SGW-61095
Revision 0

Borehole Summary Report for the Four Characterization Boreholes in the 200-DV-1 Operable Unit, FY 2017

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

SGW-61095
Revision 0

Borehole Summary Report for the Four Characterization Boreholes in the 200-DV-1 Operable Unit, FY 2017

T. Mallgren
Freestone Environmental, Inc.

Date Published
January 2018

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

P.O. Box 1600
Richland, Washington 99352

APPROVED
By Julia Raymer at 10:55 am, Feb 20, 2018

Release Approval Date

Approved for Public Release;
Further Dissemination Unlimited

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by tradename, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

Contents

1 Introduction 1-1

1.1 Purpose and Scope 1-1

2 Drilling, Sampling, and Borehole Decomissioning 2-1

2.1 General Information 2-1

2.1.1 Drilling, Sampling and Borehole Logging 2-1

2.1.2 Health and Safety Screening 2-4

2.1.3 Borehole Decommissioning 2-7

2.2 Borehole-Specific Information 2-7

2.2.1 Borehole C9497 2-7

2.2.2 Borehole C9503 2-13

2.2.3 Borehole C9513 2-19

2.2.4 Borehole C9555 (Replacement for C9498) 2-26

2.2.5 Borehole C9498 (Replaced by C9555) 2-32

3 Geologic Observations 3-1

3.1 Geology of the B Complex 3-1

3.1.1 Borehole Geology for C9497 3-1

3.2 Geology of the T Complex 3-2

3.2.1 Borehole Geology for C9503 3-2

3.2.2 Borehole Geology for C9555 (Replacement for C9498) 3-3

3.3 Geology of the S Complex 3-6

3.3.1 Borehole Geology for C9513 3-6

4 Waste Management 4-1

5 Civil Survey 5-1

6 Borehole Acceptance 6-1

7 References 7-1

Figures

Figure 1-1. Location of C9497 within the B-Complex, 200-East Area....1-3
Figure 1-2. Location of C9503 and C9555 Boreholes within the T Complex, 200 West Area....1-4
Figure 1-3. Location of C9513 within the S Complex, 200 West Area....1-5
Figure 2-1. TerraSonic 150CC Sonic Drill Rig....2-2
Figure 2-2. Great West AP 1000 Becker Hammer drill rig....2-3
Figure 2-3. Adaptation of Becker Hammer Casing for Direct Push Drilling....2-4
Figure 2-4. LEXAN™ Core Samples....2-5
Figure 3-1. C9555 Silty Gravel at 258 ft bgs....3-5
Figure 3-2. C9555 Sandy Gravel at 260 ft bgs....3-5

Tables

Table 1-1. Borehole Identification, Location, Waste Site Association, and Drilling Date....1-2
Table 2-1. Decommissioning Information....2-7
Table 2-2. Geophysical Logging Information for Four Boreholes....2-6
Table 2-3. C9497 Sample Collection Summary....2-8
Table 2-4. Radiological Contamination at Borehole C9497....2-12
Table 2-5. VOC and Ammonia Contamination at Borehole C9497....2-13
Table 2-6. C9503 Sediment Sample Collection Summary....2-14
Table 2-7. Radiological Contamination at Borehole C9503....2-17
Table 2-8. VOC and Ammonia Contamination at Borehole C9503....2-18
Table 2-9. C9513 Sediment Sample Collection Summary....2-20
Table 2-10. Radiological Contamination at Borehole C9513....2-23
Table 2-11. VOC and Ammonia Contamination at Borehole C9513....2-23
Table 2-12. C9555 Core Sample Collection Summary....2-27
Table 2-13. Radiological Contamination at Borehole C5555....2-31
Table 2-14. VOC and Ammonia Contamination at Borehole C9555....2-32
Table 2-15. C9498 Sample Collection Summary....2-33

Appendices

A. Well Summary Sheets ..... A-i

B. Borehole Geologic Logs for the Characterization Boreholes in 200-DV-1 Operable Unit ..... B-i

C. Log Data Reports ..... C-i

D. Survey Data Reports ..... D-i

E. Core Borehole Geologic Logs for 200-DV-1 Operable Unit Boreholes ..... E-i

F. Core Photos for 200-DV-1 Operable Unit Boreholes ..... F-i

Terms

°F	Fahrenheit
bgs	below ground surface
Becker Hammer	AP1000 Becker Hammer
CCU	Cold Creek unit
CCUc	Cold Creek unit calcic
CCUz	Cold Creek unit silt-dominated
CHPRC	CH2M Hill Plateau Remediation Company
DOE	United States Department of Energy
dpm	disintegrations per minute
Ecology	Washington State Department of Ecology
ft	feet or foot
Freestone	Freestone Environmental Services, Inc.
H1	Hanford formation gravel-dominated unit
H2	Hanford formation sand-dominated unit
HEIS	Hanford Environmental Information System
Holt	Holt Services Inc.
HRLS	High Rate Logging System
ID	identification
IDW	investigation-derived waste
in.	inch
IH	industrial hygienist
I/R	injection/reverse well
N/A	not applicable
NMLS	Neutron Moisture Logging System
NR	not recorded
OD	outer diameter
PNLS	Passive Neutron Logging System
ppmv	parts per million by volume
RCT	Radiological control technician
Rev.	revision
Rtf	Ringold Formation member of Taylor Flat
Rwie	Ringold Formation member of Wooded Island-unit E
SAP	sampling and analysis plan
SGLS	Spectral Gamma Logging System
SN3	Stoller Newport News Nuclear, Inc.
Sonic	TerraSonic 150cc drill rig

TD	total depth
OU	Operable Unit
VOC	volatile organic compound
WAC	*Washington Administrative Code*

Metric Conversion Chart

Into Metric Units			Out of Metric Units		
If you know	*Multiply by*	*To get*	*If you know*	*Multiply by*	*To get*
Length			**Length**		
inches	25.40	millimeters	millimeters	0.0394	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles (statute)	1.609	kilometers	kilometers	0.621	miles (statute)
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.0929	sq. meters	sq. meters	10.764	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.591	sq. kilometers	sq. kilometers	0.386	sq. miles
acres	0.405	hectares	hectares	2.471	acres
Mass (weight)			**Mass (weight)**		
ounces (avoir)	28.349	grams	grams	0.0353	ounces (avoir)
pounds	0.454	kilograms	kilograms	2.205	pounds (avoir)
tons (short)	0.907	ton (metric)	ton (metric)	1.102	tons (short)
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.034	ounces (U.S., liquid)
tablespoons	15	milliliters	liters	2.113	pints
ounces (U.S., liquid)	29.573	milliliters	liters	1.057	quarts (U.S., liquid)
cups	0.24	liters	liters	0.264	gallons (U.S., liquid)
pints	0.473	liters	cubic meters	35.315	cubic feet
quarts (U.S., liquid)	0.946	liters	cubic meters	1.308	cubic yards
gallons (U.S., liquid)	3.785	liters			
cubic feet	0.0283	cubic meters			
cubic yards	0.764	cubic meters			
Radioactivity			**Radioactivity**		
picocurie	37	millibecquerel	millibecquerel	0.027	picocurie

1 Introduction

This report presents field-generated records and summarizes field activities performed during the direct-push drilling, continuous core sampling, and decommissioning of four boreholes in the 200-DV-1 Operable Unit (OU) of the Hanford Site. The report also presents information for one borehole that did not reach total depth (TD) and had to be redrilled at an adjacent location. This report focuses on the advancement of boreholes in accordance with SGW-58552, *Description of Work for the Characterization of 200-DV-1 Operable Unit, FY15 – FY17,* Rev. 3, DOE/RL-2011-104, Rev. 0, *Characterization Sampling and Analysis Plan for the 200-DV-1 Operable Unit* (hereafter referred to as the Rev. 0 sampling and analysis plan [SAP]), and DOE/RL-2011-104-ADD1. The purpose of advancing the boreholes was to characterize contaminant concentrations and their vertical distribution in the vadose zone at 200-DV-1 OU waste sites.

The forty-three 200-DV-1 OU waste sites are located in three areas on the Central Plateau at the Hanford Site. The 200-DV-1 OU waste sites are primarily the cribs and trenches adjacent to, and associated with, the 241-B/BX/BY, 241-T/TX/TY, and 241-S/SX Tank Farms, referred to as the B Complex, the T Complex, and the S Complex, respectively. The 200-DV-1 OU was created in 2010 to support remedy selection for waste sites with deep vadose zone contamination. In general, deep vadose zone contamination poses a potential threat to groundwater and is not easily remediated using typical surface remedies.

The 200-DV-1 OU contaminants of potential concern are identified in Table 1-2 of the Rev. 0 SAP as revised by Tri-Party Agreement (Ecology et al., (1989), the *Hanford Federal Facility Agreement and Consent Order*) change order TPA-CN-688.

Holt Services, Inc. (Holt), and Great West, Inc., conducted drilling and decommissioning activities associated with the 200-DV-1 OU boreholes between May 17, 2017, and October 12, 2017 under the direction of CH2M Hill Plateau Remediation Company (CHPRC). Freestone Environmental Services, Inc., provided well-site geology and well decommissioning documentation services. Stoller Newport News Nuclear, Inc. (SN3) provided geophysical logging services.

1.1 Purpose and Scope

This document summarizes the observations and measurements made during the drilling, direct-push advancement, continuous core sampling, and decommissioning activities for the 200-DV-1 OU boreholes. This report includes field notes and completed field forms, borehole decommissioning information, radiological data, geologic observations, civil survey results, and records of investigation-derived waste (IDW) management and disposition. Technical requirements, applicable CHPRC procedures, and other supporting information are summarized in SGW-58552. Sediment samples were collected in accordance with the Rev. 0 SAP, and the Rev. 0 SAP ADD1.

The Well Summary Sheets, borehole geologic logs, Log Data Reports, and Well Survey Data Reports for each borehole are in Appendices A, B, C, and D, respectively. Sample details including Hanford Environmental Information System (HEIS) numbers, sample interval depths, dates, temperature data, and percent recovery are summarized in Section 2.2.

Borehole location and associated waste sites are presented in Figure 1-1, Figure 1-2, and Figure 1-3. The unsuccessful drilling attempt of borehole C9498 is represented on the location map by the borehole identification (ID) in parentheses. Borehole identification, location, and drilling summary information are presented in Table 1-1.

All drilling data are reported in the original units recorded at the time of measurement.

Table 1-1. Borehole Identification, Location, Waste Site Association, and Drilling Date

Borehole ID	Associated Waste Site	Northing[a]	Easting[a]	Elevation of Brass Survey Marker[b]	Total Drilled Depth (ft bgs)	Field Activity Dates	
		meters				Initiate Field Work	Conclude Field Work
C9497	216-B-42 Trench	137276.54	573371.07	204.82	274.3	5/17/2017	8/16/2017
C9498	216-T-3 (I/R Well)	136668.74	567259.27	216.72	18.6	5/24/2017	9/6/2017
C9503	216-T-7 Tile Field	136658.31	566699.92	205.73	225.5	5/22/2017	8/15/2017
C9513	216-S-13 Crib	134013.30	567160.18	205.00	240.5	5/18/2017	9/6/2017
C9555	216-T-3 (I/R Well)	136667.49	567258.75	216.75	270.0	6/13/2017	10/12/2017

a. Northing and easting coordinates are based on Washington State Plane Coordinates NAD83, *North American Datum of 1983*.

b. Vertical Elevation values are based on NAVD88, *North American Vertical Datum of 1988* and are rounded to 0.01 meter.

ft bgs = feet below ground surface.

ID = identification.

I/R = injection/reverse well

N/A = not applicable.

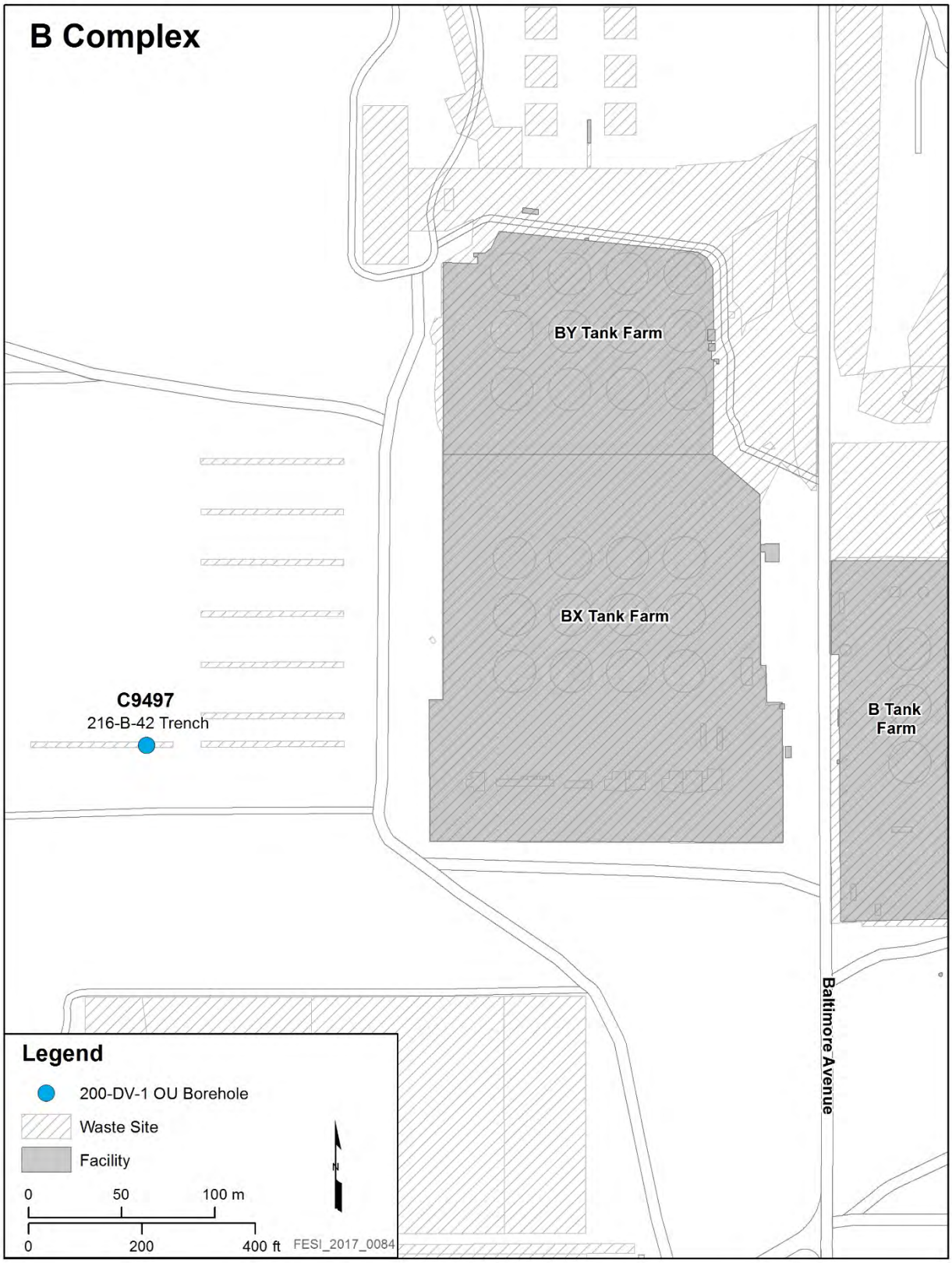


Figure 1-1. Location of C9497 within the B-Complex, 200-East Area

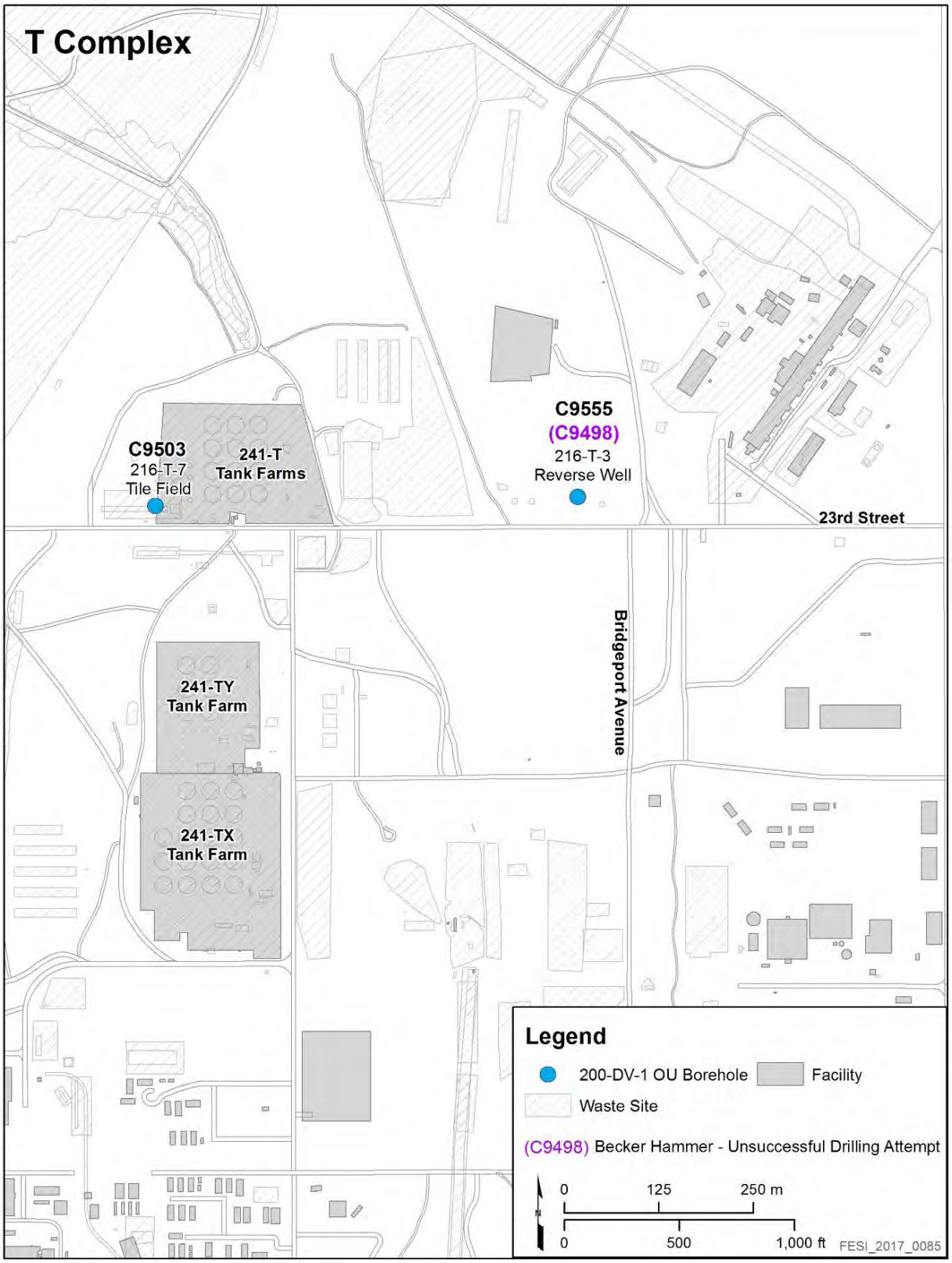


Figure 1-2. Location of C9503 and C9555 Boreholes within the T Complex, 200 West Area

