residential well impacts. However, the activities described in this status report were initiated before the Administrative Order went into effect and were performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1.1 Performance Objectives

The Site 8 PFC Investigation Work Plan (Work Plan; CB&I, 2015a) proposed investigation activities to help characterize PFC contamination at Site 8. The Work Plan summarized previous PFC sampling activities at Site 8 and listed two main performance objectives:

1. Determine if the Site 8 groundwater treatment system (GWTS) presents a migration pathway for perfluorooctanoic acid (PFOA)/perfluorooctane sulfonate (PFOS) release. Results and discussions of work completed pertaining to this objective can be found in the *Perfluorinated Compounds Results for the Fire Department Training Area 2, Site 8 (AT008) and the Burn Area 1, Site 22 (AB022)* letter report (CB&I, 2015b).

2. Define the boundaries and/or leading edge of the PFC plume downgradient of Site 8 by the installation of four off-site open borehole bedrock wells. Perform geophysical evaluation of the new wells to understand bedrock hydrology downgradient of Site 8 to help determine potential contaminant migration flow pathways. Activities and results related to the second performance objective are detailed in this *Perfluorinated Compound Investigation Status Report, Site 8, AT008, Fire Department Training Area 2.*

The investigation focused on the bedrock aquifer downgradient of Site 8, which is used for private water supply by residents of the town of Newington, New Hampshire. New bedrock wells 08-6722 through 08-6725 are sited downgradient from the outermost site or private residential well (RES17 located approximately 1,900 feet northeast of Site 8) with PFOA and/or PFOS concentrations above the EPA's Provisional Health Advisories (PHAs) (**Figure 3**). The locations of bedrock wells 08-6722 and 08-6723 were chosen to assess bedrock groundwater leaving Site 8 in northwest-trending fractures towards Watering Spring and to assess if Recharge Trench E (**Figures 3** and **4**) at the end of the runway may represent a migration pathway. The location of well 08-6724 was chosen in an attempt to intercept groundwater flow in fractured bedrock in the direction of residential wells (RES19, RES20, RES21, and RES22) on Fox Point Road and Coleman Drive, where PFOS and PFOA concentrations greater than one-tenth the PHA limits were measured in 2014. The location of well 08-6725 was chosen to delineate/bound the bedrock PFC plume downgradient of residential well RES17. One existing bedrock well (08-6046) was rehabilitated to provide additional downgradient PFC information.

The activities detailed in this status report are supplemented by the procedures and general work practices included in the Final Installation-Wide Quality Program Plan (IWQPP) (Shaw Environmental & Infrastructure, Inc. [Shaw], 2012), the Final Accident Prevention Plan (CB&I, 2014), and the *Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Compounds (PFCs) Sites,* Revision 1 (AMEC Environment & Infrastructure [AMEC], 2014). This work is being conducted under the WERC Contract No. FA8903-09-D-8580, Task Order No. 0010, issued to CB&I by the AFCEC, JBSA Lackland, Texas.

1.2 Report Organization

This status report is organized into the following sections:

- Section 1.0—Introduction
- Section 2.0—Field Investigation
- Section 3.0—Bedrock Hydrogeology Downgradient of Site 8
- Section 4.0—Summary, Conclusions, and Recommendations
- Section 5.0—References

1.3 Site 8 Description and History

The former Pease AFB is located in the town of Newington, the town of Greenland, and the city of Portsmouth in Rockingham County, New Hampshire. The former Pease AFB was historically used by the U.S. Air Force to maintain a combat-ready force capable of long-range bombardment operations. Various quantities of fuels, oils, lubricants, solvents, and protective coatings were used to support the missions, and as a result, contaminants from those substances were released into the environment.

The former Pease AFB was proposed for addition to the National Priorities List on July 14, 1989, and was added on February 21, 1990. This placed the former Pease AFB under the Federal Facilities provisions of Section 120 of CERCLA. On April 24, 1991, the U.S. Air Force, EPA, and the New Hampshire Department of Environmental Services (NHDES) signed a Federal Facility Agreement.

The Site 8 Groundwater Management Zone (**Figure 2**) is approximately 25 acres with the source area originally consisting of approximately 11 acres. This Groundwater Management Zone was established to monitor groundwater quality and treatment based on historic site activities and the natural groundwater flow.

Historical activities at Site 8 included an active fire training area from 1961 to 1988. The majority of fire training exercises were performed in a large circular pit located in the southeastern section of the site. Various aircraft crash scenarios were simulated using jet propulsion fuel No. 4 (JP-4) at this location. Prior to 1971, mixed waste oils, solvents, and fuels were also disposed of at this site. The pit was presaturated with water, and then the waste oils, solvents, and fuels were poured on top of the water and onto a mock aircraft. The practice of mixing waste oils and solvents with fuel for training fires ceased in the mid-1970s, and only JP-4 was used thereafter (Roy F. Weston [Weston], 1994).

In 1970, the U.S. Air Force began purchasing and using aqueous film forming foam (AFFF) containing PFCs with PFOA and PFOS for extinguishing petroleum fires and for use during firefighting training activities at the FDTAs (U.S. Air Force, 2012). PFCs are synthetic (man-made) chemicals that do not occur naturally in the environment. It was standard practice for the U.S. Air Force to use AFFF to extinguish fires during training exercises. AFFF contains PFCs, which makes the Site 8 FDTA the likely source area for PFCs.

As part of the AFCEC's ongoing efforts to evaluate for emerging contaminants, CB&I was contracted to evaluate for potential chemicals in groundwater that may have originated from Site 8. The emerging contaminants that were evaluated included PFOA and PFOS that are PFCs.

1.3.1 Site 8 PFC Sampling

There are no promulgated New Hampshire Ambient Groundwater Quality Standards (NHAGQS) or EPA Maximum Contaminant Levels for PFCs; therefore, EPA's PHAs (2009) are used to serve as an informal technical guidance to assist federal, state, and local officials in response to an urgent or rapidly developing drinking water contamination. The PHAs were developed to protect against potential risk from exposure to these chemicals through drinking water. The PHA values for PFOA and PFOS are 0.4 and 0.2 micrograms per liter (µg/L), respectively.

During June and September 2013, two rounds of sampling were conducted at a total of 21 locations to determine if PFOA and PFOS were present in groundwater at Site 8 and at a downgradient surface water location. The sample locations between the two sampling events included 13 overburden wells, 7 bedrock wells, and the GWTS effluent. One surface water sample was collected during the September sampling event only at Watering Spring (misidentified as Pickering Spring during sampling). 2013 sample locations are shown on **Figure 4**. Samples were analyzed for PFOA/PFOS according to EPA Method 537.1.

For the June 2013 sampling event, 19 locations were sampled including 11 overburden wells, 7 bedrock wells, and the GWTS effluent. Both PFOA and PFOS were detected in all samples collected. The PFOA and PFOS concentrations ranged from 0.0055 to 120 µg/L and 0.032 to 95 µg/L, respectively. The highest PFOA and PFOS concentrations were detected at wells that are screened in the overburden. The PFOA concentrations were above the PHA (0.4 µg/L) in 10 of the 11 overburden wells and 5 of 7 bedrock wells. The PFOS concentrations were above the PHA (0.2 µg/L) at all 11 overburden wells and 5 of 7 bedrock wells. The GWTS effluent was below the PHA for both PFOA and PFOS (**Figure 4**).

For the September 2013 sampling event, 21 locations were sampled including 12 overburden wells, 7 bedrock wells, the GWTS effluent, and Watering Spring. Again, both PFOA and PFOS were detected in all samples collected, but were at slightly lower concentrations than the June 2013 values. The PFOA and PFOS concentrations ranged from 0.0021 to 72 µg/L and 0.015 to 42 µg/L, respectively. The highest PFOA and PFOS concentrations were again also detected in overburden wells—08-563 and 08-5133, respectively. PFOA concentrations were above the PHA (0.4 µg/L) in 9 of 12 overburden wells, 5 of 7 bedrock wells, and Watering Spring. PFOS concentrations were above the PHA (0.2 µg/L) at 9 of 12 overburden wells, 6 of 7 bedrock wells, and Watering Spring. The GWTS effluent was again below the PHAs for PFOA and PFOS (**Figure 4**).

Additional investigations for PFCs in overburden and bedrock groundwater and surface water associated with Site 8 are currently being conducted in accordance with the

Administrative Order (EPA Docket No. SDWA-01-2015-0061; EPA, 2015). The results will be provided under separate cover in an Investigation Report.

1.3.2 Residential Well PFC Sampling

A separate effort is ongoing to determine the presence of PFCs in residential wells within an approximate 1-mile radius of the boundaries of the former Pease AFB by another AFCEC contractor. A total of 731 properties were located within the inventory area; however, interviews with the property owners indicated that only 39 of the properties utilized private wells for drinking water. Initial data indicate that PFCs are present in some of these wells and PFOS is above the current PHA (0.2 µg/L) in one residential well (RES17), located to the northeast approximately 2,800 feet from Site 8 (**Figure 3**).

1.4 Site Geology

The overburden beneath Site 8 consists of upper sand (US), marine clay silt (MCS), lower sand (LS), and glacial till (GT) (Weston, 1992). The four units identified at Site 8 are consistent with the geology located throughout the former Pease AFB. At Site 8, the unconsolidated sediments consist primarily of fine to silty sand with some thin discontinuous MCS seams and GT deposits. The MCS unit is not continuous and occurs locally in very limited areas. Where the MCS is absent, the US/LS contact is undifferentiated. Site overburden also includes more recent surficial materials that include marsh deposits and imported fill. Bedrock underlying the site consists primarily of metasedimentary rocks of the Eliot Formation, which contain calcareous, dark gray to dark green quartz/chlorite/sericite phyllite interbedded with sericite/chlorite quartzite. Diabase dikes occur throughout the bedrock as dark green to black, fine- to medium-grained, massive pyroxene/plagioclase diabase with traces of both pyrite and magnetite. Additional details of site geology can be found in the 1992 Site 8 Remedial Investigation Report (Weston, 1992). Additional information regarding bedrock fractures is discussed in Section 3.0.

1.5 Site Hydrogeology

A conceptual hydrogeologic model for Site 8 was presented in the site Alternatives Analysis (MWH Americas, Inc., 2005) and was based on site data and observations collected over an 8-year period. Salient points are summarized as follows:

- A north–northeast/south–southwest-trending bedrock trough controls the direction of overburden groundwater flow and the distribution of contaminants in the overburden at Site 8.
- Groundwater at Site 8 occurs in the overburden under unconfined (water table) conditions within the axis of the trough.

- Unsaturated conditions occur throughout the overburden at the western and southeastern limbs of the trough.
- Prior to the operation of the GWTS, overburden groundwater flowed along the axis of the bedrock trough and discharged to Pickering Brook to the northeast and to the bedrock along the western limb of the trough. A regional bedrock recharge zone existed east of the former burn pit where groundwater within the bedrock flowed approximately east to west across the burn pit and discharged to the headwaters of Knights Brook.
- 2013 overburden groundwater data suggest that the GWTS does not significantly affect the original groundwater flow direction, which is still to the north–northeast along the bedrock trough, and the GWTS does not appear to fully contain the groundwater leaving Site 8 to the north–northeast. No significant change in the overall potentiometric surface is observable during pumping and nonpumping conditions; however, mounding occurs in the areas of the recharge trenches and narrow cone of depressions form around the extraction wells when the GWTS is in operation (CB&I, 2015a).

Based on data collected from 1990 to 2007 (URS Group, Inc., 2007), the median elevation of the Site 8 water table surface is approximately 90 feet above mean sea level (amsl), which corresponds to approximately 25 feet below ground surface (bgs). Short-term low and high elevations of approximately 80 and 100 feet amsl, respectively, have been observed; however, the typical variation occurs over an approximately 3-foot range of 88 to 91 feet amsl. Under high water conditions, the water table occurs within the US/LS units. At low water, the water table occurs within the US/LS units, the GT unit, or the sand/GT interface.

Groundwater at Site 8 is present in both overburden and bedrock aquifers. Overburden flow is to the north–northeast following a bedrock trough with some discharge to Pickering Brook. The bedrock aquifer is used for water supply, although there is very limited data available on the construction of residential wells. **Figure 3** shows the regional bedrock potentiometric surface with data adopted from the U.S. Geological Survey (USGS, 2003a). Regionally, bedrock groundwater flow is radially away from the former Pease AFB towards the surrounding water bodies: Great Bay, Little Bay, and the Piscataqua River. Site 8 bedrock groundwater flows to the northwest towards Little Bay; however, it is likely that a portion of Site 8 bedrock groundwater already surfaces at Watering Spring and Knights Brook.

1.6 Conceptual Site Model

The existing Site 8 Conceptual Site Model (CSM) does not currently address PFCs; however, the data collected during this investigation, and from other ongoing investigations, will be used to update the CSM to include PFCs. Based on data obtained from historic site documents, the current Site 8 CSM has been summarized in previous historical documents as follows:

- Historical activities at the site resulted in releases of gasoline, jet fuel, waste oils, and solvents, along with AFFF used for fire suppression that contained PFCs.
- The source of the contamination came from pouring flammable chemicals over several burn pits located throughout the site with the largest source area being located on the southeastern section of the site.
- The contaminants of concern leached from the former burn pits to groundwater approximately 25 feet bgs. At the groundwater interface, the light nonaqueous phase liquid (LNAPL) pooled and diffused into groundwater.
- Both LNAPL and dissolved-phase contaminants migrated downgradient from the source area in a northern direction towards Great Bay.
- Volatile organic compound (VOC) contamination generally has been located around the groundwater interface area in both the LS and GT units. However, contamination historically has migrated as deep as 100 feet bgs in downgradient wells.
- Since 1995, the soil vapor extraction (SVE) system has removed over an estimated 205,000 pounds (lbs) of VOCs and an estimated 100,000 gallons of LNAPL.
- Based on SVE vapor concentrations and groundwater data, it appears that most of the VOCs in the unsaturated and saturated zones have been remediated with the possibility of more recalcitrant semivolatile organic compounds persisting in the saturated zone.

Environmental receptors downgradient (northeast to northwest) of Site 8 include seeps, creeks, wetlands, streams, and water wells. The operation of the GWTS at Site 8 with discharge of treated water to recharge trenches represents a potential migration pathway for PFCs, which are considered emerging contaminants that were not previously analyzed for in the GWTS effluent.

Because of an air sparge/SVE system and natural attenuation, the non-PFC contaminant concentrations have decreased significantly over time at Site 8. The decrease in contaminant concentrations is reflected in documented reductions in total contaminant recovery and in reduced concentrations in site wells. In 2013, an estimated total of 42 lbs of organic contaminant was removed from the subsurface, which is greatly reduced from approximately 150,000 lbs when contaminant removal was first implemented in 1996 (Shaw, 2013). Concentrations of VOCs and metals have been measured during long-term monitoring

(LTM) at the site. As of the 2013 sampling event, there are three wells with contaminants of concern concentrations above the NHAGQS. Additional information supplementing this CSM is discussed in Section 3.0.

2.0 FIELD INVESTIGATION

Discussion of the activities that were conducted for the 2015 investigation, including two-dimensional (2-D) electric resistivity logging, installation of four bedrock wells, geophysical logging, discrete interval groundwater sampling, and rehabilitation of bedrock well 08-6046, are presented in this section.

2.1 2-D Electrical Soil Resistivity Testing

Soil resistivity can be used to evaluate a 2-D portion of the subsurface; the resulting images can then be used to choose specific target locations of highest conductivity indicating a water-bearing zone within the subsurface. These zones likely have a greater bedrock fracture system that will help aid in choosing the optimal well placement.

Four open borehole bedrock wells (08-6722 through 08-6725) were installed downgradient of Site 8 during the 2015 investigation (**Figure 3**). Prior to drilling, three (08-6722, 08-6723, and 08-6724) of the four well locations were adjusted based on the results of 2-D electrical resistivity testing. Four 800-foot long 2-D resistivity lines were completed on May 18 and 19, 2015, by Northeast Geophysical Services (NGS) of Bangor, Maine. One 2-D resistivity line each was completed at locations 08-6722 and 08-6723 and two 2-D resistivity lines were completed at location 08-6724 (**Figure 3**).

NGS prepared an electrical resistivity survey report, which is provided in **Appendix A**. The electrical resistivity survey report includes more detailed views of the resistivity survey areas (Figures 1 and 2 in **Appendix A**). CB&I shared the resistivity data with AFCEC, EPA, and the NHDES and included their input before selecting the final well locations. **Figures 5** through **8** are adopted from the electrical resistivity survey report and show the modeled soil resistivity together with the selected drilling locations:

- The drilling location of well 08-6722 (located on Pease Development Authority property) was selected at 400 feet of Survey Line 1 based on the modeled low soil resistivity in that area, which might be indicative of a fracture zone (**Figure 5**).
- The drilling location of well 08-6723 (adjacent to the Newington Cemetery) was selected at 440 feet of Survey Line 2 based on the modeled low soil resistivity in that area, which might be indicative of a fracture zone (**Figure 6**). Initially, a drilling location at 420 feet of Survey Line 2 was discussed due to its close proximity to the likely fracture zone. However, the area at 420 feet on Survey Line 2 was not accessible for a drill rig due to mature trees, granite fence posts, and the location of graves.

- The drilling location of well 08-6724 (located next to the Newington Public School) was selected on the modeled soil resistivity of Survey Lines 3 (**Figure 7**) and 4 (**Figure 8**), which cross each other at an approximately 90-degree angle. **Figure 8** shows two possible fracture areas along Survey Line 4. The drilling location for 08-6724 was selected at 360 feet of Survey Line 4 at the more prominent of the two likely fracture zones. Survey Line 3 (**Figure 7**) also shows a possible fracture at the selected drilling location.

2.2 Utility Clearance/Property Access

All clearance activities were performed in accordance with Shaw Procedure No. EIG-HS-308, *Underground/Overhead Utility Contract Prevention*. Prior to equipment mobilization, the AFCEC coordinated property access for investigation locations 08-6722 through 08-6725. Before starting any intrusive work, CB&I coordinated and reviewed DigSafe® mark-outs and all locations were hand-cleared to a depth of 5 feet bgs to prevent any possible damage to unmarked utilities.

2.3 Open Borehole Bedrock Well Installation

Between June 22 and July 29, 2015, four bedrock boreholes (08-6722 through 08-6725) were drilled to define the boundaries and/or leading edge of the PFC plume downgradient of Site 8 and to evaluate contaminant migration within the bedrock aquifer. The drilling company was New England Boring Contractors (NEBC) of Derry, New Hampshire. Boring logs with soil/bedrock descriptions and well construction information are provided in **Appendix B**. Refer to **Figure 3** for the open bedrock well locations.

In boreholes 08-6722 through 08-6725, the top of bedrock was encountered at 69.5 feet bgs, 79.5 feet bgs, 8.5 feet bgs, and 18.5 feet bgs respectively. Steel casings were permanently installed approximately 2 to 7 feet into competent bedrock at each location. Competent bedrock was determined by the drilling contractor based on the downhole pressure required to advance the air hammer bit. Competent bedrock was encountered at boreholes 08-6722 through 08-6725 at 72 feet bgs, 82 feet bgs, 12.5 feet bgs, and 20.5 feet bgs respectively. A 5-inch inner diameter (ID) and 5.5 inch outer diameter (OD) casing was installed at well 08-6722, and the open hole section was completed with a 4.5-inch air hammer bit. NEBC had difficulties during the installation of the 08-6722 casing (5-inch ID/5.5-inch OD), which could only get lowered to a depth of 74 feet bgs into a 5-⅞–inch diameter rock socket extending to 79 feet bgs. Since NEBC did not have the capability to drill rock sockets larger than 5-⅞ inch, the decision was made to downsize the casing diameters and open hole section diameters for remaining wells 08-6723, 08-6724, and 08-6725. Those wells were completed with 4.25-inch ID (4.5-inch OD) steel casings and a 3-⅞–inch open hole section. Bedrock consisted of a dark gray metasediment with some quartzitic zones. Water-bearing zones and well construction information for each of the boreholes is summarized in **Exhibit 1**.

Exhibit 1
Open Borehole Well Summary

Well Identification	Drilling Observations	Well Construction
08-6722 (PDA Property)	Top of bedrock was encountered at 69.5 feet bgs. The zone from 69.5 to 140.5 feet bgs ranged from highly weathered to slightly weathered. The total flow out of the 74-to-140.5–foot section was approximately 50 gpm during air-lifting. Water-bearing zones were noted from 115.5 to 120.5 feet bgs (4 gpm), 120.5 to 125.5 feet bgs (10 gpm), 130.5 to 135.5 feet bgs (15 gpm), and 135.5 to 140.5 feet bgs (20 gpm).	Borehole consisted of a 4.5-inch open hole section from 74 to 140.5 feet bgs. Stopped drilling at depth due to rig limitations: flow out of borehole was not manageable during drilling and gravel pieces out of fracture zone were locking up air hammer.
08-6723 (Newington Cemetery)	Top of bedrock was encountered at 79.5 feet bgs. The zone from 79.5 to 108.5 feet bgs ranged from highly weathered to slightly weathered. The total flow out of the 88-to-108.5–foot section was approximately 50 gpm during air-lifting. Water-bearing zones were noted from 88 to 90 feet bgs (20 gpm) and from 93.5 to 94.5 feet bgs (30 gpm).	Borehole consisted of a 3-⅞ inch open hole section from 88 to 108.5 feet bgs. Per discussion with the NHDES and AFCEC, the borehole was stopped at 108.5 feet bgs. The concern was that potential PFCs out of the highly productive shallow bedrock zone (88 to 108.5 feet bgs) might get introduced into the deeper bedrock zones.
08-6724 (Newington Public School)	Top of bedrock was encountered at 8.5 feet bgs. The zone from 8.5 to 180.8 feet bgs ranged from highly weathered to fresh. The total flow out of the 19.2-to-180.8–foot section was approximately 30 gpm during air-lifting. Water-bearing zones were noted from 19.2 to 20 feet bgs (1 gpm), 35 to 40 feet bgs (1 gpm), 60 to 65 feet bgs (2 gpm), 65 to 70 feet bgs (2 gpm), 72 to 73 feet bgs (6 gpm), 75 to 80 feet bgs (3 gpm), 110 to 115 feet bgs (5 gpm), and 166 to 168 feet bgs (10 gpm).	Borehole consisted of 3-⅞ inch open hole section from 19.2 to 180.8 feet bgs. Stopped drilling at depth since maximum capacity of silt fence was met at 30 gpm.
08-6725 (Frizzell Property)	Top of bedrock was encountered at 18.5 feet bgs. The zone from 27.5 to 228 feet bgs ranged from highly weathered to fresh. The total flow out of the 18.5-to-228–foot section was approximately 50 gpm during air-lifting. Multiple low-producing (< 1 gpm) zones in the zone from 56.5 to 216.5 feet bgs produced a combined flow of 4 gpm. A productive fracture in the 221.5-to-226.5–foot zone produced an estimated 46 gpm.	Borehole consisted of a 3-⅞ inch open hole section from 27.5 to 228 feet bgs. Stopped drilling at depth since air hammer stopped advancing due to high water pressure and air compressor was overheating.

< denotes less than.

AFCEC denotes Air Force Civil Engineer Center.

bgs denotes below ground surface.

gpm denotes gallons per minute.

NHDES denotes New Hampshire Department of Environmental Services.

PDA denotes Pease Development Authority.

PFC denotes perfluorinated compound.

2.4 Well Development

Following drilling, each open borehole was developed via air lifting. An air compressor was used to inject air through the drill stem into the borehole to flush out water and suspended sediments. Well development was considered complete when the purged water was sediment free and turbidity readings of 5 to 10 nephelometric turbidity units (NTU) were recorded. The final turbidities of wells 08-6722, 08-6724, and 08-6725 were 9.2 NTU, 9.5 NTU, and 5.5 NTU respectively. The final turbidity of well 08-6723 (29 NTU) was above the 10-NTU goal; however, well development was considered complete since the water was visually clear and a total of 235 well volumes had been removed. Well development logs are provided in **Appendix C**.

2.5 Well Survey

The vertical and horizontal positions of the new open bedrock wells were professionally surveyed on October 18, 2015, by TFMoran of Bedford, New Hampshire. The well survey report is provided in **Appendix D**.

2.6 Geophysical Logging

From August 24 through 26, 2015, NGS conducted geophysical borehole logging of the open bedrock boreholes 08-6722 through 08-6725 to help identify and characterize hydraulically active bedrock fractures in the boreholes. Logging techniques included fluid temperature and fluid resistivity, three-arm caliper, heat pulse/flowmeter, and acoustic televiewer (ATV) imaging. A copy of the geophysical logging report is provided as **Appendix E**.

NGS identified multiple potential fractures in the boreholes and presented observations regarding which fractures are likely transmissive. **Table 1** lists both the transmissive zones encountered during drilling and the potentially transmissive zones identified during geophysical logging. The following is a summary of possible transmissive fracture zones based the ATV logging, inflections in the fluid resistivity and temperature logs, and measurable flow during heat pulse/flowmeter logging:

- **08-6722**—Bedrock well 08-6722 was constructed with approximately 66.5 feet of open borehole (74 to 140.5 feet bgs). Potentially transmissive fractures were identified in the zones from 74.5 to 75 feet bgs, 79 to 80 feet bgs, 88.5 to 95.5 feet bgs, 119 to 121.5 feet bgs, 130 to 131 feet bgs, and 134 to 138 feet bgs based on caliper log, fluid temperature, heat pulse flowmeter, and ATV (Plates A-1 and A-4, **Appendix E**). The largest caliper deflections were recorded from 119 to 121.5 feet bgs and from 134 to 138 feet bgs, which were also two of most transmissive zones encountered during drilling (**Table 1**). Based on the flowmeter measurements under pumping conditions, most of the water enters the borehole at these two zones and moves up the borehole. The ATV log shows that the two zones have fractures generally striking north-northeast and dip between 21 to 77 degrees to the west-northwest.

- **08-6723**—Bedrock well 08-6723 was constructed with approximately 20.5 feet of open borehole (88 to 108.5 feet bgs). Potentially transmissive fractures were identified at 88.5 to 89.5 feet bgs, at 94.4 feet bgs, at 97.5 feet bgs, and at 105.5 feet bgs based on caliper log, fluid temperature, heat pulse flowmeter, and ATV (Plates B-1 and B-4, **Appendix E**). During drilling, top of bedrock was encountered at 79.5 feet bgs, and the competent bedrock was estimated to be at 82 feet bgs. The shallow bedrock was fractured and transmissive as indicated by a 30-gallon per minute (gpm) flow rate of the 80.5 to 89 feet bgs zone during air-lifting. The flow rate increased to 40 gpm when reaching 92 feet bgs. The bottom of the permanent steel casing was set at 88 feet bgs to include a suspected fracture in the 89 to 92 foot zone. The caliper and ATV logs confirmed a fracture from approximately 88.5 to 89.5 feet bgs and second fracture at 94.4 feet bgs. The two zones produced 20 gpm and 30 gpm respectively during air-lifting (**Table 1**). The heat-pulse flowmeter indicated that the fractures at 97.5 and 105.5 feet bgs are not transmissive and that water in the borehole flows downward and exits the borehole through the fracture at 94.4 feet bgs. The ATV log shows that the two transmissive fractures at 88.5–89.5 feet and at 94.4 feet strike to the northeast and dip to the southeast at angles of 34 and 49 degrees respectively.

- **08-6724**—Bedrock well 08-6724 was constructed with approximately 161.6 feet of open borehole (19.2 to 180.8 feet bgs). Potentially transmissive fractures were identified at 19.2 feet bgs, 24 to 24.5 feet bgs, 35 to 35.5 feet bgs, 37 feet bgs, 64 to 64.5 feet bgs, 66 to 66.5 feet bgs, 113.5 feet bgs, 126.5 to 127 feet bgs, 129.5 feet bgs, 131 feet bgs, 157 to 164 feet bgs, 165.5 to 169 feet bgs, and 171 to 178 feet bgs based on caliper log, fluid temperature, heat pulse flowmeter, and ATV (Plates C-1 and C-4, **Appendix E**). Most of the productive zones encountered during drilling match up well with fractures identified during geophysical logging (**Table 1**). The ATV log shows that the most productive zone (approximately 10 gpm during air-lifting) from 165.5 to 169 feet bgs is comprised of five fractures striking north-northeast and dip to the west-northwest at angles between 30 and 67 degrees. In well 08-6724, NGS measured the highest fluid conductivity of the four wells with a median value of over 2,900 microsiemens per centimeter (µS/cm). Under ambient conditions, a strong downflow was measured with water entering the borehole just below the casing at 19.2 feet bgs. Additional water was entering the borehole between 35 and 37 feet and moved downwards. There was an abrupt increase in fluid conductivity and a temperature deflection at this depth. Water moves downwards in the borehole and exits the borehole through fractures at 66 feet and below. A possible explanation for the high conductivity in 08-6724 is that it is being affected by road salt or by septic water from a nearby school septic field located approximately 100 feet from the borehole. In order to assess potential septic water impacts, additional groundwater samples were collected (Section 2.8.3).

- **08-6725**—Bedrock well 08-6725 was constructed with approximately 200.5 feet of open borehole (27.5 to 228 feet bgs). Potentially transmissive fractures were identified at 28 to 28.5 feet bgs, 36 feet bgs, 40 to 43 feet bgs, 48 feet bgs, 63 feet bgs, 75.5 to 76.5 feet bgs, 80 feet bgs, 189.2 feet bgs, and 221.2 to 225.2 feet bgs based on caliper log, fluid temperature, heat pulse flowmeter, and ATV (Plates D-1 and D-4, **Appendix E**). The ambient heat-pulse flowmeter measurements in borehole 08-6725 showed strong downflow with water entering the borehole through fractures located between 28.5 and 63 feet. Water moves downward in the borehole, and most of the water exits the borehole through fractures located at the bottom of the borehole below 220 feet. The fluid conductivity in 08-6725 was third highest of the four boreholes logged with a median value of 1,045 µS/cm. In order to assess if road salt or septic water from the neighboring property is causing the elevated conductivity readings, additional groundwater samples were collected (Section 2.8.3). Two highly productive fractures near the borehole bottom produced approximately 46 gpm during air-lifting. Based on the ATV log, the fractures are located at 224.4 feet bgs and 225.2 feet bgs. The two fractures strike to the west-northwest and northwest and dip to the south-southwest and southwest at angles of 23 degrees and 19 degrees, respectively.

2.7 Rehabilitation of Open Borehole Bedrock Well 08-6046

Bedrock well 08-6046 (**Figure 3**) is located adjacent to the cemetery in the town of Newington and has historically been the northernmost well of the Site 8 monitoring network. Well 08-6046 was installed in 1992 with a 6-inch open hole section from 85 to 282 feet bgs. The ground elevation was 108.86 feet amsl, and bedrock was encountered at 65 feet bgs. The 08-6046 boring and well construction log (**Appendix F**) notes fractures from 145 to 150 feet bgs, a possibly larger fracture in the 155 to 160 feet bgs zone, and a possibly large fracture at 259 feet bgs.

Due to an obstruction in the well, groundwater samples have not been collected as part of the LTM program from well 08-6046 since 2007. Since VOCs were not detected in this well from 1998 through 2007, when the well was last sampled, it was recommended that well 08-6046 be abandoned and removed from the LTM program. In 2015, the NHDES asked that well 08-6046 be rehabilitated or replaced in order to use the well for monitoring of PFCs.

On August 18 and 19, 2015, NEBC performed rehabilitation activities of well 08-6046. It was determined that the well had been vandalized and an obstruction was gauged at 42.2 feet bgs. To clear the obstruction, a 3-⅞–inch diameter roller bit was lowered/drilled down the well while blowing compressed air out of the roller bit. NEBC drilled through the obstruction and cleaned out the well to its bottom at 282 feet bgs. The obstruction and materials in the well bottom included cobbles, gravel, tree branches, beer bottles, and polyethylene sample tubing. The borehole produced approximately 10 gpm during air-lifting. A potential fracture zone was noted from 159 to 164 feet bgs during air-lifting as indicated by a flow increase to 5 gpm and brown water indicative of silt/clay being washed out of a fracture zone. A total of 1,400 gallons were flushed out of well 08-6046, and the water was clear with a turbidity of 43.1 NTU at the end of re-development. The re-development log is included in **Appendix C**.

2.8 Groundwater Sample Collection and Analysis

Groundwater sampling activities for PFCs and other parameters are described in Sections 2.8.1 through 2.8.3. All groundwater samples were collected according to AMEC field sampling protocols (AMEC, 2014). All PFC groundwater samples were submitted to ALS Environmental in Kelso, Washington, for analysis of PFOA, PFOS, and nine other PFCs using liquid chromatography/tandem mass spectrometry (summarized in **Exhibit 2**). This method provides a limit of quantitation of 0.005 µg/L for all 11 analytes to meet the current PHAs. CB&I validated 100 percent of the data for each sample matrix using validation criteria from the *DoD Quality Systems Manual for Environmental Laboratories, Version 5.0* (Quality Systems Manual; U.S. Department of Defense [DOD], 2013). The quality control criteria and control limit values specified in the Final IWQPP (Shaw, 2012) and Appendix F of the Quality Systems Manual (DOD, 2013) will be used as the validation criteria. The Data Quality Summary Report is provided in **Appendix G**.

Exhibit 2
Summary of Analyzed PFC Compounds

Parameter Name	CAS No.	EPA PHAs (µg/L)	LOQ (µg/L)	MDL (µg/L)
Perfluorooctanoic Acid (PFOA)	335-67-1	0.4	0.005	0.002
Perfluorooctane Sulfonate (PFOS)	45298-90-6	0.2	0.005	0.0007
Perfluoropentanoic Acid	2706-90-3	-	0.005	0.0009
Perfluorobutane Sulfonate	45187-15-3	-	0.005	0.0008
Perfluorohexanoic Acid	307-24-4	-	0.005	0.0007
Perfluoroheptanoic Acid	375-85-9	-	0.005	0.001
Perfluorohexane Sulfonate	10827-53-8	-	0.005	0.0007
Perfluorononanoic Acid	375-95-1	-	0.005	0.002
Perfluorodecanoic Acid	335-76-2	-	0.005	0.001
Perfluoroundecanoic Acid	2058-94-8	-	0.005	0.002
Perfluorododecanoic Acid	307-55-1	-	0.005	0.003

- denotes not applicable.
µg/L denotes micrograms per liter.
CAS denotes Chemical Abstracts Service.
EPA denotes U.S. Environmental Protection Agency.
LOQ denotes limit of quantitation.
MDL denotes method detection limit.
PHA denotes Provisional Health Advisory.

2.8.1 Discrete Interval PFC Groundwater Sampling

Based on the geophysical logging results and drilling observations, fractures were identified for discrete interval groundwater sampling. The results of the geophysical logging and proposed sample zones were shared with AFCEC and the NHDES, and their input was used to update proposed sample zones. The zones proposed for groundwater PFC sampling are listed in **Table 1**. Since well 08-6723 has only 20.5 feet of open borehole, it was decided not to use packers in this well and instead collect a single sample from the entire borehole, as described in Section 2.8.2.

NGS conducted packer sampling of wells 08-6722, 08-6724, and 08-6725 from October 6 through October 9, 2015, with oversight by a CB&I geologist. The selected intervals were isolated by use of a straddle packer assembly to allow for sampling of groundwater from discrete fractures without mixing of groundwater from other fractures in the same borehole. The packer assembly consisted of two inflatable rubber packers placed at each end of a 1-⅜–inch diameter perforated steel pipe. After the packer assembly was placed in the borehole, the rubber packers were inflated with nitrogen gas to seal off the select interval for sampling. NGS had to adjust multiple packer sampling zones slightly in order to center the straddle-packers over fractures or to avoid damaging the packers (e.g. the packer might rupture when inflated on the edge of a fracture or on the edge of permanent casing). A comparison of proposed sample zones versus actual sample zones is provided in **Table 1**.

A stainless steel submersible pump (model: Geotech Geosub) and polyethylene tubing was used for purging and sample collection. During purging, water level readings were collected both inside and outside the packer riser pipe to confirm the packer seal. The water levels were generally stable indicating a good packer seal with the exception of the sample zones at 08-6722 and the 218-to-228–foot bgs zone at 08-6725, which showed some changing water levels in the zone above the packer. NGS confirmed that the packer was firmly seated against the borehole and indicated that interconnected fractures are likely the reason for the water level fluctuations. Three casing volumes were purged before PFC groundwater samples were collected from each of the packer zones. Groundwater sample collection and purge logs are provided in **Appendix H**. PFC analytical results are presented on **Figure 9** and summarized in **Table 2** and below:

- **08-6722**—PFOA and PFOS were detected above their respective PHA values of 0.4 µg/L and 0.2 µg/L in all four sampled bedrock zones with the exception of PFOA in the deepest sample zone (128 to 140.5 feet bgs). PFOA concentrations were 0.96 µg/L, 0.66 µg/L, and 0.47 µg/L for sample zones 74 to 84 feet bgs, 88 to 98 feet bgs, and 115.5 to 125.5 feet bgs, respectively. The PFOA concentration of 0.3 µg/L at 128 to 140.5 feet bgs was just below the PHA limit. PFOS concentrations were 2.8 µg/L, 2.3 µg/L, 1.6 µg/L, and 0.89 µg/L for sample zones 74 to 84 feet bgs, 88 to 98 feet bgs, 115.5 to 125.5 feet bgs, and 128 to 140.5 feet bgs, respectively.
- **08-6724**—PFOA and PFOS were detected below their respective PHA values of 0.4 µg/L and 0.2 µg/L in all four sampled bedrock zones. PFOA concentrations were 0.032 µg/L, 0.02 µg/L, 0.034 µg/L, and 0.029 µg/L for sample zones 17 to 27 feet bgs, 60 to 70 feet bgs, 110 to 120 feet bgs, and 160 to 170 feet bgs, respectively. PFOS concentrations were 0.013 µg/L, 0.024 µg/L, 0.018 µg/L, and 0.016 µg/L for sample zones 17 to 27 feet bgs, 60 to 70 feet bgs, 110 to 120 feet bgs, and 160 to 170 feet bgs, respectively.
- **08-6725**—PFOA and PFOS were detected below their respective PHA values of 0.4 µg/L and 0.2 µg/L in both sampled bedrock zones. In the sample taken from 27.5 to 37.5 feet bgs, PFOA and PFOS were detected at concentrations of 0.014 µg/L and 0.038 µg/L, respectively. In the sample taken from 218 to 228 feet bgs, PFOA was detected at 0.018 µg/L in both parent and duplicate sample and PFOS was detected at 0.055 µg/L in the parent sample and 0.058 µg/L in the duplicate sample.

2.8.2 Low-Flow PFC Groundwater Sampling

On October 14, 2015, one groundwater sample each was collected for PFC analysis from wells 08-6723 and 08-6046 via low-flow methods. Newly installed well 08-6723 has an open borehole from 88 to 108.5 feet bgs, and the pump intake was lowered to 93 feet bgs for sample collection. As discussed in Section 2.7, well 08-6046 was rehabilitated on August 19, 2015. The pump intake at this well location was placed at 160 feet bgs, which is consistent with the historic LTM sample depth for this well. In addition, a transmissive fracture is indicated at this depth based on the boring log (**Appendix F**) and observations made during well rehabilitation. Groundwater sample collection and purge logs are provided in **Appendix H**. PFC analytical results are presented on **Figure 9** and summarized in **Table 2** and below:

- **08-6046** (sample depth: 160 feet bgs)—PFOA was detected below the PHA limit (0.4 µg/L) at 0.0061 µg/L in the parent sample and 0.0069 µg/L in the duplicate sample. PFOS was detected below the PHA limit (0.2 µg/L) at 0.025 µg/L in the parent sample and 0.028 µg/L in the duplicate sample.
- **08-6723** (sample depth: 93 feet bgs)—PFOA and PFOS were detected above PHA values (0.4 µg/L and 0.2 µg/L) with concentrations of 1.5 µg/L and 3.7 µg/L, respectively.

2.8.3 Coliform Groundwater Sampling

During borehole geophysical logging conducted in August 2015 (Section 2.6), elevated groundwater electric conductivities were measured in boreholes 08-6724 and 08-6725. The electric conductivities in 08-6724 and 08-6725 (2,900 µS/cm and 1,045 µS/cm, respectively) were higher than the electric conductivities in boreholes 08-6722 and 08-6723 (296 µS/cm and 726 µS/cm, respectively). In well 08-6724, water was entering the borehole at a fracture in between 35 and 37 feet bgs and moved downwards. There was an abrupt increase in fluid conductivity and a temperature deflection at this depth. Possible causes for the increased conductivity in wells 08-6724 and 08-6725 include road salt and septic water from close-by leach fields. On October 19, 2015, two groundwater grab sample were collected from each well, 08-6724 and 08-6725, in order to investigate the nature of the elevated conductivity readings.

At well 08-6724, one sample was collected at 24 feet bgs (approximately 5 feet below the permanent casing bottom) and at 169 feet bgs (approximately 12 feet above the well bottom). At well 08-6725, one sample was collected at 32.5 feet bgs (approximately 5 feet below the permanent casing bottom) and at 223 feet bgs (approximately 5 feet above the well bottom). A peristaltic pump and polyethylene tubing were used for purging and sample collection. Water was purged until clear (turbidity smaller than 5 NTU) prior to sample collection.

Groundwater samples were submitted to Seacoast Analytical Services in Lee, New Hampshire, for analysis of fluoride, chloride, nitrite, nitrate, pH, hardness, sodium, iron, manganese, copper, lead, arsenic, total coliform bacteria, and *Escherichia coli* (*E. coli*) bacteria. Groundwater sample collection logs and purge logs are provided in **Appendix H**. Groundwater analytical results are presented in **Appendix I**.

All four samples tested positive for the presence of total coliform bacteria. No *E. coli* bacteria were detected in any of the samples. The samples from well 08-6724 were high in sodium and chloride. Based on this information alone, it is difficult to determine if infiltration from leach fields is the cause of the coliform bacteria detections.

Two NHDES fact sheets (**Appendix J**) provide information regarding coliform bacteria in groundwater:

- *Fact Sheet WD-DWGB-4-1, Interpreting the Presence of Coliform Bacteria in Drinking Water* (NHDES, 2010a)
- *Fact Sheet WD-DWGB-4-2, Causes of Positive Bacteria Results in Water Samples* (NHDES, 2010b)

The fact sheets state the following:

- The total coliform test is considered an indicator, since the presence of bacteria in this group presents the possibility, but not the certainty, that disease organisms may be present in the water (NHDES, 2010a).
- *E. coli* is a species within the fecal coliform group. *E. coli* originate only in the intestines of animals including humans. As with other fecal coliform, they have a relative short life span compared to non-fecal coliform bacteria. Their presence indicates a strong likelihood that human or animal wastes are entering the water system (NHDES, 2010a).
- Total coliform bacteria are prolific in the soil. Their presence does not necessarily imply contamination from wastewater nor the presence of other sanitation-based risks. The presence of total coliform bacteria by itself does not imply an imminent health risk but does indicate the need for analysis of all water system facilities and their operations to determine how these organisms entered the water system (NHDES, 2010a).
- Outside the host, coliform bacteria die off quickly, typically within 30 days. Therefore, if coliform bacteria are identified in a well over a long period of time, it is presumed that bacteria are continuously entering the well (NHDES, 2010b).

- Poor well construction is by far the most common explanation for bacteria in water samples from wells. Drilling a new well can also create localized short-term bacterial contamination of bedrock fractures (NHDES, 2010b).
- In many cases, errors (e.g., poor sampling practice, old/contaminated sample bottles) creating positive bacterial results can be differentiated from those bacteria attributed to poor well construction and/or poor soil filtration by taking additional bacterial samples. Errors will not likely be repeated, whereas real construction or filtration problems will show either a constant or highly irregular presence of bacteria (NHDES, 2010b).

Based on the available data, it appears that the total coliform detections in well 08-6724 and 08-6725 could have different causes:

1. Coliform bacteria contamination during sampling. Resampling the wells might produce results without coliform bacteria.
2. Coliform bacteria were introduced to the borehole during drilling and/or geophysical logging. Resampling the wells may produce results without coliform bacteria, since coliform bacteria typically die off within 30 days.
3. Coliform bacteria may be continuously entering the borehole from the overburden and/or leach field. Overburden groundwater might be entering the borehole through the shallow fractured bedrock or along the well casing. The coliform bacteria could be originating from overburden soils and/or sewage water. Bacteria levels should be consistently present in the wells for this scenario. The highest conductivity was measured at well 08-6724 at a fracture in between 35 and 37 feet bgs, which speaks against a poorly constructed well casing. Resampling might provide helpful information.

2.9 Decontamination of Equipment and Supplies

All field cleaning and decontamination of equipment was conducted in accordance with the standard operating procedures presented in Appendix E of the Final IWQPP (Shaw, 2012) and AMEC's *Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Compounds (PFC) Sites*, Revision 1 (2014). Heavy equipment including drill rig, drill pipes, and packers with associated piping were steam cleaned and allowed to air dry. Smaller equipment, including water level indicators and geophysical logging tools, were cleaned using Liquinox and/or potable water rinses followed by a rinse with PFC-free deionized water.

2.10 Investigation-Derived Waste Management and Disposal

Investigation-derived waste generated during drilling included noncontaminated soil and water (purge and decontamination). Soil cuttings were screened using a photoionization detector as documented on the boring logs (**Appendix B**). All soil photoionization detector readings were non-detected results of 0.0 parts per million by volume, and the drill cuttings were distributed onto the ground surface at either the well location or Site 8. Water generated during well development was discharged to the ground. Decontamination water and water from groundwater sampling activities was containerized in portable tanks and transferred to the Site 8 GWTS for disposal/treatment.

2.11 Site Restoration

The ground surface at well locations 08-6722 through 08-6725 was restored to its original condition once drilling was completed. Restoration activities included minor soil regrading and reseeding of grass.

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3.0 BEDROCK HYDROGEOLOGY DOWNGRADIENT OF SITE 8

This section supplements the existing CSM (Section 1.6) with observations made during the 2015 PFC investigation and provides an updated interpretation of the hydrogeology downgradient of Site 8 (Section 1.5).

3.1 Orientation of Bedrock Fractures

The existing CSM describes overburden groundwater flow to the northeast along a bedrock trough. Groundwater enters the bedrock along the western limb of the trough where groundwater flow continues along northwest-striking fractures towards Knights Brook. A dominant northeast-striking fracture corridor underlying Site 8 was noted in a USGS report prepared for EPA entitled *Geophysical Characterization of Fractured Bedrock at Site 8* (USGS, 2003b). The report concluded that fracture-correlated lineaments and regional structure correlation may indicate the presence of regional northeast-southwest anisotropy to the fractured rock. The report also discusses two wells (08-636A and 08-6022) in the northern half of Site 8 where the fractures contributing the majority of the yield are northeast-striking. The 2015 PFC investigation data confirmed a dominant northeast-striking fracture set and found evidence of a second set of northwest striking fractures:

- In borehole 08-6722, three transmissive fractures in between 122.1 to 138.3 feet bgs produce the majority of the yield (45 gpm) and strike northeast with dip angles of 21 to 77 degrees to the northwest. A set of low-yielding fractures in the shallower bedrock from 75 to 95 feet bgs strikes predominantly northwest (Plate A-1, Plate A-2, and Table A-1 in **Appendix E**).
- In borehole 08-6723, two transmissive fractures at 88.5–89.5 feet (20 gpm) and at 94.4 feet bgs (30 gpm) strike northeast and dip to the southeast at angles of 34 and 49 degrees respectively. One probable low-yielding fracture is located at 99.8 feet bgs and strikes northwest and dips 41 degrees to the southwest (Plate B-1, Plate B-2, and Table B-1 in **Appendix E**). Since 08-6723 is located northeast of 08-6722, it could be possible that the two northeast-striking fracture sets in the two boreholes are hydraulically connected (**Figure 10**).
- In borehole 08-6724, almost all fractures strike northeast including the most productive zone (10 gpm) from 165.5 to 169 feet bgs, which is comprised of five fractures striking north-northeast with dip to the west-northwest at angles between 30 and 67 degrees (Plate C-1, Plate C-2, and Table C-1 in **Appendix E**).

- In borehole 08-6725, the predominant fracture orientation is northeast-southwest parallel to Pickering Brook. The exceptions are two highly productive fractures (combined 46 gpm) near the borehole bottom at 224.4 feet bgs and 225.2 feet bgs, which strike to the west-northwest and northwest and dip to the south-southwest and southwest at angles of 23 and 19 degrees, respectively (Plate D-1, Plate D-2, and Table D-1 in **Appendix E**).

Strike and dip directions of the highest yielding fracture zones in boreholes 08-6722 through 08-6725 are displayed on **Figure 10**.

3.2 Contaminant Migration Flow Pathways

The 2015 PFC investigation was focused on the bedrock aquifer, which is likely the main pathway for PFCs northeast of the bedrock trough located along the northern Site 8 boundary. According to the current CSM, the majority of Site 8 overburden groundwater is leaving Site 8 through the bedrock trough in the north where a portion of the groundwater is believed to enter northwest-striking fractures. Data collected during the 2015 PFC investigation and historical geophysical information confirmed two main sets of fractures, one striking to the northeast and one striking to the northwest. Overburden groundwater enters the bedrock aquifer already in the area of the Site 8 air sparge/SVE field, as indicated by PFC concentrations above PHA limits in well 08-623 (**Figure 4**). Bedrock groundwater travels both along northeast-striking fractures and northwest-striking fractures:

- Northeast-trending fractures parallel to the bedrock trough channel some bedrock groundwater to the northeast towards Pickering Brook, as indicated by transmissive northeast striking fractures observed in wells 08-6022 and 08-636A north of Site 8 (USGS, 2003b), which were above EPA PHA limits in 2013 (**Figure 4**). During the 2015 PFC investigation, numerous lower-yielding northeast-striking fractures were detected in bedrock well 08-6725, which is located right next to Pickering Brook. A 2014 detection of PFOS above the PHA limit in residential bedrock well RES17 is along this likely flow path (**Figure 10**).
- Northwest-trending fractures channel some bedrock groundwater to the northwest towards Knights Brook, as indicated by PFCs detected above PHA limits (Watering Spring, 08-6722, and 08-6723) and northwest-striking fractures detected in borehole 08-6722 and 08-6723. The northwest-striking fractures in those two boreholes have low yields, and it is likely that additional (potentially higher yielding) northwest-striking fractures are present in between wells 08-6722/08-6723 and Site 8. None of the higher-yielding fractures detected in well 08-6722 are oriented northwest-southeast towards Recharge Trench E, which could indicate that the PFC

contamination in well 08-6722 might have traveled in northwest-trending fractures located north of Recharge Trench E, before intersecting the fractures in well 08-6722.

3.3 Bedrock PFC Plume

An approximation of the Site 8 bedrock PFC plume boundaries is provided on **Figure 10**. The boundaries are based on the results that were provided herein as part of the 2015 PFC investigation. The leading edge of the plume appears to be in between RES06 and well 08-6722 in the east, might be at or around the area of Watering Spring to the northwest, appears to be bound in the north by well 08-6046 and RES02, and appears to be in between RES17 and well 08-6725 in the northeast. A productive fracture zone with PFCs above PHA limits in borehole 08-6723 is striking northeast and dipping to the southeast does not intersect the nearby 08-6046 borehole. It is possible that one or more northwest-striking fractures are located in between wells 08-6722 and 08-6723 and discharge into Watering Springs and Knights Brook. The 2015 PFC investigation was focused on the bedrock aquifer with residential wells towards the west, northwest, north, and northeast. Therefore, only limited information is available to refine the plume boundary towards the southwest, south, southeast and east of Site 8.

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4.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This section summarizes results of the 2015 PFC investigation that was conducted to delineate off-site migration of PFCs at Site 8 and provides the conclusions and recommendations for the further evaluation of PFCs that may be associated with the historical activities at Site 8.

4.1 Summary

Following 2-D soil resistivity testing in May 2015, four bedrock wells (08-6722 through 08-6725) were installed north of Site 8 to assess PFCs in bedrock downgradient of Site 8.

Downhole geophysical logging was completed at all four boreholes. Geophysical logging identified multiple fractures per borehole. The majority of fractures strike to the northeast. A secondary set of fractures strikes to the northwest.

Groundwater from different fracture zones within each borehole was collected for PFC analysis utilizing packers or low-flow technique (well 08-6723). In addition, historic well 08-6046 was rehabilitated and sampled via low-flow technique. Only the groundwater samples from bedrock well 08-6722 and the groundwater sample from bedrock well 08-6723 were above PHA limits for PFOA and PFOS. PFC concentrations were decreasing with sample depth in well 08-6722, which had a upward gradient within the borehole.

Groundwater samples for coliform bacteria and general water chemistry were collected from wells 08-6724 and 08-6725 to assess potential causes (e.g., road salt, sewage water) of elevated groundwater conductivity readings. All groundwater samples indicated the presence of total coliform bacteria, and the samples from well 08-6724 were also high in sodium and chloride. *E. coli* bacteria were absent in all samples.

4.2 Conclusions

The following statements can be made based on the results of the 2015 PFC investigation:

- Bedrock groundwater flow north of Site 8 is primarily along the orientation of northeast-striking and northwest-striking fracture sets.
- The bedrock PFC groundwater plume extends to the northeast to the headwaters of Pickering Brook, but is bound by well 08-6725. The plume extends to the northwest past wells 08-6722 and 08-6723 to the headwaters of Knights Brook (**Figure 10**). The bedrock PFC groundwater plume is not fully delineated and may extend further to the northwest (east of Watering Springs). Northeast-striking fractures in 08-6722 may also allow PFC-impacted groundwater to travel to the southwest. Additionally, the

plume has not been delineated towards the southwest, south, southeast, and east, which was not an objective of this field investigation.

- Due to the absence of high-yielding northwest-striking fractures in well 08-6722, it is unlikely that Recharge Trench E is the primary migration pathway for PFC-impacted bedrock groundwater in between Site 8 and Watering Spring.
- PFOS and PFOA concentrations in well 08-6724 are just below one-tenth of their respective PHA limits, with the exception of one PFOS detection (0.024 µg/L) just above one-tenth the PHA limit in the 60-to-70–foot bgs sample. This indicates that the fracture(s) carrying PFCs toward residential wells RES19 through RES22 was not intercepted in the 08-6724 borehole. A highly productive fracture zone at approximately 225 feet bgs in borehole 08-6725 strikes to the west-northwest (224.4 feet bgs fracture) and northwest (225.2 feet bgs fracture) with PFC concentrations (PFOS: 0.058 µg/L, PFOA: 0.018 µg/L) similar to the concentrations in RES19 through RES22 (2014: PFOS up to 0.089 µg/L and PFOA up to 0.06 µg/L). The fractures run approximately parallel to Fox Point Road and could potentially channel groundwater with PFC concentrations below PHA limits towards residential wells RES19 through RES22.
- It is uncertain if sewage water from leach fields has caused elevated groundwater conductivity readings in wells 08-6724 and 08-6725, since no *E. coli* bacteria were detected in 2015 groundwater samples. The presence of total coliform bacteria does not necessarily imply contamination from wastewater nor the presence of other sanitation-based risks. Water with high conductivity is entering the 08-6724 borehole at a fracture zone from 35 to 37 feet bgs, which indicates that a poorly constructed well casing is not the reason for elevated conductivities in that well.

4.3 Recommendations

Based on the results of the 2016 PFC investigation and the conclusions that were made, the following recommendations are provided for further evaluation of PFCs associated with the historical activities at Site 8:

- Install two additional bedrock wells (08-6726 and 08-6727) as shown on **Figure 10**. Follow the same methodology (2-D resistivity logging, well installation, geophysical logging, packer sampling) used for wells 08-6722 through 08-6725. Wells 08-6726 and 08-6727 will further refine the bedrock groundwater PFC plume boundary towards the northwest and west. Select the final 08-6726 boring location based on the results of 2-D soil resistivity line oriented northeast to southwest, which could identify northwest-striking fractures. Select the final 08-6727 boring location based on the results of 2-D soil resistivity line oriented northwest to southeast, which could identify northeast-striking fractures extending towards 08-6722.

- Sample existing bedrock wells west, south, and east of Site 8 for PFCs to refine the bedrock PFC plume boundary.
- Sample all available overburden monitoring wells in the area of wells 08-6722 and 08-6723 to assess the overburden PFC migration pathway in those areas.
- Resample wells 08-6724 and 08-6725 for total coliform bacteria and *E. coli* bacteria. If total coliform bacteria persist in the wells, meet with NHDES to discuss if a health risk is present and if further steps are required.

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5.0 REFERENCES

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Figures

Site 8 Boundary

Former AFB Boundary

N

0 1,000 2,000 4,000 Feet

PROJECTION: NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet

U.S. AIR FORCE

SITE 8 PFC INVESTIGATION STATUS REPORT

FIGURE NUMBER 1

LOCATION MAP
SITE 8
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

G:\Pease_AFB\GIS_Documents\Project_Maps\PFC\Site_8\Jan2016\Pease_Site08_PFC_001_Loc_Map.mxd; Date: 1/22/2016 9:39:26 AM

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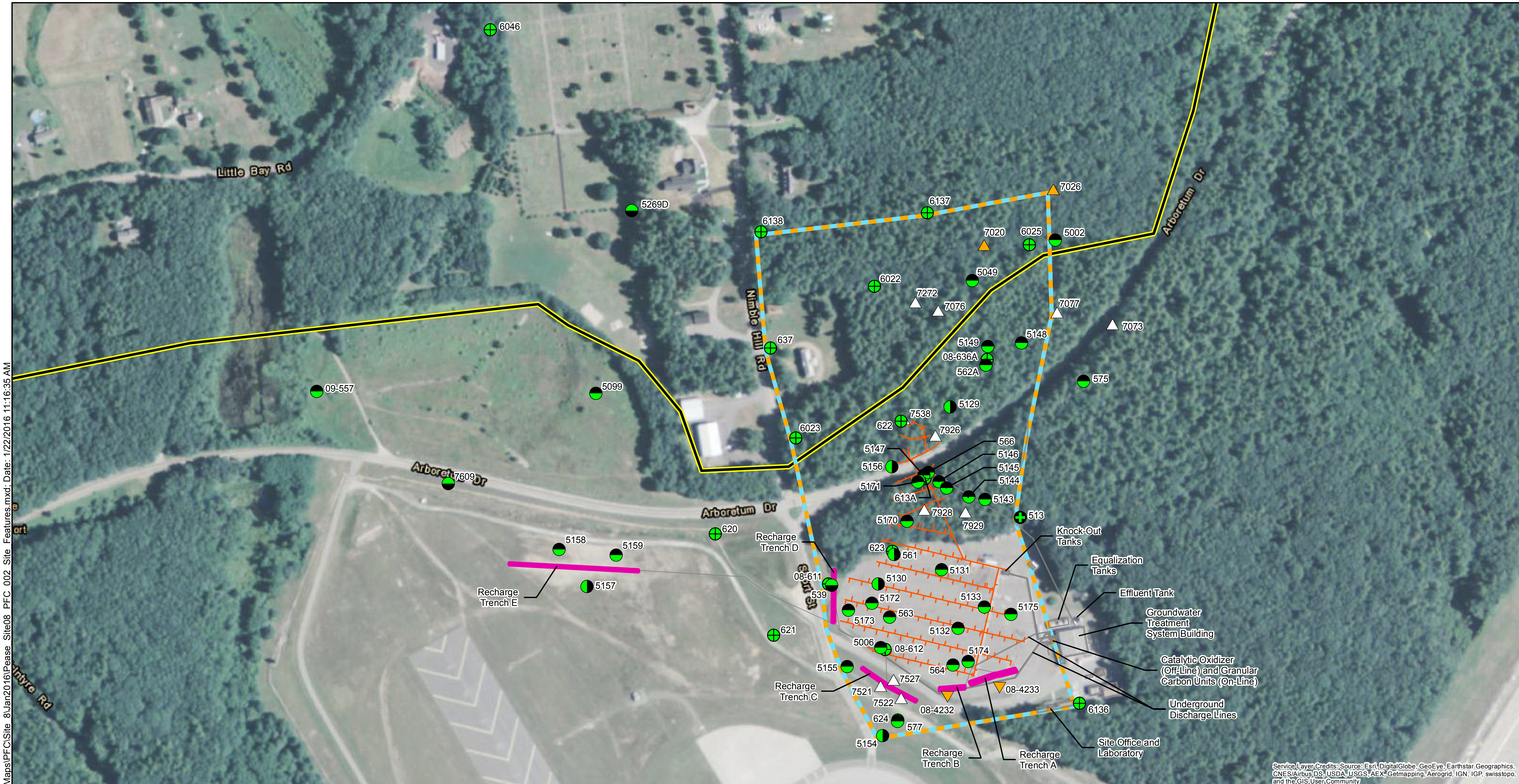

- Former Air Force Base Boundary
- Site 8 GMZ Boundary
- SVE System Piping
- Recharge Trench
- Upper Sand Overburden Well
- Lower Sand Overburden Well
- Hybrid Well
- Bedrock Well
- Fractured Bedrock Well
- Overburden Piezometer
- Upper Sand Overburden Piezometer
- Lower Sand Overburden Piezometer

Notes:
1) GMZ = Groundwater Management Zone

N

Pease AFB
NH

0 300 600 Feet

Projection : NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet

U.S. AIR FORCE

SITE 8 PFC INVESTIGATION STATUS REPORT

FIGURE NUMBER 2

SITE FEATURES
SITE 8
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE

CBI

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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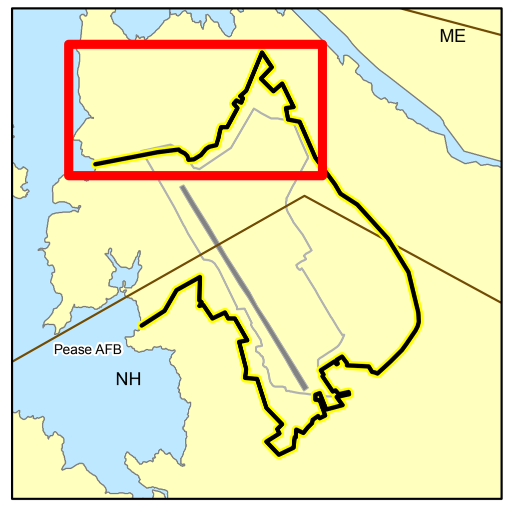
Legend

- Surface Water/Sediment Sample Location
- Surface Water Sample Location
- Overburden Wells
- Upper Sand Overburden Wells
- Shallow Overburden Wells
- Bedrock Wells
- Hybrid Wells
- New Bedrock Wells (surveyed locations)

Private Supply Well (Approx. Location)

- Below Provisional Health Advisory for PFOA and PFOS
- Above Provisional Health Advisory for PFOA and/or PFOS
- Historic Bedrock Groundwater VOC Plume
- Historic Overburden Groundwater VOC Plume
- Former AFB Boundary
- USGS Potentiometric Bedrock Contours 2003
- Potentiometric Bedrock Contours Based on 2013 Site 8 Annual Report
- 2D Soil Resistivity Lines (approximate)
- Parcels With No Wells or Wells Not Sampled
- Parcels With Wells That Were Tested
- Parcels With Wells To Be Tested
- Site 8 Boundary
- Recharge Trench Area E
- Site 8 Groundwater Management Zone Boundary (GMZ)



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0 200 400 800 1,200 Feet

PROJECTION: NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet

U.S. AIR FORCE

SITE 8 PFC INVESTIGATION STATUS REPORT

FIGURE NUMBER 3

SITE 8 WELL LOCATIONS
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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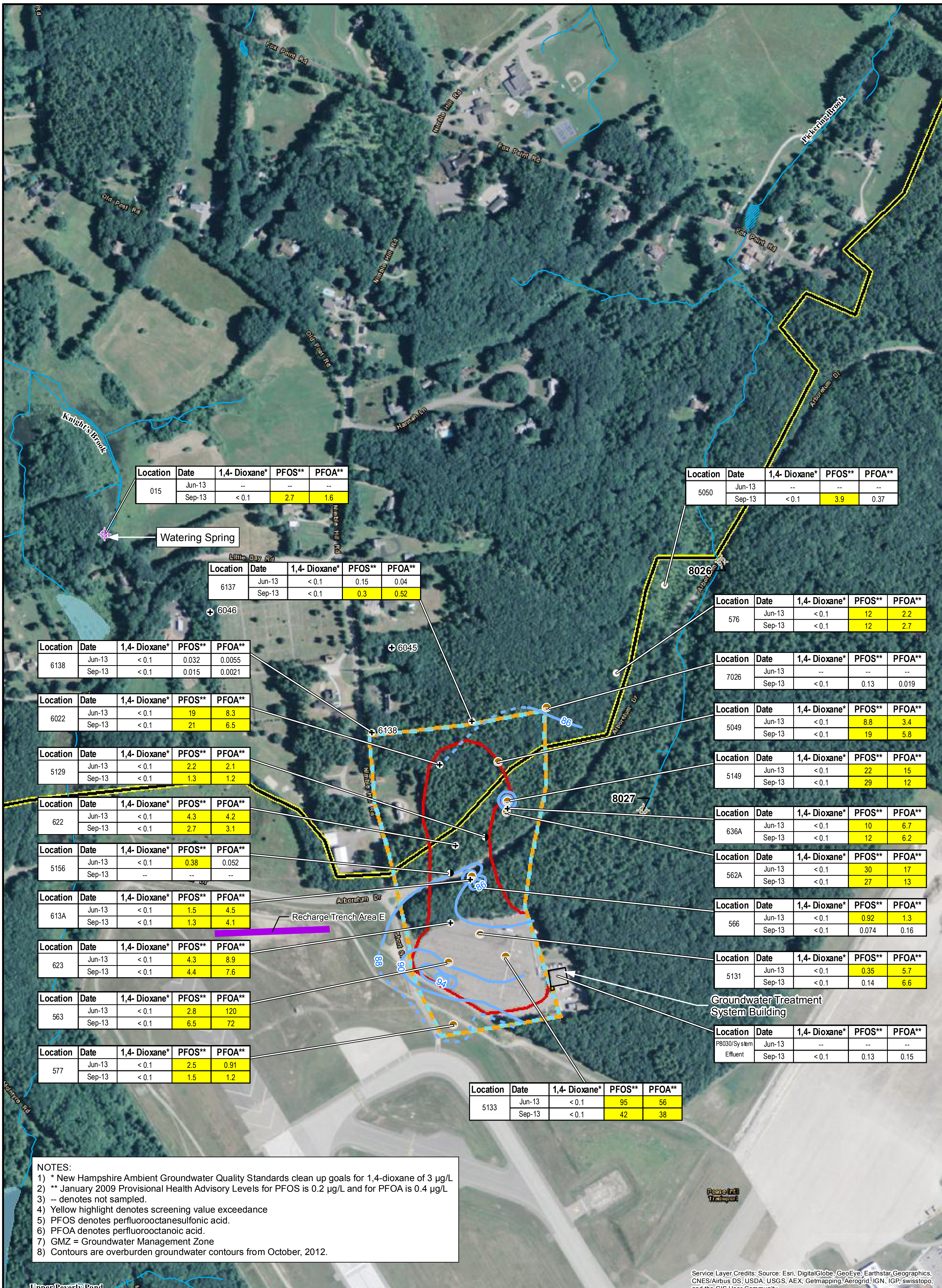
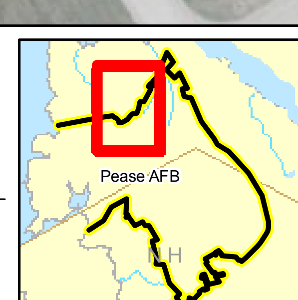


Location	Date	1,4- Dioxane*	PFOS**	PFOA**
015	Jun-13	--	--	--
	Sep-13	< 0.1	2.7	1.6
5050	Jun-13	--	--	--
	Sep-13	< 0.1	3.9	0.37
6137	Jun-13	< 0.1	0.15	0.04
	Sep-13	< 0.1	0.3	0.52
576	Jun-13	< 0.1	12	2.2
	Sep-13	< 0.1	12	2.7
6138	Jun-13	< 0.1	0.032	0.0055
	Sep-13	< 0.1	0.015	0.0021
7026	Jun-13	--	--	--
	Sep-13	< 0.1	0.13	0.019
6022	Jun-13	< 0.1	19	8.3
	Sep-13	< 0.1	21	6.5
5049	Jun-13	< 0.1	8.8	3.4
	Sep-13	< 0.1	19	5.8
5129	Jun-13	< 0.1	2.2	2.1
	Sep-13	< 0.1	1.3	1.2
5149	Jun-13	< 0.1	22	15
	Sep-13	< 0.1	29	12
622	Jun-13	< 0.1	4.3	4.2
	Sep-13	< 0.1	2.7	3.1
636A	Jun-13	< 0.1	10	6.7
	Sep-13	< 0.1	12	6.2
5156	Jun-13	< 0.1	0.38	0.052
	Sep-13	--	--	--
562A	Jun-13	< 0.1	30	17
	Sep-13	< 0.1	27	13
613A	Jun-13	< 0.1	1.5	4.5
	Sep-13	< 0.1	1.3	4.1
566	Jun-13	< 0.1	0.92	1.3
	Sep-13	< 0.1	0.074	0.16
623	Jun-13	< 0.1	4.3	8.9
	Sep-13	< 0.1	4.4	7.6
5131	Jun-13	< 0.1	0.35	5.7
	Sep-13	< 0.1	0.14	6.6
563	Jun-13	< 0.1	2.8	120
	Sep-13	< 0.1	6.5	72
P8030/System Effluent	Jun-13	--	--	--
	Sep-13	< 0.1	0.13	0.15
577	Jun-13	< 0.1	2.5	0.91
	Sep-13	< 0.1	1.5	1.2
5133	Jun-13	< 0.1	95	56
	Sep-13	< 0.1	42	38

NOTES:
1) * New Hampshire Ambient Groundwater Quality Standards clean up goals for 1,4-dioxane of 3 µg/L
2) ** January 2009 Provisional Health Advisory Levels for PFOS is 0.2 µg/L and for PFOA is 0.4 µg/L
3) -- denotes not sampled.
4) Yellow highlight denotes screening value exceedance
5) PFOS denotes perfluorooctanesulfonic acid.
6) PFOA denotes perfluorooctanoic acid.
7) GMZ = Groundwater Management Zone
8) Contours are overburden groundwater contours from October, 2012.