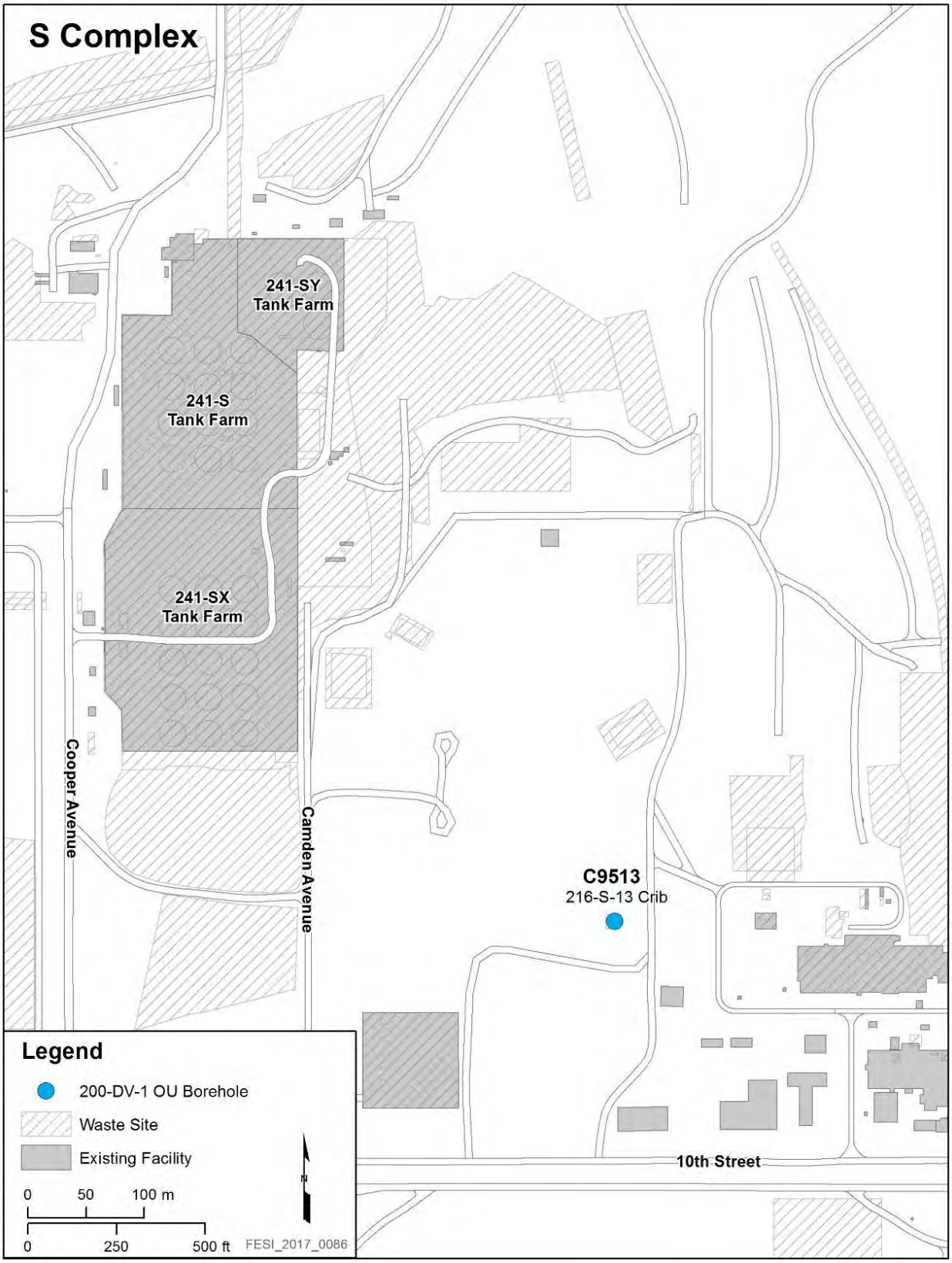


Figure 1-3. Location of C9513 within the S Complex, 200 West Area

2 Drilling, Sampling, and Borehole Decomissioning

This section summarizes the drilling, sampling, and decommissioning details associated with four boreholes. Field activity details common to all boreholes are summarized in Section 2.1 and borehole-specific information is presented in Section 2.2.

2.1 General Information

Borehole-specific details are included in Section 3. The boreholes were drilled and decommissioned to Washington State standards as detailed in the WAC 173-160, *Minimum Standards for Construction and Maintenance of Wells*. Well decommissioning activities were recorded in accordance with applicable CHPRC procedures. Due to the drilling and sampling methods, soil cuttings were not available for photographs, sieve analysis or detailed geologic logging at the drill site. Detailed descriptions and photographs of soil within the continuous core samples were completed at an offsite location following drilling.

2.1.1 Drilling, Sampling and Borehole Logging

The 200-DV-1 OU characterization boreholes were drilled in areas with the potential for elevated levels of radiological and chemical contamination. Two types of drilling technologies, sonic and direct-push, were used to reduce the potential for worker exposure to contaminated soil cuttings and reduce IDW.

Tri-Party Agreement (Ecology et al., 1989) change notice TPA-CN-668 incorporates the Becker Hammer and sonic drilling continuous coring method into the Rev. 0 SAP (DOE/RL-2011-104) field sampling plan. Phase I sonic drilling activities began using a TerraSonic 150cc (Sonic) drill rig (Figure 2-1) operated by Holt and threaded 12-inch (in.) or 10 1/2-in. outer diameter (OD) temporary casing. Continuous cores were collected from ground surface to the top of an anticipated zone of high contamination using a 7-in. inner diameter core barrel. Direct-push activities, performed by Great West, began using a Becker Hammer AP1000 drill rig (Becker Hammer) (Figure 2-2) and threaded, 8 5/8-in. OD (7 1/2-in. inner diameter) temporary casing. The Becker Hammer drill rig was used to advance the direct-push portion of the borehole through zones which may contain radiological contamination greater than 10,000 pCi/g. During Phase II of sonic drilling, Holt advanced additional threaded 7-in. and 6-in. OD temporary casing through the direct push casing to collect 3 1/2-in. inner diameter continuous cores to target Rev. 0 SAP depths. All drilling and decommissioning activities concluded October 12, 2017.

The Sonic drill rig used resonant energy, coupled with the weight of the drill pipe and downward momentum of the drill head, to advance temporary casing into the formation. The resonant energy transmitted along the length of the drill pipe substantially reduces the amount of friction between the temporary casing and the borehole wall, PNNL-11321, *Phase III ResonantSonic® Report*. Concurrent with the resonant energy, the drill head can be rotated to assist penetration and to place the cutting surfaces of the drill bit adjacent to the formation. The soil cuttings entered the drill string through an open-face drill bit and were contained in an inner core tube. Borehole integrity was maintained by the threaded temporary casing that remained in the subsurface, while the coring string was removed and sections of the drill pipe were added.

Figure 2-1. TerraSonic 150CC Sonic Drill Rig

Figure 2-2. Great West AP 1000 Becker Hammer drill rig

Becker Hammer direct-push drilling uses a hydraulic hammer and double-walled temporary casing to advance the borehole. Typically, the drilling cuttings are retrieved using compressed air without a means to contain potentially contaminated sediment. This conventional method to retrieve cuttings was unsuitable for use in the zone of elevated radiological contamination. Instead, a custom-designed drill tip and casing shoe was developed for this project (Figure 2-3). The solid drill tip on the inner casing (7 1/2-in. inner diameter) seats within the 8 5/8-in. OD casing shoe to create a solid end which can penetrate the vadose zone without producing soil cuttings. When the desired depth is reached, the 7-1/2-in. inner diameter drill tip is removed and the temporary casing is downsized to 7-in. with the sonic drill rig.

Grab samples for laboratory analysis were collected during Phase I of drilling from ground surface with the sonic drilling to the depth where the direct push was initiated, skipped for the direct push segment and resumed in Phase II drilling. Using plastic sleeves, sediment grab samples were collected during drilling from the sonic core barrel at 2.5-ft composited intervals. During Phase II of drilling, samples were collected using LEXAN™[1]liners and continuous core samples were collected (Figure 2-4) by driving a decontaminated 3 1/2-in. OD liner through the sampling interval or until refusal. LEXAN™ liner sample depths and associated HEIS numbers are included for each individual borehole in Section 2.2. Thermal measurements were collected and recorded from the drill shoe and the LEXAN™ liners, because

LEXAN ™ is a trademark of Saudi Basic Industries Corporation, Houston, Texas.

sediment retrieval methods may result in unintentional increases in core barrel temperature and affect sample quality. Core barrel, LEXAN™, and direct soil temperatures were measured using an infrared digital thermometer, upon retrieval of samples.

Each borehole was logged using SN3's Spectral Gamma Logging System (SGLS) and Neutron Moisture Logging System (NMLS) to identify natural and man-made gamma-emitting radionuclides and moisture levels in each borehole. Before temporary casing was down-sized and after TD was achieved, the temporary casing strings were logged individually to produce a geophysical log of the entire length of the borehole. SN3 prepared a Log Data Report for each borehole. The report numbers for the Log Data Reports are presented in Table 2-1.

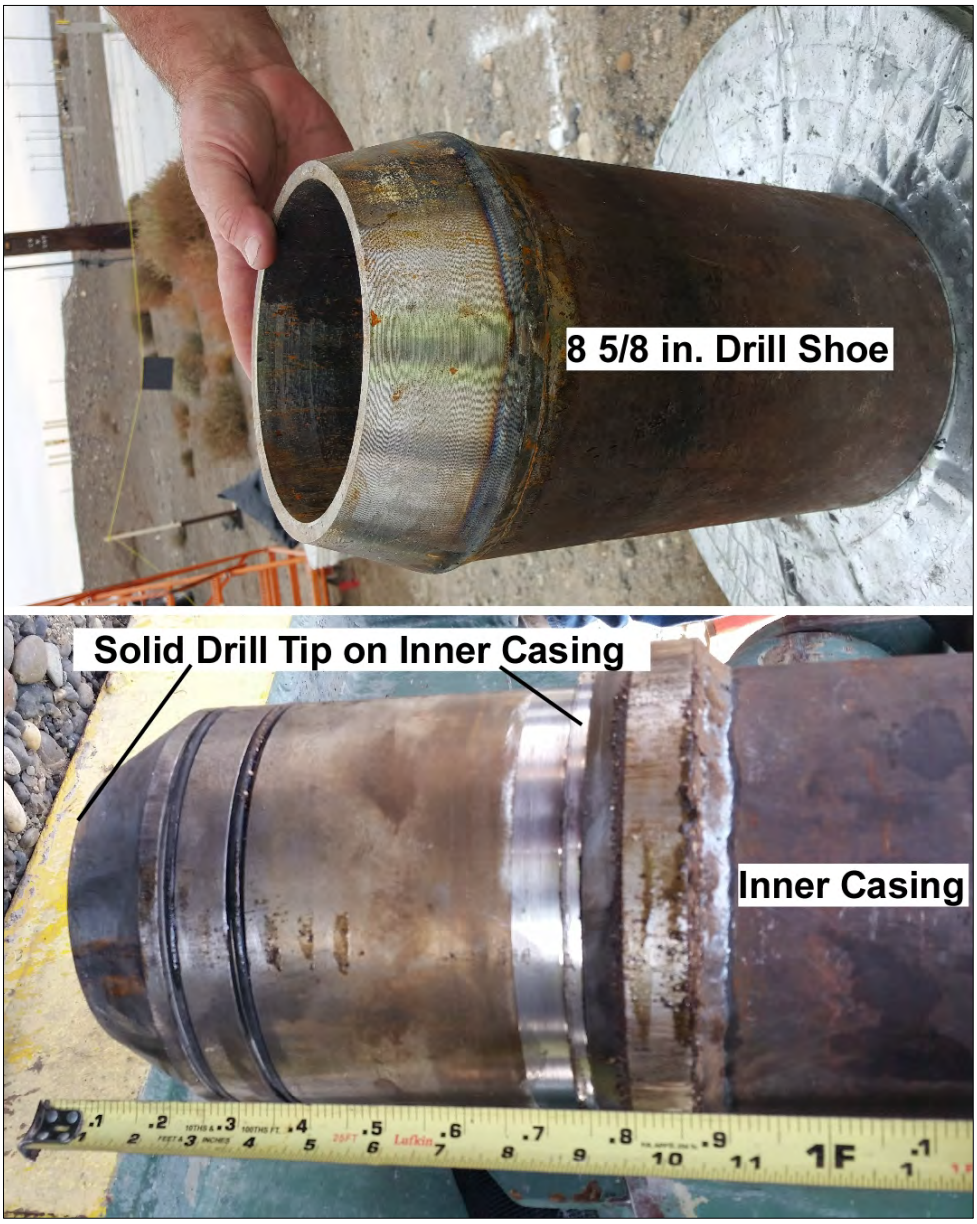


Figure 2-3. Adaptation of Becker Hammer Casing for Direct Push Drilling

Figure 2-4. LEXAN™ Core Samples

Table 2-1. Geophysical Logging Information for Four Boreholes

Borehole ID	Total Depth Drilled (ft bgs)	Report Number	Logging System	Man-made Contamination Present
C9497	274.3	HGLP-LDR-1005, Rev.0	SGLS, NMLS	Cs-137, Pa-234m (U-238), U-235
C9498[a]	N/A	N/A	N/A	N/A
C9503	225.5	HGLP-LDR-1013, Rev.0	SGLS, NMLS, HRLS, PNLS	Cs-137, Pa-234m (U-238), U-235
C9513	240.5	HGLP-LDR-1017, Rev.0	SGLS, NMLS	Cs-137, Pa-234m (U-238), U-235
C9555	250.8	HGPL-LDR-1025, Rev. 0	SGLS, NMLS, PNLS	Cs-137

a. This borehole met refusal and was replaced by C9555. No geophysical logging was performed.

ft bgs = feet below ground surface
HRLS = High Rate Logging System
ID = identification
N/A = not applicable, borehole was not logged
NMLS = Neutron Moisture Logging System
PNLS = Passive Neutron Logging System
Rev. = revision
SGLS = Spectral Gamma Logging System

2.1.2 Health and Safety Screening

A radiological control technician (RCT) performed continuous radiological surveys of any soil cuttings generated during the sonic portion of drilling, LEXAN™ liners, temporary drive casing, core barrel and drill rods, and driller's control station using standard field screening instruments. Radiological activity levels greater than background were recorded and are discussed in Section 2.2. Field-related activities associated with the Becker Hammer portion of drilling were performed in accordance with the requirements of RWP-GW-072, REV. 0. Field-related activities associated with the sonic portion of drilling were performed under RWP-GW-074 REV. 0 and RWP-GW-076 REV. 0. Sampling related activites were performed under RWP-GW-073 REV. 0 and RWP GW-076 REV. 2.

Air quality monitoring for volatile organic compounds (VOCs) and ammonia was performed during drilling and sampling activities by an industrial hygienist professional (IH). The drillers' breathing zone near the wellhead, and the fresh soil generated during the sonic portion of drilling were surveyed for VOCs using a photo-ionization detector. Field measurements of contaminant concentrations above background levels are discussed in Section 2.2.

2.1.3 Borehole Decommissioning

Well summary sheets included in Appendix A provide visual representations of each decommissioning profile.

All of the boreholes were decommissioned by Holt Services, Inc. Annular seal materials include 3/8-in. diameter granular bentonite crumbles or chips. High-strength concrete mix was used to seal the top two feet (ft) of annular space. Borehole-specific decommissioning details are listed in Table 2-2, and discussed in Section 2.2.

The surface completion consists of a cement marker at the location of the decommissioned borehole. The cement marker contains a brass survey marker that is die-stamped with the borehole ID and date of decommissioning.

2.2 Borehole-Specific Information

This section summarizes the borehole drilling and sampling, geophysical logging, and decommissioning activities specific to each borehole. Geophysical logging information for each borehole is summarized in Table 2-1. Decommissioning information for each borehole is summarized in Table 2-2.

Table 2-2. Decommissioning Information

Borehole ID	Total Depth Drilled (ft bgs)	Surface Seal[a] (ft bgs)	Bentonite Backfill (ft bgs)
C9497	274.3	0.0 – 2.3	2.3 – 274.3
C9498	18.6	0.0 – 2.0	2.0 – 18.6
C9503	225.5	0.0 – 2.1	2.1 – 225.5
C9513	240.5	0.0 – 2.0	2.0 – 240.5
C9555	270.0	0.0 – 1.9	1.9 – 260.6[b]

a. type I/II cement grout.

b. 260.6 to 270.0 feet below ground surface is natural fill.

ft bgs = feet below ground surface.

ID = identification.

N/A = not applicable.

2.2.1 Borehole C9497

Borehole C9497 is located at the 216-B-42 Trench. Phase I drilling activities from ground surface to 12.0 ft bgs were performed by Holt on May 17, 2017, using a Sonic drill rig. The 12-in. OD temporary casing was advanced from ground surface to 10.1 ft bgs. Six grab samples were collected from ground surface to 12.0 ft bgs.

Phase I drilling activities from 12.0 to 55.6 ft bgs were performed by Great West, from May 18, through May 25, 2017, using a Becker Hammer drill rig. The borehole was advanced through the high

contamination zone with direct push using 8 5/8-in. OD temporary casing. Radiological contamination up to 2,000 dpm was detected on the drill shoe as it was removed from the borehole on May 25, 2017.

Phase II drilling operations from May 31, to June 22, 2017 were performed by Holt using a sonic drilling rig. The 7-in. OD temporary casing was used to advance the borehole from 55.6 to 200.5 ft bgs and 6-in. OD temporary casing was used to advance the borehole from 200.5 to a TD of 274.3 ft bgs. Forty-five core samples were collected during drilling in LEXAN™ liners. On June 22, 2017, Holt added approximately one gallon of water to the borehole at an estimated depth of 274 ft bgs. Radiological contamination up to 20,000 dpm of direct beta/gamma was detected on the sediment from 53.4 to 55.2 ft bgs. The maximum temperature of the drill shoe was recorded as 140°Fahrenheit (°F) and the maximum temperature of the LEXAN™ liners was recorded as 137°F at 70.0 ft bgs.

Following the placement of 12-in. and 8 5/8-in. OD temporary casing, the borehole was logged on May 25, 2017, using SGLS and NMLS, from ground surface to 52.0 ft bgs. Following the placement of the 7-in. OD temporary casing, the borehole was logged from 51.0 to 202.0 ft bgs on June 8, and June 9, 2017, using SGLS and NMLS. The 6-in. OD temporary casing was logged from 201.0 to 272.0 ft bgs on June 22, 2017, using SGLS and NMLS.

Borehole decommissioning was performed from June 26, 2017 to August 16, 2017. The borehole was filled from depth to surface with 272.0 ft of bentonite chips and 2.3 ft of high strength concrete. All temporary casing was removed during decommissioning activities.

All sample information is presented in Table 2-3. All radiological contamination is summarized in Table 2-4. All VOC and ammonia contamination measurements are summarized in Table 2-5.

Table 2-3. C9497 Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
5/17/2017	0.0 – 2.0	Grab	N/A	100	B39LL7, B39LL8
5/17/2017	2.0 – 4.0		N/A	100	B39LM0, B39LM1
5/17/2017	4.0 – 6.0		N/A	100	B39LM3, B39LM4
5/17/2017	6.0 – 8.0		N/A	100	B39LM6, B39LM7
5/17/2017	8.0 – 10.0		N/A	100	B39LM9, B39LN0
5/17/2017	10.0 – 12.0		N/A	100	B39WM7, B39WM8
5/31/2017	55.0 – 57.5	LEXAN™ liner core	55.0 ft bgs = 59 56.3 ft bgs = 60 57.5 ft bgs = 65	100	B39LN2
5/31/2017	57.5 – 60.0		N/A	0	N/A
5/31/2017	60.0 – 65.0		60.0 ft bgs = 76 62.5 ft bgs = 77 65.0 ft bgs = 88	100	B39LN6

Table 2-3. C9497 Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
5/31/2017	65.0 – 70.0		65.0 ft bgs = 85 67.5 ft bgs = 89 70.0 ft bgs = 137	100	B39LN8
5/31/2017	70.0 – 75.0		70.0 ft bgs = 82 72.5 ft bgs = 82 75.0 ft bgs = 90	100	B39LP0
6/1/2017	75.0 – 80.0		75.0 ft bgs = 69 77.5 ft bgs = 77 80.0 ft bgs = 102	100	B39LP2
6/1/2017	80.0 – 85.0		80.0 ft bgs = 75 82.5 ft bgs = 78 85.0 ft bgs = 102	100	B39LP4
6/1/2017	85.0 – 90.0		85.0 ft bgs = 71 87.5 ft bgs = 71 90.0 ft bgs = 86	100	B39LP6
6/1/2017	90.0 – 95.0		90.0 ft bgs = 71 92.5 ft bgs = 73 95.0 ft bgs = 83	100	B39LP8
6/1/2017	95.0 – 100.0		95.0 ft bgs = 75 97.5 ft bgs = 79 100.0 ft bgs = 91	100	B39LR0
6/1/2017	100.0 – 105.0		100.0 ft bgs = 75 102.5 ft bgs = 80 105.0 ft bgs = 87	100	B39LR2
6/3/2017	105.0 – 110.0		105.0 ft bgs = 68 107.5 ft bgs = 67 110.0 ft bgs = 71	100	B39LR4
6/5/2017	110.0 – 115.0		110.0 ft bgs = 73 112.5 ft bgs = 73 115.0 ft bgs = 80	100	B39LR6
6/5/2017	115.0 – 120.0		115.0 ft bgs = 80 117.5 ft bgs = 80 120.0 ft bgs = 84	100	B39LR8
6/5/2017	120.0 – 125.0		120.0 ft bgs = 78 122.5 ft bgs = 79 125.0 ft bgs = 82	85	B39LT0
6/5/2017	125.0 – 130.0		125.0 ft bgs = 82 127.5 ft bgs = 83 130.0 ft bgs = 86	100	B39LT2

Table 2-3. C9497 Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
6/6/2017	130.0 – 135.0		130.0 ft bgs = 70 132.5 ft bgs = 72 135.0 ft bgs = 92	100	B39LT4
6/6/2017	135.0 – 140.0		135.0 ft bgs = 77 137.5 ft bgs = 78 140.0 ft bgs = 84	100	B39LT6
6/6/2017	140.0 – 145.0		140.0 ft bgs = 80 142.5 ft bgs = 83 145.0 ft bgs = 94	100	B39LT8
6/6/2017	145.0 – 150.0		145.0 ft bgs = 76 147.5 ft bgs = 77 150.0 ft bgs = 81	100	B39LV0
6/6/2017	150.0 – 155.0		150.0 ft bgs = 79 152.5 ft bgs = 81 155.0 ft bgs = 87	100	B39LV2
6/6/2017	155.0 – 160.0		155.0 ft bgs = 80 157.5 ft bgs = 81 160.0 ft bgs = 95	100	B39LV4
6/7/2017	160.0 – 165.0		160.0 ft bgs = 68 162.5 ft bgs = 75 165.0 ft bgs = 87	100	B39LV6
6/7/2017	165.0 – 170.0		165.0 ft bgs = 76 167.5 ft bgs = 77 170.0 ft bgs = 85	100	B39LV8
6/7/2017	170.0 – 175.0		170.0 ft bgs = 84 172.5 ft bgs = 86 175.0 ft bgs = 99	100	B39LW0
6/7/2017	175.0 – 180.0		175.0 ft bgs = 81 177.5 ft bgs = 82 180.0 ft bgs = 93	100	B39LW2
6/7/2017	180.0 – 185.0		180.0 ft bgs = 84 182.5 ft bgs = 86 185.0 ft bgs = 91	100	B39LW4
6/8/2017	185.0 – 190.0		185.0 ft bgs = 66 187.5 ft bgs = 72 190.0 ft bgs = 83	100	B39LW6
6/8/2017	190.0 – 195.0		190.0 ft bgs = 74 192.5 ft bgs = 75 195.0 ft bgs = 88	100	B39LW8

Table 2-3. C9497 Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
6/8/2017	195.0 – 200.0		195.0 ft bgs = 73 197.5 ft bgs = 74 200.0 ft bgs = 93	100	B39LX0
6/8/2017	200.0 – 205.0		200.0 ft bgs = 77 202.5 ft bgs = 78 205.0 ft bgs = 95	100	B39LX2
6/12/2017	205.0 – 210.0		205.0 ft bgs = 97 207.5 ft bgs = 99 210.0 ft bgs = 101	100	B39LX4
6/19/2017	210.0 – 215.0		210.0 ft bgs = 78 212.5 ft bgs = 100 215.0 ft bgs = 107	100	B39LX6
6/19/2017	215.0 – 220.0		215.0 ft bgs = 90 217.5 ft bgs = 92 220.0 ft bgs = 90	100	B39LX8
6/19/2017	220.0 – 225.0		220.0 ft bgs = 82 222.5 ft bgs = 80 225.0 ft bgs = 82	100	B39LY0
6/19/2017	225.0 – 230.0		225.0 ft bgs = 81 227.5 ft bgs = 80 230.0 ft bgs = 80	100	B39LY2
6/20/2017	230.0 – 235.0		230.0 ft bgs = 75 232.5 ft bgs = 78 235.0 ft bgs = 85	100	B39LY4
6/20/2017	235.0 – 240.0		235.0 ft bgs = 92 237.5 ft bgs = 80 240.0 ft bgs = 82	100	B39LY8, B39LY9, B39M00, B39M01, B39M02
6/20/2017	240.0 – 245.0		240.0 ft bgs = 96 242.5 ft bgs = 91 245.0 ft bgs = 86	100	B39M04, B39M05, B39M06, B39M07 B39M08
6/20/2017	245.0 – 250.0		245.0 ft bgs = 117 247.5 ft bgs = 100 250.0 ft bgs = 98	100	B39M10, B39M11, B39M12, B39M13, B39M14
6/21/2017	250.0 – 255.0		250.0 ft bgs = 91 252.5 ft bgs = 92 255.0 ft bgs = 120	100	B39M16
6/21/2017	255.0 – 260.0		255.0 ft bgs = 100 257.5 ft bgs = 80 260.0 ft bgs = 83	95	B39M18

Table 2-3. C9497 Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
6/22/2017	260.0 – 265.0		260.0 ft bgs = 68 262.5 ft bgs = 71 265.0 ft bgs = 72	80	B39M20
6/22/2017	265.0 – 270.0		265.0 ft bgs = 89 267.5 ft bgs = 86 270.0 ft bgs = 82	70	B39M22
6/22/2017	269.0 – 274.0		269.0 ft bgs = N/A 271.5 ft bgs = N/A 274.0 ft bgs = 82	20	B39M24
6/22/2017	272.3 – 275.0		272.3 ft bgs = N/A 273.7 ft bgs = N/A 275.0 ft bgs = 92	10	B39M26

ft bgs = feet below ground surface.

HEIS = *Hanford Environmental Information System*.

Table 2-4. Radiological Contamination at Borehole C9497

Date	Depth (ft bgs)	Media	Radiological Condition
5/25/2017	55.6	Drill shoe	Removable, 2,000 dpm, beta/gamma
5/30/2017	53.4 – 55.2	Soil	Direct, 20,000 dpm beta/gamma
5/31/2017	55.5	LEXAN™ liner	Direct, 10,000 dpm beta/gamma
8/16/2017	-	8 5/8-in. casing	Direct, 10,000 dpm beta/gamma

dpm = disintegrations per minute.

ft bgs = feet below ground surface.

Table 2-5. VOC and Ammonia Contamination at Borehole C9497

Date	Depth (ft bgs)	Media	VOC Concentration (ppm)
5/31/2017	55.0	Split barrel sample	3.4
5/31/2017	57.5	Split barrel sample	3.7

ft bgs = feet below ground surface.
ppm = parts per million.
VOC = volatile organic compounds.

2.2.2 Borehole C9503

Borehole C9503 is located in the 216-T-7 Tile Field. Phase I drilling activities from ground surface to 34.9 ft bgs were performed by Holt on May 22, 2017, using a Sonic drill rig and 12-in. OD temporary casing. Eight grab samples were collected from ground surface to 27.0 ft bgs.

Phase I drilling activites from 34.9 to 70.0 ft bgs were performed by Great West, from June 1, 2017 through June 7, 2017, using a Becker hammer drill rig. The borehole was advanced through the high contamination zone using 8 5/8-in. OD temporary casing. Radiological contamination up to 2,000 dpm direct, and 1,000 dpm removable was detected on the drill shoe as the shoe was removed from the borehole on June 7, 2017.

Phase II drilling operations from July 25, 2017, to August 10, 2017 were performed by Holt using a Sonic drill rig. The 7-in. OD temporary casing was used to advance the borehole from 70.0 to 135.3 ft bgs and 6-in. OD temporary casing was used to advance the borehole from 135.3 to a TD of 225.4 ft bgs. Thirty-four core samples were collected in LEXAN™ liners. Radiological contamination up to 20,000 dpm of direct beta/gamma contamination was detected on the soil from 53.4 to 55.2 ft bgs. The maximum temperature of the drill shoe throughout drilling Phases I and II was recorded as 184.5°F at 135.0 ft bgs, and the maximum temperature of the LEXAN™ liners was recorded as 141°F at 150.0 ft bgs.

Following the placement of the 10 1/2-in. and 8 5/8-in. OD temporary casing, the borehole was logged on June 7, 2017, and June 8, 2017, using SGLS and NMLS, from ground surface to 70.0 ft bgs. The borehole was logged on June 12, 2017, using Passive Neutron Logging System (PNLS) from ground surface to 70.0 ft bgs and HRLS from 39.0 to 46.0 ft bgs. Following the placement of the 7-in. OD casing, the borehole was logged on August 1, 2017, using SGLS and NMLS, from 68.0 to 134.0 ft bgs. The 6-in. OD temporary casing was logged on August 10, 2017, using SGLS and NMLS from 133.0 to 224.0 ft bgs.

Borehole decommissioning was performed from August 14, 2017, to August 15, 2017. The borehole was filled from depth to surface with 223.3 ft of bentonite chips, and 2.1 ft of high-strength concrete. All temporary casing was removed during decommissioning.

All sample information is presented in Table 2-6. All radiological contamination is summarized in Table 2-7. All VOC and ammonia contamination measurements are summarized in Table 2-8.

Table 2-6. C9503 Sediment Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (°F)	Recovery %	HEIS number
5/22/2017	0.0 – 2.0	Grab	N/A	100	B39VL7, B39VL8
5/22/2017	2.0 – 4.0		N/A	100	B39VM1, B39VM0
5/22/2017	4.0 – 6.0		N/A	100	B39VM4, B39VM3
5/22/2017	6.0 – 8.0		N/A	100	B39VM7, B39VM6
5/22/2017	8.0 – 10.0		N/A	100	B39VN0, B39VM9
5/22/2017	10.0 – 12.0		N/A	100	B39VN3, B39VN2
5/22/2017	12.0 – 15.0		N/A	100	B39VN6, B39VN5
5/22/2017	25.0 – 27.0		N/A	100	B39VN9, B39VN8
7/25/2017	70.0 – 72.5	LEXAN™ liner core	70.0 ft bgs = N/A 71.3 ft bgs = 78 72.5 ft bgs = N/A	60	B39VP1, B39VP0
7/25/2017	72.5 – 75.0		72.5 ft bgs = 74 73.8 ft bgs = 78 75.0 ft bgs = 96	100	B39VP3
7/25/2017	75.0 – 80.0		75.0 ft bgs = 77 77.5 ft bgs = 84 80.0 ft bgs = 102	100	B39VP5, B39VP6, B39VP7, B39VP8, B39VP9
7/25/2017	80.0 – 85.0		80.0 ft bgs = 85 82.5 ft bgs = 80 85.0 ft bgs = 95	100	B39VR1, B39VR2, B39VR3, B39VR4, B39VR5
7/25/2017	85.0 – 90.0		85.0 ft bgs = 103 87.5 ft bgs = 113 90.0 ft bgs = 131	100	B39VR7, B39VR8, B39VR9, B39VT0, B39VT1
7/25/2017	90.0 – 93.0		90.0 ft bgs = 105 91.5 ft bgs = 80 93.0 ft bgs = 81	100	B39VT3, B39VT4, B39VT5
7/26/2017	93.0 – 95.0		93.0 ft bgs = 68 94.5 ft bgs = 75 95.0 ft bgs = 72	100	B39W44, B39W43
7/26/2017	95.0 – 98.0		95.0 ft bgs = 78 96.5 ft bgs = 82 98.0 ft bgs = 95	100	B39W49, B39W50, B39W51
7/26/2017	98.0 – 100.0		98.0 ft bgs = 89 99.5 ft bgs = 89 100.0 ft bgs = 81	100	B39W55, B39W56

Table 2-6. C9503 Sediment Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (°F)	Recovery %	HEIS number
7/26/2017	100.0 – 105.0		100.0 ft bgs = 87 102.5 ft bgs = 92 105.0 ft bgs = 111	100	B39VV5, B39VV6, B39VV7, B39VV8, B39VV9
7/26/2017	105.0 – 110.0		105.0 ft bgs = 87 107.5 ft bgs = 98 110.0 ft bgs = 119	100	B39VW1
7/26/2017	110.0 – 115.0		110.0 ft bgs = 82 112.5 ft bgs = 95 115.0 ft bgs = 102	100	B39VW3
7/27/2017	115.0 – 120.0		115.0 ft bgs = 72 117.5 ft bgs = 78 120.0 ft bgs = 84	100	B39VW5
7/27/2017	120.0 – 125.0		120.0 ft bgs = 75 122.5 ft bgs = 82 125.0 ft bgs = 91	100	B39VW7
7/27/2017	125.0 – 130.0		125.0 ft bgs = 80 127.5 ft bgs = 84 130.0 ft bgs = 84	100	B39VW9
7/27/2017	130.0 – 135.0		130.0 ft bgs = 87 132.5 ft bgs = 114 135.0 ft bgs = 134	100	B39VX1
8/2/2017	135.0 – 140.0		135.0 ft bgs = 89 137.5 ft bgs = 105 140.0 ft bgs = 137	100	B39VX3
8/2/2017	140.0 – 145.0		140.0 ft bgs = 106 142.5 ft bgs = 107 145.0 ft bgs = 140	100	B39VX5
8/2/2017	145.0 – 150.0		145.0 ft bgs = 95 147.5 ft bgs = 136 150.0 ft bgs = 141	100	B39VX7
8/3/2017	150.0 – 155.0		150.0 ft bgs = 87 152.5 ft bgs = 85 155.0 ft bgs = 122	100	B39VX9, B39VY0, B39VY1, B39VY2, B39VY3
8/3/2017	155.0 – 160.0		155.0 ft bgs = 102 157.5 ft bgs = 110 160.0 ft bgs = 87	81	B39VY5, B39VY6, B39VY7, B39VY8, B39VY9
8/3/2017	160.0 – 165.0		160.0 ft bgs = 105 162.5 ft bgs = 136 165.0 ft bgs = 126	100	B39W02, B39W03, B39W04, B39W05

Table 2-6. C9503 Sediment Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (°F)	Recovery %	HEIS number
8/3/2017	165.0 – 170.0		165.0 ft bgs = 97 167.5 ft bgs = 97 170.0 ft bgs = 133	100	B39W07
8/7/2017	170.3 – 175.3		170.3 ft bgs = 86 172.8 ft bgs = 89 175.3 ft bgs = 119	100	B39W09
8/7/2017	175.4 – 180.4		175.4 ft bgs = 98 177.9 ft bgs = 102 180.4 ft bgs = 122	100	B39W11
8/8/2017	180.2 – 185.2		180.2 ft bgs = 82 182.7 ft bgs = 97 185.2 ft bgs = 140	100	B39W13
8/8/2017	185.2 – 190.2		185.2 ft bgs = 73 187.7 ft bgs = 85 190.2 ft bgs = 114	100	B39W15
8/8/2017	190.5 – 195.5		190.5 ft bgs = 77 193.0 ft bgs = 82 195.5 ft bgs = 99	100	B39W17
8/8/2017	195.4 – 200.4		195.4 ft bgs = 96 197.9 ft bgs = 99 200.4 ft bgs = 113	100	B39W19
8/9/2017	200.2 – 205.2		200.2 ft bgs = 86 202.7 ft bgs = 97 205.2 ft bgs = 129	100	B39W21
8/9/2017	205.1 – 210.1		205.1 ft bgs = 84 207.6 ft bgs = 87 210.1 ft bgs = 112	100	B39W23
8/9/2017	210.4 – 215.4		210.4 ft bgs = 82 212.9 ft bgs = 84 215.4 ft bgs = 105	100	B39W25
8/9/2017	215.3 – 220.3		215.3 ft bgs = 88 217.8 ft bgs = 91 220.3 ft bgs = 108	100	B39W27
8/10/2017	220.5 – 225.5		220.5 ft bgs = 76 223.0 ft bgs = 80 225.5 ft bgs = 101	100	B39W29

ft bgs = feet below ground surface.

HEIS = *Hanford Environmental Information System.*

Table 2-7. Radiological Contamination at Borehole C9503

Date	Depth (ft bgs)	Media	Radiological Condition
6/7/2017	71.1	Drill shoe	Direct, 2,000 dpm, beta/gamma
			Removable, 1,000 dpm beta/gamma
7/25/2017	70.0 – 72.5	LEXAN™ liner	Direct, 9,000 dpm, beta/gamma
7/25/2017	70.0 – 71.0	Soil	Direct, 10,000 dpm, beta/gamma
7/25/2017	85.0 – 90.0	LEXAN™ liner	Direct, 100,000 dpm, beta/gamma
7/25/2017	85.0 – 90.0	Split barrel	Direct, 30,000 dpm, beta/gamma
7/25/2017	85.0 – 90.0	Soil	Direct, 50,000 dpm, beta/gamma
7/26/2017	90.0 – 91.0	Soil	Direct, 4,000 dpm, beta/gamma
	93.0 – 95.0	LEXAN™ liner	Direct, 8,000 dpm, beta/gamma
8/15/2017	-	8 5/8-in. casing	Direct, 40,000 dpm beta/gamma

dpm = disintegrations per minute.
ft bgs = feet below ground surface.