Site 8 Boundary
Site 8 GMZ Boundary
Former AFB Boundary
Overburden Wells
Upper Sand Overburden Wells
Shallow Overburden Wells
Bedrock Wells
Hybrid Wells
Groundwater Elevation Contour (Ft AMSL)
Groundwater Elevation Contour (Inferred)
Recharge Trench Area E



N

0 250 500 1,000 Feet

PROJECTION: NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet

U.S. AIR FORCE

SITE 8 PFC INVESTIGATION STATUS REPORT

FIGURE NUMBER 4

EMERGING CONTAMINANT CONCENTRATIONS
SITE 8
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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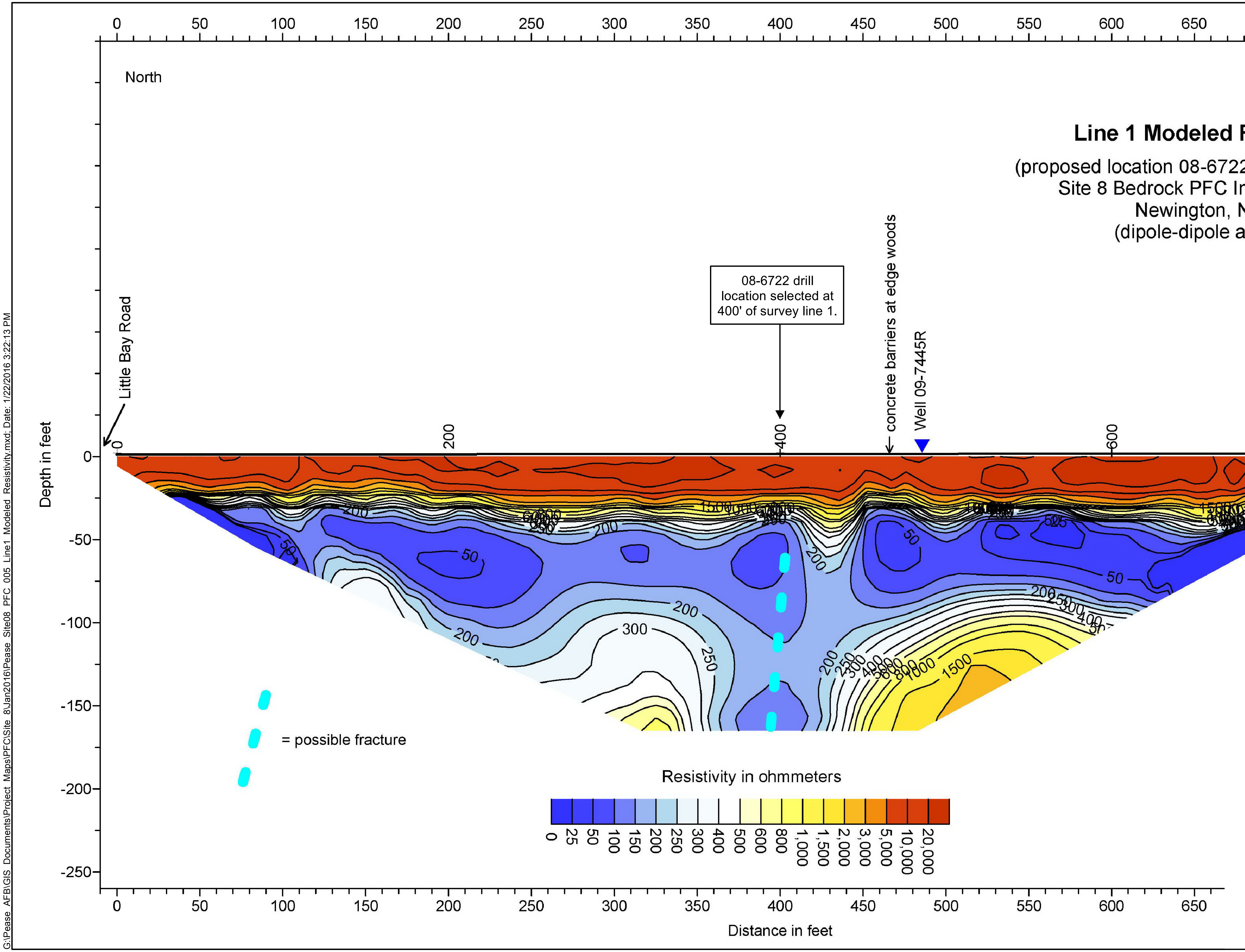

U.S. AIR FORCE

SITE 8 PFC INVESTIGATION STATUS REPORT

FIGURE NUMBER	SURVEY LINE 1 - MODELED RESISTIVITY
5	SITE 8 FORMER PEASE AIR FORCE BASE PORTSMOUTH, NEW HAMPSHIRE

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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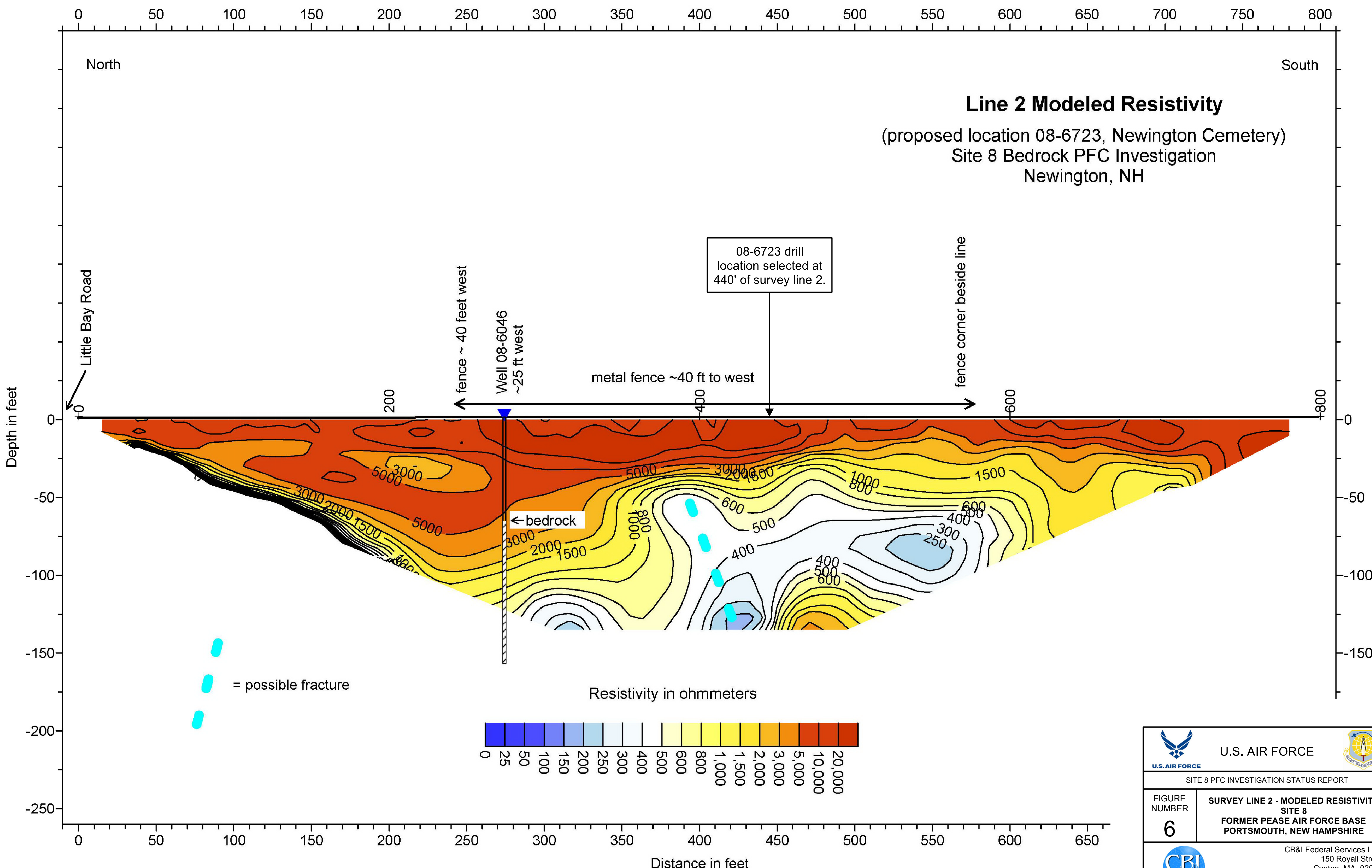

U.S. AIR FORCE

SITE 8 PFC INVESTIGATION STATUS REPORT

FIGURE NUMBER 6

SURVEY LINE 2 - MODELED RESISTIVITY
SITE 8
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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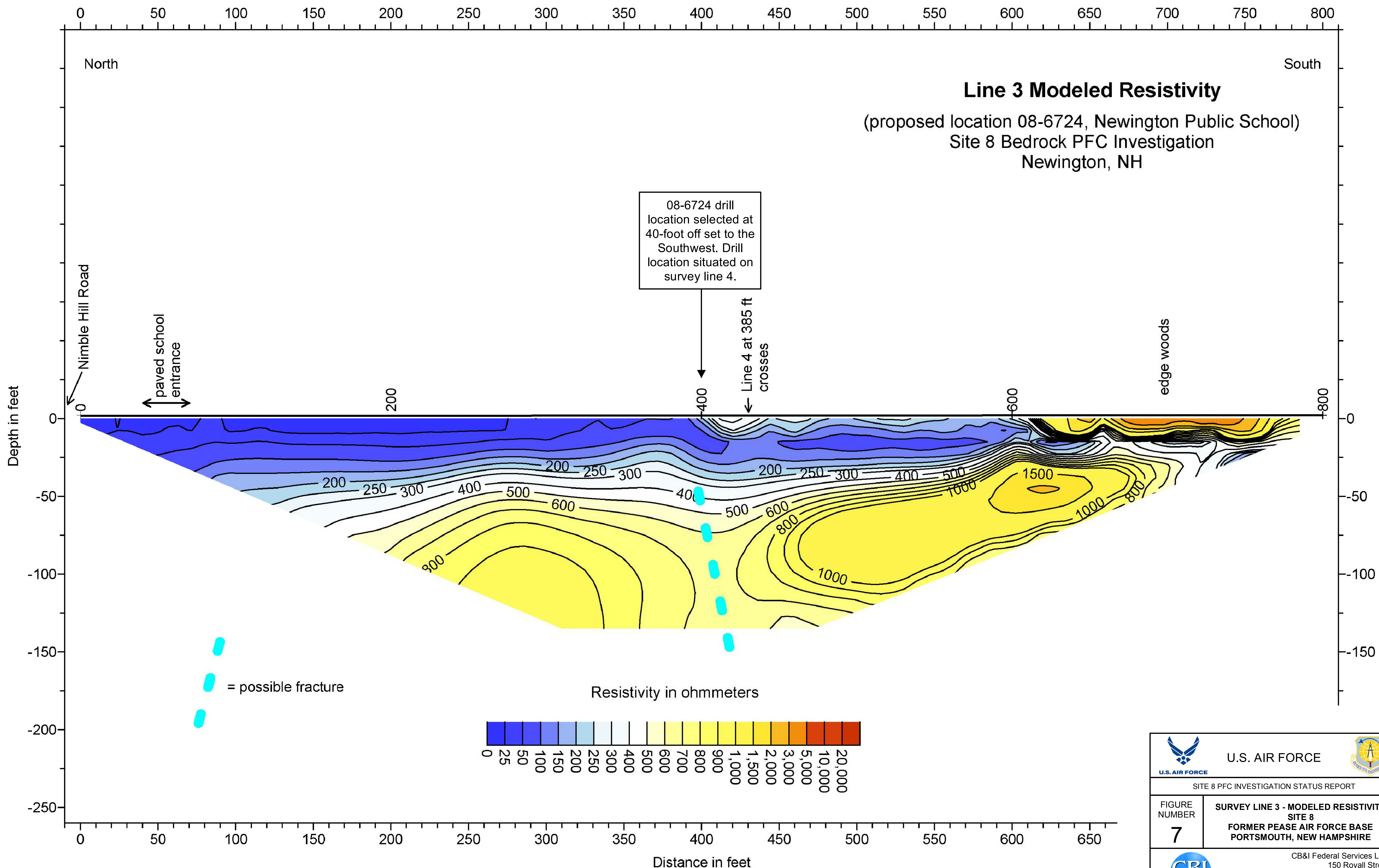

U.S. AIR FORCE

SITE 8 PFC INVESTIGATION STATUS REPORT

FIGURE NUMBER	SURVEY LINE 3 - MODELED RESISTIVITY SITE 8 FORMER PEASE AIR FORCE BASE PORTSMOUTH, NEW HAMPSHIRE
7	

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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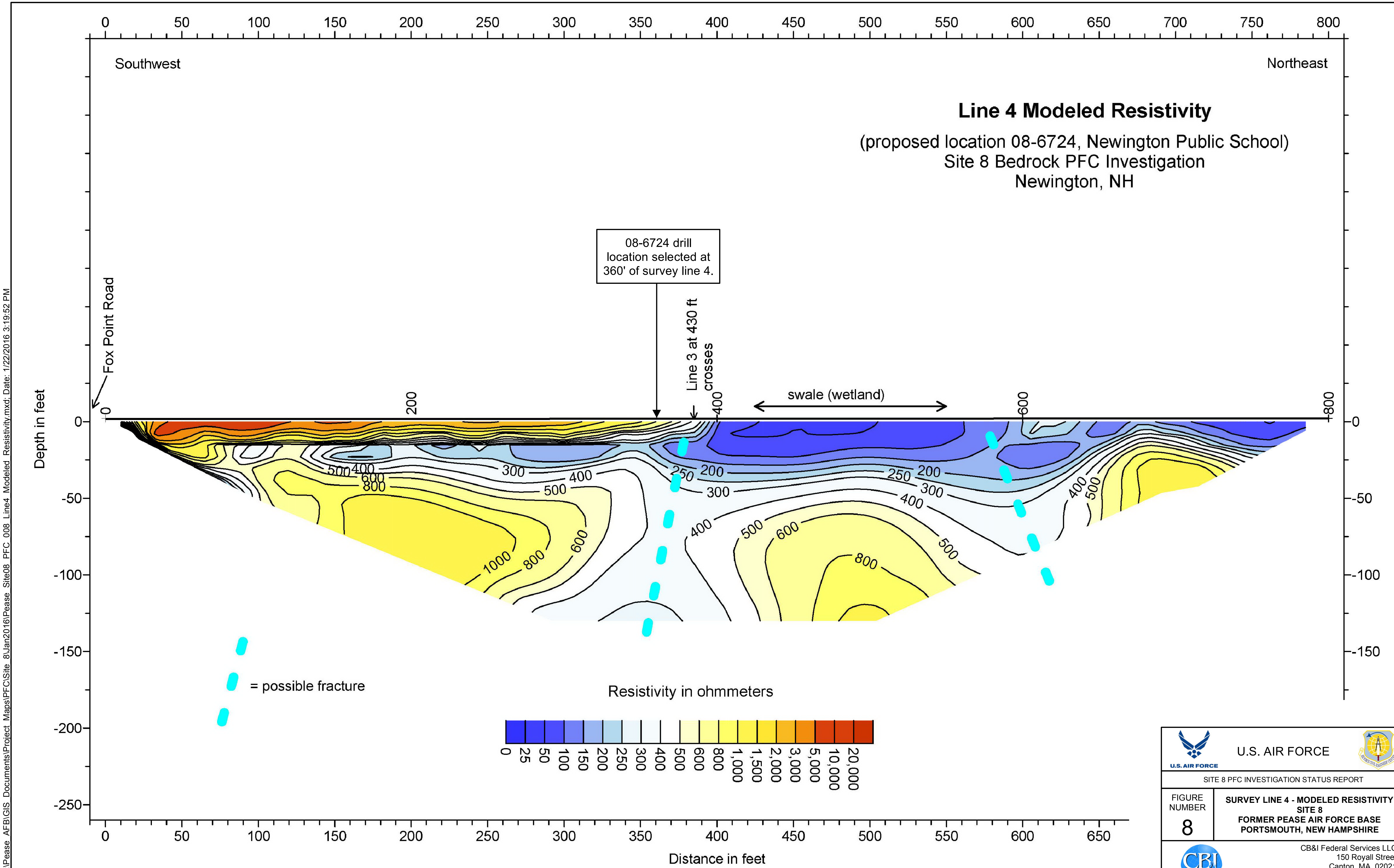

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Location	Date	Sample Depth (feet bgs)	PFOS (µg/L)	PFOA (µg/L)
08-6724	Oct-15	17-27	0.013	0.032
		60-70	0.024	0.02
		110-120	0.018	0.034
		160-170	0.016	0.029

Location	Date	Sample Depth (feet bgs)	PFOS (µg/L)	PFOA (µg/L)
08-6725	Oct-15	27.5-37.5	0.038	0.014
		218-228	0.058	0.018

Location	Date	Sample Depth (feet bgs)	PFOS (µg/L)	PFOA (µg/L)
08-6046	Oct-15	160	0.028	0.0069

Location	Date	Sample Depth (feet bgs)	PFOS (µg/L)	PFOA (µg/L)
08-6723	Oct-15	93	3.7	1.5

Location	Date	Sample Depth (feet bgs)	PFOS (µg/L)	PFOA (µg/L)
08-6722	Oct-15	74-86	2.8	0.96
		88-98	2.3	0.66
		115.5-125.5	1.6	0.47
		128-140.5	0.89	0.3

Legend

- Surface Water/Sediment Sample Location
- Surface Water Sample Location
- Overburden Wells
- Upper Sand Overburden Wells
- Shallow Overburden Wells
- Bedrock Wells
- Hybrid Wells

New Bedrock Wells
(actual location based on 10/18/15 survey)

- Below Provisional Health Advisory for PFOA and PFOS
- Above Provisional Health Advisory for PFOA and PFOS

Private Supply Well (Approx. Location)

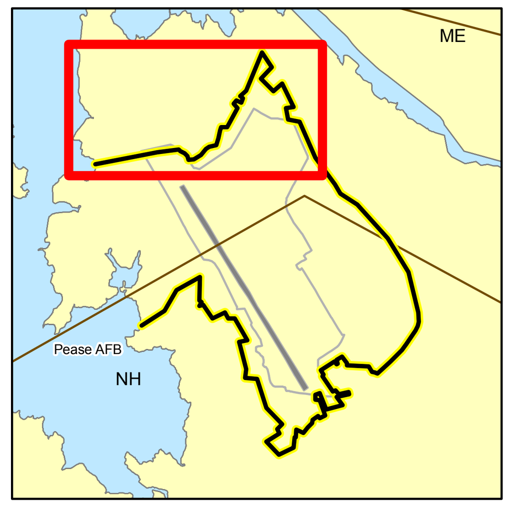
- Below Provisional Health Advisory for PFOA and PFOS in 2014
- Above Provisional Health Advisory for PFOA and/or PFOS in 2014

- Historic Bedrock Groundwater VOC Plume
- Historic Overburden Groundwater VOC Plume
- Former AFB Boundary
- USGS Potentiometric Bedrock Contours 2003
- Potentiometric Bedrock Contours Based on 2013 Site 8 Annual Report
- Parcels With No Wells or Wells Not Sampled
- Parcels With Wells That Were Tested
- Parcels With Wells To Be Tested
- Site 8 Boundary
- Recharge Trench Area E
- Site 8 Groundwater Management Zone Boundary (GMZ)

U.S. Environmental Protection Agency (EPA) Provisional Health Advisory (PHA) Limits:
PFOA PHA = 0.4 µg/L.
PFOS PHA = 0.2 µg/L.

(yellow) denotes result is above EPA PHA Limit.

N



0 200 400 800 1,200 Feet

PROJECTION: NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet

U.S. AIR FORCE

SITE 8 PFC INVESTIGATION STATUS REPORT

FIGURE NUMBER 9

NEWLY INSTALLED BEDROCK WELL GROUNDWATER RESULTS
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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Legend

- Proposed Bedrock Well Location
- Surface Water/Sediment Sample Location
- Surface Water Sample Location
- Overburden Wells
- Upper Sand Overburden Wells
- Shallow Overburden Wells
- Bedrock Wells
- Hybrid Wells

New Bedrock Wells
(actual location based on 10/18/15 survey)

- Below Provisional Health Advisory for PFOA and PFOS
- Above Provisional Health Advisory for PFOA and PFOS

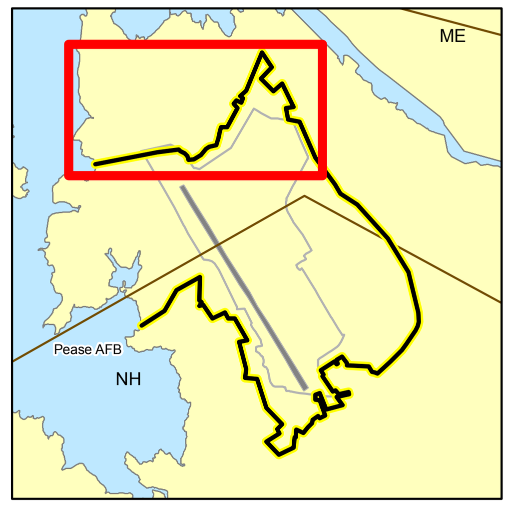
Private Supply Well (Approx. Location)

- Below Provisional Health Advisory for PFOA and PFOS
- Above Provisional Health Advisory for PFOA and/or PFOS

- Historic Bedrock Groundwater Plume
- Historic Overburden Groundwater Plume
- Former AFB Boundary
- USGS Potentiometric Bedrock Contours 2003
- Potentiometric Bedrock Contours Based on 2013 Site 8 Annual Report
- Proposed 2D Soil Resistivity Lines (approximate)
- Approximate Extent of Bedrock PFC Plume with Concentrations Above Provisional Health Advisory Limits.
- 23 Strike and dip of water bearing fracture

- Recharge Trench Area E
- Site 8 Boundary
- Parcels With No Wells or Wells Not Sampled
- Parcels With Wells That Were Tested
- Parcels With Wells To Be Tested
- Site 8 Groundwater Management Zone Boundary (GMZ)

N



0 200 400 800 1,200
Feet

PROJECTION: NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet

U.S. AIR FORCE

U.S. AIR FORCE

SITE 8 PFC INVESTIGATION STATUS REPORT

FIGURE NUMBER
10

PERFLUORINATED COMPOUND BEDROCK PLUME
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE

CBI

CB&I Federal Services LLC
150 Royall Street
Canton, MA 02021

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Tables

Table 1
Summary of Transmissive Zones and Sample Zones
Site 8, Fire Department Training Area 2
Former Pease Air Force Base
Portsmouth, New Hampshire

Well Identification	Drilling: Transmissive Zones[a]	Geophysical: Transmissive Zones (feet bgs)	Proposed Sample Zone (feet bgs)	Actual Sample Zone (feet bgs)
08-6722 (open bedrock hole 74-140.5 feet bgs)	---	possible 74.5-75'	74-84'	74-86'
	---	possible 79-80'		
	---	possible 88.5-95.5'	89-99'	88-98'
	115.5-120.5': 4 gpm	likely 119-121.5'	115.5-125.5'	115.5-125.5'
	120.5-125.5': 10 gpm			
	130.5-135.5': 15 gpm	possible 130-131'	130-140'	128-140.5'
	135.5-140.5: 20 gpm	likely 134-138'		
08-6723 (open bedrock hole 88-108.5 feet bgs)	88-90': 20 gpm	likely 88.5-89.5'	pump intake at 93' (low flow)	
	93.5-94.5': 30 gpm	likely 94.4'		
	---	possible 97.5'		
	---	possible 105.5'		
08-6724 (open bedrock hole 19.2-180.8 feet bgs)	19.2-20': 1 gpm	likely 19.2	19-29'	17-27'
	---	likely 24-24.5'		
	35-40': 1 gpm	likely 35-35.5'	---	---
		likely 37'		
	60-65': 2 gpm	possible 64-64.5'	64-74'	60-70'
	65-70': 2 gpm	likely 66-66.5'		
	72-73': 6 gpm	---		---
	75-80': 3 gpm	---	---	---
	110-115': 5 gpm	possible 113.5'	110-120'	110-120'
	---	possible 126.5-127'	---	---
	---	possible 129.5'	---	---
	---	possible 131'	---	---
	---	possible 157-164'	---	---
	166-168': 10 gpm	likely 165.5-169'	166-176'	160-170'
	---	possible 171-178'	---	---
08-6725 (open bedrock hole 27.5-228 feet bgs)	---	likely 28-28.5'	27.5-37.5'	27.5-37.5'
	---	likely 36'		
	---	likely 40-43'	---	---
	---	possible 48'	---	---
	---	likely 63'	---	---
	---	possible 75.5-76.5'	---	---
	---	possible 80'	---	---
	---	possible 189.2'	---	---
	221.5-226.5: ~46 gpm	likely 221.2-225.2'	215.5-225.5'	218-228'

[a] *denotes zones producing 1 gpm or more during air lifting.*

' denotes feet.

--- denotes no data to report.

bgs denotes below ground surface.

gpm denotes gallons per minute.

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Table 2
Groundwater PFC Results, October 2015
Site 8, Fire Department Training Area 2
Former Pease Air Force Base
Portsmouth, New Hampshire

Well ID	Field Sample ID	Groundwater Sample Depth (feet bgs)	Sample Method	Sample Date	Lab Sample ID	Parameter	Units	Result	VQ	LOQ	LOD	DL	Dilution Factor
08-6046	S8-0485	160'	low flow	10/14/2015	K1511678-002	Perfluorobutane sulfonate	µg/L	0.0016	J	0.0045	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0015	U	0.0045	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.0016	J	0.0045	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.014		0.0045	0.002	0.0007	1
						Perfluorohexanoic acid	µg/L	0.0075		0.0045	0.002	0.0006	1
						Perfluorononanoic acid	µg/L	0.0014	U	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.025		0.0045	0.002	0.0018	1
						Perfluorooctanoic acid (PFOA)	µg/L	0.0061		0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.0033	J	0.0045	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1
08-6046	S8-0486 (duplicate)	160' duplicate	low flow	10/14/2015	K1511678-003	Perfluorobutane sulfonate	µg/L	0.0018	J	0.0044	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0015	U	0.0044	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.0018	J	0.0044	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.016		0.0044	0.002	0.0007	1
						Perfluorohexanoic acid	µg/L	0.0086		0.0044	0.002	0.0006	1
						Perfluorononanoic acid	µg/L	0.0014	U	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.028		0.0044	0.002	0.0018	1
						Perfluorooctanoic acid (PFOA)	µg/L	0.0069		0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.0036	J	0.0044	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1
08-6722	S8-0487	128 to 140.5'	packer sample	10/05/2015	K1511321-001	Perfluorobutane sulfonate	µg/L	0.15		0.005	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0015	U	0.005	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.076		0.005	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.75		0.25	0.1	0.0340	50
						Perfluorohexanoic acid	µg/L	0.43		0.25	0.1	0.0310	50
						Perfluorononanoic acid	µg/L	0.0015	J	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.89		0.25	0.1	0.0900	50
						Perfluorooctanoic acid (PFOA)	µg/L	0.3	J	0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.18		0.005	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1

Table 2 (continued)
Groundwater PFC Results, October 2015
Site 8, Fire Department Training Area 2
Former Pease Air Force Base
Portsmouth, New Hampshire

Well ID	Field Sample ID	Groundwater Sample Depth (feet bgs)	Sample Method	Sample Date	Lab Sample ID	Parameter	Units	Result	VQ	LOQ	LOD	DL	Dilution Factor
08-6722	S8-0488	115 to 125.5'	packer sample	10/06/2015	K1511321-002	Perfluorobutane sulfonate	µg/L	0.24		0.005	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0015	U	0.005	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.12		0.005	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	1.2		0.25	0.1	0.0340	50
						Perfluorohexanoic acid	µg/L	0.66		0.25	0.1	0.0310	50
						Perfluorononanoic acid	µg/L	0.0027	J	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	1.6		0.25	0.1	0.0900	50
						Perfluorooctanoic acid (PFOA)	µg/L	0.47		0.25	0.25	0.0750	50
						Perfluoropentanoic acid	µg/L	0.29		0.005	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1
08-6722	S8-0489	88 to 98'	packer sample	10/06/2015	K1511321-003	Perfluorobutane sulfonate	µg/L	0.26		0.005	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0015	U	0.005	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.16		0.005	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	1.6		0.25	0.1	0.0340	50
						Perfluorohexanoic acid	µg/L	0.82		0.25	0.1	0.0310	50
						Perfluorononanoic acid	µg/L	0.0042	J	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	2.3		0.25	0.1	0.0900	50
						Perfluorooctanoic acid (PFOA)	µg/L	0.66		0.25	0.25	0.0750	50
						Perfluoropentanoic acid	µg/L	0.45		0.25	0.1	0.0470	50
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1
08-6722	S8-0490	74 to 86'	packer sample	10/06/2015	K1511321-004	Perfluorobutane sulfonate	µg/L	0.22		0.005	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0015	U	0.005	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.22		0.005	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	2.2		0.25	0.1	0.0340	50
						Perfluorohexanoic acid	µg/L	1		0.25	0.1	0.0310	50
						Perfluorononanoic acid	µg/L	0.0064		0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	2.8		0.25	0.1	0.0900	50
						Perfluorooctanoic acid (PFOA)	µg/L	0.96		0.25	0.25	0.0750	50
						Perfluoropentanoic acid	µg/L	0.73		0.25	0.1	0.0470	50
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1

Table 2 (continued)
Groundwater PFC Results, October 2015
Site 8, Fire Department Training Area 2
Former Pease Air Force Base
Portsmouth, New Hampshire

Well ID	Field Sample ID	Groundwater Sample Depth (feet bgs)	Sample Method	Sample Date	Lab Sample ID	Parameter	Units	Result	VQ	LOQ	LOD	DL	Dilution Factor
08-6723	S8-0491	93'	low flow	10/14/2015	K1511678-001	Perfluorobutane sulfonate	µg/L	0.24	J	0.01	0.004	0.0015	1
						Perfluorodecanoic acid	µg/L	0.003	U	0.01	0.004	0.0030	1
						Perfluorododecanoic acid	µg/L	0.0096	U	0.01	0.01	0.0096	1
						Perfluoroheptanoic acid	µg/L	0.31		0.01	0.004	0.0010	1
						Perfluorohexane sulfonate	µg/L	2.8	J	0.2	0.08	0.0280	20
						Perfluorohexanoic acid	µg/L	1.2		0.2	0.08	0.0250	20
						Perfluorononanoic acid	µg/L	0.0083	J	0.01	0.01	0.0028	1
						Perfluorooctane sulfonate (PFOS)	µg/L	3.7		0.2	0.08	0.0720	20
						Perfluorooctanoic acid (PFOA)	µg/L	1.5		0.2	0.2	0.0600	20
						Perfluoropentanoic acid	µg/L	0.87		0.01	0.004	0.0019	1
						Perfluoroundecanoic acid	µg/L	0.0052	U	0.01	0.01	0.0052	1
08-6724	S8-0492	160 to 170'	packer sample	10/07/2015	K1511425-001	Perfluorobutane sulfonate	µg/L	0.0017	J	0.005	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0044	J	0.005	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.0076		0.005	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.0074		0.005	0.002	0.0007	1
						Perfluorohexanoic acid	µg/L	0.042		0.005	0.002	0.0006	1
						Perfluorononanoic acid	µg/L	0.003	J	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.016		0.005	0.002	0.0018	1
						Perfluorooctanoic acid (PFOA)	µg/L	0.029		0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.06		0.005	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0032	J	0.005	0.005	0.0026	1
08-6724	S8-0493	110 to 120'	packer sample	10/07/2015	K1511425-002	Perfluorobutane sulfonate	µg/L	0.0026	J	0.005	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0031	J	0.005	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.0089		0.005	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.013		0.005	0.002	0.0007	1
						Perfluorohexanoic acid	µg/L	0.053		0.005	0.002	0.0006	1
						Perfluorononanoic acid	µg/L	0.0031	J	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.018		0.005	0.002	0.0018	1
						Perfluorooctanoic acid (PFOA)	µg/L	0.034		0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.066		0.005	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1

Table 2 (continued)
Groundwater PFC Results, October 2015
Site 8, Fire Department Training Area 2
Former Pease Air Force Base
Portsmouth, New Hampshire

Well ID	Field Sample ID	Groundwater Sample Depth (feet bgs)	Sample Method	Sample Date	Lab Sample ID	Parameter	Units	Result	VQ	LOQ	LOD	DL	Dilution Factor
08-6724	S8-0494	60 to 70'	packer sample	10/08/2015	K1511425-004	Perfluorobutane sulfonate	µg/L	0.0032	J	0.005	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0017	J	0.005	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.0043	J	0.005	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.022		0.005	0.002	0.0007	1
						Perfluorohexanoic acid	µg/L	0.026		0.005	0.002	0.0006	1
						Perfluorononanoic acid	µg/L	0.0016	J	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.024		0.005	0.002	0.0018	1
						Perfluorooctanoic acid (PFOA)	µg/L	0.02		0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.028		0.005	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1
08-6724	S8-0495	17 to 27'	packer sample	10/08/2015	K1511425-005	Perfluorobutane sulfonate	µg/L	0.0018	J	0.005	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0024	J	0.005	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.0087		0.005	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.0078		0.005	0.002	0.0007	1
						Perfluorohexanoic acid	µg/L	0.054		0.005	0.002	0.0006	1
						Perfluorononanoic acid	µg/L	0.0027	J	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.013		0.005	0.002	0.0018	1
						Perfluorooctanoic acid (PFOA)	µg/L	0.032		0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.076		0.005	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1
08-6725	S8-0496	27.5 to 37.5'	packer sample	10/09/2015	K1511544-003	Perfluorobutane sulfonate	µg/L	0.0099		0.0043	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0015	U	0.0043	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.0037	J	0.0043	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.03		0.0043	0.002	0.0007	1
						Perfluorohexanoic acid	µg/L	0.016		0.0043	0.002	0.0006	1
						Perfluorononanoic acid	µg/L	0.0014	U	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.038		0.0043	0.002	0.0018	1
						Perfluorooctanoic acid (PFOA)	µg/L	0.014		0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.007		0.0043	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1

Table 2 (continued)
Groundwater PFC Results, October 2015
Site 8, Fire Department Training Area 2
Former Pease Air Force Base
Portsmouth, New Hampshire

Well ID	Field Sample ID	Groundwater Sample Depth (feet bgs)	Sample Method	Sample Date	Lab Sample ID	Parameter	Units	Result	VQ	LOQ	LOD	DL	Dilution Factor
08-6725	S8-0497	218 to 228'	packer sample	10/09/2015	K1511544-001	Perfluorobutane sulfonate	µg/L	0.011		0.0045	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0015	U	0.0045	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.0047		0.0045	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.04		0.0045	0.002	0.0007	1
						Perfluorohexanoic acid	µg/L	0.02		0.0045	0.002	0.0006	1
						Perfluorononanoic acid	µg/L	0.0014	U	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.055		0.0045	0.002	0.0018	1
						Perfluorooctanoic acid (PFOA)	µg/L	0.018		0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.0088		0.0045	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1
08-6725	S8-0498 (duplicate)	218 to 228' duplicate	packer sample	10/09/2015	K1511544-002	Perfluorobutane sulfonate	µg/L	0.012		0.0045	0.002	0.0008	1
						Perfluorodecanoic acid	µg/L	0.0015	U	0.0045	0.002	0.0015	1
						Perfluorododecanoic acid	µg/L	0.0048	U	0.005	0.005	0.0048	1
						Perfluoroheptanoic acid	µg/L	0.005		0.0045	0.002	0.0005	1
						Perfluorohexane sulfonate	µg/L	0.042		0.0045	0.002	0.0007	1
						Perfluorohexanoic acid	µg/L	0.023		0.0045	0.002	0.0006	1
						Perfluorononanoic acid	µg/L	0.0014	U	0.005	0.005	0.0014	1
						Perfluorooctane sulfonate (PFOS)	µg/L	0.058		0.0045	0.002	0.0018	1
						Perfluorooctanoic acid (PFOA)	µg/L	0.018		0.005	0.005	0.0015	1
						Perfluoropentanoic acid	µg/L	0.0094		0.0045	0.002	0.0009	1
						Perfluoroundecanoic acid	µg/L	0.0026	U	0.005	0.005	0.0026	1

denotes result is above U.S. Environmental Protection Agency Provisional Health Advisory (PHA) Limit (PFOA PHA = 0.4 µg/L; PFOS PHA = 0.2 µg/L).

' denotes feet.

µg/L denotes micrograms per liter.

bgs denotes below ground surface.

DL denotes detection limit.

ID denotes identification.

J denotes estimated.

LOD denotes limit of detection.

LOQ denotes limit of quantitation.

U denotes nondetect.

VQ denotes validation qualifier.

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Appendix A
Electrical Resistivity Report

ELECTRICAL RESISTIVITY
SURVEY AT THE
FORMER PEASE AIR FORCE BASE,
PORTSMOUTH, NH

For:

CB&I, INC.

Northeast Geophysical Services
4 Union Street, Suite 3
Bangor, Maine 04401
June, 2015

ELECTRICAL RESISTIVITY
SURVEY AT THE
FORMER PEASE AIR FORCE BASE,
PORTSMOUTH, NH

INTRODUCTION

At the request of CB&I, Inc. an electrical resistivity survey was completed by Northeast Geophysical Services (NGS) near the Former Pease Air Force Base property in Portsmouth, New Hampshire as part of the Site 8 Bedrock PFC Investigation. Four survey lines totaling 3,200 feet were surveyed. Fieldwork was done on May 18 and 19, 2015 by Rudy Rawcliffe and Wayne Campbell of NGS assisted by Christian Buerkle of CB&I. The results of the survey will be used to assist in the selection of well drilling locations. This report describes the equipment and methods used and the results of the survey. Vertical profiles that show the modeled 2-D resistivity for each survey line are included with the report.

LOCATION AND SITE CONDITIONS

Resistivity Lines 1 and 2 are located just north of the runway. Line 1 trends 800 feet north to south along a dirt pathway and field beginning at the Little Bay Road in the north and approaching the Arboretum Road to the south. Line 2 trends 800 feet north to south just west of a cemetery beginning at the Little Bay Road in the north. Figure 1, on the following page shows the approximate location and orientation of Lines 1 and 2.

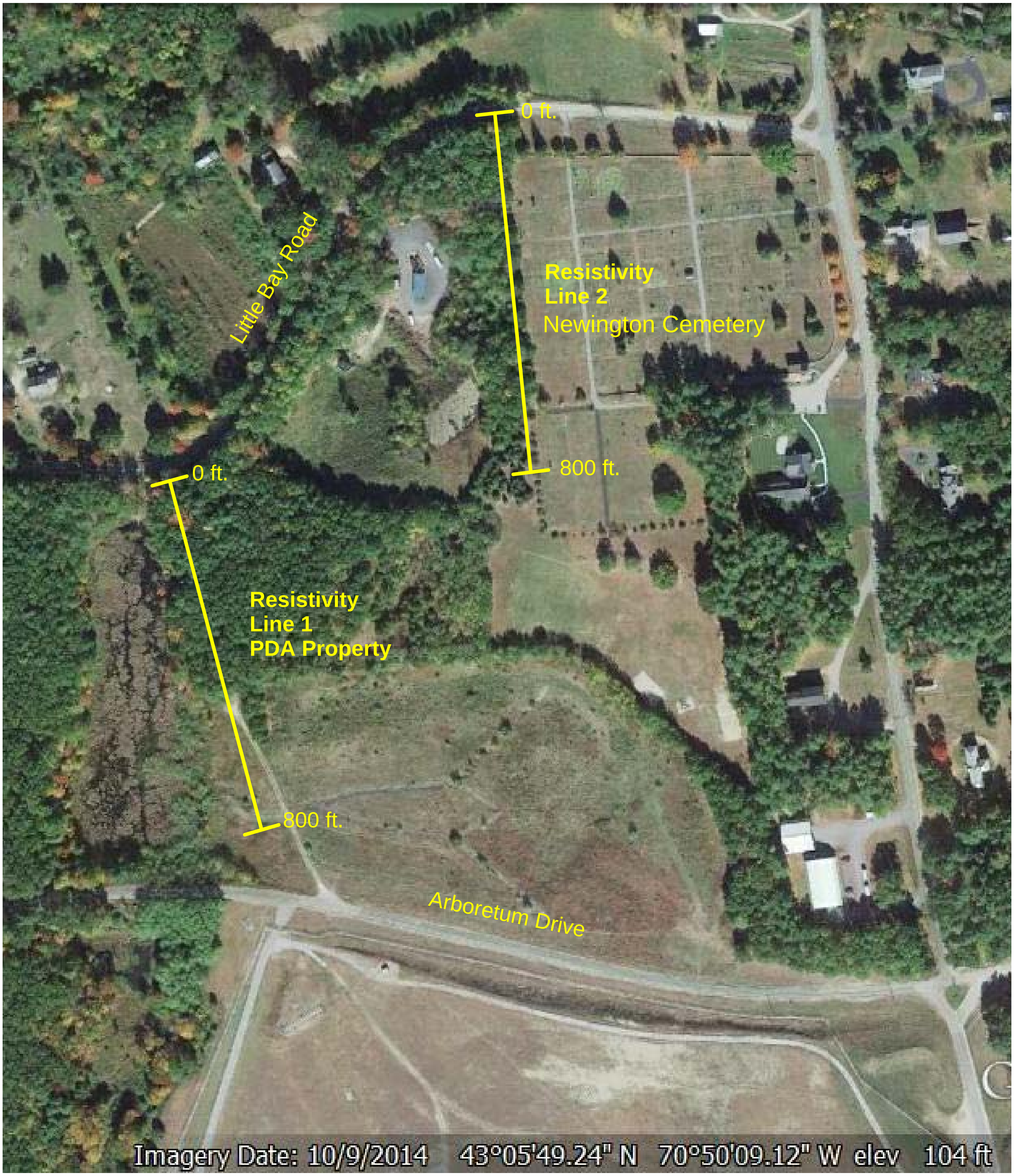
Resistivity Lines 3 and 4 are located in the Newington Elementary School property. Line 3 trends 800 feet north to south across the school athletic fields beginning at the Nimble Hill Road in the north and approaching the Fox Hill Road Road to the south. Line 2 trends 800 feet southwest to northeast across the school athletic fields beginning at the Fox Hill Road Road in the southwest. Figure 2, on page 3, shows the approximate location and orientation of Lines 3 and 4.

Surface conditions along Lines 1 and 2 was generally dry sand or gravel. Surface conditions along Lines 3 and 4 was generally moist loamy soil. Each line was marked at 200-foot intervals with a pink pin flag.

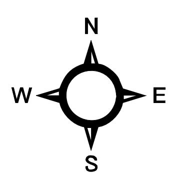
SUMMARY OF RESULTS

The interpreted data are presented in the appendix as colorized vertical profiles of the modeled resistivity for each of the four survey lines. The lowest resistivities, which are shown in blue, are interpreted to represent saturated soils or highly fractured saturated bedrock. The highest resistivities, shown in dark red-brown, are interpreted to represent dry sand and gravel soil or massive (unfractured) bedrock. Intermediate colors (yellows to light orange) are interpreted to represent intermediate conditions, i.e. - moist silty or sandy soils or saturated fractured bedrock. Possible fracture zones are shown as dashed blue lines in the models.

FIGURE 1 Line Location Map



Site 8 Bedrock PFC Investigation
Newington, NH

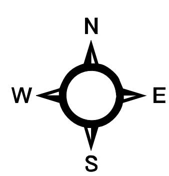


Locations are approximate

2

FIGURE 2 Line Location Map

(proposed location 08-6724, Newington Public School)
Site 8 Bedrock PFC Investigation
Newington, NH



Locations are approximate

3

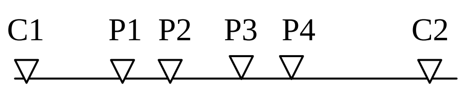
RESISTIVITY METHOD AND INSTRUMENTATION

Electrical resistivity is the resistance (in ohms) to the flow of electricity across a volume of material. Resistivity values are commonly expressed in ohmmeters. The resistivity of earth material is determined by measuring the voltage drop between two electrodes when current is applied into the earth through two other electrodes located a set distance away. Resistivity is calculated by dividing the voltage by the current multiplied by a constant. This constant is determined by the electrode spacing and configuration. The resistivity of earth material is primarily determined by its water content and the water salinity. Lower resistivities can be caused by increasing the water content or by increasing the water salinity or both. Thus, dry soil or rock typically has a higher resistivity than if it is saturated. And generally, the more porous or highly fractured that saturated material is, the lower its resistivity will be. The following table shows some general ranges in resistivity of some common earth materials.

Material	Resistivity (ohmmeters)
Wet to moist clayey soil and wet clay	1s to 10s
Wet to moist silty soil and silty clay	Low 10s
Wet to moist silty and sandy soils	10s to 100s
Sand and gravel with layers of silt	Low 1000s
Course dry sand and gravel deposits	High 1000s
Well-fractured to slightly fractured saturated rock	100s
Slightly fractured rock with dry, soil filled cracks	Low 1000s
Massively bedded rock	High 1000s

(from Burger, H. R., 1992, Exploration Geophysics of the Shallow Subsurface pp. 295
Prentice Hall, Inc., Englewood Cliffs, New Jersey 07632)

At the Former Pease AFB site resistivity data were collected using an ABEM Terrameter SAS 4000 resistivity meter with an ABEM LUND 10-64e electrode selector. This is an automated multi-electrode resistivity system. The survey was conducted using the gradient array.[1*] The gradient configuration consists of pairs of potential electrodes that are inside a pair of current electrodes. Depth of investigation is determined by the spacing between the current electrodes with the wider spacing penetrating more deeply into the earth.



gradient configuration

SURVEY RESULTS

The data were interpreted using the RES2DINV interpretation software written by M.H. Loke. This program creates a 2-dimensional model of the subsurface resistivity based on the apparent resistivities measured at the surface. The effectiveness of the model to match the surface measurements is calculated as a percentage of the root-mean-square (% RMS) difference between the modeled and actual measurements. In general, a RMS value of 10% or less is

*Line 1 was done using the dipole-dipole array, however, because of background noise, the other lines were done using the gradient array which has a higher signal strength.

considered a close match between the model and field measurements. At the Former Pease AFB site the RMS values for the models was generally good, averaging about 7%. The exception was Line 1 which had an RMS value of 17.6%.

The interpreted data was then contoured using the Surfer contouring program by Golden Software and presented as colorized vertical sections of apparent resistivity for each line. The colors in these sections depict the modeled resistivity with light orange-red to dark red-brown representing areas of high resistivity (2,000 to >20,000 ohmmeters) and low resistivities (below 400 ohmmeters) shown in blue shades. Resistivities from 500 to 2,000 ohmmeters are represented by white to yellow tones.

Modeled resistivity profiles of each survey line are appended. Following is a description of each resistivity model:

Line 1

Line 1 (800 feet) trends north to south. The ground surface along Line 1 was dry gravel. Because of this the amount of current injected into the ground averaged less than 20 milliamps. As a result the data for Line 1 was noisier than the other lines and the model has more uncertainty. The model shows a high resistivity surface layer generally ranging from 25 to 30 feet thick. This likely represents dry sand and gravel. Beneath this layer there is a layer of lower resistivity. This probably represents saturated soil. Below this layer the resistivity then increases with depth beginning anywhere from 75 to 100 feet deep along the line. This probably represents the bedrock.

The modeled results for Line 1 show a steep cross-cutting low resistivity zone that may represent a bedrock fracture zone located at about 400 feet along the line.

Line 2

Line 2 (800 feet) trends north to south. The resistivity model for Line 2 shows a high resistivity surface layer that is thickest in the north and thins towards the south. Resistivity is generally lower at depth. The model depicts a cross-cutting low resistivity zone that may represent a bedrock fracture zone located at about 390 to 420 feet along the line.

One concern about the model for Line 2 is that starting at about 240 feet along the line there is a wire fence that roughly parallels the line. This fence gradually gets closer to the line until about 580 feet at a corner where it is about two feet from the resistivity line. It is possible that this fence may have influenced the resistivity measurements and that the apparent low resistivity measurements at depth in the model are a result of the nearby fence rather than geologic changes

Line 3

Line 3 (800 feet) trends north to south. The model for Line 3 shows a low resistivity surface layer that probably represents saturated soil. This layer is thickest to the north about 50 feet and thins towards the north. Below this layer the resistivity then increases with depth beginning anywhere from less than 25 feet in the north to over 50 feet deep to the south along the line. This probably represents the bedrock.

The modeled results for Line 3 show a subtle cross-cutting low resistivity zone that may represent a bedrock fracture zone located at about 410 feet along the line as shown on the Line 3 model.

Line 4

Line 4 (800 feet) trends southwest to northeast. The model shows a thin high resistivity surface layer about 15 feet thick or less from about 0 to 300 feet along the line. This likely represents dry soil. Beneath this layer there is a layer of lower resistivity. This probably represents saturated soil. Below this layer the resistivity then increases with depth beginning anywhere from 30 to over 50 feet deep along the line. This probably represents the bedrock.

The modeled results for Line 1 show two steep, cross-cutting low resistivity zones that may represent bedrock fracture zones. One is located at about 350 feet along the line which is near to the intersection with Line 3. The second zone is at about 610 feet along the line as shown on the Line 4 model.

LIMITATIONS

The interpreted resistivity sections in this report provide an indication of subsurface conditions at the sites surveyed. This information should be used along with other sources such as geologic mapping, photo-lineament mapping and other geophysical surveys in order to prioritize and optimize drill hole locations.

Electrical resistivity is an effective tool for mapping subsurface features such as saturated sediment or bedrock fracture zones. However, as with any indirect measurement, there are limitations to this method that should be kept in mind. First, it is possible that erroneous or bad data points may have been collected. Bad data would result in incorrect interpretations of the subsurface. A common difficulty in resistivity surveys is high contact resistance between the electrodes and the ground. Ideally, contact resistance should be about 1,000 ohms. The dry soil along much of survey lines 1 and 2 was challenging but the data collected at the Former Pease AFB site appeared to be generally good.

Data quality was assessed in two ways. During data acquisition the instrument makes resistivity readings at each point using forward and reversed polarities (pulsing from electrode A to electrode B and then pulsing from B to A). Unless the data is noisy, these readings should repeat to less than 1%. The difference between the forward and reversed polarity measurements in the resistivity readings at the Former Pease AFB site was generally less than 1%. The exception was Line 1 which had the noisiest data, due to dry soil that caused high contact resistance. On Line 1 206 of the 1,113 measurements exceeded 1% error.

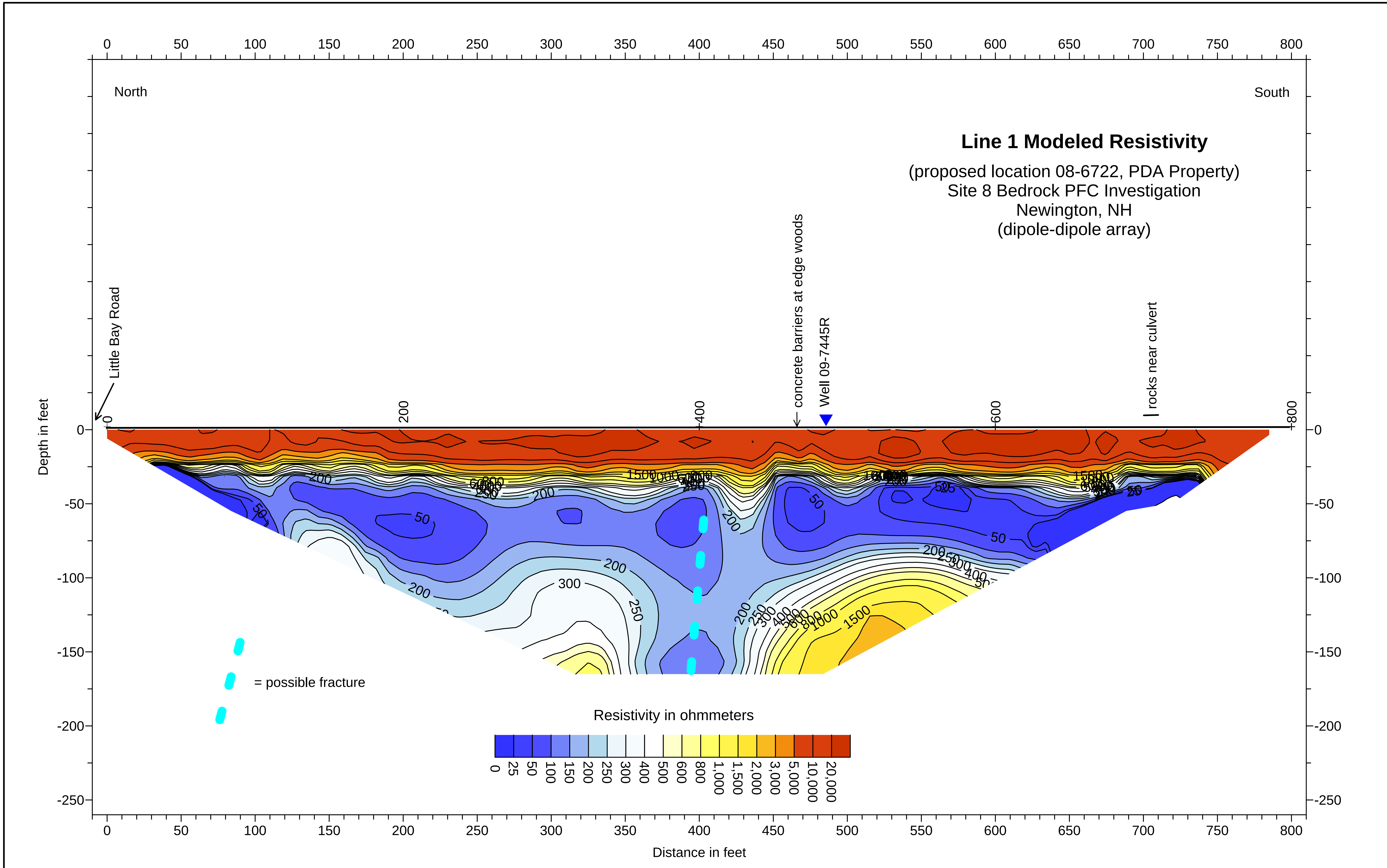
After the data had been collected, profiles of the apparent resistivity for each “n” level on each of the lines surveyed were examined. Normally, these resistivity profiles should be relatively flat or smoothly varying. Bad data points can be identified as data points that abruptly deflect either upwards or downwards from the profile. There were a few bad data points observed in each of lines of the Former Pease AFB site data set. Obviously bad data points were removed before each profile was interpreted.

The modeled resistivity sections presented in this report created interpretations of the subsurface that closely agree mathematically with the field measurements. However, it is possible that other models of the subsurface exist that could also match the field measurements.

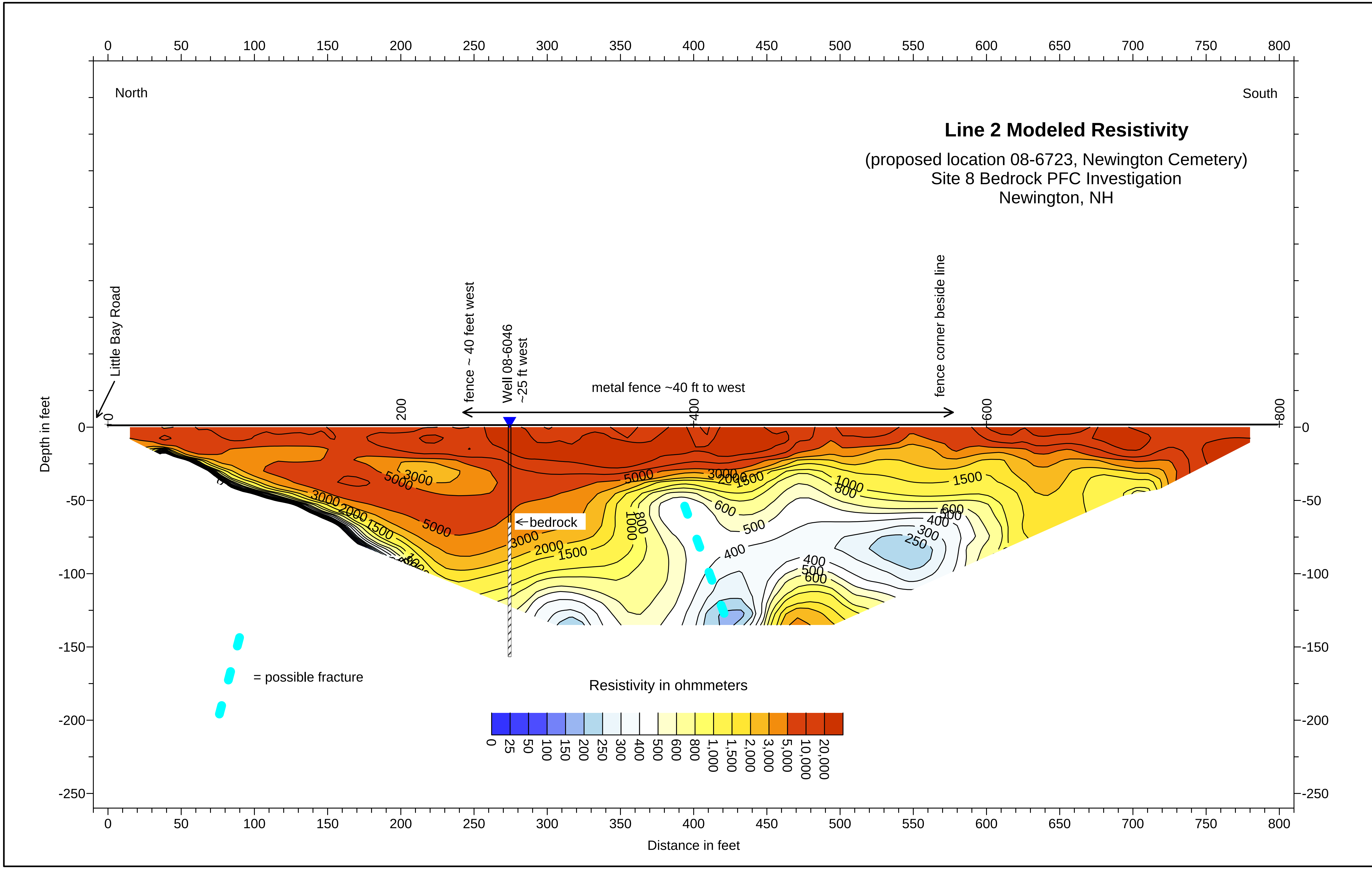
It should also be kept in mind that the modeled interpretations assume that changes in resistivity occur in two dimensions, either with depth or distance along the line. In reality the resistivity measurements also measure material to the left and right of the survey line. Thus it is possible that the program might model a feature that is not actually directly below the electrodes. A worst case scenario of this would be if a resistivity survey line were run parallel to a vertical conductor such as a metal pipeline or a vertical bedrock fracture. This feature might be detected and shown on the profile as a resistivity low zone even though it is not below the electrodes. Ideally, the resistivity lines should be oriented so as to cross any suspected features (such as bedrock fractures) at right angles to the strike of that feature. Of the four lines, Line 2 had a wire fence that paralleled the line about 40 feet away for about 340 feet. It is possible that the wire fence may have influenced the measurements on this line which would then distort the model.

MODELED RESISTIVITY

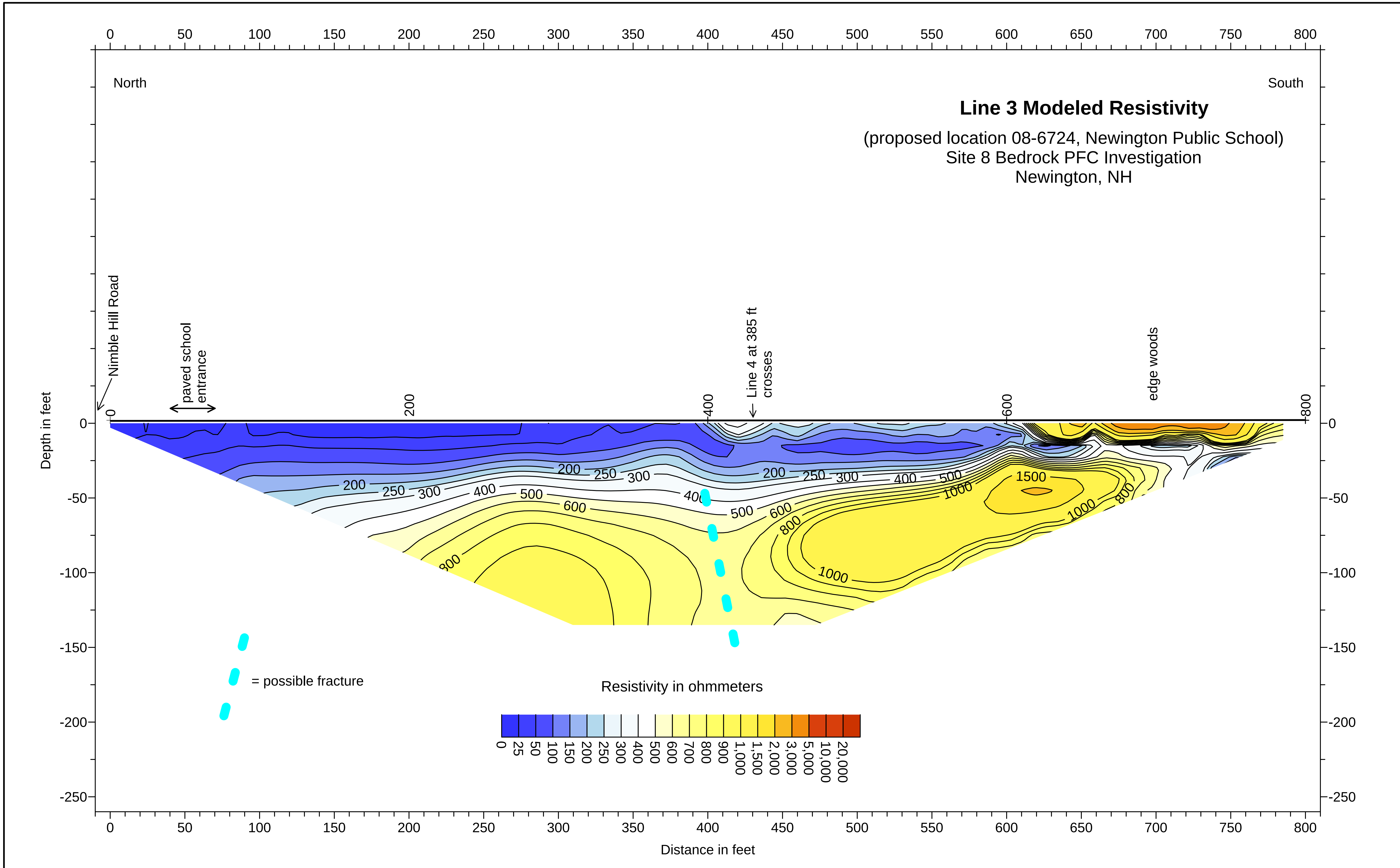
PROFILES



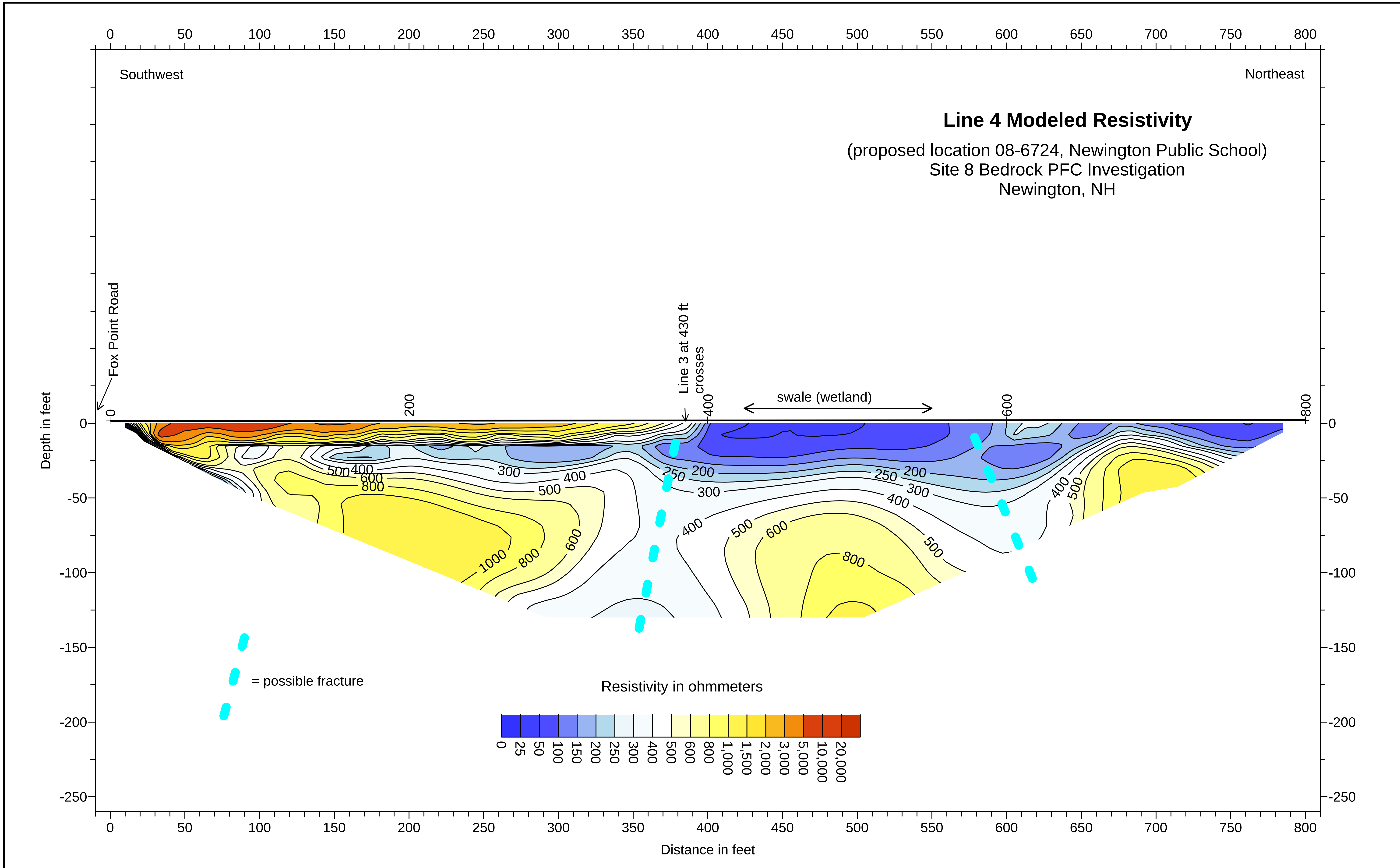
Line 1 Modeled Resistivity
(proposed location 08-6722, PDA Property)
Site 8 Bedrock PFC Investigation
Newington, NH
(dipole-dipole array)
North
South
Little Bay Road
concrete barriers at edge woods
Well 09-7445R
rocks near culvert
Depth in feet
Distance in feet
= possible fracture
Resistivity in ohmmeters
0
25
50
100
150
200
250
300
400
500
600
800
1,000
1,500
2,000
3,000
5,000
10,000
20,000



Line 2 Modeled Resistivity
(proposed location 08-6723, Newington Cemetery)
Site 8 Bedrock PFC Investigation
Newington, NH
North
South
Little Bay Road
fence ~ 40 feet west
Well 08-6046
~25 ft west
metal fence ~40 ft to west
fence corner beside line
←bedrock
= possible fracture
Resistivity in ohmmeters
0
25
50
100
150
200
250
300
400
500
600
800
1,000
1,500
2,000
3,000
5,000
10,000
20,000
Depth in feet
Distance in feet



Line 3 Modeled Resistivity
(proposed location 08-6724, Newington Public School)
Site 8 Bedrock PFC Investigation
Newington, NH
North
South
Nimble Hill Road
paved school entrance
Line 4 at 385 ft crosses
edge woods
Depth in feet
Distance in feet
= possible fracture
Resistivity in ohmmeters
0
25
50
100
150
200
250
300
400
500
600
700
800
900
1,000
1,500
2,000
3,000
5,000
10,000
20,000



Line 4 Modeled Resistivity
(proposed location 08-6724, Newington Public School)
Site 8 Bedrock PFC Investigation
Newington, NH
Southwest
Northeast
Fox Point Road
Line 3 at 430 ft crosses
swale (wetland)
Depth in feet
Distance in feet
= possible fracture
Resistivity in ohmmeters
0 25 50 100 150 200 250 300 400 500 600 800 1,000 1,500 2,000 3,000 5,000 10,000 20,000

Appendix B
Boring and Well Construction Logs

Drilling Log

Monitoring Well **08-6722**

Project	Former Pease AFB - Site 8 Bedrock PFCs	Owner	AFCEC				
Location	Portsmouth, NH			Proj. No.	143279		
Surface Elev.	77.2 ft.	Total Hole Depth	140.5 ft.	North	218528.7202 ft.	East	1205723.9497 ft.
Top of Casing	78.18 ft.	Water Level Initial	NA	Static	24.8 ft.	Diameter	4.5 in.
Screen: Dia	4.5 in.	Length	66.5 ft.	Type/Size	open hole		
Casing: Dia	5.0ID/5.5OD in.	Length	74 ft.	Type	mild steel		
Fill Material	(see well materials in comments)	Rig/Core	Failing Strata Star 15				
Drill Co.	New England Boring Contr.	Method	Drive and Wash / Air Hammer				
Driller	Gregg Leavitt	Log By	Chris Buerkle	Date	6/28/15	Permit #	---
Checked By	Chris Buerkle	License No.	NH P.G. 827				

COMMENTS
- 0-5' hand cleared.
- No soil analytical samples collected.
- PID readings of cuttings 5 to 140.5' bgs: 0.0 to 0.4 ppm.

Well 08-6722:
1.0 ft stick up, 5"ID/5.5"OD mild steel casing grouted into 5-7/8" borehole to 74' bgs, 4.5-inch open hole section from 74 to 140.5' bgs.

Note: 5-7/8" hole drilled to 79' bgs but 5.5-inch casing got stuck at 74' bgs and was grouted in place.

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
0			100%			OH	0-0.5': Organic topsoil, loose, very dark brown 10YR 2/2.
2		0.0	100%				0.5-5': Poorly graded SAND with gravel (SP), moist, medium dense, dark yellowish brown 10YR 4/6, 60% fine to medium sand, 35% fine to coarse gravel (angular to subrounded), 5% silt, trace coarse sand, no odor, (Upper Sand).
4							
6							
8							
10							
12						SP	5-20': Same as 0.5-5' (gravel portion getting ground up by roller bit), (Upper Sand).
14							
16							
18							
20							
22							
24							

Continued Next Page

Drilling Log

Monitoring Well **08-6722**

Project: *Former Pease AFB - Site 8 Bedrock PFCs* Owner: *AFCEC*

Location: *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
24–33						SP	20-33': Poorly graded SAND with gravel (SP), dark yellowish brown 10YR 4/6, fine to medium sand, trace coarse sand, gravel percentage unknown: ground up by roller bit, no odor, (Upper Sand).
33–38						SP	33-38': Poorly graded SAND (SP), 100% fine to medium sand, trace coarse sand, 10YR 4/6, no odor, (Upper Sand).
38–42.5						CL	38-42.5': Slity CLAY (CL), 80% clay, 20% silt, dark greenish gray Gley1 4/10Y, no odor, (Marine Clay/Silt).
42.5–45						SP	42.5-45': Poorly graded SAND with gravel (SP), fine sand, gravel, trace cobble, Gley1 4/10Y, (Lower Sand).
45–53						SM	45-53': Silty SAND (SM), fine sand, silt (unknown amount), gray 10YR 5/1, (Lower Sand).
53–55						SM	53-55': Silty SAND (SM), fine sand, ~25% silt, trace fine gravel, gray 10YR 5/1, no odor, (Lower Sand).

Depth scale: 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56

Continued Next Page

Project: *Former Pease AFB - Site 8 Bedrock PFCs* Owner: *AFCEC*

Location: *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
56–64						SM	55-64': Silty SAND (SM), fine sand, ~25% silt, dark yellowish brown 10YR 5/6, (Lower Sand).
64–69.5							64-69.5': Silty SAND (SM), fine sand, ~25% silt, gray 10YR 5/1, (Lower Sand).
69.5–72							69.5-72': Highly weathered phyllite, dark bluish gray Gley2 4/5PB, rust-brown weathering, trace calcite, (highly weathered bedrock).
72–80.5							72-80.5': Weathered phyllite, Gley2 4/5PB, some rust-brown weathering, trace calcite, (weathered bedrock). Driller indicates competent bedrock at 72' bgs based on downhole pressure. Note: bottom of 5-inch casing installed at 74' bgs. [5-7/8" hole drilled to 79' bgs but 5.5-inch casing got stuck at 74' bgs and was grouted in place.] Flow (Q) 74-80.5': Very small amount of water.
80.5–85.5							80.5-85.5': Slightly weathered metasediment (siltstone/mudstone), some calcite pieces, dark bluish gray Gley2 4/5PB.
85.5–88							85.5-90.5': Slightly weathered metasediment (siltstone/mudstone), some calcite and quartz pieces, dark bluish gray Gley2 4/5PB. Fast drill rate 84-84.5' bgs.

Continued Next Page

Project: *Former Pease AFB - Site 8 Bedrock PFCs* | Owner: *AFCEC*
Location: *Portsmouth, NH* | Proj. No.: *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
88							
90							Q at 90.5': Still very small amount of water.
92							90.5-95.5': Weathered metasediment (siltstone/mudstone), some calcite and quartz pieces, dark bluish gray Gley2 4/5PB.
94							
96							Q at 95.5': Still very small amount of water.
98							95.5-100.5: Slightly weathered to weathered metasediment (siltstone/mudstone) ~40% calcite pieces, bluish gray Gley2 6/10B.
100							
102							100.5-105.5': Slightly weathered metasediment (siltstone/mudstone) ~15% calcite pieces, bluish gray Gley2 6/10B.
104							
106							
108							105.5-110.5: Slightly weathered metasediment (siltstone/mudstone) ~25% calcite pieces, dark bluish gray Gley2 4/5PB. Zone is producing water.
110							Q at 110.5': 0.9 gpm.
112							110.5-115.5: Slightly weathered metasediment (siltstone/mudstone) ~20% calcite pieces, dark bluish gray Gley2 4/5PB.
114							
116							
118							115.5-120.5': Slightly weathered metasediment (siltstone/mudstone) ~20% calcite pieces, dark bluish gray Gley2 4/5PB. Increase in water, fast drill rate 116-120.5', gravel up to 3/4" blowing out of fracture zone.
120							Q at 120.5': 5 gpm.

Continued Next Page

Drilling Log

Monitoring Well **08-6722**

Project *Former Pease AFB - Site 8 Bedrock PFCs* Owner *AFCEC*

Location *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
120							
122							120.5-125.5': Weathered metasediment (siltstone/mudstone), ~40% calcite pieces. Increase in Q by 10gpm (total Q: 15 gpm), 1.5" gravel pieces blowing out of fracture zone.
124							
126							
128							125.5-130.5': Slightly weathered metasediment (siltstone/mudstone), ~15% calcite pieces, dark bluish gray Gley2 3/5PB. No noticable increase in Q.
130							Q at 130.5': 15 gpm.
132							130.5-135.5': Weathered metasediment (siltstone/mudstone), ~20% calcite pieces, Gley2 3/5PB. Increase in Q. Gravel up to 1.5" blowing out of fracture zone.
134							
136							Q at 135.5': 30 gpm.
138							135.5-140.5': Weathered metasediment (siltstone/mudstone), ~15% quartz pieces, Gley2 3/5PB. Increase in Q. Gravel up to 2" blowing out of fracture zone.
140							Q at 140.5': ~50 gpm.
142							140.5' Total Depth (Stopped drilling due to rig limitations. Flow out of hole too high to manage and gravel pieces are starting to lock up air hammer).
144							
146							
148							
150							
152							

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Drilling Log

Monitoring Well **08-6723**

Project: Former Pease AFB - Site 8 Bedrock PFCs   Owner: AFCEC
Location: Portsmouth, NH   Proj. No. 143279
Surface Elev. 108.2 ft.   Total Hole Depth 108.5 ft.   North 219225.477 ft.   East 1206319.8175 ft.
Top of Casing 110.16 ft.   Water Level Initial 51.0 ft.   Static NA   Diameter 3-7/8 in.
Screen: Dia 3-7/8 in.   Length 20.5 ft.   Type/Size open hole
Casing: Dia 4.25ID/4.5OD in.   Length 88 ft.   Type mild steel
Fill Material (see well materials in comments)   Rig/Core Failing Strata Star 15
Drill Co. New England Boring Contr.   Method Drive and Wash / Air Hammer
Driller Gregg Leavitt   Log By Chris Buerkle   Date 8/17/15   Permit # ---
Checked By Chris Buerkle   License No. NH P.G. 827

COMMENTS
- 0-5' hand cleared.
- No soil analytical samples collected.
- PID readings of cuttings 5 to 108.5' bgs: all 0.0 ppm.

Well 08-6723:
2.0 ft stick up, 4.25"ID/4.5"OD mild steel casing grouted into 5-7/8" borehole to 88' bgs, 3-7/8 inch open hole section from 88 to 108.5' bgs.

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
0-5		0.0	100%			GW GM	0-5': Well graded GRAVEL with silt and sand (GW-GM), dry, medium dense, dark yellowish brown 10YR 4/4, 55% fine to coarse gravel (ang. to subang.), 30% fine sand, 10% silt, 5% cobbles.
5-10						SW	5-10': Well graded SAND (SW), moist, 10YR 4/4, 100% fine to coarse sand.
10-15						SW	10-15': Well graded SAND (SW), moist, 10YR 4/4, 100% fine to coarse sand.
15-20						SP	15-20': Poorly graded SAND (SP), moist, yellowish brown 10YR 5/4, fine to medium sand, trace coarse sand.
20-25						SW	20-25': Well graded SAND with gravel (SW), moist, dark yellowish brown 10YR 4/4, 70% fine to coarse sand, 30% fine to coarse gravel (ang. to subang.).