Table 2-8. VOC and Ammonia Contamination at Borehole C9503

Date	Depth (ft bgs)	Media	VOC Concentration (ppm)	Ammonia Concentration (ppm)
6/7/2017	71.1	Borehole	5.0	0.0
7/27/2017	125.0 – 130.4	Clean out cuttings	13.4	52.0
7/27/2017	125.0 – 130.0	Split barrel sample	20.8	99.0
7/27/2017	130.0 – 135.0	Clean out cuttings	42.9	99.0
8/2/2017	135.0 – 140.0	Drill rod	3.5	0.0
8/2/2017	135.0 – 140.0	Clean out cuttings	9.6	15.0
8/2/2017	140.0 – 145.0	Drill rod	192.0	0.0
8/2/2017	140.0 – 145.0	Clean out cuttings	0.0	2.0
8/2/2017	145.0 – 150.0	Drill rod	206.0	0.0
8/2/2017	145.0 – 150.0	Split barrel	3.5	0.0
8/3/2017	155.0 – 160.0	Split barrel sample	3.2	1.0
8/3/2017	160.0 – 165.0	Split barrel sample	5.3	2.0
8/3/2017	160.0 – 165.0	Breathing zone	1.9	0.0
8/3/2017	165.0 – 170.0	Split barrel sample	12.2	1.1
8/3/2017	165.0 – 170.0	Breathing zone	3.2	0.0
8/7/2017	165.0 – 170.3	Core barrel	283.7	19.2
8/7/2017	175.4 – 180.4	Drill rod	34.0	0.0
8/7/2017	175.4 – 180.4	Split barrel sample	3.1	2.0
8/8/2017	190.5 – 195.5	Drill rod	15.0	23.0
8/10/2017	210.0 – 220.5	Core barrel	5.6	0.0

ft bgs = feet below ground surface.
ppm = parts per million.
VOC = volatile organic compounds.

2.2.3 Borehole C9513

Borehole C9513 is located in the 216-S-13 Crib. Phase I drilling activites from ground surface to 15.0 ft bgs were performed by Holt on May 18, 2017, using a Sonic drill rig. The 12-in. OD temporary casing was advanced from ground surface to 11.9 ft bgs. Seven grab samples were collected from ground surface to 15.0 ft bgs.

Phase I drilling activites from 15.0 to 43.0 ft bgs were performed by Great West, from May 30, 2017, through June 1, 2017, using a Becker hammer drill rig. The borehole was advanced through the high contamination zone using 8 5/8-in. OD temporary casing. Radiological contamination of 3,000 dpm direct beta/gamma was detected on the drill shoe as it was removed from the borehole on June 1, 2017.

Phase II of drilling operations from July 10, 2017 to August 31, 2017 were performed by Holt using a Sonic drill rig. The 7-in. OD temporary casing was used to advance the borehole from 43.0 to 160.3 ft bgs and 6-in. OD temporary casing was used to advance the borehole from 160.3 to a TD of 240.5 ft bgs. Forty core samples were collected during drilling in LEXAN™ liners. Radiological contamination up to 3,000 dpm of direct beta/gamma was detected on the soil from 11.9 to 43.9 ft bgs. The maximum temperature of the drill shoe was recorded as 187.4°F at 229.7 ft bgs, and the maximum temperature of the LEXAN™ liners was recorded as 159.2°F at 55.0 ft bgs.

Following the placement of the 12-in. OD and 8 5/8-in. OD temporary casing, the borehole was logged on June 1,2017 and June 5, 2017, using SGLS and NMLS, from ground surface to 42.0 ft bgs. Following placement of the 7-in. OD temporary casing, the borehole was logged on August 24, 2017, using SGLS and NMLS, from 41.0 to 159.0 ft bgs. Following placement of the 6-in. OD temporary casing, the borehole was logged on August 31, 2017, and September 5, 2017, using SGLS and NMLS from 158.0 to 239.0 ft bgs.

Borehole decommissioning was performed from September 5, 2017, to September 6, 2017. The borehole was filled from total depth to surface with 198.3 ft of bentonite chips, and 2.0 ft of high-strength concrete. All 6-in., 7-in., 8 5/8-in., and 12-in. OD temporary casing was removed during decommissioning activities.

All sample information is presented in Table 2-9. All radiological contamination is summarized in Table 2-10. All VOC and ammonia contamination measurements are summarized in Table 2-11.

Table 2-9. C9513 Sediment Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
7/10/2017	0.0 – 2.0	Grab	N/A	100	B39WN3, B39WN4, B39WN2
7/10/2017	2.0 – 4.0		N/A	100	B39WN8, B39WN9, B39WN7
7/10/2017	4.0 – 6.0		N/A	100	B39WP3, B39WP4, B39WP2
7/10/2017	6.0 – 8.0		N/A	100	B39WP8, B39WP9, B39WP7
7/10/2017	8.0 – 10.0		N/A	100	B39WR3, B39WR4, B39WR2
5/18/2017	10.0 – 12.0		N/A	100	B39WR8, B39WR9, B39WR7
5/18/2017	12.0 – 15.0		N/A	100	B39WT3, B39WT4, B39WT2
7/10/2017	45.0 – 47.5	LEXAN™ liner core	45.0 ft bgs = 87 46.3 ft bgs = 89 47.5 ft bgs = 149	100	B39WV0, B39WV1, B39WV2
7/10/2017	47.5 – 50.0		47.5 ft bgs = 84 48.8 ft bgs = N/A 50.0 ft bgs = 92	50	B39WV4
7/10/2017	50.0 – 55.0		50.0 ft bgs = 104 52.5 ft bgs = 109 55.0 ft bgs = 159	100	B39WV6
7/10/2017	55.0 – 60.0		55.0 ft bgs = 102 57.5 ft bgs = 121 60.0 ft bgs = 151	100	B39WV8
7/10/2017	60.0 – 65.0		60.0 ft bgs = 96 62.5 ft bgs = 103 65.0 ft bgs = 94	100	B39WW0
7/11/2017	65.0 – 70.0		65.0 ft bgs = 79 67.5 ft bgs = 77 70.0 ft bgs = 92	100	B39WW2
7/11/2017	70.0 – 75.0		70.0 ft bgs = 76 72.5 ft bgs = 78 75.0 ft bgs = 113	100	B39WW4
7/11/2017	75.0 – 80.0		75.0 ft bgs = 94 77.5 ft bgs = 96 80.0 ft bgs = 145	100	B39WX0, B39WX1, B39WX3
7/11/2017	80.0 – 85.0		80.0 ft bgs = 84 82.5 ft bgs = 89 85.0 ft bgs = 96	100	B39WX5
7/11/2017	85.0 – 90.0		85.0 ft bgs = 105 87.5 ft bgs = 108 90.0 ft bgs = 150	100	B39WX7

Table 2-9. C9513 Sediment Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
7/11/2017	90.0 – 95.0		90.0 ft bgs = 83 92.5 ft bgs = 87 95.0 ft bgs = 96	100	B39WX9
7/17/2017	95.0 – 100.0		95.0 ft bgs = 74 97.5 ft bgs = 76 100.0 ft bgs = 75	100	B39WY1. B39WY2, B39WY3, B39WY4
7/17/2017	100.0 – 105.0		100.0 ft bgs = 87 102.5 ft bgs = 94 105.0 ft bgs = 85	100	B39WY6
8/22/2017	105.5 – 110.5		105.5 ft bgs = 78 108.0 ft bgs = 83 110.5 ft bgs = 95	100	B39WY8
8/22/2017	110.5 – 115.5		110.5 ft bgs = 89 113.0 ft bgs = 87 115.5 ft bgs = 100	100	B39X04, B39X03, B39X02, B39X01, B39X00
8/22/2017	115.6 – 120.6		115.6 ft bgs = 92 118.1 ft bgs = 92 120.6 ft bgs = 105	100	B39X10, B39X09, B39X08, B39X07, B39X06
8/22/2017	120.2 – 125.2		120.2 ft bgs = 94 122.7 ft bgs = 98 125.2 ft bgs = 111	100	B39X16, B39X15, B39X14, B39X13, B39X12,
8/23/2017	124.8 – 129.8		124.8 ft bgs = 81 127.3 ft bgs = 81 129.8 ft bgs = 100	100	B39X20, B39X19, B39X18, B39X39
8/23/2017	130.5 – 135.5		130.5 ft bgs = 82 133.0 ft bgs = 82 135.5 ft bgs = 90	100	B39X41
8/23/2017	135.2 – 140.2		135.2 ft bgs = 99 137.7 ft bgs = 86 140.2 ft bgs = 116	100	B39X43
8/23/2017	140.5 – 145.5		140.5 ft bgs = 89 143.0 ft bgs = 90 145.5 ft bgs = 108	100	B39X47, B39X46,B39X45
8/23/2017	145.1 – 150.1		145.1 ft bgs = 104 147.6 ft bgs = 102 150.1 ft bgs = 121	100	B39X50
8/23/2017	150.7 – 155.7		150.7 ft bgs = 106 153.2 ft bgs = 129 155.7 ft bgs = 136	100	B39X56, B39X55, B39X54, B39X53, B39X52

Table 2-9. C9513 Sediment Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
8/24/2017	154.9 – 159.9		154.9 ft bgs = N/A 157.4 ft bgs = N/A 159.9 ft bgs = N/A	100	B39X64, B39X63, B39X62, B39X61, B39X60, B39X59, B39X58
8/28/2017	160.7 – 165.7		160.7 ft bgs = 75 163.2 ft bgs = 76 165.7 ft bgs = 87	100	B39X70, B39X69, B39X68, B39X67, B39X66
8/28/2017	165.3 – 170.3		165.3 ft bgs = 84 167.8 ft bgs = 88 170.3 ft bgs = 100	100	B39X72
8/28/2017	170.5 – 175.5		170.5 ft bgs = 86 173.0 ft bgs = 94 175.5 ft bgs = 100	100	B39X77, B39X76, B39X75, B39X74
8/28/2017	175.1 – 180.1		175.1 ft bgs = 92 177.6 ft bgs = 92 180.1 ft bgs = 104	100	B39X79
8/28/2017	180.6 – 185.6		180.6 ft bgs = 86 183.1 ft bgs = 92 185.6 ft bgs = 103	100	B39X81
8/28/2017	184.9 – 189.9		184.9 ft bgs = 143 187.4 ft bgs = 115 190.9 ft bgs = 138	100	B39X83
8/29/2017	190.4 – 195.4		190.4 ft bgs = 75 192.9 ft bgs = 75 195.4 ft bgs = 97	98	B39X88, B39X87, B39X86, B39X85
8/29/2017	194.7 – 199.7		194.7 ft bgs = 94 197.2 ft bgs = 111 199.7 ft bgs = 102	100	B39X90
8/29/2017	200.5 – 205.5		200.5 ft bgs = 101 203.0 ft bgs = 107 205.5 ft bgs = 122	100	B39X92
8/29/2017	205.5 – 210.5		205.5 ft bgs = 110 208.0 ft bgs = 113 210.5 ft bgs = 145	100	B39X94
8/30/2017	210.5 – 215.5		210.5 ft bgs = 86 213.0 ft bgs = 88 215.5 ft bgs = 102	100	B39XB0, B39X99, B39X98, B39X97, B39X96
8/30/2017	214.9 – 219.9		214.9 ft bgs = 111 217.1 ft bgs = 89 219.9 ft bgs = 137	100	B39XB8, B39XB7, B39XB6, B39XB5, B39XB4, B39XB3, B39XB2

Table 2-9. C9513 Sediment Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
8/30/2017	220.5 – 225.5		220.5 ft bgs = 86 223.0 ft bgs = 84 225.5 ft bgs = 89	100	B39XC4, B39XC3, B39XC2, B39XC1, B39XC0
8/30/2017	224.7 – 229.7		220.5 ft bgs = 91 223.0 ft bgs = 97 225.5 ft bgs = 152	92	B39XC6
8/31/2017	230.4 – 235.4		230.4 ft bgs = N/A 232.9 ft bgs = N/A 235.4 ft bgs = N/A	100	B39XC8
8/31/2017	235.5 – 240.5		235.5 ft bgs = 75 238.0 ft bgs = 78 240.5 ft bgs = 82	100	B39XD0

ft bgs = feet below ground surface.

HEIS = *Hanford Environmental Information System.*

Table 2-10. Radiological Contamination at Borehole C9513

Date	Depth (ft bgs)	Media	Radiological Condition
6/1/2017	43.0	Drill shoe	Direct, 3,000 dpm, beta/gamma

dpm = disintegrations per minute.

ft bgs = feet below ground surface.

Table 2-11. VOC and Ammonia Contamination at Borehole C9513

Date	Depth (ft bgs)	Media	VOC Concentration (ppm)
6/1/2017	43.9	Inner drill string	10.1
7/11/2017	90.0 – 95.0	Split-spoon shoe	139.7
7/11/2017	90.0 – 95.0	Cleanout cuttings	1,881
7/11/2017	90.0 – 95.0	Bag samples	>2,000
7/13/2017	90.0 – 95.0	Cleanout cuttings	33.7
7/17/2017	95.0 – 100.0	Split-spoon shoe	130
7/17/2017	95.0 – 100.0	Cleanout cuttings	414

Table 2-11. VOC and Ammonia Contamination at Borehole C9513

Date	Depth (ft bgs)	Media	VOC Concentration (ppm)
7/17/2017	100.0 -- 105.0	Split-spoon sample	33
7/17/2017	100.0 – 105.0	Cleanout cuttings	215
8/22/2017	105.5 – 110.5	Split-spoon shoe	212
8/22/2017	110.2 – 115.2	Breathing zone	8
8/22/2017	110.2 – 115.2	Split-spoon sample	14
8/22/2017	110.2 – 115.2	Split-spoon shoe	100
8/22/2017	110.2 – 115.2	Drill rod	56
8/22/2017	115.6 – 120.6	Split-spoon pin	49
8/22/2017	115.6 – 120.6	Split-spoon shoe	16
8/22/2017	115.6 – 120.6	Split-spoon sample	344
8/22/2017	120.2 – 125.2	Split-spoon sample	700
8/22/2017	124.8	Core barrel	396
8/22/2017	124.8	Breathing zone	7.8
8/23/2017	124.8 – 129.8	Split-spoon pin	14
8/23/2017	124.8 – 129.8	Split-spoon shoe	318
8/23/2017	130.5	Drill rod	343
8/23/2017	130.5	Breathing zone	19
8/23/2017	130.5 – 135.5	Split-spoon sample	278
8/23/2017	135.2 – 140.2	Split-spoon shoe	344
8/23/2017	140.2	Drill rod	353
8/23/2017	140.5	Breathing zone	141
8/23/2017	140.5	Drill rod	112
8/23/2017	140.5 – 145.5	Drill rod	586
8/23/2017	140.5 – 145.5	Split-spoon shoe	196
8/23/2017	145.1 – 150.1	Drill rod	288
8/23/2017	145.1 – 150.1	Breathing zone	10
8/23/2017	145.1 – 150.1	Split-spoon shoe	139
8/23/2017	150.7	Drill rod	600
8/23/2017	150.7	Breathing zone	256

Table 2-11. VOC and Ammonia Contamination at Borehole C9513

Date	Depth (ft bgs)	Media	VOC Concentration (ppm)
8/23/2017	150.7 – 155.7	Drill rod	679
8/23/2017	155.7	Breathing zone	24
8/23/2017	150.7 – 155.7	Split-spoon shoe	358
8/23/2017	154.9 – 159.9	Drill rod	454
8/23/2017	154.9 – 159.9	Split-spoon shoe	141
8/23/2017	160.7	Drill rod	749
8/24/2017	154.9 – 159.9	Split-spoon pin	114.8
8/28/2017	160.7 – 165.7	Split-spoon sample	224
8/28/2017	165.3	Cleanout cuttings	7.4
8/28/2017	165.3 – 170.3	Split-spoon sample	27.3
8/28/2017	170.5	Split-spoon sample	25.9
8/28/2017	170.5	Breathing zone	7.6
8/28/2017	170.5 – 175.5	Split-spoon sample	50
8/28/2017	175.1	Borehole	7.7
8/28/2017	175.1 – 180.1	Split-spoon sample	24.7
8/28/2017	180.6	Cleanout cuttings	86.4
8/28/2017	180.6 – 185.6	Split-spoon sample	24
8/28/2017	189.9	Cleanout cuttings	164
8/29/2017	190.4	Cleanout cuttings	101
8/29/2017	200.5	Core barrel	17.7
8/29/2017	200.5 – 205.5	Split-spoon sample	7.7
8/30/2017	214.9 – 219.9	Split-spoon sample	9.5
8/31/2017	235.5	Core barrel	9.4
8/31/2017	240.2	Clean out cuttings	16.1

ft bgs = feet below ground surface.
ppm = parts per million.
VOC = volatile organic compounds.

2.2.4 Borehole C9555 (Replacement for C9498)

Borehole C9555 is located west of the 216-T-3 Injection/Reverse well. Phase I drilling activites from ground surface to 30 ft bgs were performed by Great West from June 13, 2017, through June 15, 2017, using a Becker Hammer drill rig. The borehole was advanced through the high contamination zone using 8 5/8-in. OD temporary casing.

Phase II of drilling operations from September 11, 2017, to October 11, 2017 were performed by Holt using a Sonic drill rig. The 7-in. OD temporary casing was used to advance the borehole from 30.0 to 160.2 ft bg and 6-in. temporary casing was used to advance the borehole from 160.2 to 250.8 ft bgs. The borehole was advanced with a 4-in. core barrel from 250.8 to a TD of 270.0 ft bgs. Fifty core samples were collected during drilling in LEXAN™ liners from 30.1 to 254.7 ft bgs and one grab sample was collected from 260.0 to 262.0 ft bgs. Radiological contamination up to 30,000 dpm of direct beta/gamma was detected on the LEXAN™ liner from 90.4 to 95.4 ft bgs . The maximum temperature of the drill shoe was recorded as 198.6°F at 169.6 ft bgs and the maximum temperature of the LEXAN™ liners was recorded as 134°F at 240.7 ft bgs.

Following the placement of the 8 5/8-in. OD temporary casing, the borehole was logged on June 19,2017 using SGLS and NMLS, from ground surface to 29.5 ft bgs. Following placement of the 7-in. OD temporary casing, the borehole was logged on September 21, 2017, and September 22, 2017, using SGLS, NMLS, and PNLS from 28.0 to 157.0 ft. Following placement of the 6-in. OD temporary casing, the borehole was logged on October 9, 2017, and October 10 2017, using SGLS, NMLS, from 156.0 to 250.3 ft bgs.

Borehole decommissioning was performed on October 11, 2017 and October 12, 2017. The borehole was filled from depth to surface with 258.7 ft of bentonite chips, and 1.9 ft of cement grout. All 6-in., 7-in., and 8 5/8-in. OD temporary casing was removed during decommissioning activities.

All sample information is presented in Table 2-12. All radiological contamination is summarized in Table 2-13. All VOC and ammonia contamination measurements are summarized in Table 2-14.

Table 2-12. C9555 Core Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (°F)	Recovery %	HEIS number
9/11/2017	30.1 – 34.8	LEXAN™ liner core	30.1 ft bgs = 104 32.4 ft bgs = 105 34.8 ft bgs = 100	100	B3BKW3
9/11/2017	34.8 – 39.8		34.8 ft bgs = 98 37.3 ft bgs = 89 39.8 ft bgs = 113	100	B3BKW5
9/11/2017	40.5 – 44.8		40.5 ft bgs = 81 42.7 ft bgs = 85 44.8 ft bgs = 89	100	B3BKW7
9/11/2017	44.8 – 49.8		44.8 ft bgs = 95 47.3 ft bgs = 100 49.8 ft bgs = 98	100	B3BKW9
9/11/2017	50.3 – 54.7		50.3 ft bgs = 91 52.5 ft bgs = 94 54.7 ft bgs = 100	100	B3BKY1
9/11/2017	54.7 – 59.7		54.7 ft bgs = 108 57.2 ft bgs = 98 59.7 ft bgs = 96	100	B3BKY3
9/11/2017	60.4 – 65.4		60.4 ft bgs = 93 62.9 ft bgs = 95 65.4 ft bgs = 101	100	B3BKY5
9/12/2017	65.4 – 70.4		65.4 ft bgs = 73 67.9 ft bgs = 74 70.4 ft bgs = 78	100	B3BKY7
9/12/2017	70.4 – 75.4		70.4 ft bgs = 71 72.9 ft bgs = 72 75.4 ft bgs = 83	100	B3BKY9
9/12/2017	74.7 – 79.7		74.7 ft bgs = 81 77.2 ft bgs = 89 79.7 ft bgs = 121	100	B3BL01
9/12/2017	80.4 – 85.4		80.4 ft bgs = 84 82.9 ft bgs = 87 85.4 ft bgs = 94	100	B3BL03
9/12/2017	84.8 – 89.8		84.8 ft bgs = 85 87.3 ft bgs = 88 89.8 ft bgs = 95	100	B3BL05
9/12/2017	90.4 – 95.4		90.4 ft bgs = 89 92.9 ft bgs = 87 95.4 ft bgs = 87	100	B3BKY7, B3BL06

Table 2-12. C9555 Core Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (°F)	Recovery %	HEIS number
9/12/2017	94.8 – 97.8		94.8 ft bgs = 86 97.3 ft bgs = 85 99.8 ft bgs = 86	100	B3BL13, B3BL12, B3BL11, B3BL10, B3BL09, B3BL08
9/13/2017	98.0 – 100.0		98.0 ft bgs = 65 99.0 ft bgs = 66 100.0 ft bgs = 65	100	B3BL15, B3BL16, B3BL17
9/13/2017	100.3 – 103.3		100.3 ft bgs = 70 101.8 ft bgs = 70 103.3 ft bgs = 70	100	B3BL21, B3BL22, B3BL23, B3BL20
9/13/2017	102.9 – 104.9		102.9 ft bgs = 73 103.9 ft bgs = 75 104.9 ft bgs = 74	100	B3DB60, B3DB61, B3DB62
9/13/2017	105.0 – 108.0		105.0 ft bgs = 73 106.5 ft bgs = 74 108.0 ft bgs = 75	100	B3DB66, B3DB67, B3DB68, B3DB65
9/13/2017	108.1 – 110.1		108.1 ft bgs = 75 109.1 ft bgs = 75 110.1 ft bgs = 75	100	B3DB72, B3DB73
9/19/2017	110.4 – 113.4		110.4 ft bgs = 75 111.9 ft bgs = 75 113.4 ft bgs = 75	100	B3BL27
9/19/2017	112.9 – 114.9		112.9 ft bgs = 62 113.9 ft bgs = 79 114.9 ft bgs = 68	100	B3BL29
9/19/2017	115.4 – 120.4		115.4 ft bgs = 63 117.9 ft bgs = 64 120.4 ft bgs = 72	100	B3BL31, B3BL30
9/19/2017	120.4 – 122.4		120.4 ft bgs = 74 121.4 ft bgs = 70 122.4 ft bgs = 73	100	B39L39
9/19/2017	122.4 – 125.4		122.4 ft bgs = 73 123.9 ft bgs = 75 125.4 ft bgs = 80	100	B39L41
9/19/2017	125.5 – 130.5		125.5 ft bgs = 72 128.0 ft bgs = 75 130.5 ft bgs = 80	100	B39L43
9/19/2017	129.8 – 134.8		129.8 ft bgs = 76 132.3 ft bgs = 79 134.8 ft bgs = 83	100	B39L45

Table 2-12. C9555 Core Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (°F)	Recovery %	HEIS number
9/20/2017	135.4 – 140.4		135.4 ft bgs = 73 137.9 ft bgs = 86 140.4 ft bgs = 113	100	B3BL47
9/20/2017	140.5 – 145.5		140.5 ft bgs = 71 143.0 ft bgs = 73 145.5 ft bgs = 89	100	B3BL49
9/20/2017	145.5 – 150.5		145.5 ft bgs = N/A 148.0 ft bgs = N/A 150.5 ft bgs = N/A	100	B3BL51
9/20/2017	150.5 – 155.5		150.5 ft bgs = 64 153.0 ft bgs = 64 155.5 ft bgs = 79	100	B3BL53
9/21/2017	155.3 – 160.3		155.3 ft bgs = 60 157.8 ft bgs = 64 160.3 ft bgs = 70	100	B3BLB9
9/25/2017	160.3 – 165.3		160.3 ft bgs = 75 162.8 ft bgs = 115 165.3 ft bgs = 124	75	B3BLC1
9/25/2017	165.3 – 169.6		165.3 ft bgs = 94 167.5 ft bgs = 108 169.6 ft bgs = 188	100	B3BLC3
9/25/2017	170.3 – 175.3		170.3 ft bgs = 94 172.8 ft bgs = 106 175.3 ft bgs = 132	90	B3BL97
9/26/2017	175.4 – 180.4		175.4 ft bgs = 75 177.9 ft bgs = 88 180.4 ft bgs = 119	100	B3BL99
9/26/2017	180.3 – 185.3		180.3 ft bgs = 86 182.8 ft bgs = 108 185.3 ft bgs = 124	100	B3BL59, B3BL58, B3BL57, B3BL56, B3BL55
9/26/2017	185.4 – 190.4		185.4 ft bgs = 84 187.9 ft bgs = 95 190.4 ft bgs = 122	100	B3BL64, B3BL63, B3BL62, B3BL61
9/26/2017	190.4 – 193.4		190.4 ft bgs = 95 192.1 ft bgs = 107 193.4 ft bgs = 123	100	B3BL69, B3BL68, B3BL67
9/27/2017	195.3 – 199.3		195.3 ft bgs = 87 197.3 ft bgs = 93 199.3 ft bgs = 103	100	B3BL73

Table 2-12. C9555 Core Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (°F)	Recovery %	HEIS number
9/27/2017	200.3 – 204.8		200.3 ft bgs = 100 202.6 ft bgs = 94 204.8 ft bgs = 101	100	B3BL75
9/27/2017	205.4 – 210.4		205.4 ft bgs = 87 207.9 ft bgs = 88 210.4 ft bgs = 105	98	B3BL77
9/28/2017	210.4 – 215.4		210.4 ft bgs = 80 212.9 ft bgs = 94 215.4 ft bgs = 117	100	B3BL79
9/28/2017	215.4 – 220.4		215.4 ft bgs = 95 217.9 ft bgs = 92 220.4 ft bgs = 103	100	B3BL81
9/28/2017	220.5 – 225.5		220.5 ft bgs = 87 223.0 ft bgs = 93 225.5 ft bgs = 114	100	B3BL83
10/2/2017	225.3 – 230.3		225.3 ft bgs = 82 227.8 ft bgs = 99 230.3 ft bgs = 122	100	B3BL85
10/2/2017	230.2 – 235.2		230.2 ft bgs = 82 232.7 ft bgs = 94 235.2 ft bgs = 116	100	B3BL87
10/2/2017	235.7 – 240.7		235.7 ft bgs = 84 238.2 ft bgs = 109 240.7 ft bgs = 134	100	B3BL89
10/3/2017	240.4 – 245.4		240.4 ft bgs = 82 242.9 ft bgs = 85 245.4 ft bgs = 119	100	B3BL91
10/4/2017	245.3 – 250.3		245.3 ft bgs = 80 247.8 ft bgs = 86 250.3 ft bgs = 98	100	B3BL93
10/5/2017	250.2 – 254.7		250.2 ft bgs = 65 252.7 ft bgs = 104 255.2 ft bgs = 123	100	B3BL95
10/11/2017	260.0 – 262.0	Grab	N/A	100	B3FC13, B3FC14, B3FC15, B3FC16, B3FC17, B3FC18, B3FC19

ft bgs = feet below ground surface

HEIS = *Hanford Environmental Information System*.

Table 2-13. Radiological Contamination at Borehole C5555

Date	Depth (ft bgs)	Media	Radiological Condition
9/12/2017	90.4 – 95.4	Soil	Direct, 10,000 dpm, beta/gamma
9/12/2017	90.4 – 95.4	LEXAN™ liner	Direct, 30,000 dpm, beta/gamma
9/12/2017	94.8 – 97.8	Soil	Direct, 5,000 dpm, beta/gamma
9/12/2017	94.8 – 97.8	LEXAN™ liner	Direct, 10,000 dpm, beta/gamma
9/12/2017	95.0 – 100.0	Soil	Direct, 40,000 dpm, beta/gamma
9/13/2017	98.0 – 100.0	Soil	Direct, 10,000 dpm, beta/gamma
9/13/2017	100.3 – 103.3	Split barrel	Direct, 18,000 dpm, beta/gamma
9/13/2017	100.3 – 103.3	LEXAN™ liner	Direct, 24,000 dpm, beta/gamma
9/13/2017	102.9 – 104.9	LEXAN™ liner	Direct, 3,000 dpm, beta/gamma
9/13/2107	105.0 – 108.0	Split barrel	Direct, 11,000 dpm, beta/gamma
			Removable, 5,000 dpm, beta/gamma
9/13/2017	105.0 – 108.0	LEXAN™ liner	Direct, 20,000 dpm, beta/gamma
9/13/2017	108.1 – 110.1	Split barrel	Direct, 8,000 dpm, beta/gamma
9/13/2017	108.1 – 110.1	LEXAN™ liner	Direct, 3,000 dpm, beta/gamma
9/18/2017	105.0 – 110.0	Soil	Direct, 30,000 dpm, beta/gamma
9/19/2017	110.0 – 115.0	Soil	Direct, 4,000 dpm, beta/gamma
9/19/2017	115.4 – 120.4	LEXAN™ liner	Direct, 8,000 dpm, beta/gamma

dpm = disintegrations per minute.
ft bgs = feet below ground surface.

Table 2-14. VOC and Ammonia Contamination at Borehole C9555

Date	Depth (ft bgs)	Media	VOC Concentration (ppm)
9/12/2017	70.4 – 75.4	Split barrel sample	0.3
9/12/2017	80.4 – 85.4	Split barrel sample	2.2
9/13/2017	98.0 – 100.0	Split barrel sample	1.0
9/13/2017	108.1 – 110.1	Split-barrel shoe	0.5
9/25/2017	160.3 – 165.3	Split-barrel shoe	0.5
9/26/2017	175.4	Split barrel sample	0.3
9/26/2017	185.4	Split barrel sample	0.5
9/26/2017	190.4	Split barrel sample	2.5
9/28/2017	210.4 – 215.4	Split barrel sample	2.2
10/5/2017	250.2	Split barrel sample	1.0
10/11/2017	255.0 – 262.0	Soil	5.0

ft bgs = feet below ground surface.
ppm = parts per million.
VOC = volatile organic compounds.

2.2.5 Borehole C9498 (Replaced by C9555)

Borehole C9498 is located west of the 216-T-3 Injection/Reverse well. Phase I drilling activites from ground surface to 10.5 ft bgs were performed by Holt between May 22, 2017, and May 25, 2017, using a Sonic drill rig and 12-in. OD temporary casing. Five grab samples were collected from ground surface to 10.5 ft bgs.

Phase I drilling activites from 10.5 to 18.6 ft bgs were performed by Great West, from June 8, 2017, through June 13, 2017, using a Becker Hammer drill rig and 8 5/8-in. OD temporary casing. Refusal was encountered at 18.6 ft bgs. On May 24, 2017, radiological contamination was detected in the soil from 11 to 15 ft bgs, but the measure of activity could not be made due to windy conditions. The maximum temperature of the drill shoe was recorded as 77°F at 6.0 ft bgs.

Borehole decommissioning was performed on September 6, 2017. The borehole was filled from depth to surface with 7.5 ft of bentonite chips, and 2.0 ft of cement grout on. All temporary casing was removed during decommissioning. C9498 was not geophysically logged.

The IH detected no VOC contamination related to drilling activites. No contamination was detected in the breathing zone.

All sample information is presented in Table 2-15.

Table 2-15. C9498 Sample Collection Summary

Date	Sample Depth (ft bgs)	Sample Method	IR LEXAN Temperature (ºF)	Recovery %	HEIS number
5/24/2017	0.0 – 2.0	Grab	N/A	100	B39V03, B39V02
5/24/2017	2.0 – 4.0		N/A	100	B39V06, B39V05
5/24/2017	4.0 – 6.0		N/A	100	B39V09, B39V08
5/24/2017	6.0 – 8.0		N/A	100	B39V12, B39V11
5/24/2017	8.0 – 10.0		N/A	100	B39V15, B39V14

ft bgs = feet below ground surface.

HEIS = *Hanford Environmental Information System*.

3 Geologic Observations

This section summarizes the general geology in the area of the 200-DV-1 OU boreholes and presents the stratigraphy encountered during the drilling of each borehole. Due to the drilling method, limited visual observations of sediments were available during the Becker Hammer direct-push portion of drilling. Limited visual observations were made through the LEXAN™ liners. Exact geologic unit contacts, grain size distribution, lithology, and mineralogy were difficult to describe and estimate in the field. In addition, all reported observations are estimated. Stratigraphic unit contacts included in this document are based on soil cuttings examination in the field, when possible, and drilling observations (e.g. drill rate). Final stratigraphic unit contact depths will be determined during the remedial investigation and will incorporate the field observations, borehole geophysical logging information, and regional stratigraphic interpretations. The basis for the field stratigraphic unit contacts is included in the individual borehole summaries below.

3.1 Geology of the B Complex

The major stratigraphic units encountered during drilling in the B Complex included the gravel-dominated Hanford formation unit 1 (H1), sand dominated Hanford formation unit 2 (H2), and the coarse-grained, gravel-dominated Cold Creek unit (CCUg). The H2 overlies the CCUg and is a sand-dominated flood sequence that is composed mostly of horizontal to tabular cross-bedded sand to gravelly sand. The H1 unit is a gravel-dominated flood sequence composed of mostly poorly-sorted, basaltic, sandy gravel to silty sandy gravel.

The following discussion focuses on the geologic conditions encountered at C9497. The borehole log is included in Appendix B.

3.1.1 Borehole Geology for C9497

Sediments extracted from C9497 include the H1 and H2. From ground surface to 6 ft bgs sediments comprise reworked Hanford and surficial deposits. From 6.0 to 10.0 ft bgs, sandy gravel of the H1 unit is present and consists of approximately 70% gravel, 25% sand, and 5% silt. The sandy gravel transitions to silty sandy gravel at 10.0 ft bgs, which extends to 12.0 ft bgs. From 12.0 until 55 ft bgs, a direct push drilling method was used with no sediment recovery. Below 55.0 ft bgs, LEXAN™ liners were obtained from the borehole. Silty sandy gravel occurs from 55.0 to 57.5 ft bgs. This silty sandy gravel is comprised of approximately 35% gravel, 45% sand, and 20% silt. The gravel fraction with clasts between medium pebble and very fine pebble. Sediments were not recovered over the interval from 57.5 to 60 ft bgs. Gravelly silty sand is present from 60 to 65 ft bgs.

Sediments from 65.0 to 95.0 ft bgs alternate between gravelly silty sand and silty sand of the H2 unit. Gravelly silty sand is present from 65 to 70.0 ft bgs and from 75.0 to 80.0 ft bgs; silty sand is present from 70.0 to 75.0 ft bgs and from 80.0 to 95.0 ft bgs. At 65.0 ft bgs, the gravelly silty sand consists of approximately 25% gravel, which consists of medium pebbles to very fine pebbles; approximately 45%, coarse-to-very coarse, grained sand; and 30% silt. The silty sand at 70.0 ft bgs is 5% gravel, 65% sand, and 30% silt. The moderately sorted sand fraction ranges in size from very fine to coarse, and the gravel fraction includes grain sizes from very fine pebble-to-fine pebble. Slightly silty gravelly sand is encountered at 95.0 to 105.0 ft bgs. The slightly silty gravelly sand interval consists of 10% gravel, 75% sand, and 15% silt. The gravel fraction ranges from very fine to medium pebbles, and the moderately sorted, micaceous sand fraction consists of coarse to fine grains. At 105.0 ft bgs, sediments transition to a slightly silty sand, which extends to 170 ft bgs. The slightly silty sand is comprised of trace to 5% gravel, 55 to 75% sand, and 25 to 40% silt. The sand fraction ranges from poorly to well-sorted sorted, with grains ranging in size from very coarse to very fine. The gravel fraction, where present, is composed

of very-fine to fine pebbles. From 170 to 210 ft bgs, sediments alternate between silty sand and sandy silt. Occasional carbonate-cemented sandy clasts are present at 175.0 ft bgs, and micas are present from 175.0 to 195.0 ft bgs.

Gravel content increases at 210.0 ft bgs resulting in silty gravel which is comprised of approximately 30% gravel, 30% sand, and 40% silt. The sand fraction includes very fine to medium grain sizes. The gravel fraction comprises very fine to medium pebbles. Gravelly silty sand is present from 215.0 to 230.0 ft bgs and is comprised of 15 to 20% gravel, 50 to 55% sand, and 30% silt. The sand fraction contains very fine to coarse grains. The gravel fraction includes, very fine to coarse pebbles, which are sub-angular to sub-round. Micas are intermittently present from 215.0 to 230.0 ft bgs, and carbonate concretions are present at approximately 220.0 ft bgs. Silty sandy gravel is encountered from 230.0 to 274.3 ft bgs. At 230.0 to 235.0 ft bgs the sediment is composed of an estimated 40% gravel, 40% sand, and 20% silt. From 235.0 to 274.3 ft bgs (TD) the silty sandy gravel is consists of 55% gravel, 30% sand, and 15% silt. Within the silty sandy gravel interval, sand grain sizes range from very fine to coarse. The gravel fraction includes grain sizes from very fine pebbles to very coarse pebbles, with an average gravel size of coarse to very coarse pebbles.

The CCUg contact could not be definitively identified in the field.

3.2 Geology of the T Complex

The major stratigraphic units encountered during drilling in the T Complex include sand and gravel of the Hanford formation and/or surficial deposits, silt and sand of the CCUz and CCUc, sand and gravel of the Ringold Formation member of Taylor Flat (Rtf), and sand and gravel of the Ringold Formation member of Wooded Island – Unit E (Rwie).