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SHAW_COMMERCIAL Rev: 8/9/13 2015 PEASE SITE 8 BEDROCK PFC (FINAL).GPJ IT_CORP.GDT 1/19/16

Project *Former Pease AFB - Site 8 Bedrock PFCs* Owner *AFCEC*

Location *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
25-35						SW	25-30': Well graded SAND with gravel (SW), moist, 10YR 4/4, 80% fine to coarse sand, 20% fine to coarse gravel (ang. to subang.).
							30-35': Well graded SAND with gravel (SW), moist, 10YR 4/4, 70% fine to coarse sand, 25% fine gravel (ang. to subang.), 5% silt.
35-40						GP GM	35-40': Poorly graded GRAVEL with silt and sand (GP-GM), moist, brown 10YR 4/3, 65% fine gravel (ang. to subang.), 25% fine to coarse sand, 10% silt.
40-43						SW	40-43': Well graded SAND with gravel (SW), moist brown 10YR 4/3, 70% fine to coarse sand, 25% fine gravel (ang. to subang.), 5% silt.
43-44						---	43-44': Boulder.
44-45						SW	44-45': Well graded SAND with gravel (SW), moist, brown 10YR 4/3, 70% fine to coarse sand, 25% fine gravel (ang. to subang.), 5% silt.
45-50						GP	45-50': Poorly graded GRAVEL with sand (GP), moist, 10YR 4/3, 70% fine gravel (ang. to subang.), 25% fine to coarse sand, 5% silt.
50-55						GM	50-55': Silty GRAVEL with sand (GM), moist, wet at 51', 10YR 4/3, 50% fine gravel (ang. to subang.), 35% fine to coarse sand, 15% silt, trace coarse gravel.

Depth scale: 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56

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Drilling Log

Monitoring Well **08-6723**

Project: *Former Pease AFB - Site 8 Bedrock PFCs* Owner: *AFCEC*

Location: *Portsmouth, NH* Proj. No.: *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
56–60						GM	55-60': Silty GRAVEL with sand (GM), wet, 10YR 4/3, 60% fine gravel (ang. to subang.), 25% fine to coarse sand, 15% silt.
60–65						GM	60-65': Silty GRAVEL (GM), wet, brown 10YR 4/3, 75% fine to coarse gravel (ang. to subang., different components: quartz, metasediment, quartzite), 15% silt, 10% fine to coarse sand.
65–70						GW	65-70': Well graded GRAVEL (GW), wet, 10YR 4/3, 90% fine to coarse gravel (ang. to rounded, different components: granite, metasediment, sandstone, mafic, quartzite), 5% fine to coarse sand, 5% silt.
70–75						GW	70-75': Well graded GRAVEL (GW), wet, 10YR 4/3, 90% fine to coarse gravel (ang. to rounded, different components: mostly metasediment), 5% fine to coarse sand, 5% silt.
75–79.5						SP	75-79.5': Poorly Graded SAND with gravel (SP), wet, brown 10YR 4/3, 75% fine to medium sand, 20% fine gravel (ang. to subrounded, different components), 5% silt, trace coarse sand.
79.5–88						Bedrock	79.5-88': Weathered bedrock: metasediment (phyllite), dark bluish gray Gley2 3/5B, trace quartz pieces. Competent bedrock at 82' bgs. Bottom of steel casing set at 88' bgs.

Depth scale: 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88

Continued Next Page

Drilling Log

Monitoring Well **08-6723**

Project *Former Pease AFB - Site 8 Bedrock PFCs* Owner *AFCEC*

Location *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
88							88-90': Highly weathered bedrock: metasediment (phyllite), Gley2 3/5B, fast drilling, increase in Q, fracture zone.
90							Flow (Q) at 92': 20 gpm. Approximately 20 gpm produced by 88-90' fracture zone.
92							90-92': Weathered bedrock: metasediment (phyllite), dark bluish gray Gley2 3/5B, trace quartz pieces.
94							92-98': Weathered metasediment (phyllite), Gley2 3/5B. 93.5-94.5' fast drilling, increase in Q, fracture zone.
96							
98						Bedrock	Q at 98': 50 gpm. Approximately 30 gpm produced by 93.5-94.5' fracture zone.
100							98-103': Slightly weathered metasediment (phyllite), dark bluish gray Gley2 3/5B, no noticable increase in Q.
102							
104							Q at 103': ~50 gpm.
106							103-108.5': Slightly weathered metasediment (phyllite), dark bluish gray Gley2 3/5B, no noticable increase in Q.
108							Q at 108.5': ~50 gpm.
110							108.5' Total Depth (Reached target depth per discussions with Air Force and NH DES).
112							
114							
116							
118							
120							

Drilling Log

Monitoring Well **08-6724**

Project	Former Pease AFB - Site 8 Bedrock PFCs	Owner	AFCEC
Location	Portsmouth, NH	Proj. No.	143279
Surface Elev.	49.2 ft.	Total Hole Depth	180.8 ft.
North	222052.0672 ft.	East	1208174.0573 ft.
Top of Casing	48.88 ft.	Water Level Initial	4.5 ft.
Static	NA	Diameter	3-7/8 in.
Screen: Dia	3-7/8 in.	Length	161.6 ft.
Type/Size	open hole		
Casing: Dia	4.25ID/4.5OD in.	Length	19.2 ft.
Type	mild steel		
Fill Material	(see well materials in comments)	Rig/Core	Failing Strata Star 15
Drill Co.	New England Boring Contr.	Method	Drive and Wash / Air Hammer
Driller	Gregg Leavitt	Log By	Chris Buerkle
Date	7/14/15	Permit #	---
Checked By	Chris Buerkle	License No.	NH P.G. 827

COMMENTS
- 0-5' hand cleared.
- No soil analytical samples collected.
- PID readings of cuttings 5 to 180.8' bgs: all 0.0 ppm.

Well 08-6724:
flush mounted, 4.25"ID/4.5"OD mild steel casing grouted into 5-7/8" borehole to 19.2' bgs, 3-7/8 inch open hole section from 19.2 to 180.8' bgs.

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
0	0.0	100%	ML	0-1': Sandy SILT (ML), moist, medium stiff, dark yellowish brown 10YR 4/4, no odor, (Fill, roots).
1	0.0	100%	ML	1-6': Sandy SILT (ML), moist, stiff, wet at 4.5', olive yellow 2.5Y 6/6, (native soil).
6				6-8.5': Sandy SILT (ML), wet, very stiff, dark yellowish brown 10YR 4/4, 60% silt, 20% clay, 20% fine gravel (metasediment: mudstone/siltstone).
8.5			Bedrock	8.5-9': Silty GRAVEL (GM), wet, very dense, 10YR 4/4, 60% fine gravel (siltstone/mudstone), 30% silt, 10% clay, (decomposed bedrock): Top of bedrock at 8.5' bgs.
9				9-12': Metasediment (siltstone/mudstone), yellowish brown 10YR 5/4 (brown due to weathering), (highly weathered bedrock).
12				<u>12-12.5': fracture zone producing ~10 gpm, gravel up to 2" blowing out of fracture zone during air lifting.</u>
12.5				12.5-19.2': Metasediment (mudstone/siltstone), brown 10YR 4/3, <u>Q increased to ~15 gpm</u> but no major fractures noticed. Driller indicates competent rock at 12.5' bgs based on down hole pressure. Bottom of 4" casing installed at 19.2'.
19.2				19.2-20': Highly weathered metasediment (siltstone/mudstone), gray 10YR 5/1 and dark yellowish brown 10YR 3/4. Flow (Q) <u>19.2-20': ~1 gpm.</u>
20				20-25': Weathered metasediment (siltstone/mudstone), ~20% quartz pieces, gray 10YR 5/1, no increase in Q (still ~1 gpm).

Continued Next Page

Drilling Log

Monitoring Well **08-6724**

Project *Former Pease AFB - Site 8 Bedrock PFCs* Owner *AFCEC*

Location *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
24							
26							25-30': Weathered metasediment (siltstone/mudstone), ~10% quartz pieces, gray 10YR 5/1, no increase in Q (still ~1 gpm).
28							
30							
32							30-35': Metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B.
34							
36							35-40': Slightly weathered metasediment (siltstone/mudstone), Gley2 4/10B.
38							Q increased to ~2 gpm in 35-40' zone.
40						Bedrock	
42							40-45': Fresh metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B, (Q still ~2 gpm).
44							
46							
48							45-50': Slightly weathered metasediment (siltstone/mudstone), Gley2 4/10B, (Q still ~2 gpm).
50							
52							50-55': Slightly weathered metasediment (siltstone/mudstone), Gley2 4/10B, (measured Q: 2 gpm).
54							
56							

Continued Next Page

Drilling Log

Monitoring Well **08-6724**

Project *Former Pease AFB - Site 8 Bedrock PFCs* Owner *AFCEC*

Location *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
56–60							55-60': Fresh metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B, (Q still ~2 gpm).
60–65							60-65': Fresh to slightly weathered metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B, probable fracture zone 62.5-63.5' as indicated by fast drilling, Q at 65': 4 gpm.
65–70							65-70': Weathered metasediment (siltstone/mudstone), gray 10YR 5/1 and brown weathered pieces, probable fracture zone 66-68' as indicated by fast drilling, Q at 70': 6 gpm.
70–75						Bedrock	70-75': Slightly weathered metasediment (siltstone/mudstone), gray 10YR 5/1, probable fracture zone 72-73' as indicated by fast drilling, Q at 75': 12 gpm.
75–80							75-80': Fresh metasediment (siltstone/mudstone), gray 10YR 5/1, no fractures noticed during drilling but Q increased to 15 gpm (when measured at 80' bgs).
80–85							80-85': Fresh metasediment (siltstone/mudstone), gray 10YR 5/1, Q at 85' still 15 gpm.
85–88							85-90': Slightly weathered metasediment (siltstone/mudstone), gray 10YR 5/1, Q at 90' still 15 gpm.

Continued Next Page

Project Former Pease AFB - Site 8 Bedrock PFCs   Owner AFCEC
Location Portsmouth, NH   Proj. No. 143279

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
88							
90							
92							90-95': Fresh metasediment (siltstone/mudstone), gray 10YR 5/1, Q at 95' still 15 gpm.
94							
96							
98							95-100': Slightly weathered metasediment (siltstone/mudstone), gray 10YR 5/1, Q at 100' still 15 gpm.
100							
102							100-105': Fresh metasediment (siltstone/mudstone), gray 10YR 5/1, Q at 105' still 15 gpm.
104						Bedrock	
106							
108							105-110': Fresh metasediment (siltstone/mudstone), gray 10YR 5/1, Q at 105' still 15 gpm.
110							
112							110-115': Fresh to slightly weathered metasediment (siltstone/mudstone), gray 10YR 5/1, fast drilling 113.5-114', possible fracture, Q increased. Q at 115': 20 gpm.
114							
116							
118							115-120': Fresh to slightly weathered metasediment (siltstone/mudstone), greenish gray Gley1 4/5GY, fast drilling 117.5-119.5'. Q at 120' still 20 gpm.
120							

Continued Next Page

Project *Former Pease AFB - Site 8 Bedrock PFCs* Owner *AFCEC*

Location *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
120							
122							120-125': Fresh to slightly weathered metasediment (siltstone/mudstone), greenish gray Gley1 4/5GY. Q at 125' still 20 gpm.
124							
126							
128							125-130': Fresh metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B. Q at 130' still 20 gpm.
130							
132							130-135': Fresh metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B. Q at 135' still 20 gpm.
134							
136						Bedrock	
138							135-140': Fresh metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B. Q at 140' still 20 gpm.
140							
142							140-145': Slightly weathered metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B. Q at 145' still 20 gpm.
144							
146							
148							145-150': Fresh metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B. Q at 150' still 20 gpm.
150							
152							*Continued Next Page*

Drilling Log

Monitoring Well **08-6724**

Project: *Former Pease AFB - Site 8 Bedrock PFCs* Owner: *AFCEC*

Location: *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
152							150-155': Fresh metasediment (siltstone/mudstone), dark bluish gray Gley2 4/10B. Q at 155' still 20 gpm.
154							
156							
158							155-160': Fresh metasediment (siltstone/mudstone), gray 10YR 5/1. Q at 160' still 20 gpm.
160							
162							160-165': Fresh to slightly weathered metasediment (siltstone/mudstone), greenish gray Gley1 5/5GY. Q at 165' still 20 gpm.
164							
166						Bedrock	
168							165-170': Fresh to slightly weathered metasediment (siltstone/mudstone), ~20% quartz pieces, greenish gray Gley1 5/5GY. Q increased, fast drilling 166-168, possible fracture, Q at 170': 30 gpm.
170							
172							170-176': Slightly weathered metasediment (siltstone/mudstone), ~20% quartz pieces, greenish gray Gley1 5/5GY. Q at 175' still 30 gpm.
174							
176							
178							176-180.8': Fresh metasediment (siltstone/mudstone), very hard/quartzitic, black, Q at 180.8' still 30 gpm.
180							
182							180.8' Total Depth (Stopped drilling since maximum capacity of silt fence was met at 30 gpm).
184							

SHAW_COMMERCIAL Rev: 8/9/13 2015 PEASE SITE 8 BEDROCK PFC (FINAL).GPJ IT_CORP.GDT 1/19/16

Drilling Log

Monitoring Well **08-6725**

Project: Former Pease AFB - Site 8 Bedrock PFCs		Owner: AFCEC	
Location: Portsmouth, NH		Proj. No.: 143279	
Surface Elev.: 38.2 ft.	Total Hole Depth: 228.0 ft.	North: 221400.3463 ft.	East: 1209157.0159 ft.
Top of Casing: 37.68 ft.	Water Level Initial: ▽ 9.0 ft.	Static: NA	Diameter: 3-7/8 in.
Screen: Dia: 3-7/8 in.	Length: 200.5 ft.	Type/Size: open hole	
Casing: Dia: 4.25ID/4.5OD in.	Length: 27.5 ft.	Type: mild steel	
Fill Material: (see well materials in comments)		Rig/Core: Failing Strata Star 15	
Drill Co.: New England Boring Contr.		Method: Drive and Wash / Air Hammer	
Driller: Gregg Leavitt	Log By: Chris Buerkle	Date: 7/29/15	Permit #: ---
Checked By: Chris Buerkle		License No.: NH P.G. 827	

COMMENTS
- 0-5' hand cleared.
- No soil analytical samples collected.
- PID readings of cuttings 5 to 228' bgs: all 0.0 ppm.

Well 08-6725:
flush mounted, 4.25"ID/4.5"OD mild steel casing grouted into 5-7/8" borehole to 27.5' bgs, 3-7/8 inch open hole section from 27.5 to 228' bgs.

Depth (ft.)	PID (ppm)	Sample ID / % Recovery	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
0-5	0.0	100%	SW	0-5': Well graded SAND, dry to moist, dark brown 10YR 3/3, 90% fine to coarse sand, 10% fine gravel.
5-9			SM	5-7': Silty SAND with clay, moist, dark olive brown 2.5Y 3/3, ~55% fine sand, ~30% silt, 10% clay, 5% medium to coarse sand. 7-9': Silty SAND with clay, moist, dark brown 10YR 3/3, ~50% fine sand, ~30% silt, 10% clay, 10% medium sand, trace coarse sand and fine gravel.
9-18			GW GM	9-18': Sandy GRAVEL with silt, moist, wet ~9', dark yellowish brown 10YR 4/4 to bluish gray Gley2 6/1, 50% fine to coarse gravel (subangular to rounded), 40% fine to coarse sand, 10% silt.
18-18.5			SP	18-18.5': Poorly graded SAND, wet, 90% medium to coarse sand, 10% fine gravel (rounded).
18.5-24			Bedrock	18.5-21': Weathered metasediment (siltstone/mudstone), gray 10YR 5/1, (weathered bedrock). Competent rock at 20.5' bgs. 21-23': Highly weathered metasediment (siltsone/mudstone), bluish black Gley2 2.5/5PB.

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SHAW_COMMERCIAL Rev: 8/9/13 2015 PEASE SITE 8 BEDROCK PFC (FINAL).GPJ IT_CORP.GDT 1/19/16

Drilling Log

Monitoring Well **08-6725**

Project *Former Pease AFB - Site 8 Bedrock PFCs* Owner *AFCEC*

Location *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
24–27.5							23-27.5': Weathered metasediment (siltsone/mudstone), bluish black Gley2 2.5/5PB. Steel casing installed to 27.5' bgs.
27.5–31.5							27.5-31.5': Fresh metasediment (siltsone/mudstone), bluish black Gley2 2.5/10PB. No water 27.5-31.5' bgs (waited 10 min before blowing air).
31.5–36.5							31.5-36.5': Fresh metasediment (siltsone/mudstone), 5% calcite pieces, bluish black Gley2 2.5/10PB, (No water in borehole).
36.5–41.5						Bedrock	36.5-41.5': Fresh metasediment (siltsone/mudstone), trace calcite pieces, bluish black Gley2 2.5/10PB, (No water in borehole).
41.5–46.5							41.5-46.5': Fresh metasediment (siltsone/mudstone), trace calcite pieces, dark bluish gray Gley2 3/5B, (No water in borehole).
46.5–51.5							46.5-51.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 4/5B, (No water in borehole).
51.5–56							51.5-56.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 4/5B, (No water in borehole).

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Drilling Log

Monitoring Well **08-6725**

Project: *Former Pease AFB - Site 8 Bedrock PFCs* Owner: *AFCEC*

Location: *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
56							
58							56.5-61.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 4/5B, trace water (not enough to measure Q).
60							
62							
64							61.5-66.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 4/5B, no increase in Q (still trace water).
66							
68							
70							66.5-71.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 4/5B, no increase in Q (still trace water: 1 gallon total blew out of borehole after waiting 40 min.
72						Bedrock	
74							71.5-76.5': Fresh quatzitic metasediment (siltsone/mudstone), dark bluish gray Gley2 4/5B, no increase in Q (still trace water).
76							
78							76.5-81.5': Fresh quatzitic metasediment (siltsone/mudstone), dark bluish gray Gley2 4/5B, no increase in Q (still trace water).
80							
82							
84							81.5-86.5': Fresh quatzitic metasediment (siltsone/mudstone), dark bluish gray Gley2 4/5B, no increase in Q (waited 30 min before blowing air: still trace water).
86							
88							

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Drilling Log

Monitoring Well **08-6725**

Project *Former Pease AFB - Site 8 Bedrock PFCs* Owner *AFCEC*

Location *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
88							86.5-91.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/10B, no increase in Q (still trace water).
90							
92							
94							91.5-96.5': Fresh metasediment (siltsone/mudstone), dark gray Gley2 4/N, Q increased to 0.7 gpm.Likely fracture in 96-98' zone.
96							
98							96.5-101.5': Fresh metasediment (siltsone/mudstone), ~5% calcite pieces, dark bluish gray Gley2 3/5B,Q increased to 0.85 gpm.
100							
102							
104						Bedrock	101.5-106.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B,slight increase in Q, now 0.9 gpm.
106							
108							106.5-111.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B, no increase in Q (still 0.9 gpm).
110							
112							
114							111.5-116.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B, no increase in Q (still 0.9 gpm).
116							
118							116.5-121.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B,slight increase in Q, now 1.0 gpm.
120							

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Drilling Log

Monitoring Well **08-6725**

Project *Former Pease AFB - Site 8 Bedrock PFCs* Owner *AFCEC*

Location *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
120							
122							
124							121.5-126.5': Fresh metasediment (siltsone/mudstone), ~5% calcite pieces, dark bluish gray Gley2 3/5B,slight increase in Q, now 1.05 gpm.
126							
128							126.5-131.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B,slight increase in Q, now 1.1 gpm.
130							
132							
134							131.5-136.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B,slight increase in Q, now 1.2 gpm.
136						Bedrock	
138							136.5-141.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B,increase in Q to 1.6 gpm.
140							
142							
144							141.5-146.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B, no increase in Q.
146							
148							146.5-151.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B, larger cuttings up to 3/4",increase in Q to 2.0 gpm.
150							
152							

Continued Next Page

Project: *Former Pease AFB - Site 8 Bedrock PFCs* Owner: *AFCEC*

Location: *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
152–156.5							151.5-156.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B, no increase in Q.
156.5–161.5							156.5-161.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B, increase in Q to 2.15 gpm.
161.5–166.5							161.5-166.5': Fresh metasediment (siltsone/mudstone), dark bluish gray Gley2 3/5B, no increase in Q.
166.5–171.5						Bedrock	166.5-171.5': Fresh metasediment (siltsone/mudstone), dark greenish gray Gley2 4/5BG, no increase in Q.
171.5–176.5							171.5-176.5': Fresh metasediment (siltsone/mudstone), dark greenish gray Gley2 4/5BG, no increase in Q.
176.5–181.5							176.5-181.5': Fresh metasediment (siltsone/mudstone), dark greenish gray Gley2 4/5BG, no increase in Q.
181.5–184							181.5-186.5': Fresh metasediment (siltsone/mudstone), ~20%

Continued Next Page

Project Former Pease AFB - Site 8 Bedrock PFCs Owner AFCEC
Location Portsmouth, NH Proj. No. 143279

Depth (ft.)	Well Completion	PID (ppm)	Sample ID % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
184							quartz pieces, dark greenish gray Gley2 4/5BG, no increase in Q.
186							
188							186.5-191.5': Fresh metasediment (siltsone/mudstone), ~20% quartz pieces, dark greenish gray Gley2 4/5BG,increase in Q to 3.0 gpm.
190							
192							
194							191.5-196.5': Fresh metasediment (siltsone/mudstone), ~20% quartz pieces, dark greenish gray Gley2 4/5BG, no increase in Q.
196							
198							196.5-201.5': Fresh metasediment (siltsone/mudstone), ~20% quartz pieces, dark greenish gray Gley2 4/5BG, no increase in Q.
200						Bedrock	
202							
204							201.5-206.5': Fresh metasediment (siltsone/mudstone), ~20% quartz pieces, greenish gray Gley1 5/10Y,increase in Q to 3.3 gpm.
206							
208							206.5-211.5': Fresh metasediment (siltsone/mudstone), greenish gray Gley1 5/10Y, 210.5-211.5' black Gley1 2.5/N, no increase in Q.
210							
212							
214							211.5-216.5': Fresh metasediment (siltsone/mudstone), gray Gley1 5/N, cuttings up to 3/4",increase in Q to 4.0 gpm.
216							

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Drilling Log

Monitoring Well **08-6725**

Project: *Former Pease AFB - Site 8 Bedrock PFCs* Owner: *AFCEC*

Location: *Portsmouth, NH* Proj. No. *143279*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Blow Count Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
							Continued
216–221.5						Bedrock	216.5-221.5': Fresh metasediment (siltsone/mudstone), gray Gley1 5/N, no increase in Q.
221.5–226.5							221.5-226.5': Fresh metasediment (siltsone/mudstone), greenish gray Gley1 5/5GY,<u>increase in Q to ~50 gpm. Major fracure - likely in 223-223.5' zone (soft drilling).</u>
226.5–228							226.5-228': Fresh quartzitic metasediment (siltsone/mudstone), greenish gray Gley1 6/5GY, no noticable increase in Q (still ~50gpm), 3/4" gravel pieces.
228							228' Total Depth (air hammer stopped advancing due to high water pressure and air compressor overheating).

Depth scale: 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248

Appendix C
Well Development Logs

WELL DEVELOPMENT RECORD

Project Name: FORMER PEASE AFB, SITE 8 BEDROCK PFC INVESTIGATION

Location: SITE 8 — Well/~~Piez.~~ No.: 08-6722

Personnel: CHRIS BERKEL — Date Installed: 6-29-15

Date (Start/End): 6-30-15 → ~~6-30-15~~ 7-1-15 — Csg. Diameter (I.D.): 5" ID RISER TO 74', 1.0' CASING STICKUP

Method of Development: AIR LIFTING USING COMPRESSOR — Total Depth (ft. TOC): BEFORE DEV.: 130.0' @ 8:54 AM * AFTER DEV.: 141.5 @ 11:30, 7-1-15

☒ Surging ☐ Bailing ☒ Pumping ☐ Other (State Method)

☒ Original Development ☐ Redevelopment — Development Date: 6-30-15

Depth to water before developing well: 25.75' FROM TOP OF STEEL CASING (NO PVC INSTALLED) AT 8:35 AM.

[49' IN 5" / 66.5' IN 4.5"] → 50 gal / 55 gal

Height of Water Column: ~115 feet ~~8/16~~ = ______ gal.* ______ = ______ (Volume (V) / Purge Factor / Volume To Purge)

105 gal = ONE WELL VOLUME

$V = (B * r_c^2 * L_c * 7.48)+(B*(r_w-r_c)^2*L_s*ø_s*7.48)=$ ______ gallons (See Notes below)

Depth purging from: 140' feet — Time purging begins: 9:03 AM

Weather: 70°s, CLEAR — Screened Interval (ft. BGL): 74-140.5' (4.5" OPEN HOLE)

Equipment Nos.: pH Meter HYDRION W/STD CHECK — EC Meter N/A — Turbidity Meter HACH 2100P (09050C035694)

Equipment decontaminated prior to development Y X N ______

Describe DOWNHOLE RODS & AIRHAMMER WERE STEAMCLEANED WITH POTABLE WATER BEFORE DRILLING AND ALLOWED TO AIR DRY.

Date	Time	Water Level (ft. below TOC)	Volume Removed (gal.)	Temp (C or F)	pH	EC	Turbidity [NTU]	D.O.	Comments
6-30-15	9:03	25.75'	0	—	~7.5	—	>1,000	—	START AIR LIFTING
6-30-15	9:20	NM	850	—	~7-7.5	—	560	—	—
6-30-15	9:20-9:38 STOPPED PUMPING: BIT-WAS LOCKED BY GRAVEL								—
6-30-15	9:53	NM	1,600	—	~7.0	—	105	—	(STILL BLOWING OUT SOME GRAVEL).
6-30-15	10:08	NM	2,350	—	~7.0	—	46.7	—	(LESS GRAVEL BLOWING OUT).
6-30-15	10:25	NM	3,200	—	~7.0	—	54.2	—	(STOPPED BLOWING GRAVEL OUT).
6-30-15	10:48	NM	4,350	—	~7.0	—	25.4	—	—
6-30-15	11:22	NM	6,050	—	~7.0	—	9.2	—	

Q ~ 50 GPM

→ ~57 WELL VOLUMES REMOVED.

Notes:

- Water levels – Reported to the nearest 0.01 foot.
- pH – Reading rounded to 0.1 pH units
- Electrical conductivity (EC) – Reported to the nearest 10% mhos/cm or
- µmho/cm @25 C or in mS/cm of instrument set range
- Water temperature – Reported to the nearest 0.1 C or F feet
- Dissolved oxygen (D.O.) report in 0.1 mg/L
- Turbidity report in NTV nearest whole #

Where:

B=3.14
$ø_s$=porosity of the sand pack
r_c =radius of the well casing and screen in feet
L_c=length of water column inside the casing and screen in
r_w =radius of the well bore in feet
L_s =length of saturated portion of the sand pack in feet
7.48 gallons/cubic foot=conversion from cubic feet to gallons

[NM = NOT MEASURED]

11:25 PULLING DEVELOPMENT RODS WITH AIR HAMMER.

* 10.5' OF SEDIMENT IN WELL BOTTOM.

7-1-15: REMOVED ROCK BLOCKAGE AT 123' BGS & REMOVED 2' OF GRAVEL FROM WELL BOTTOM. → HOLE STAYING OPEN TO 140.5' BGS

WELL DEVELOPMENT RECORD

Project Name: FORMER PEASE AFB, SITE 8 BEDROCK PFC INVESTIGATION.

Location: NEXT TO NEWINGTON CEMETERY

Well/Piez. No.: 08-6723

Personnel: CHRIS BURKLE

Date Installed: 8-17-15

Date (Start/End): 8-17-15 → 8-17-15

~~Csg.~~ Diameter (I.D.): 4" OPEN HOLE

Method of Development: AIR LIFTING (AIR HAMMER AND AIR COMPRESSOR)

Total Depth (ft. TOC): 108.5'

☒ Surging ☐ Bailing ☒ Pumping ☐ Other (State Method) ____________

☒ Original Development ☐ Redevelopment Development Date: 8-17-15

Depth to water before developing well: 51.3' BGS @ 10:15 Am, 8-17-15

	Volume (V)	Purge Factor	Volume To Purge
~~Height of Water Column: ______ feet~~	~~= ______ gal.*~~		~~= ______~~

[38 gal = 1 WELL VOLUME]

~~V = (B * r_c^2 * L_c * 7.48)+(B*(r_w-r_c)^2*L_s*$ø_s$*7.48)= ______ gallons (See Notes below)~~

Depth purging from: 108' feet

Time purging begins: 10:20

Weather: 80-90/es

Screened Interval (ft. BGL): 88-108.5'

Equipment Nos.: pH Meter PH YORION / INTM-CHECK ~~EC Meter 2100P HACH~~ N/A

Turbidity Meter 2100P HACH TURBIDITY METER

Equipment decontaminated prior to development Y X N ______

Describe STEAM CLEANED & AIR DRYED.

Date	Time	Water Level (ft. below TOC)	Volume Removed (gal.)	Temp (C or F)	pH	EC	Turbidity [NTU]	D.O.	Comments
8-17-15	10:20	51.3'	0	—	6.0	—	71,000	—	Q ~50 GPM
8-17-15	10:30	—	500	—	6.5	—	71,000	—	
8-17-15	10:50	—	1,500	—	6.5	—	140	—	
8-17-15	11:10	—	2,500	—	6.5	—	54.1	—	
8-17-15	11:30	—	3,500	—	6.5	—	80.4	—	
8-17-15	12:30	—	6,500	—	6.5	—	27.8	—	
8-17-15	13:30	—	9,500	—	6.5	—	29.0	—	

13:30 COMPLETED DEVELOPMENT. WATER CLEAR, COLORLESS, NO ODOR. ~235 WELL VOLUMES REMOVED.

Notes:

- Water levels – Reported to the nearest 0.01 foot.
- pH – Reading rounded to 0.1 pH units
- Electrical conductivity (EC) – Reported to the nearest 10% mhos/cm or
- µmho/cm @25 C or in mS/cm of instrument set range
- Water temperature – Reported to the nearest 0.1 C or F feet
- Dissolved oxygen (D.O.) report in 0.1 mg/L
- Turbidity report in NTV nearest whole #

Where:
B=3.14
$ø_s$=porosity of the sand pack
r_c =radius of the well casing and screen in feet
L_c=length of water column inside the casing and screen in
r_w =radius of the well bore in feet
L_s =length of saturated portion of the sand pack in feet
7.48 gallons/cubic foot=conversion from cubic feet to gallons

14:00 DTW POST DEVELOPMENT: 51.38' BGS.

08-6724

WELL DEVELOPMENT RECORD

Project Name: SITE 8 BEDROCK PFC INVESTIGATION

Location: FORMER PEASE AFB, PORTSMOUTH, NH

Well/Piez. No.: 08-6724

Personnel: C. BURKLE, B. HEDRICK

Date Installed: 7-14-15

Date (Start/End): 7-14-15 → 7-14-15

Csg. Diameter (I.D.): 3 7/8"

Method of Development: AIR LIFTING *

Total Depth ~~(ft. TOC)~~: 182.4' - 1.6' = 180.8'

☒ Surging ☐ Bailing ☒ Pumping ☐ Other (State Method) ____________

☒ Original Development ☐ Redevelopment Development Date: 7-14-15

Depth to water before developing well: NO MEASUREMENT (DEVELOPED IMMEDIATELY AFTER REACHING TARGET DEPTH). **

(1 WELL VOLUME ≈ 117 GAL)

~~Volume (V) Purge Factor Volume To Purge~~ (N/A)

~~Height of Water Column: ________ feet ________ = ________ gal.* ________ = ________~~ (N/A)

~~$V = (B * r_c^2 * L_c * 7.48) + (B*(r_w - r_c)^2 * L_s * ø_s * 7.48) =$ ______ gallons (See Notes below)~~ (N/A)

Depth purging from: 180' feet

Time purging begins: 9:00

Weather: 70-80 DEGS, OVERCAST

Screened Interval (ft. BGL): 19.2-180.8' BGS

Equipment Nos.: pH Meter pHYDRION INSTANT CHECK EC Meter — Turbidity Meter HACH 2100P

Equipment decontaminated prior to development Y X N ____

Describe DRILL RODS STEAM CLEANED PRIOR TO DRILLING & ALLOWED TO AIR DRY.

Date	Time	Water Level (ft. below TOC)	Volume Removed (gal.)	Temp (C or F)	pH	EC	Turbidity [NTU]	D.O.	Comments
7-14-15	9:00	—	0	—	7.0	—	>1,000	—	Q = 30 GPM
7-14-15	9:10	—	300	—	7.0	—	119	—	
7-14-15	9:20	—	600	—	7.0	—	59.6	—	
7-14-15	9:30	—	900	—	7.0	—	32.1	—	
7-14-15	9:40	—	1200	—	7.0	—	28.6	—	
7-14-15	10:00	—	1,800	—	7.0	—	20.9	—	
7-14-15	10:20	—	2,400	—	7.0	—	15.6	—	
7-14-15	10:40	—	3,000	—	7.0	—	9.5	—	

10:46 FINISHED DEVELOPMENT

~25 WELL VOLUMES

Notes:
- Water levels – Reported to the nearest 0.01 foot.
- pH – Reading rounded to 0.1 pH units
- Electrical conductivity (EC) – Reported to the nearest 10% mhos/cm or
- µmho/cm @25 C or in mS/cm of instrument set range
- Water temperature – Reported to the nearest 0.1 C or F feet
- Dissolved oxygen (D.O.) report in 0.1 mg/L
- Turbidity report in NTV nearest whole #

Where:
B=3.14
$ø_s$=porosity of the sand pack
r_c =radius of the well casing and screen in feet
L_c=length of water column inside the casing and screen in feet
r_w =radius of the well bore in feet
L_s =length of saturated portion of the sand pack in feet
7.48 gallons/cubic foot=conversion from cubic feet to gallons

* AIR LIFTING USING 3 7/8" AIR HAMMER AND AIR COMPRESSOR

** DTW AFTER DEVELOPMENT (TOC) ? 7.17' @ 11:23, WATER STILL RISING SLOWLY (7.16' @ 11:25) → = 5.56' BGS STILL RISING VERY SLOWLY

WELL DEVELOPMENT RECORD

Project Name: FORMER PEASE AFB, PORTSMOUTH, NH

Location: ~~AOC~~ 08 SITE 8 BEDROCK PFC INVESTIGATION | Well/Piez. No.: 08 - 6725 (AT FRIZZELL PROPERTY)

Personnel: CHRIS BURNING (CBRI) / G. LOVITT (NEDC) | Date Installed: 7-29-15

Date (Start/End): 7-29-15 → 7-29-15 | ~~Csg.~~ Diameter (I.D.): 3 7/8" OPEN HOLE

Method of Development: AIRLIFTING | Total Depth (ft. TOC): 228' (MEASURED WITH DRILL STRING)

☒ Surging ☐ Bailing ☒ Pumping ☒ Other (State Method) AIRLIFTING USING 3 7/8" AIRHAMMER AND AIR COMPRESSOR

☐ Original Development ☐ Redevelopment Development Date: 7-29-15

Depth to water before developing well: NOT MEASURED [7.9' BGS 1 DAY AFTER WELL DEVELOPMENT]

~~Height of Water Column: ______ feet ______ = ______ gal.* ______ = ______~~ (A)

~~Volume (V)~~ ~~Purge Factor~~ ~~Volume To Purge~~ (A)

1 WELL VOLUME EQUALS ~147 GAL

$V = (B * r_c^2 * L_c * 7.48)+(B*(r_w-r_c)^2*L_s*ø_s*7.48)=$ ______ gallons (See Notes below)

Depth purging from: 228' feet | Time purging begins: 13:30

Weather: 80-90 DEGS, PARTLY CLOUDY | Screened Interval (ft. BGL): 27.5 - 228'

Equipment Nos.: pH Meter HYDRION ~~INSTACHECK~~ | EC Meter — | Turbidity Meter HACH 2100P

Equipment decontaminated prior to development Y X N ______

Describe DRILL RODS/AIR HAMMER STEAMCLEANED & AIR DRIED.

Date	Time	Water Level (ft. below TOC)	Volume Removed (gal.)	Temp (C or F)	pH	EC	Turbidity	D.O.	Comments
7-29-15	13:30	—	—	—	7.0	—	151.5	—	Q ~ 50 GPM
↓	13:50	—	1,000	—	7.0	—	22.3	—	↓
↓	14:00	—	1,500	—	7.0	—	9.74	—	↓
↓	14:05	—	1,750	—	7.0	—	5.48	—	↓

14:05

CB 7-29-15

CB 7-29-15

↳ 12 WELL VOLUMES REMOVED.

Notes:

- Water levels – Reported to the nearest 0.01 foot.
- pH – Reading rounded to 0.1 pH units
- Electrical conductivity (EC) – Reported to the nearest 10% mhos/cm or
- µmho/cm @25 C or in mS/cm of instrument set range
- Water temperature – Reported to the nearest 0.1 C or F feet
- Dissolved oxygen (D.O.) report in 0.1 mg/L
- Turbidity report in NTV nearest whole #

Where:

B=3.14
$ø_s$=porosity of the sand pack
r_c =radius of the well casing and screen in feet
L_c=length of water column inside the casing and screen in feet
r_w =radius of the well bore in feet
L_s =length of saturated portion of the sand pack in feet
7.48 gallons/cubic foot=conversion from cubic feet to gallons

WELL DEVELOPMENT RECORD

Project Name: FORMER PEASE AFB, PORTSMOUTH, NH

Location: ADJACENT TO NEWINGTON (CEMETERY)
Well/Piez. No.: 08-6046 REDEVELOPMENT

Personnel: CHRIS BUERKLE
Date Installed: 02/21/92

Date (Start/End): 8-19-15 → 8-19-15
Csg. Diameter (I.D.): 6"

Method of Development: AIRLIFTING (
Total Depth (ft. TOC): 282' BGS

☒ Surging ☐ Bailing ☒ Pumping ☐ Other (State Method) ______

☐ Original Development ☒ Redevelopment Development Date: 8-19-15

Depth to water before developing well: 52.55' BGS (7:40 AM, 8-19-15).

	Volume (V)	Purge Factor	Volume To Purge
~~Height of Water Column: ______ feet ______ =~~	~~______ gal.*~~	~~______~~	~~= ______~~ CB

~~$V = (B * r_c^2 * L_c * 7.48) + (B * (r_w - r_c)^2 * L_s * ø_s * 7.48) =$~~ ______ gallons (See Notes below) CB

337 gal = 1 WELL VOLUME

Depth purging from: 281' feet
Time purging begins: 11:10

Weather: 80ies, CLEAR, HUMID.
Screened Interval (ft. BGL): 85-282'

Equipment Nos.: pH Meter PHYDRION INSTACHECK EC Meter — Turbidity Meter HACH 2100P

Equipment decontaminated prior to development Y X N ______

Describe STEAMCLEANED & AIR DRIED DEWATERS EQUIPMENT.

Date	Time	Water Level (ft. below TOC)	Volume Removed (gal.)	Temp (C or F)	pH	EC	Turbidity [NTU]	D.O.	Comments
~~8-19-15~~	~~8:40~~	~~—~~	~~0~~	~~—~~	~~7.0~~	~~—~~		~~—~~	~~Q = 5 GPM~~ CB
8-19-15	11:10	—	0	—	7.0	—	>1000	—	Q = 10 GPM
8-19-15	11:30	—	200	—	7.0	—	684	—	
8-19-15	11:50	—	400	—	7.0	—	221	—	
8-19-15	12:20	—	700	—	7.0	—	83.1	—	
8-19-15	12:50	—	1,000	—	7.0	—	60.9	—	
8-19-15	13:20	—	1,300	—	7.0	—	54.9	—	
8-19-15	13:30	—	1,400	—	7.0	—	43.1	—	

11:10 → START REDEVELOP.

13:30 → COMPLETED RE-DEVELOPMENT

Notes:

- Water levels – Reported to the nearest 0.01 foot.
- pH – Reading rounded to 0.1 pH units
- Electrical conductivity (EC) – Reported to the nearest 10% mhos/cm or
- µmho/cm @25 C or in mS/cm of instrument set range
- Water temperature – Reported to the nearest 0.1 C or F feet
- Dissolved oxygen (D.O.) report in 0.1 mg/L
- Turbidity report in NTV nearest whole #

Where:

B=3.14
$ø_s$=porosity of the sand pack
r_c =radius of the well casing and screen in feet
L_c=length of water column inside the casing and screen in
r_w =radius of the well bore in feet
L_s =length of saturated portion of the sand pack in feet
7.48 gallons/cubic foot=conversion from cubic feet to gallons

1,400 gal REMOVED (= 4.15 WELL VOLUMES).
WATER CLEAR, COLORLESS, NO ODOR.

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Appendix D
TFMoran Survey Report

10/18/2015
FBK 2067
STB

TFMORAN INC
MONITOR WELLS
for
CB&I
PEASE AIR FORCE BASE

DATUM : NAD83/86
VERTICAL : NGVD 29
PROJECTION : NH SP
UNITS : USFT

PNT#	Northing	Easting	Tcase	TPVC	GND	Well ID	Desc.
			SITE 8				
1524	219225.48	1206319.82	110.16	NO PVC	108.2	08-6723	
1525	221400.35	1209157.02	38.18	37.68	38.18	08-6725	
1526	222052.07	1208174.06	49.19	48.88	49.19	08-6724	
1527	218528.72	1205723.95	78.18	NO PVC	77.18	08-6722	
1528	217528.30	1207532.31	114.87	114.55	114.87	08-5176	
			SITE 17				
1529	209361.71	1217563.95	34.69	34.42	34.69	17-5034	
			LANDFILL 5				
1530	218151.15	1212482.94	87.74	87.53	84.14	5-5008	
			SITE 32				
1531	211528.42	1213633.30	57.28	57.08	54.78	32-5024R	
1532	211515.03	1213597.16	56.20	55.98	54.40	32-TW5297	
1533	211602.72	1213568.99	54.77	54.57	52.47	32-5267R	
1534	211617.37	1213581.87	54.68	54.47	52.48	32-6073R	
1535	211894.03	1213673.28	55.01	54.57	55.01	32-7853	
1536	212010.25	1213865.79	53.94	53.79	53.94	32-7548	
			SITE 36				
1537	212012.72	1213245.67	59.87	59.38	58.22	36-7852	
			SITE 39				
1538	211863.52	1212215.67	64.67	64.42	64.67	39-MW101	
1539	212003.41	1212079.84	65.59	64.99	65.59	39-MW100	
1540	212092.69	1212158.31	65.60	65.10	65.60	39-IW002	
1541	212161.32	1212030.24	65.58	65.19	65.58	39-IW001	

TFM Survey 2015-10-30 (2).xls

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Appendix E
Geophysical Logging Report

BOREHOLE GEOPHYSICAL LOGGING
OF FOUR BEDROCK BOREHOLES
AT THE
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE
PROJECT # 143279

Northeast Geophysical Services
4 Union Street, Suite 3
Bangor, Maine 04401
November, 2015

BOREHOLE GEOPHYSICAL LOGGING
OF FOUR BEDROCK BOREHOLES
AT THE
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE
PROJECT # 143279

Introduction

At the request of the CBI Federal Services, four bedrock boreholes were geophysically logged by Rudy Rawcliffe of Northeast Geophysical Services (NGS). The boreholes were located the near the Site 8 area which is in located near the north portion of the former Pease Air Force Base in Portsmouth, New Hampshire. The boreholes were named 08-6722, 08-6723, 08-6724 and 08-6725. The boreholes were logged August 24 - 26, 2015.

The purpose of the geophysical logging was to identify water-bearing fractures for subsequent packer sampling. Weather during the surveys was fair.

Geophysical Methods and Instrumentation

The boreholes were logged with a Mount Sopris Matrix digital logger. The boreholes were logged with a caliper tool, a fluid temperature/fluid conductivity tool and an ATV tool. In general the logging sequence was fluid temperature/fluid conductivity followed by the caliper and ATV logs. The final log on each borehole was the flowmeter measurements. Prior to entering the borehole each tool was decontaminated using soap (alconox) and deionized water rinse.

The logging procedure for the temperature probe was to lower the probe about two feet into the water column and allow the tool to equilibrate to the ambient borehole fluid temperature which takes about five to eight minutes. The temperature/fluid resistivity log is measured moving downwards in the borehole so that there is less disturbance of the water column. The caliper and ATV logs are logged from the bottom of the borehole. The final log on each borehole was the Heat pulse flowmeter. Similar to the temperature probe, the heat pulse tool is lowered into the water column and allowed to stabilize for about five to eight minutes before data collection. Logging rates for the tools were: caliper at 20 feet per minute (fpm), fluid at 10 fpm and ATV at 6 fpm.

Following is a brief description of each parameter that was measured and how that information is used to locate possible bedrock fractures.

Temperature (in degrees Centigrade [^{o}C]) is measured with the probe going down each hole. Areas where water may be entering or exiting the borehole are sometimes revealed on the temperature log as abrupt temperature changes or sometimes as temperature gradient changes. Other factors that can affect the temperature log besides transmissive fractures include variations in the thermal resistivity of the rock with depth along the borehole, surface climatic changes, thermal effects of drilling activity, and localized heat sources such as radionuclides in the rock or cement setting outside the casing.

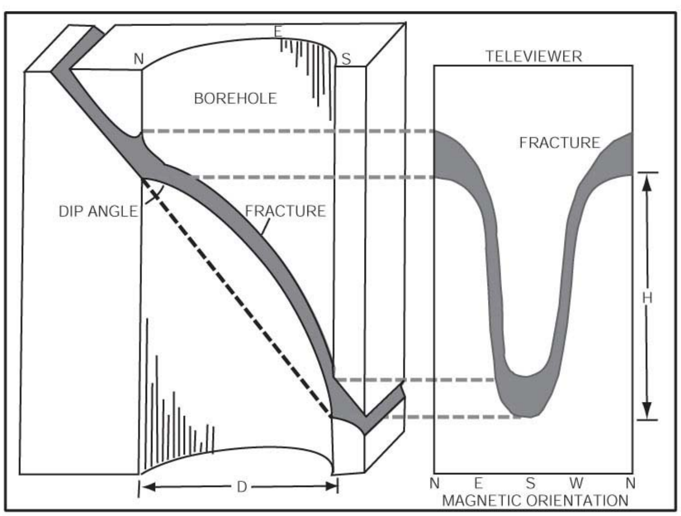
Fluid conductivity is the conductivity (in µS/cm) of the water in the borehole. Fluid conductivity can be useful in identifying transmissive fractures because water entering the borehole through fractures sometimes has a different conductivity than the water that is already in the borehole. The tool actually measures fluid resistivity in ohmmeters (Ωm) rather than fluid conductivity. Fluid resistivity is essentially the inverse of fluid conductivity. For example: 1 Ωm is equal to 10,000 μS/cm and 1,000 Ωm is equal to 10 μS/cm. Because fluid conductivity is more commonly used in groundwater investigations the fluid resistivity data were converted to fluid conductivity for presentation on the logs.

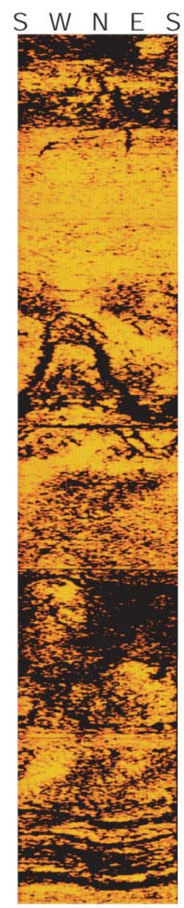
<u>Caliper</u> measures the borehole diameter. Fractures are often revealed on the caliper log as abrupt widenings of the borehole.

<u>The acoustical televiewer (ATV) log</u> provides an acoustical image of the borehole walls. The ATV works by scanning the borehole wall with an acoustic beam that is produced by a rapidly rotating piezoelectric source. Planar features such as fractures, bedding surfaces and joints can be identified with the ATV tool and the strike, dip direction and dip angle of these features can often be determined.

The ATV data are presented as “unwrapped” images of the borehole wall that are oriented to magnetic north. The dip angle and dip direction of any planar feature that intersects the borehole can be measured from this image as illustrated below.

Borehole Televiewer Data





Each identified feature was digitized using WellCad software which then calculates the dip and dip direction of the features taking into account the borehole tilt and orientation.

The temperature, caliper, fluid conductivity and ATV logs were examined and possible bedrock fractures were identified. This information was used to select measurement locations for the flowmeter instrument. Generally, flowmeter measurements were taken in the areas immediately above and below locations where potential transmissive fractures might exist in the boreholes. At each flowmeter measurement location a minimum of three repeatable (within 0.01 gpm) readings were made.

Borehole Geophysical Results

The following table summarizes some of the attributes of each well:

Well Summary - Former Pease AFB Site Portsmouth, New Hampshire				
Attachment:	**A**	**B**	**C**	**D**
Well	**08-6722**	**08-6723**	**08-6724**	**08-6725**
Total Depth (ft from toc)	141.1	110.7	179.70	226.20
Casing Length (ft)	74.0	89.5	18.50	26.50
Water Level (ft from toc)	26.55	53.65	6.15	7.43
Caliper (inches*)	4.98	3.87	3.92	3.90
maximum	>18	9.55	4.58	4.63
Temperature (^{o}C*)	9.70	9.50	10.50	10.37
minimum	9.69	9.47	10.35	10.20
maximum	9.73	9.59	11.22	10.46
Fld Conductivity (uS/cm*)	296	726	2,933	1,045
minimum	285	580	2,330	987
maximum	605	781	4,013	1,353
* median value				

Geophysical logs for each of the four boreholes are attached to this report as Attachments A through D respectively. Attachment A contains data from the 08-6722; Attachment B contains data from 08-6723 and so on. For each borehole the data are presented in a series of graphs (Plates 1-6) that show the results of the geophysical measurements. Tables that provide the depth and calculated strike and dip of each identified feature for each borehole are also presented in the attachments.

Plate 1 in each attachment (A-D) is a composite geophysical log containing caliper, flowmeter, temperature, fluid conductivity measurements and a tadpole plot derived from the televiewer data. Plate 1 shows the locations of potential fractures in each of the boreholes. The flowmeter results, temperature and fluid conductivity results provide indications of which of these potential fractures that may carry notable groundwater flow (i.e. are transmissive).

The fractures interpreted to be transmissive are highlighted in yellow on Plate 1. Dark yellow highlights indicate likely transmissive fractures. Lighter yellow highlights indicate possible transmissive fractures. The tadpole plot (far right column) on Plate 1 also shows possible and likely transmissive fractures. The blue colored tadpoles represent possible (light blue) and likely (dark blue) transmissive fractures. It is possible that there are other transmissive fractures in the borehole but these are the ones that are most apparent based on the geophysical measurements.

Plate 2 is a rose plot of the strike and dip angle of all the interpreted planar features in each borehole. These rose plots show that the majority of the planar features in the boreholes strike northeast at about 20° true and dip towards the northwest. This may represent the foliation in the rock or bedding.

Plate 3 is borehole deviation of each borehole. Borehole 08-6722 deviated slightly (~2.5 feet) towards the east. Borehole 08-6723 only had about 20 feet of open borehole below the casing and so had minor deviation. The largest deviations were in 08-6724 (about 23 feet to the southeast) and 08-6725 (about 35 feet southeast). This deviation direction is approximately perpendicular to the predominant strike in these boreholes and opposite the predominant dip direction.

Plate 4 is the televiewer image log plots and interpreted structure for each borehole.

Plate 5 is a repeat log of caliper and fluid temperature and conductivity for sections of each borehole. In general the caliper logs repeated fairly closely. The slight discrepancies that can be seen between the original and repeat runs on some logs are most likely due to a different orientation of the 3-armed caliper or different pathway up the borehole by the tool between the original and repeat runs.

The repeat fluid temperature and conductivity measurements also matched quite closely. The slight variations between the original and repeat runs could be due to disturbance of the water column in the borehole because of repeated runs of tools going up and down in the borehole or they may be due to warming of the electronics in the tool over time.

Plate 6 is an ATV repeat log of a section of each borehole. The ATV logs for all of the boreholes repeated very closely with the original logs.

Table 1 (A-D) provides the depth and calculated strike and dip of the planar features in each borehole that have been interpreted from the televiewer log. These planar features may be fractures or may represent cleavage, joints or bedding planes. The results in Table 1 have been categorized and also have been color-coded on the logs to provide an interpretative range of the likelihood that the associated feature signifies a transmissive fracture as follows:

- Dark blue symbol (category 107) - multiple distinct borehole geophysical logging responses indicating borehole enlargement (caliper, acoustic signal), or evident change in the borehole fluid characteristic (temperature, fluid conductivity or quantified vertical flow) that provides the strongest data that the indicated bedrock feature represents a likely transmissive water-bearing fracture.

- Light blue symbol (category 108) - less amount of corroborating geophysical data to support that the indicated feature will transmit groundwater compared to the dark blue symbol. However, the televiewer logs show a fairly distinct acoustic signal or optical image that perhaps under a higher stress condition (e.g. pumping rate), vertical flow could be induced in the borehole. Less degree of confidence that the feature represents a transmissive feature than category 107.

- Black symbol (category 100) - bedrock feature not interpreted to transmit water; more likely to represent planes of foliation, bedding planes, healed or filled fractures, or mechanical breaks in the rock matrix due to drilling advancement.

It is possible that there are other transmissive fractures in the boreholes but the ones indicated on the logs and tables are considered the most likely based on the geophysical measurements.

Table 2 in each attachment is a summary of the flowmeter measurements taken in the borehole.

Discussion of the results

The main objective of the geophysical logging was to identify and characterize transmissive fractures in the boreholes. Plate 1 and Table 1 in the attachments (A-D) indicate the zones in each borehole that are interpreted to be transmissive. This was based primarily on the flowmeter measurements and to a lesser degree on the temperature and fluid conductivity measurements.

Overall, of the 271 planar features (possible fractures) identified in the boreholes, 28 were interpreted as being likely transmissive and 25 as being possibly transmissive.

<u>08-6722</u>

In borehole 08-6722, there are several anomalously wide caliper deflections that represent likely fractures. The widest anomalies occur at 137.6 and 121.4 feet. Based on the flowmeter measurements under pumping conditions most of the water enters the borehole at these two zones. Plate A-1 and in Table A-1 show the location and orientations of fractures within these areas as well as several other possibly transmissive fractures in the borehole.

<u>08-6723</u>

In borehole 08-6723 there was only about 20 feet of open borehole. The caliper log shows a very wide void immediately below the casing from 89.9 to 91.2 feet and a second wide zone (likely fracture) at 96.4 feet.

Under ambient conditions the flowmeter shows that water enters the borehole through this upper void and moves downward and exits the borehole through the fracture at 96.4 feet. It is unusual to have ambient flow between fractures that are so close to each other. One possibility is that the casing is not sealed tightly into the bedrock and that surficial water from sediments is entering the borehole just below the casing and exiting through the bedrock fracture 96.4 feet.

The orientations of the possibly fractures are shown on Plate B-1 and in Table B-1.

<u>08-6724</u>

Borehole 08-6724 was an interesting borehole. It had the highest fluid conductivity of the four wells logged with a median value of over 2,900 µS/cm. Under ambient conditions there was a strong downflow with water entering the borehole just below the casing at 19 feet as seen on Plate C-1. There is also an abrupt increase in fluid conductivity and a temperature deflection at this depth. Additional water enters the borehole between 35 and 37 feet and moves downwards. There is also an abrupt increase in fluid conductivity and a temperature deflection at this depth. Water moves downwards in the borehole and exits the borehole through fractures at 66 feet and below as show on Plate C-1.

The hydraulic gradient (or head difference) between the fracture or void located at 19 feet and the fractures located deeper in the borehole was very high as the flowmeter still measured downflow below 19 feet while pumping the well at over 1 gallon per minute.

A possible explanation for the high conductivity in 08-6724 is that it is being affected by septic water from a nearby school septic field that is located upslope and less than 100 feet from the borehole.

<u>08-6725</u>

The ambient flowmeter measurements in Borehole 08-6725 show strong downflow with water entering the borehole through fractures located between 26 and 65 feet as seen on Plate D-1. Water moves downward in the borehole and most of the water exits the borehole through fractures located at the bottom of the borehole below 220 feet.

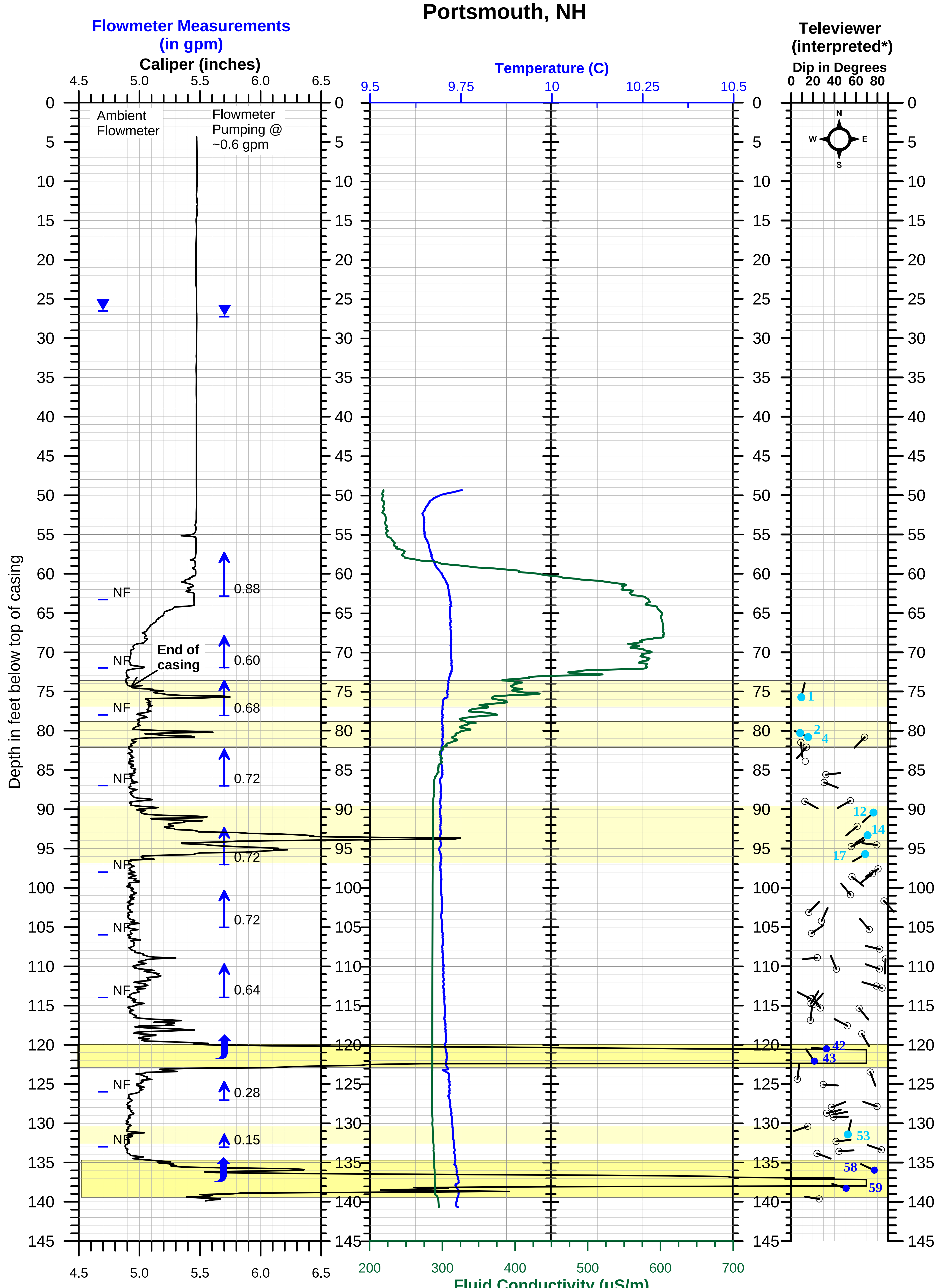
The fluid conductivity in 08-6725 was third highest of the four boreholes logged with a median value of 1,045 µS/cm.

ATTACHMENT A
08-6722
BOREHOLE GEOPHYSICAL LOGS

Northeast Geophysical Services

Date logged: 8/24/15

PLATE A-1
Borehole 08-6722
Pease Project 143279
Portsmouth, NH



= Likely transmissive zone

= possible transmissive zone

PLATE A-1
Borehole Geophysical Log
Borehole 08-6722

The dip direction is indicated by the line extending from the circle. The strike of the feature is 90 degrees from this.

Date logged: 8/24/15

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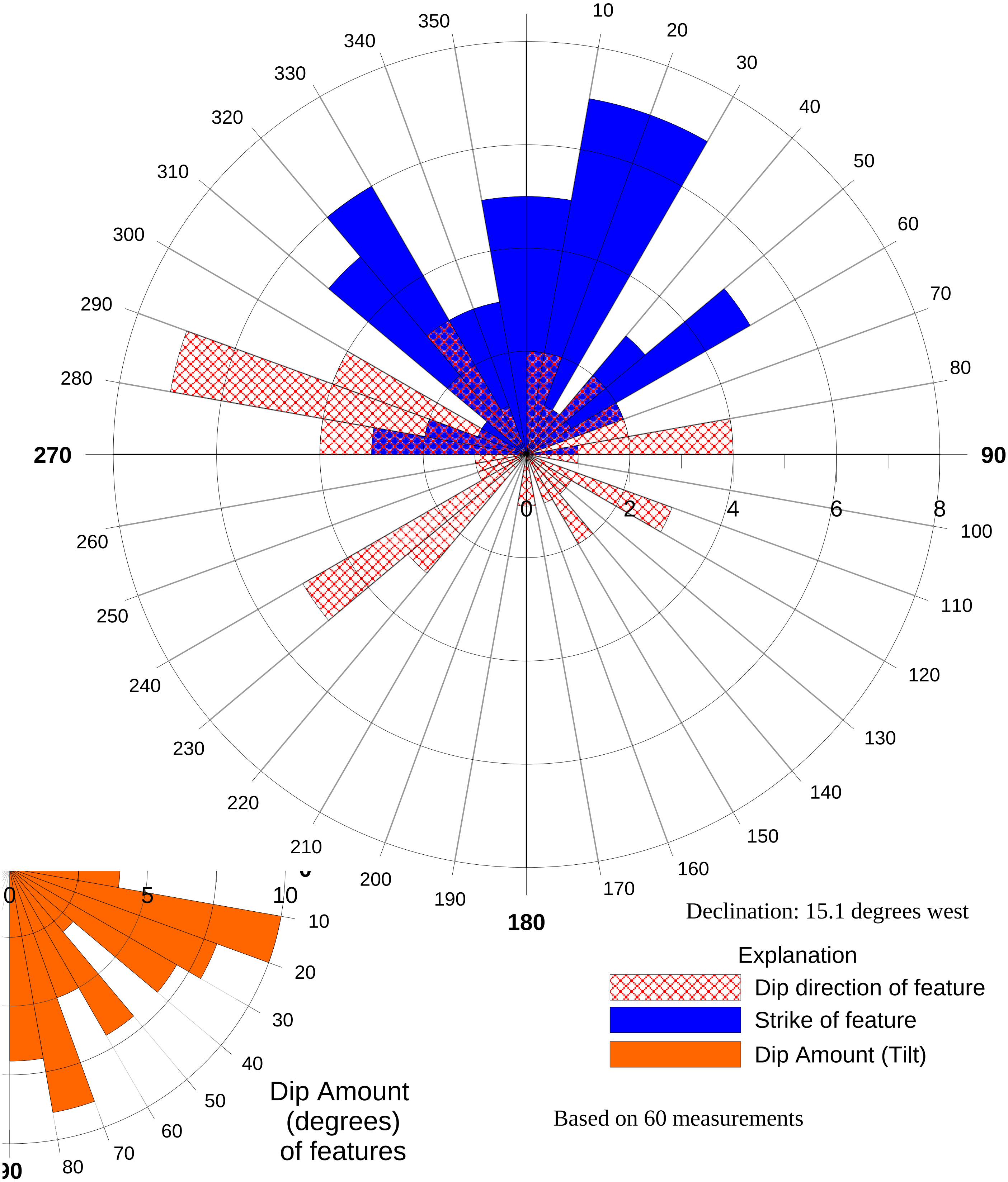
Northeast Geophysical Services

Borehole 08-6722
Pease Site
Portsmouth, NH

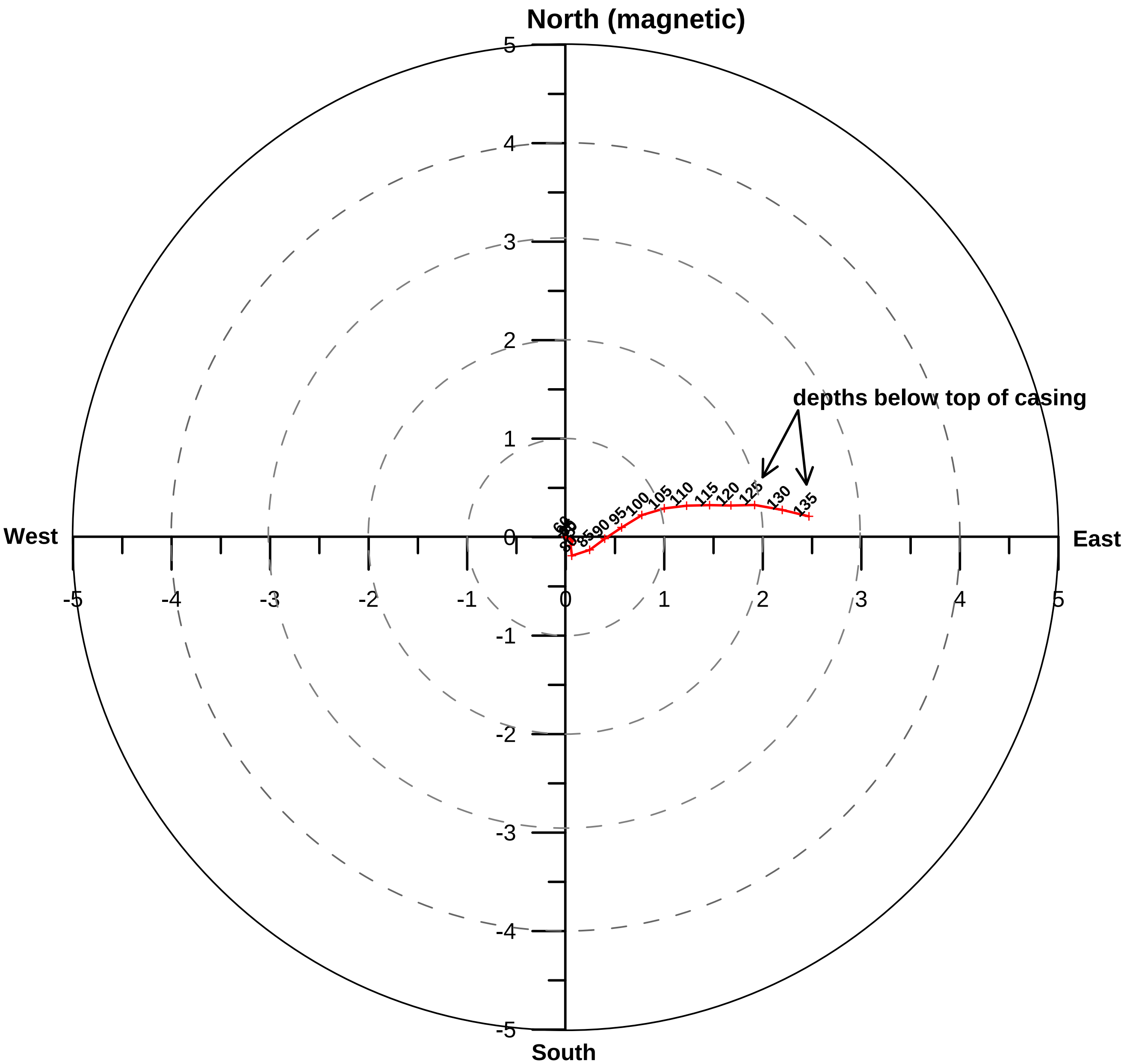
PLATE A-2
Strike and Dip Direction of all features



Declination: 15.1 degrees west

Based on 60 measurements

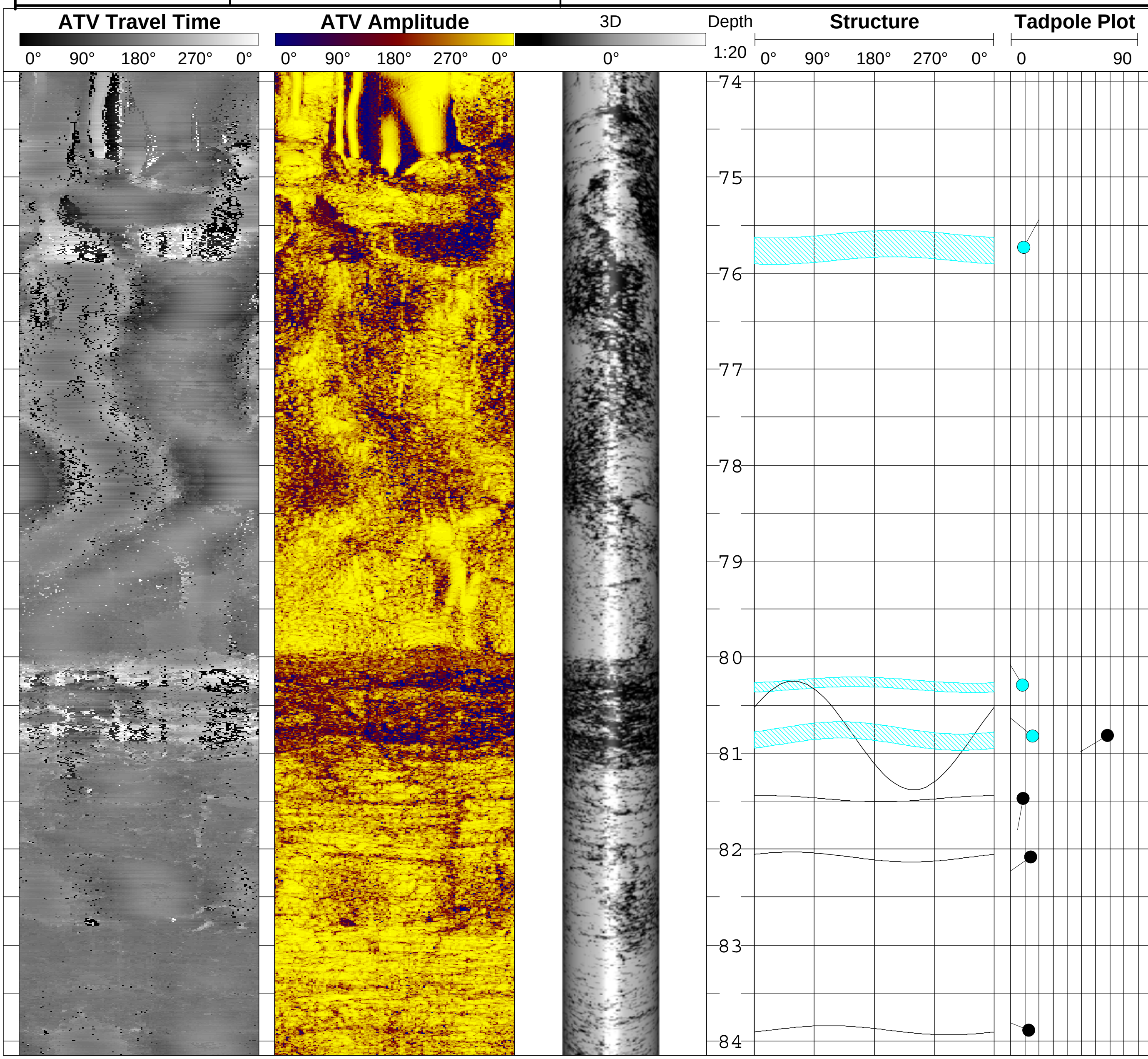
Plate A-3
Borehole Deviation Plot
08-6722
Pease Site
Portsmouth, NH

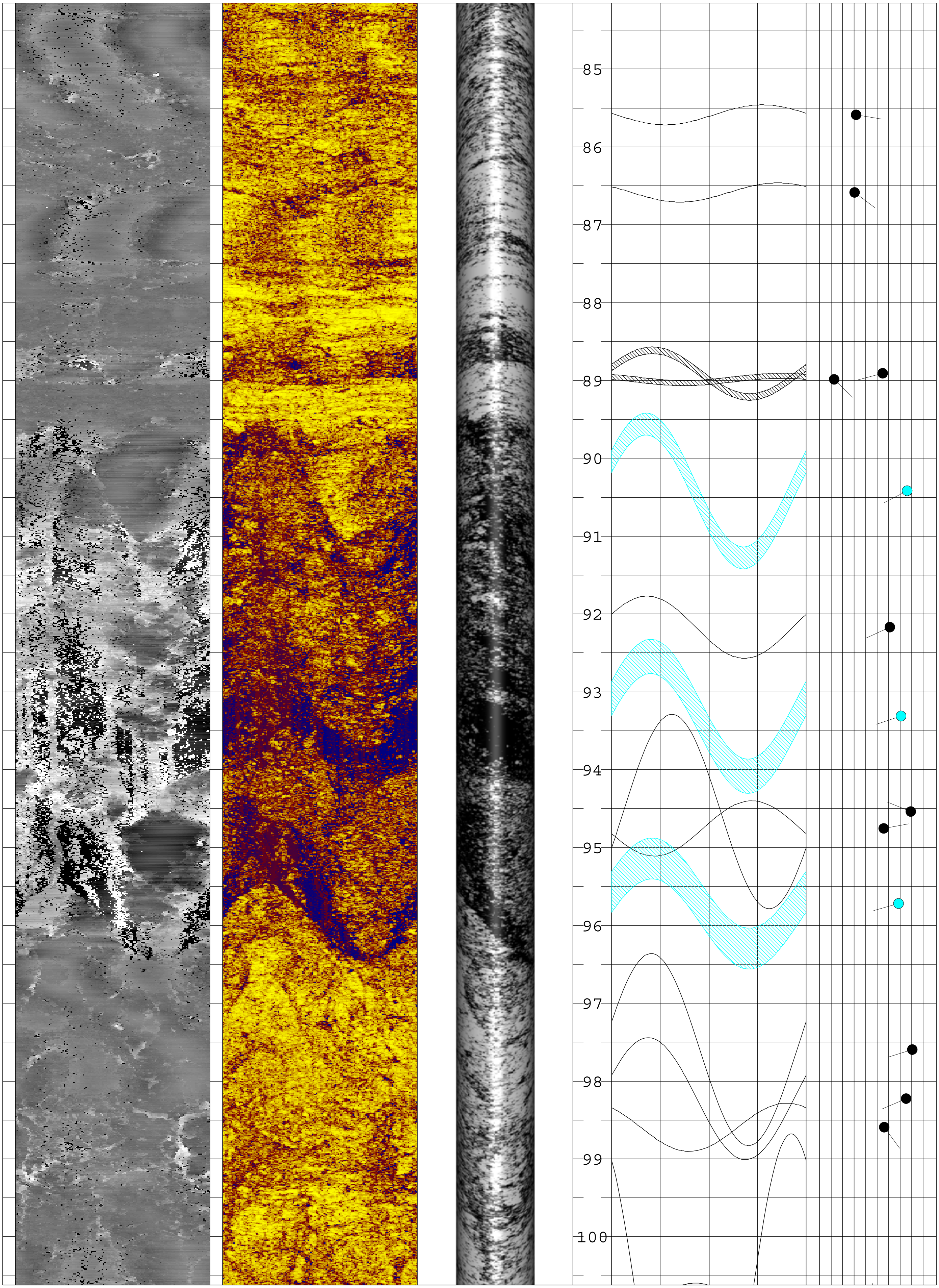


Distances in feet

Northeast Geophysical Services
4 Union Street Bangor, Maine 04401
Tel. 207-942-2700
email: ngsinc@negeophysical.com