The Ringold Formation was deposited on the Columbia River Basalt Group and is up to 600 ft thick in the Cold Creek syncline. The Ringold Formation consists mainly of fluvial gravels and sands. The Rwie is described as a pebble-to-cobble gravel with a fine- to coarse-grained sand matrix. The Rwie is overlain by sediments of the Rtf. The Rtf is a mixture of fluvial-sand and overbank facies associations consisting of bedded, unconsolidated to consolidated and poorly to well-sorted sandy silt, sand, and silty sand. The CCU lies unconformably on the tilted and truncated Ringold Formation surface. The CCUc consists of calcium carbonate-cemented silt, silty sand and sandy silt with some gravel in places. The CCUz overlies the CCUc and consists of slightly to well-consolidated, moderately to well-sorted silt and sandy silt. The CCUz may contain calcium carbonate but lacks the cementation found in the underlying calcic paleosols. The Hanford formation overlays the CCU and is a sand and gravel dominated flood sequence composed of medium sands and poorly-sorted, basaltic, sandy gravels and silty sandy gravels.

The following discussion focuses on the geologic conditions encountered at each individual borehole. The borehole logs are presented in Appendix B.

3.2.1 Borehole Geology for C9503

Sediments extracted from C9503 include the Hanford formation, CCUz, CCUc, Rtf, and Rwie. From ground surface to 4.0 ft bgs, sediments consist of reworked Hanford formation and surficial deposits. At 4.0 ft bgs, Hanford sandy gravel is present and consists of approximately 45% gravel, 50% sand, and 5% silt. The sandy gravel extends to 25.0 ft bgs and ranges from 45 to 60% gravel, 35 to50 % sand, and 3 to 8 % silt. The gravel fraction ranges from very fine pebbles to cobbles that are subangular. From 34.6 to 72.5 ft bgs a direct push drilling method was used with no sediment recovery. Below 72.5ft bgs, LEXAN™ liners were obtained from the borehole. Sandy gravel of the Hanford formation is present to 75.0 ft bgs. The sandy gravel is composed of 30% medium pebbles, 60% medium grained sand, and 10%

silt. The Hanford formation transitions to silty sand at 75.0 ft bgs. The CCUz is interpreted to be at this depth and consists of 85% sand, 15% silt, and a trace of gravel. The sand fraction ranges in size from very fine to very coarse. The silt content increases to 35% at 85.0 ft bgs and decreases to 10% at 95.0 ft bgs.

Sand is encountered from 95 to 100.0 ft bgs and is interpreted to be the CCUz to CCUc contact, where the silt content decreases to from 15% to 10% and sand content increases from 85 to 90%. The medium grained sand extends to 100.0 ft bgs. From 100.0 ft to 125.0 ft bgs silty sand is present and is comprised of 80%, medium grained, sand, and 20% silt. Silt content increases to 30% at 110.0 ft bgs. The CCUc to Rtf transistion is interpreted to be at 110.0 ft bgs where silty sand is present with clay. The silty sand is comprised of 70% sand and 30% sand. The sand is fine to very fine, well sorted and moist. At 125.0 to 130.0 ft bgs, sediments transition to the gravelly sand of the Rwie. The gravelly sand is comprised of an estimated 80%, fine to coarse grained, sand, 10% gravel, and 10% silt.

At 130.0 ft bgs, sediments transition to silty sandy gravel. The silty sandy gravel extends to 210.0 ft bgs with a lens of slightly silty gravelly sand from 190.0 to 195.0 ft bgs. The silty sandy gravel is comprised of 40 to 65% gravel, 20 to 48% sand, and 12 to 20% silt. The gravel fraction consists of very fine pebbles to small cobbles, that are sub-round to round. The sand fraction consists of fine to very coarse grained sand. Sandy gravel is present from 210.0 to 220.0 ft bgs. The sandy gravel is comprised of approximately 60% sand, and 40% gravel. The gravel fraction consists of very fine to very coarse pebbles that are sub-angular to round. Gravel content decreases with depth and gravelly sand is encountered at 220.0 ft bgs. The gravelly sand is comprised of 80% sand, and 20% gravel. Drilling in the gravelly sand of the Rwie continued until TD at 225.4 ft bgs.

The Hanford formation has a thickness of 75.0 ft, the CCUz has a thickness of 20.0 ft, the CCUc has a thickness of 30.0 ft, and the Rtf has a thickness of 5.0 ft.

3.2.2 Borehole Geology for C9555 (Replacement for C9498)

Sediments extracted from C9555 include the Hanford formation, CCUz, CCUc, Rtf, and Rwie. The upper 108.0 ft of the borehole consists of the sands and gravels of the Hanford formation. Very fine to medium grained sand is encountered from ground surface to 2.0 ft bgs and contains approximately 10% silt and trace, very fine to fine, pebbles. At 2.0 ft bgs, gravel content increases to 10% and sand content decreases to 80% to form a gravelly sand. Gravel ranges in size from very fine to coarse pebbles and sand ranges in size from very fine to coarse. At 4.0 ft bgs the sand content ranges from 68% to 77%, the gravel ranges from 12 to 20%, and the silt ranges from 11 to 12% to form slightly silty sandy gravel which extends to 10.0 ft bgs. The sand ranges in grain size from very fine to medium, the gravel ranges in size from very fine pebbles to small cobbles. From 10.0 to 30.1 ft bgs a direct push drilling method was used with no sediment recovery. Below 30.1ft bgs, LEXAN™ liners were obtained from the borehole until 258.0 ft bgs where two grab samples were collected to 262.0 ft bgs. At 30.1 to 34.8 ft bgs, slightly silty sand is present. The slightly silty sand is comprised of approximately 80% sand, 15% silt, and 5% gravel. Sand content ranges in grain size from very fine to very coarse, and the gravel ranges from very fine to fine pebbles. At 34.8 ft bgs, the gravel content increases to an estimated 40%, the silt content increases to 30%, and the sand content decreases to 30% to form silty sandy gravel. The gravel ranges in size from fine pebbles to small cobbles that are sub-angular to sub-round, and the sand grains range in size from very fine to medium.The sand content increases to approximately 90%, at 39.8 ft bgs, with 10% silt to form a very fine to very coarse grained sand that extends to 60.4 ft bgs. Slightly silty sand is encountered from 60.4 to 65.4 ft bgs, and is comprised of an estimated 80% sand, and 20% silt. The sand fraction ranges in grain size from very fine to very coarse. Silt content decreases to 5% at 65.4 ft bgs and, very fine to very coarse grained, sand is present with 5% very fine pebbles. Gravelly sand is encountered at 75.4 ft bgs. The sand content ranges from 70 to 85%, the gravel content ranges from 10 to 25%, and the

silt comprises approximately 5% of the gravelly sand. At 105.0 ft bgs, very fine to very coarse grained sand is present and is comprised of, 5% very fine to fine pebbles, and 5% silt.

The Hanford formation to CCUz transition is interpreted to be at 108.0 ft bgs where sandy silt is present. The sandy silt consists of 75% silt, and 25% very fine to fine grained sand. Silty sand occurs from 115.4 to 120.4 ft bgs. Sand content increases from 25 to 75%, and silt decreases from 75 to 25%. The silt content continues to decrease with depth and slightly silty sand is encountered from 120.4 to 122.4 ft bgs, and sand from 122.4 to 140.5 ft bgs. The slightly silty sand is comprised of approximately 85% sand, and 15% silt. The sand that is encountered at 122.4 ft bgs is very fine to coarse grained and contains an estimated 5% silt.

The CCUz to CCUc transistion is interpreted to be at 135.0 ft bgs where caliche nodules are present in the sand. Slightly silty gravelly sand occurs from 140.5 to 145.5 ft bgs. Sand content decreases to 75%, gravel content increases to 14%, and silt content increases to 11%. The sand fraction ranges in grain size from very fine to very coarse, and the gravel ranges in size from very fine to coarse pebbles. Gravel content increases to approximately 60%, sand content decreases to 20%, and silt increases to 20% at 145.5 ft bgs where silty sandy gravel is encountered. The gravel fraction is comprised of fine pebbles to small cobbles that are sub-angular to sub-round. The sand fraction grains range in size from very fine to very coarse. Caliche nodules that are approximately 1-mm in diameter are present in the silty sandy gravel.

The CCUc to Rtf transistion is interpreted to be at 150.5 ft bgs where silty sand is encountered. The silty sand is comprised of approximately 75%, very fine to medium grained, sand, and 25% silt. At 155.5 to 160.3 ft bgs slightly silty sand occurs and consists of an estimated 80% sand, 15% silt, and 5% gravel. Sand ranges in grain size from medium to coarse, and the gravel ranges from very fine to fine pebbles, that are sub-angular to sub-round.

The Rtf to Rwie transistion is interpreted to be at 160.3 ft bgs where the gravel increases to 80%, sand decreases to 20%. The gravel consists of very fine pebbles to small cobbles that are sub-round. The sand ranges in size from very fine to very coarse grained. At 235.7 to 240.7 ft bgs sandy gravel occurs. Gravel content decreases to 75%, and the sand content increases to 25%. The gravel is comprised of very fine pebbles to small cobbles, and the sand ranges in grain size from very fine to medium. Gravel is encountered at 240.7 until 245.4 ft bgs. The gravel, which ranges in size from very fine to very coarse pebbles, contains 15%, very fine to fine grained, sand. The sand increases to approximately 40 to 55%, and the gravel decreases to 45 to 60% from 245.4 to254.7 ft bgs where sandy gravel occurs. At 254.7 ft bgs, the sand decreases to trace amounts, the gravel increases to 60%, and silt increases to 40% where silty gravel occurs (Figure 3-1). The gravel fraction consists of very fine to very coarse pebbles that are sub-angular to round. The silty gravel extends to 260.0 ft bgs where the sand content increases to 40%, and the silt decreases to trace amounts and sandy gravel is present (Figure 3-2). The gravel fractionconsists of very fine pebbles to small cobbles, the sand ranges in grain size from very fine to coarse. The sandy gravel continues to 262.0 ft bgs. No sediment recovery occurred from 262.0 to TD at 270.0 ft bgs.

The Hanford formation has a thickness of 108.0 ft, the CCUz has a thickness of 27.0 ft, the CCUc has a thickness of 15.5 ft, and the Rtf has a thickness of 9.8 ft.

Figure 3-1. C9555 Silty Gravel at 258 ft bgs

Figure 3-2. C9555 Sandy Gravel at 260 ft bgs

3.3 Geology of the S Complex

The major stratigraphic units encountered during drilling in the S Complex include sand and gravel of the Hanford formation and/or surficial deposits, the silt and sand of the CCUz, sand and gravel of the Rtf, and sand and gravel of Rwie.

The Ringold Formation consists mainly of fluvial gravels and sands. The Rwie is described as a pebble-to-cobble gravel with a fine- to coarse-grained sand matrix. The Rwie is overlain by sediments of the Rtf. The Rtf is a mixture of fluvial-sand and overbank facies associations consisting of bedded, unconsolidated to consolidated and poorly to well-sorted sandy silt, sand, and silty sand. The CCU lies unconformably on the tilted and truncated Ringold Formation surface. The CCUz overlies the Rtf and consists of interstratified, uncemented fine sand, silt, and/or clay. The Pleistocene-age deposits of the Hanford formation overlie the CCUz and represents the dominant vadose zone materials in this area. The Hanford formation is composed of medium sands and poorly-sorted, basaltic, sandy gravels and silty sandy gravels.

The following discussion focuses on the geologic conditions encountered at C9513. The borehole log is presented in Appendix B.

3.3.1 Borehole Geology for C9513

Sediments extracted from C9513 include the Hanford formation, CCUz, Rtf and Rwie. The re-worked Hanford formation sand was encountered from ground surface to 15.0 ft bgs. The direct-push drilling method was used with no sediment recovered from 15.0 ft to 43.0 ft bgs. Beneath 43.0 ft bgs LEXAN™ liners were obtained from the borehole. From 43.0 to 47.5 ft bgs gravelly silty sand was encountered and contains approximately 65%, fine to coarse grained, sand, 30% silt and 15% gravel. The gravel portion is comprised of, angular to sub-angular, medium to coarse, pebbles. At 47.5 ft bgs, the gravels and silt decrease to 10%, and, fine to coarse grained, sand is encountered until 50.0 ft bgs. Alternating intervals of silty sand and slightly silty sand in the Hanford formation are encountered from 50.0 ft to 150.7 ft bgs. Silty sand was encountered from 50.0 to 65.0 ft bgs. The well-sorted medium, sand is 90% felsic and contains 30% silt. The silt decreases to an estimated 15% at 65.0 ft bgs and slightly silty sand is present until 113.5 ft bgs. The silt content, comprised of clay, increases to approximately 40% at 113.5 ft bgs and silty sand is encountered until 124.8 ft bgs. Slightly silty sand is encountered from 124.8 to 130.5 ft bgs and the silt and clay content decreases to 15%.

The Hanford formation and CCUz contact is interpreted to be at 130.5 ft bgs where the slightly silty sand grades to silty sand. The silty sand is comprised of approximately 30 to 40% silt and clay and 60 to 70% sand. In the silty sand interval from 150.7 to 159.9 ft bgs caliche nodules were encounterd and ranged from 5 to 40 mm in size. The silty sand is present until 175.1 ft bgs.

The CCUz to Rtf transition is interpreted to be at 175.1 ft bgs where the silt and clay content decreases to 5% and sediments transition to a sand. The grain size of the sand increases from a very fine to medium grained matrix to include coarse grains at a depth of 185.4 ft. The very fine to coarse grained sand continues until 195.0 ft bgs.

The Rtf to Rwie transistion is interpreted to be at 195.0 ft bgs where the sediment increases in silt and gravel content to form a silty sandy gravel. The silty sand gravel includes approximately 60% coarse to very coarse pebbles, 30%very fine to medium grained sand, and 11% silt. The silt content decreases with depth and a sandy gravel is present from 210.5 to 215.5 ft bgs. The sandy gravel is estaimated to contain 55% gravel, 40% sand, and 5% silt. Sediment from 215.5 to 229.7 ft bgs is comprised of sand that contains trace gravels. The sand is very fine to very coarse grained. The gravel content increases at

229.7 ft bgs where sandy gravel is encountered. The sandy gravel is comprised of approximately 35% gravel and 35% sand. Drilling in the sandy gravel continued until TD at 240.5 ft.

The Hanford formation has a thickness of 130.5 ft, the CCUz has a thickness of 44.6 ft, and the Rtf has a thickness of 19.9 ft.

4 Waste Management

Waste from individual boreholes was managed according to DOE/RL-2012-20, *Waste Control Plan for the 200-DV-1 Operable Unit* and DOE/RL-2011-41, *Hanford Site Strategy for Management of Investigation Derived Waste*. Waste generated during drilling activities included soil cuttings, decontamination water, personal protective equipment, and miscellaneous solid waste.

All vadose and saturated zone soil cuttings were released into tip dumpsters, dewatered, and placed in designated waste roll-off boxes. Dewatered fluid was treated as purge water. Water-absorbing crystals were spread over the dewatered soil cuttings to capture free liquids that could not be dewatered, allowing the waste container to be designated as solid waste. Miscellaneous solid waste associated with soil cuttings, including nitrile gloves, plastic bags used to collect soil cuttings, and other waste associated with sampling activities, were contained in clear plastic bags and placed in the designated roll-off box. All waste was managed as IDW and surveyed by the IH professional and RCTs in accordance with the site-specific Health and Safety Plan, and transferred for disposal to the Environmental Restoration Disposal Facility.

Purgewater, and decontamination fluids generated during borehole drilling, sample screening, and analysis was managed as purgewater consistent with guidance provided in DOE/RL-2009-39, *Investigation-Derived Waste Purgewater Management Action Memorandum*, and DOE/RL-2009-80, *Investigation Derived Waste Purgewater Management Work Plan.*

5 Civil Survey

Vertical and horizontal surveys were performed following borehole decommissioning in accordance with CHPRC procedure SGRP-PRO-SMP-52857 (GRP-EE-01-1.6), *Survey Requirements and Techniques*. Vertical survey data were recorded using NAVD88, *North American Vertical Datum of 1988* and the horizontal coordinates were recorded using the Washington State Plane (South Zone) NAD83, *North American Datum of 1983*, with the 1991 adjustment for horizontal coordinates. Surveyed coordinates and elevation for all borehole locations are presented in Table 1-1, and Well Survey Data Reports are included in Appendix D.

6 Borehole Acceptance

Borehole acceptance is the final step in the decommissioning process and represents confirmation of meeting requirements of the work scope. Borehole acceptance also serves as the contractual completion of the finished product.

Representatives from CHPRC and Holt (drilling contractor), participated in the acceptance inspection for boreholes C9498, C9513, and C9555 on October 24, 2017. The acceptance inspection for boreholes C9497 and C9503 was completed on August 17, 2017. Final acceptance was documented by completion of a checklist and signatures from representatives of the drilling contractor and CHPRC. A Quality Assurance Work Site Assessment will be prepared to document well acceptance.

7 References

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq., Pub. L. 107-377, December 31, 2002. Available at: https://www.gpo.gov/fdsys/pkg/USCODE-2011-title42/html/USCODE-2011-title42-chap103.htm

DOE/RL-2012-20, 2012, *Waste Control Plan for the 200-DV-l Operable Unit*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=1506301062.

DOE/RL-2009-39, 2009, *Investigation-Derived Waste Purgewater Management Action Memorandum*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0096133.

DOE/RL-2011-41, 2011, *Hanford Site Strategy for Management of Investigation Derived Waste*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0093937.

DOE/RL-2009-80, 2009, *Investigation Derived Waste Purgewater Management Work Plan*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0094946.

DOE/RL-2011-104, 2012, *Characterization Sampling and Analysis Plan for the 200-DV-1 Operable Unit*, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=1202020261.

Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=81.

NAD83, 1991, *North American Datum of 1983*, National Geodetic Survey, Federal Geodetic Control Committee, Silver Springs, Maryland, as revised.

NAVD88, 1988, *North American Vertical Datum of 1988*, National Geodetic Survey, Federal Geodetic Control Committee, Silver Springs, Maryland.

PNNL-11321, 1996, Phase *III ResonantSonic® Report*, Pacific Northwest National Laboratory, Richland, Washington. Available at: http://www.osti.gov/scitech/servlets/purl/390551-YXtThE/webviewable/.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq. Available at: http://www.epa.gov/rcraonline/.

SGW-58552, 2015, *Description of Work for the Characterization of 200-DV-1 Operable Unit, FY2015*, REV. 2, CH2M Hill Plateau Remediation Company, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0073390H

SGW-58569, 2015, *Supplemental Sampling Instruction for the Field investigation of B-Complex Area in 200-DV-l Operable Unit*, DRAFT, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0079502H

TPA-CN-668, 2015, *Tri-Party Agreement Change Notice Form TPA-CN-668, DOE/RL-2011-104, Characterization Sampling and Analysis Plan for the 200-DV-1 Operable Unit*. Available at: http://pdw.hanford.gov/arpir/index.cfm/viewDoc?accession=0081112H.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, as amended, Washington State Department of Ecology, Olympia, Washington.