Log:	**Plate A-4 Televiewer**		
Well:	08-6722		
Site:	Pease AFB		
Date:	8/24/2015	Location:	Portsmouth, NH
Casing Depth:	74 ft	For:	CB&I
Casing Type:	5 in	Logged by:	R. Rawcliffe
Boring Depth:	141.1 ft	Orientation:	magnetic
Meas. From:	toc	Structure Plots:	black = planar features (faults, foliation, bedding, joints, etc) light blue = possibly transmissive fracture dark blue = likely transmissive fracture
Stickup:	0.9 ft		
Water Level:	26.55 ft		

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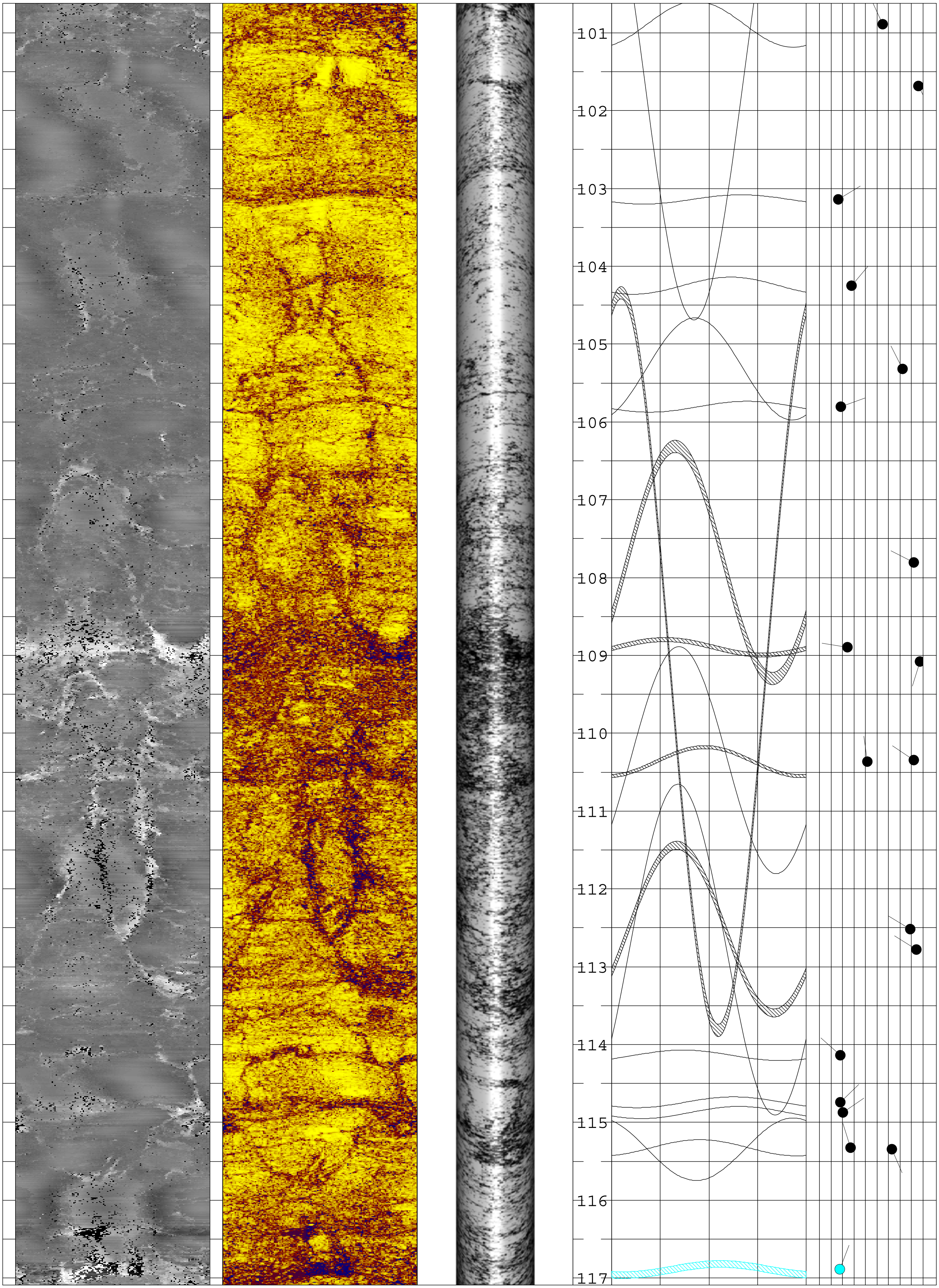
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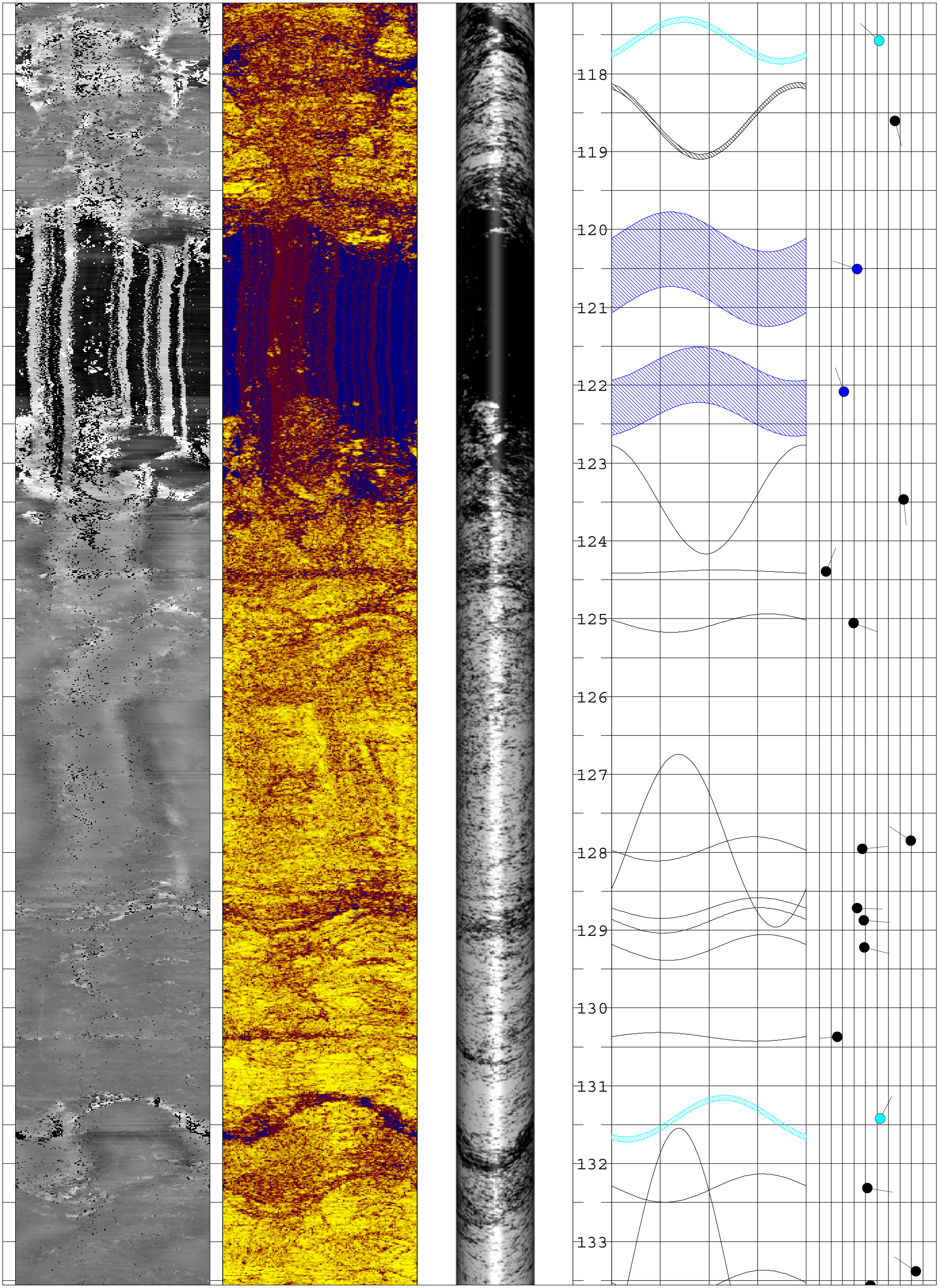
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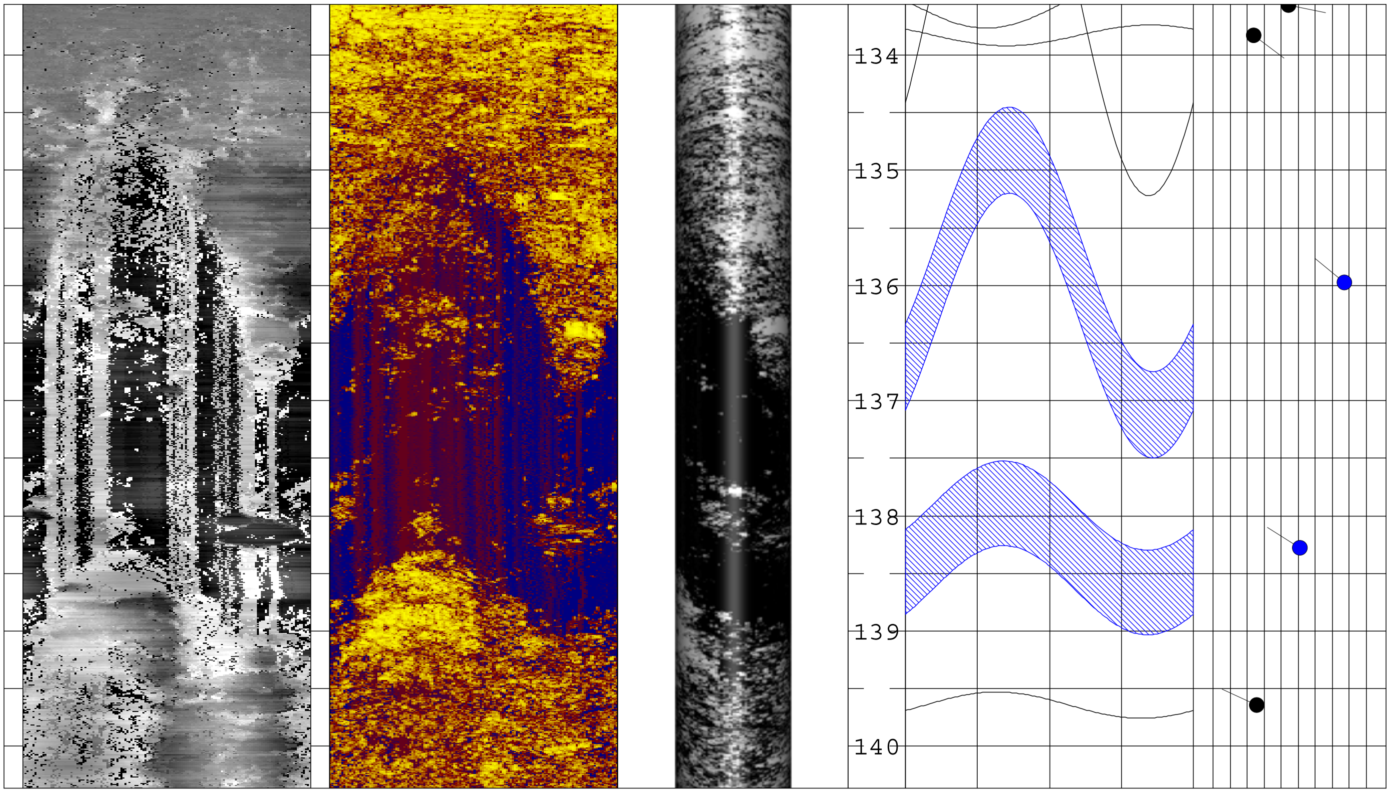
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Northeast Geophysical Services

Date logged: 8/24/15

Borehole Geopysical Log
08-6722 Repeat Logs
Pease Project 143279
Portsmouth, NH

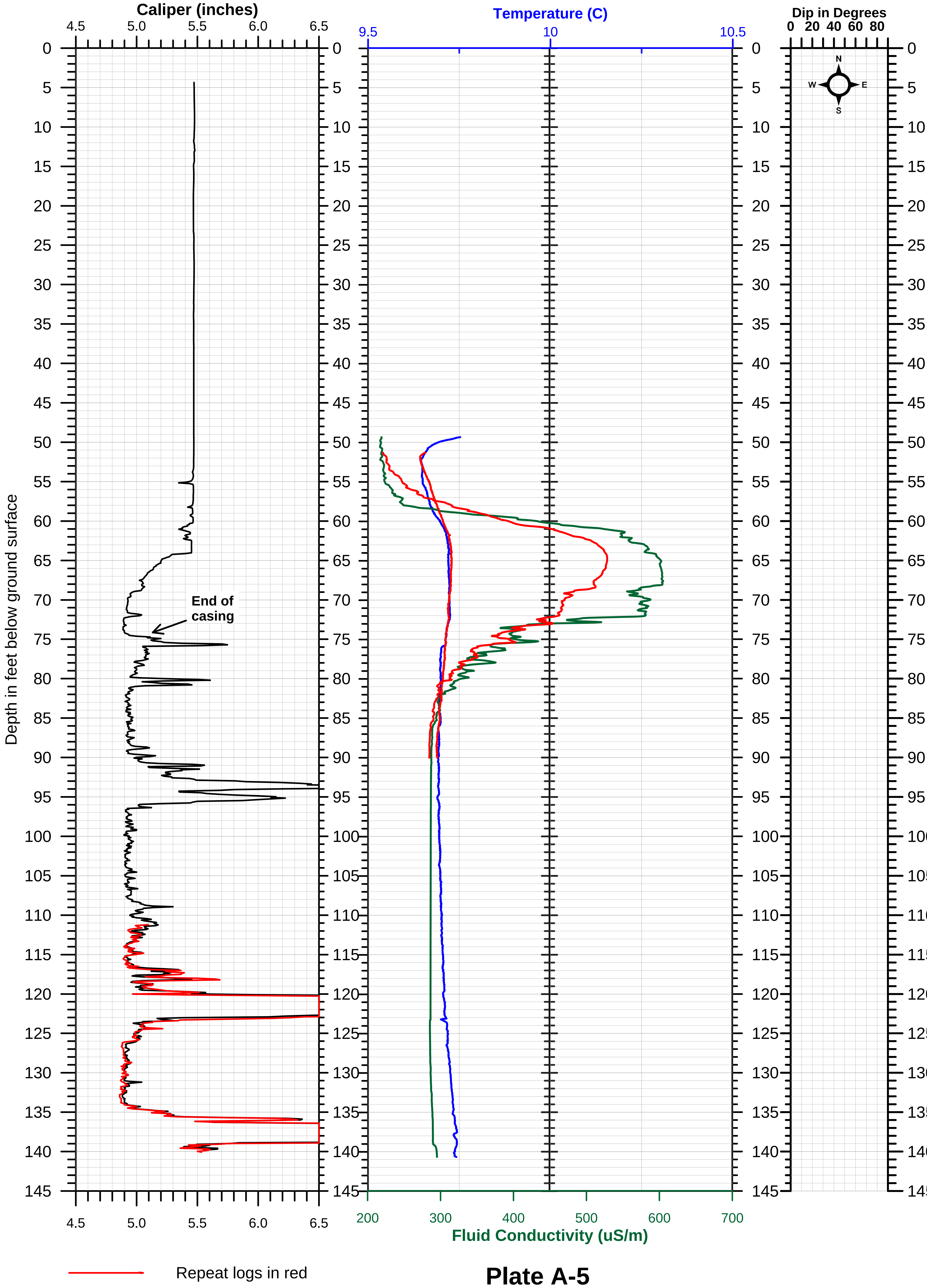

Plate A-5
Borehole Geophysical Log
08-6722 Repeat Logs

Date logged: 8/24/15

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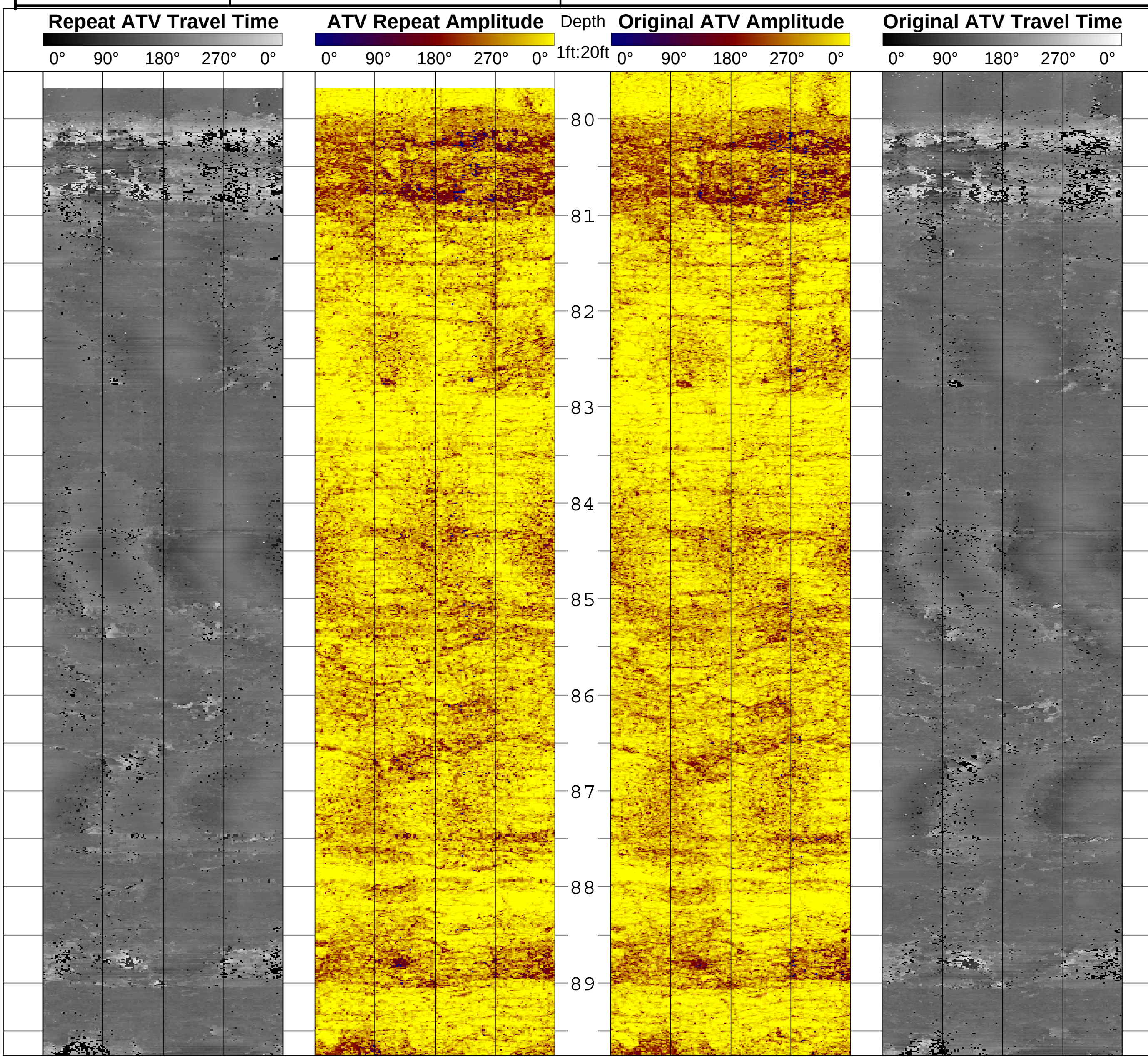
Northeast Geophysical Services
4 Union Street Bangor, Maine 04401
Tel. 207-942-2700
email: ngsinc@negeophysical.com

Log:	**Plate A-6 ATV Repeat Log**		
Well:	08-6722		
Site:	Pease AFB		
Date:	8-24-15	Location:	Portsmouth, NH
Casing Depth:	74 ft	For:	CB&I
Casing Type:	5 in steel	Logged by:	R. Rawcliffe
Boring Depth:	141.1 ft	Orientation:	magnetic
Meas. From:	top of casing	Structure Plots:	
Stickup:	0.9 ft ft		
Water Level:	26.55 ft		



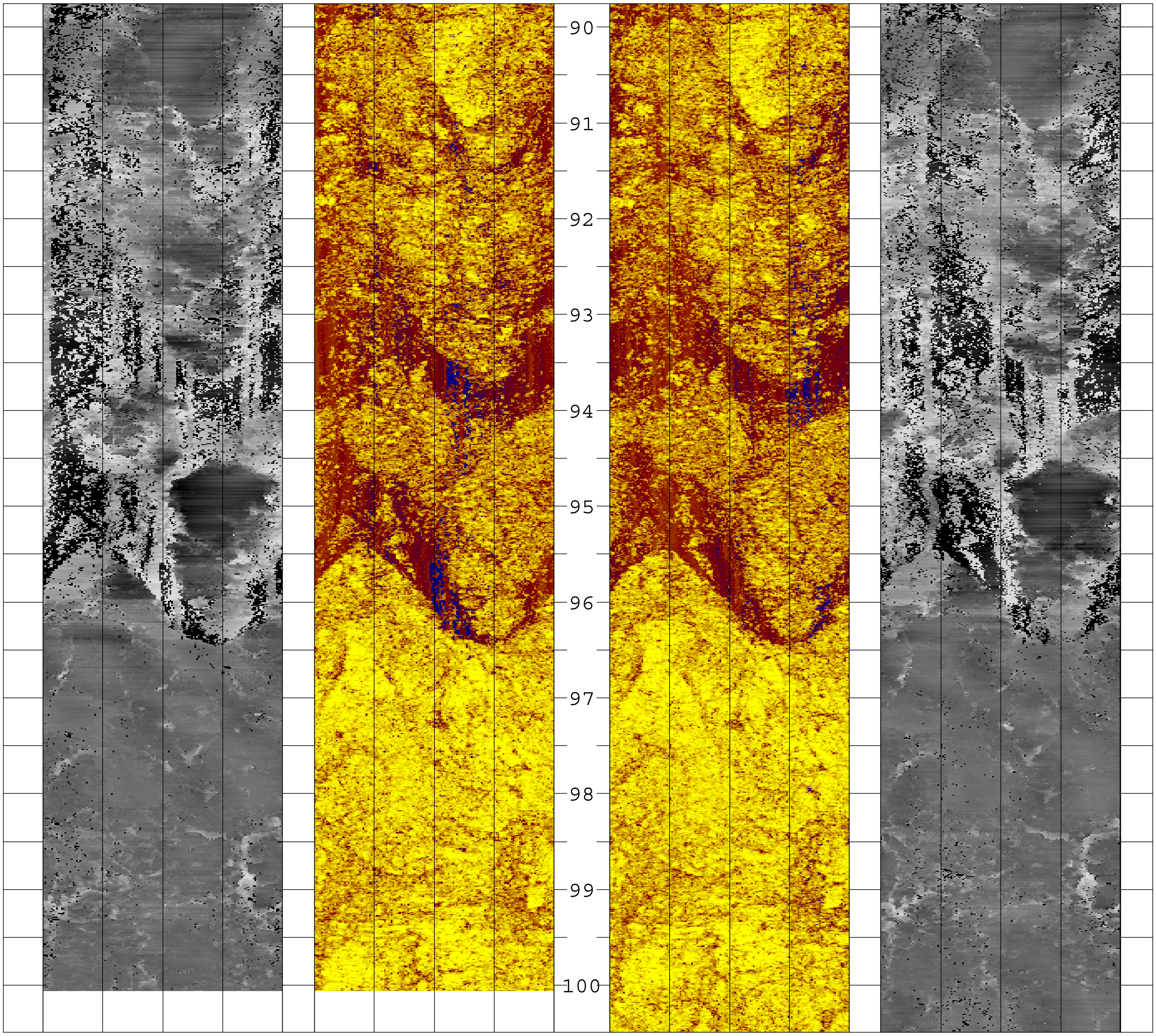

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TABLE A-1 Planar features interpreted from acoustical televiewer
08-6722 Pease AFB, Portsmouth, New Hampshire Logged: 08/24/2015

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6722	1	75.7	9	29	299	13	283	83	108
08-6722	2	80.3	8	329	59	314	44	30	108
08-6722	3	80.8	68	239	329	224	314	<1 mm	100
08-6722	4	80.8	16	310	40	294	24	50	108
08-6722	5	81.5	9	189	279	174	84	<1 mm	100
08-6722	6	82.1	14	236	326	220	310	<1 mm	100
08-6722	7	83.9	13	292	22	277	7	<1 mm	100
08-6722	8	85.6	32	99	9	84	354	<1 mm	100
08-6722	9	86.6	31	127	37	112	22	<1 mm	100
08-6722	10	88.9	55	255	345	240	330	15	100
08-6722	11	89.0	13	134	44	119	29	20	100
08-6722	12	90.4	76	244	334	229	319	20	108
08-6722	13	92.2	61	245	335	230	320	<1 mm	100
08-6722	14	93.3	71	252	342	237	327	44	108
08-6722	15	94.5	79	292	22	277	7	<1 mm	100
08-6722	16	94.8	56	79	349	64	334	<1 mm	100
08-6722	17	95.7	69	255	345	240	330	59	108
08-6722	18	97.6	81	253	343	238	328	<1 mm	100
08-6722	19	98.2	75	248	338	232	322	<1 mm	100
08-6722	20	98.6	56	144	54	129	39	<1 mm	100
08-6722	21	100.9	55	335	65	320	50	<1 mm	100
08-6722	22	101.7	86	152	62	137	47	<1 mm	100
08-6722	23	103.1	16	59	329	44	314	<1 mm	100
08-6722	24	104.3	28	40	310	25	295	<1 mm	100
08-6722	25	105.3	72	334	64	319	49	<1 mm	100
08-6722	26	105.8	19	70	340	55	325	<1 mm	100
08-6722	27	107.8	82	298	28	283	13	6	100
08-6722	28	108.9	24	279	9	264	354	15	100
08-6722	29	109.1	87	197	287	182	272	2	100
08-6722	30	110.4	82	305	35	289	19	<1 mm	100
08-6722	31	110.4	42	352	82	337	67	10	100
08-6722	32	112.5	79	301	31	286	16	6	100
08-6722	33	112.8	84	303	33	288	18	<1 mm	100

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6722	34	114.1	18	312	42	297	27	<1 mm	100
08-6722	35	114.7	18	46	316	31	301	<1 mm	100
08-6722	36	114.9	21	55	325	40	310	<1 mm	100
08-6722	37	115.3	27	343	73	328	58	<1 mm	100
08-6722	38	115.3	63	156	66	141	51	<1 mm	100
08-6722	39	116.9	18	21	291	6	276	24	100
08-6722	40	117.6	52	313	43	298	28	14	100
08-6722	41	118.6	66	165	75	150	60	8	100
08-6722	42	120.5	33	289	19	273	3	246	107
08-6722	43	122.1	21	340	70	325	55	201	107
08-6722	44	123.5	73	174	84	159	69	<1 mm	100
08-6722	45	124.4	6	22	292	7	277	<1 mm	100
08-6722	46	125.1	30	109	19	94	4	<1 mm	100
08-6722	47	127.9	80	304	34	289	19	<1 mm	100
08-6722	48	128.0	37	84	354	69	339	<1 mm	100
08-6722	49	128.7	33	91	1	76	346	<1 mm	100
08-6722	50	128.9	39	94	4	79	349	<1 mm	100
08-6722	51	129.2	39	104	14	88	358	<1 mm	100
08-6722	52	130.4	15	266	356	251	341	<1 mm	100
08-6722	53	131.4	53	28	298	13	283	12	108
08-6722	54	132.3	42	99	9	84	354	<1 mm	100
08-6722	55	133.4	84	304	34	289	19	<1 mm	100
08-6722	56	133.6	44	101	11	86	356	<1 mm	100
08-6722	57	133.8	24	126	36	111	21	<1 mm	100
08-6722	58	136.0	77	310	40	295	25	51	107
08-6722	59	138.3	51	303	33	288	18	141	107
08-6722	60	139.6	26	295	25	279	9	<1 mm	100

Category Explanation:

100 planar feature likely foliation or bedding surface
108 possibly transmissive fracture or crack
107 likely transmissive fracture or crack

TABLE A-2 - Flowmeter measurements
08-6722 - Pease AFB **Logged: 08/24/2015**
Portsmouth, NH

Ambient Measurements

Borehole	Depth Feet	Flow Readings (in gallons per minute)			Average or Median Flow		
08-6722	26.6	water level					
08-6722	63.3	NF	NF	NF		NF	
08-6722	72.0	NF	NF	NF		NF	
08-6722	78.0	NF	NF	NF		NF	
08-6722	87.0	NF	NF	NF		NF	
08-6722	98.0	NF	NF	NF		NF	
08-6722	106.0	NF	NF	NF		NF	
08-6722	114.0	NF	NF	NF		NF	
08-6722	126.0	NF	NF	NF		NF	
08-6722	133.0	NF	NF	NF		NF	

Measurements while pumping pump rate = ~0.6 gpm

Borehole	Depth Feet	Flow Readings (in gallons per minute)			Average or Median Flow		
08-6722	27.3	water level					
08-6722	62.9	0.82	0.88	0.88		0.88	
08-6722	72.0	0.57	0.60	0.60		0.60	
08-6722	78.0	0.68	0.68	1.12	0.68	0.68	
08-6722	87.0	0.68	0.77	1.36	0.72	0.72	
08-6722	97.1	0.68	0.72	0.72		0.72	
08-6722	105.0	0.64	0.72	0.72	0.72	0.72	
08-6722	113.9	0.64	0.64	0.60	0.64	0.64	
08-6722	127.0	0.28	0.27	0.28		0.28	
08-6722	133.0	0.16	0.15	0.15	0.15	0.15	

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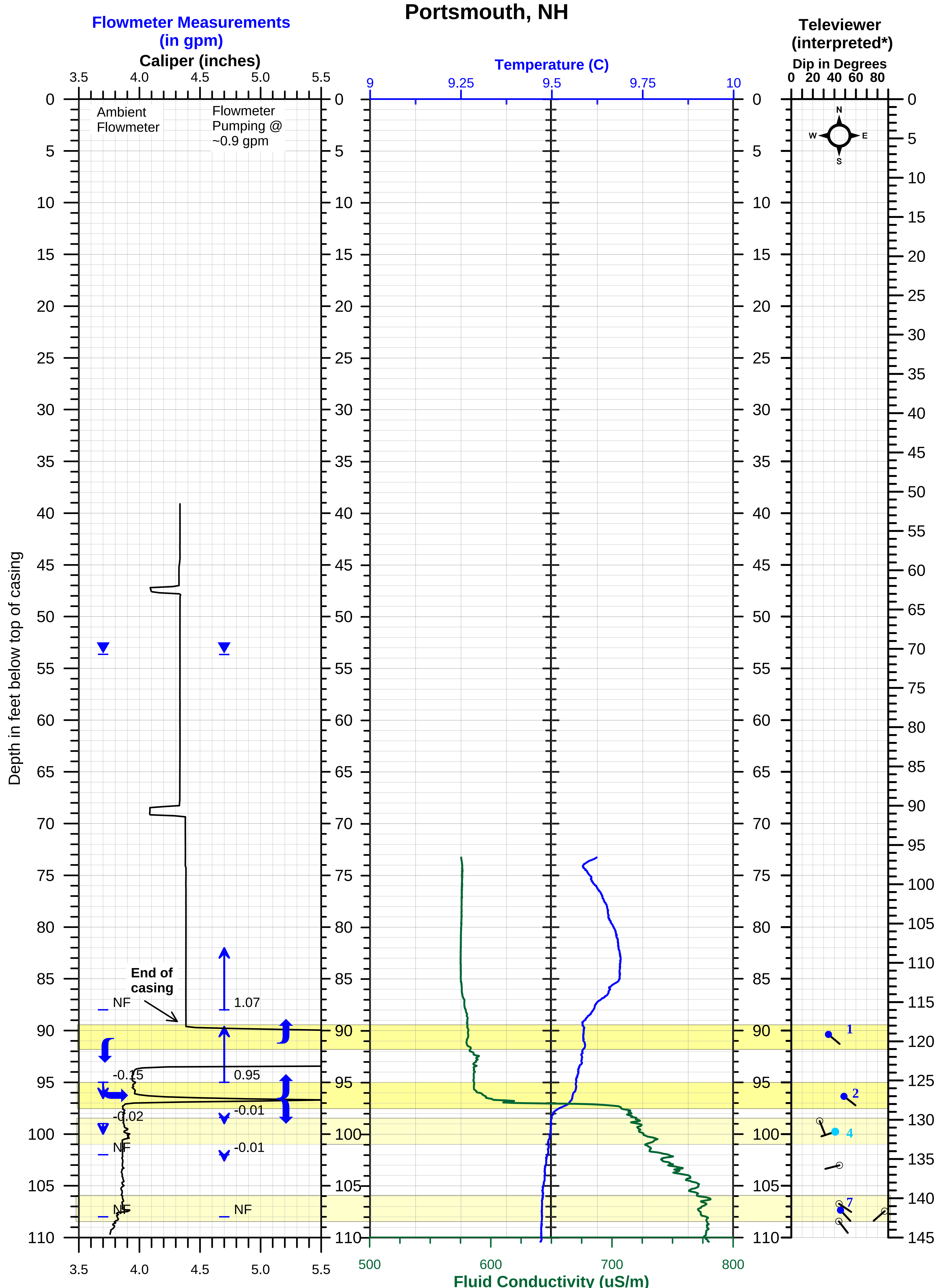
ATTACHMENT B
08-6723
BOREHOLE GEOPHYSICAL LOGS

Northeast Geophysical Services

Date logged: 8/25/15

PLATE B-1
Borehole 08-6723
Pease Project 143279
Portsmouth, NH



= Likely transmissive zone

= possible transmissive zone

The dip direction is indicated by the line extending from the circle. The strike of the feature is 90 degrees from this.

PLATE B-1
Borehole Geophysical Log
Borehole 08-6723

Date logged: 8/25/15

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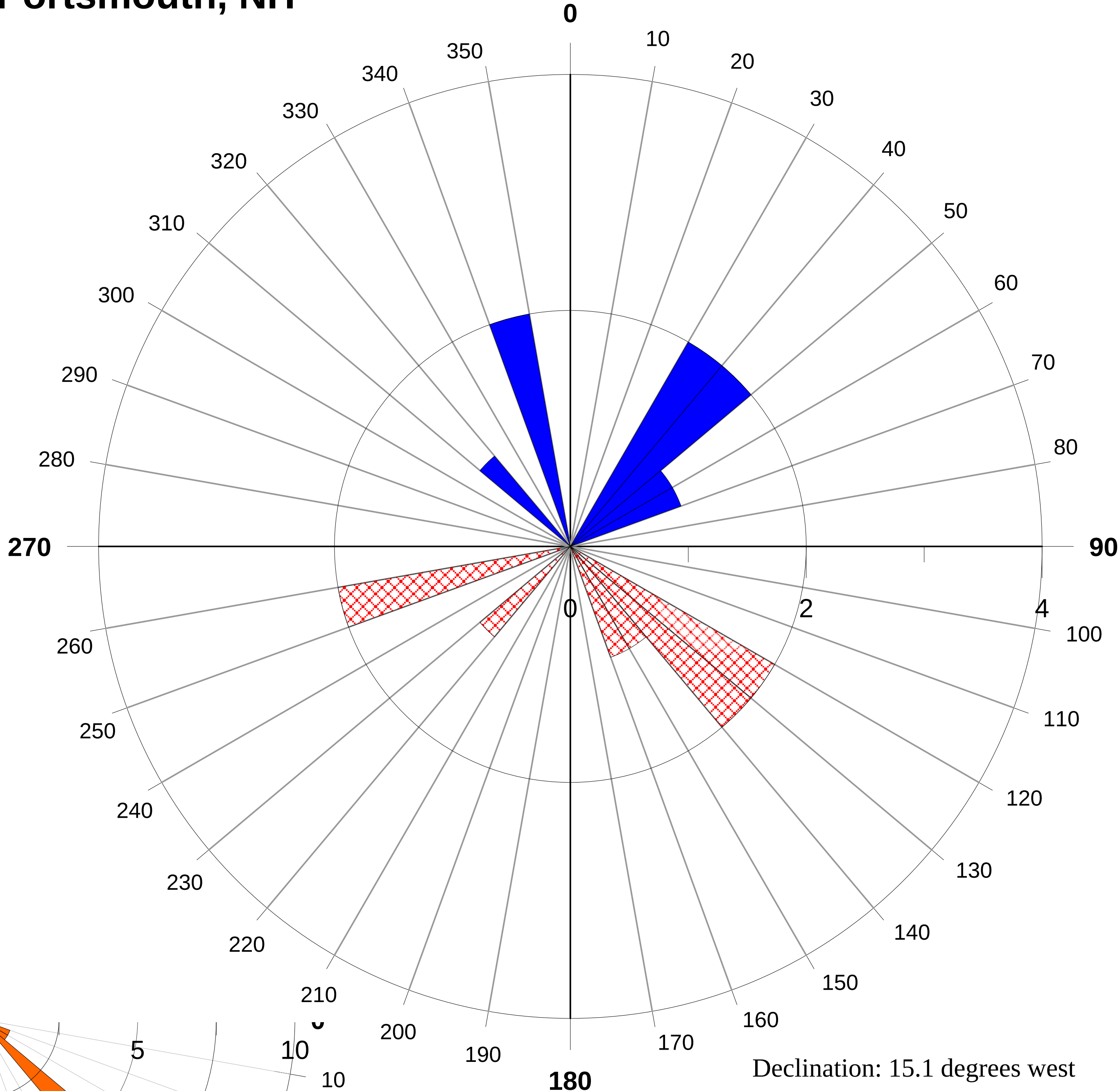
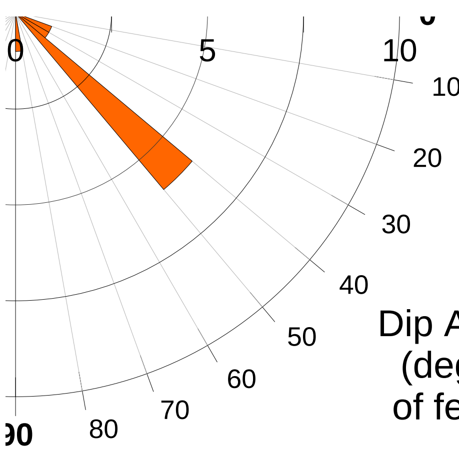
Northeast Geophysical Services

Borehole 08-6723
Pease Site
Portsmouth, NH

PLATE B-2
Strike and Dip Direction
of all features





Dip Amount
(degrees)
of features

Declination: 15.1 degrees west

Explanation

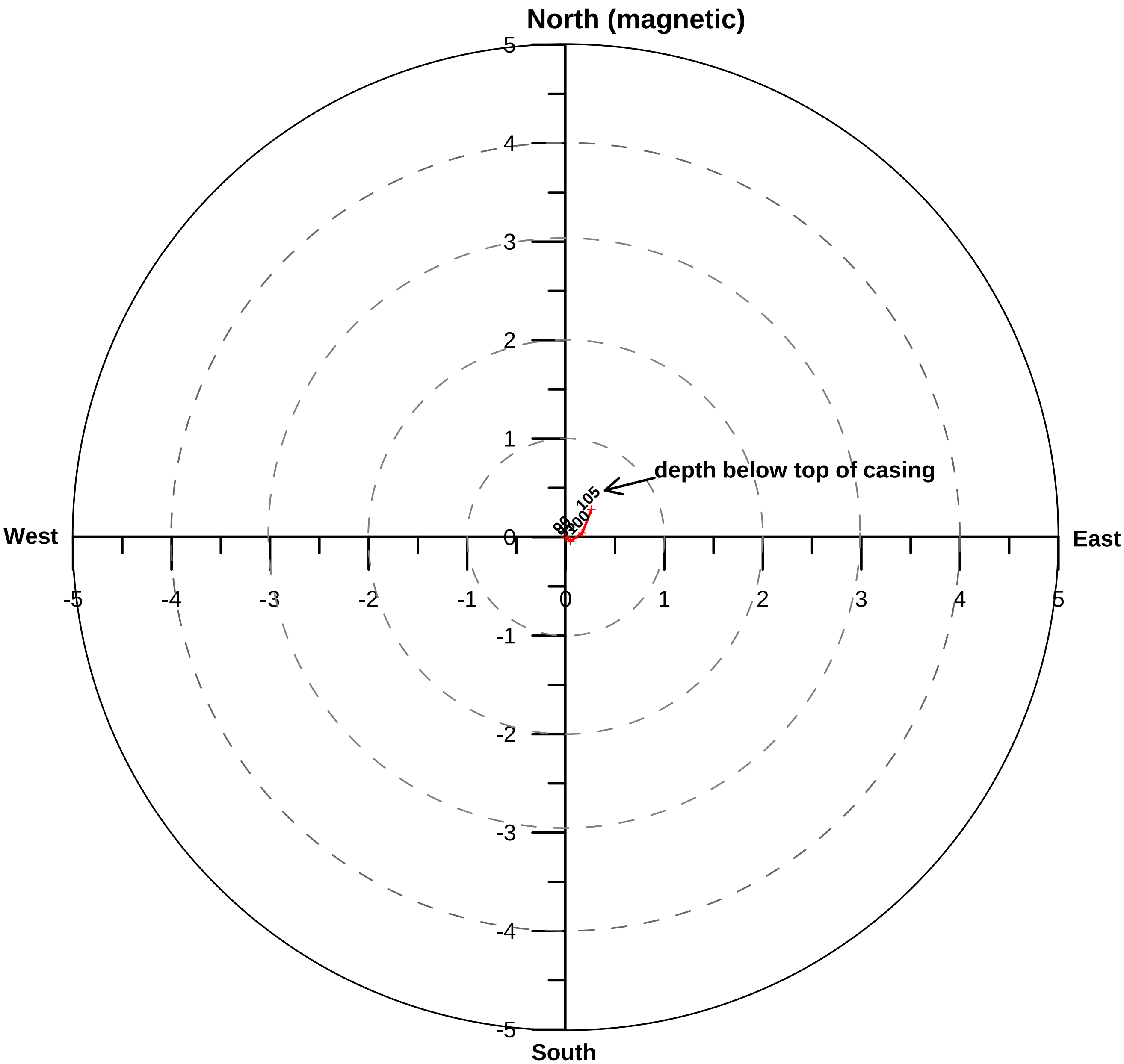
Dip direction of feature

Strike of feature

Dip Amount (Tilt)

Based on 9 measurements

Plate B-3
Borehole Deviation Plot
08-6723
Pease Site
Portsmouth, NH



Distances in feet

Northeast Geophysical Services

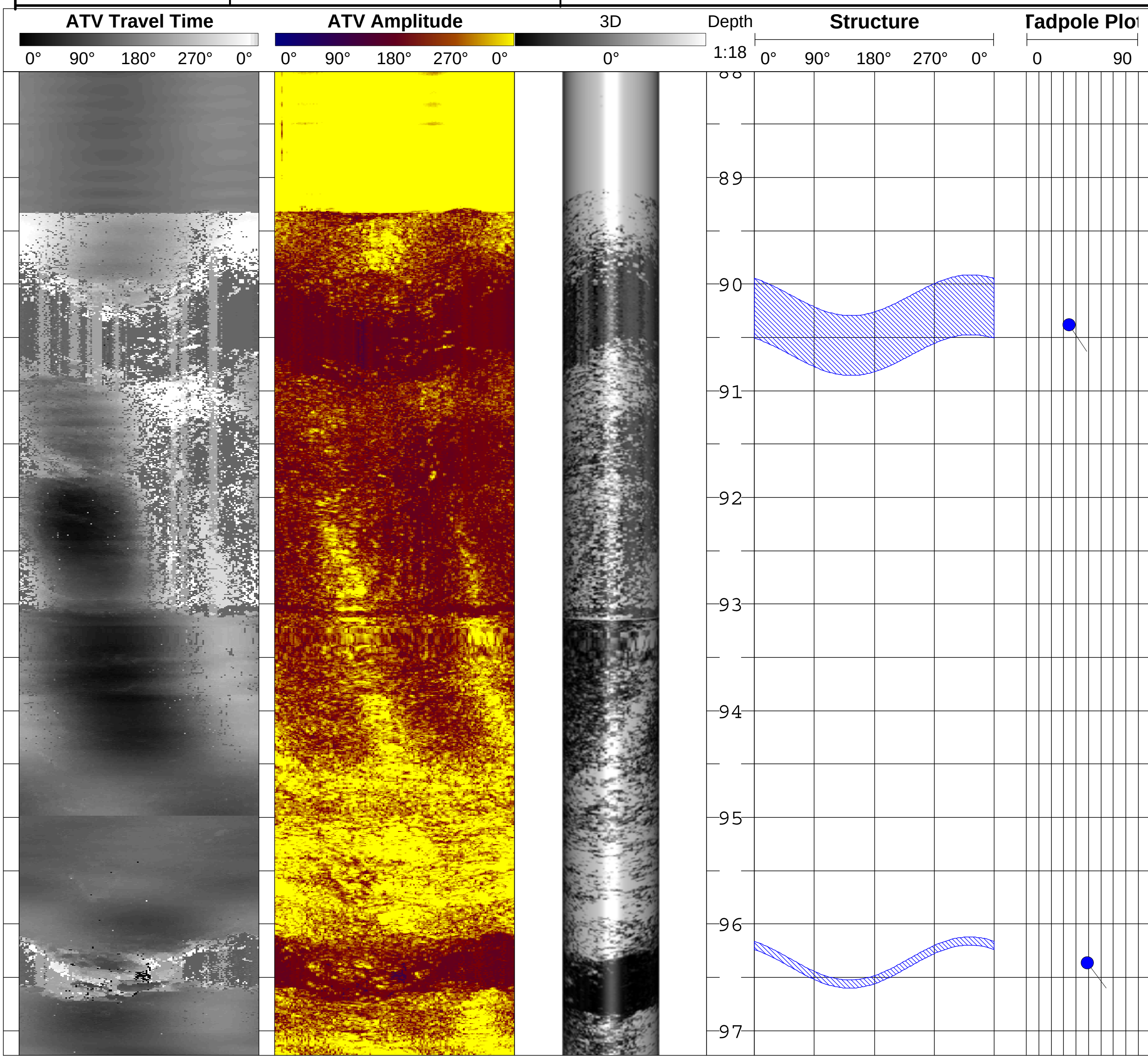
4 Union Street Bangor, Maine 04401
Tel. 207-942-2700
email: ngsinc@negeophysical.com

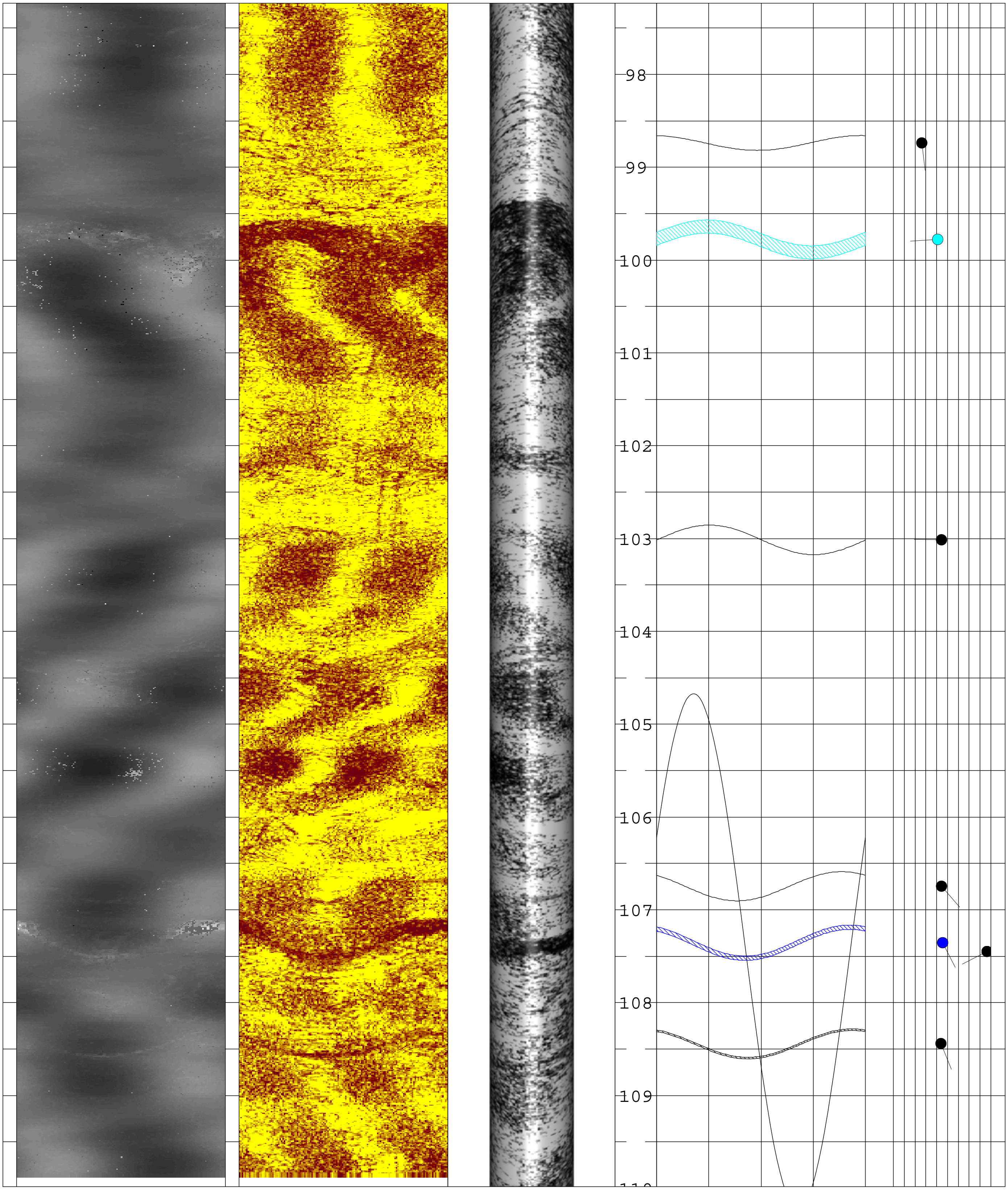
Log: Plate B-4 Acoustic Televiewer Log

Well: 08-6723

Site: Pease AFB

Date:	8/25/2015	Location:	Portsmouth, NH
Casing Depth:	89.5 ft	For:	CB&I
Casing Type:	4 inch	Logged by:	R. Rawcliffe
Boring Depth:	110.7 ft	Orientation:	magnetic
Meas. From:	toc	Structure Plots:	black = planar features (faults, foliation, bedding, joints, etc) light blue = possibly transmissive fracture dark blue = likely transmissive fracture
Stickup:	1.5 ft		
Water Level:	53.65 ft		

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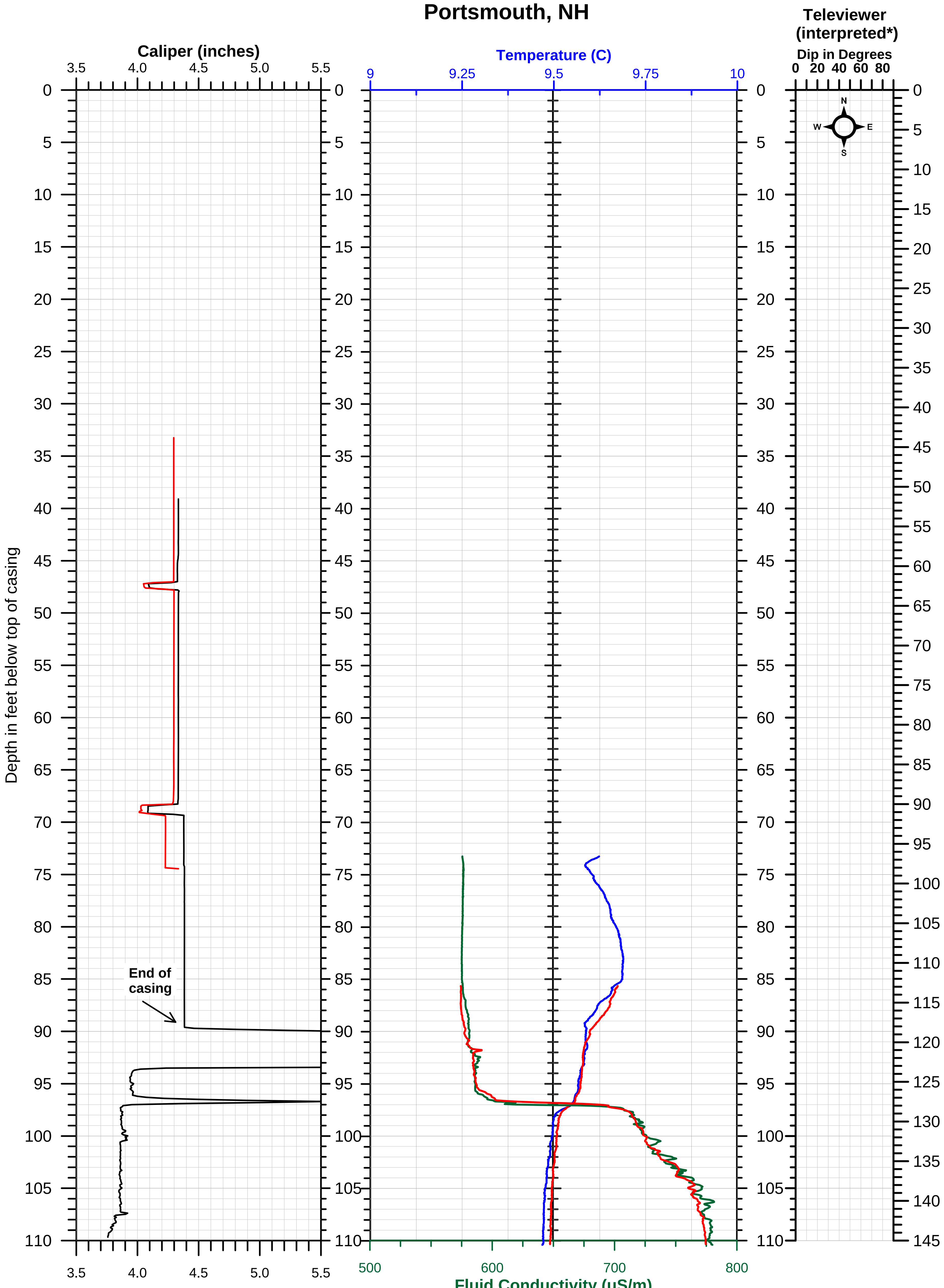
Northeast Geophysical Services

Date logged: 8/25/15

Borehole Geopysical Log
08-6723 Repeat Logs
Pease Project 143279
Portsmouth, NH



Repeat logs in red

Plate B-5
Borehole Geophysical Log
08-6723 Repeat Logs

The dip direction is indicated by the line extending from the circle. The strike of the feature is 90 degrees from this.

Date logged: 8/25/15

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Northeast Geophysical Services 4 Union Street Bangor, Maine 04401 Tel. 207-942-2700 email: ngsinc@negeophysical.com	**Log: Plate B-6 ATV Repeat Log** Well: 08-6723 **Site:** Pease AFB
Date: 8/25/2015	Location: Portsmouth, NH
Casing Depth: 89.5 ft	For: CB&I
Casing Type: 4 inch	Logged by: R. Rawcliffe
Boring Depth: 110.7 ft	Orientation: magnetic
Meas. From: top of casing	Structure Plots:
Stickup: 1.5 ft	
Water Level: 53.65 ft	

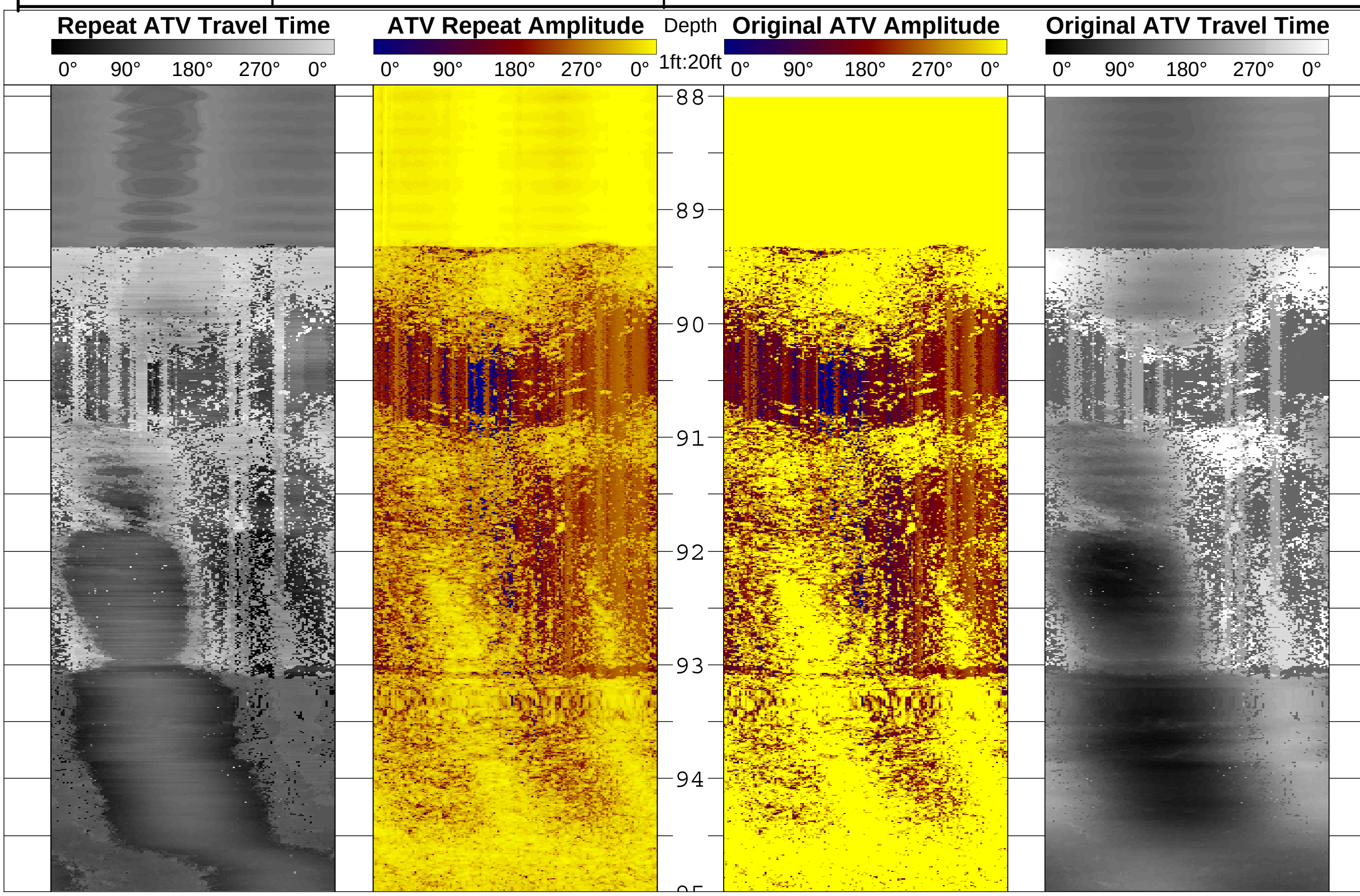

TABLE B-1 Planar features interpreted from acoustical televiewer

08-6723 Pease AFB, Portsmouth, New Hampshire Logged: 08/25/2015

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6723	1	90.4	34	145	55	130	40	142	107
08-6723	2	96.4	49	143	53	128	38	16	107
08-6723	3	98.7	26	173	83	158	68	<1 mm	100
08-6723	4	99.8	41	267	357	252	342	33	108
08-6723	5	103.0	45	271	1	256	346	<1 mm	100
08-6723	6	106.7	44	139	49	124	34	<1 mm	100
08-6723	7	107.4	46	153	63	138	48	10	107
08-6723	8	107.5	87	244	334	229	319	<1 mm	100
08-6723	9	108.4	44	157	67	142	52	4	100

Category Explanation:

100 planar feature likely foliation or bedding surface
108 possibly transmissive fracture or crack
107 likely transmissive fracture or crack

TABLE B-2 - Flowmeter measurements

08-6723 - Pease AFB **Logged: 08/25/2015**

Portsmouth, NH

Ambient Measurements

Borehole	Depth Feet	Flow Readings (in gallons per minute)			Average or Median Flow		
08-6723	53.7	water level					
08-6723	88.0	NF	NF	NF		NF	
08-6723	95.0	-0.16	-0.15	-0.15		-0.15	
08-6723	99.0	-0.02	-0.02	-0.02		-0.02	
08-6723	102.0	NF	NF	NF		NF	
08-6723	108.0	NF	NF	NF		NF	

Measurements while pumping pump rate = ~0.9 gpm

Borehole	Depth Feet	Flow Readings (in gallons per minute)			Average or Median Flow		
08-6723	53.7	water level					
08-6723	88.0	1.12	0.99	1.12	1.03	1.07	1.07
08-6723	95.0	0.95	0.95	0.95			0.95
08-6723	98.4	-0.01	-0.01	-0.01			-0.01
08-6723	102.0	-0.01	-0.01	-0.01			-0.01
08-6723	108.0	NF	NF	NF			NF

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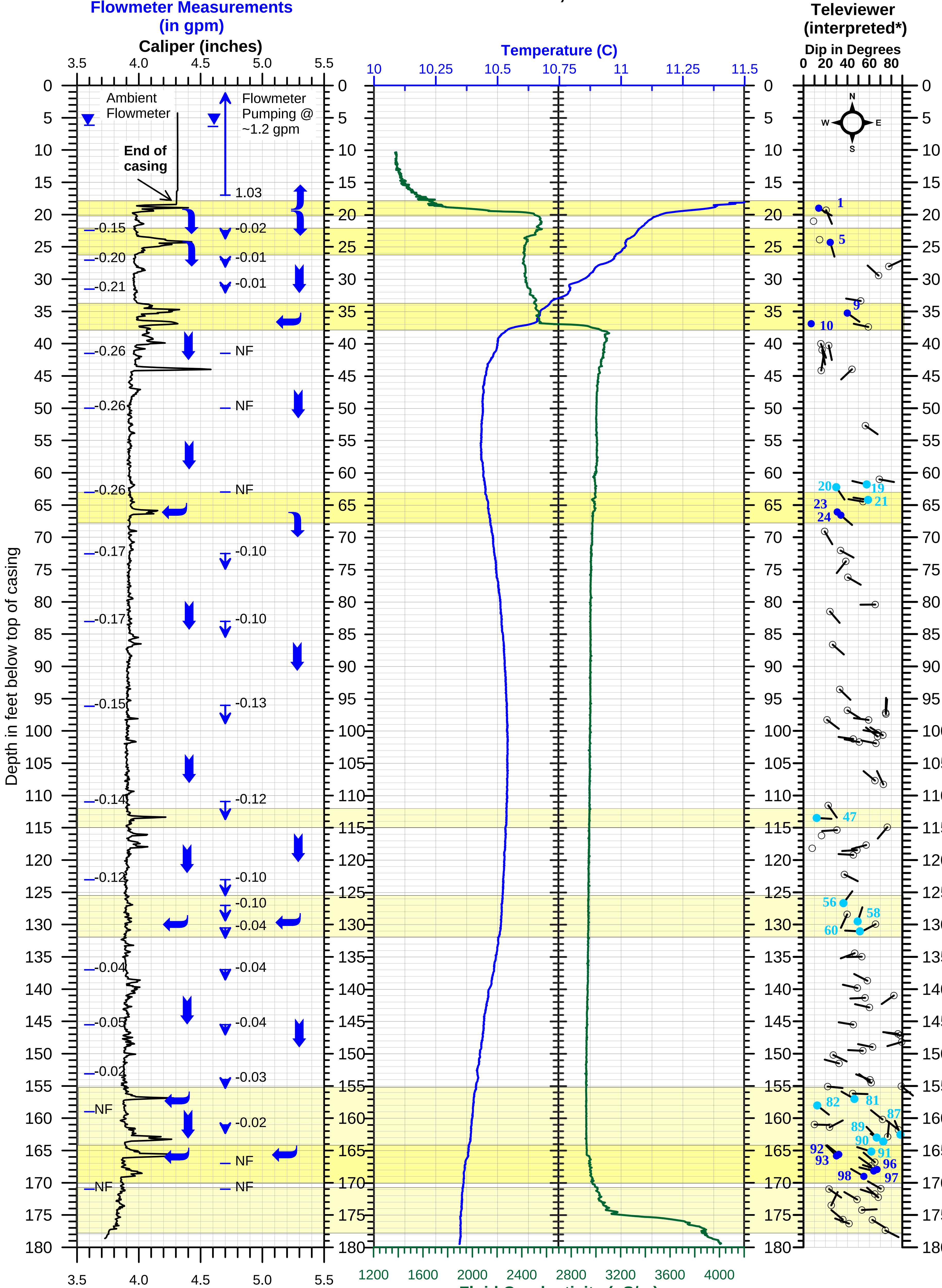
ATTACHMENT C
08-6724
BOREHOLE GEOPHYSICAL LOGS

Northeast Geophysical Services

Date logged: 8/25/15

PLATE C-1
Borehole 08-6724
Pease Project 143279
Portsmouth, NH



= Likely transmissive zone

= possible transmissive zone

The dip direction is indicated by the line extending from the circle. The strike of the feature is 90 degrees from this.