Appendix A

Well Summary Sheets

This page intentionally left blank.

WELL SUMMARY SHEET

Well ID : C9497	Well Name: N/A	Start Date: 5-16-2017
Project: Installation of 4 Boreholes in 200-DV-1 OU	Location: 216-B-42 Trench	Finish Date: 8-16-2017

CONSTRUCTION DATA

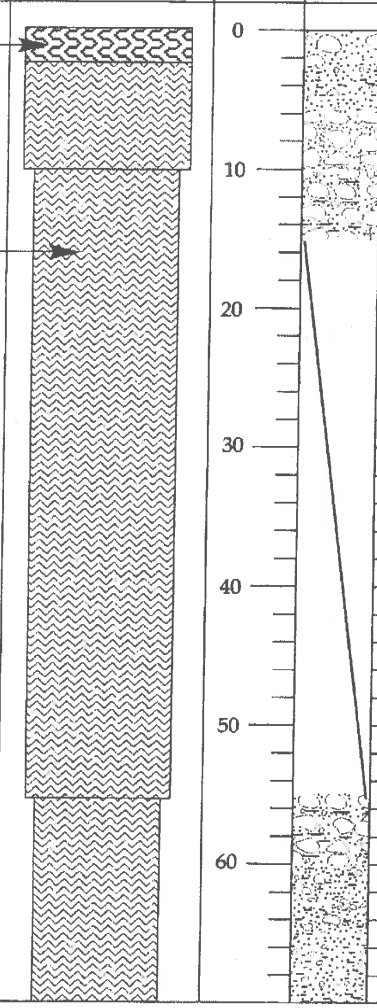
Sakrete Concrete Mix:
0.0 - 2.3 ft bgs

3/8-in Bentonite Chips:
2.3 - 274.3 ft bgs

Depths are in ft below ground surface.

Borehole drilled with 12-in O.D.
casing from 0.0 - 10.1 ft bgs
Borehole drilled with 8 5/8-in O.D
casing from 10.1 - 55.6 ft bgs
Borehole drilled with 7-in O.D
casing from 55.6 - 200.5 ft bgs
Borehole drilled with 6-in O.D
casing from 200.5 - 274.4 ft bgs

All temporary drill
casing was removed from the ground.



GEOLOGIC/HYDROLOGIC DATA

Lithologic Description (ft bgs)

0.0 - 6.0 Gravelly Sand (gS)

6.0 - 10.0 Sandy Gravel (sG)

10.0 - 12.0 Silty Sandy Gravel (msG)

12.0 - 55.0 No sediment recovered, unable to determine.

55.0 - 57.5 Silty Sandy Gravel (msG)

60.0 - 70.0 Gravelly Silty Sand (gmS)

Reported By:

Kim Schuyler	Geologist	Kim Schuyler	11/15/17
Print Name	*Title*	*Signature*	*Date*

Reviewed By:

Kelly Whitley	Well Coordinator	Kelly Whitley	12/6/17
Print Name	*Title*	*Signature*	*Date*

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-643 (REV 2)

WELL SUMMARY CONTINUATION SHEET

Page 2 of 4

Well ID: C9497 | Well Name: N/A | Project: Installation of 4 Boreholes in the 200-DV-1 OU

CONSTRUCTION DATA

Description

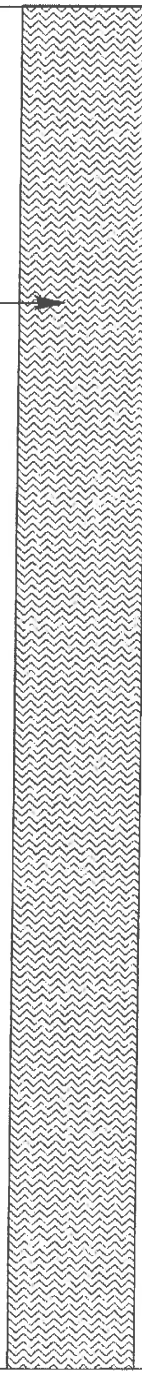
3/8-in Bentonite Chips:
2.3 - 274.3 ft bgs

Depths are in ft below ground surface.

Borehole drilled with 12-in O.D.
casing from 0.0 - 10.1 ft bgs
Borehole drilled with 8 5/8-in O.D
casing from 10.1 - 55.6 ft bgs
Borehole drilled with 7-in O.D
casing from 55.6 - 200.5 ft bgs
Borehole drilled with 6-in O.D
casing from 200.5 - 274.4 ft bgs

All temporary drill
casing was removed from the ground.

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 70, 80, 90, 100, 110, 120, 130, 140, 150, 160

Graphic Log

Lithologic Description (ft bgs)

70.0 - 75.0 Silty Sand (mS)

75.0 - 80.0 Slightly Silty Gravelly Sand ((m)gS)

80.0 - 95.0 Slightly Silty Sand ((m)S)

95.0 - 105.0 Slightly Silty Gravelly Sand ((m)gS)

105.0 - 170.0 Slightly Silty Sand ((m)S)

A-6006-992 (Rev 2)

WELL SUMMARY CONTINUATION SHEET

Well ID: C9497 | Well Name: N/A | Project: Installation of 4 Boreholes in the 200-DV-1 OU

CONSTRUCTION DATA

Description

3/8-in Bentonite Chips:
2.3 - 274.3 ft bgs

Depths are in ft below ground surface.

Borehole drilled with 12-in O.D.
casing from 0.0 - 10.1 ft bgs
Borehole drilled with 8 5/8-in O.D
casing from 10.1 - 55.6 ft bgs
Borehole drilled with 7-in O.D
casing from 55.6 - 200.5 ft bgs
Borehole drilled with 6-in O.D
casing from 200.5 - 274.4 ft bgs

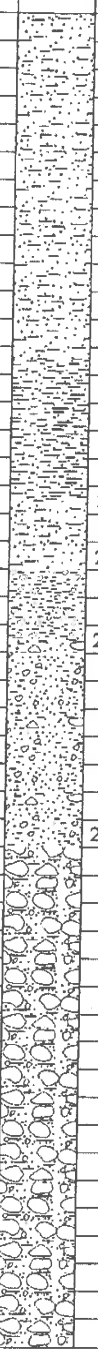
All temporary drill
casing was removed from the ground.

Diagram

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 170, 180, 190, 200, 210, 220, 230, 240, 250, 260

Graphic Log



Lithologic Description (ft bgs)

170.0 - 195.0 Silty Sand (mS)

195.0 - 205.0 Sandy Silt (sM)

205.0 - 210 Silty Sand (mS)

210.0 - 215.0 Silty Gravel (mG)

215.0 - 230.0 Gravelly Silty Sand (gmS)

230.0 - 274.3 Silty Sandy Gravel (msG)

A-6006-992 (Rev 2)

WELL SUMMARY CONTINUATION SHEET			Page 4 of 4
Well ID: C9497	Well Name: N/A	Project:	Installation of 4 Boreholes in the 200-DV-1 OU

CONSTRUCTION DATA			GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram	Depth in Feet	Graphic Log	Lithologic Description (ft bgs)
3/8-in Bentonite Chips: 2.3 - 274.3 ft bgs		270		230.0 - 274.3 Silty Sandy Gravel (msG)
				Total Depth: 274.3 ft bgs 8-16-2017
		280		
		290		
		300		
		310		
		320		
		330		
		340		
Depths are in ft below ground surface. Borehole drilled with 12-in O.D. casing from 0.0 - 10.1 ft bgs Borehole drilled with 8 5/8-in O.D casing from 10.1 - 55.6 ft bgs Borehole drilled with 7-in O.D casing from 55.6 - 200.5 ft bgs Borehole drilled with 6-in O.D casing from 200.5 - 274.4 ft bgs All temporary drill casing was removed from the ground.		350		
		360		

A-6006-992 (Rev 2)

WELL SUMMARY SHEET

Well ID : C9503	Well Name: N/A	Start Date: 5-22-2017
Project: Installation of 4 Boreholes in 200-DV-1 OU	Location: 216-T-7 Tile Field	Finish Date: 8-15-2017

CONSTRUCTION DATA

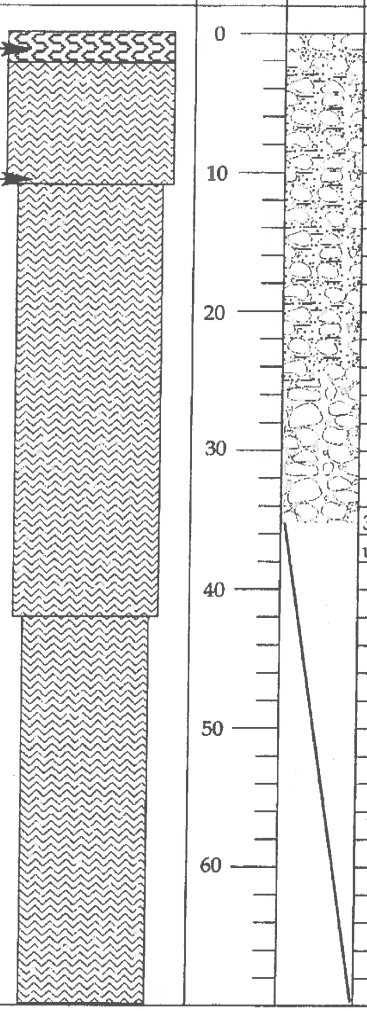
Sakrete Concrete Mix:
0.0 - 2.1 ft bgs

3/8-in Bentonite Chips:
2.1 - 225.4 ft bgs

Depths are in ft below ground surface.

Borehole drilled with 10 1/2-in O.D.
casing from 0.0 - 34.9 ft bgs
Borehole drilled with 8 5/8-in O.D
casing from 34.9 - 70.0 ft bgs
Borehole drilled with 7-in O.D
casing from 70.0 - 135.3 ft bgs
Borehole drilled with 6-in O.D
casing from 135.3 - 225.3 ft bgs

All temporary drill
casing was removed from the ground.



GEOLOGIC/HYDROLOGIC DATA

Lithologic Description (ft bgs)

0.0 - 2.0 Sandy Gravel (sG)
2.0 - 4.0 Silty Sandy Gravel (msG)
4.0 - 25.0 Sandy Gravel (sG)
25.0 - 34.6 Gravel (G)
34.6 - 72.5 No sediment recovered, unable to determine

Reported By:	Kim Schuyler	Geologist	Kim Schuyler	11/15/17
	Print Name	*Title*	*Signature*	*Date*
Reviewed By:	Kelly Whitley	Well Coordinator	Kelly Whitley	12/6/17
	Print Name	*Title*	*Signature*	*Date*

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-643 (REV 2)

WELL SUMMARY CONTINUATION SHEET

Page 2 of 3

Well ID: C9503 | Well Name: N/A | Project: Installation of 4 Boreholes in the 200-DV-1 OU

CONSTRUCTION DATA

Description

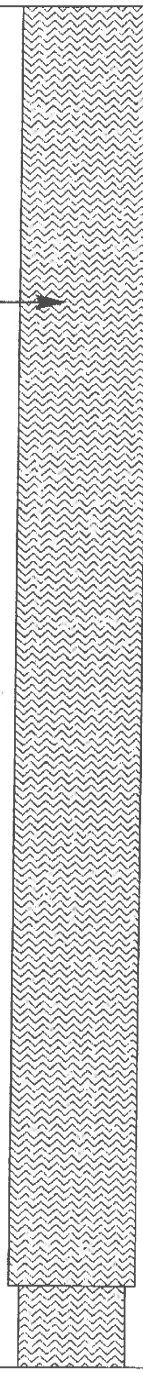
3/8-in Bentonite Chips:
2.1 - 225.4 ft bgs

Depths are in ft below ground surface.

Borehole drilled with 10 1/2-in O.D. casing from 0.0 - 34.9 ft bgs
Borehole drilled with 8 5/8-in O.D casing from 34.9 - 70.0 ft bgs
Borehole drilled with 7-in O.D casing from 70.0 - 135.3 ft bgs
Borehole drilled with 6-in O.D casing from 135.3 - 225.3 ft bgs

All temporary drill casing was removed from the ground.

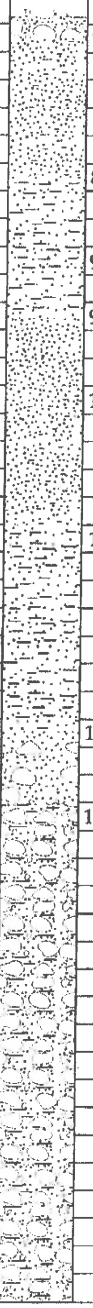
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 70, 80, 90, 100, 110, 120, 130, 140, 150, 160

Graphic Log



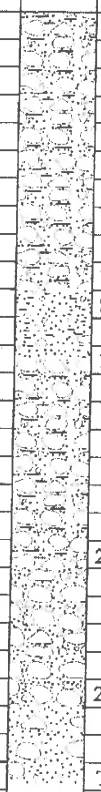
Lithologic Description (ft bgs)

- 72.5 - 75.0 Sandy Gravel (sG)
- 75.0 - 85.0 Slightly Silty Sand ((m)S)
- 85.0 - 90.0 Silty Sand (mS)
- 90.0 - 95.0 Slightly Silty Sand ((m)S)
- 95.0 - 100.0 Sand (S)
- 100.0 - 110.0 Slightly Silty Sand ((m)S)
- 110.0 - 125.0 Silty Sand (mS)
- 125.0 - 130.0 Gravelly Sand (gS)
- 130.0 - 190 Silty Sandy Gravel (msG)

A-6006-992 (Rev 2)

WELL SUMMARY CONTINUATION SHEET

Well ID: C9503	Well Name: N/A	Project	Installation of 4 Boreholes in the 200-DV-1 OU

CONSTRUCTION DATA			GEOLOGIC/HYDROLOGIC DATA	
Description	Diagram	Depth in Feet	Graphic Log	Lithologic Description (ft bgs)
3/8-in Bentonite Chips: 2.1 - 225.4 ft bgs		170		130.0 - 190.0 Silty Sandy Gravel (msG)
		180		
		190		190.0 - 195.0 Slightly Silty Gravelly Sand ((m)gS)
				195.0 - 210.0 Silty Sandy Gravel (msG)
		200		
		210		210.0 - 220.0 Sandy Gravel (sG)
		220		220.0 - 225.5 Gravelly Sand (gS)
				Total Depth: 225.4 ft bgs 8-10-2017
		230		
		240		
Depths are in ft below ground surface. Borehole drilled with 10 1/2-in O.D. casing from 0.0 - 34.9 ft bgs Borehole drilled with 8 5/8-in O.D casing from 34.9 - 70.0 ft bgs Borehole drilled with 7-in O.D casing from 70.0 - 135.3 ft bgs Borehole drilled with 6-in O.D casing from 135.3 - 225.3 ft bgs All temporary drill casing was removed from the ground.		250		
		260		

A-6006-992 (Rev 2)

WELL SUMMARY SHEET

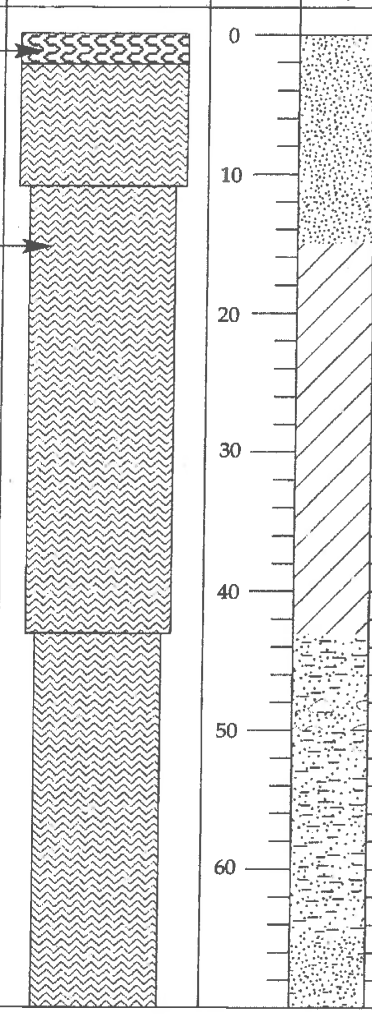
Well ID : C9513	Well Name: N/A	Start Date: 5-18-2017
Project: Installation of 4 Boreholes in 200-DV-1 OU	Location: 216-S-13 Crib	Finish Date: 9-06-2017

CONSTRUCTION DATA

Sakrete Concrete Mix:
0.0 - 2.0 ft bgs

3/8-in Bentonite Chips:
2.0 - 240.2 ft bgs

Depths are in ft below ground surface.
Borehole drilled with 12-in O.D.
casing from 0.0 - 11.9 ft bgs
Borehole drilled with 8 5/8-in O.D
casing from 11.9 - 43.0 ft bgs
Borehole drilled with 7-in O.D
casing from 43.0 - 160.3 ft bgs
Borehole drilled with 6-in O.D
casing from 160.3 - 240.3 ft bgs
All temporary drill
casing was removed from the ground.



GEOLOGIC/HYDROLOGIC DATA

Graphic Log

Lithologic Description (ft bgs)

0.0 - 15.0 Sand (S)

15.0 - 43.0 Unable to Determine*

43.0 - 47.5 Silty Sand (mS)

47.5 - 50.0 Gravelly Sand (gS)

50.0 - 65.0 silty Sand (mS)

65.0 - 113.5 slightly silty Sand ((m)S)

* = Drilling method did not produce cuttings at this depth.

Reported By:

Kim Schuyler	Geologist	Kim Schuyler	1/15/17
Print Name	*Title*	*Signature*	*Date*

Reviewed By:

Kelly Whitley	Well Coordinator	Kelly Whitley	12/6/17
Print Name	*Title*	*Signature*	*Date*

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-643 (REV 2)

WELL SUMMARY CONTINUATION SHEET

Page 2 of 3

Well ID: C9513 | Well Name: N/A | Project Installation of 4 Boreholes in the 200-DV-1 OU

CONSTRUCTION DATA

Description

3/8-in Bentonite Chips:
2.0 - 240.2 ft bgs

Depths are in ft below ground surface.

Borehole drilled with 12-in O.D.
casing from 0.0 - 11.9 ft bgs
Borehole drilled with 8 5/8-in O.D
casing from 11.9 - 43.0 ft bgs
Borehole drilled with 7-in O.D
casing from 43.0 - 160.3 ft bgs
Borehole drilled with 6-in O.D
casing from 160.3 - 240.3 ft bgs

All temporary drill
casing was removed from the ground.

Diagram

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 70, 80, 90, 100, 110, 120, 130, 140, 150, 160

Graphic Log

Lithologic Description (ft bgs)

65.0 - 113.5 slightly silty Sand ((m)S)

113.5 - 124.8 silty Sand (mS)

124.8 - 130.5 slightly silty Sand ((m)S)

130.5 - 175.1 silty Sand (mS)

A-6006-992 (Rev 2)

WELL SUMMARY CONTINUATION SHEET

Page 3 of 3

Well ID: C9513 | Well Name: N/A | Project: Installation of 4 Boreholes in the 200-DV-1 OU

CONSTRUCTION DATA

Description

3/8-in Bentonite Chips:
2.0 - 240.2 ft bgs

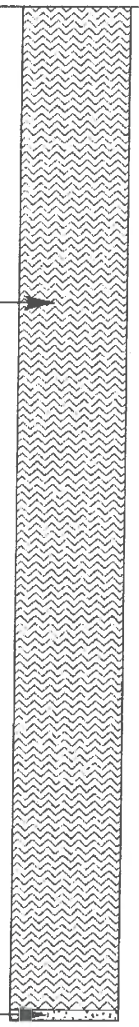
Natural fill:
240.2 - 240.5 ft bgs

Depths are in ft below ground surface.