PLATE C-1
Borehole Geophysical Log
Borehole 08-6724

Date logged: 8/25/15

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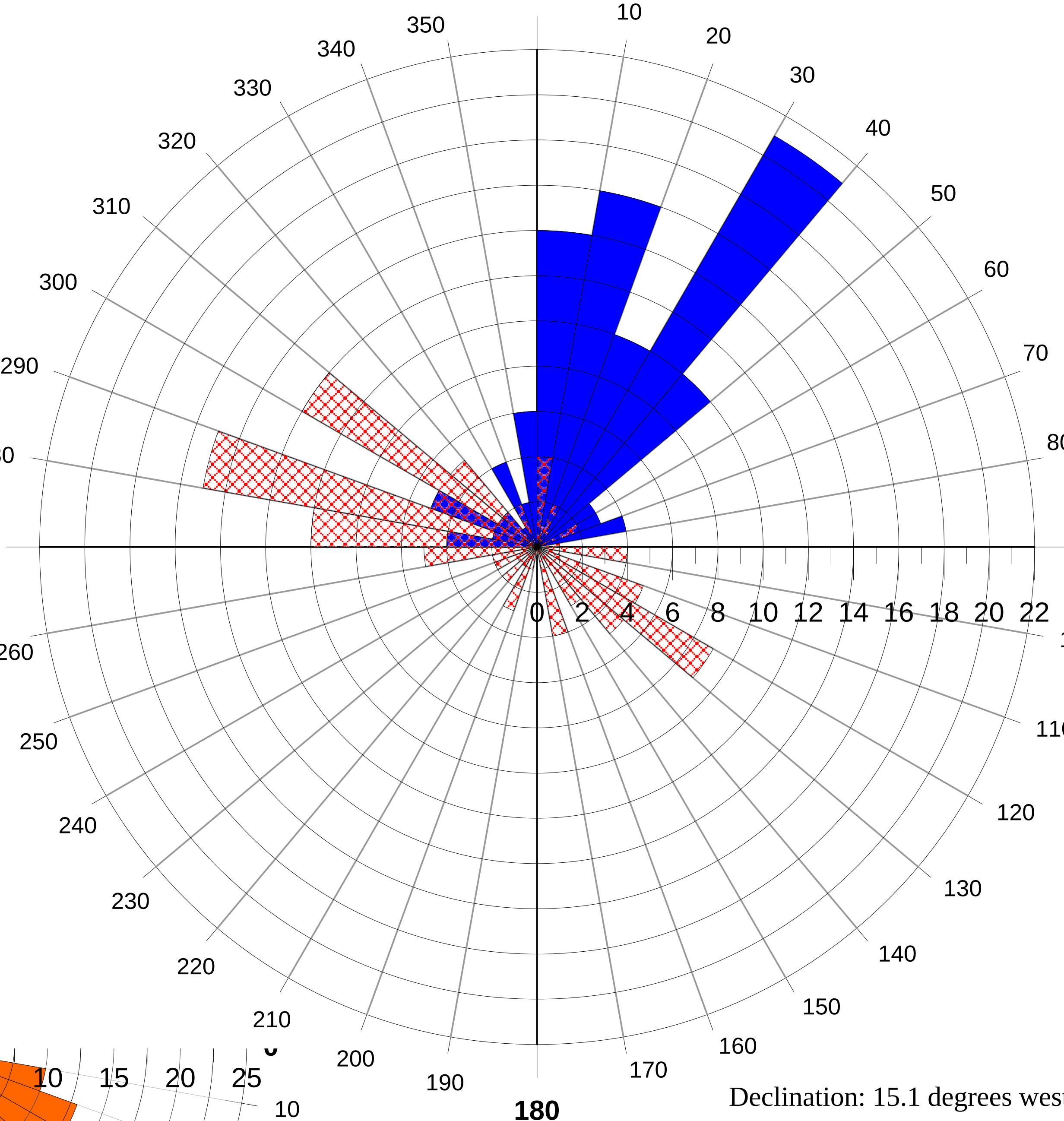
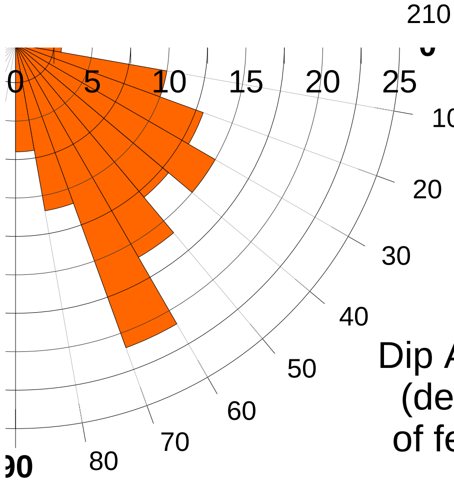
Northeast Geophysical Services

Borehole 08-6724
Pease Site
Portsmouth, NH

PLATE C-2
Strike and Dip Direction
of all features





Dip Amount
(degrees)
of features

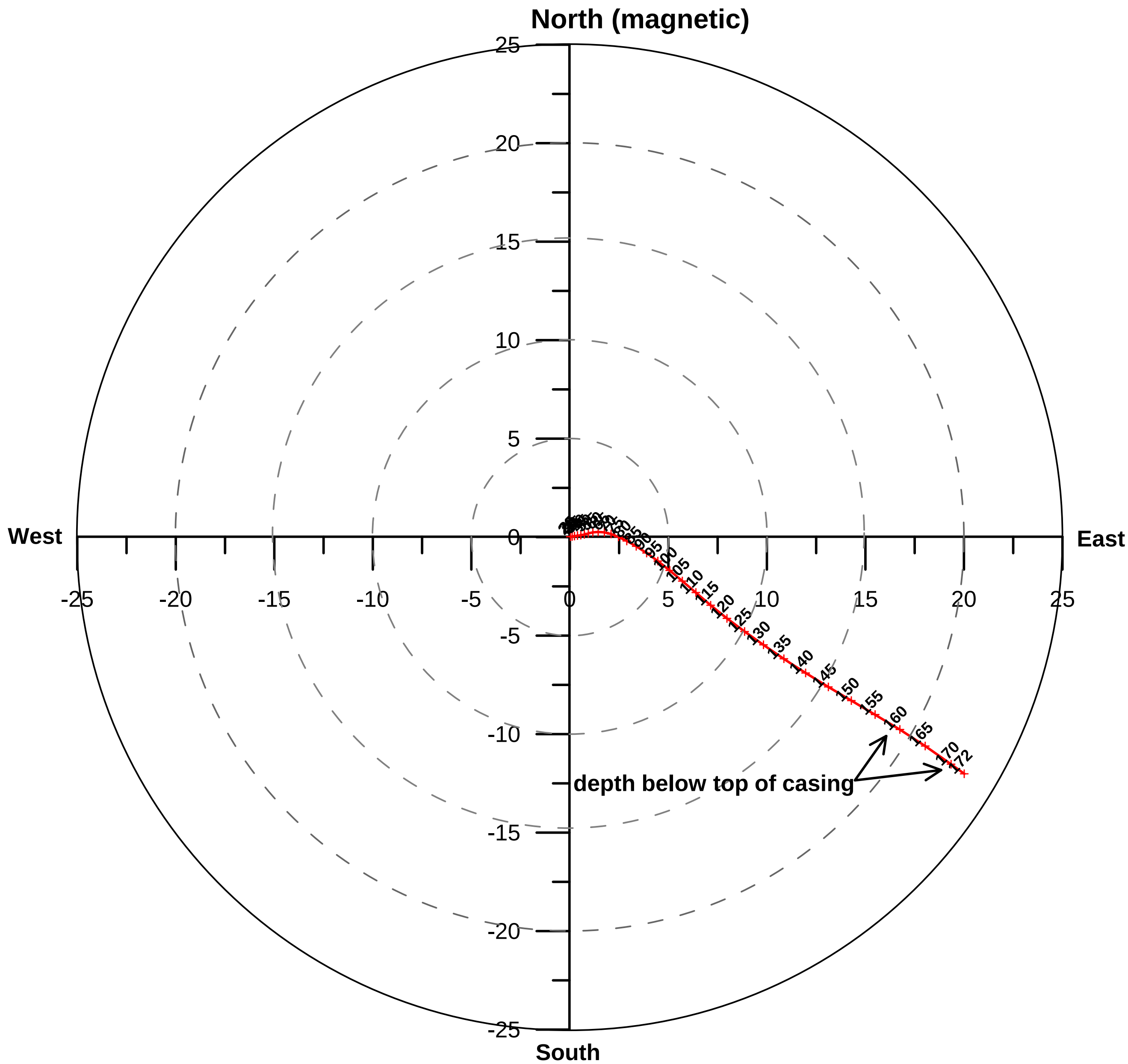
Declination: 15.1 degrees west

Explanation

- Dip direction of feature
- Strike of feature
- Dip Amount (Tilt)

Based on 109 measurements

Plate C-3
Borehole Deviation Plot
08-6724
Pease Site
Portsmouth, NH



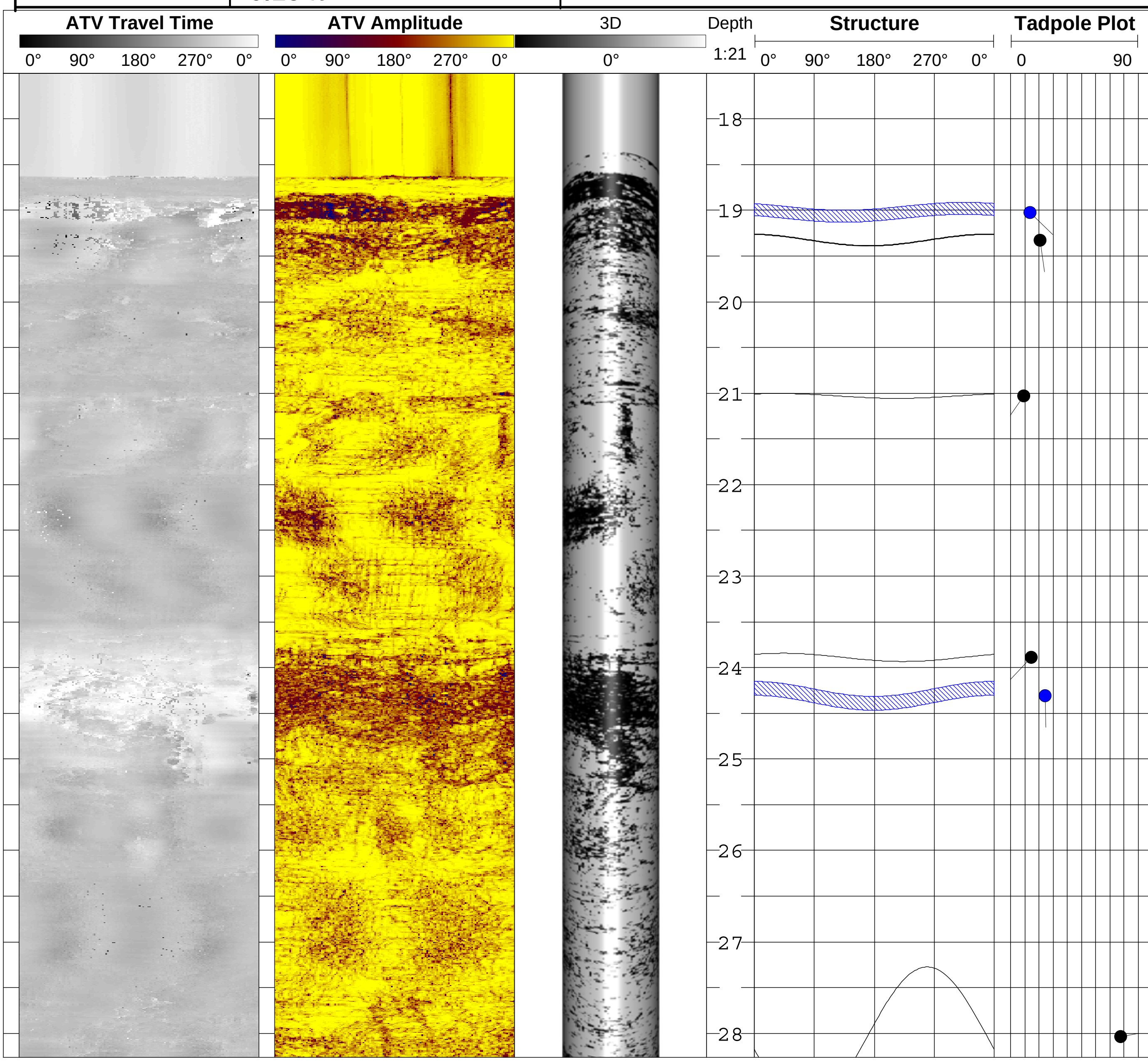
Distances in feet

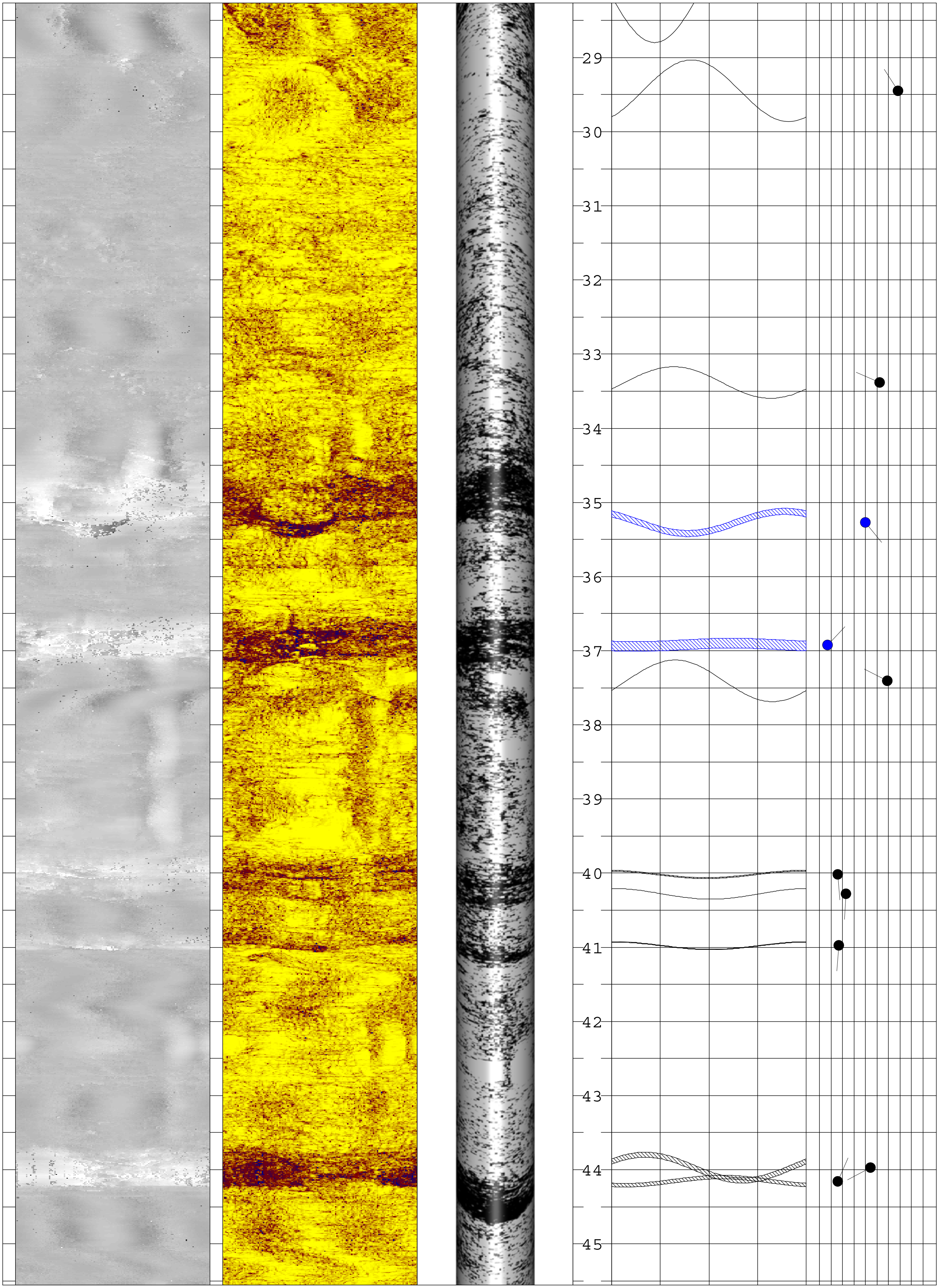
Northeast Geophysical Services
4 Union Street Bangor, Maine 04401
Tel. 207-942-2700
email: ngsinc@negeophysical.com

Log: Plate C-4 Acoustic Televiewer Log

Well:	08-6724		
Site:	Pease AFB		
Date:	8/25/2015	Location:	Portsmouth, NH
Casing Depth:	18.5 ft	For:	CB&I
Casing Type:	4 inch	Logged by:	R. Rawcliffe
Boring Depth:	179.7 ft	Orientation:	magnetic
Meas. From:	toc	Structure Plots:	
Stickup:	- 0.3 ft		
Water Level:	6.15 ft		

Structure Plots:
black = planar features (faults, foliation, bedding, joints, etc)
light blue = possibly transmissive fracture
dark blue = likely transmissive fracture

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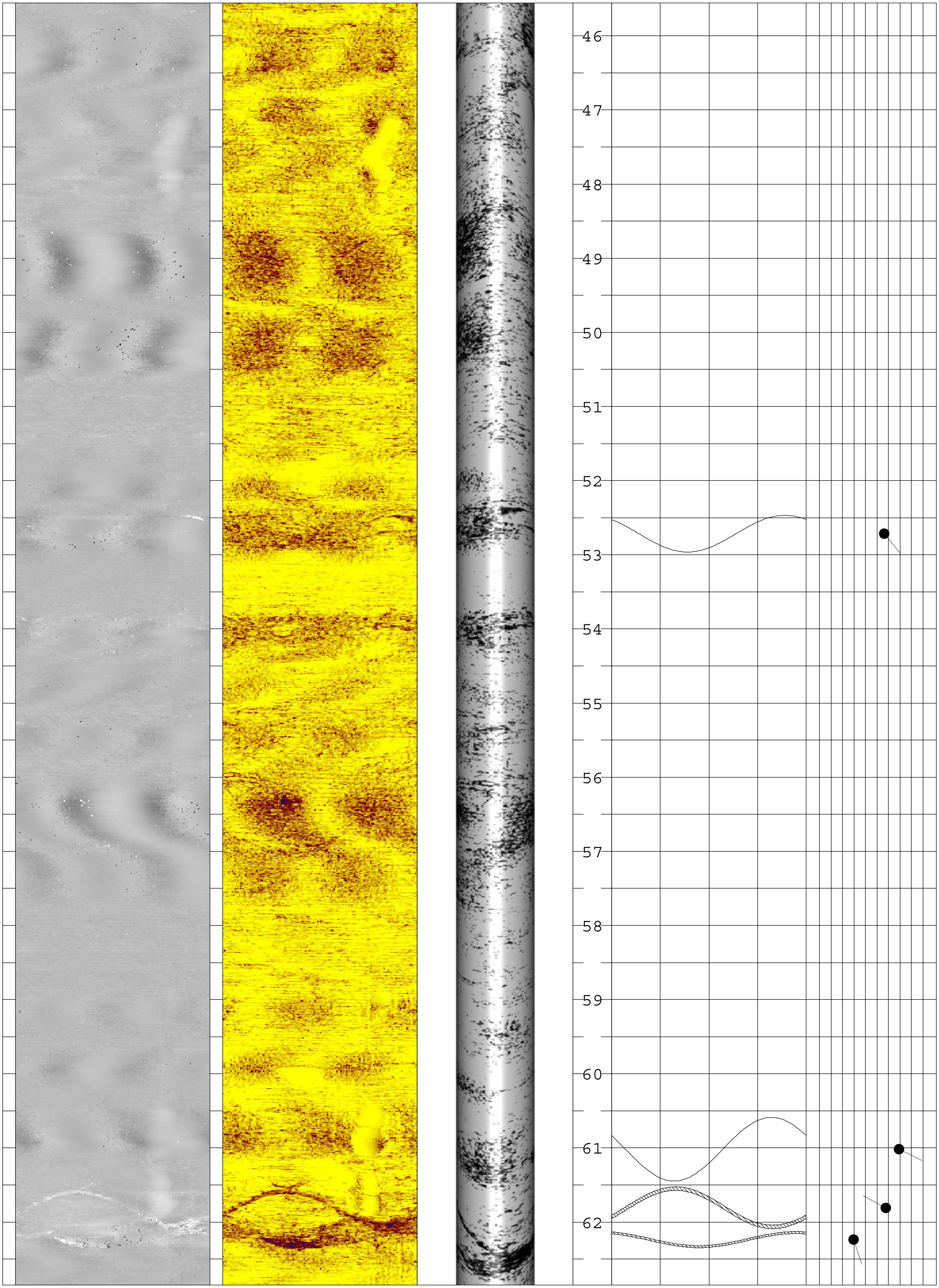
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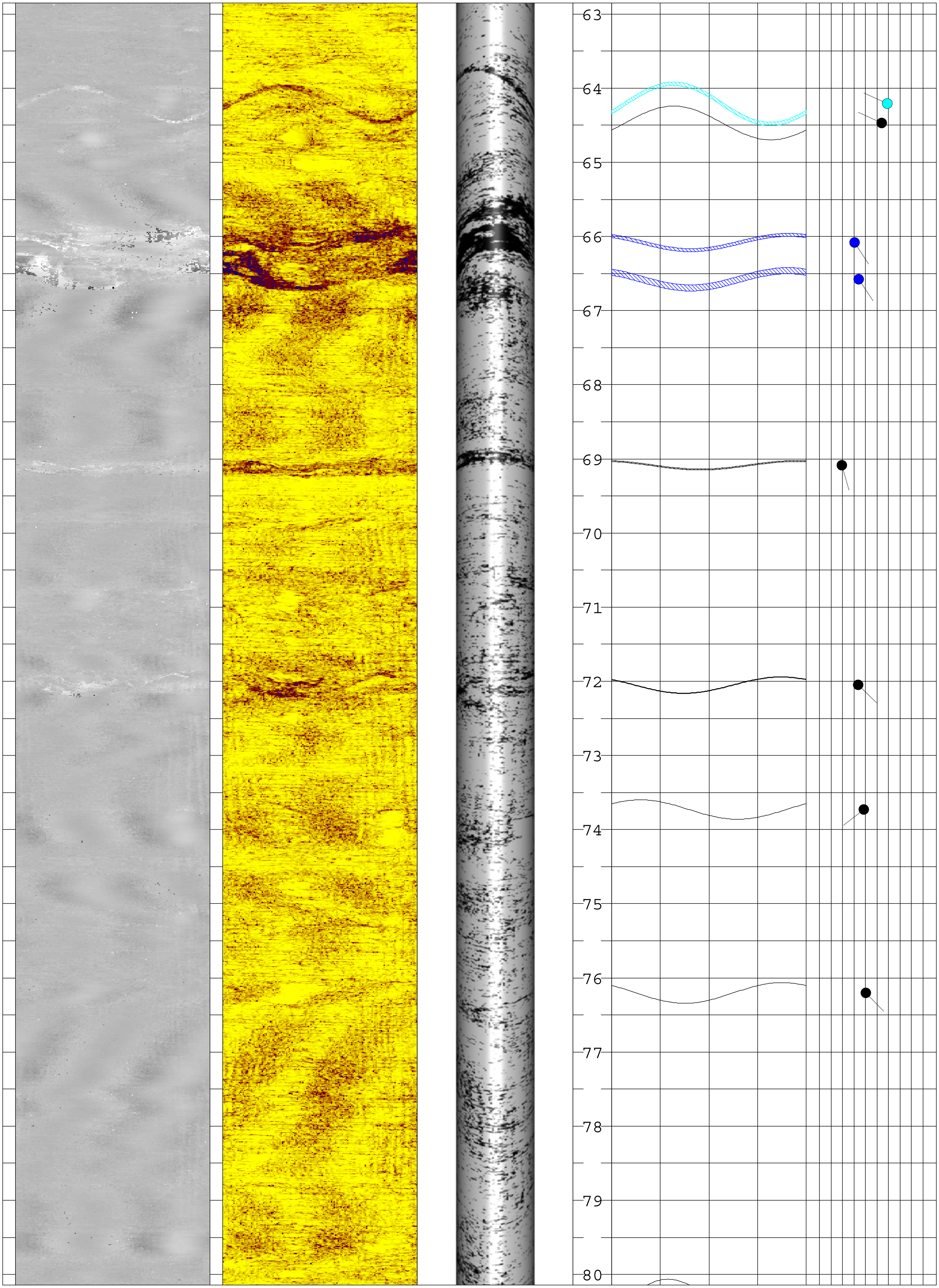
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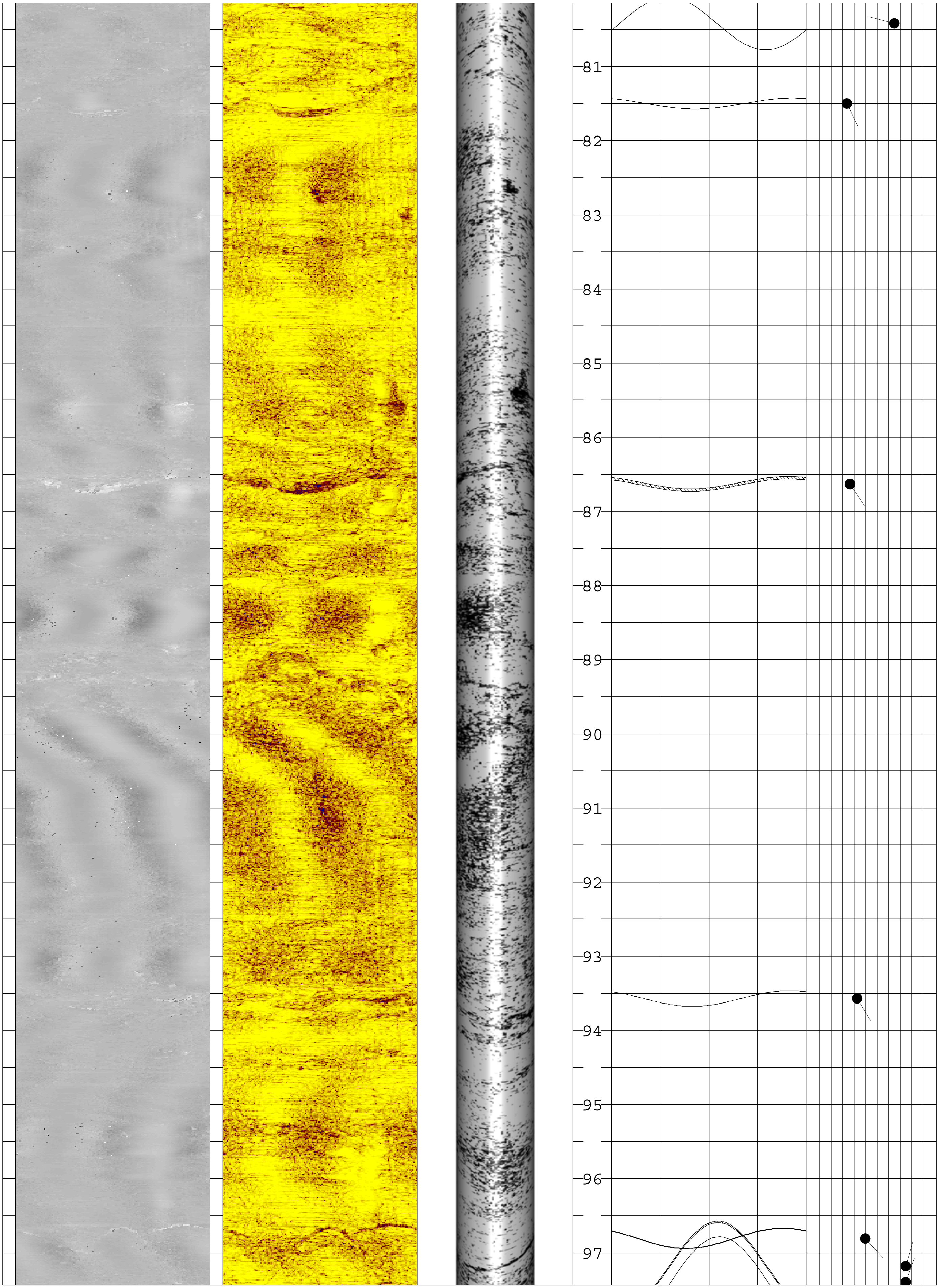
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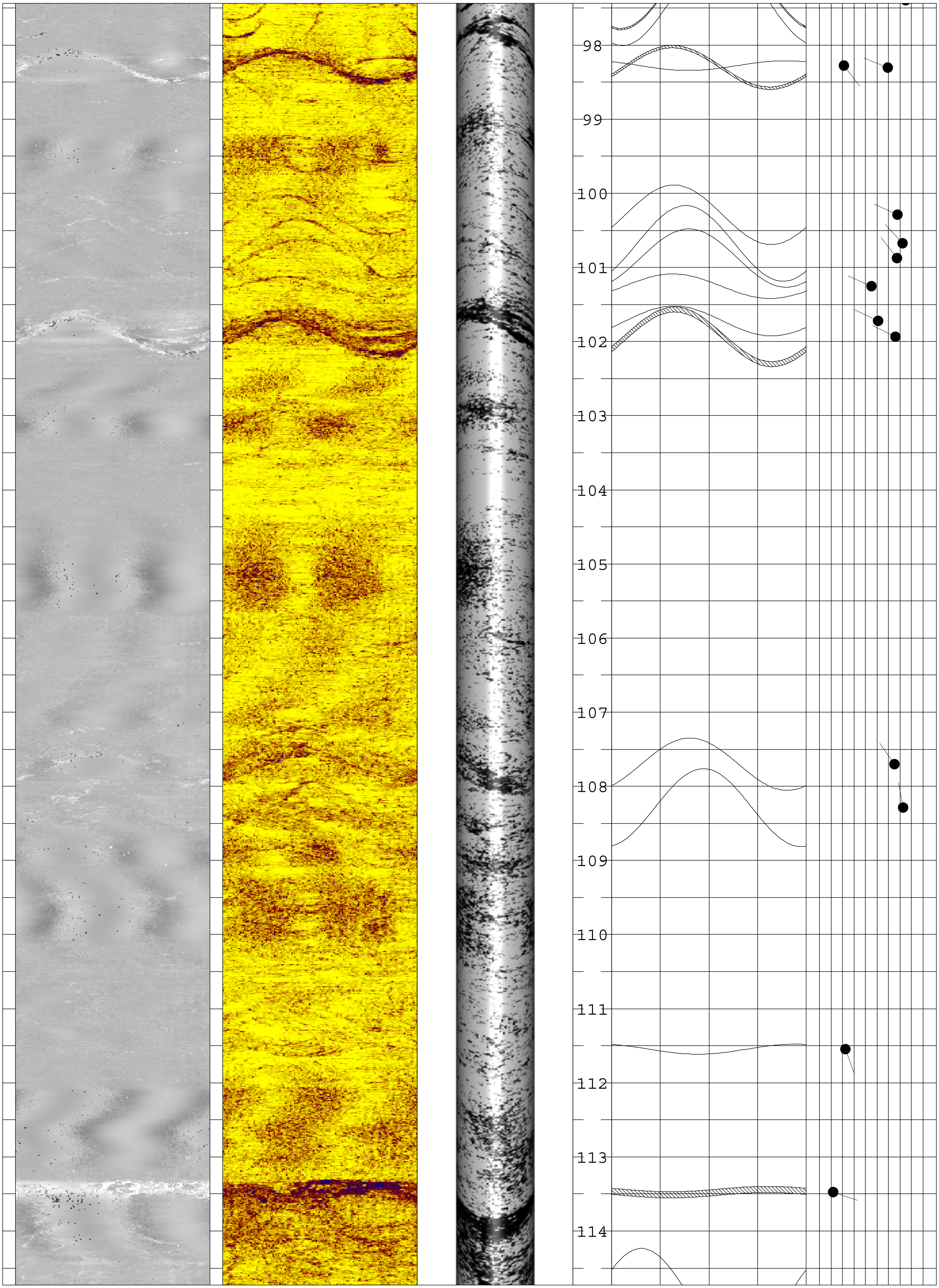
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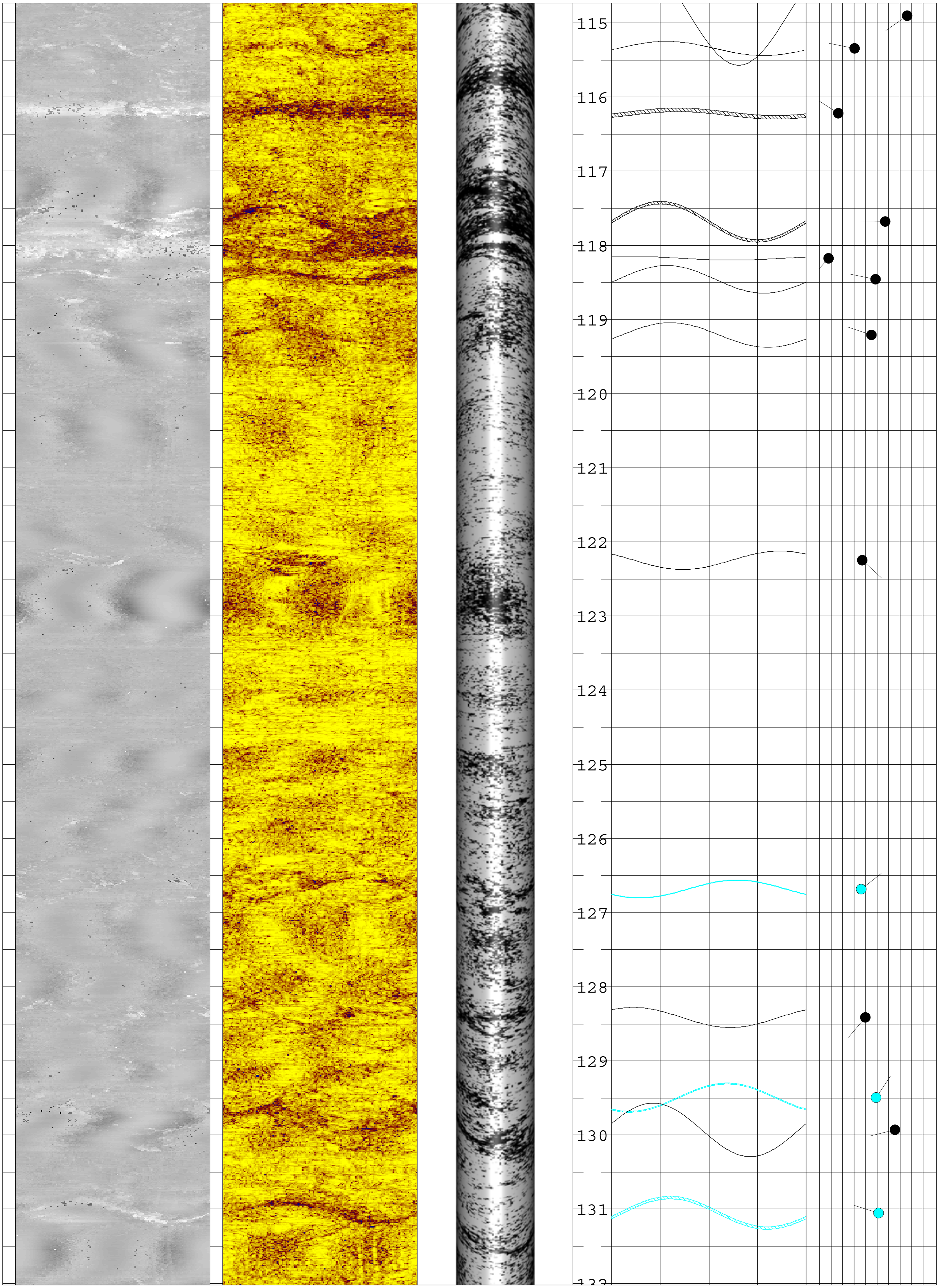
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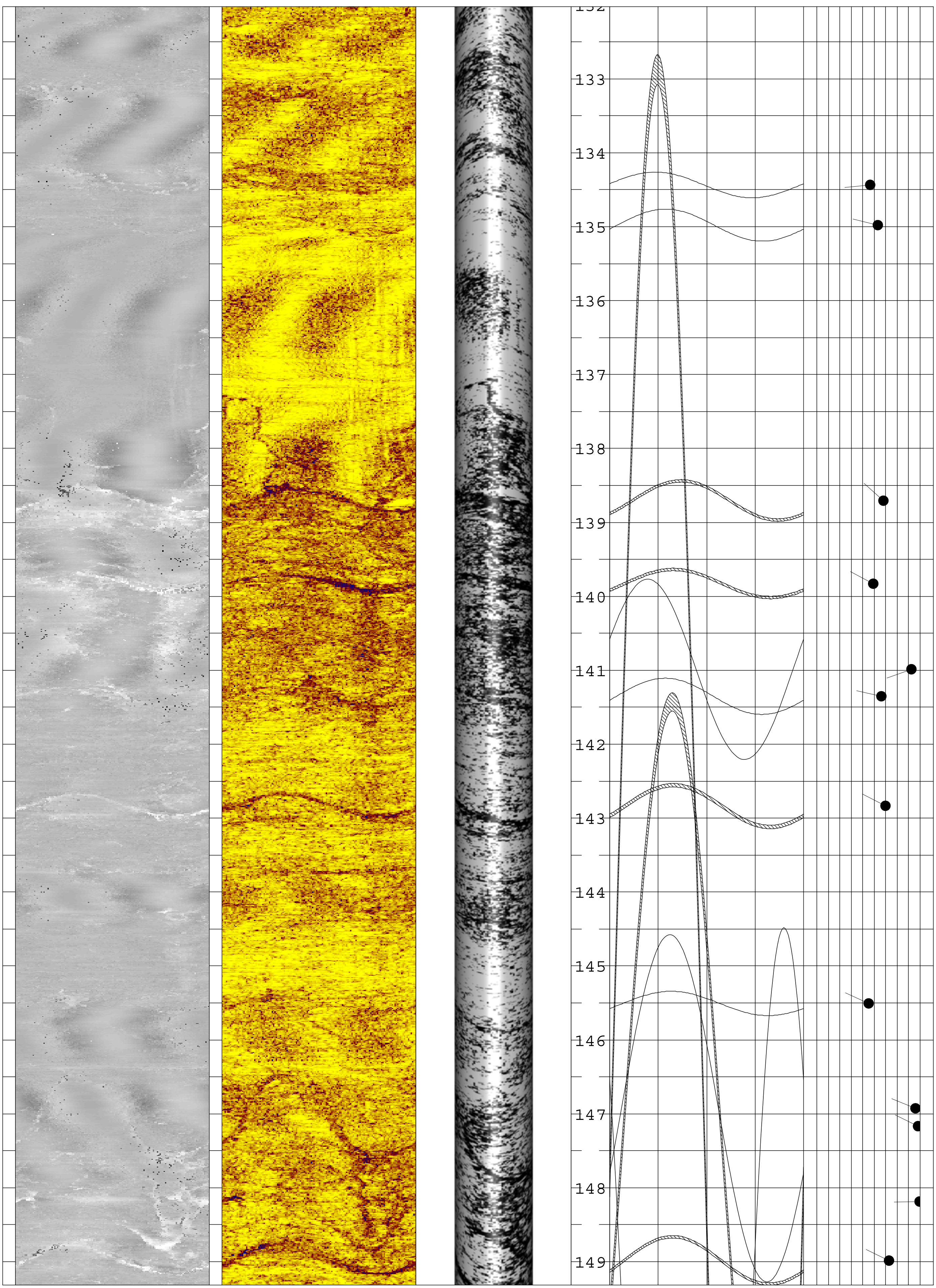
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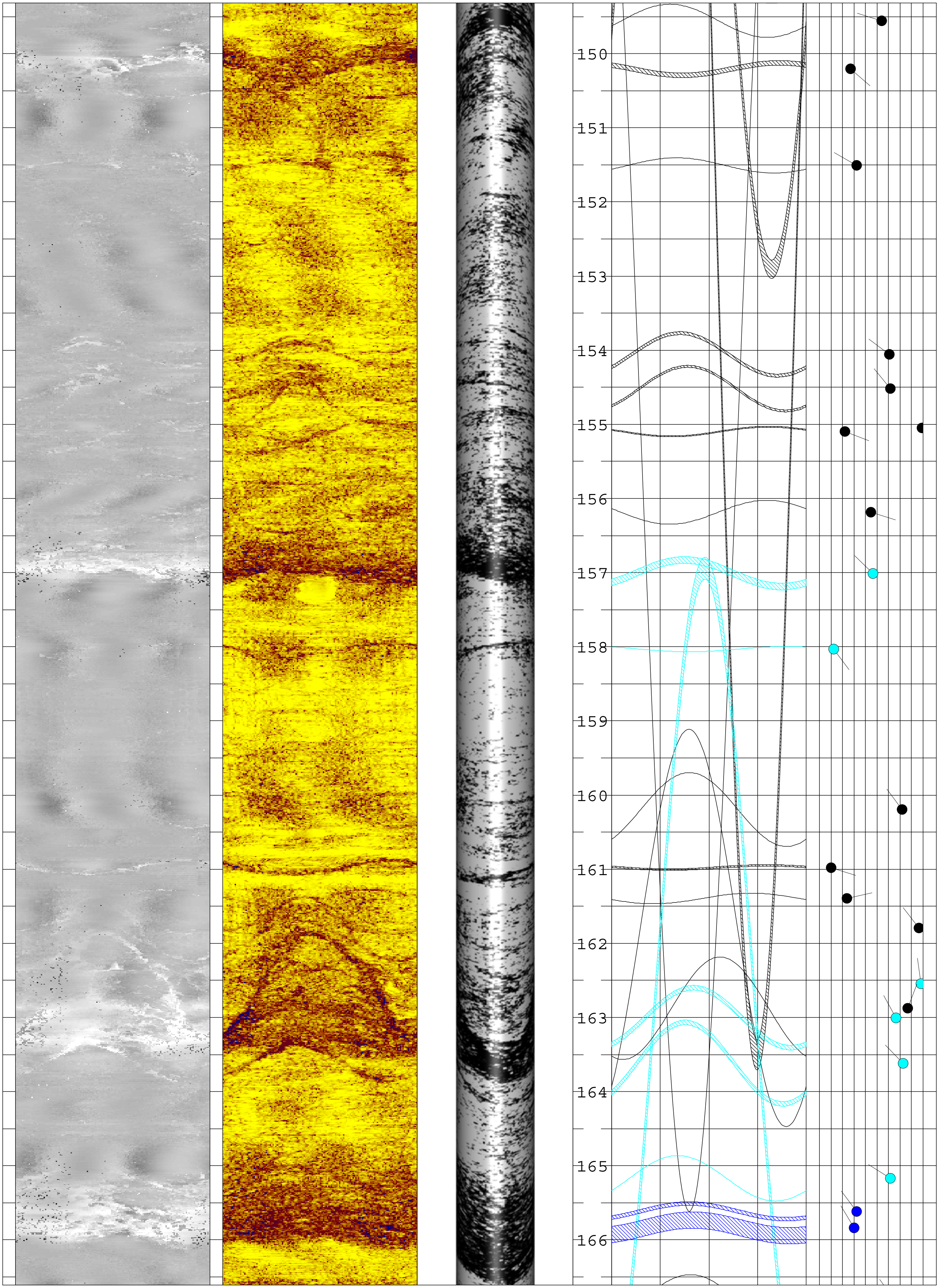
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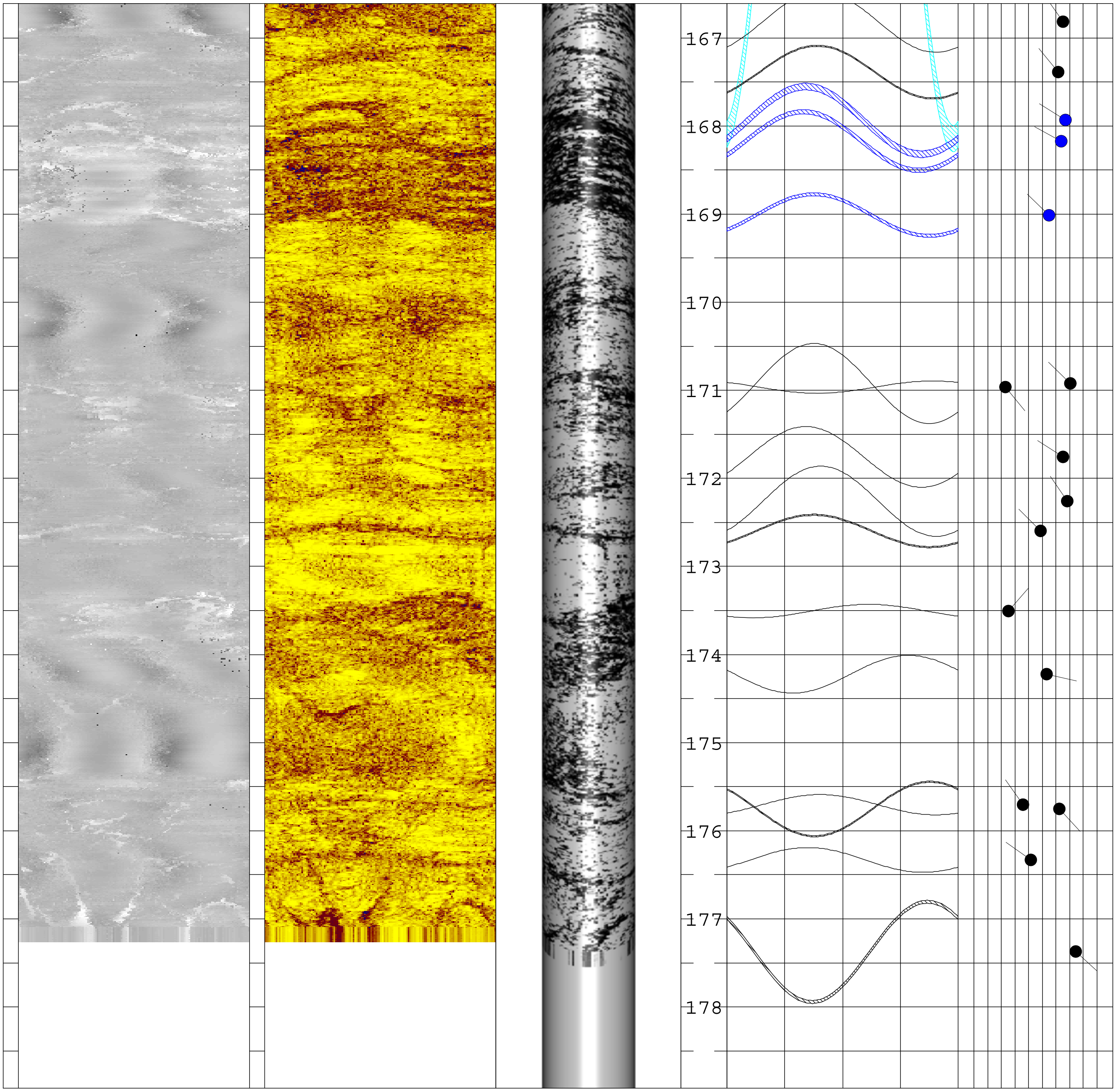

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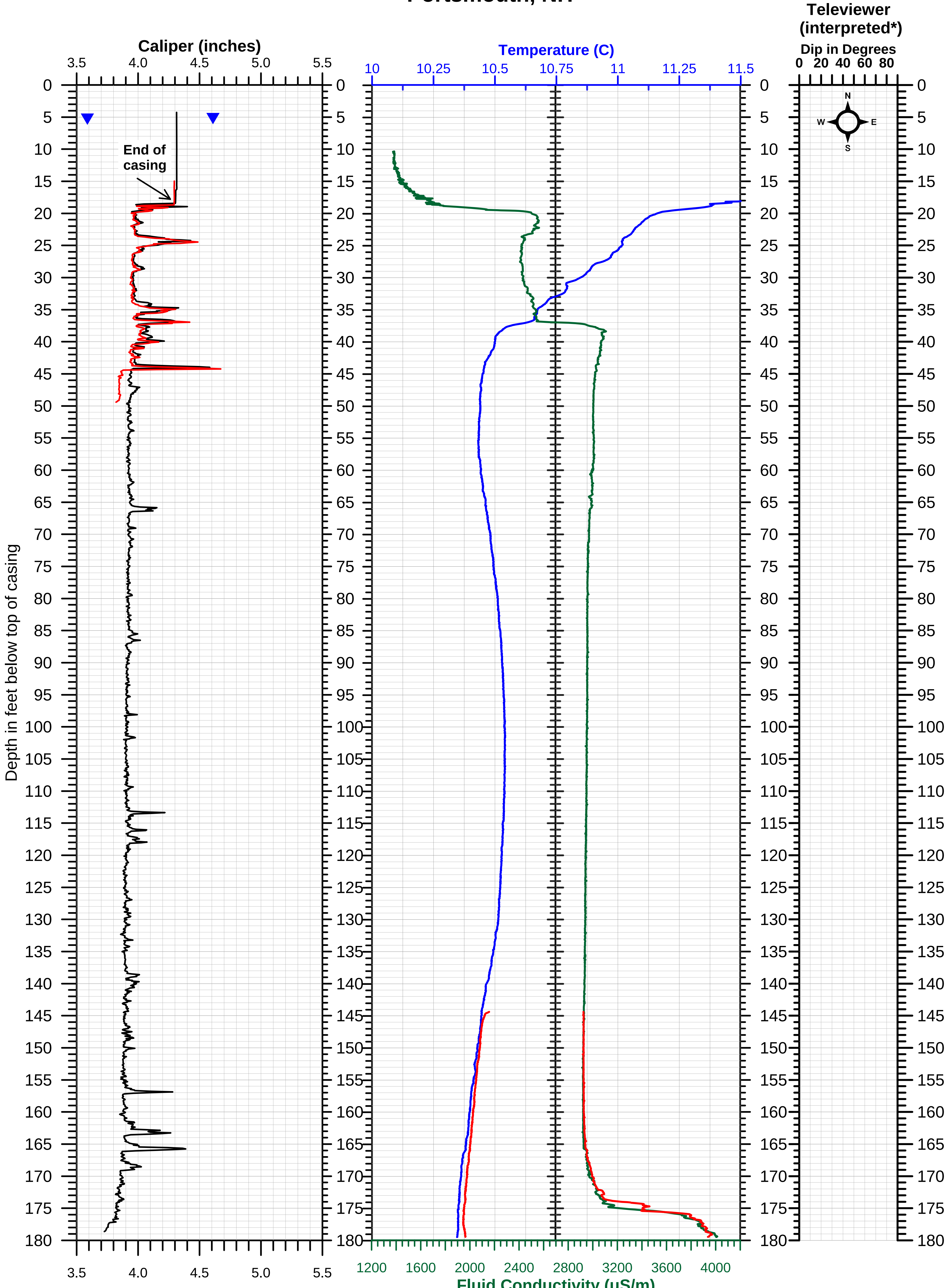
Northeast Geophysical Services

Date logged: 8/25/15

Borehole Geopysical Log
08-6724 Repeat Logs
Pease Project 143279
Portsmouth, NH



The dip direction is indicated by the line extending from the circle. The strike of the feature is 90 degrees from this.

Repeat logs in red

Plate C-5
Borehole Geophysical Log
08-6724 Repeat Logs

Date logged: 8/25/15

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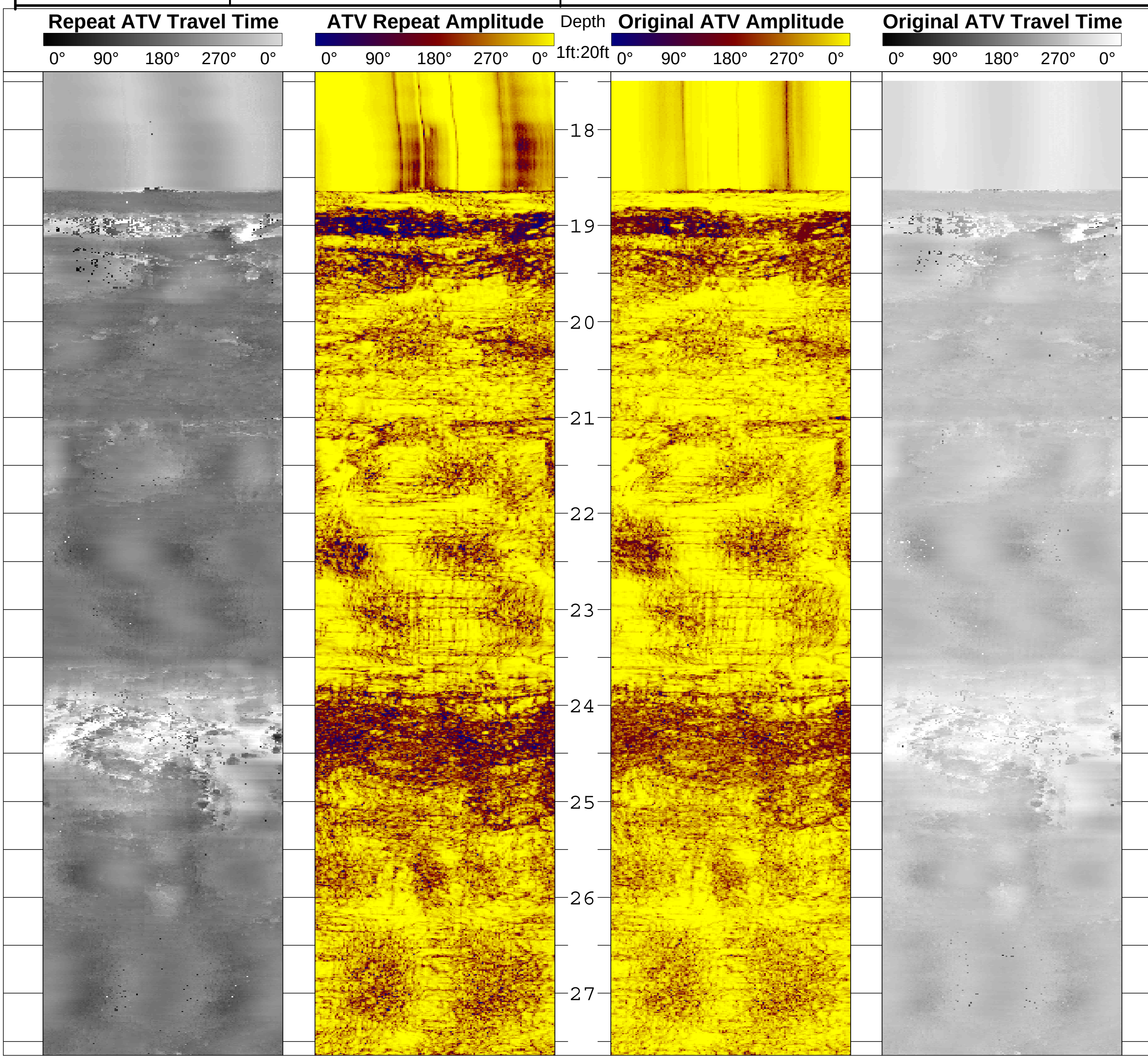
Northeast Geophysical Services
4 Union Street Bangor, Maine 04401
Tel. 207-942-2700
email: ngsinc@negeophysical.com

Log:	**Plate C-6 ATV Repeat Log**		
Well:	08-6724		
Site:	Pease AFB		
Date:	8/25/2015	Location:	Portsmouth, NH
Casing Depth:	18.5 ft	For:	CB&I
Casing Type:	4 inch	Logged by:	R. Rawcliffe
Boring Depth:	179.7 ft	Orientation:	magnetic
Meas. From:	top of casing	Structure Plots:	
Stickup:	- 0.3 ft		
Water Level:	6.15 ft		



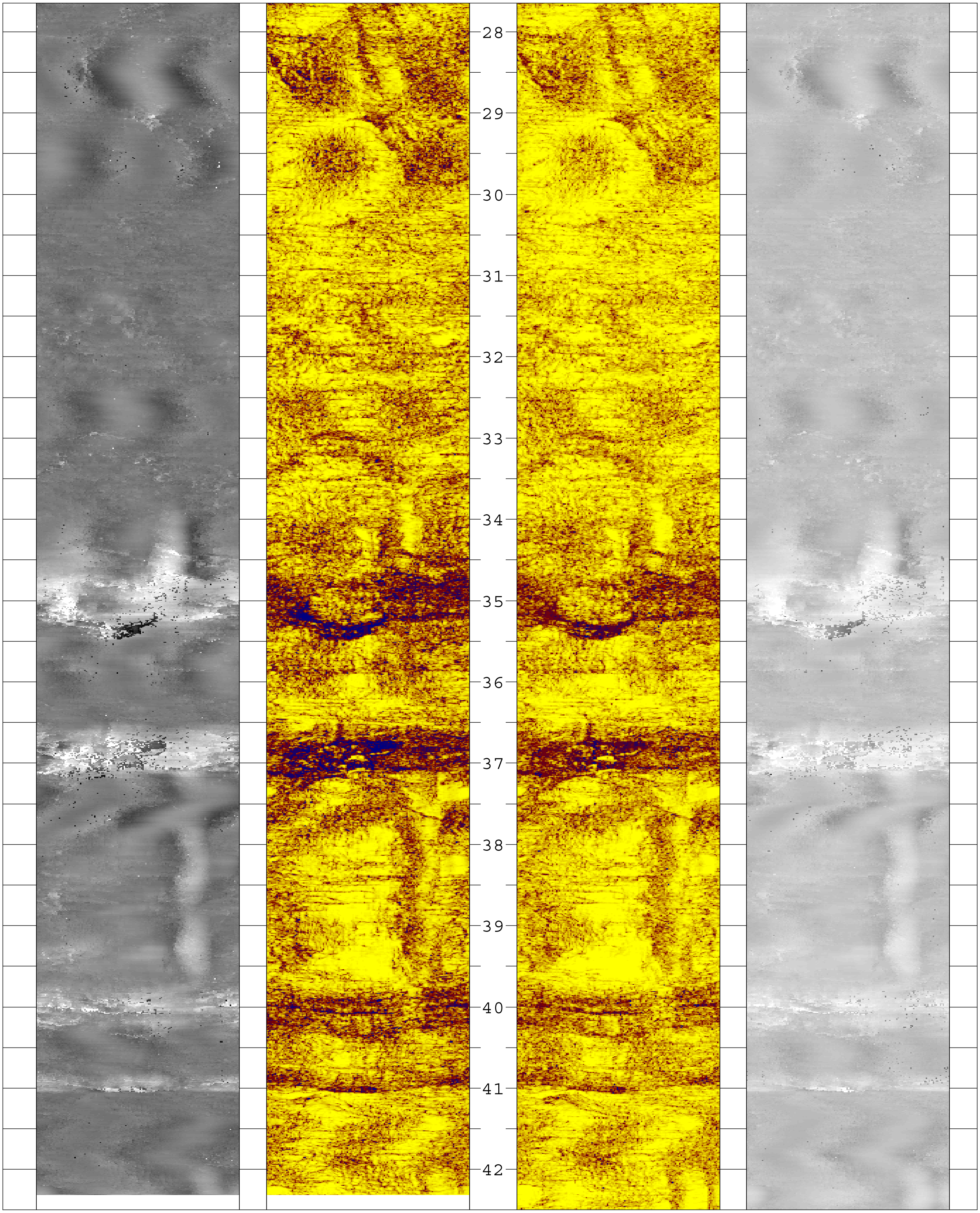

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TABLE C-1 Planar features interpreted from acoustical televiewer

08-6724 Pease AFB, Portsmouth, New Hampshire Logged: 08/25/2015

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6724	1	19.0	14	134	44	119	29	37	107
08-6724	2	19.3	21	172	82	157	67	2	100
08-6724	3	21.0	9	215	305	200	290	<1 mm	100
08-6724	4	23.9	15	223	313	208	298	<1 mm	100
08-6724	5	24.3	24	179	89	164	74	42	107
08-6724	6	28.0	78	80	350	64	334	<1 mm	100
08-6724	7	29.5	68	328	58	313	43	<1 mm	100
08-6724	8	33.4	52	294	24	279	9	<1 mm	100
08-6724	9	35.3	40	141	51	125	35	19	107
08-6724	10	36.9	7	43	313	28	298	41	107
08-6724	11	37.4	59	298	28	282	12	<1 mm	100
08-6724	12	40.0	16	175	85	160	70	5	100
08-6724	13	40.3	23	183	273	168	78	<1 mm	100
08-6724	14	41.0	17	184	274	168	78	1	100
08-6724	15	44.0	44	242	332	227	317	16	100
08-6724	16	44.2	16	24	294	9	279	14	100
08-6724	17	52.7	56	140	50	125	35	<1 mm	100
08-6724	18	61.0	69	116	26	100	10	<1 mm	100
08-6724	19	61.8	58	298	28	283	13	7	108
08-6724	20	62.2	30	162	72	146	56	8	108
08-6724	21	64.2	59	294	24	279	9	7	108
08-6724	22	64.5	54	295	25	280	10	<1 mm	100
08-6724	23	66.1	31	147	57	132	42	11	107
08-6724	24	66.6	34	146	56	131	41	20	107
08-6724	25	69.1	19	164	74	149	59	5	100
08-6724	26	72.1	34	133	43	118	28	1	100
08-6724	27	73.7	39	233	323	218	308	<1 mm	100
08-6724	28	76.2	40	135	45	120	30	<1 mm	100
08-6724	29	80.4	65	285	15	270	360	<1 mm	100
08-6724	30	81.5	24	155	65	139	49	<1 mm	100

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6724	31	86.6	27	147	57	131	41	10	100
08-6724	32	93.6	33	149	59	134	44	<1 mm	100
08-6724	33	96.8	40	137	47	122	32	1	100
08-6724	34	97.2	75	17	287	2	272	2	100
08-6724	35	97.4	75	19	289	4	274	<1 mm	100
08-6724	36	98.3	21	142	52	127	37	<1 mm	100
08-6724	37	98.3	59	292	22	277	7	6	100
08-6724	38	100.3	68	295	25	280	10	<1 mm	100
08-6724	39	100.7	72	317	47	302	32	<1 mm	100
08-6724	40	100.9	68	323	53	308	38	<1 mm	100
08-6724	41	101.3	45	293	23	278	8	<1 mm	100
08-6724	42	101.7	51	296	26	280	10	<1 mm	100
08-6724	43	101.9	66	297	27	281	11	8	100
08-6724	44	107.7	65	325	55	310	40	<1 mm	100
08-6724	45	108.3	73	350	80	335	65	<1 mm	100
08-6724	46	111.5	23	160	70	144	54	<1 mm	100
08-6724	47	113.5	12	109	19	93	3	25	108
08-6724	48	114.9	76	235	325	220	310	<1 mm	100
08-6724	49	115.4	30	281	11	266	356	<1 mm	100
08-6724	50	116.2	16	303	33	288	18	15	100
08-6724	51	117.7	57	270	360	255	345	6	100
08-6724	52	118.2	8	223	313	208	298	<1 mm	100
08-6724	53	118.5	49	282	12	267	357	<1 mm	100
08-6724	54	119.2	45	289	19	274	4	<1 mm	100
08-6724	55	122.2	37	132	42	117	27	<1 mm	100
08-6724	56	126.7	36	52	322	37	307	3	108
08-6724	57	128.4	40	220	310	205	295	<1 mm	100
08-6724	58	129.5	49	33	303	18	288	2	108
08-6724	59	129.9	66	257	347	242	332	<1 mm	100
08-6724	60	131.1	51	288	18	273	3	7	108
08-6724	61	134.4	47	265	355	250	340	<1 mm	100
08-6724	62	135.0	53	284	14	269	359	<1 mm	100
08-6724	63	138.7	58	312	42	297	27	5	100

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6724	64	139.8	49	298	28	283	13	7	100
08-6724	65	141.0	82	250	340	235	325	<1 mm	100
08-6724	66	141.4	56	283	13	267	357	<1 mm	100
08-6724	67	142.8	60	298	28	283	13	8	100
08-6724	68	145.5	45	294	24	279	9	<1 mm	100
08-6724	69	146.9	86	292	22	277	7	<1 mm	100
08-6724	70	147.2	88	296	26	281	11	2	100
08-6724	71	148.2	89	269	359	254	344	1	100
08-6724	72	149.0	63	297	27	282	12	5	100
08-6724	73	149.6	54	288	18	273	3	<1 mm	100
08-6724	74	150.2	27	131	41	115	25	16	100
08-6724	75	151.5	32	300	30	285	15	<1 mm	100
08-6724	76	154.1	61	307	37	292	22	7	100
08-6724	77	154.5	62	321	51	306	36	4	100
08-6724	78	155.1	89	144	54	129	39	<1 mm	100
08-6724	79	155.1	22	110	20	95	5	3	100
08-6724	80	156.2	45	107	17	92	2	<1 mm	100
08-6724	81	157.0	46	315	45	300	30	20	108
08-6724	82	158.0	13	143	53	128	38	<1 mm	108
08-6724	83	160.2	72	324	54	309	39	<1 mm	100
08-6724	84	161.0	10	107	17	92	2	6	100
08-6724	85	161.4	24	78	348	62	332	<1 mm	100
08-6724	86	161.8	86	323	53	308	38	<1 mm	100
08-6724	87	162.5	88	353	83	338	68	3	108
08-6724	88	162.9	77	21	291	6	276	<1 mm	100
08-6724	89	163.0	67	332	62	317	47	8	108
08-6724	90	163.6	73	317	47	301	31	5	108
08-6724	91	165.2	62	303	33	288	18	<1 mm	108
08-6724	92	165.6	32	323	53	308	38	12	107
08-6724	93	165.8	30	330	60	315	45	59	107
08-6724	94	166.8	65	326	56	310	40	<1 mm	100
08-6724	95	167.4	62	321	51	306	36	3	100
08-6724	96	167.9	67	303	33	288	18	8	107

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6724	97	168.2	64	299	29	284	14	6	107
08-6724	98	169.0	55	315	45	300	30	6	107
08-6724	99	170.9	70	315	45	300	30	<1 mm	100
08-6724	100	171.0	23	140	50	125	35	<1 mm	100
08-6724	101	171.8	65	303	33	288	18	<1 mm	100
08-6724	102	172.3	68	326	56	311	41	<1 mm	100
08-6724	103	172.6	49	315	45	300	30	3	100
08-6724	104	173.5	25	41	311	26	296	<1 mm	100
08-6724	105	174.2	53	102	12	87	357	<1 mm	100
08-6724	106	175.7	36	325	55	310	40	<1 mm	100
08-6724	107	175.8	63	136	46	121	31	2	100
08-6724	108	176.3	41	305	35	290	20	<1 mm	100
08-6724	109	177.4	75	132	42	117	27	2	100

Category Explanation:

100	planar feature likely foliation or bedding surface
108	possibly transmissive fracture or crack
107	likely transmissive fracture or crack

TABLE C-2 - Flowmeter measurements
08-6724 - Pease AFB **Logged: 08/25/2015**
Portsmouth, NH

Ambient Measurements

Borehole	Depth Feet	Flow Readings (in gallons per minute)			Average or Median Flow		
08-6724	6.16	water level					
08-6724	22.45	-0.13	-0.21	-0.14	-0.15	-0.15	-0.15
08-6724	27.05	-0.16	-0.18	-0.19	-0.20		-0.20
08-6724	31.55	-0.17	-0.20	-0.21	-0.21		-0.21
08-6724	41.51	-0.17	-0.24	-0.26	-0.26	-0.26	-0.26
08-6724	49.99	-0.22	-0.24	-0.26	-0.26	-0.26	-0.26
08-6724	63.05	-0.20	-0.24	-0.26	-0.26		-0.26
08-6724	72.56	-0.16	-0.16	-0.16	-0.16	-0.17	-0.16
08-6724	83.05	-0.16	-0.16	-0.17	-0.17		-0.17
08-6724	96.19	-0.15	-0.14	-0.15			-0.15
08-6724	110.99	-0.15	-0.14	-0.14			-0.14
08-6724	123.06	-0.12	-0.12	-0.12			-0.12
08-6724	137.02	-0.04	-0.04	-0.04	-0.04		-0.04
08-6724	145.52	-0.03	-0.05	-0.05			-0.05
08-6724	153.12	-0.02	-0.02	-0.02			-0.02
08-6724	159.00	NF					NF
08-6724	171.00	NF					NF

Measurements while pumping pump rate = ~1.2 gpm

Borehole	Depth Feet	Flow Readings (in gallons per minute)			Average or Median Flow		
08-6724	6.4	water level					
08-6724	17.0	1.01	1.12	1.12	1.03		1.08
08-6724	22.5	-0.02	-0.02	-0.02			-0.02
08-6724	27	-0.01	-0.10	-0.10			-0.10
08-6724	31	-0.01	-0.10	-0.10			-0.10
08-6724	41.5	NF	NF	NF			NF
08-6724	50	NF	NF	NF			NF
08-6724	63	NF	NF	NF			NF
08-6724	72.5	-0.11	-0.10	-0.10			-0.10
08-6724	83.0	-0.11	-0.10	-0.10			-0.10
08-6724	96.0	-0.13	-0.13	-0.13			-0.13
08-6724	110.9	-0.12	-0.12	-0.12			-0.12
08-6724	123.0	-0.10	-0.10	-0.10			-0.10
08-6724	127.0	-0.10	-0.09	-0.10			-0.10
08-6724	130.5	-0.05	-0.04	-0.04			-0.04
08-6724	137.0	-0.04	-0.04	-0.04			-0.04
08-6724	145.5	-0.04	-0.04	-0.04			-0.04
08-6724	154.0	-0.03	-0.02	-0.03			-0.03
08-6724	161.1	-0.02	-0.02	-0.02			-0.02
08-6724	167.0	NF	NF	NF			NF
08-6724	171.0	NF	NF	NF			NF

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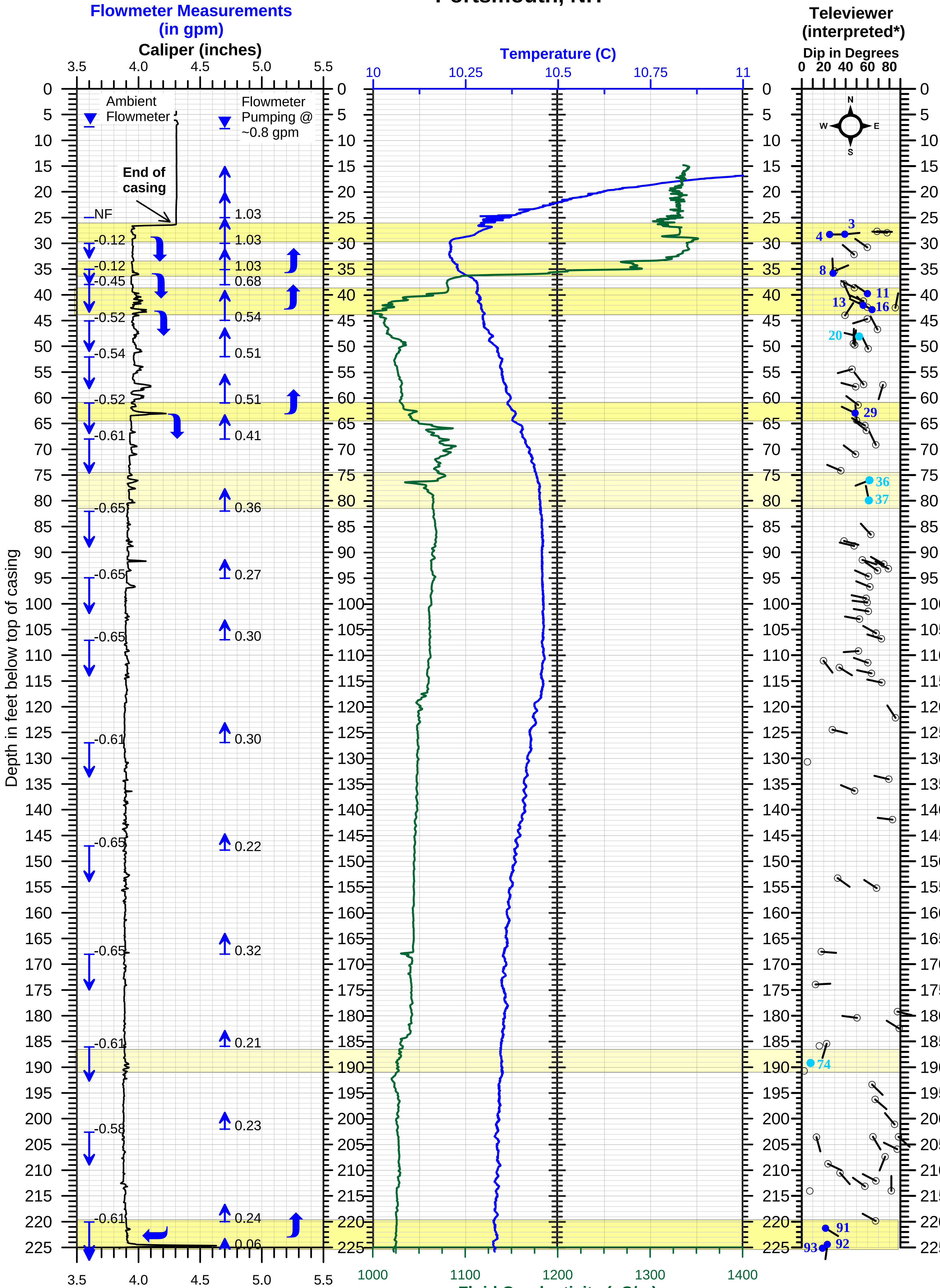
ATTACHMENT D
08-6725
BOREHOLE GEOPHYSICAL LOGS

Northeast Geophysical Services

Date logged: 8/26/15

PLATE D-1
Borehole 08-6725
Pease Project 143279
Portsmouth, NH



= Likely transmissive zone

= possible transmissive zone

The dip direction is indicated by the line extending from the circle. The strike of the feature is 90 degrees from this.

PLATE D-1

Borehole Geophysical Log

Borehole 08-6725

Date logged: 8/26/15

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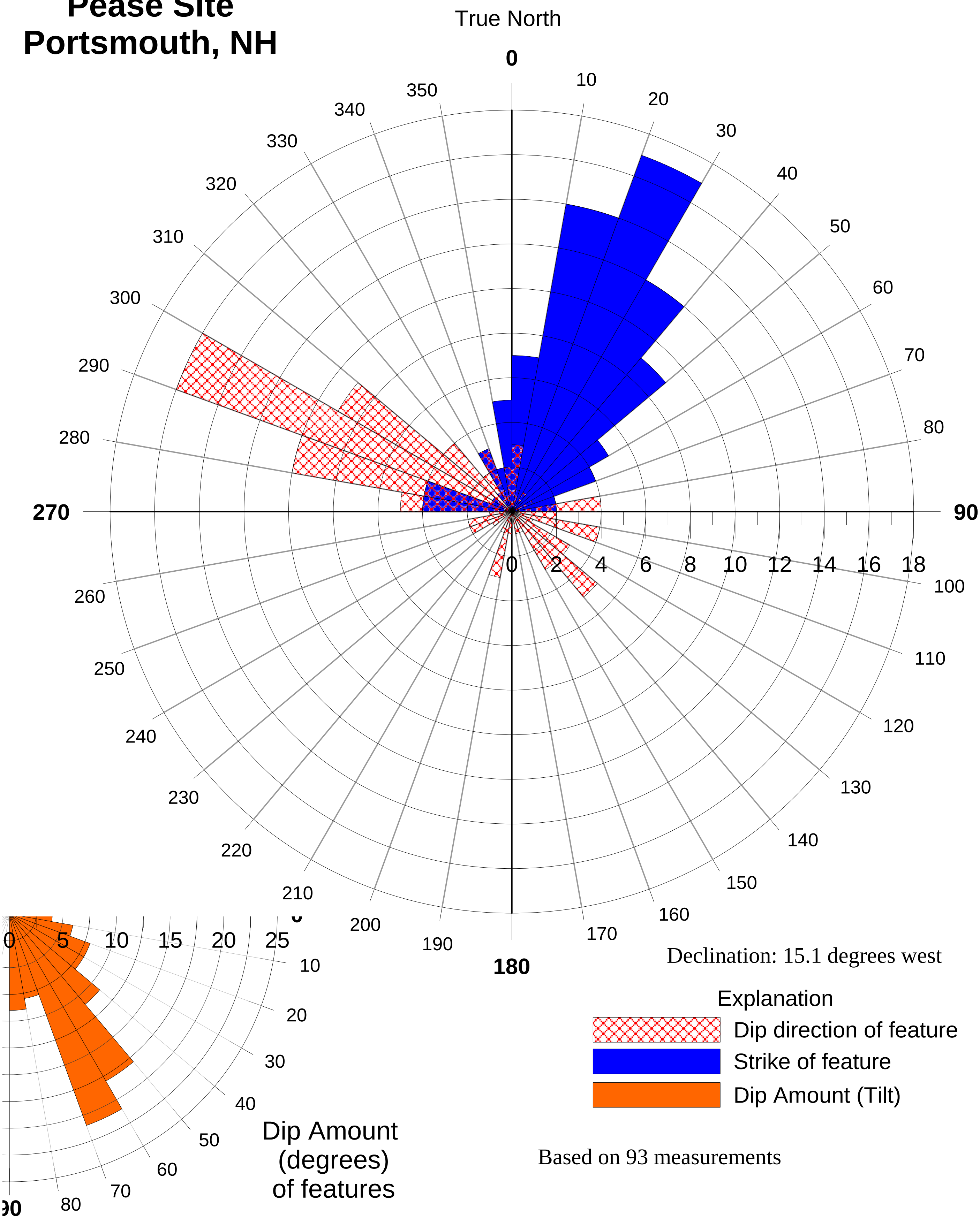
Northeast Geophysical Services

Borehole 08-6725
Pease Site
Portsmouth, NH

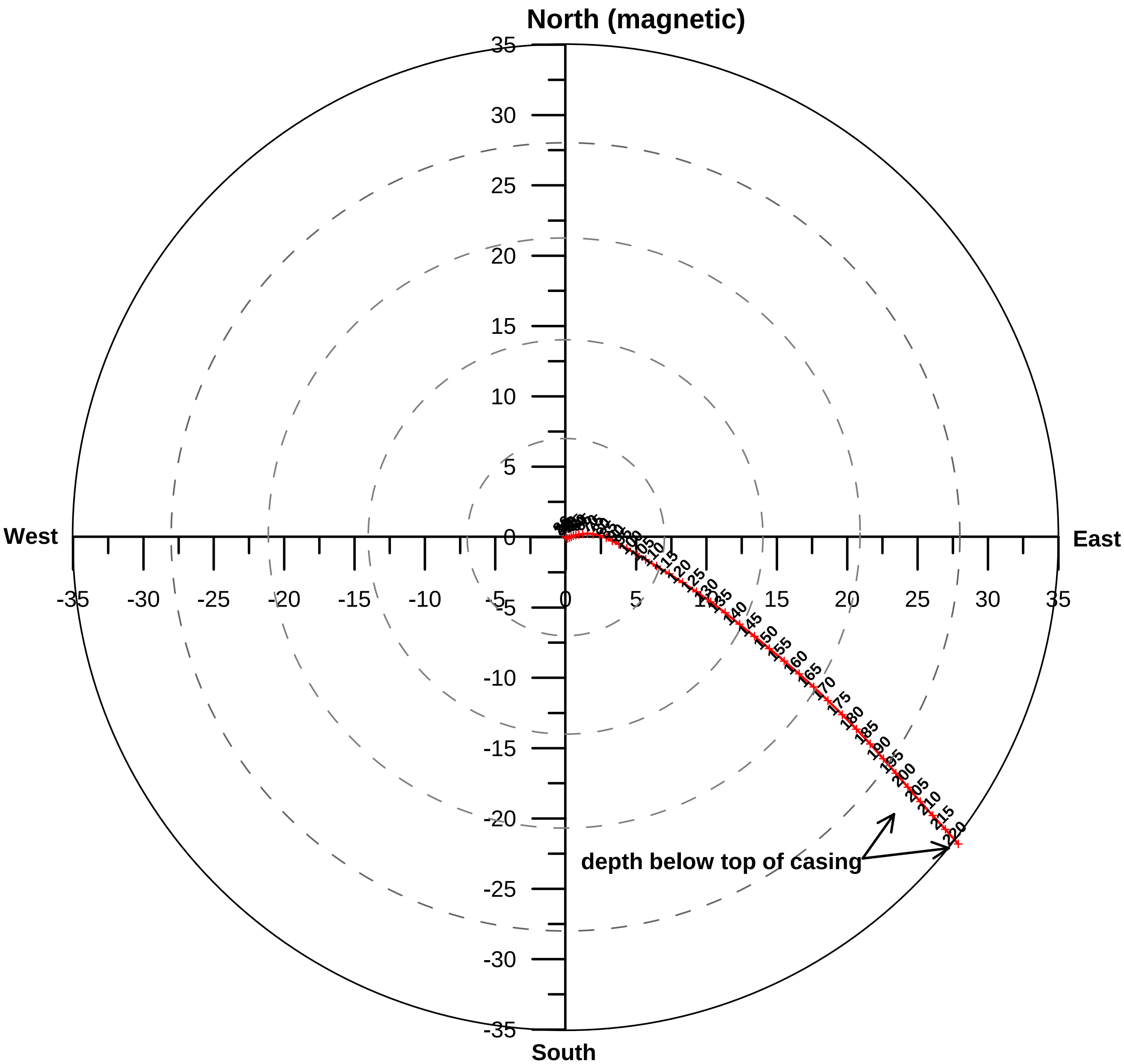
PLATE D-2
Strike and Dip Direction of all features



Declination: 15.1 degrees west

Based on 93 measurements

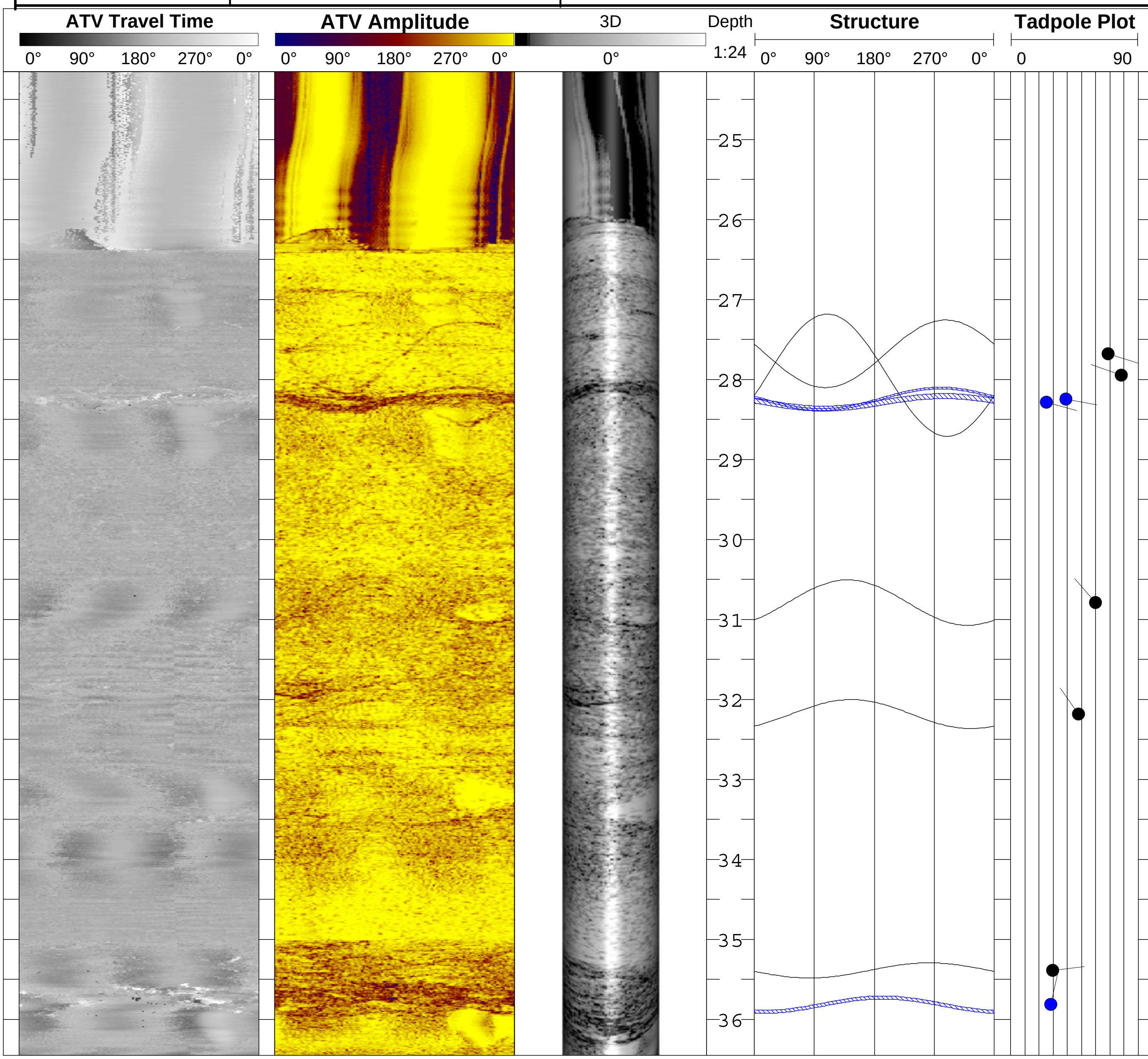
Plate D-3
Borehole Deviation Plot
08-6725
Pease Site
Portsmouth, NH

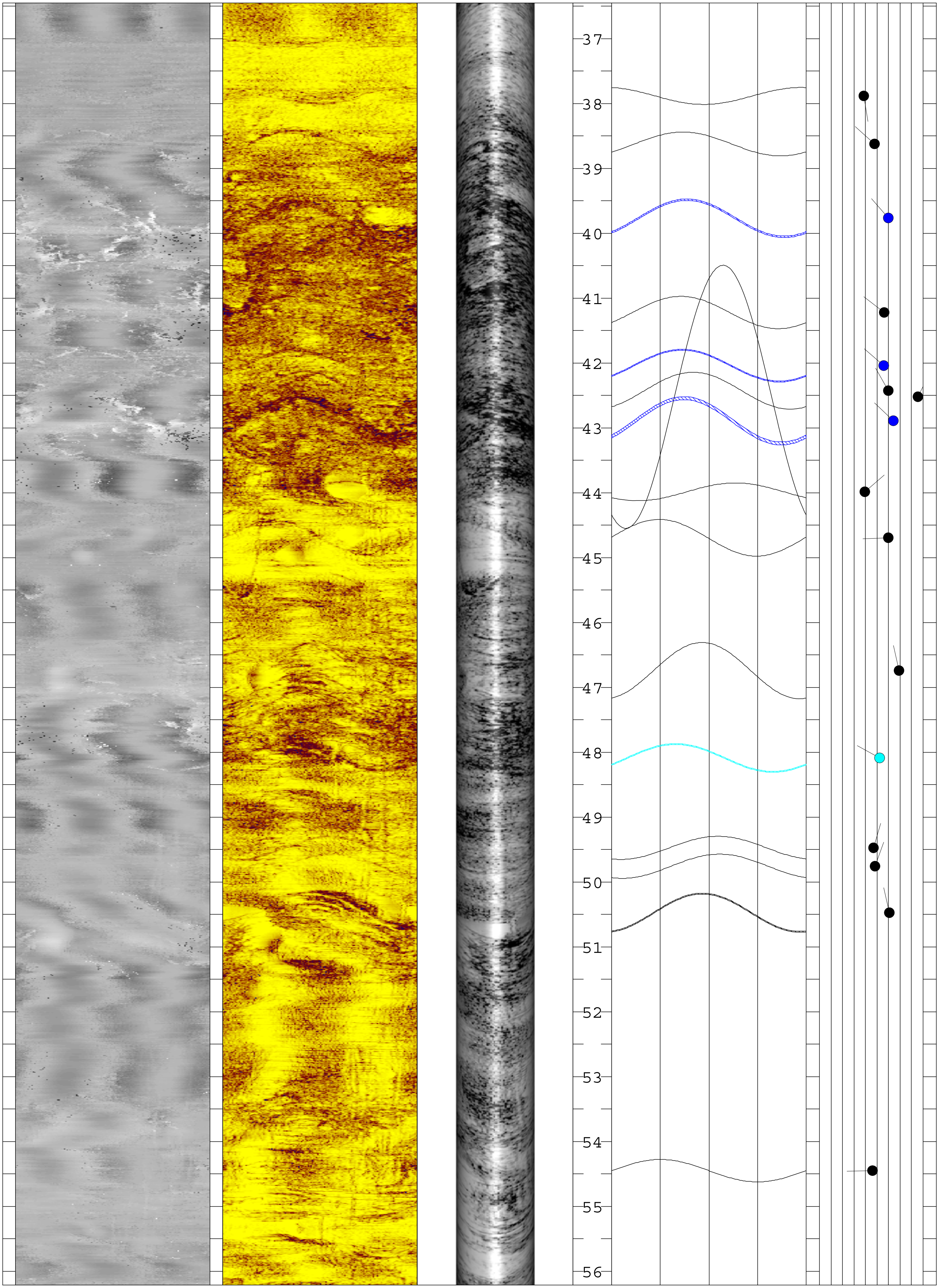


Distances in feet

Northeast Geophysical Services
4 Union Street Bangor, Maine 04401
Tel. 207-942-2700
email: ngsinc@negeophysical.com

Log:	**Plate D-4 Acoustic Televiewer**		
Well:	08-6725		
Site:	Pease AFB		
Date:	8/26/2015	Location:	Portsmouth, NH
Casing Depth:	26.5 ft	For:	CB&I
Casing Type:	4 inch	Logged by:	R. Rawcliffe
Boring Depth:	226.2 ft	Orientation:	magnetic
Meas. From:	toc	Structure Plots:	black = planar features (faults, foliation, bedding, joints, etc) light blue = possibly transmissive fracture dark blue = likely transmissive fracture
Stickup:	- 0.4 ft		
Water Level:	7.43 ft		

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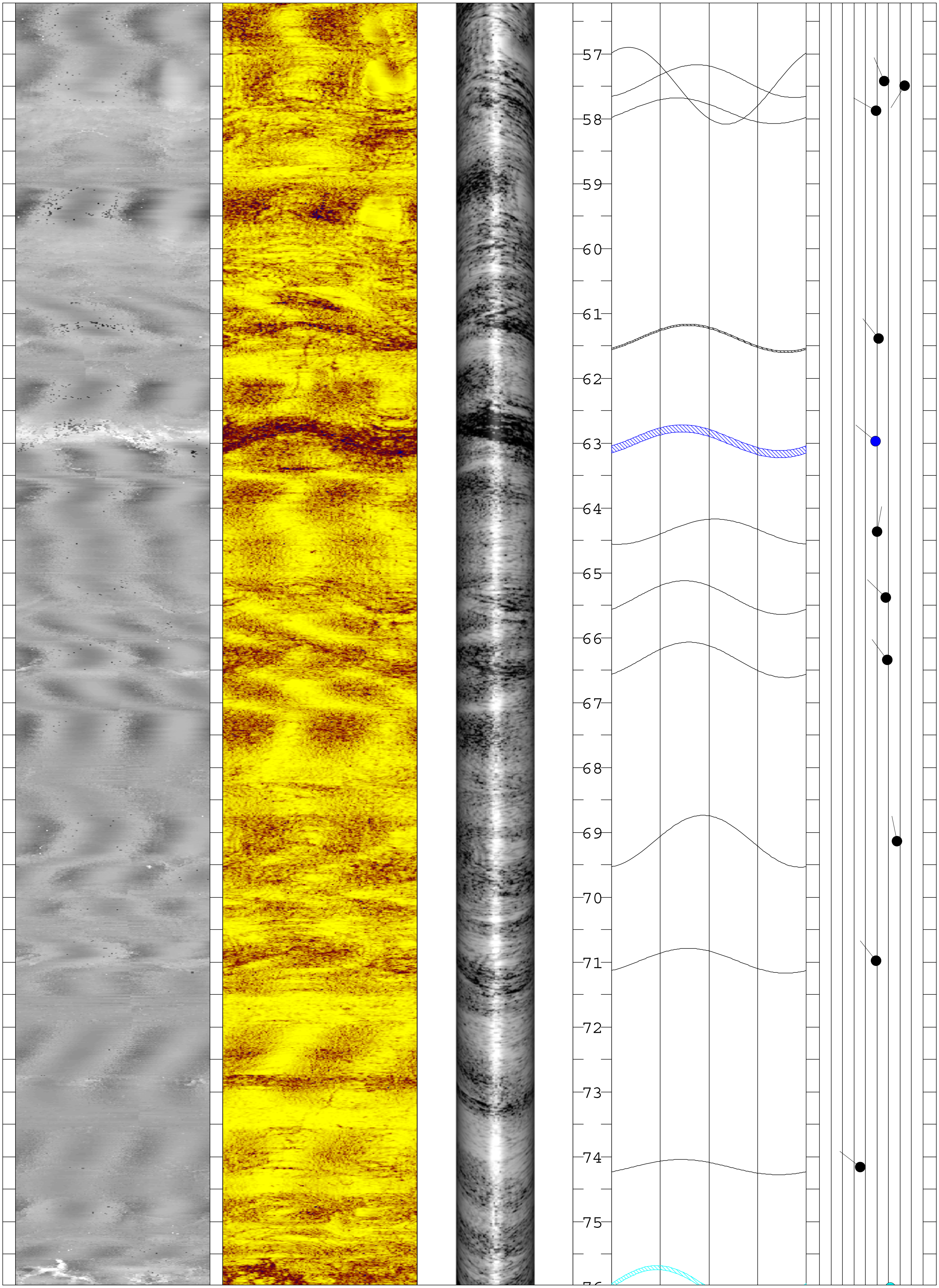
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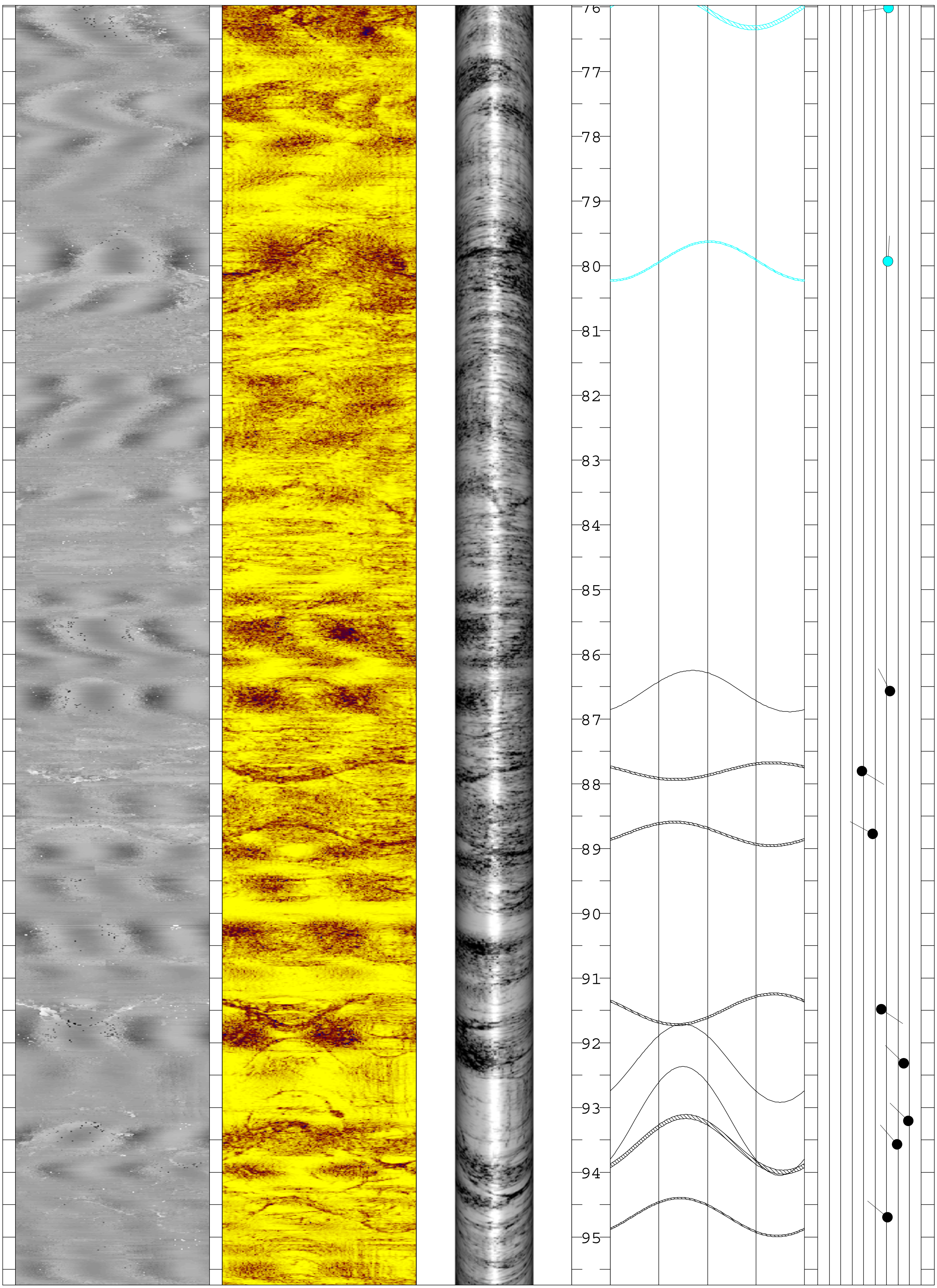
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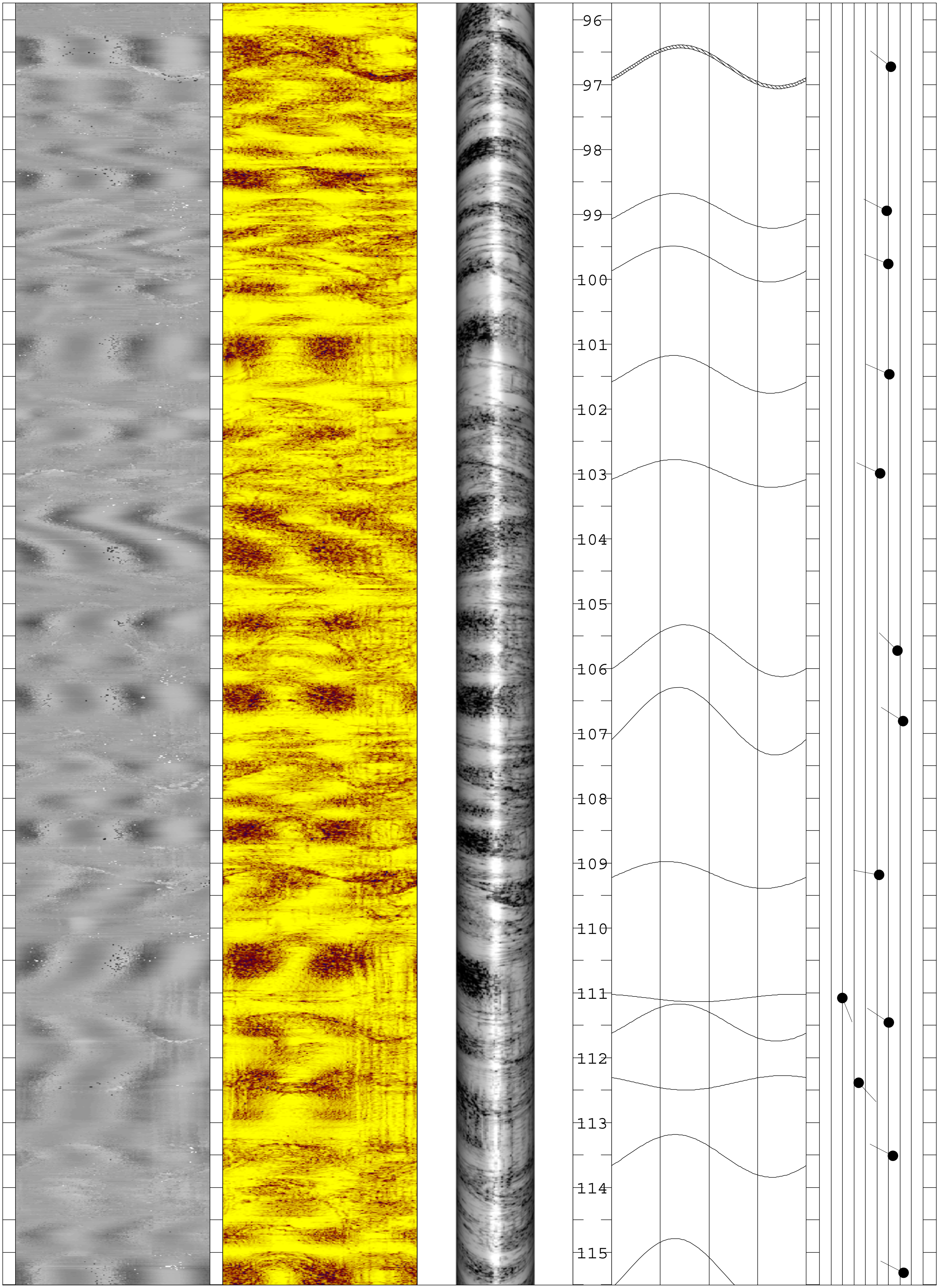
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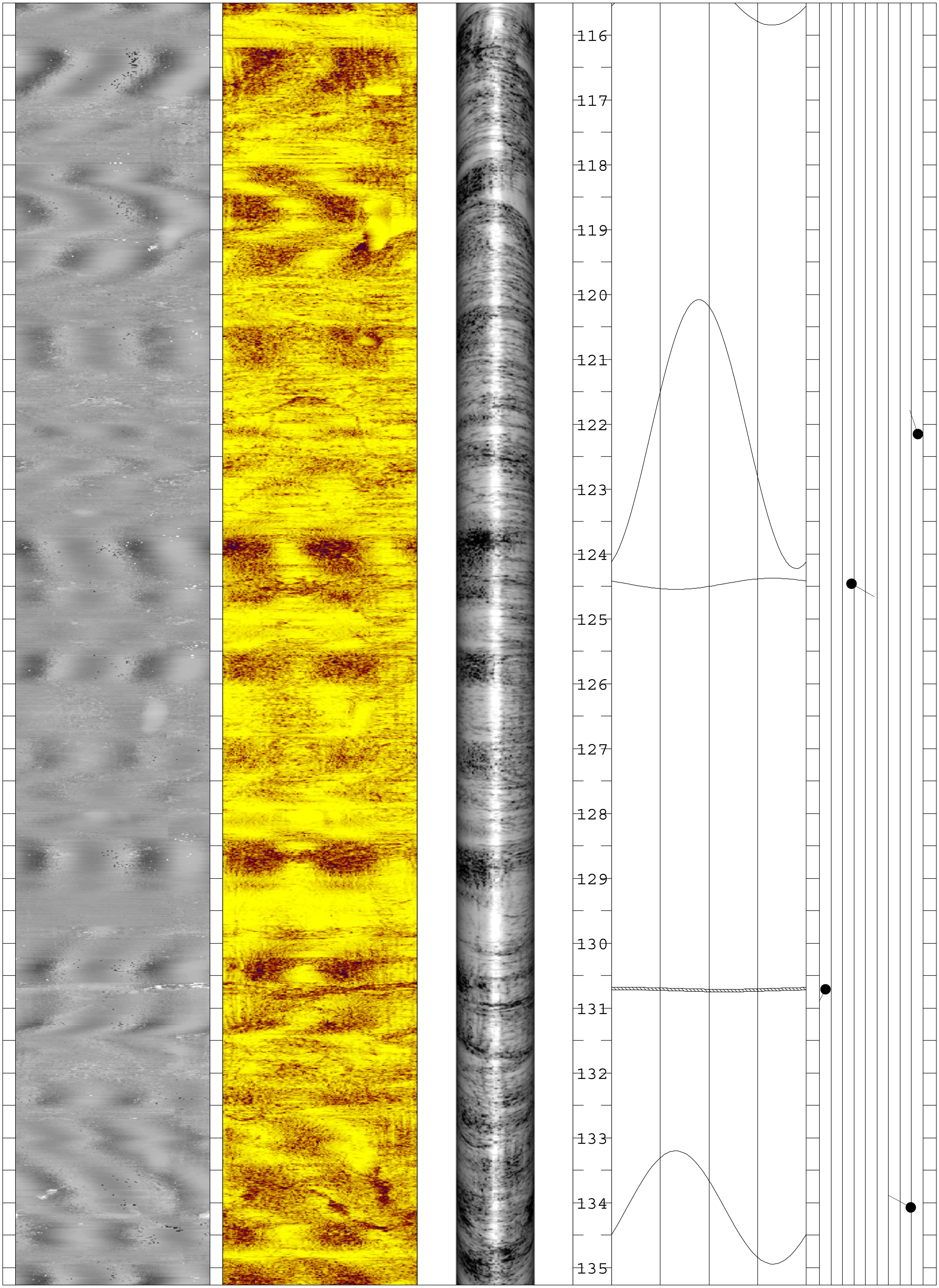
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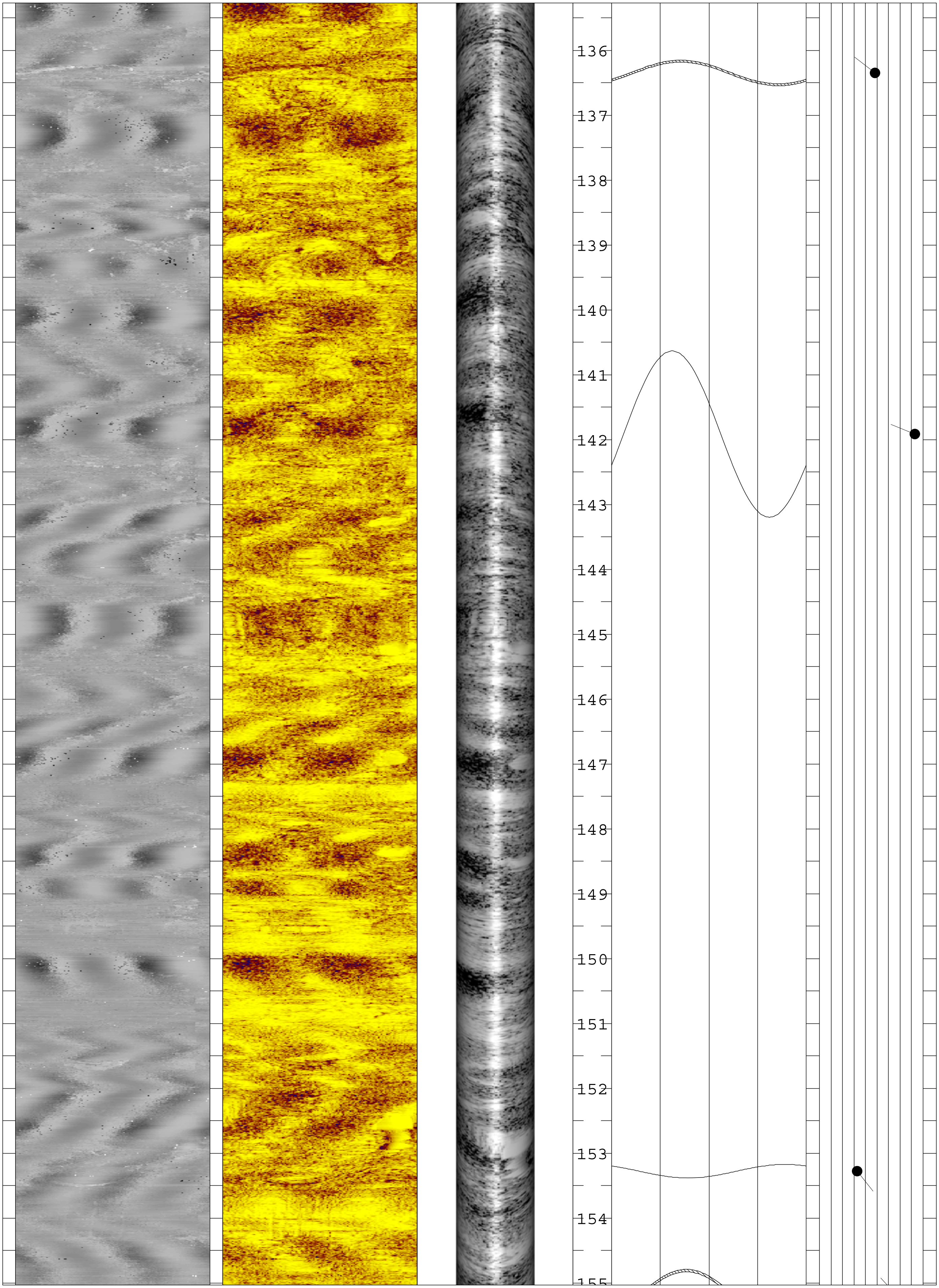
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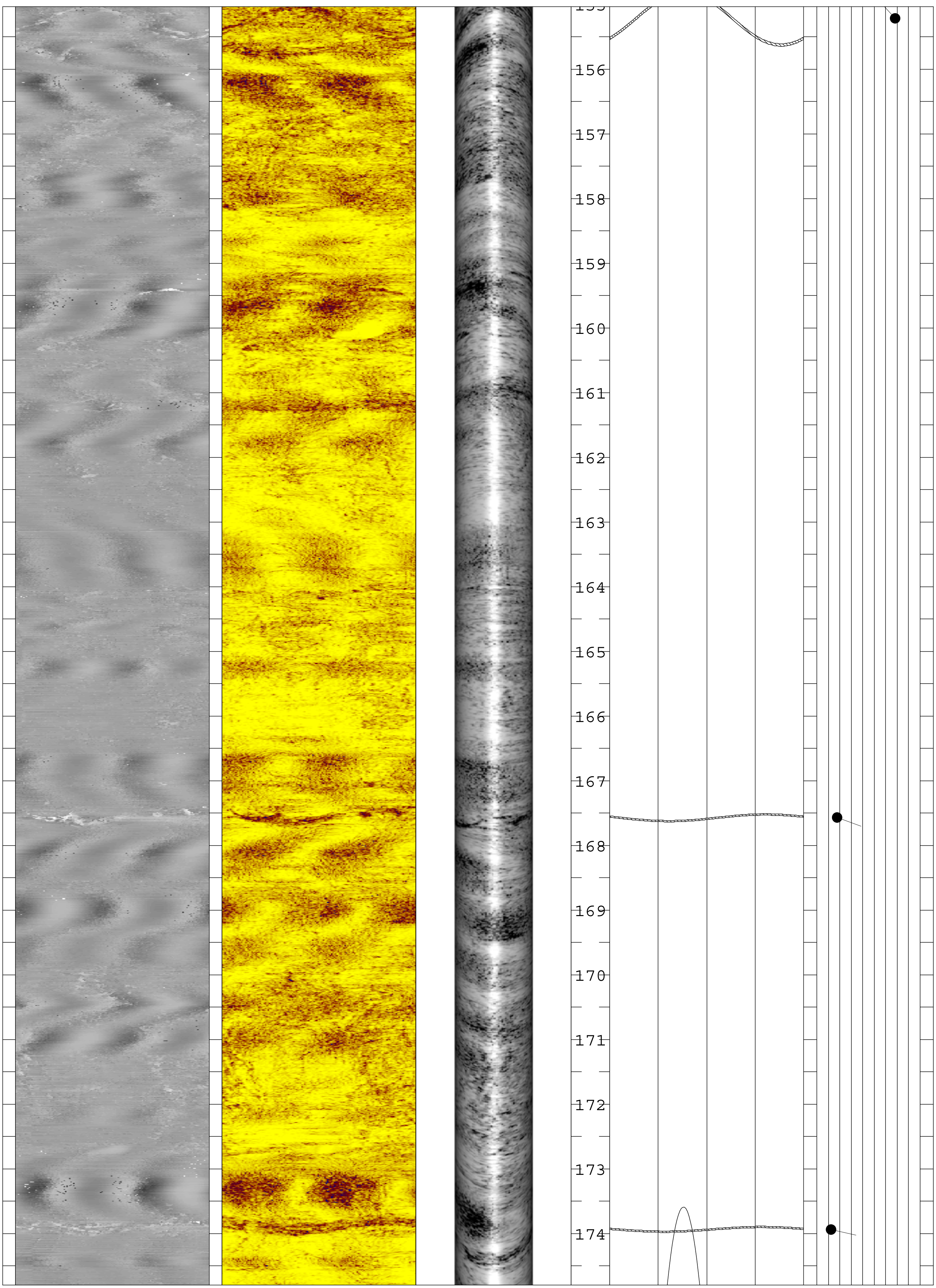
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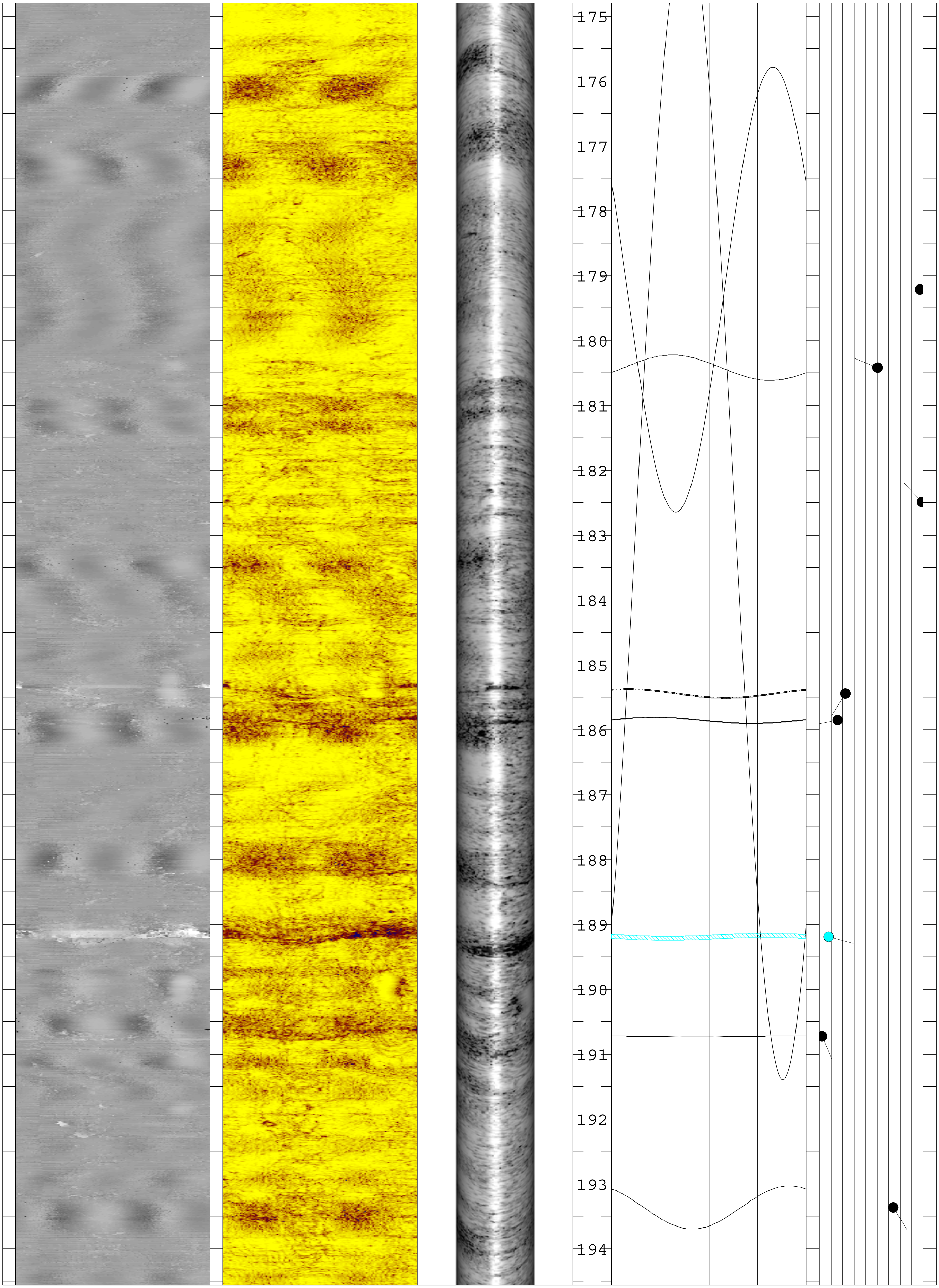
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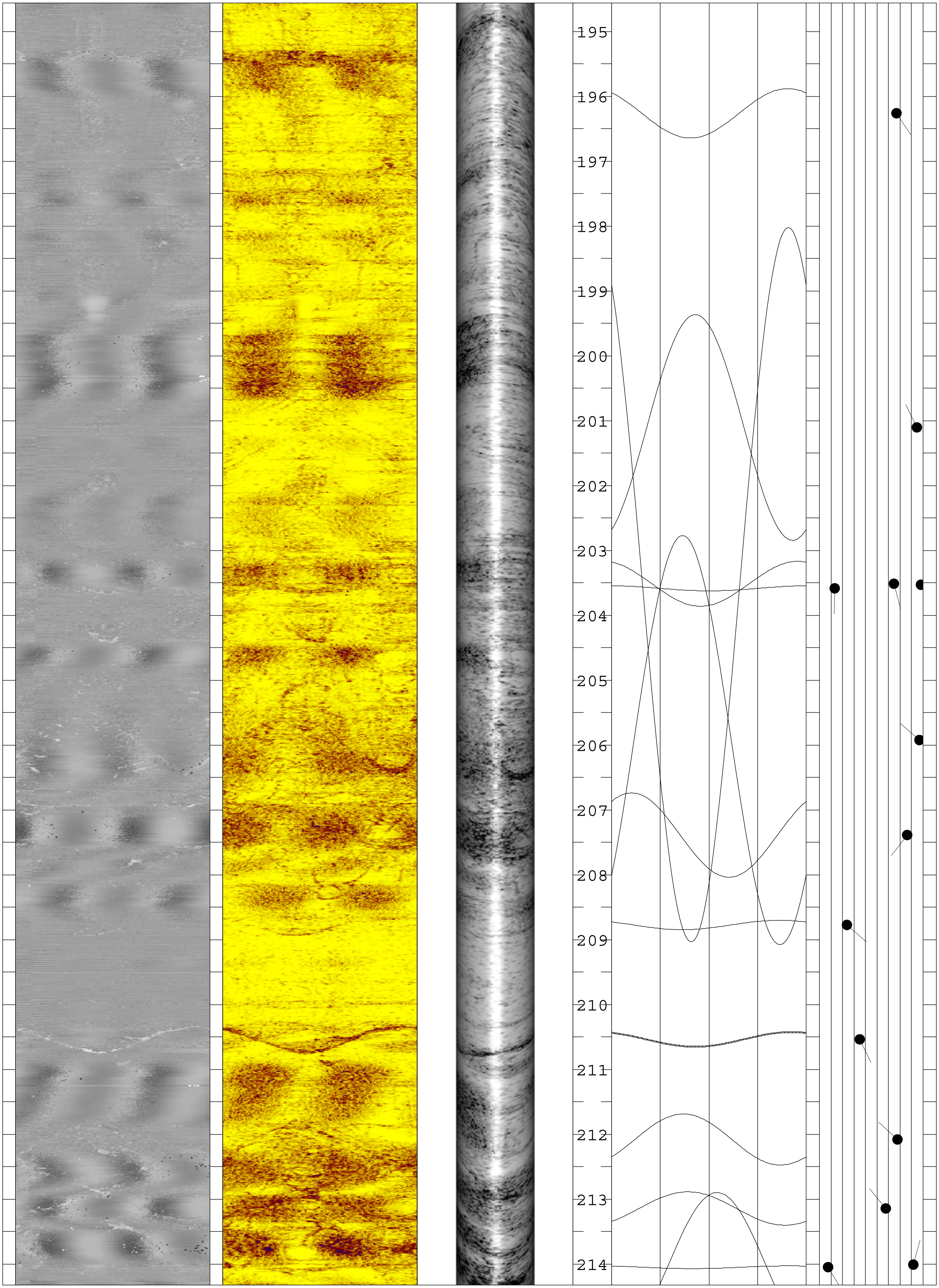
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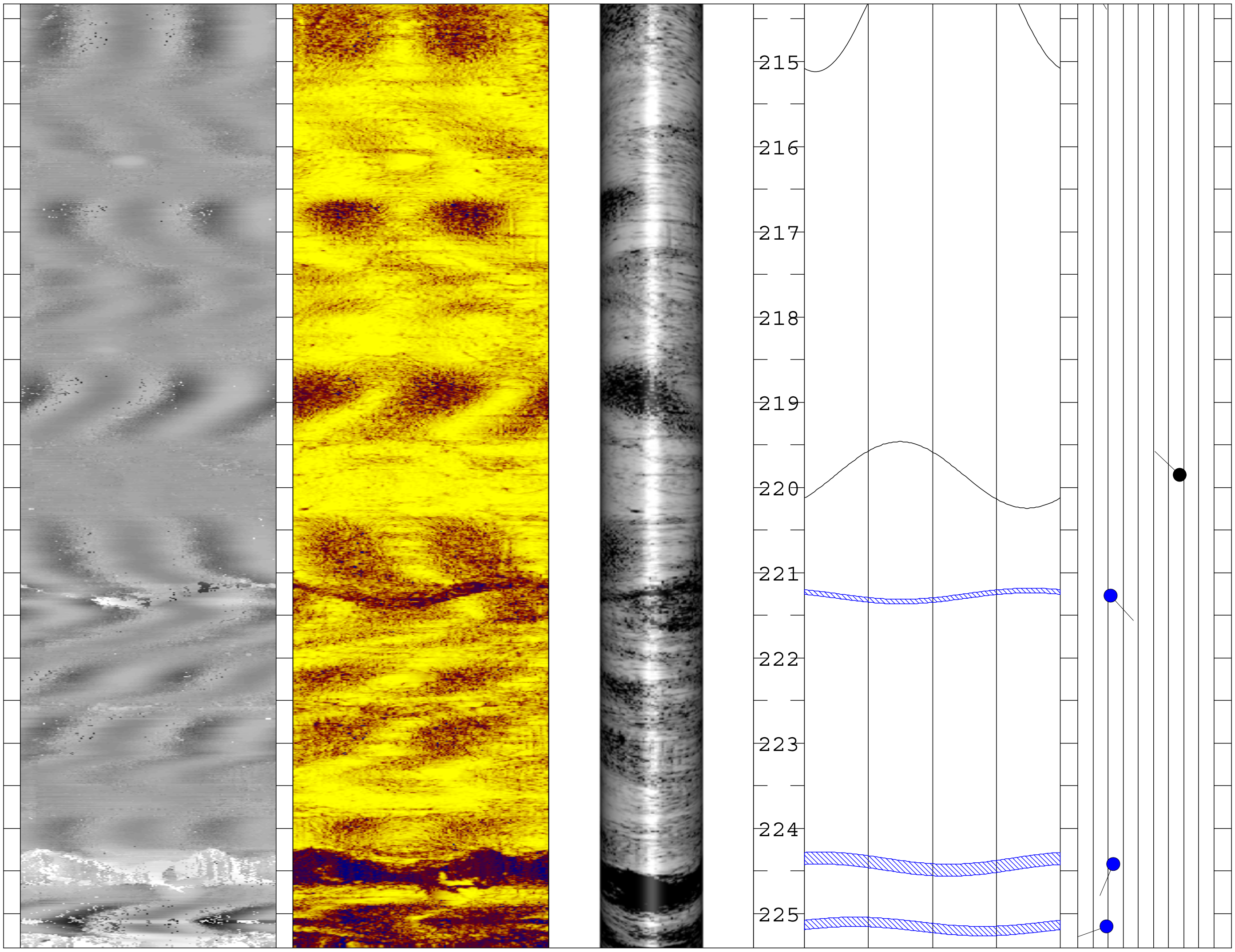
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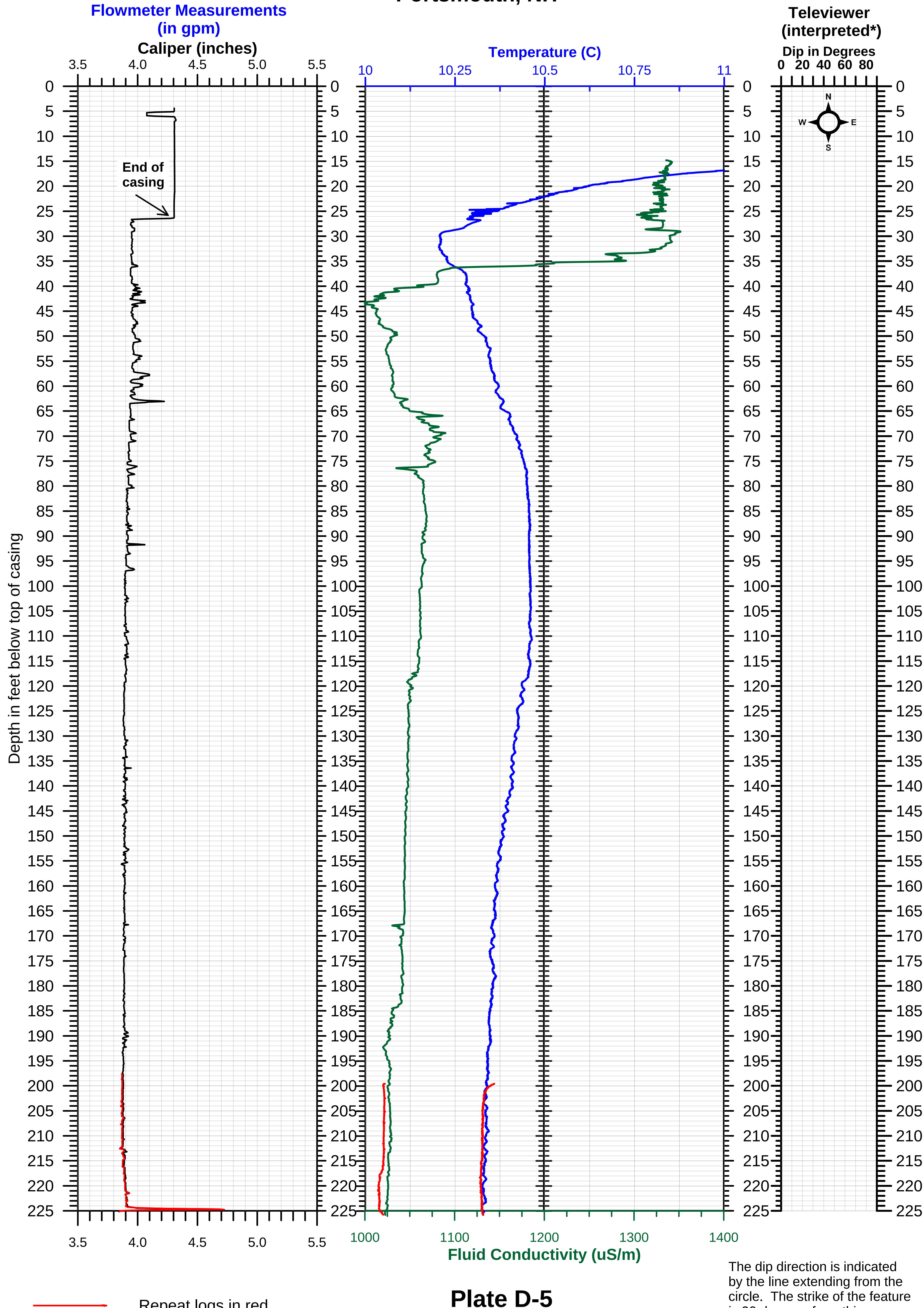
Northeast Geophysical Services

Borehole Geopysical Log
08-6725 Repeat Logs
Pease Project 143279
Portsmouth, NH

Date logged: 8/26/15



The dip direction is indicated by the line extending from the circle. The strike of the feature is 90 degrees from this.

Plate D-5
Borehole Geophysical Log
08-6725 Repeat Logs

Date logged: 8/26/15

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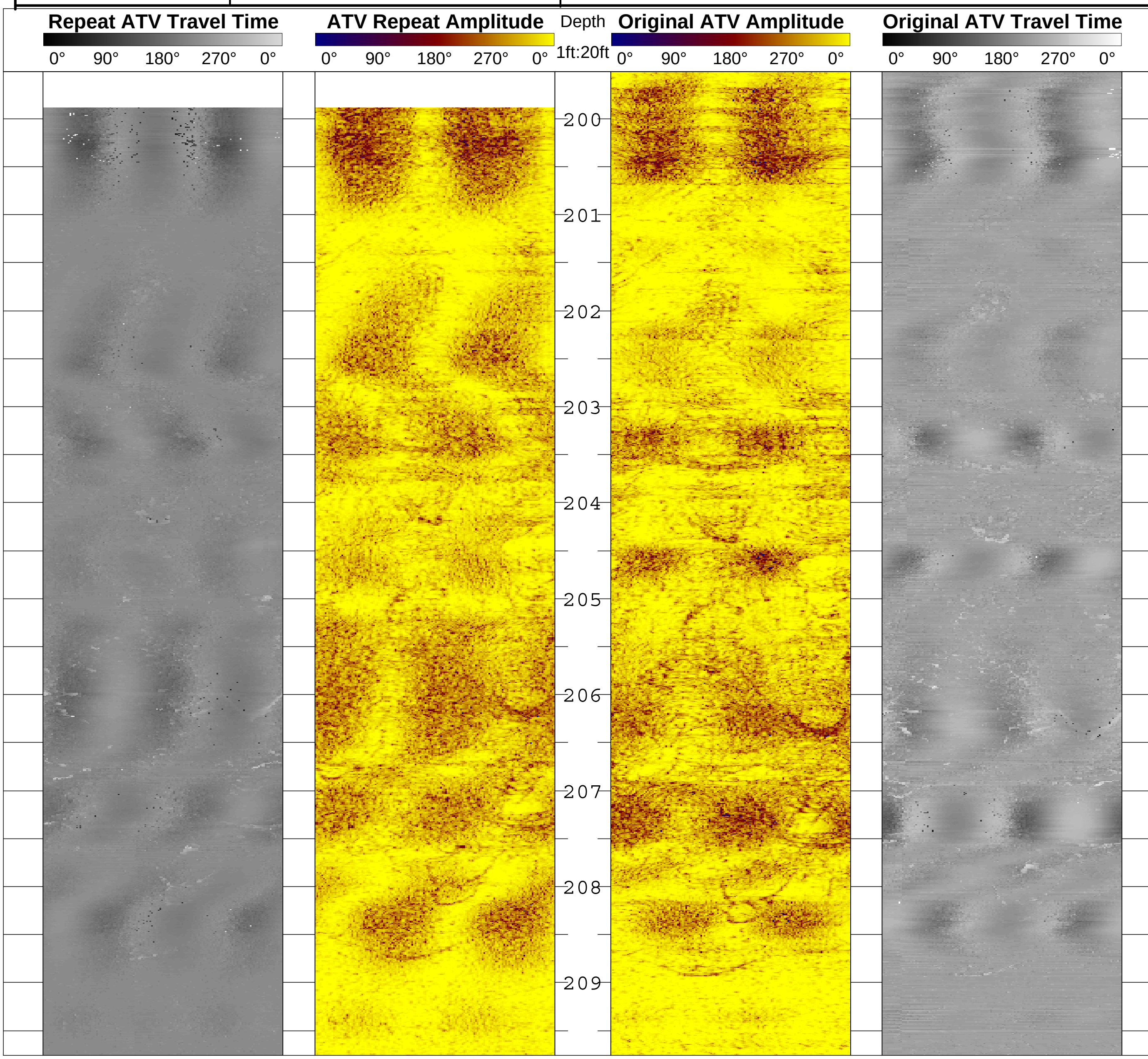
Northeast Geophysical Services 4 Union Street Bangor, Maine 04401 Tel. 207-942-2700 email: ngsinc@negeophysical.com		**Log: Plate D-6 ATV Repeat Log**	
		Well: 08-6725	
		Site: Pease AFB	
Date:	8/26/2015	Location: Portsmouth, NH	
Casing Depth:	26.5 ft	For:	CB&I
Casing Type:	4 inch	Logged by:	R. Rawcliffe
Boring Depth:	226.2 ft	Orientation:	magnetic
Meas. From:	top of casing	Structure Plots:	
Stickup:	- 0.4 ft		
Water Level:	7.43 ft		



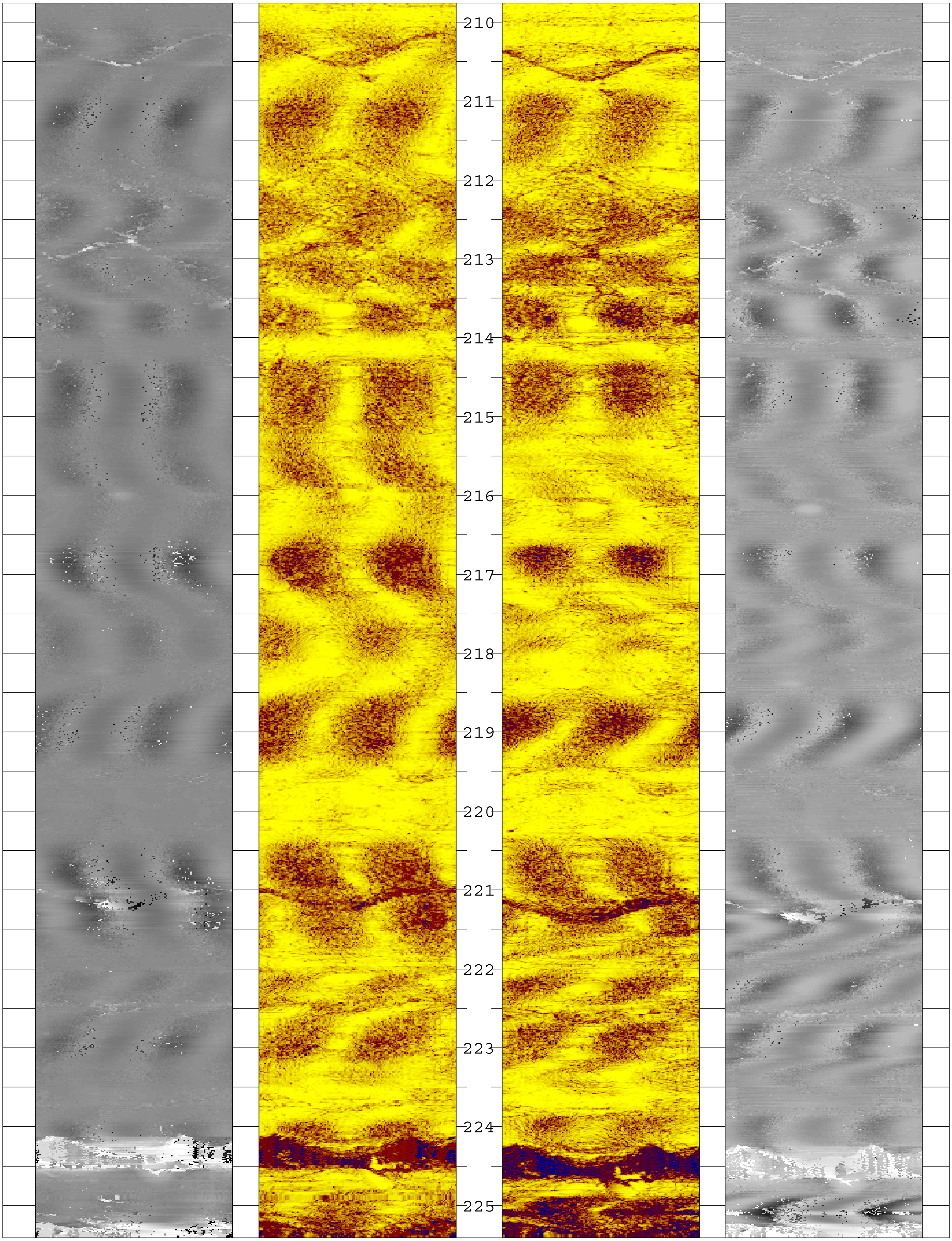

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TABLE D-1 Planar features interpreted from acoustical televiewer

08-6725 Pease AFB, Portsmouth, New Hampshire Logged: 08/26/2015

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6725	1	27.7	69	107	17	92	2	<1 mm	100
08-6725	2	28.0	78	290	20	274	4	<1 mm	100
08-6725	3	28.2	39	100	10	85	355	6	107
08-6725	4	28.3	25	104	14	89	359	18	107
08-6725	5	30.8	60	320	50	305	35	<1 mm	100
08-6725	6	32.2	48	325	55	310	40	<1 mm	100
08-6725	7	35.4	30	83	353	68	338	<1 mm	100
08-6725	8	35.8	29	12	282	357	87	9	107
08-6725	9	37.9	39	171	81	155	65	<1 mm	100
08-6725	10	38.6	48	312	42	297	27	<1 mm	100
08-6725	11	39.8	60	319	49	304	34	3	107
08-6725	12	41.2	56	308	38	293	23	<1 mm	100
08-6725	13	42.0	56	311	41	295	25	3	107
08-6725	14	42.4	60	331	61	315	45	<1 mm	100
08-6725	15	42.5	85	26	296	11	281	<1 mm	100
08-6725	16	42.9	64	314	44	299	29	6	107
08-6725	17	44.0	39	49	319	34	304	<1 mm	100
08-6725	18	44.7	60	268	358	253	343	<1 mm	100
08-6725	19	46.7	69	347	77	332	62	<1 mm	100
08-6725	20	48.1	52	299	29	284	14	3	108
08-6725	21	49.5	47	17	287	2	272	<1 mm	100
08-6725	22	49.8	48	20	290	5	275	<1 mm	100
08-6725	23	50.5	61	348	78	333	63	2	100
08-6725	24	54.5	46	270	360	255	345	<1 mm	100
08-6725	25	57.4	56	338	68	323	53	<1 mm	100
08-6725	26	57.5	74	212	302	197	287	<1 mm	100
08-6725	27	57.9	49	300	30	285	15	<1 mm	100
08-6725	28	61.4	51	322	52	307	37	4	100
08-6725	29	63.0	49	311	41	295	25	21	107
08-6725	30	64.4	50	11	281	355	85	<1 mm	100
08-6725	31	65.4	58	315	45	300	30	<1 mm	100
08-6725	32	66.3	59	324	54	308	38	<1 mm	100

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6725	33	69.1	68	349	79	334	64	<1 mm	100
08-6725	34	71.0	49	322	52	307	37	<1 mm	100
08-6725	35	74.2	36	309	39	293	23	<1 mm	100
08-6725	36	76.0	62	264	354	249	339	9	108
08-6725	37	79.9	61	4	274	348	78	3	108
08-6725	38	86.6	63	333	63	318	48	<1 mm	100
08-6725	39	87.8	39	120	30	105	15	9	100
08-6725	40	88.8	48	299	29	284	14	6	100
08-6725	41	91.5	55	123	33	108	18	5	100
08-6725	42	92.3	75	315	45	300	30	<1 mm	100
08-6725	43	93.2	79	314	44	299	29	<1 mm	100
08-6725	44	93.6	69	320	50	305	35	6	100
08-6725	45	94.7	61	309	39	294	24	3	100
08-6725	46	96.7	62	308	38	292	22	6	100
08-6725	47	98.9	59	297	27	282	12	<1 mm	100
08-6725	48	99.8	60	292	22	277	7	<1 mm	100
08-6725	49	101.5	61	294	24	279	9	<1 mm	100
08-6725	50	103.0	53	295	25	280	10	<1 mm	100
08-6725	51	105.7	68	314	44	299	29	<1 mm	100
08-6725	52	106.8	73	303	33	287	17	<1 mm	100
08-6725	53	109.2	52	281	11	266	356	<1 mm	100
08-6725	54	111.1	20	158	68	142	52	<1 mm	100
08-6725	55	111.5	60	305	35	290	20	<1 mm	100
08-6725	56	112.4	34	137	47	122	32	<1 mm	100
08-6725	57	113.5	64	297	27	282	12	<1 mm	100
08-6725	58	115.3	73	297	27	282	12	<1 mm	100
08-6725	59	122.2	86	342	72	327	57	<1 mm	100
08-6725	60	124.5	28	119	29	104	14	<1 mm	100
08-6725	61	130.7	5	208	298	193	283	12	100
08-6725	62	134.1	79	299	29	283	13	<1 mm	100
08-6725	63	136.4	48	308	38	293	23	5	100
08-6725	64	141.9	83	292	22	277	7	<1 mm	100
08-6725	65	153.3	33	141	51	126	36	<1 mm	100
08-6725	66	155.2	68	318	48	303	33	5	100
08-6725	67	167.6	18	110	20	94	4	7	100

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture width (mm)	Category
08-6725	68	173.9	13	102	12	87	357	6	100
08-6725	69	179.2	87	119	29	104	14	<1 mm	100
08-6725	70	180.4	50	293	23	278	8	<1 mm	100
08-6725	71	182.5	89	317	47	302	32	<1 mm	100
08-6725	72	185.4	23	212	302	197	287	4	100
08-6725	73	185.9	16	259	349	244	334	3	100
08-6725	74	189.2	8	105	15	90	360	19	108
08-6725	75	190.7	2	156	66	141	51	<1 mm	100
08-6725	76	193.4	64	149	59	134	44	<1 mm	100
08-6725	77	196.3	67	146	56	131	41	<1 mm	100
08-6725	78	201.1	85	335	65	320	50	<1 mm	100
08-6725	79	203.5	65	164	74	149	59	<1 mm	100
08-6725	80	203.5	88	147	57	132	42	<1 mm	100
08-6725	81	203.6	13	180	270	165	75	<1 mm	100
08-6725	82	205.9	87	311	41	296	26	<1 mm	100
08-6725	83	207.4	76	217	307	202	292	<1 mm	100
08-6725	84	208.8	24	131	41	116	26	<1 mm	100
08-6725	85	210.5	35	154	64	139	49	5	100
08-6725	86	212.1	68	313	43	298	28	<1 mm	100
08-6725	87	213.1	58	321	51	306	36	<1 mm	100
08-6725	88	214.0	82	15	285	0	270	<1 mm	100
08-6725	89	214.1	7	149	59	134	44	<1 mm	100
08-6725	90	219.9	67	314	44	299	29	<1 mm	100
08-6725	91	221.3	22	137	47	122	32	16	107
08-6725	92	224.4	23	203	293	188	278	40	107
08-6725	93	225.2	19	251	341	236	326	33	107

Category Explanation:

100 planar feature likely foliation or bedding surface
108 possibly transmissive fracture or crack
107 likely transmissive fracture or crack

TABLE D-2 - Flowmeter measurements
08-6725 - Pease AFB **Logged: 08/26/2015**
Portsmouth, NH

Ambient Measurements

Borehole	Depth Feet	Flow Readings (in gallons per minute)					Average or Median Flow
08-6725	7.4	water table					
08-6725	25	NF					
08-6725	30.0	-0.12	-0.12	-0.12			-0.12
08-6725	35.0	-0.22	-0.11	-0.12	-0.12		-0.12
08-6725	38.0	-0.49	-0.45	-0.45			-0.45
08-6725	45.1	-0.35	-0.54	-0.52	-0.52		-0.52
08-6725	52.1	-0.58	-0.54	-0.52	-0.52		-0.53
08-6725	61.0	-0.58	-0.54	-0.52	-0.52		-0.53
08-6725	68.0	-0.52	-0.61	-0.61	-0.61	-0.65	-0.61
08-6725	82.1	-0.79	-0.58	-0.61	-0.65		-0.63
08-6725	95.0	-0.69	-0.58	-0.65	-0.61		-0.63
08-6725	107.1	-0.65	-0.61	-0.65			-0.65
08-6725	127.0	-0.85	-0.61	-0.61	-0.61		-0.61
08-6725	147.0	-0.65	-0.65	-0.61	-0.65		-0.65
08-6725	168.1	-0.65	-0.65	-0.54	-0.61		-0.63
08-6725	186.1	-1.00	-0.58	-0.58	-0.61	-0.61	-0.61
08-6725	202.6	-1.00	-0.58	-0.58	-0.58		-0.58
08-6725	220.1	-0.85	-0.61	-0.61	-0.58		-0.61
08-6725	225.1	-0.06	-0.06	-0.06	-0.06		-0.06

Measurements while pumping pump rate = ~0.8 gpm

Borehole	Depth Feet	Flow Readings (in gallons per minute)					Average or Median Flow
08-6725	7.7	water level					
08-6725	25.0	1.12	1.03	0.97	1.12	1.03	1.03
08-6725	30.0	1.07	1.03	0.95			1.03
08-6725	35.1	1.03	0.88	0.95	1.03		0.99
08-6725	38.0	0.60	0.68	0.68	0.68		0.68
08-6725	45.0	0.77	0.54	0.54	0.54		0.54
08-6725	52.0	0.77	0.51	0.51			0.51
08-6725	61.0	0.49	0.51	0.82	0.49	0.51	0.51
08-6725	68.0	0.51	0.41	0.41	0.39		0.41
08-6725	82.0	0.34	0.30	0.35	0.36		0.34
08-6725	95.0	0.24	0.28	0.27	0.27		0.27
08-6725	107.0	0.27	0.29	0.30			0.29
08-6725	127.0	0.29	0.26	0.30			0.29
08-6725	147.8	0.17	0.21	0.21	0.22	0.22	0.21
08-6725	168.0	0.57	0.30	0.31	0.32		0.32
08-6725	185.9	0.19	0.21	0.21			0.21
08-6725	202.0	0.22	0.26	0.23			0.23
08-6725	220.0	0.29	0.24	0.24	0.24		0.24
08-6725	225.1	0.06	0.06	0.06			0.06

Appendix F
08-6046 Boring Log

Well Completion Summary

Roy F. WESTON, Inc.

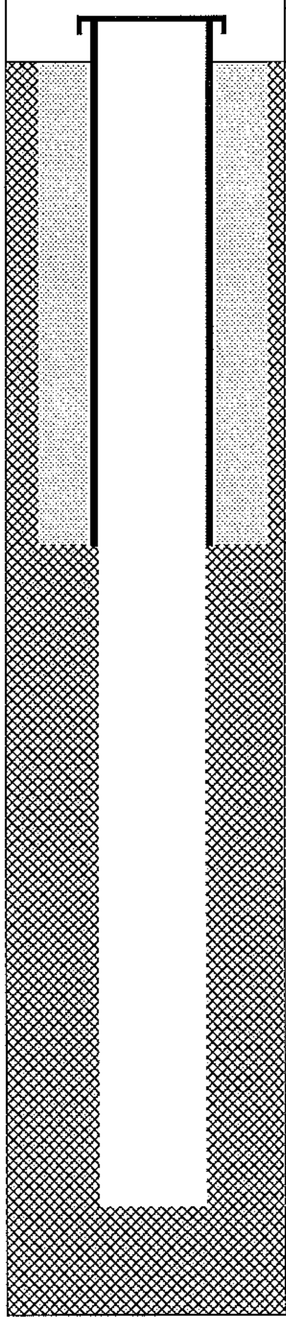
CONFIDENTIAL

CLIENT: COMBINED DATA OF ALL
SITE NAME: FDTA 2 / SITE 8

DRILLING FIRM: D.L. MAHER
INSPECTOR: T. MCCANN

WELL ID: 08-6046
START DATE: 02/18/92
COMPLETION DATE: 02/21/92

WATER LEVELS
4.91 FT (TOC) ON 02/21/92



DEPTH		ELEV.
1.50	TC	110.36
0.00	GS	108.86
85.00	OC	23.86
0.00	SC	108.86
282.00	TD	-173.14

DRILLING SUMMARY

Driller: JIM ASH
Drilling Fluid:
Well Type: SINGLE CASED, OPEN HOLE

WELL DESIGN CONSTRUCTION

Casing #1 Diameter: 6.00 *inch* *Interval:* 0.00 to 85.00 *ft.*
Type : LOW CARBON

Stick Up Inner Casing: 1.50 *ft.*

Casing Grout: C *Interval:* 0.00 to 85.00 *ft.*

Open Hole Diameter: 6.00 inches *Interval:* 85.00 to 280.00 *ft.*

Top of Bedrock: 65 ft.

Backfill Type: *Interval:* 0.00 to 0.00 *ft.*

WELL DEVELOPMENT

Date: 02/21/92
Method: OVERPUMPING
Yield: *Purged Volume:*

COMMENTS

TC = Top of Casing	SP = Top Sand Pack	= Grout
GS = Ground Surface	SC = Top Screen	= Seal
BN = Top Seal	BS = Bottom Screen	= Sand Pack
OC = Outer Casing	TD = Total Depth	= Formation

Additional Comments:
WELL PRODUCES AT LEAST 4 GPM.

NOTE: Well Diagram Not to Scale

Elevations are feet above Mean Sea Level

 01/28/98

Borehole Log

Roy F. WESTON, Inc.

PROJECT :	COMBINED DATA OF ALL	TOTAL DEPTH :	282.00
SITE NAME :	FDTA 2 / SITE 8	LOGGER :	T. MCCANN
BORING ID :	08-6046	DRILLING COMPANY :	D.L. MAHER
NORTHING :	219377.0000 surveyed	DRILLING RIG :	CP-650
EASTING :	1206280.0000 surveyed	DATE STARTED :	02/18/92
ELEVATION :	108.860 surveyed	DATE COMPLETED :	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
	0			Well-graded sand with gravel, SW	YELLOW BROWN	LSE	DRY		HNU 0.0	BOULDER AT 4-5 FT, LARGE GRAINED GRANITE SALT AND PEPPER COLOR, LITTLE QUARTZ, SILTSTONE.
107	1									
106	2									
105	3									
104	4									
103	5			Poorly graded sand, SP	YELLOW BROWN	SFT	MST		HNU 0.0	FINE SAND, SOME CLASTS AND QUARTZ FRAGMENTS
102	6									
101	7									
100	8									
99	9									
98	10			Poorly graded sand, SP		SFT	MST		HNU 0.0	SAND WITH TRACE FRAGMENTS QUARTZ AND PHYLLITE. NO BOULDER OR COBBLES BETWEEN 10-15FT.
97	11									
96	12									
95	13									
94	14									
93	15			Poorly graded sand, SP		LSE	DRY		HNU 0.0	QUARTZ, TRACE SILTSTONE, VERY LITTLE GRAVEL, TRACE MAFICS POSSIBLE. COBBLES AT 18.5 FT.
92	16									
91	17									
90	18									
89	19									
88	20			Poorly graded sand, SP	LT YELLOW BROWN	LSE	WET		HNU 0.0	LITTLE QUARTZITE FRAGMENTS.

Borehole Log

Roy F. WESTON, Inc.

PROJECT	: COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00
SITE NAME	: FDTA 2 / SITE 8	LOGGER	:	T. MCCANN
BORING ID	: 08-6046	DRILLING COMPANY	:	D.L. MAHER
NORTHING	: 219377.0000 surveyed	DRILLING RIG	:	CP-650
EASTING	: 1206280.0000 surveyed	DATE STARTED	:	02/18/92
ELEVATION	: 108.860 surveyed	DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Poorly graded sand, SP	LT YELLOW BROWN	LSE	WET		HNU 0.0	LITTLE QUARTZITE FRAG-MENTS.
87	21									
86	22									
85	23									
84	24									
83	25			Poorly-graded gravel, GP	LT YELLOW BROWN	LSE	SAT		HNU 0.0	SOME QUARTZITE GRAVEL AND LITTLE QUARTZ.
82	26									
81	27									
80	28									
79	29									
78	30			Poorly graded sand with gravel, SP		LSE	SAT			SAME AS ABOVE - GRAVEL MORE ROUNDED.
77	31									
76	32									
75	33									
74	34									
73	35			Poorly graded sand, SP	LT YELLOW BROWN	LSE	SAT			SAME; SOME QUARTZITE AND QUARTZ, TRACE MICA FLAKES COBBLES AT 38 FT.
72	36									
71	37									
70	38									
69	39									
68	40			Well-graded sand with gravel, SW	LT YELLOW BROWN	LSA	SAT			DARK GRAY QUARTZITE SOME QUARTZ; LITTLE GRANITE, SOME ROUNDED GRANITE - STILL IN COBBLES.

PROJECT	: COMBINED DATA OF ALL		TOTAL DEPTH	:	282.00
SITE NAME	: FDTA 2 / SITE 8		LOGGER	:	T. MCCANN
BORING ID	: 08-6046		DRILLING COMPANY	:	D.L. MAHER
NORTHING	: 219377.0000 surveyed		DRILLING RIG	:	CP-650
EASTING	: 1206280.0000 surveyed		DATE STARTED	:	02/18/92
ELEVATION	: 108.860 surveyed		DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Well-graded sand with gravel, SW	LT YELLOW BROWN	LSA	SAT			DARK GRAY QUARTZITE SOME QUARTZ; LITTLE GRANITE, SOME ROUNDED GRANITE - STILL IN COBBLES.
67	41									
66	42									
65	43									
64	44									
63	45			Well-graded gravel with sand, GW	LT YELLOW BROWN	NA	SAT		HNU 0.0	FINE SAND, FINE AND MEDIUM GRAVEL STILL IN COBBLES.
62	46									
61	47									
60	48									
59	49									
58	50			Well-graded gravel with sand, GW	VY PALE BROWN	LSE	SAT		HNU 0.0	GRAVEL/FRAGMENTS ARE MOSTLY QUARTZ AND QUARTZITE; LITTLE GRANITE, TR MICA FLAKES.
57	51									
56	52									
55	53									
54	54									
53	55			Well-graded sand with gravel, SW	PALE BROWN	NA	SAT		HNU 0.0	SAME - STILL IN COBBLES
52	56									
51	57									
50	58									
49	59									
48	60			Well-graded sand, SW	PALE BROWN	LSE	SAT			SAME, COBBLES, HIT WEATHERED ROCK AT APPROXIMATELY 65FT.

Borehole Log

Roy F. WESTON, Inc.

PROJECT	:	COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00
SITE NAME	:	FDTA 2 / SITE 8	LOGGER	:	T. MCCANN
BORING ID	:	08-6046	DRILLING COMPANY	:	D.L. MAHER
NORTHING	:	219377.0000 surveyed	DRILLING RIG	:	CP-650
EASTING	:	1206280.0000 surveyed	DATE STARTED	:	02/18/92
ELEVATION	:	108.860 surveyed	DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Well-graded sand, SW	PALE BROWN	LSE	SAT			SAME, COBBLES. HIT WEATHERED ROCK AT APPROXIMATELY 65FT.
47	61									
46	62									
45	63									
44	64									
43	65			Well-graded sand with gravel, SW	VY PALE BROWN	NA	SAT			WEATHERED ROCK, PHYLLITE FRAGMENTS IN CUTTINGS.
42	66									
41	67			Poorly graded sand, SP	VY PALE BROWN	STF	SAT		HNU 0.0	PHYLLITE FLAKES, MOSTLY QTZ SAND, TRACE PYRITE TRACE MICA, COMPETENT BEDROCK AT 69FT.
40	68									
39	69			Phyllite	GRAY BLACK	MOD			HNU 0.0	PHYLLITE FLAKES, 20% IS WEATHERED AND IRON STAIN-ED
38	70									
37	71									
36	72			Phyllite		STR			HNU 0.0	DRILLING DIFFICULT
35	73									
34	74									
33	75			Phyllite	DK GRAY	MOD				10% OF PHYLLITE IS WEATHERED/IRON STAINED.
32	76									
31	77									
30	78									
29	79									
28	80			Phyllite	DK GRAY	MOD			HNU 0.0	GRAVEL IN SAMPLE IS SMALL DUE TO THE MUD VISCOSITY DECREASING.

Borehole Log

Roy F. WESTON, Inc.

PROJECT	:	COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00
SITE NAME	:	FDTA 2 / SITE 8	LOGGER	:	T. MCCANN
BORING ID	:	08-6046	DRILLING COMPANY	:	D.L. MAHER
NORTHING	:	219377.0000 surveyed	DRILLING RIG	:	CP-650
EASTING	:	1206280.0000 surveyed	DATE STARTED	:	02/18/92
ELEVATION	:	108.860 surveyed	DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Phyllite	DK GRAY	MOD			HNU 0.0	GRAVEL IN SAMPLE IS SMALL DUE TO THE MUD VISCOSITY DECREASING.
-81	81									
-82	82									
-83	83									
-84	84									
-85	85			Phyllite	DK GRAY	STR			HNU 0.0	BEGIN DRILLING AT END OF CASED BEDROCK (85FT). PHYLLITE BEDROCK. BIT IS STILL JUMPING, FLAKEY.
-86	86			Phyllite	DK GRAY	STR			HNU 0.0	PHYLLITE TO PHYLLITE QUARTZITE, RUSTY SEAM AT 89FT, TRACE QUARTZ.
-87	87									
-88	88									
-89	89									
-90	90			Phyllite	DK GRAY	STR				PHYLLITIC QUARTZITE, ABUNDANT CALCITE FILLED MICRO FRACTURES.
-91	91									
-92	92									
-93	93									
-94	94									
-95	95			Quartzite		MOD			HNU 0.0	PHYLLITIC QUARTZITE, MICRO FRACTURE; CALCITE FILLED.
-96	96									
-97	97									
-98	98									
-99	99									
-100	100			Quartzite	DK GRAY	MOD			HNU 0.0	PHYLLITIC QUARTZITE, SCARCE FRACTURING.

PROJECT	:	COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00
SITE NAME	:	FDTA 2 / SITE 8	LOGGER	:	T. MCCANN
BORING ID	:	08-6046	DRILLING COMPANY	:	D.L. MAHER
NORTHING	:	219377.0000 surveyed	DRILLING RIG	:	CP-650
EASTING	:	1206280.0000 surveyed	DATE STARTED	:	02/18/92
ELEVATION	:	108.860 surveyed	DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Quartzite	DK GRAY	MOD			HNU 0.0	PHYLLITIC QUARTZITE, SCARCE FRACTURING.
-101	101									
-102	102									
-103	103									
-104	104									
-105	105			Quartzite	DK GRAY	MOD				PHYLLITE QUARTZITE - SINGLE 1/16" CALCITE FILLED FRACTURE.
-106	106									
-107	107									
-108	108									
-109	109									
-110	110			Quartzite	DK GRAY	MOD				1/16" FRACTURE WITH CALCITE FILL.
-111	111									
-112	112									
-113	113									
-114	114									
-115	115			Phyllite	DK GRAY	MOD				LOW FRACTURING (I.E. LESS CALCITE FILL). NO YIELD YET.
-116	116									
-117	117									
-118	118									
-119	119									
-120	120			Phyllite	DK GRAY	MOD			HNU 0.0	PHYLLITE MASSIVE, SOME SEAMS, CALCITE FILLED.

PROJECT	: COMBINED DATA OF ALL	TOTAL DEPTH	: 282.00
SITE NAME	: FDTA 2 / SITE 8	LOGGER	: T. MCCANN
BORING ID	: 08-6046	DRILLING COMPANY	: D.L. MAHER
NORTHING	: 219377.0000 surveyed	DRILLING RIG	: CP-650
EASTING	: 1206280.0000 surveyed	DATE STARTED	: 02/18/92
ELEVATION	: 108.860 surveyed	DATE COMPLETED	: 02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Phyllite	DK GRAY	MOD			HNU 0.0	PHYLLITE MASSIVE, SOME SEAMS, CALCITE FILLED.
-121	121									
-122	122									
-123	123									
-124	124									
-125	125			Phyllite	DK GRAY	MOD			HNU 0.0	PHYLLITE (MASSIVE), TRACE SEAMS (CALCITE). BEDROCK SLIGHTLY DARKER WITH INCREASING DEPTH.
-126	126									
-127	127									
-128	128									
-129	129									
-130	130			Phyllite	DK GRAY	MOD				PHYLLITE, MARKED INCREASE IN CALCITE FILL.
-131	131									
-132	132									
-133	133									
-134	134									
-135	135			Phyllite	DK GRAY	WEK				MARKED DECREASE IN CALCITE AGAIN TO TRACE AMOUNTS - LOW FRACTURE AREA POSSIBLE.
-136	136									
-137	137									
-138	138									
-139	139									
-140	140			Phyllite	DK GRAY	STR			HNU 0.0	DARKER COLOR STILL WITH DEPTH, LOW CALCITE (TR). DRILLING IS SLOWER, BEDROCK IS HARDER. MASS.PHY.

PROJECT	:	COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00
SITE NAME	:	FDTA 2 / SITE 8	LOGGER	:	T. MCCANN
BORING ID	:	08-6046	DRILLING COMPANY	:	D.L. MAHER
NORTHING	:	219377.0000 surveyed	DRILLING RIG	:	CP-650
EASTING	:	1206280.0000 surveyed	DATE STARTED	:	02/18/92
ELEVATION	:	108.860 surveyed	DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Phyllite	DK GRAY	STR			HNU 0.0	DARKER COLOR STILL WITH DEPTH, LOW CALCITE (TR). DRILLING IS SLOWER, BED-ROCK IS HARDER. MASS.PHY.
-141	141									
-142	142									
-143	143									
-144	144									
-145	145			Phyllite	DK GRAY	STR			HNU 0.0	PHYLLITE - LOW CALCITE (FRACTURES).
-146	146									
-147	147									
-148	148									
-149	149									
-150	150			Phyllite	DK GRAY				HNU 0.0	LOW FRACTURING, PHYLLITE
-151	151									
-152	152									
-153	153									
-154	154									
-155	155			Phyllite	DK GRAY	STR			HNU 0.0	TRACE CALCITE FILL POSSIBLY, LARGER FRACTURE
-156	156									
-157	157									
-158	158									
-159	159									
-160	160			Phyllite	DK GRAY	STR				ROCK IS MORE COMPETENT. NO FRACTURES EVIDENT, PHYLLITE.

Borehole Log

Roy F. WESTON, Inc.

PROJECT	:	COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00
SITE NAME	:	FDTA 2 / SITE 8	LOGGER	:	T. MCCANN
BORING ID	:	08-6046	DRILLING COMPANY	:	D.L. MAHER
NORTHING	:	219377.0000 surveyed	DRILLING RIG	:	CP-650
EASTING	:	1206280.0000 surveyed	DATE STARTED	:	02/18/92
ELEVATION	:	108.860 surveyed	DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Phyllite	DK GRAY	STR				ROCK IS MORE COMPETENT. NO FRACTURES EVIDENT, PHYLLITE.
-161	161									
-162	162									
-163	163									
-164	164									
-165	165			Phyllite	DK GRAY	STR				PHYLLITE - LITTLE OR NO EVIDENCE OF FRACTURES.
-166	166									
-167	167									
-168	168									
-169	169									
-170	170			Phyllite	DK GRAY					SAME AS ABOVE.
-171	171									
-172	172									
-173	173									
-174	174									
-175	175			Phyllite	DK GRAY	STR				NO LONGER MASSIVE PHYLLITE
-176	176									
-177	177									
-178	178									
-179	179									
-180	180			Phyllite	GRAY BLACK	STR			HNU 0.0	TRACE CALCITE, LOW POROSITY.

Borehole Log

Roy F. WESTON, Inc.

PROJECT	: COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00	
SITE NAME	: FDTA 2 / SITE 8	LOGGER	:	T. MCCANN	
BORING ID	: 08-6046	DRILLING COMPANY	:	D.L. MAHER	
NORTHING	: 219377.0000 surveyed	DRILLING RIG	:	CP-650	
EASTING	: 1206280.0000 surveyed	DATE STARTED	:	02/18/92	
ELEVATION	: 108.860 surveyed	DATE COMPLETED	:	02/21/92	

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Phyllite	GRAY BLACK	STR			HNU 0.0	TRACE CALCITE, LOW POROSITY.
-181	181									
-182	182									
-183	183									
-184	184									
-185	185			Phyllite	GRAY BLACK	STR				TRACE CALCITE - PHYLLITE
-186	186									
-187	187									
-188	188									
-189	189									
-190	190			Phyllite	GRAY BLACK	STR			HNU 0.0	PHYLLITE, NO EVIDENCE OF FRACTURING.
-191	191									
-192	192									
-193	193									
-194	194									
-195	195			Phyllite	GRAY BLACK	STR			HNU 0.0	PHYLLITE - NO EVIDENCE OF FRACTURING
-196	196									
-197	197									
-198	198									
-199	199									
-200	200			Phyllite	GRAY BLACK	STR			HNU 0.0	SAME

PROJECT :	COMBINED DATA OF ALL	TOTAL DEPTH :	282.00
SITE NAME :	FDTA 2 / SITE 8	LOGGER :	T. MCCANN
BORING ID :	08-6046	DRILLING COMPANY :	D.L. MAHER
NORTHING :	219377.0000 surveyed	DRILLING RIG :	CP-650
EASTING :	1206280.0000 surveyed	DATE STARTED :	02/18/92
ELEVATION :	108.860 surveyed	DATE COMPLETED :	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Phyllite	GRAY BLACK	STR			HNU 0.0	SAME
-201	201									
-202	202									
-203	203									
-204	204									
-205	205			Phyllite	GRAY BLACK	STR			HNU 0.0	SAME
-206	206									
-207	207									
-208	208									
-209	209									
-210	210			Phyllite	GRAY BLACK	STR				PHYLLITE GETTING PROGRESSIVELY DARKER STILL, TRACE PYRITE.
-211	211									
-212	212									
-213	213									
-214	214									
-215	215			Phyllite	BLACK	STR			HNU 0.0	PHYLLITE - SLIGHT TRACE OF CALCITE.
-216	216									
-217	217									
-218	218									
-219	219									
-220	220			Phyllite	BLACK	STR				SAME

Borehole Log

Roy F. WESTON, Inc.

PROJECT	: COMBINED DATA OF ALL		TOTAL DEPTH	:	282.00
SITE NAME	: FDTA 2 / SITE 8		LOGGER	:	T. MCCANN
BORING ID	: 08-6046		DRILLING COMPANY	:	D.L. MAHER
NORTHING	: 219377.0000 surveyed		DRILLING RIG	:	CP-650
EASTING	: 1206280.0000 surveyed		DATE STARTED	:	02/18/92
ELEVATION	: 108.860 surveyed		DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Phyllite	BLACK	STR				SAME
-221	221									
-222	222									
-223	223									
-224	224									
-225	225			Phyllite	BLACK	STR				SAME
-226	226									
-227	227									
-228	228									
-229	229									
-230	230			Phyllite	BLACK	STR			HNU 0.0	PHYLLITE WITH TRACE CALCITE
-231	231									
-232	232									
-233	233									
-234	234									
-235	235			Phyllite	BLACK	STR				PHYLLITE - TRACE QUARTZ
-236	236									
-237	237									
-238	238									
-239	239									
-240	240			Phyllite	BLACK	STR			HNU 0.0	PHYLLITE

Borehole Log

Roy F. WESTON, Inc.

PROJECT	:	COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00
SITE NAME	:	FDTA 2 / SITE 8	LOGGER	:	T. MCCANN
BORING ID	:	08-6046	DRILLING COMPANY	:	D.L. MAHER
NORTHING	:	219377.0000 surveyed	DRILLING RIG	:	CP-650
EASTING	:	1206280.0000 surveyed	DATE STARTED	:	02/18/92
ELEVATION	:	108.860 surveyed	DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Phyllite	BLACK	STR			HNU 0.0	PHYLLITE
-241	241									
-242	242									
-243	243									
-244	244									
-245	245			Phyllite	BLACK	STR			HNU 0.0	SAME
-246	246									
-247	247									
-248	248									
-249	249									
-250	250			Phyllite	BLACK	STR			HNU 0.0	SAME
-251	251									
-252	252									
-253	253									
-254	254									
-255	255			Phyllite	BLACK	STR			HNU 0.0	SOME CALCITE STAINING - POSSIBLE LARGE OPEN FRACTURE AT 259 FT
-256	256									
-257	257									
-258	258									
-259	259									
-260	260			Not Classified - Incomplete Data		STR			HNU 0.0	TRACE QUARTZ (AND CALCITE?)

PROJECT	:	COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00
SITE NAME	:	FDTA 2 / SITE 8	LOGGER	:	T. MCCANN
BORING ID	:	08-6046	DRILLING COMPANY	:	D.L. MAHER
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ELEVATION	:	108.860 surveyed	DATE COMPLETED	:	02/21/92

ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Not Classified - Incomplete Data		STR			HNU 0.0	TRACE QUARTZ (AND CALCITE?)
-261	261									
-262	262									
-263	263									
-264	264									
-265	265			Phyllite	BLACK	STR				TRACE CALCITE
-266	266									
-267	267									
-268	268									
-269	269									
-270	270			Phyllite	BLACK	STR				
-271	271									
-272	272									
-273	273									
-274	274									
-275	275			Phyllite	BLACK	STR				PHYLLITE
-276	276									
-277	277									
-278	278									
-279	279									
-280	280									

Borehole Log

Roy F. WESTON, Inc.

PROJECT	:	COMBINED DATA OF ALL	TOTAL DEPTH	:	282.00
SITE NAME	:	FDTA 2 / SITE 8	LOGGER	:	T. MCCANN
BORING ID	:	08-6046	DRILLING COMPANY	:	D.L. MAHER
NORTHING	:	219377.0000 surveyed	DRILLING RIG	:	CP-650
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ELEVATION	DEPTH	MATERIAL	% RECOVERY	CLASSIFICATION	COLOR	STRENGTH	MOISTURE	BLOW COUNT	FIELD INSTRUMENT READING	COMMENTS
				Phyllite	BLACK	STR				PHYLLITE
-281	281									
-282	282									
-283	283									
-284	284									
-285	285									
-286	286									
-287	287									
-288	288									
-289	289									
-290	290									
-291	291									
-292	292									
-293	293									
-294	294									
-295	295									
-296	296									
-297	297									
-298	298									
-299	299									
-300	300									

Appendix G
Data Quality Summary Report

Appendix G

Data Quality Summary Report

Perfluorinated Compound Investigation
Site 8, AT008, Fire Department Training Area 2
(NHDES Site No. 100330508)
Former Pease Air Force Base
Portsmouth, New Hampshire

Prepared for Air Force Civil Engineer Center
2261 Hughes Avenue, Suite 155
JBSA Lackland, Texas 78236-9853

Prepared by CB&I Federal Services LLC
150 Royall Street
Canton, Massachusetts 02021

Contract No. FA8903-09-D-8580, Task Order No. 0010
Project No. 143279
Revision 0

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Acronyms and Abbreviations

AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center
ALS	ALS Environmental
CB&I	CB&I Federal Services LLC
CCV	continuing calibration verification
DL	detection limit
DOD	U.S. Department of Defense
DQO	data quality objective
DQSR	Data Quality Summary Report
EPA	U.S. Environmental Protection Agency
ICAL	initial calibration
ICV	initial calibration verification
ID	identification
IWQPP	Installation-Wide Quality Program Plan
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MS	matrix spike
MSD	matrix spike duplicate
PFC	perfluorinated compounds
PHA	Provisional Health Advisory
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
RPD	relative percent difference
Shaw	Shaw Environmental & Infrastructure, Inc.
SOP	standard operating procedure
U.S.	United States

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1.0 INTRODUCTION

This appendix presents the Analytical Data Quality Summary Report (DQSR) for the 2015 perfluorinated compound (PFC) investigation for Site 8, AT008, Fire Department Training Area 2, at the former Pease Air Force Base (AFB) located in Portsmouth, New Hampshire. Site 8 was a former fire training area located at the former Pease AFB that was used from 1961 to 1988. Fire training exercises were performed in a burn pit located in the southeastern section of the site. This DQSR will discuss results of the quality assurance (QA)/quality control (QC) measures implemented during the sampling events at locations associated with Site 8. The successful execution of project-specific objectives and procedures provides strong support for the acceptance of the data as adequate for the purpose of evaluating site conditions of petroleum hydrocarbon plumes associated with the Site 8.

The data review process presented in this DQSR compares sample results to pre-established criteria referenced in the Final Installation-Wide Quality Program Plan (IWQPP) (Shaw Environmental & Infrastructure, Inc. [Shaw], 2012) to confirm that the data are of acceptable technical quality. ALS Environmental (ALS), located in Kelso, Washington, provided CB&I Federal Services LLC (CB&I) with Level 4 data packages including "Contract Laboratory Program–like" summary forms for all sample delivery groups. CB&I conducted a data assessment on all results reported by ALS in support of this investigation. One hundred percent of the analytical data have been reviewed, and validation qualifiers have been assigned based on the United States (U.S.) Department of Defense (DOD) *DoD Quality Systems Manual for Environmental Laboratories*, Version 5.0 (Quality Systems Manual [QSM]) (DOD, 2013). Data were evaluated against specific criteria to verify the achievement of all precision, accuracy, representativeness, completeness, comparability, and sensitivity goals established to meet the project data quality objectives (DQOs).

To verify that these DQOs were met, field measurements, sampling and handling procedures, laboratory analysis and reporting, and all nonconformances and discrepancies in the data were examined to determine compliance with the appropriate and applicable procedures. The results of this review are presented in the following sections, with all outliers or nonconformances discussed where they occurred.

1.1 Data Quality Summary Report Organization

This DQSR is organized as follows:

- Section 1.0—This section presents the introduction and report organization.
- Section 2.0—This section discusses the overall field investigation and QC procedures used by CB&I during the sampling effort.
- Section 3.0—This section outlines the analytical program and the associated QC activities as specified in the Final IWQPP (Shaw, 2012).
- Section 4.0—This section summarizes the data findings and their overall impact on the usability of the analytical data.
- Section 5.0—This section presents the references cited in this DQSR.

2.0 FIELD SAMPLING AND QC ACTIVITIES

CB&I is responsible for conducting the 2015 Site 8 PFC Investigation at the former Pease AFB, Portsmouth, New Hampshire, under the Air Force Civil Engineer Center (AFCEC) Contract No. FA8903-09-D-8580, Task Order No. 0010. Field activities at Site 8 included the collection of groundwater samples at five locations in accordance with the Final IWQPP (Shaw, 2012). ALS performed the following analyses:

- PFCs by ALS internal standard operating procedure (SOP) *Perfluorinated Compounds by High Performance Liquid Chromatography/Tandem Mass Spectroscopy (HPLC/MS/MS)*

The PFC analyte list includes perfluorobutane sulfonate, perfluorodecanoic acid, perfluorododecanoic acid, perfluoroheptanoic acid, perfluorohexane sulfonate, perfluorohexanoic acid, perfluorononanoic acid, perfluorooctane sulfonate, perfluorooctanoic acid, perfluoropentanoic acid, and perfluoroundecanoic acid. Additional groundwater samples were collected at locations 08-6724 and 08-6725 were submitted to Seacoast Analytical Services located in Lee, New Hampshire. Samples were screened for chloride, nitrate, and sulfate by U.S. Environmental Protection Agency (EPA) Method 300 and total coliforms by EPA Method SM9221B. All screening results are presented in **Attachment 1**. It should be noted screening data were not validated.

Table 1 summarizes the station name (or location), the field sample identification (ID), sample purpose, sample matrix, date of collection, laboratory sample ID, and the specific analytical program for each sample collected during the 2015 Site 8 PFC Investigation. Sample shipments from the field were performed under custody and were documented using standard analysis request/chain-of-custody forms. These forms provide project-specific analytical specifications and QC instructions to the laboratory. No amendments were made to the original analysis request/chain-of-custody forms associated with the Site 8 PFC Investigation.

2.1 Field Audits

A technical system audit of field activities was performed by CB&I during the spring 2015 long-term monitoring sampling activities. No major findings were identified by CB&I during the field inspection.

2.2 Field Duplicates

Field duplicate samples are collected and submitted "blind" to the laboratory for analysis along with their corresponding parent sample. The data generated from the analysis of field duplicate samples are used to evaluate the precision of the sample collection and analysis procedures. Field duplicate samples are collected at a frequency of approximately 1 for every 10 samples collected (10 percent) per matrix.

A high relative percent difference (RPD) value between a parent sample's result and its corresponding field duplicate's result may be attributed to the difference in sample matrix or the distribution of the constituent within the sample rather than the lack of precision of the collection process. Also, when estimated results are reported, there is a potential for increased variability between the parent and duplicate sample results. At low concentrations, the relative difference in results is magnified by the RPD calculation even though the results are comparable in absolute terms. There is also an increased uncertainty in the results as the lower detection limit (DL) is approached because of decreasing analytical accuracy. The RPD is calculated by using the following formula:

$$\mathrm{RPD} = \frac{(V_1 - V_2)}{\frac{(V_1 + V_2)}{2}} \times 100$$

Where:

RPD = relative percent difference
V1 = value 1
V2 = value 2

Field duplicate samples are collected in immediate succession after the initial parent samples employing identical recovery techniques. In cases where duplicates were performed and both results are less than the limit of quantitation (LOQ) and in cases where one result is greater than the LOQ and the second result is less than the LOQ, the RPD is not calculated. Precision evaluation criteria for field duplicate comparison were established at an RPD less than 30 percent for groundwater samples. No sample results were qualified due to their calculated RPD exceeding the evaluation criteria.

2.3 AFCEC Split Samples

No AFCEC field split samples were collected during the 2015 Site 8 PFC Investigation.

2.4 Equipment Blanks

Equipment blanks are used to assess the effectiveness of the decontamination procedures used by the sampling team on reusable sampling equipment. Target analytes detected in associated equipment blanks increase the uncertainty regarding the presence of the same constituents in field samples. For an analyte identified in both an equipment blank and a field sample, it must be present at a concentration of 5 times higher in the field sample to be considered a “hit.” Common laboratory contaminants such as acetone, methylene chloride, and toluene are not assumed present until sample concentrations exceed 10 times the associated equipment blank value. This is referred to as the “5×/10×” rule. One equipment blank sample was collected during the 2015 Site 8 PFC Investigation. No sample results were impacted by contamination detected in the associated equipment blank.

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3.0 ANALYTICAL PROGRAM AND QC ACTIVITIES

The project QA/QC program described in the Final IWQPP (Shaw, 2012) was followed for the collection and laboratory analysis of samples associated with this sampling event. Each of the analytical methods used requires that method-specific QA/QC protocols be followed during sample analysis. These protocols are a critical part of the methods employed and were followed by the laboratory during sample analysis. Specific measures included detailed record-keeping procedures; instrument calibrations; and analysis of method blanks, blank spikes, and matrix spikes (MS). **Attachments 2** and **3** to this DQSR contain both a summary of analytical results and a summary of analytical results greater than the DL, respectively. These data summaries also include the assigned data validation qualifiers and data validation qualifier reason codes. A summary of data validation reason code definitions is provided in **Attachment 4**.

Laboratory data qualifiers are defined as follows:

- J indicates the reported analyte is an estimated value.
- U indicates the compound was analyzed for, but was not detected at the minimum DL.
- No qualifier denotes the result is a value greater than or equal to the LOQ.

CB&I's data validation qualifiers are defined as follows:

- J denotes the analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed.
- R denotes the reported sample results are rejected due to the following: (1) severe deficiencies in the supporting QC data, (2) anomalies noted in the sampling and/or analysis process which could affect the validity of the reported data, (3) the presence or absence of the constituent cannot be verified based on the data provided, and (4) to indicate not to use a particular result in the event of a reanalysis.
- U denotes not detected. The compound/analyte was analyzed for, but was not detected above the associated DL or above the reported concentration due to blank contamination.
- UJ denotes the compound/analyte was analyzed for, but was not detected above the established reporting limit. However, review and evaluation of supporting QC

data and/or the sampling and analysis process have indicated that the reporting limit may be inaccurate or imprecise. The nondetect result should be estimated.

- nv denotes analyte not validated.
- No qualifier denotes the target analyte was detected in the associated sample; no qualification of the data required.

3.1 Laboratory QA/QC Procedures

The following sections discuss a few of the QA/QC protocols required and performed by the laboratory during the 2015 Site 8 PFC Investigation:

3.1.1 Method Blanks

Method blanks were analyzed with each analytical "batch" processed on a per matrix (i.e., soil and water) basis. These blanks were carried stepwise through the same analytical procedure as the field samples including the addition of solvents, surrogate and standard spikes, and reagents as required in the analysis process. The purpose of the blank is to identify any possible contaminants that may be introduced to the sample as a result of the analytical process. During validation, the data validation qualifiers evaluated all blank data associated with each sample. Data were evaluated based on the QSM (DOD, 2013).

Target compounds detected in associated blanks increase the uncertainty regarding the presence of the same constituents in field samples. For a compound identified in both a blank and field sample, it must be present at a concentration of 5 times higher in the field sample to be considered a "hit." Common laboratory contaminants such as acetone, methylene chloride, and toluene are not assumed present until sample concentrations exceed 10 times the associated blank value. This is referred to as the "5×/10×" rule. Field sample concentrations were evaluated during data validation to determine if the sample results could have been biased by the presence of any contamination measured in associated method blanks. No sample results were impacted due to contamination detected in associated method blanks.

3.1.2 Surrogate Spikes

Spiked surrogate compounds were used in the analytical program to monitor the efficiency of the sample preparation and accuracy of the analysis of PFCs by ALS SOP *Perfluorinated Compounds by High Performance Liquid Chromatography/Tandem Mass Spectroscopy (HPLC/MS/MS)* on a sample-by-sample basis. The compounds used as surrogates and the target acceptance limits for their recovery were those specified in ALS's SOP *Perfluorinated Compounds by High Performance Liquid Chromatography/Tandem Mass Spectroscopy (HPLC/MS/MS)*. All surrogate recoveries met QC criteria.

3.1.3 Internal Standards

Internal standards are known amounts of standards added to an aliquot of sample or sample extract and carried through the entire analytical procedure. Internal standards are added to all field samples, laboratory controls, and blanks in accordance with the referenced method requirements. They are used as a basis for quantitation of target analytes. Internal standard retention times and recoveries are compared against acceptance limits presented in ALS's SOP *Perfluorinated Compounds by High Performance Liquid Chromatography/Tandem Mass Spectroscopy (HPLC/MS/MS)*. Acceptable internal standard performance criteria ensure that method sensitivity and instrument response are stable during every analytical run. No sample results were impacted by spiked internal standard recoveries reported outside QC criteria.

3.1.4 Matrix Spikes and Laboratory Control Spikes

Two types of spikes were generally performed for all analyses: (1) the spike applied to the sample matrix identified as an MS and (2) the spike applied to a "blank" matrix known as an laboratory control sample (LCS). The spiked compounds are target analytes that are quantified during performance of the method. Spikes are introduced during sample preparation on an aliquot of the sample or a blank matrix. Results of these spiked aliquots are then compared to the native concentrations of the same analytes, and a recovery is calculated. Recovery of the spiked compound is used as an assessment of analytical accuracy on the sample matrix analyzed. These results are useful in distinguishing sample matrix interference from analysis interference through a comparison of MS and blank spike recovery data. Often, the MSs are performed in duplicate (as a matrix spike duplicate [MSD] or laboratory control sample duplicate [LCSD]) on prepared sample aliquots. In this manner, an assessment of precision can be quantified as the RPD of the original and duplicate spike. The target acceptance limits are presented in the Final IWQPP (Shaw, 2012).

The MSs are assigned at a frequency of approximately 5 percent or 1 for every 20 field samples collected. If a sample is designated for analysis as an MS/MSD, additional sample volume is provided to the laboratory. This sampling meets the collection criteria as specified in the Final IWQPP (Shaw, 2012). One MS/MSD pair was collected in the field and analyzed for the following analytical suite:

Field Sample ID	Sample Station	Sample Date	Analytical Suite
S8-0487	08-6722	10/05/2015	PFCs by ALS's SOP *Perfluorinated Compounds by High Performance Liquid Chromatography/Tandem Mass Spectroscopy (HPLC/MS/MS)*

ID denotes identification.

PFC denotes perfluorinated compound.

The MS/MSD target acceptance criteria are established in ALS's SOP *Perfluorinated Compounds by High Performance Liquid Chromatography/Tandem Mass Spectroscopy (HPLC/MS/MS)*. **Table 2** summarizes sample results impacted by MS/MSD recoveries reported outside the QC criteria.

The LCS results are used to evaluate laboratory method performance in the same manner as the MS/MSD results, except the LCS is not performed on an actual field sample matrix. An LCS is prepared for each analytical batch for each parameter and matrix analyzed. The LCS target acceptance criteria are established in ALS's SOP *Perfluorinated Compounds by High Performance Liquid Chromatography/Tandem Mass Spectroscopy (HPLC/MS/MS)*. No sample results were impacted by LCS/LCSD recoveries and/or RPDs reported outside the QC criteria.

3.1.5 Calibrations

Initial calibration (ICAL) information is verified to demonstrate that the reported results are comparable to known concentrations of target compounds. A series of standard reference solutions containing all target constituents are analyzed using the type of instrumentation specified by the method. The standards are used to determine the sensitivity of the analysis and the effective analytical (i.e., linear) range for which data can be accurately reported. High ICAL percent relative standard deviation indicates that a nonlinear response was obtained during the ICAL. A low ICAL mean relative response factor indicates that the compound exhibits poor response to the selected method (or detector). The ICAL, initial calibration verification (ICV), and continuing calibration verification (CCV) target acceptance criteria are established in ALS's SOP *Perfluorinated Compounds by High Performance Liquid Chromatography/Tandem Mass Spectroscopy (HPLC/MS/MS).* No sample results were impacted by ICALs, ICVs, and/or CCVs exceeding the QC criteria.

3.2 Reporting Limits

The analytical program executed required the use of SW-846 methods, which specify the procedure for calculating the LOQ. Each laboratory is required to demonstrate method performance through DL studies for every method employed. These studies are required to be laboratory specific so that individual laboratory variables such as equipment brands, reagent suppliers, and chemist technique are factored into the performance study. The DLs are established using controlled matrices (i.e., deionized water). The LOQ calculation adjusts the limit by a predetermined mathematical factor for the analysis of actual environmental sample matrices (i.e., soil, groundwater, etc.). The actual values reported have been corrected for all necessary dilutions, dryness, and interference factors, as applicable, based on the resulting analytical data for a sample. The DL, limit of detection (LOD), and LOQ are generally defined as follows:

- The DL is the smallest analyte concentration that can be demonstrated to be different from 0 or a blank concentration at the 99-percent level of confidence.
- The LOD is the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a 99-percent level of confidence.
- The LOQ is the smallest concentration of a substance that produces a quantitative result within specified limits of precision and bias. The LOQ is typically larger than the LOD, but may be equal to the LOD, depending upon the acceptance limits for precision and bias. The LOQ is set at the lowest standard used in the ICAL or higher for each target analyte.

The DL is the lower limit at which the laboratory can differentiate a measurement from background. The DL is determined in accordance with the procedures in 40 Code of Federal Regulations Part 136. A DL is the lower limit at which a measurement becomes meaningful. The LOQ is generally a multiple of 2 to 5 times the DL. Actual sample LOQs can be reviewed on a sample-by-sample basis by reviewing the summary of analytical results presented in **Attachment 2**.

3.3 Holding Times

All laboratory results submitted for this sampling event have been reviewed with respect to laboratory adherence to extraction and analysis holding times. Maximum sample extraction and analysis holding times are presented in the Final IWQPP (Shaw, 2012). All sample shipments were received by ALS in good condition and within the required temperature criteria (4±2 degrees Celsius). All extraction and analysis holding times met QC criteria.

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4.0 DATA EVALUATION AND USABILITY

The data review process identified multiple QC exceedances that were noted during this sampling event. These exceedances have been discussed in this DQSR. The following definitions are used for defining precision, accuracy, representativeness, completeness, comparability, and sensitivity as they have been applied to this evaluation:

4.1 Precision

Precision is a measurement of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. For this project, precision data were obtained through the analysis and evaluation of field duplicate samples as the RPD. The RPD is calculated as follows:

$$\text{RPD} = \frac{(V_1 - V_2)}{\frac{(V_1 + V_2)}{2}} \times 100$$

Where:

RPD = relative percent difference
V1 = value 1
V2 = value 2

Parent sample and field duplicate comparisons show that the field team is consistent in their sample collection practices. Field duplicate results are summarized in Section 2.2. Precision was also evaluated through the comparison of MS and MSD or LCS and LCSD results. The spiked sample (MS, MSD, LCS, and LCSD) RPDs are evaluated during data validation, and data are qualified accordingly. The RPDs within the acceptance criteria indicate that the laboratory is performing adequately and that the results are reproducible for the analytes of interest at this site. Acceptance criteria are defined in ALS's SOP *Perfluorinated Compounds by High Performance Liquid Chromatography/Tandem Mass Spectroscopy (HPLC/MS/MS)* for each analyte of concern. These data and all necessary qualifications are discussed in Section 3.1.4. In respect to precision, the data are usable for their intended purpose.

4.2 Accuracy

Accuracy is a measurement of bias in a system and is expressed as a percent recovery. Accuracy is typically determined through the analysis and evaluation of blanks, spiked surrogates, LCSs, and MS/MSD samples. Percent recovery is calculated as follows:

$$\% \text{ Recovery} = 100 \times \frac{\text{measured value}}{\text{true value}}$$

The MS/MSDs, LCS, method blanks, surrogate, internal standards, ICAL, and CCV results and all data qualifications are summarized in Section 3.1 and **Table 2**. In respect to accuracy, all data are deemed usable for their intended purpose.

4.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which sample data actually represent the matrix and site conditions. General requirements and procedures referenced in the Final IWQPP (Shaw, 2012) and corporate SOPs for sample collection and handling are designed to maximize sample representativeness. Representativeness also can be monitored by reviewing field documentation and by performing field inspections. All samples were collected using the SOPs and were fully documented through the use of standard field forms. Samples are representative of the matrix and site sampled.

4.4 Completeness

Completeness is a measure of the amount of valid data obtained during a sampling event as compared to the amount of data planned for collection and determined to be usable for the intended purpose. An overall completeness goal of 90 percent is set for this sampling event. Completeness is calculated as follows:

$$\%C = (U/T) \times 100$$

Where:

%C = percent completeness
U = number of measurements judged usable
T = total number of measurements

During the 2015 Site 8 PFC Investigation, 12 groundwater samples were collected and reported resulting in a total of 154 records. No results were rejected during the data quality evaluation. Using the above calculation, 100-percent (154/154 = 100%) analytical completeness was achieved for this sampling event. A summary of results with the assigned data validation qualifiers and the data validation qualifier reason codes is presented in **Attachment 2**.

4.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Comparability ensures that results for the sampling event can be compared with data from past and future sampling programs. Comparability for this sampling event was achieved through the use of established and recognized techniques and through the laboratory's use of standard EPA methodology. All samples collected for this task were subjected to the same sampling, handling, preparation, analysis, reporting, and validation criteria for the purpose of achieving comparability goals within the data set.

4.6 Sensitivity

Sensitivity is defined as the ability of the laboratory's established LOQs/DLs to meet project-specific DQOs. The DL is defined as the smallest analyte concentration that can be demonstrated to be different from 0 or a blank concentration at the 99-percent level of confidence. The LOQ is a threshold value based upon the sensitivity capability of method and instrument. The LOQs are normally set at a minimum of 2 times the DL. The DLs/LOQs are adjusted based on the sample matrix, moisture (solids only), and any necessary sample dilutions. The laboratory cannot reliably quantitate values reported above the DL but below the LOQ. Therefore, these reported values must be flagged as estimated quantities ("J" flagged).

To evaluate method sensitivity, the laboratory's aqueous LOQs/DLs were compared against EPA Provisional Health Advisory (PHA) values established for PFCs. ALS's PFC LOQs met or were below EPA's PHA values.

4.7 Statement of Data Usability

One hundred percent of the analytical data have been reviewed, and validation qualifiers have been assigned based on the QSM (DOD, 2013). The overall quality of the data collected for the 2015 Site 8 PFC Investigation has been discussed in this DQSR. Results of the analyses suggest that the data are indicative of the media analyzed and do reflect expected site conditions and are fully usable for their intended purpose.

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5.0 REFERENCES

Shaw Environmental & Infrastructure, Inc. (Shaw), 2012. *Installation-Wide Quality Program Plan, Former Pease Air Force Base, Portsmouth, New Hampshire*, Final, September.

U.S. Department of Defense (DOD), 2013. *DoD Quality Systems Manual for Environmental Laboratories*, Version 5.0, U.S. Department of Defense Environmental Data Quality Workgroup, July.

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Tables

Table 1
Summary of Samples Collected and Sample Tracking Information
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Suite
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0487-MS	08-6722	10/05/2015	MS	WG	128	140.5	KQ1511535-01	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0487-MSD	08-6722	10/05/2015	SD	WG	128	140.5	KQ1511535-02	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0499	08-6724	10/19/2015	N	WG	24	24	S10195P	Chloride, Nitrate, and Sulfate by EPA Method 300 and Total Coliforms by EPA Method SM9221B
S8-0500	08-6724	10/19/2015	N	WG	169	169	S10195Q	Chloride, Nitrate, and Sulfate by EPA Method 300 and Total Coliforms by EPA Method SM9221B
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	PFCs[1] by ALS Internal SOP (HPLC/MS technique)
S8-0501	08-6725	10/19/2015	N	WG	32.5	32.5	S10195R	Chloride, Nitrate, and Sulfate by EPA Method 300 and Total Coliforms by EPA Method SM9221B
S8-0502	08-6725	10/19/2015	N	WG	223	223	S10195S	Chloride, Nitrate, and Sulfate by EPA Method 300 and Total Coliforms by EPA Method SM9221B
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	---	---	K1511425-003	PFCs[1] by ALS Internal SOP (HPLC/MS technique)

[1] *PFC analyte list includes perfluorobutane sulfonate, perfluorodecanoic acid, perfluorododecanoic acid, perfluoroheptanoic acid, perfluorohexane sulfonate, perfluorohexanoic acid, perfluorononanoic acid, perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), perfluoropentanoic acid, and perfluoroundecanoic acid.*

--- denotes not applicable.
ALS denotes ALS Environmental.
EB denotes equipment blank sample.
EPA denotes U.S. Environmental Protection Agency.
FD denotes field duplicate sample.
ft bgs denotes feet below ground surface.
HPLC/MS denotes high performance liquid chromatography/mass spectrometry.
ID denotes identification.
MS denotes matrix spike sample.
N denotes regular field sample.
PFC denotes perfluorinated compound.
QC denotes quality control.
SD denotes matrix spike duplicate sample.
SOP denotes standard operating procedure.
WG denotes groundwater matrix.
WQ denotes water quality matrix.

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Table 2
Summary of Impacted Results due to MS/MSD Recoveries Exceeding QC Criteria
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.3	0.005	0.005	0.0015	µg/L		J	08A		1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.24	0.01	0.004	0.0015	µg/L		J	08A		1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	108427-53-8	Perfluorohexane sulfonate	2.8	0.2	0.08	0.028	µg/L		J	08A		20
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0032	0.005	0.005	0.0026	µg/L	J	J	15	08A	1

µg/L denotes micrograms per liter.
CAS denotes Chemical Abstracts Service.
DL denotes detection limit.
ft bgs denotes feet below ground surface.
ID denotes identification.
LC/MS denotes liquid chromatography/mass spectrometry.
LOD denotes limit of detection.
LOQ denotes limit of quantitation.
LQ denotes laboratory data qualifier.
N denotes regular field sample.
QC denotes quality control.
R1 denotes validation qualifer reason code number 1.
R2 denotes validation qualifer reason code number 2.
VQ denotes validation qualifier.
WG denotes groundwater matrix.

Laboratory Data Qualifier Definitions:
No qualifier denotes analyte was detected in the associated sample.
J denotes the reported analyte is an estimated value.

Validation Qualifier Definitions:
J denotes the analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed.

Validation Qualifier Reason Code Definitions:
08A denotes MS/MSD/Duplicate results outside QC criteria.
15 denotes result reported below the LOQ and above the DL.

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Attachment 1
Seacoast Analytical Services Screening Data

SEACOAST ANALYTICAL SERVICES
Route 125 & Pinkham Road
Lee, New Hampshire
603 868 1457
(Mail to: PO Box 555, Barrington, NH 03825)

SUPERIOR QUALITY & SERVICE SINCE 1989

WATER TEST RESULTS

Date: October 22, 2015

Reference #: S10195P

Client: CB & I Federal Services
312 Directors Drive
Knoxville, TN 37923

Water location: Former Pease Air Force Base Site 8
Portsmouth, NH
Well Id 08-6724
Sample Id S8-0499

Test Method	ANALYTE (mg/L) = milligrams per liter	EPA MAXIMUM recommended concentration	YOUR WATER'S VALUE < means less than	Exceeds Primary Standard	Exceeds Secondary Standard
EPA 300.0	Fluoride (mg/L)	4.0	< 0.6	-	-
EPA 300.0	Chloride (mg/L)	250	606 *	-	X
EPA 300.0	Nitrite-N (mg/L)	1.0	< 1.0	-	-
EPA 300.0	Nitrate-N (mg/L)	10.0	< 2.0	-	-
EPA 150.1	pH (range)	(6.5 - 8.5)	6.4	-	X
SM 2340B	Hardness (mg/L)	No limit	246	-	-
SM 3111B	Sodium (mg/L)	250	280 *	-	X
SM 3111B	Iron (mg/L)	0.300	0.834	-	X
SM 3111B	Manganese (mg/L)	0.050	< 0.025	-	-
SM 3111B	Copper (mg/L)	1.300	< 0.200	-	-
SM 3113B	Lead (mg/L)	0.015	< 0.005	-	-
SM 3113B	Arsenic (mg/L)	0.010	< 0.005	-	-
COLILERT	Total Coliform Bacteria	absent	PRESENT	X	-
COLILERT	E. Coli Bacteria	absent	absent	-	-

THE TESTED PARAMETERS DO NOT MEET FEDERAL PRIMARY DRINKING WATER STANDARDS. Secondary standards measure the aesthetic quality of the water and if exceeded should not affect healthy individuals. Analytes which exceed the recommended concentration or range are indicated with an X under the primary or secondary column above. Nitrate-N/nitrite-N should be analyzed within 48 hours of collection. Samples tested after this time period may not yield accurate results. pH should ideally be measured at the time of collection. Reported pH may differ from field measurement. This report relates only to the sample received.

http://des.nh.gov/organization/commissioner/pip/index.htm is the NHDES website where you can get information about water contaminants. Scroll down to 'Publications', and choose 'Fact Sheets', then Drinking Water/Ground Water.
Date/time sampled: 10/19/15 9:15am
EPA 300.0 analysis: 10/20/15 10:31am
COLILERT analysis: 10/19/15 4:10pm
SM3111B, SM3113B analysis: 10/21/15
Date rec'd: 10/19/15 Temp (°C) rec'd: 14
EPA 150.1 analysis: 10/19/15 3:00pm
* estimated value - greater than highest standard
THIS REPORT IS CONFIDENTIAL. IF YOU RECEIVE THIS INFORMATION IN ERROR, PLEASE CALL 603-868-1457.

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Katy Anderson, Laboratory Director

SEACOAST ANALYTICAL SERVICES
Route 125 & Pinkham Road
Lee, New Hampshire
603 868 1457
(Mail to: PO Box 555, Barrington, NH 03825)

SUPERIOR QUALITY & SERVICE SINCE 1989

WATER TEST RESULTS

Date: October 22, 2015

Reference #: S10195Q

Client: CB & I Federal Services
312 Directors Drive
Knoxville, TN 37923

Water location: Former Pease Air Force Base Site 8
Portsmouth, NH
Well Id 08-6724
Sample Id S8-0500

Test Method	ANALYTE (mg/L) = milligrams per liter	EPA MAXIMUM recommended concentration	YOUR WATER'S VALUE < means less than	Exceeds Primary Standard	Exceeds Secondary Standard
EPA 300.0	Fluoride (mg/L)	4.0	< 0.6	-	-
EPA 300.0	Chloride (mg/L)	250	734 *	-	X
EPA 300.0	Nitrite-N (mg/L)	1.0	< 1.0	-	-
EPA 300.0	Nitrate-N (mg/L)	10.0	< 2.0	-	-
EPA 150.1	pH (range)	(6.5 - 8.5)	6.6	-	-
SM 2340B	Hardness (mg/L)	No limit	339	-	-
SM 3111B	Sodium (mg/L)	250	327 *	-	X
SM 3111B	Iron (mg/L)	0.300	0.767	-	X
SM 3111B	Manganese (mg/L)	0.050	< 0.025	-	-
SM 3111B	Copper (mg/L)	1.300	< 0.200	-	-
SM 3113B	Lead (mg/L)	0.015	< 0.005	-	-
SM 3113B	Arsenic (mg/L)	0.010	< 0.005	-	-
COLILERT	Total Coliform Bacteria	absent	PRESENT	X	-
COLILERT	E. Coli Bacteria	absent	absent	-	-

THE TESTED PARAMETERS DO NOT MEET FEDERAL PRIMARY DRINKING WATER STANDARDS. Secondary standards measure the aesthetic quality of the water and if exceeded should not affect healthy individuals. Analytes which exceed the recommended concentration or range are indicated with an X under the primary or secondary column above. Nitrate-N/nitrite-N should be analyzed within 48 hours of collection. Samples tested after this time period may not yield accurate results. pH should ideally be measured at the time of collection. Reported pH may differ from field measurement. This report relates only to the sample received.

http://des.nh.gov/organization/commissioner/pip/index.htm is the NHDES website where you can get information about water contaminants. Scroll down to 'Publications', and choose 'Fact Sheets', then Drinking Water/Ground Water.
Date/time sampled: 10/19/15 10:20am
EPA 300.0 analysis: 10/20/15 10:53am
COLILERT analysis: 10/19/15 4:10pm
SM3111B, SM3113B analysis: 10/21/15
Date rec'd: 10/19/15 Temp (°C) rec'd: 11
EPA 150.1 analysis: 10/19/15 3:00pm
* estimated value - greater than highest standard
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SEACOAST ANALYTICAL SERVICES

Route 125 & Pinkham Road
Lee, New Hampshire
603 868 1457
(Mail to: PO Box 555, Barrington, NH 03825)

SUPERIOR QUALITY & SERVICE SINCE 1989

WATER TEST RESULTS

Date: October 22, 2015

Reference #: S10195R

Client: CB & I Federal Services
312 Directors Drive
Knoxville, TN 37923

Water location: Former Pease Air Force Base Site 8
Portsmouth, NH
Well Id 08-6725
Sample Id S8-0501

Test Method	ANALYTE (mg/L) = milligrams per liter	EPA MAXIMUM recommended concentration	YOUR WATER'S VALUE < means less than	Exceeds Primary Standard	Exceeds Secondary Standard
EPA 300.0	Fluoride (mg/L)	4.0	< 0.3	-	-
EPA 300.0	Chloride (mg/L)	250	200	-	-
EPA 300.0	Nitrite-N (mg/L)	1.0	< 0.5	-	-
EPA 300.0	Nitrate-N (mg/L)	10.0	< 1.0	-	-
EPA 150.1	pH (range)	(6.5 - 8.5)	7.5	-	-
SM 2340B	Hardness (mg/L)	No limit	297 *	-	-
SM 3111B	Sodium (mg/L)	250	97	-	-
SM 3111B	Iron (mg/L)	0.300	0.456	-	X
SM 3111B	Manganese (mg/L)	0.050	0.040	-	-
SM 3111B	Copper (mg/L)	1.300	< 0.200	-	-
SM 3113B	Lead (mg/L)	0.015	< 0.005	-	-
SM 3113B	Arsenic (mg/L)	0.010	0.006	-	-
COLILERT	Total Coliform Bacteria	absent	PRESENT	X	-
COLILERT	E. Coli Bacteria	absent	absent	-	-

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http://des.nh.gov/organization/commissioner/pip/index.htm is the NHDES website where you can get information about water contaminants. Scroll down to 'Publications', and choose 'Fact Sheets', then Drinking Water/Ground Water.
Date/time sampled: 10/19/15 11:25am
EPA 300.0 analysis: 10/20/15 11:12am
COLILERT analysis: 10/19/15 4:10pm
SM3111B, SM3113B analysis: 10/21/15
Date rec'd: 10/19/15 Temp (°C) rec'd: 13
EPA 150.1 analysis: 10/19/15 3:00pm
* estimated value - greater than highest standard
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Route 125 & Pinkham Road
Lee, New Hampshire
603 868 1457
(Mail to: PO Box 555, Barrington, NH 03825)

SUPERIOR QUALITY & SERVICE SINCE 1989

WATER TEST RESULTS

Date: October 22, 2015

Reference #: S10195S

Client: CB & I Federal Services
312 Directors Drive
Knoxville, TN 37923

Water location: Former Pease Air Force Base Site 8
Portsmouth, NH
Well Id 08-6725
Sample Id S8-0502

Test Method	ANALYTE (mg/L) = milligrams per liter	EPA MAXIMUM recommended concentration	YOUR WATER'S VALUE < means less than	Exceeds Primary Standard	Exceeds Secondary Standard
EPA 300.0	Fluoride (mg/L)	4.0	< 0.3	-	-
EPA 300.0	Chloride (mg/L)	250	167	-	-
EPA 300.0	Nitrite-N (mg/L)	1.0	< 0.5	-	-
EPA 300.0	Nitrate-N (mg/L)	10.0	< 1.0	-	-
EPA 150.1	pH (range)	(6.5 - 8.5)	7.5	-	-
SM 2340B	Hardness (mg/L)	No limit	272 *	-	-
SM 3111B	Sodium (mg/L)	250	102	-	-
SM 3111B	Iron (mg/L)	0.300	1.776	-	X
SM 3111B	Manganese (mg/L)	0.050	0.039	-	-
SM 3111B	Copper (mg/L)	1.300	< 0.200	-	-
SM 3113B	Lead (mg/L)	0.015	< 0.005	-	-
SM 3113B	Arsenic (mg/L)	0.010	< 0.005	-	-
COLILERT	Total Coliform Bacteria	absent	PRESENT	X	-
COLILERT	E. Coli Bacteria	absent	absent	-	-

THE TESTED PARAMETERS DO NOT MEET FEDERAL PRIMARY DRINKING WATER STANDARDS. Secondary standards measure the aesthetic quality of the water and if exceeded should not affect healthy individuals. Analytes which exceed the recommended concentration or range are indicated with an X under the primary or secondary column above. Nitrate-N/nitrite-N should be analyzed within 48 hours of collection. Samples tested after this time period may not yield accurate results. pH should ideally be measured at the time of collection. Reported pH may differ from field measurement. This report relates only to the sample received.

http://des.nh.gov/organization/commissioner/pip/index.htm is the NHDES website where you can get information about water contaminants. Scroll down to 'Publications', and choose 'Fact Sheets', then Drinking Water/Ground Water.
Date/time sampled: 10/19/15 12:20pm
EPA 300.0 analysis: 10/20/15 11:48am
COLILERT analysis: 10/19/15 4:10pm
SM3111B, SM3113B analysis: 10/21/15
Date rec'd: 10/19/15 Temp (°C) rec'd: 13
EPA 150.1 analysis: 10/19/15 3:00pm
* estimated value - greater than highest standard
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Katy Anderson, Laboratory Director

Attachment 2
Summary of Analytical Results

Attachment 2
Summary of Analytical Results
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0016	0.0045	0.002	0.00075	µg/L	J	J	15		1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.0045	0.002	0.0015	µg/L	U	U			1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0016	0.0045	0.002	0.00049	µg/L	J	J	15		1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.014	0.0045	0.002	0.00068	µg/L					1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	307-24-4	Perfluorohexanoic acid	0.0075	0.0045	0.002	0.00062	µg/L					1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	375-95-1	Perfluorononanoic acid	0.0014	0.005	0.005	0.0014	µg/L	U	U			1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.025	0.0045	0.002	0.0018	µg/L					1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.0061	0.005	0.005	0.0015	µg/L					1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	2706-90-3	Perfluoropentanoic acid	0.0033	0.0045	0.002	0.00094	µg/L	J	J	15		1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0018	0.0044	0.002	0.00075	µg/L	J	J	15		1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.0044	0.002	0.0015	µg/L	U	U			1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0018	0.0044	0.002	0.00049	µg/L	J	J	15		1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.016	0.0044	0.002	0.00068	µg/L					1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	307-24-4	Perfluorohexanoic acid	0.0086	0.0044	0.002	0.00062	µg/L					1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	375-95-1	Perfluorononanoic acid	0.0014	0.005	0.005	0.0014	µg/L	U	U			1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.028	0.0044	0.002	0.0018	µg/L					1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.0069	0.005	0.005	0.0015	µg/L					1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	2706-90-3	Perfluoropentanoic acid	0.0036	0.0044	0.002	0.00094	µg/L	J	J	15		1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.15	0.005	0.002	0.00075	µg/L					1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.005	0.002	0.0015	µg/L	U	U			1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	375-85-9	Perfluoroheptanoic acid	0.076	0.005	0.002	0.00049	µg/L					1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.75	0.25	0.1	0.034	µg/L					50
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	307-24-4	Perfluorohexanoic acid	0.43	0.25	0.1	0.031	µg/L					50
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	375-95-1	Perfluorononanoic acid	0.0015	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.89	0.25	0.1	0.09	µg/L					50
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.3	0.005	0.005	0.0015	µg/L		J	08A		1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	2706-90-3	Perfluoropentanoic acid	0.18	0.005	0.002	0.00094	µg/L					1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.24	0.005	0.002	0.00075	µg/L					1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.005	0.002	0.0015	µg/L	U	U			1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1

Attachment 2 (continued)
Summary of Analytical Results
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	375-85-9	Perfluoroheptanoic acid	0.12	0.005	0.002	0.00049	µg/L					1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	108427-53-8	Perfluorohexane sulfonate	1.2	0.25	0.1	0.034	µg/L					50
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	307-24-4	Perfluorohexanoic acid	0.66	0.25	0.1	0.031	µg/L					50
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	375-95-1	Perfluorononanoic acid	0.0027	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	1.6	0.25	0.1	0.09	µg/L					50
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.47	0.25	0.25	0.075	µg/L					50
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	2706-90-3	Perfluoropentanoic acid	0.29	0.005	0.002	0.00094	µg/L					1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.26	0.005	0.002	0.00075	µg/L					1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.005	0.002	0.0015	µg/L	U	U			1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	375-85-9	Perfluoroheptanoic acid	0.16	0.005	0.002	0.00049	µg/L					1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	108427-53-8	Perfluorohexane sulfonate	1.6	0.25	0.1	0.034	µg/L					50
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	307-24-4	Perfluorohexanoic acid	0.82	0.25	0.1	0.031	µg/L					50
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	375-95-1	Perfluorononanoic acid	0.0042	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	2.3	0.25	0.1	0.09	µg/L					50
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.66	0.25	0.25	0.075	µg/L					50
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	2706-90-3	Perfluoropentanoic acid	0.45	0.25	0.1	0.047	µg/L					50
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.22	0.005	0.002	0.00075	µg/L					1
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.005	0.002	0.0015	µg/L	U	U			1
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	375-85-9	Perfluoroheptanoic acid	0.22	0.005	0.002	0.00049	µg/L					1
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	108427-53-8	Perfluorohexane sulfonate	2.2	0.25	0.1	0.034	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	307-24-4	Perfluorohexanoic acid	1	0.25	0.1	0.031	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	375-95-1	Perfluorononanoic acid	0.0064	0.005	0.005	0.0014	µg/L					1
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	2.8	0.25	0.1	0.09	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.96	0.25	0.25	0.075	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	2706-90-3	Perfluoropentanoic acid	0.73	0.25	0.1	0.047	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.24	0.01	0.004	0.0015	µg/L		J	08A		1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	335-76-2	Perfluorodecanoic acid	0.003	0.01	0.004	0.003	µg/L	U	U			1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	307-55-1	Perfluorododecanoic acid	0.0096	0.01	0.01	0.0096	µg/L	U	U			1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	375-85-9	Perfluoroheptanoic acid	0.31	0.01	0.004	0.00098	µg/L					1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	108427-53-8	Perfluorohexane sulfonate	2.8	0.2	0.08	0.028	µg/L		J	08A		20
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	307-24-4	Perfluorohexanoic acid	1.2	0.2	0.08	0.025	µg/L					20

Attachment 2 (continued)
Summary of Analytical Results
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	375-95-1	Perfluorononanoic acid	0.0083	0.01	0.01	0.0028	µg/L	J	J	15		1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	3.7	0.2	0.08	0.072	µg/L					20
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	1.5	0.2	0.2	0.06	µg/L					20
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	2706-90-3	Perfluoropentanoic acid	0.87	0.01	0.004	0.0019	µg/L					1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0052	0.01	0.01	0.0052	µg/L	U	U			1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0017	0.005	0.002	0.00075	µg/L	J	J	15		1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	335-76-2	Perfluorodecanoic acid	0.0044	0.005	0.002	0.0015	µg/L	J	J	15		1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0076	0.005	0.002	0.00049	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.0074	0.005	0.002	0.00068	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	307-24-4	Perfluorohexanoic acid	0.042	0.005	0.002	0.00062	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	375-95-1	Perfluorononanoic acid	0.003	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.016	0.005	0.002	0.0018	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.029	0.005	0.005	0.0015	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	2706-90-3	Perfluoropentanoic acid	0.06	0.005	0.002	0.00094	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0032	0.005	0.005	0.0026	µg/L	J	J	15	08A	1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0026	0.005	0.002	0.00075	µg/L	J	J	15		1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	335-76-2	Perfluorodecanoic acid	0.0031	0.005	0.002	0.0015	µg/L	J	J	15		1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0089	0.005	0.002	0.00049	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.013	0.005	0.002	0.00068	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	307-24-4	Perfluorohexanoic acid	0.053	0.005	0.002	0.00062	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	375-95-1	Perfluorononanoic acid	0.0031	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.018	0.005	0.002	0.0018	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.034	0.005	0.005	0.0015	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	2706-90-3	Perfluoropentanoic acid	0.066	0.005	0.002	0.00094	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0032	0.005	0.002	0.00075	µg/L	J	J	15		1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	335-76-2	Perfluorodecanoic acid	0.0017	0.005	0.002	0.0015	µg/L	J	J	15		1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0043	0.005	0.002	0.00049	µg/L	J	J	15		1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.022	0.005	0.002	0.00068	µg/L					1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	307-24-4	Perfluorohexanoic acid	0.026	0.005	0.002	0.00062	µg/L					1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	375-95-1	Perfluorononanoic acid	0.0016	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.024	0.005	0.002	0.0018	µg/L					1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.02	0.005	0.005	0.0015	µg/L					1

Attachment 2 (continued)
Summary of Analytical Results
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	2706-90-3	Perfluoropentanoic acid	0.028	0.005	0.002	0.00094	µg/L					1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0018	0.005	0.002	0.00075	µg/L	J	J	15		1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	335-76-2	Perfluorodecanoic acid	0.0024	0.005	0.002	0.0015	µg/L	J	J	15		1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0087	0.005	0.002	0.00049	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.0078	0.005	0.002	0.00068	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	307-24-4	Perfluorohexanoic acid	0.054	0.005	0.002	0.00062	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	375-95-1	Perfluorononanoic acid	0.0027	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.013	0.005	0.002	0.0018	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.032	0.005	0.005	0.0015	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	2706-90-3	Perfluoropentanoic acid	0.076	0.005	0.002	0.00094	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0099	0.0043	0.002	0.00075	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.0043	0.002	0.0015	µg/L	U	U			1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0037	0.0043	0.002	0.00049	µg/L	J	J	15		1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.03	0.0043	0.002	0.00068	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	307-24-4	Perfluorohexanoic acid	0.016	0.0043	0.002	0.00062	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	375-95-1	Perfluorononanoic acid	0.0014	0.005	0.005	0.0014	µg/L	U	U			1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.038	0.0043	0.002	0.0018	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.014	0.005	0.005	0.0015	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	2706-90-3	Perfluoropentanoic acid	0.007	0.0043	0.002	0.00094	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.011	0.0045	0.002	0.00075	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.0045	0.002	0.0015	µg/L	U	U			1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0047	0.0045	0.002	0.00049	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.04	0.0045	0.002	0.00068	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	307-24-4	Perfluorohexanoic acid	0.02	0.0045	0.002	0.00062	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	375-95-1	Perfluorononanoic acid	0.0014	0.005	0.005	0.0014	µg/L	U	U			1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.055	0.0045	0.002	0.0018	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.018	0.005	0.005	0.0015	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	2706-90-3	Perfluoropentanoic acid	0.0088	0.0045	0.002	0.00094	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.012	0.0045	0.002	0.00075	µg/L					1

Attachment 2 (continued)
Summary of Analytical Results
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.0045	0.002	0.0015	µg/L	U	U			1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	U			1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	375-85-9	Perfluoroheptanoic acid	0.005	0.0045	0.002	0.00049	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.042	0.0045	0.002	0.00068	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	307-24-4	Perfluorohexanoic acid	0.023	0.0045	0.002	0.00062	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	375-95-1	Perfluorononanoic acid	0.0014	0.005	0.005	0.0014	µg/L	U	U			1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.058	0.0045	0.002	0.0018	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.018	0.005	0.005	0.0015	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	2706-90-3	Perfluoropentanoic acid	0.0094	0.0045	0.002	0.00094	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	U			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.00075	0.005	0.002	0.00075	µg/L	U	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	335-76-2	Perfluorodecanoic acid	0.0015	0.005	0.002	0.0015	µg/L	U	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	307-55-1	Perfluorododecanoic acid	0.0048	0.005	0.005	0.0048	µg/L	U	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	375-85-9	Perfluoroheptanoic acid	0.00049	0.005	0.002	0.00049	µg/L	U	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.00068	0.005	0.002	0.00068	µg/L	U	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	307-24-4	Perfluorohexanoic acid	0.0023	0.005	0.002	0.00062	µg/L	J	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	375-95-1	Perfluorononanoic acid	0.0014	0.005	0.005	0.0014	µg/L	U	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.0018	0.005	0.002	0.0018	µg/L	U	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.0015	0.005	0.005	0.0015	µg/L	U	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	2706-90-3	Perfluoropentanoic acid	0.00094	0.005	0.002	0.00094	µg/L	U	nv			1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0026	0.005	0.005	0.0026	µg/L	U	nv			1

µg/L denotes micrograms per liter.
CAS denotes Chemical Abstracts Service.
EB denotes equipment blank.
DL denotes detection limit.
FD denotes field duplicate sample.
ft bgs denotes feet below ground surface.
ID denotes identification.
LC/MS denotes liquid chromatography/mass spectrometry.
LOD denotes limit of detection.
LOQ denotes limit of quantitation.
LQ denotes laboratory data qualifier.
MS denotes matrix spike.
MSD denotes matrix spike duplicate.
N denotes regular field sample.
QC denotes quality control.
R1 denotes validation qualifer reason code number 1.
R2 denotes validation qualifer reason code number 2.
VQ denotes validation qualifier.
WG denotes groundwater matrix.
WQ denotes water quality matrix.

Laboratory Data Qualifier Definitions:
No qualifier denotes analyte was detected in the associated sample.
J denotes the reported analyte is an estimated value.
U denotes the compound was analyzed for, but was not detected at the minimum DL.

Validation Qualifier Definitions:
No qualifier denotes analyte was detected in the associated sample; no qualification of the data required.
J denotes the analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed.
nv denotes the analyte was not validated.
U denotes not detected. The compound/analyte was analyzed for, but was not detected above the associated DL or above the reported concentration due to blank contamination.

Validation Qualifier Reason Code Definitions:
08A denotes MS/MSD/Duplicate results outside QC criteria.
15 denotes result reported below the LOQ and above the DL.

Attachment 3
Summary of Analytical Results greater than the Detection Limit

Attachment 3
Summary of Analytical Results greater than the Detection Limit
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0016	0.0045	0.002	0.00075	µg/L	J	J	15		1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0016	0.0045	0.002	0.00049	µg/L	J	J	15		1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.014	0.0045	0.002	0.00068	µg/L					1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	307-24-4	Perfluorohexanoic acid	0.0075	0.0045	0.002	0.00062	µg/L					1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.025	0.0045	0.002	0.0018	µg/L					1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.0061	0.005	0.005	0.0015	µg/L					1
S8-0485	08-6046	10/14/2015	N	WG	160	160	K1511678-002	LC/MS	2706-90-3	Perfluoropentanoic acid	0.0033	0.0045	0.002	0.00094	µg/L	J	J	15		1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0018	0.0044	0.002	0.00075	µg/L	J	J	15		1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0018	0.0044	0.002	0.00049	µg/L	J	J	15		1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.016	0.0044	0.002	0.00068	µg/L					1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	307-24-4	Perfluorohexanoic acid	0.0086	0.0044	0.002	0.00062	µg/L					1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.028	0.0044	0.002	0.0018	µg/L					1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.0069	0.005	0.005	0.0015	µg/L					1
S8-0486	08-6046	10/14/2015	FD	WG	160	160	K1511678-003	LC/MS	2706-90-3	Perfluoropentanoic acid	0.0036	0.0044	0.002	0.00094	µg/L	J	J	15		1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.15	0.005	0.002	0.00075	µg/L					1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	375-85-9	Perfluoroheptanoic acid	0.076	0.005	0.002	0.00049	µg/L					1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.75	0.25	0.1	0.034	µg/L					50
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	307-24-4	Perfluorohexanoic acid	0.43	0.25	0.1	0.031	µg/L					50
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	375-95-1	Perfluorononanoic acid	0.0015	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.89	0.25	0.1	0.09	µg/L					50
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.3	0.005	0.005	0.0015	µg/L		J	08A		1
S8-0487	08-6722	10/05/2015	N	WG	128	140.5	K1511321-001	LC/MS	2706-90-3	Perfluoropentanoic acid	0.18	0.005	0.002	0.00094	µg/L					1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.24	0.005	0.002	0.00075	µg/L					1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	375-85-9	Perfluoroheptanoic acid	0.12	0.005	0.002	0.00049	µg/L					1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	108427-53-8	Perfluorohexane sulfonate	1.2	0.25	0.1	0.034	µg/L					50
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	307-24-4	Perfluorohexanoic acid	0.66	0.25	0.1	0.031	µg/L					50
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	375-95-1	Perfluorononanoic acid	0.0027	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	1.6	0.25	0.1	0.09	µg/L					50
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.47	0.25	0.25	0.075	µg/L					50
S8-0488	08-6722	10/06/2015	N	WG	115	125.5	K1511321-002	LC/MS	2706-90-3	Perfluoropentanoic acid	0.29	0.005	0.002	0.00094	µg/L					1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.26	0.005	0.002	0.00075	µg/L					1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	375-85-9	Perfluoroheptanoic acid	0.16	0.005	0.002	0.00049	µg/L					1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	108427-53-8	Perfluorohexane sulfonate	1.6	0.25	0.1	0.034	µg/L					50
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	307-24-4	Perfluorohexanoic acid	0.82	0.25	0.1	0.031	µg/L					50
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	375-95-1	Perfluorononanoic acid	0.0042	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	2.3	0.25	0.1	0.09	µg/L					50

Attachment 3 (continued)
Summary of Analytical Results greater than the Detection Limit
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.66	0.25	0.25	0.075	µg/L					50
S8-0489	08-6722	10/06/2015	N	WG	88	98	K1511321-003	LC/MS	2706-90-3	Perfluoropentanoic acid	0.45	0.25	0.1	0.047	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.22	0.005	0.002	0.00075	µg/L					1
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	375-85-9	Perfluoroheptanoic acid	0.22	0.005	0.002	0.00049	µg/L					1
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	108427-53-8	Perfluorohexane sulfonate	2.2	0.25	0.1	0.034	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	307-24-4	Perfluorohexanoic acid	1	0.25	0.1	0.031	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	375-95-1	Perfluorononanoic acid	0.0064	0.005	0.005	0.0014	µg/L					1
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	2.8	0.25	0.1	0.09	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.96	0.25	0.25	0.075	µg/L					50
S8-0490	08-6722	10/06/2015	N	WG	74	86	K1511321-004	LC/MS	2706-90-3	Perfluoropentanoic acid	0.73	0.25	0.1	0.047	µg/L					50
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.24	0.01	0.004	0.0015	µg/L		J	08A		1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	375-85-9	Perfluoroheptanoic acid	0.31	0.01	0.004	0.00098	µg/L					1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	108427-53-8	Perfluorohexane sulfonate	2.8	0.2	0.08	0.028	µg/L		J	08A		20
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	307-24-4	Perfluorohexanoic acid	1.2	0.2	0.08	0.025	µg/L					20
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	375-95-1	Perfluorononanoic acid	0.0083	0.01	0.01	0.0028	µg/L	J	J	15		1
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	3.7	0.2	0.08	0.072	µg/L					20
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	1.5	0.2	0.2	0.06	µg/L					20
S8-0491	08-6723	10/14/2015	N	WG	93	93	K1511678-001	LC/MS	2706-90-3	Perfluoropentanoic acid	0.87	0.01	0.004	0.0019	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0017	0.005	0.002	0.00075	µg/L	J	J	15		1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	335-76-2	Perfluorodecanoic acid	0.0044	0.005	0.002	0.0015	µg/L	J	J	15		1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0076	0.005	0.002	0.00049	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.0074	0.005	0.002	0.00068	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	307-24-4	Perfluorohexanoic acid	0.042	0.005	0.002	0.00062	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	375-95-1	Perfluorononanoic acid	0.003	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.016	0.005	0.002	0.0018	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.029	0.005	0.005	0.0015	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	2706-90-3	Perfluoropentanoic acid	0.06	0.005	0.002	0.00094	µg/L					1
S8-0492	08-6724	10/07/2015	N	WG	160	170	K1511425-001	LC/MS	2058-94-8	Perfluoroundecanoic acid	0.0032	0.005	0.005	0.0026	µg/L	J	J	15	08A	1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0026	0.005	0.002	0.00075	µg/L	J	J	15		1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	335-76-2	Perfluorodecanoic acid	0.0031	0.005	0.002	0.0015	µg/L	J	J	15		1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0089	0.005	0.002	0.00049	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.013	0.005	0.002	0.00068	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	307-24-4	Perfluorohexanoic acid	0.053	0.005	0.002	0.00062	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	375-95-1	Perfluorononanoic acid	0.0031	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.018	0.005	0.002	0.0018	µg/L					1
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.034	0.005	0.005	0.0015	µg/L					1

Attachment 3 (continued)
Summary of Analytical Results greater than the Detection Limit
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0493	08-6724	10/07/2015	N	WG	110	120	K1511425-002	LC/MS	2706-90-3	Perfluoropentanoic acid	0.066	0.005	0.002	0.00094	µg/L					1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0032	0.005	0.002	0.00075	µg/L	J	J	15		1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	335-76-2	Perfluorodecanoic acid	0.0017	0.005	0.002	0.0015	µg/L	J	J	15		1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0043	0.005	0.002	0.00049	µg/L	J	J	15		1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.022	0.005	0.002	0.00068	µg/L					1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	307-24-4	Perfluorohexanoic acid	0.026	0.005	0.002	0.00062	µg/L					1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	375-95-1	Perfluorononanoic acid	0.0016	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.024	0.005	0.002	0.0018	µg/L					1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.02	0.005	0.005	0.0015	µg/L					1
S8-0494	08-6724	10/08/2015	N	WG	60	70	K1511425-004	LC/MS	2706-90-3	Perfluoropentanoic acid	0.028	0.005	0.002	0.00094	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0018	0.005	0.002	0.00075	µg/L	J	J	15		1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	335-76-2	Perfluorodecanoic acid	0.0024	0.005	0.002	0.0015	µg/L	J	J	15		1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0087	0.005	0.002	0.00049	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.0078	0.005	0.002	0.00068	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	307-24-4	Perfluorohexanoic acid	0.054	0.005	0.002	0.00062	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	375-95-1	Perfluorononanoic acid	0.0027	0.005	0.005	0.0014	µg/L	J	J	15		1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.013	0.005	0.002	0.0018	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.032	0.005	0.005	0.0015	µg/L					1
S8-0495	08-6724	10/08/2015	N	WG	17	27	K1511425-005	LC/MS	2706-90-3	Perfluoropentanoic acid	0.076	0.005	0.002	0.00094	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.0099	0.0043	0.002	0.00075	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0037	0.0043	0.002	0.00049	µg/L	J	J	15		1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.03	0.0043	0.002	0.00068	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	307-24-4	Perfluorohexanoic acid	0.016	0.0043	0.002	0.00062	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.038	0.0043	0.002	0.0018	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.014	0.005	0.005	0.0015	µg/L					1
S8-0496	08-6725	10/09/2015	N	WG	27.5	37.5	K1511544-003	LC/MS	2706-90-3	Perfluoropentanoic acid	0.007	0.0043	0.002	0.00094	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.011	0.0045	0.002	0.00075	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	375-85-9	Perfluoroheptanoic acid	0.0047	0.0045	0.002	0.00049	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.04	0.0045	0.002	0.00068	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	307-24-4	Perfluorohexanoic acid	0.02	0.0045	0.002	0.00062	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.055	0.0045	0.002	0.0018	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.018	0.005	0.005	0.0015	µg/L					1
S8-0497	08-6725	10/09/2015	N	WG	218	228	K1511544-001	LC/MS	2706-90-3	Perfluoropentanoic acid	0.0088	0.0045	0.002	0.00094	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	29420-43-3	Perfluorobutane sulfonate	0.012	0.0045	0.002	0.00075	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	375-85-9	Perfluoroheptanoic acid	0.005	0.0045	0.002	0.00049	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	108427-53-8	Perfluorohexane sulfonate	0.042	0.0045	0.002	0.00068	µg/L					1

Attachment 3 (continued)
Summary of Analytical Results greater than the Detection Limit
Site 8, Fire Department Training Area 2 PFC Investigation
Former Pease Air Force Base
Portsmouth, New Hampshire

Field Sample ID	Station Name	Sample Date	QC Sample Code	Sample Matrix	Start Depth (ft bgs)	End Depth (ft bgs)	Laboratory Sample ID	Analytical Method	CAS No.	Parameter	Result	LOQ	LOD	DL	Units	LQ	VQ	R1	R2	Dilution Factor
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	307-24-4	Perfluorohexanoic acid	0.023	0.0045	0.002	0.00062	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	1763-23-1	Perfluorooctane sulfonate (PFOS)	0.058	0.0045	0.002	0.0018	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	335-67-1	Perfluorooctanoic acid (PFOA)	0.018	0.005	0.005	0.0015	µg/L					1
S8-0498	08-6725	10/09/2015	FD	WG	218	228	K1511544-002	LC/MS	2706-90-3	Perfluoropentanoic acid	0.0094	0.0045	0.002	0.00094	µg/L					1
ER-S8-2015-PFC-1	FIELDQC	10/07/2015	EB	WQ	0	0	K1511425-003	LC/MS	307-24-4	Perfluorohexanoic acid	0.0023	0.005	0.002	0.00062	µg/L	J	nv			1

µg/L denotes micrograms per liter.
CAS denotes Chemical Abstracts Service.
EB denotes equipment blank.
DL denotes detection limit.
FD denotes field duplicate sample.
ft bgs denotes feet below ground surface.
ID denotes identification.
LC/MS denotes liquid chromatography/mass spectrometry.
LOD denotes limit of detection.
LOQ denotes limit of quantitation.
LQ denotes laboratory data qualifier.
MS denotes matrix spike.
MSD denotes matrix spike duplicate.
N denotes regular field sample.
QC denotes quality control.
R1 denotes validation qualifer reason code number 1.
R2 denotes validation qualifer reason code number 2.
VQ denotes validation qualifier.
WG denotes groundwater matrix.
WQ denotes water quality matrix.

Laboratory Data Qualifier Definitions:
No qualifier denotes analyte was detected in the associated sample.
J denotes the reported analyte is an estimated value.

Validation Qualifier Definitions:
No qualifier denotes analyte was detected in the associated sample; no qualification of the data required.
J denotes the analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed.
nv denotes the analyte was not validated.

Validation Qualifier Reason Code Definitions:
08A denotes MS/MSD/Duplicate results outside QC criteria.
15 denotes result reported below the LOQ and above the DL.

Attachment 4
Data Validation Qualifier Reason Code Definitions

Reason Code	Definition
01	Sample received outside of 4+/-2 °C
01A	Improper sample preservation
02	Holding time exceeded
02A	Extraction
02B	Analysis
03	Instrument performance—outside criteria
03A	BFB
03B	DFTPP
03C	DDT and/or Endrin percent breakdown exceeds criteria
03D	Retention time windows
03E	Resolution
04	Initial calibration results outside specified criteria
04A	Compound mean RRF QC criteria not met
04B	Individual %RSD criteria not met
04C	Correlation coefficient <0.995
05	Continuing calibration results outside specified criteria
05A	Compound mean RRF QC criteria not met
05B	Compound %D QC criteria not met
06	Result qualified as a result of the 5×/10× blank correction
06A	Method or preparation blank
06B	ICB or CCB
06C	ER
06D	TB
06E	FB
07	Surrogate recoveries outside control limits
07A	Sample
07B	Associated method blank or LCS
08	MS/MSD/duplicate results outside criteria
08A	MS and/or MSD recovery not within control limits (accuracy)
08B	%RPD outside acceptance criteria (precision)
09	Postdigestion spike outside criteria (GFAA)
10	Internal standards outside specified control limits

Reason Code	Definition
10A	Recovery
10B	Retention time
11	LCS recoveries outside specified limits
11A	Recovery
11B	%RPD (if run in duplicate)
12	Interference check standard
13	Serial dilution
14	Tentatively identified compounds
15	Quantitation
16	Multiple results available; alternate analysis preferred
17	Field duplicate RPD criteria is exceeded
18	Percent difference between original and second column exceeds QC criteria
19	Professional judgment was used to qualify the data
20	Pesticide cleanup checks
21	Target compound identification
22	Radiological calibration
23	Radiological quantitation
24	Reported result and/or laboratory qualifier revised to reflect validation findings

°C denotes degrees Celsius.
%D denotes percent difference.
%RPD denotes percent relative percent difference.
%RSD denotes percent relative standard deviation.
BFB denotes bromofluorobenzene.
CCB denotes continuing calibration blank.
DDT denotes dichlorodiphenyltrichloroethane.
DFTPP denotes decafluorotriphenylphosphine.
ER denotes equipment rinsate.
FB denotes field blank.
GFAA denotes graphite furnace atomic absorption.
ICB denotes initial calibration blank.
LCS denotes laboratory control sample.
MS denotes matrix spike.
MSD denotes matrix spike duplicate.
QC denotes quality control.
RPD denotes relative percent difference.
RRF denotes relative response factor.
TB denotes trip blank.

Appendix H
Groundwater Sample Collection and Purge Logs

08-6046

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

PROJECT: 143279

SITE ID: SITE 8: NEWINGTON CEMETERY LOCATION ID: 08-6046 (Well Number) SAMPLE #: S8-0485 +DUPLICATE S8-0486 Pump set at depth: 160' BGS

Purging Method/Equipment: ~~MICRO PURGE~~ GEOTECH SS GEOSUMP Sampling Equipment/ID No: SUBMERSIBLE PUMP (~~Serial~~ PINE EQUIPMENT No. 023911) Type of tubing: 3/8" ID POLY

Well Casing Diameter (in): 6" Unit Casing Volume: — Weather conditions: 70°F, OVERCAST.

Sounding (Depth to Well Bottom): 282' BGS Static Water Level (Depth to Water): 55.43' (FROM TOC) Screen Length: 85-282' BGS

Date	Time 24hr	Purge Rate (mL/min)	Dynamic H2O Level (ft)	Volume Purged ~~(mL)~~ LITER	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-14-15	13:00	200	55.43'	0	10.21	8.64	0.651	13.4	0.88	-124.0	C.B.	CLEAR, COLORLESS, NO ODOR.
10-14-15	13:10	200	55.46'	2	10.07	8.56	0.642	8.25	0.38	-96.1	C.B.	
10-14-15	13:20	200	55.46'	4	10.02	8.54	0.642	11.2	0.27	-98.7	C.B.	
10-14-15	13:30	200	55.46'	6	10.02	8.56	0.642	16.4	0.23	-114.5	C.B.	
10-14-15	13:40	200	55.46'	8	10.02	8.57	0.641	15.3	0.20	-107.1	C.B.	
10-14-15	13:45	SAMPLE TIME.										
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	:											
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	:											

CB 10-14-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

Recovery Depth* (ft from TOC): 55.43' Final Recovery Time* (min): 10

* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.

STRADDLE PACKER

ISOLATING SAMPLE ZONE
115.5-125.5'.

10-6-15

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BLEAKLE

PROJECT: 143279

- 9:32 INFLATED PACKERS -
27.46' TO WATER OUTSIDE & INSIDE PACKER
- 9:48 STARTED PURGING AT 1.5 GPM
- 9:50 CONFIRMED PACKER SEAL, MINOR LEAKAGE AFTER PUMP START, 1' HEAD DIFFERENCE INSIDE VS. OUTSIDE PACKER

28.94' V.S 27.82'

SITE ID: SITE 8 LOCATION ID: 08-6722 (Well Number) SAMPLE #: S8-0488 Pump set at depth: 126.5'

Purging Method/Equipment: ~~MICRO PURGE~~ GEOTECH SS GEOSUMP Sampling Equipment/ID No: SUBMERSIBLE PUMP (~~Serial~~ PUMP EQUIPMENT No. 023911) Type of tubing: 3/4" ID POLY

Well Casing Diameter (in): 4.5" Unit Casing Volume: 24 gal 3 WELL VOLUMES: 72 GAL Weather conditions: 60's, CLEAR.

Sounding (Depth to Well Bottom): ~140.5 Static Water Level (Depth to Water): 27.25' (TOC) TOC IS 1' ABOVE GROUND Screen Length: 74-140.5'

Date	Time 24hr	Purge Rate (~~mL/min~~)	Dynamic H2O Level (ft)	Volume Purged (~~mL~~) GAL	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description	OUTSIDE
10-6-15	9:50	1.5 GPM	28.94'	3 gal	9.5	8.17	0.488	17.2	1.63	144.0	C.B.	WATER CLEAR, COLORLESS, NO ODOR	
10-6-15	10:10	1.5 GPM	29.60'	24 gal	9.6	8.40	0.473	6.88	0.70	98.2	C.B.	↓	(28.90')
10-6-15	10:25	1.5 GPM	29.67'	48 gal	9.5	8.35	0.470	3.14	0.78	69.8	C.B.	↓	(29.00')
10-6-15	10:40	1.5 GPM	29.71'	72 gal	9.5	8.32	0.466	2.50	0.85	14.1	C.B.	↓	(29.05')
	↳ 10:40 COLLECTED SAMPLE S8-0488 FROM 115.5-125.5' ZONE												
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CB 10-6-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

~~Recovery Depth* (ft from TOC):~~ ~~Final Recovery Time* (min):~~ ~~* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.~~

SINGLE PACKER
ISOLATING SAMPLE ZONE 128-140.5' BGS

10-5-15

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BUERKLE

PROJECT: 143279

- 15:09 INFLATED PACKER
- 15:15 CONFIRMED PACKER SEAL. PACKER IS SEALED. MINOR LEAKAGE. → 0.5' HEAD DIFFERENCE INSIDE VS. OUTSIDE PACKERS INTERVAL.
- SINGLE PACKER SET AT 126-128'

SITE ID: SITE 8 LOCATION ID: 08-6722 (Well Number) SAMPLE #: S8-0487 + MS/MSD Pump set at depth: 125'

Purging Method/Equipment: ~~MICRO PURGE~~ GEOTECH SS GEOSUMP Sampling Equipment/ID No: SUBMERSIBLE PUMP (~~Serial~~ PINE EQUIPMENT No. 023911) Type of tubing: 3/8" ID POLY

Well Casing Diameter (in): 4.5" ~~Unit~~ PACKER Casing Volume: 28.5 gal 3 VOLUMES = 85.5 GAL Weather conditions: 60les, PARTLY CLOUDY

Sounding (Depth to Well Bottom): ~140.5' Static Water Level (Depth to Water): 27.11' (TOC). TOC IS 1' ABOVE GROUND Screen Length: 74-140.5'

15:41 START PURGING AT Q = 1.5 GPM

Date	Time 24hr	Purge Rate (mL/min)	Dynamic H2O Level (ft)	Volume Purged ~~(mL)~~ GAL	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-5-15	15:50	1.5 gpm	28.55'	15 gal	10.0	7.97	0.488	6.00	1.24	35.5	CB	CLEAR, COLORLESS, NO ODOR
10-5-15	16:00	1.5 GPM	28.81'	28.5 gal	9.7	8.21	0.471	4.33	0.94	17.7	CB	↓
10-5-15	16:25	1.5 GPM	29.05'	57 gal	9.7	8.38	0.456	2.35	0.77	-0.5	CB	↓
10-5-15	16:45	1.5 GPM	29.13'	85.5 gal	9.6	8.40	0.458	1.87	0.68	-10.5	CB	↓
	→ SAMPLE S8-0487 + MS/MSD COLLECTED											
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CB 10-5-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

CB ~~Recovery Depth* (ft from TOC):~~ ~~Final Recovery Time* (min):~~ ~~* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.~~

STRADDLE PACKER
ISOLATING SAMPLE ZONE
88 - 98' ~~BGS~~

- 11:09 INFLATED PACKERS 27.35' TO WATER INSIDE & OUTSIDE PACKERS.
- GOOD PACKER SEAL - MINOR LEAKAGE.
- 11:24 PUMP START AT 0.4 GPM
11:30 31.95, 27.75 (OUTSIDE)

10-6-15

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BUERKLE

PROJECT: 143279

SITE ID: SITE 8 LOCATION ID: 08-6722 (Well Number) SAMPLE #: S8-0489 Pump set at depth: ~97' (TOC)

Purging Method/Equipment: GEOTECH SS GEOSUB ~~MICRO PURGE~~ Sampling Equipment/ID No: SUBMERSIBLE PUMP (~~Serial~~ PINE EQUIPMENT No. 023911) Type of tubing: 3/8" POLY

Well Casing Diameter (in): 4.5" Unit Casing Volume: 19 gal [3 VOLUMES 57 gal] Weather conditions: 60ies, CLEAR.

Sounding (Depth to Well Bottom): ~140.5' Static Water Level (Depth to Water): 27.25' (TOC) TOC 1.5' ABOVE GROUND Screen Length: 74-140.5'

Date	Time 24hr	Purge Rate (~~mL/min~~)	Dynamic H2O Level (ft)	Volume Purged (mL)	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-6-15	11 : 30	0.4 GAL	31.95'	3 gal	10.0	8.98	0.470	58.7	0.87	8.1	C.B.	SL. CLOUDY, NO ODOR, COLORLESS
10-6-15	11 : 39	0.4 GPM	32.65	← WATER TABLE STILL DROPPING AT	VERY LOW	PUMPING RATES.				—	|	|
10-6-15	11 : 54	INCREASED	Q TO 1.5	GPM , 1219	INCREASED Q SINCE FLOW			RATE STARTED TO SLOW	DUE TO		FALLING	HEAD. (Q~1.8GPM)
10-6-15	12 : 10	1.8 GPM	63.20'	20 gal	9.9	9.29	0.439	47.1	1.22	22.4	|	↓
10-6-15	12 : 30	1.5 GPM	67.86'	38 gal	9.9	9.04	0.473	9.3	~~1.19~~ 0.88	23.8	|	CLEAR, COLORLESS, NO ODOR.
10-6-15	12 : 50	1.5 GPM	68.62'	57 gal	10.0	8.99	0.487	6.02	0.92	15.9	↓	↓ (38.20') OUTSIDE
	↳ 12:50 COLLECTED SAMPLE			S8-0489	FROM	88-98'	ZONE.					
	:											
	:											
	:			CB	10-6-15							
	:											
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	:											
	:											

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

~~Recovery Depth* (ft from TOC) : ______ Final Recovery Time* (min) : ______ * Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.~~

1118 INSERTED PUMP INSIDE: 26.35', OUTSIDE 27.17'

SET PACKER 86-88' TO CASE OFF 74-86' FOR SAMPLING (NOTE: 74' IS BOTTOM OF 5" CASING)

10-6-15

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER

PROJECT: 143279

- PACKER INFLATED AT 15:09 AND SEAL TESTED. GOOD SEAL (WATER LEAKAGE)

13:48 STARTED AT Q = 1.5 GPM

SITE ID: SITE 8 LOCATION ID: 08-6722 (Well Number) SAMPLE #: S8-0490 Pump set at depth: ~86'

Purging Method/Equipment: ~~MICRO PURGE~~ GEOTECH SS GEOSUB AP Sampling Equipment/ID No: SUBMERSIBLE PUMP PLUS EQUIPMENT (~~Serial~~ No. 023911) Type of tubing: 3/8" ID POLY TUBING

Well Casing Diameter (in): 4.5" Unit Casing Volume: 49 gal Weather conditions: 60's, CLEAR

Sounding (Depth to Well Bottom): ~140.5' Static Water Level (Depth to Water): 27.25' (TOC) Screen Length: 74-140.5'

13:40 DTW (TOC): 29.72' (= BEFORE PUMP START)

Date	Time 24hr	Purge Rate (~~ml/min~~)	Dynamic H2O Level (ft)	Volume Purged (~~mL~~) GAL	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-6-15	13:48	1.5 GPM	34.05'	2 GAL	10.2	9.85	0.454	16.3	0.86	-1.9	CB	CLEAR, COLORLESS, NO ODOR
10-6-15	14:27	1.0 GPM	55.90'	49 GAL	10.1	9.29	0.511	14.1	0.67	-4.1	C.B.	
10-6-15	14:41	INCREASED Q TO 1.5 GPM -										
10-6-15	15:03	PUMPED DRY AFTER PURGING 90 GAL. 15:06 SHUT PUMP OFF TO LET WATER RECHARGE										
10-6-15		15:10 55.90' DTW,		15:22	DTW: 55.40'							
	:	15:45 COLLECTED 74-86' SAMPLE S8-0490										
10-6-15	15:45	1.0 GPM	52.60'	100 GAL	10.4	8.40	0.622	3.60	0.46	-10.9	CB	
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CB 10-6-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

~~Recovery Depth* (ft from TOC) :~~ ______ ~~Final Recovery Time* (min) :~~ ______ ~~* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.~~

08-6723

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BUERKLE

PROJECT: 143279

SITE ID: SITE 8: NEWINGTON CEMETERY LOCATION ID: 08-6723 (Well Number) SAMPLE #: S8-0491 Pump set at depth: 93' BGS

Purging Method/Equipment: ~~MICRO PURGE~~ GEOTECH SS GEOSUB Sampling Equipment/ID No: SUBMERSIBLE PUMP (~~Serial~~ PINE EQUIPMENT No. 023911) Type of tubing: 3/8" ID POLY

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: —— Weather conditions: 70°F, PARTLY CLOUDY.

Sounding (Depth to Well Bottom): 108.5' BGS Static Water Level (Depth to Water): 55.01' (FROM TOC) Screen Length: 88-108.5' BGS

Date	Time 24hr	Purge Rate (mL/min)	Dynamic H2O Level (ft)	Volume Purged (~~mls~~ LITER)	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-14-15	10:25	200 mL/MIN	55.02'	0	10.17	7.65	0.799	117	8.91	-21.2	CB	SLIGHTLY CLOUDY LIGHT BROWN, NO ODOR
10-14-15	10:35	200	55.02'	2 LITERS	10.22	7.58	0.796	101	8.75	-35.4	CB	↓
10-14-15	10:45	200	55.02'	4 LITERS	10.19	7.56	0.800	79.2	8.31	-48.1	CB	CLEAR TO SL. CLOUDY, LIGHT BROWN TINT, NO ODOR.
10-14-15	10:55	200	55.02'	6 LITERS	10.21	7.50	0.809	65.4	8.07	-50.8	CB	
10-14-15	11:00	200	55.02'	7 LITERS	10.22	7.43	0.822	58.7	7.91	-47.2	CB	
10-14-15	11:10	200	55.02'	9 LITERS	10.23	7.38	0.831	51.3	7.88	-46.0	CB	
10-14-15	11:20	200	55.02'	11 LITERS	10.25	7.33	0.834	45.1	7.90	-42.5	CB	
10-14-15	11:30	200	55.02'	13 LITERS	10.30	7.31	0.836	38.8	7.94	-36.5	CB	
10-14-15	11:40	200	55.02'	15 LITERS	10.28	7.29	0.842	34.5	7.98	-30.7	CB	↓
10-14-15	11:50	200	55.02'	17 LITERS	10.29	7.27	0.842	27.6	8.04	-20.4	CB	CLEAR, COLORLESS, NO ODOR.
10-14-15	12:00	200	55.02	19 LITERS	10.32	7.27	0.844	24.2	8.01	-17.5	CB	
10-14-15	12:10	200	55.02	21 LITERS	10.34	7.26	0.846	23.1	8.05	-14.5	CB	↓
10-14-15	12:15	SAMPLE TIME.										
	CB 10-14-15											

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

Recovery Depth* (ft from TOC): 55.01' Final Recovery Time* (min): 10

* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.

12:24 INFLATED PACKER.

12:24
SET STRADDLE PACKER AT 160-170' BGS

10-7-15

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BLERKLE

PROJECT: 143279

12:35 DTW (INSIDE): 7.95', 12:36 8.22'
12:36 DTW (OUTSIDE): 8.35'
PUMP START AT 12:37 AT 1.5 GPM
12:38 DTW — 22.70' INSIDE / 8.40' OUTSIDE

SITE 8: NEWINGTON PUBLIC SCHOOL

SITE ID: SCHOOL LOCATION ID: 08-6724 (Well Number) SAMPLE #: S8-0492 Pump set at depth: 160'

Purging Method/Equipment: ~~MICRO PURGE~~ GEOTECH SS GEOSUB Sampling Equipment/ID No: SUBMERSIBLE PUMP (~~Serial~~ PING EQUIPMENT No. 02391) Type of tubing: 3/8" ID POLY

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: 30 GAL 3 VOLUMES: 90 GAL Weather conditions: 60-70's, CLEAR

Sounding (Depth to Well Bottom): ~180.8' Static Water Level (Depth to Water): 8.44' FROM 1' ABOVE TOC Screen Length: 19.2-180.8'

REFERENCE POINT IS PACKER RISER AT 1' ABOVE GROUND

Date	Time 24hr	Purge Rate ~~(mL/min)~~	Dynamic H2O Level (ft)	Volume Purged ~~(mL)~~ GAL	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description	
10-7-15	12:38	1.5 GPM	22.70'	1.5 GAL	11.9	7.51	3.03	49.6	6.62	-4.3	CB	CLOUDY, BROWN, NO ODOR	
10-7-15	13:03*	0.5 GPM	38.70'	30 GAL	11.8	6.78	2.97	36.1	3.41	-36.6	CB	SL. CLOUDY, LIGHT BROWN, NO ODOR	
10-7-15	13:40	1.0 GPM	35.50'	60 GAL	12.1	6.82	2.87	23.7	3.55	-49.9	CB	CLEAR, COLORLESS, NO ODOR	(8.47' OUTSIDE)
10-7-15	14:10	1.0 GPM	45.75'	90 GAL	11.9	6.78	2.89	9.10	3.60	-42.5	CB	↓	(8.49' OUTSIDE)
	↳ 14:10 COLLECTED 160-170' GW SAMPLE S8-0492.												
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CB 10-7-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

Recovery Depth* (ft from TOC): ________ Final Recovery Time* (min): ________ * Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.

* Q DROPPED TO >0.5 GPM. 13:05 INCREASED Q TO 1.0 GPM

13:17 DTW: 36.20' / 8.48' (~~OUT~~ INSIDE / OUTSIDE) ⟹ GOOD PACKER SEAL.

14:35 SET STRADDLE PACKER TO ISOLATE 110-120' ZONE (BGS).

14:35 INFLATED STRADDLE PACKER 110-120' BGS.
14:37 DTW*: 8.45'/8.45' (INSIDE/OUTSIDE)
PUMP START AT 14:42

GOOD PACKER SEAL:
WATER CONSTANT AT 8.50'
OUTSIDE PACKER.

10-7-15

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BLENKLE

PROJECT: 143279

SITE ID: SITE 8: NEWINGTON PUBLIC ~~SCHOOL~~ LOCATION ID: 08-6724 (Well Number) SAMPLE #: S8-0493 Pump set at depth: 110'.

Purging Method/Equipment: ~~MICRO PURGE~~ GEOTECH SS GEOSUMP Sampling Equipment/ID No: SUBMER~~SIBLE PUMP~~ PINE EQUIPMENT ~~(Serial~~ No. 023911) Type of tubing: 3/16 POLY

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: ~~2~~ 22 gal ~~66~~ gal = 3 VOLUMES Weather conditions: 60-70 DEG, CLEAR

Sounding (Depth to Well Bottom): ~180.8' Static Water Level (Depth to Water*): 8.44' Screen Length: 19.2-130.8'

Date	Time 24hr	Purge Rate (~~mL/min~~ GPM)	Dynamic* H2O Level (ft)	Volume Purged ~~(mL)~~ GAL	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description	DTW* OUTSIDE PACKER.
10-7-15	14:47	1.5 GPM	38.50'	8 GAL	12.1	6.71	2.81	17.6	4.34	1.7	CB	CLEAR, COLORLESS, NO ODOR	8.50'
10-7-15	15:05	1.1 GPM	64.30'	24 GAL	12.2	6.70	2.80	23.3	3.68	-29.8	CB	↓	8.50'
10-7-15	15:27	1.0 GPM	94.70'	44 GAL	12.4	6.90	2.85	23.2	2.96	-62.6	CB		8.50'
10-7-15	15:50	1.0 GPM	93.80'	66 GAL	12.5	6.82	2.79	17.2	3.35	-70.9	CB		8.50'
	↳ 15:50 COLLECTED 110-120' SAMPLE S8-0493												
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CB 10-7-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

~~Recovery Depth* (ft from TOC): Final Recovery Time* (min): * Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.~~ CB

* DTW MEASURED FROM 1' ABOVE TOC.

SETTING STRADDLE PACKER TO ISOLATE 17-27' ZONE

10-8-15

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BUENKE

PROJECT: 143279

10:00 SET STRADDLE PACKER 17-27'.
DTW*: 8.65'/8.65' (INSIDE/OUTSIDE).
10:01 INFLATED PACKER
DTW*: 8.52'/8.63' (INSIDE/OUTSIDE)
10:23 PUMP START

SITE ID: SITE 8 NEWINGTON PUBLIC SCHOOL LOCATION ID: 08-6724 (Well Number) SAMPLE #: S8-0495 Pump set at depth: 17'

Purging Method/Equipment: MICRO PURGE Sampling Equipment/ID No: SUBMERSIBLE PUMP (~~Serial~~ PINE EQUIPMENT No. 023911) Type of tubing: 3/8" ID POLY

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: 6.5 gal $\boxed{\text{3 VOLUMES = 19.5 GAL}}$ Weather conditions: 60-70°F, CLEAR

Sounding (Depth to Well Bottom): 180.8' Static Water Level (Depth to Water): 8.44' Screen Length: 19.2-180.8'

Date	Time 24hr	Purge Rate GPM ~~(ml/min)~~	Dynamic H2O Level (ft)	Volume Purged ~~(mL)~~ GAL	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description	DTW* OUTSIDE PACKER
10-8-15	10:25	0.5 GPM	8.63'	1 GAL	11.6	6.80	2.57	9.51	4.22	-24.3	C.B.	WATER CLEAR, COLORLESS, NO ODOR	8.55'
10-8-15	10:35	0.5 GPM**	8.72'	6 GAL	11.8	6.62	2.58	3.50	4.52	3.6	C.B.	↓	8.57'
10-8-15	10:50	1.8 GPM	8.93'	33 GAL	11.8	6.60	2.70	0.90	4.46	24.3	C.B.	↓	8.60'
10-8-15	11:05	1.8 GPM	8.95'	60 GAL	11.9	6.59	2.62	0.39	4.71	43.7	C.B.	↓	8.63'
	↳: 11:15 COLLECTED GROUNDWATER SAMPLE 17-27' (S8-0495).												
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CB 10-8-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

~~Recovery Depth* (ft from TOC): Final Recovery Time* (min):~~ * ~~Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.~~

* DTW MEASURED FROM 1' ABOVE TOC

** 10:38 INCREASED Q TO 1.8 GPM

SET STRADDLE PACKER TO ISOLATE 60-70' ZONE (BGS)

10-8-15

8:30 SET STRADDLE PACKER AT 60-70' BGS
8:40 SET PUMP AT 60' BGS
8:40 DTW*: 8.55'/8.55' (INSIDE/OUTSIDE PACKER)
8:45 INFLATED PACKERS.
8:55 PUMP START.

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BURKE

GOOD PACKER SEAL: WATER OUTSIDE PACKER NOT DROPPING -

PROJECT: 143279

SITE ID: SITE 8: NEWINGTON PUBLIC SCHOOL LOCATION ID: 08-6724 (Well Number) SAMPLE #: S8-0494 Pump set at depth: 60'

Purging Method/Equipment: MICRO PURGE Sampling Equipment/ID No: SUBMERSIBLE PUMP (PINE EQUIPMENT ~~Serial~~ No. 023911) Type of tubing: 3/8" ID POLY

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: 14 gal (3 Vol: 42 gal) Weather conditions: 60's, CLEAR

Sounding (Depth to Well Bottom): ~180.8' Static Water Level (Depth to Water)*: 8.44' Screen Length: 19.2-180.8'

Date	Time 24hr	Purge Rate ~~(ml/min)~~ GPM	Dynamic H2O Level* (ft)	Volume Purged ~~(mL)~~ Gal	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description	OUTSIDE PACKER
10-8-15	8:56	2 GPM	8.66'	1 GAL	10.6	6.94	2.78	12.4	4.46	80.9	C.B.	CLEAR, COLORLESS, NO ODOR	8.54'
10-8-15	9:03	2 GPM	10.64'	16 GAL	10.2	6.98	2.32	2.67	1.63	29.4	C.B.	↓	8.58'
10-8-15	9:10	2 GPM	10.70'	30 GAL	10.3	7.07	2.16	0.80	1.26	20.3	C.B.	↓	8.58'
10-8-15	9:17	2 GPM	10.71'	44 GAL	10.2	7.11	2.13	1.09	1.16	9.4	C.B.	↓	8.58'
	→ 9:20 COLLECTED 60-70' SAMPLE S8-0494												
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CB 10-8-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

Recovery ~~Depth* (ft from TOC):~~ ______ ~~Final Recovery Time* (min):~~ ______ ~~* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.~~

*BOTH MEASURED FROM 1' BELOW TOC.

~~3 FAD~~ SINGLE PACKER AT 218' TO SAMPLE 218-228'

10-9-15

800 INFLATED PACKER 218'

8:51 PUMP START

9:00 CONFIRMED PACKER SEAL. ONLY MINOR CHANGE OR FLOW/COMMUNICATION.

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BUERKLE

PROJECT: 143279

SITE ID: SITE 8 (FRIZZELL PROPERTY) LOCATION ID: 08-6725 (Well Number) SAMPLE #: S8-0497 + DUP S8-0498 Pump set at depth: 200'

Purging Method/Equipment: GEOSUB SS ~~MICRO PURGE~~ Sampling Equipment/ID No: SUBMERSIBLE PUMP (PINE EQUIPMENT ~~Serial~~ No. 023911) Type of tubing: 3/8" ID POLY

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: 38 gal (3 VOLUMES = 114 gal) Weather conditions: 60'S, OVERCAST

Sounding (Depth to Well Bottom): 228' Static Water Level (Depth to Water): 9.29' (BGS) Screen Length: 27.5-228'

Date	Time 24hr	Purge Rate (~~mL/min~~ GPM)	Dynamic H2O Level (ft)	Volume Purged (~~mL~~ Gal)	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description	DTW OUTSIDE PACKER
10-9-15	8:53	1.7 GPM	9.25'	3	10.4	7.34	1.14	2.05	1.99	-103.4	C.B.	CLEAR, COLORLESS, NO ODOR	8.83' BGS
AT 8:59 INCREASED Q TO 2 GPM													9.04' BGS
10-9-15	8:58	2 GPM	9.71'	13	10.2	7.49	1.13	0.92	0.87	-146.2	C.B.	CLEAR, COLORLESS, NO ODOR	9.21' BGS
10-9-15	9:15	2 GPM	9.95'	48	10.2	7.56	1.13	0.64	0.76	-143	C.B.	↓	9.34' BGS
10-9-15	9:35	2 GPM	10.08'	88	10.3	7.61	1.13	0.54	0.86	-133.3	C.B.		—
10-9-15	9:55	2 GPM	10.18'	128	10.2	7.63	1.12	0.65	0.99	-131.0	C.B.		9.39' BGS
	9:55 COLLECTED 218-228' SAMPLE S8-0497 + DUPLICATE S8-0498.												
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CB 10-9-15

~~NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.~~

~~Recovery Depth* (ft from TOC): Final Recovery Time* (min):~~ ~~* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.~~

NOTE: DTW MEASUREMENTS ARE FROM GROUND SURFACE AT THIS LOCATION.

11:14 DTW: 9.45'
11:15 ~~[illegible]~~ INFLATED PACKER AT 37.5' BGS
11:21 DTW: 8.82' (WATER SLOWLY COMING UP)
GOOD PACKER SEAL
11:27 PUMP START:

SINGLE PACKER SET AT ~~TO~~ SAMPLE 27.5-37.5' ZONE

10-9-15

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BUERKLE

PROJECT: 143279

SITE ID: SITE 8: ~~FRIZZELL~~ PROPERTY LOCATION ID: 08-6725 (Well Number) SAMPLE #: 58-0496 Pump set at depth: 27.5'

Purging Method/Equipment: MICRO PURGE Sampling Equipment/ID No: SUBMERSIBLE PUMP (~~Serial~~ PLUS EQUIPMENT No. 023911) Type of tubing: 3/8" ID POLY

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: 17.5 Gal (3VOC = 52.5gal) Weather conditions: 60ies, RAIN

Sounding (Depth to Well Bottom): ~228' Static Water Level (Depth to Water): 9.29' BGS Screen Length: 27.5-228'

Date	Time 24hr	Purge Rate (~~ml/min~~ GPM)	Dynamic H2O Level (ft)	Volume Purged (~~mL~~ GAL)	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-9-15	11:27	1.3 Gpm	9.39'	0	11.0	7.61	1.08	18.2	2.11	-168.4	CB.	CLEAR, COLORLESS, NO ODOR
10-9-15	11:43	1.0 Gpm	19.65'	18	10.7	7.58	1.15	6.32	0.87	-141.9		
10-9-15	12:00	1.0 Gpm	21.00'	36	10.6	7.55	1.17	2.60	0.72	-135.7		
10-9-15	12:18	1.0 Gpm	21.43'	54	10.6	7.55	1.19	2.01	0.79	-129.4		
	:	12:20 COLLECTED 27.5-37.5' SAMPLE 58-0496.										
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CB 10-9-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

~~Recovery Depth* (ft from TOC): ________ Final Recovery Time* (min): ________ * Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.~~

NOTE: ALL DTW MEASUREMENTS ARE FROM GROUND SURFACE.

8:39 PUMP START

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BLEAKLE

PROJECT: 143279

SITE ID: SITE 8 (NEWINGTON PUBLIC SCHOOL) LOCATION ID: 08-6724 (Well Number) SAMPLE #: S8-0499 TUBING ~~Pump~~ set at depth: 24' BGS

Purging Method/Equipment: MICRO PURGE Sampling Equipment/ID No: PERISTALTIC ~~SUBMERSIBLE~~ PUMP (Serial No. 2290) Type of tubing: POLY TUBING

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: — Weather conditions: 30°F, CLEAR

Sounding (Depth to Well Bottom): ~180.8' Static Water Level (Depth to Water TOC): 8.56' Screen Length: 19.2-180.8'

Date	Time 24hr	Purge Rate (mL/min)	Dynamic H2O Level (ft)	Volume Purged (mL)	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-19-15	8:39	300	8.59	0	11.3	7.10	1.61	24.8	4.21	-59.3	CB	SL. CLOUDY, COLORLESS, NO ODOR
10-19-15	8:59	300	8.59	6,000	11.0	6.67	1.77	5.76	4.54	-49.5	CB	CLEAR, COLORLESS, NO ODOR
10-19-15	9:10	300	8.59	9,000	10.8	6.59	1.09	4.10	4.32	-37.7	CB	↓
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CB 10-19-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

Recovery Depth* (ft from TOC): 8.56' Final Recovery Time* (min): 10

* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.

Groundwater Purge Log

9:45 PUMP STARTED

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BURKLE

PROJECT: 143279

SITE ID: SITE 8 (NEWINGTON PUBLIC SCHOOL) LOCATION ID: 08-6724 (Well Number) SAMPLE #: S8-0500 ~~Pump~~ TUBING set at depth: 169'/BGS

Purging Method/Equipment: MICRO PURGE Sampling Equipment/ID No: SUBMERSIBLE PUMP (Serial No. 2290) Type of tubing: POLY TUBING

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: — Weather conditions: 30°F, CLEAR

Sounding (Depth to Well Bottom): ~180.8' Static Water Level (Depth to Water): 8.56 Screen Length: 19.2'-180.8'

Date	Time 24hr	Purge Rate (mL/min)	Dynamic H2O Level (ft)	Volume Purged (mL)	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-19-15	9:45	300	8.59	0	9.9	6.65	2.29	4.33	4.44	4.1	C.B.	CLEAR, COLORLESS, NO ODOR
10-19-15	9:55	300	8.59	3,000	10.1	6.70	2.35	11.7	4.60	6.0	C.B.	
10-19-15	10:05	300	8.59	6,000	10.2	6.72	2.36	5.43	4.66	5.7	C.B	
10-19-15	10:15	300	8.59	9,000	10.4	6.73	2.36	4.87	4.74	6.4	C.B	
	→ 10:20 COLLECTED SAMPLES			S8-0500								
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CB 10-19-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

Recovery Depth* (ft from TOC): 8.56' Final Recovery Time* (min): 10

* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.

10:52 PUMP START

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BUERKLE

PROJECT: 143279

SITE ID: SITE 8 (FRIZZELL PROPERTY) LOCATION ID: 08-6725 (Well Number) SAMPLE #: S8-0501 TUBING ~~Pump~~ set at depth: 32.5'

Purging Method/Equipment: MICRO PURGE Sampling Equipment/ID No: PERISTALTIC ~~SUBMERSIBLE~~ PUMP (Serial No. 2290) Type of tubing: POLY TUBING

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: — Weather conditions: 32° F, CLEAR

Sounding (Depth to Well Bottom): ~228' Static Water Level (Depth to Water): 8.85' Screen Length: 27.5-228'

Date	Time 24hr	Purge Rate (mL/min)	Dynamic H2O Level (ft)	Volume Purged (mL)	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-19-15	10:52	300	8.87'	0	10.7	7.16	1.05	4.21	2.12	-159.6	C.B	CLEAR, COLORLESS, NO ODOR.
10-19-15	11:02	300	8.90'	3,000	11.3	7.44	1.03	4.10	1.01	-179.7	C.B	
10-19-15	11:12	300	8.90'	6,000	11.2	7.50	1.03	3.25	0.91	-182.3	C.B.	
10-19-15	11:22	300	8.90'	9,000	11.3	7.57	1.03	1.92	0.87	-185.1	C.B.	
	11:25	COLLECTED SAMPLE S8-0501 FROM 32.5'.										
	:											
	:											
	:											
	:											
	:											
	:											
	:											
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	:											

SB 10-19-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

Recovery Depth* (ft from TOC) : 8.85' Final Recovery Time* (min) : 10

* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.

11:42 PUMP START.

Groundwater Purge Log

Former Pease Air Force Base, Portsmouth, NH

SAMPLER: CHRIS BURRILLE

PROJECT: 143279

SITE ID: SITE 8 (FRIZZELL PROPERTY) LOCATION ID: 08-6725 (Well Number) SAMPLE #: S8-0502 Pump set at depth: 223'

Purging Method/Equipment: MICRO PURGE Sampling Equipment/ID No: ~~SUBMERSIBLE~~ PERISTALTIC PUMP (Serial No. 2290) Type of tubing: POLY TUBING

Well Casing Diameter (in): 3 7/8" Unit Casing Volume: — Weather conditions: 32°F, CLEAR

Sounding (Depth to Well Bottom): ~228' Static Water Level (Depth to Water): 8.85' Screen Length: 27.5-228'

Date	Time 24hr	Purge Rate (mL/min)	Dynamic H2O Level (ft)	Volume Purged (mL)	Temp C°	pH	Specific Cond. (mS/cm)	Turbidity (NTU)	Dissolved oxygen (mg/L)	ORP (mV)	Prepared By:	Water Description
10-19-15	11 : 42	300	8.90'	0	11.6	7.60	1.09	3.49	0.86	-172.2	CB	CLEAR, COLORLESS, NO ODOR.
10-19-15	11 : 52	300	8.90'	3,000	11.7	7.53	1.09	3.20	0.79	-169.1	CB	
10-19-15	12 : 02	300	8.90'	6,000	11.9	7.66	1.09	3.30	0.99	-156.4	CB	
10-19-15	12 : 12	300	8.90'	9,000	11.7	7.66	1.09	2.57	0.79	-160.0	CB	
10-19-15	→ 12:20	SAMPLE	S8-052	FROM 223'	COLLECTED.							
	:											
	:											
	:											
	:											
	:											
	:											
	:											
	:											
	:											

CB 10-19-15

NOTE - DO NOT FORGET TO INCLUDE THE UNITS FOR THE CONDUCTIVITY READINGS.

Recovery Depth* (ft from TOC): 8.85' Final Recovery Time* (min): 10

* Taken As Final Water Level Reading and Time after sampling is complete and well has recovered.

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6046

RFA / COC Number 101415-01

Sample Number S8-0485

Logging Co

Filtered Sample Total

Collection Date 10-14-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 13:45

Sample Type Ground Water *Sample Purpose* Investigatory

Start Depth 160'

QC Code NORMAL

End Depth 160'

Sampling Equipment GEOTECH SS GEOSUB + POLY TUBING.

Sample Matrix GROUNDWATER

QC Partners:

(TB) – *(EB)* – *(FB)* –

SampleTeam CHRIS BERKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: PUMP INTAKE AT 160'. LOW FLOW SAMPLING. OPEN HOLE SECTION 85-282' BGS.

Sketch Location:

Logged By / Date: 10-14-15, [signature]

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6046

RFA / COC Number 101415-01

Sample Number S8-0486

Logging Co

Filtered Sample Total

Collection Date 10-14-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 13:45

Sample Type Ground Water *Sample Purpose* Investigatory

Start Depth 160'

QC Code FIELD DUPLICATE

End Depth 160'

Sampling Equipment GEOTECH SS GEOSUB + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BURKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: DUP OF S8-0485.
(PUMP INTAKE AT 160', LOW FLOW SAMPLE, OPEN HOLE SECTION 85-282' BGS).

Sketch Location:

Logged By / Date: [signature] / 10-14-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6722

RFA / COC Number 100715-01

Sample Number S8-0487

Logging Co

Filtered Sample Total

Collection Date 10-5-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 1614 5

Sample Type Ground Water

Sample Purpose Investigatory

Start Depth 128'

QC Code NORMAL

End Depth 140.5'

Sampling Equipment GEOTECH SS GEOSUB & POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BURKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: (SINGLE PACKER SET 126-128')

Sketch Location:

Logged By / Date: [signature], 10-5-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code	08-6722	*RFA / COC Number*	100715-01
Sample Number	S8-0487-MS	*Logging Co*	
Filtered Sample	Total	*Collection Date*	10-5-15
Sampling Method	SUBMERSIBLE PUMP	*Collection Time*	1645
Sample Type	Ground Water	*Start Depth*	128'
Sample Purpose	Investigatory	*End Depth*	140.5'
QC Code	MATRIX SPIKE	*Sample Matrix*	GROUNDWATER
Sampling Equipment	GEOTECH SS GEOSUB + POLY TUBING	*SampleTeam*	CHRIS BURRELLS

QC Partners:

(TB) — *(EB)* — *(FB)* —

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: (SINGLE PACKER SET 126-128')

Sketch Location:

Logged By / Date: [signature], 10-5-15 *Reviewed By / Date:*

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6722

RFA / COC Number 100715-01

Sample Number S8-0487-MSD

Logging Co

Filtered Sample Total

Collection Date 10-5-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 1645

Sample Type Ground Water *Sample Purpose* Investigatory

Start Depth 128'

QC Code MATRIX SPIKE DUPLICATE

End Depth 140.5'

Sampling Equipment GEOTECH SS GEOSUB & POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BURKE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: (SINGLE PACKER SET 126-128')

Sketch Location:

Logged By / Date: [signature] / 10-5-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6722

RFA / COC Number 100715-01

Sample Number S8-0488

Logging Co

Collection Date 10-6-15

Filtered Sample Total

Collection Time 10:40

Sampling Method SUBMERSIBLE PUMP

Start Depth 115.5'

Sample Type Ground Water *Sample Purpose* Investigatory

End Depth 125.5'

QC Code NORMAL

Sampling Equipment GEOTECH SS GEOSUMP + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BURKE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: —

Sketch Location:

Logged By / Date: [signature] / 10-6-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6722

RFA / COC Number 100715-01

Sample Number S8-0489

Logging Co

Collection Date 10-6-15

Filtered Sample Total

Collection Time 12:50

Sampling Method SUBMERSIBLE PUMP

Start Depth 88'

Sample Type Ground Water

Sample Purpose Investigatory

End Depth 98'

QC Code NORMAL

Sampling Equipment GEOTECH SS GEOSUMP + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) —

(EB) —

(FB) —

SampleTeam CHRIS BLEAKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: —

Sketch Location:

Logged By / Date: [signature] / 10-6-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6722

RFA / COC Number 100715-01

Sample Number S8-0490

Logging Co

Filtered Sample Total

Collection Date 10-6-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 1545

Start Depth 74'

Sample Type Ground Water *Sample Purpose* Investigatory

End Depth 86'

QC Code NORMAL

Sampling Equipment GEOTECH SS GEOSUB + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BURKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: —

Sketch Location:

Logged By / Date: [signature] / 10-6-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6723 *RFA / COC Number* 101415-01

Sample Number S8-0491 *Logging Co*

Filtered Sample Total *Collection Date* 10-14-15

Sampling Method SUBMERSIBLE PUMP *Collection Time* 12:15

Sample Type Ground Water *Sample Purpose* Investigatory *Start Depth* ~~88'-108.5~~ 93'

QC Code NORMAL *End Depth* ~~108.5~~ 93'

Sampling Equipment GEOTECH SS GEOSUB + POLY TUBING *Sample Matrix* GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* — *SampleTeam* CHRIS BUERKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: (PUMP INTAKE SET AT 93'). LOW FLOW SAMPLES. OPEN HOLE SECTION 88-108.5'

Sketch Location:

Logged By / Date: [signature], 10-14-15 *Reviewed By / Date:*

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6724

RFA / COC Number 100815-01

Sample Number S8-0492

Logging Co

Filtered Sample Total

Collection Date 10-7-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 14:10

Sample Type Ground Water

Sample Purpose Investigatory

Start Depth 160'

QC Code NORMAL

End Depth 170'

Sampling Equipment GEOTECH SS GEOSUB + POLY TUBING.

Sample Matrix GROUNDWATER

QC Partners:

(TB) – *(EB)* ✓ *(FB)* –

SampleTeam CHRIS BURKS

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments:

Sketch Location:

Logged By / Date: [signature], 10-7-15

Reviewed By / Date:

Sample Collection Log

CB&I

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6724

RFA / COC Number 100815-01

Sample Number S8-0493

Logging Co

Filtered Sample Total

Collection Date 10-7-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 15:50

Start Depth 110'

Sample Type Ground Water *Sample Purpose* Investigatory

End Depth 120'

QC Code NORMAL

Sampling Equipment GEOTECH SS GEOSUB + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* ✓ *(FB)* —

SampleTeam CHRIS BLAKKE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: —

Sketch Location:

Logged By / Date: [signature], 10-7-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6724

RFA / COC Number 100815-01

Sample Number S8-0494

Logging Co

Filtered Sample Total

Collection Date 10-8-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 9:20

Start Depth 60'

Sample Type Ground Water *Sample Purpose* Investigatory

QC Code NORMAL

End Depth 70'

Sampling Equipment GEOTECH SS GEOSUMP + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BURKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type			Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250	ML	250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: —

Sketch Location:

Logged By / Date: [signature], 10-8-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6724

RFA / COC Number 100815-01

Sample Number S8-0495

Logging Co

Collection Date 10-8-15

Filtered Sample Total

Collection Time 11:15

Sampling Method SUBMERSIBLE PUMP

Start Depth 17'

Sample Type Ground Water *Sample Purpose* Investigatory

End Depth 27'

QC Code NORMAL

Sampling Equipment GEOTECH SS GEOPUMP + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BUERKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type			Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250	ML	250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: —

Sketch Location:

Logged By / Date: [signature], 10-8-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6725

RFA / COC Number 101315-02

Sample Number S8-0496

Logging Co

Filtered Sample Total

Collection Date 10-9-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 12:20

Sample Type Ground Water *Sample Purpose* Investigatory

Start Depth 27.5'

QC Code NORMAL

End Depth 37.5'

Sampling Equipment GEOTECH SS GEOSUB + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — (EB) — (FB) —

SampleTeam CHRIS BERKE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: —

Sketch Location:

Logged By / Date: [signature], 10-9-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6725

RFA / COC Number 101315-02

Sample Number S8-0497

Logging Co

Filtered Sample Total

Collection Date 10-9-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 9:55

Sample Type Ground Water

Sample Purpose Investigatory

Start Depth 218'

QC Code NORMAL

End Depth 228'

Sampling Equipment GEOTECH SS GEOSUB + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS DURKLES

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: —

Sketch Location:

Logged By / Date: [signature], 10-9-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6725

RFA / COC Number 101315-02

Sample Number S8-0498

Logging Co

Filtered Sample Total

Collection Date 10-9-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 9:55

Sample Type Ground Water *Sample Purpose* Investigatory

Start Depth 218'

QC Code FIELD DUPLICATE

End Depth 228'

Sampling Equipment GEOTECH SS GEOSUB + POLY TUBING.

Sample Matrix GROUNDWATER

QC Partners:

(TB) ______ *(EB)* ______ *(FB)* ______

SampleTeam CHRIS BLENKES

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: DUP OF S8-0497.

Sketch Location:

Logged By / Date: [signature] / 10-9-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6724

RFA / COC Number 101915-01

Sample Number S8-0499

Logging Co

Filtered Sample Total

Collection Date 10-19-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 9:15

Sample Type Ground Water

Sample Purpose Investigatory

Start Depth 24'

QC Code NORMAL

End Depth 24'

Sampling Equipment PERISTALTIC PUMP + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BUERKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type			Preservative	Lab
Chloride, Nitrate, and Sulfate by EPA 300	A	Total	1	125	ML	125 mL Poly Container	Cool to 4°	SEACOAST ANALYTICA
Total Coliforms by A9221B	B	Total	1	125	ML	125 mL Poly Container	Cool to 4°	SEACOAST ANALYTICA

Comments: —

Sketch Location:

Logged By / Date: [signature] / 10-19-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6724

RFA / COC Number 101915-01

Sample Number S8-0500

Logging Co

Filtered Sample Total

Collection Date 10-19-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 10120

Sample Type Ground Water *Sample Purpose* Investigatory

Start Depth 169'

QC Code NORMAL

End Depth 169'

Sampling Equipment PERISTALTIC PUMP + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) – *(EB)* – *(FB)* –

SampleTeam CHRIS BLEAKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type			Preservative	Lab
Chloride, Nitrate, and Sulfate by EPA 300	A	Total	1	125	ML	125 mL Poly Container	Cool to 4°	SEACOAST ANALYTICA
Total Coliforms by A9221B	B	Total	1	125	ML	125 mL Poly Container	Cool to 4°	SEACOAST ANALYTICA

Comments: –

Sketch Location:

Logged By / Date: [illegible] , 10-19-15 *Reviewed By / Date:*

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6725

RFA / COC Number 101915-01

Sample Number S8-0501

Logging Co

Filtered Sample Total

Collection Date 10-19-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 1125

Start Depth 32.5'

Sample Type Ground Water *Sample Purpose* Investigatory

End Depth 32.5'

QC Code NORMAL

Sampling Equipment PERISTALTIC PUMP + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BURRICS

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type			Preservative	Lab
Chloride, Nitrate, and Sulfate by EPA 300	A	Total	1	125	ML	125 mL Poly Container	Cool to 4°	SEACOAST ANALYTIC/
Total Coliforms by A9221B	B	Total	1	125	ML	125 mL Poly Container	Cool to 4°	SEACOAST ANALYTIC/

Comments: —

Sketch Location:

Logged By / Date: [signature] , 10-19-15 *Reviewed By / Date:*

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code 08-6725

RFA / COC Number 101915-01

Sample Number S8-0502

Logging Co

Filtered Sample Total

Collection Date 10-19-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 12:20

Sample Type Ground Water

Sample Purpose Investigatory

Start Depth 223'

QC Code NORMAL

End Depth 223'

Sampling Equipment PERISTALTIC PUMP + POLY TUBING

Sample Matrix GROUNDWATER

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BERRIGG

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type			Preservative	Lab
Chloride, Nitrate, and Sulfate by EPA 300	A	Total	1	125	ML	125 mL Poly Container	Cool to 4°	SEACOAST ANALYTIC
Total Coliforms by A9221B	B	Total	1	125	ML	125 mL Poly Container	Cool to 4°	SEACOAST ANALYTIC

Comments: —

Sketch Location:

Logged By / Date: [signature] / 10-19-15

Reviewed By / Date:

Sample Collection Log

143279 - Site 8 Treatment System - PEASE

Manager Mike Quinlan

Location Code FIELDQC

RFA / COC Number 100815-01

Sample Number ER-S8-2015-PFC-1

Logging Co

Filtered Sample Total

Collection Date 10-7-15

Sampling Method SUBMERSIBLE PUMP

Collection Time 17:00

Sample Type Ground Water *Sample Purpose* Unknown

Start Depth N/A

QC Code EQUIPMENT BLANK

End Depth N/A

Sampling Equipment DI RINSE OF PUMP (GEOTECH SS GEOSUMP) *Sample Matrix* WQ

QC Partners:

(TB) — *(EB)* — *(FB)* —

SampleTeam CHRIS BLENKLE

Containers:

Analytical Suite	Frtn	Filtered	Qty	Container Type	Preservative	Lab
PFCs by ALS Internal Method HPLC/MS Technique	A	Total	2	250 ML 250 ml Poly Container	Cool to 4°	ALS - Kelso, WA

Comments: COLLECTED DI WATER EQUIPMENT RINSE FROM SUBMERSIBLE PUMP (PUMP MODEL: GEOTECH SS GEOSUB).

Sketch Location:

Logged By / Date:

Reviewed By / Date:

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Appendix I
Seacoast Analytical Lab Results

SEACOAST ANALYTICAL SERVICES
Route 125 & Pinkham Road
Lee, New Hampshire
603 868 1457
(Mail to: PO Box 555, Barrington, NH 03825)

SUPERIOR QUALITY & SERVICE SINCE 1989

WATER TEST RESULTS

Date: October 22, 2015

Reference #: S10195P

Client: CB & I Federal Services
312 Directors Drive
Knoxville, TN 37923

Water location: Former Pease Air Force Base Site 8
Portsmouth, NH
Well Id 08-6724
Sample Id S8-0499

Test Method	ANALYTE (mg/L) = milligrams per liter	EPA MAXIMUM recommended concentration	YOUR WATER'S VALUE < means less than	Exceeds Primary Standard	Exceeds Secondary Standard
EPA 300.0	Fluoride (mg/L)	4.0	< 0.6	-	-
EPA 300.0	Chloride (mg/L)	250	606 *	-	X
EPA 300.0	Nitrite-N (mg/L)	1.0	< 1.0	-	-
EPA 300.0	Nitrate-N (mg/L)	10.0	< 2.0	-	-
EPA 150.1	pH (range)	(6.5 - 8.5)	6.4	-	X
SM 2340B	Hardness (mg/L)	No limit	246	-	-
SM 3111B	Sodium (mg/L)	250	280 *	-	X
SM 3111B	Iron (mg/L)	0.300	0.834	-	X
SM 3111B	Manganese (mg/L)	0.050	< 0.025	-	-
SM 3111B	Copper (mg/L)	1.300	< 0.200	-	-
SM 3113B	Lead (mg/L)	0.015	< 0.005	-	-
SM 3113B	Arsenic (mg/L)	0.010	< 0.005	-	-
COLILERT	Total Coliform Bacteria	absent	PRESENT	X	-
COLILERT	E. Coli Bacteria	absent	absent	-	-

THE TESTED PARAMETERS DO NOT MEET FEDERAL PRIMARY DRINKING WATER STANDARDS. Secondary standards measure the aesthetic quality of the water and if exceeded should not affect healthy individuals. Analytes which exceed the recommended concentration or range are indicated with an X under the primary or secondary column above. Nitrate-N/nitrite-N should be analyzed within 48 hours of collection. Samples tested after this time period may not yield accurate results. pH should ideally be measured at the time of collection. Reported pH may differ from field measurement. This report relates only to the sample received.

http://des.nh.gov/organization/commissioner/pip/index.htm is the NHDES website where you can get information about water contaminants. Scroll down to 'Publications', and choose 'Fact Sheets', then Drinking Water/Ground Water.
Date/time sampled: 10/19/15 9:15am
EPA 300.0 analysis: 10/20/15 10:31am
COLILERT analysis: 10/19/15 4:10pm
SM3111B, SM3113B analysis: 10/21/15
Date rec'd: 10/19/15 Temp (°C) rec'd: 14
EPA 150.1 analysis: 10/19/15 3:00pm
* estimated value - greater than highest standard
THIS REPORT IS CONFIDENTIAL. IF YOU RECEIVE THIS INFORMATION IN ERROR, PLEASE CALL 603-868-1457.

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Katy Anderson, Laboratory Director

SEACOAST ANALYTICAL SERVICES
Route 125 & Pinkham Road
Lee, New Hampshire
603 868 1457
(Mail to: PO Box 555, Barrington, NH 03825)

SUPERIOR QUALITY & SERVICE SINCE 1989

WATER TEST RESULTS

Date: October 22, 2015

Reference #: S10195Q

Client: CB & I Federal Services
312 Directors Drive
Knoxville, TN 37923

Water location: Former Pease Air Force Base Site 8
Portsmouth, NH
Well Id 08-6724
Sample Id S8-0500

Test Method	ANALYTE (mg/L) = milligrams per liter	EPA MAXIMUM recommended concentration	YOUR WATER'S VALUE < means less than	Exceeds Primary Standard	Exceeds Secondary Standard
EPA 300.0	Fluoride (mg/L)	4.0	< 0.6	-	-
EPA 300.0	Chloride (mg/L)	250	734 *	-	X
EPA 300.0	Nitrite-N (mg/L)	1.0	< 1.0	-	-
EPA 300.0	Nitrate-N (mg/L)	10.0	< 2.0	-	-
EPA 150.1	pH (range)	(6.5 - 8.5)	6.6	-	-
SM 2340B	Hardness (mg/L)	No limit	339	-	-
SM 3111B	Sodium (mg/L)	250	327 *	-	X
SM 3111B	Iron (mg/L)	0.300	0.767	-	X
SM 3111B	Manganese (mg/L)	0.050	< 0.025	-	-
SM 3111B	Copper (mg/L)	1.300	< 0.200	-	-
SM 3113B	Lead (mg/L)	0.015	< 0.005	-	-
SM 3113B	Arsenic (mg/L)	0.010	< 0.005	-	-
COLILERT	Total Coliform Bacteria	absent	PRESENT	X	-
COLILERT	E. Coli Bacteria	absent	absent	-	-

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http://des.nh.gov/organization/commissioner/pip/index.htm is the NHDES website where you can get information about water contaminants. Scroll down to 'Publications', and choose 'Fact Sheets', then Drinking Water/Ground Water.
Date/time sampled: 10/19/15 10:20am
EPA 300.0 analysis: 10/20/15 10:53am
COLILERT analysis: 10/19/15 4:10pm
SM3111B, SM3113B analysis: 10/21/15
Date rec'd: 10/19/15 Temp (°C) rec'd: 11
EPA 150.1 analysis: 10/19/15 3:00pm
* estimated value - greater than highest standard
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Katy Anderson, Laboratory Director

SEACOAST ANALYTICAL SERVICES

Route 125 & Pinkham Road
Lee, New Hampshire
603 868 1457
(Mail to: PO Box 555, Barrington, NH 03825)

SUPERIOR QUALITY & SERVICE SINCE 1989

WATER TEST RESULTS

Date: October 22, 2015

Reference #: S10195R

Client: CB & I Federal Services
312 Directors Drive
Knoxville, TN 37923

Water location: Former Pease Air Force Base Site 8
Portsmouth, NH
Well Id 08-6725
Sample Id S8-0501

Test Method	ANALYTE (mg/L) = milligrams per liter	EPA MAXIMUM recommended concentration	YOUR WATER'S VALUE < means less than	Exceeds Primary Standard	Exceeds Secondary Standard
EPA 300.0	Fluoride (mg/L)	4.0	< 0.3	-	-
EPA 300.0	Chloride (mg/L)	250	200	-	-
EPA 300.0	Nitrite-N (mg/L)	1.0	< 0.5	-	-
EPA 300.0	Nitrate-N (mg/L)	10.0	< 1.0	-	-
EPA 150.1	pH (range)	(6.5 - 8.5)	7.5	-	-
SM 2340B	Hardness (mg/L)	No limit	297 *	-	-
SM 3111B	Sodium (mg/L)	250	97	-	-
SM 3111B	Iron (mg/L)	0.300	0.456	-	X
SM 3111B	Manganese (mg/L)	0.050	0.040	-	-
SM 3111B	Copper (mg/L)	1.300	< 0.200	-	-
SM 3113B	Lead (mg/L)	0.015	< 0.005	-	-
SM 3113B	Arsenic (mg/L)	0.010	0.006	-	-
COLILERT	Total Coliform Bacteria	absent	PRESENT	X	-
COLILERT	E. Coli Bacteria	absent	absent	-	-

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http://des.nh.gov/organization/commissioner/pip/index.htm is the NHDES website where you can get information about water contaminants. Scroll down to 'Publications', and choose 'Fact Sheets', then Drinking Water/Ground Water.
Date/time sampled: 10/19/15 11:25am
EPA 300.0 analysis: 10/20/15 11:12am
COLILERT analysis: 10/19/15 4:10pm
SM3111B, SM3113B analysis: 10/21/15
Date rec'd: 10/19/15 Temp (°C) rec'd: 13
EPA 150.1 analysis: 10/19/15 3:00pm
* estimated value - greater than highest standard
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Lee, New Hampshire
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(Mail to: PO Box 555, Barrington, NH 03825)

SUPERIOR QUALITY & SERVICE SINCE 1989

WATER TEST RESULTS

Date: October 22, 2015

Reference #: S10195S

Client: CB & I Federal Services
312 Directors Drive
Knoxville, TN 37923

Water location: Former Pease Air Force Base Site 8
Portsmouth, NH
Well Id 08-6725
Sample Id S8-0502

Test Method	ANALYTE (mg/L) = milligrams per liter	EPA MAXIMUM recommended concentration	YOUR WATER'S VALUE < means less than	Exceeds Primary Standard	Exceeds Secondary Standard
EPA 300.0	Fluoride (mg/L)	4.0	< 0.3	-	-
EPA 300.0	Chloride (mg/L)	250	167	-	-
EPA 300.0	Nitrite-N (mg/L)	1.0	< 0.5	-	-
EPA 300.0	Nitrate-N (mg/L)	10.0	< 1.0	-	-
EPA 150.1	pH (range)	(6.5 - 8.5)	7.5	-	-
SM 2340B	Hardness (mg/L)	No limit	272 *	-	-
SM 3111B	Sodium (mg/L)	250	102	-	-
SM 3111B	Iron (mg/L)	0.300	1.776	-	X
SM 3111B	Manganese (mg/L)	0.050	0.039	-	-
SM 3111B	Copper (mg/L)	1.300	< 0.200	-	-
SM 3113B	Lead (mg/L)	0.015	< 0.005	-	-
SM 3113B	Arsenic (mg/L)	0.010	< 0.005	-	-
COLILERT	Total Coliform Bacteria	absent	PRESENT	X	-
COLILERT	E. Coli Bacteria	absent	absent	-	-

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Date/time sampled: 10/19/15 12:20pm
EPA 300.0 analysis: 10/20/15 11:48am
COLILERT analysis: 10/19/15 4:10pm
SM3111B, SM3113B analysis: 10/21/15
Date rec'd: 10/19/15 Temp (°C) rec'd: 13
EPA 150.1 analysis: 10/19/15 3:00pm
* estimated value - greater than highest standard
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Appendix J
NHDES Fact Sheets

NEW HAMPSHIRE
DEPARTMENT OF
Environmental
Services

29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.nh.gov

WD-DWGB-4-1 2010

Interpreting the Presence of Coliform Bacteria in Drinking Water

Determining the bacterial quality of drinking water is the single most important water quality test. Why? Because one glass of water containing just a few disease organisms can cause illness. When minimal exposure creates an immediate health risk, that contaminant is known as an acute contaminant. Bacterial contaminants such as *E. coli* and fecal coliform in drinking water represent an acute health risk. In contrast, meaningful health risk from most chemical contaminants, such as arsenic, radon, or benzene, requires a long period of exposure. Consequently, these contaminants are considered chronic**.**

The total coliform test is the starting point for determining the biological quality of drinking water. This test is performed frequently because of the acute risk that disease-causing organisms pose to the users of that water supply. The test is easy to perform and inexpensive.

Total Coliform as an Indicator
The total coliform test is considered an indicator, since the presence of bacteria in this group indicates the possibility, but not the certainty, that disease organisms may also be present in the water. When total coliforms are absent there is a very low probability of disease organisms being present in the water. The ability of the total coliform test to reliably predict the bacterial safety of drinking water relative to the hundreds of possible diseases is critical since it is impossible, in a practical sense, to frequently check for every type of disease-causing organism.

Important exceptions to this generalization include protozoa such as *Giardia* and *Cryptosporidium*, which can be present in water even when the total coliform test shows an absence of organisms. Under such circumstances illness could occur. Nevertheless, the total coliform test remains the most commonly used standard for determining the bacterial quality of drinking water in the US and the world.

Risk Associated with Coliform Types
There are a number of subsets within the coliform group. The presence of bacteria from each progressively smaller subset heightens the concern that disease-causing organisms may also be present in the water. These groups and their relative risk implications are discussed below.

Total Coliform. These organisms are prolific in the soil. Their presence does not necessarily imply contamination from wastewater nor the presence of other sanitation-based health risks. The presence of total coliform by itself does not imply an imminent health risk but does indicate the need for an analysis of all water system facilities and their operations to determine how these organisms entered the water system. Public notice to water system users is required since a properly constructed and maintained water system should not have total coliform present. When only total coliform are present, the water system is allowed 30 days to give public notice to customers that the water has violated a drinking water standard. This lengthy period indicates regulatory agencies' perception of a low degree of immediacy to the risk.

Fecal Coliform. This is a subset of the total coliform group. Fecal coliform bacteria generally originate in the intestines of mammals. They have a relatively short life span compared to other coliform bacteria. Their presence could be related to improper disposal of sanitary waste. Immediate public notice and a boil order to the users (within 24 hours) are required due to the higher likelihood of disease organisms also being present in water.

***Escherichia coli* (*E. coli*).** This is a species within the fecal coliform group. *E. coli* originate only in the intestines of animals including humans. As with other fecal coliform, they have a relatively short life span compared to non-fecal coliform bacteria. Their presence indicates a strong likelihood that human or animal wastes are entering the water system. Immediate public notice and a boil order (within 24 hours) are required due to a higher likelihood of disease organisms also being present in the water.

Non-Coliform Bacterial Results

The membrane filter test produces a result for non-coliform organisms. High non-coliform results are generally interpreted in two ways:

Invalidation of the Total Coliform Test

When the number of non-coliform organisms is high, their presence may inhibit the growth of organisms in the total coliform group. When present in numbers over 200 colony forming units (CFUs) in a 100 milliliter sample, non-coliforms will invalidate a total coliform test.

Non-coliform as an Indicator of Inadequate Filtration

One expects to find a small number of non-coliform organisms in a properly constructed well. Thus when non-coliforms are numerous in groundwater samples, there is concern that the water in the well is not being adequately filtered. Reasons for a lack of adequate filtration include: the well is not properly constructed, or the soil/rock layering is not adequately filtering the rainfall or runoff that is percolating down from above to the well.

CONFLICTING COLIFORM DATA

Sometimes bacterial tests from the same public water system, under the same conditions, are not consistent.

Samples Taken at Different Times

In an inadequately filtered well, bacteria are expected to be present. Organisms that gain access to a well can be there one day and die off before a second sample is taken a few days or a week later.

Samples Taken at the Same Time
This is a somewhat unlikely but possible event. One explanation is the diversity of coliform test methods. Some bacterial tests use a filtration step while others do not. Each test uses a different proprietary media to incubate the organisms. Sometimes the bacteria themselves are counted while in other cases enzyme byproducts are measured. Some methods will better detect coliform species that have been stressed by chlorine or other harsh environmental conditions while others will not. Finally, fully representative samples are hard to obtain since bacteria often congregate together in clumps in pipes and in the sample container. Thus, in cases where there are few organisms, they may not be evenly distributed in the water.

Laboratory Methods for Total Coliform Identification
All methods of total coliform identification require culturing of the sample in the presence of a special food source. The culturing process requires approximately one to two days of culture growth before interpreting the bacterial data. There are three laboratory procedures that can be used for determining the presence of total coliform in a water sample:

Multiple Tubes. This method was developed in the early 1900s. It uses a number of test tubes and measures the amount of gas production during two days of incubation. Results are stated in terms of most probable number of organisms (MPN) per 100 milliliters of sample. Advantages include being the first reliable bacterial method for drinking water; disadvantages include significant glassware use and required laboratory cleanup.

Membrane Filter. This method was developed in early 1950s. It filters organisms from the water onto a paper surface and then incubates the initial parent organisms to produce visible colonies. A minimum of 22 hours incubation time is required. Resultant growths are counted by the laboratory staff. Results are identified as "counts" of CFUs per 100 milliliters. The advantage of this method is that it is much simpler than test tubes; the disadvantage is that it can't be used on muddy water.

MMO Chromogenic Fluorogenic Method. This method was developed in the late 1980s. It consists of culturing the organisms in the sample bottle. An incubation time of 18-28 hours is required. A yellow color indicates the presence of total coliform and the presence of a fluorescent condition under black light indicates *E. coli*. Results are stated as the presence or absence of coliform organisms per 100 milliliters. Non-coliform organisms are not produced.

FOR MORE INFORMATION
Please contact the Drinking Water and Groundwater Bureau and the New Hampshire Water Well Board at (603) 271-2513 or dwgbinfo@des.nh.gov or visit our website at http://des.nh.gov/organization/divisions/water/dwgb/index.htm . All of the bureau's fact sheets are online at http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/index.htm.

Note: This fact sheet is accurate as of September 2010. Statutory or regulatory changes or the availability of additional information after this date may render this information inaccurate or incomplete.

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ENVIRONMENTAL
Fact Sheet
NEW HAMPSHIRE DEPARTMENT OF Environmental Services
29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.nh.gov

WD-DWGB-4-2 2010

Causes of Positive Bacteria Results in Water Samples

This fact sheet helps to identify possible causes of positive bacteria results in drinking water samples. These causes can be categorized as either: true bacterial contamination of the water system, or errors of various types.

True Bacterial Contamination
Total and fecal coliform (including *E. coli*) grow in the intestinal tracts of animals including humans. Outside the host, these bacteria die off quickly, typically within 30 days. Therefore, if coliform bacteria are identified in a well over a long period of time, it is presumed that bacteria are continuously entering the well or aquifer as the water is withdrawn. Listed below are a number of pathways by which bacteria may enter a water system.

A. Bacterial Contamination Caused By Poor Well Construction
Poor well construction is by far the most common explanation for bacteria in water samples from wells.

Contamination of Dug Wells. Common construction problems with dug wells include a lack of mounded backfill around the outside of the well casing, insufficient casing height above the ground level, inadequate or leaky well cover, and holes or unsealed joints in the sidewall of the upper portion of the well casing.

Older wells made from fieldstone usually have many of these unsealed passageways and thus have very frequent bacterial problems. These well construction problems can sometimes be confirmed by looking for leakage on the inside of the well casing after a heavy rainstorm or simulated “rain” from a garden hose. Refer to WD-DWGB-1-4, “Dug Well Design,” for the recommended design of a dug well.

Contamination of Springs. Construction problems in springs are similar to those of dug wells with one addition: the frequent entry of bacterial contaminants in the reverse direction through the overflow pipe. See WD-DWGB-1-5, “Residential Spring Well Design for proper spring construction recommendations.

Contamination of Bedrock Wells (also called artesian or drilled wells). Common construction problems with bedrock wells include a buried well head and an inadequate well cap. Installation of a pitless adaptor should prevent the leakage of bacteria-laden surface water directly into the well. Construction problems with bedrock wells can sometimes be confirmed by identifying leakage on the inside of the well casing after a heavy rainstorm or from simulated “rain” from a garden hose. See WD-DWGB-1-2, “Bedrock (Artesian, Drilled) Well Design,” for the recommended design of a bedrock well.

B. Contamination Caused by Recent Well Pump Installation, Replacement, or Plumbing Repair
Recent repair or pump replacement is the second most likely cause of bacteria in water samples.

New Pump Installation or Plumbing Work. When a submersible pump is taken out of a well or when a new pump is prepared for installation, it is typically placed directly on the ground near the well. When this occurs, bacteria-laden dirt often adheres to the pump, the water discharge line, and/or the electrical power cable. This material then contaminates the well when the pump is installed. After reinstallation of the pump, time and flushing are necessary to remove this solid material from the assembly. Disinfection should be conducted only after flushing to loosen this material has occurred.

When recent work has been done on the home's plumbing system, such as hot water tank replacement, pipe installation, etc., bacterial problems will likely be experienced for a few days thereafter. Very strong flushing, followed by chlorination if necessary, will likely clean the plumbing system of bacteria.

Newly Constructed Wells. The installation of any new well normally allows substantial bacteria to enter the fractures of the bedrock or the soil around the outside of the dug well casing. Mud and soil particles protect these bacteria from disinfection. Sustained flushing is needed to remove this mud, pulverized rock, and bacteria prior to disinfection. In rare cases, the removal of construction debris may take months.

C. Contamination Caused by Physical Damage to the Aquifer's Filtration Capability
Bacteria are normally removed from groundwater as water percolates through soil. However, it is possible, but unlikely, that bacteria will move through the soil or the bedrock fractures for significant distance.

Dug Wells. Bacteria and viruses may travel through certain coarse soils with insufficient filtration capacity. There is no practical way to improve soil filtration in deeper layers. The location at which the bacteria entered the soil could possibly be found by using tracer dye; however the inadequate soil filtration, caused by large soil particles, would remain. This means the well would still be vulnerable to other bacterial events in the future. Even if treatment of the well water were added, the varying levels of bacterial contamination could exceed the capability of the treatment process at one or more times in the future. DES generally recommends that a different type of well be installed, if soil filtration is proven to be inadequate.

Bedrock Wells. Contamination of bedrock fractures can occur when the overlying soil is stripped from the top of the bedrock or when the upper bedrock is blasted or ripped loose. Drilling a new well can also create localized short-term bacterial contamination of bedrock fractures. Normally these construction activities will be of short duration. When the soil backfill is replaced in the disturbed area, the filtration should be reestablished. Conditions which normally remove filtering soil and expose fractures in the bedrock include:
- Road cuts through bedrock outcrops.
- Excavation into bedrock for swimming pools or house foundations.
- Artesian well drilling on other lots.
- Abandoned but uncapped bedrock wells on other lots.

DES recommends waiting out the replacement of the soil backfill at construction sites and the natural die-off and self cleansing process that will follow. Water quality should improve once the soil is replaced and has achieved compaction. There will likely be weeks of lag time between the replacement of soils and the end of the bacterial presence.

D. Biological Activity Occurring within Treatment Equipment and Piping
Water treatment equipment often uses sand or other media to filter bacteria from drinking water. This action typically brings bacteria together on the filter media. In such cases, the filtration provides an easily-obtained, concentrated food supply for these bacteria to sustain themselves.

Biofilm. Biofilm is a name given to a layer of biological material on the inside of pipes, tanks, etc. This material contains both mineral deposits and biological material. For reasons still not well understood, this material may grow at an accelerated rate for certain periods. As this occurs, some of this biological material may detach from the pipe, tank, or treatment devices and be present in water samples. This material generally cannot be seen. It is difficult to completely kill this biological layer. If this material contains organisms of the total coliform group, these cells could lead to detection of total coliform. One cannot differentiate between total coliform biofilm often present in pipes and bacteria originating directly from a disease source.

Although biofilm is a possible cause, not all positive bacterial tests are the result of biofilm. It is critically important that all other technical explanations for the presence of bacteria be fully explored. In all of these cases, well water samples should be taken after heavy precipitation to help differentiate well construction or soil filtration problems from bacteria associated with the distribution, plumbing, or treatment systems.

II. Sampling or Testing Errors
Each of the instances below identifies a possible error condition. In many cases, errors creating positive bacterial results can be differentiated from those bacteria attributed to poor construction and/or poor soil filtration by taking additional bacterial samples. Errors will not likely be repeated, whereas real construction or filtration problems will show either a constant or highly irregular presence of bacteria. Neither one good (nor one bad) bacteria sample can be considered sufficient testing to judge the long term consistency of a system's water quality.

A. Sample Collection Was Improper
Improper bacteria sample collection is a common error. Poor sampling practice can make a good water sample appear bad.

The following procedure should be used when collecting a bacteria sample.

- Use a fixed (non-swivel) cold water faucet.
- Remove all faucet devices (aerators, filters).
- Flush for 5 minutes at high velocity. (See additional comments below)
- Slow water flow to a trickle.
- Open sample bottle, hold cap facing down. (Do not set cap down)
- Fill bottle, leave 1" air space, recap bottle.
- NOW turn off water.

Wiping the sample faucet with a chlorine solution, flaming the faucet, or strong flushing are methods that have been practiced in the past to ensure that the end of the sample faucet is clean. The goal is to prevent a dirty faucet from contaminating an otherwise clean water sample. Remember that any chlorine in the sample container, that has not been neutralized, prevents the sample from being processed for bacteria. For this reason, always flush the faucet thoroughly after wiping with a chlorine solution.

B. Dirty Sample Bottle, Data Recorded Inaccurately
Other error conditions include old sample bottles or bottles subject to contamination during preparation or transit. Laboratory processing may create positive bacterial test results as may a variety of clerical errors. These are very rare occurrences and these possibilities can be addressed by taking one or more additional sample(s).

FOR MORE INFORMATION

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