Borehole drilled with 12-in O.D.
casing from 0.0 - 11.9 ft bgs
Borehole drilled with 8 5/8-in O.D
casing from 11.9 - 43.0 ft bgs
Borehole drilled with 7-in O.D
casing from 43.0 - 160.3 ft bgs
Borehole drilled with 6-in O.D
casing from 160.3 - 240.3 ft bgs

All temporary drill
casing was removed from the ground.

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 170, 180, 190, 200, 210, 220, 230, 240, 250, 260

Graphic Log

Lithologic Description (ft bgs)

130.5 - 175.1 silty Sand (mS)

175.1 - 195.0 Sand (S)

195.0 - 210.5 silty sandy Gravel (msG)

210.5 - 215.5 sandy Gravel (sG)

215.5 - 229.7 Sand (S)

229.7 - 240.5 sandy Gravel (sG)

Total Depth: 240.5 ft bgs 8-31-2017

A-6006-992 (Rev 2)

WELL SUMMARY SHEET

Well ID : C9555	Well Name: N/A	Start Date: 6-13-2017
Project: Installation of 4 Boreholes in 200-DV-1 OU	Location: 261-T-3 Reverse Well	Finish Date: 10-12-2017

CONSTRUCTION DATA

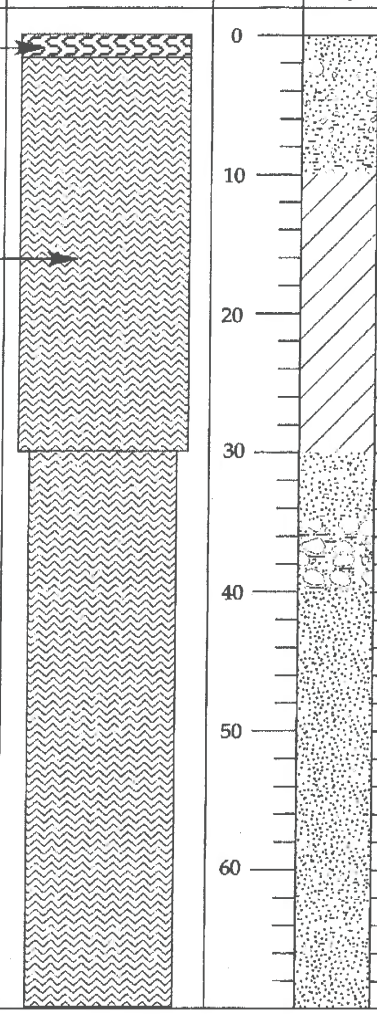
Sakrete Concrete Mix:
0.0 - 1.9 ft bgs

3/8-in Bentonite Chips:
1.9 - 260.6 ft bgs

Depths are in ft below ground surface.

Borehole drilled with 8 5/8-in O.D casing from 0.0 - 30.0 ft bgs
Borehole drilled with 7-in O.D casing from 30.0 - 160.2 ft bgs
Borehole drilled with 6-in O.D casing from 160.2 - 250.8 ft bgs

All temporary drill casing was removed from the ground.



GEOLOGIC/HYDROLOGIC DATA

Lithologic Description (ft bgs)

- 0.0 - 2.0 Sand (S)
- 2.0 - 4.0 Gravelly Sand (gS)
- 4.0 - 10.0 Slightly Silty Gravelly Sand ((m)gS)
- 10.0 - 30.1 Unable to Determine*
- 30.1 - 34.8 Slightly Silty Sand ((m)S)
- 34.8 - 39.8 Silty Sandy Gravel (msG)
- 39.8 - 60.4 Sand (S)
- 60.4 - 65.4 Slightly Silty Sand ((m)S)
- 65.4 - 75.4 Sand (S)

* = Drilling method did not produce cuttings at this depth.

Reported By:

Tracy Mallgren	Geologist		11/15/2017
Print Name	*Title*	*Signature*	*Date*

Reviewed By:

Kelly Whitley	well coordinator	Kelly Whitley	12/6/17
Print Name	*Title*	*Signature*	*Date*

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-643 (REV 2)

WELL SUMMARY CONTINUATION SHEET

Page 2 of 3

Well ID: C9555 | Well Name: N/A | Project: Installation of 4 Boreholes in the 200-DV-1 OU

CONSTRUCTION DATA

Description

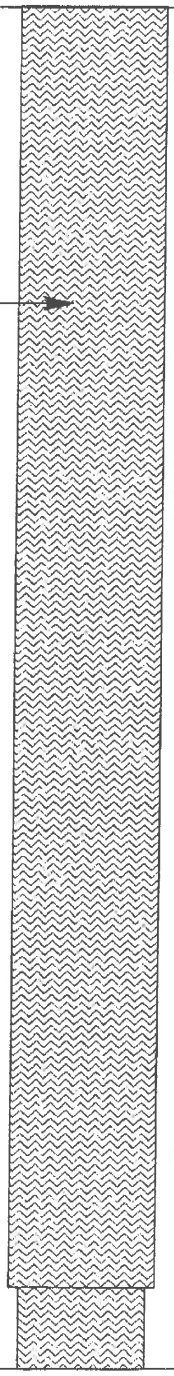
3/8-in Bentonite Chips:
1.9 - 260.6 ft bgs

Depths are in ft below ground surface.

Borehole drilled with 8 5/8-in O.D casing from 0.0 - 30.0 ft bgs
Borehole drilled with 7-in O.D casing from 30.0 - 160.2 ft bgs
Borehole drilled with 6-in O.D casing from 160.2 - 250.8 ft bgs

All temporary drill casing was removed from the ground.

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 70, 80, 90, 100, 110, 120, 130, 140, 150, 160

Graphic Log

Lithologic Description (ft bgs)

- 65.4 - 75.4 Sand (S)
- 75.4 - 105.0 Gravelly Sand (gS)
- 105.0 - 108.0 Sand (S)
- 108.0 - 115.4 Sandy Silt (sM)
- 115.4 - 120.4 Silty Sand (mS)
- 120.4 - 122.4 Slightly Silty Sand ((m)S)
- 122.4 - 140.5 Sand (S)
- 140.5 - 145.5 Slightly Silty Gravelly Sand ((m)gS)
- 145.5 - 150.5 Silty Sandy Gravel (msG)
- 150.5 - 155.5 Silty Sand (mS)
- 155.5 - 160.3 Slightly Silty Sand ((m)S)
- 160.3 - 235.7 Gravel (G)

A-6006-992 (Rev 2)

WELL SUMMARY CONTINUATION SHEET

Page 3 of 3

Well ID: C9555 | Well Name: N/A | Project: Installation of 4 Boreholes in the 200-DV-1 OU

CONSTRUCTION DATA

Description

3/8-in Bentonite Chips:
1.9 - 260.6 ft bgs

Natural Fill
260.6 - 270.0 ft bgs

Diagram

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 170, 180, 190, 200, 210, 220, 230, 240, 250, 260

Graphic Log

Lithologic Description (ft bgs)

160.3 - 235.7 Gravel (G)

235.7 - 240.7 Sandy Gravel (sG)

240.7 - 245.4 Gravel (G)

245.4 - 254.7 Sandy Gravel (sG)

254.7 - 258.0 Silty Gravel (mG)

258.0 - 262.0 Sandy Gravel (sG)

262.0 - 270.0 Unable to Determine - Core barrel reached 270.0 with no sediment recovery. Total Depth: 270.0 ft bgs 10-11-2017

A-6006-992 (Rev 2)

WELL SUMMARY SHEET

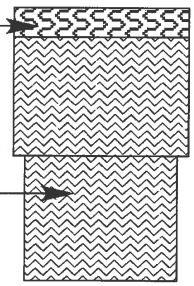
Page 1 of 1

Well ID : C9498	Well Name: N/A	Start Date: 5-24-2017
Project: Installation of 4 Boreholes in 200-DV-1 OU	Location: 216-T-3 Tile Field	Finish Date: 9-6-2017

CONSTRUCTION DATA

Sakrete Concrete Mix:
0.0 - 2.0 ft bgs

3/8-in Bentonite Chips:
2.0 - 18.6 ft bgs



Depths are in ft below ground surface.

Borehole drilled with 12-in O.D. casing from 0.0 - 10.5 ft bgs
Borehole drilled with 8 5/8-in O.D casing from 10.5 - 18.6 ft bgs

All temporary drill casing was removed from the ground.

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 10, 20, 30, 40, 50, 60

Lithologic Description (ft bgs)

- 0.0 - 2.0 Sand (S)
- 2.0 - 4.0 gravelly Sand (gS)
- 4.0 - 10.0 slightly silty gravelly Sand ((m)gS)
- 10.0 - 18.6 Unable to Determine*
- Total Depth: 18.6 ft bgs 6-12-2017

* = Drilling method did not produce cutings at this depth.

Reported By:				
	Kim Schuyler	Geologist	Kim Schuyler	9-7-2017
	Print Name	*Title*	*Signature*	*Date*

Reviewed By:				
	Kelly Whitley	Well Coordinator	Kelly Whitley	10/9/17
	Print Name	*Title*	*Signature*	*Date*

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-643 (REV 2)

Appendix B

Borehole Geologic Logs for the Characterization Boreholes in 200-DV-1 Operable Unit

This page intentionally left blank.

BOREHOLE LOG

Page 1 of 7

Date: 5/17/2017

Well ID: C9497 | Well Name: — | Location: 216-B-42 Trench

Project: Four Borings in the 200-DV-1 OU (Phase I & II) | Reference Measure Point: Ground Surface

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
0			0'-6': Gravelly Sand (gS)	Phase I: Sonic drill – 12" OD steel temp. casing drilled to 10.1 ft bgs; continuous core samples collected from 0-12 ft bgs using a 5 ft. split barrel.
			@0'-2': 10%m, 80%S, 10%G. Sand: VF-M, slightly moist. Gravel: VF-Cpeb, average 2-8mm (VF-F).	
			@2'-4': ↑ to 15%G, ↓ to 75%S, 10%m.	Becker Hammer – direct push; 8 5/8" OD steel temp. casing drilled to 55.6 ft bgs
5		2.1 min. 100% rec.	@4'-6': 10%m, 75%S, 15%G. Sand: mod. sorted, 70% VF-F, 30% med. Gravel: average VF-Fpeb	
			6'-10': Sandy Gravel (sG)	
			@6'-8': 5%m, 25%S, 70%G. Gravel: VF-Cob, average VCpeb; round to subrounded; 20% felsic, 80% mafic.	Phase II: Sonic drill – 7" OD steel temp. casing drilled to 200.5 ft bgs; 6" OD steel temp. casing drilled to 274.4 ft bgs.
10			10'-12': Silty Sandy Gravel (msG)	
	100% rec.		65% gravel, 20% sand, 15% silt	[Total Depth: 274.4 ft bgs] 6-22-17
			Sand: C → Fine, 15% Coarse, Gravel: 2-80 mm	
			avg: 2-10mm	Continuous core samples collected from 55.6 – 275 ft bgs using a 5 ft. split barrel.
			12-55' unable to determine; no sediment recovered	
15	Not Used PP 8/29	Not Used PP 8/29		[BOC @ TD = 274.4 ft bgs]
20				
25				
30				

Reported By:

Print Name	Title	Signature	Date
Paul Prevou	Geologist	Paul Prevou	8/30/2017

Reviewed By:

Print Name	Title	Signature	Date
Sarah Springer	Lic. Geologist	Sarah Springer	11-14-2017

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-642 (REV 1)

BOREHOLE LOG (Cont.)

Page 2 of 7

Date: 5/23/2017

Well ID: C94/97 | Well Name: — | Location: 216-B-4/2 Trench

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
35	Not used PP 8/29	Not used PP 8/29		Phase I: Sonic drill - 12" OD steel temp casing drilled to 10.1 ft bgs; continuous core samples collected from 0-12 ft bgs using a 5 ft split barrel. Becker Hammer - direct push; 8 5/8" OD steel temp casing drilled to 55.6 ft bgs.
40				
45				Phase II: Sonic drill - 7" OD steel temp casing drilled to 200.5 ft bgs; 6" OD steel temp. casing drilled to 274.4 ft bgs. Continuous core samples collected from 55.6 - 275 ft bgs using a 5 ft split barrel. [Total Depth: 274.3 ft. bgs] [BOC @ TD = 274.4 ft bgs]
50				@ ~45': 2,000 dpm direct beta-gamma detected on drill bit upon retrieval. @ 53.4'-55': ~20,000 dpm direct beta-gamma in cleanout cuttings
55	1 min 100% rec.		55'-57.5': Silty Sandy Gravel (msG) @55': 20% m, 45% S, 35% G. Gravel: M-VF peb. Sand: 40% mafic, 60% felsic.	@ 55.5': 10,000 dpm direct in sample; 3.4 ppm VOC
	Not used PP 8/29	Not used PP 8/29	60'-65': ~~Silty Sandy Gravel (msG)~~ gravelly silty Sand (gmS)	@ 57.5'-60': 0% recovery from split spoon; no data; 3.7 ppm VOC
60	1 min 100% rec.		@60': 25% m, 50% S, 25% G. Gravel: F-VF peb. Sand: C-VF, poorly sorted, 40% mafic, 60% felsic.	
			65'-70': Gravelly Silty Sand (gmS) @65': 30% m, 45% S, 25% G. Gravel: M-VF peb. Sand: C-VF	@ 64'-65': drill rate 2
65	1.9 min 100% rec.		70'-75': Silty Sand (mS) @70': 30% m, 65% S, 5% G. Gravel: F-VF peb. Sand: C-VF, moderately sorted, 65% felsic, 35% mafic.	
70	1.4 min 100% rec.			

Reported By:

Paul Prevou	Geologist	Paul Prevou	8/30/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 3 of 7

Date: 6/1/2017

Well ID: C9497 | Well Name: — | Location: 216-B-42 Trench

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
75	1.25 min 100% rec.		75'-80': ~~Gravelly Silty Sand (gmsf)~~ TM 10-18-17 slightly silty gravelly Sand ((m)gS)	Phase I: Sonic drill - 12" OD steel temp. casing drilled to 10.1 ft bgs; continuous core samples collected from 0-12 ft bgs using ≈ 5 ft split barrel. Becker Hammer - direct push; 8 5/8" OD steel temp. casing drilled to 55.6 ft bgs.
			@75': 20% m, 15% G, 65% S. Gravel: M-VF peb. Sand: 50% mafic, 50% felsic, VC-VF.	
			80'-95': ~~Silty Sand (msf)~~ TM 10-18-17 slightly silty Sand ((m)S)	
80	0.8 min 100% rec.		@80': 20% m, 5% G, 75% S. Gravel: F-VF peb. Sand: Well sorted, F-VF, 85% felsic, 15% mafic, dry to moist.	
85	1 min 100% rec.		@85': 20% m, 5% G, 75% S	Phase II: Sonic drill - 7" OD steel temp. casing drilled to 200.5 ft bgs; 6" OD steel temp. casing drilled to 274.4 ft bgs. Continuous core samples collected from 55.6 - 275 ft bgs using ≈ 5 ft split barrel.
90	0.8 min 100% rec.		@90': 20% m, 5% G, 75% S. Sand: Moderately sorted, VC-VF	[Total Depth = 274.3 ft bgs] [BOC @ TD = 274.4 ft bgs]
95	1.1 min 100% rec.		95'-105': ~~Silty Gravelly Sand (mgsf)~~ TM 10-18-17 slightly silty gravelly Sand ((m)gS)	
			@95': 15% m, 10% G, 75% S. Gravel: M-VF peb. Sand: Moderately sorted, C-F, 85% felsic, 45% mafic, micaceous.	
100	1.4 min 100% rec		@100': 15% m, 10% G, 75% S. Moist	
105	1.2 min 100% rec.		105'-~~100~~ 110': ~~Silty Sand (msf)~~ TM 10-18-17 slightly silty Sand ((m)S)	
			@105': 17% m, 1% G, 83% S. Sand: Poorly sorted, VC-VF, 50% mafic, 50% fel. Some Fe-staining. Dry.	
110	0.5 min 100% rec.		@110': ↑m to 20%, ↓S to 80%, 1% G.	

Reported By:

Print Name	Title	Signature	Date
Paul Prevou	Geologist	[signature]	8/30/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 4 of 7

Date: 6/5/2017

Well ID: C9497 | Well Name: — | Location: 216-B-42 Trench

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
115	0.5 min 100% rec		105'-170': ~~Sandy m-VF-C Gravel (S)~~ slightly silty Sand (LmS) @115': 20% m, 80% S, T.Gravel	Phase I: Sonic drill-12" OD steel temp casing drilled to 10.1 ft bgs; continuous core samples collected from 0-12 ft bgs using a 5 ft. split barrel. Becker Hammer – direct push; 8 5/8" OD steel temp. casing drilled to 55.6 ft. bgs.
120	1.0 min 85% rec		@120': 20% m, 80% S, T.Gravel	Phase II: Sonic drill-7" OD steel temp. casing drilled to 200.5 ft bgs; 6" OD steel temp. casing drilled to 274.4 ft. bgs. Continuous core samples collected from 55.6-235 ft bgs using a 5 ft. split barrel. [Total Depth: 274.3 ft. bgs]
125	0.7 min 100% rec		@125': Lm to 15%, ↑S to 85%, T.Gravel Sand: VF-VC, poorly sorted, 50% felsic / 50% mafic	
130	0.5 min 100% rec		@130': ↑m to 20%, ↓S to 80%, T.Gravel Sand: VF-VC, moderately sorted.	@130': some Fe-staining [BOC @ TD = 274.4 ft bgs]
135	0.6 min 100% rec		@135': 20% m, 80% S, T.Gravel	@135': Some Fe-staining
140	0.4 min 100% rec		@140': 20% m, 80% S, T.Gravel Sand: VF-C, mod. to well-sorted medium sand; 65% fel, 35% mafic; moist	@140': No Fe-staining
145	0.3 min 100% rec		@145': 20% m, 80% S, T.Gravel	
150	0.4 min 100% rec		@150': 20% m, ↑to 75% S, + to 5% G. Sand: VF-VC, poorly sorted; 50% fel, 50% mafic; dry to moist. Gravel: VF-F pebb, well-sorted	

Reported By:

Print Name	Title	Signature	Date
Paul Prevou	Geologist	[signature]	8/30/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 5 of 7

Date: 6/7/2017

Well ID: C9497 | Well Name: — | Location: ~~216-B-42~~ 216-B-42 Trench

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
155			105'-200': ~~fine sand (mS)~~ slightly silty Sand (cmS)	Phase I: Sonic drill – 12" OD steel temp. casing drilled to 10.1 ft bgs; continuous core samples collected from 0-12 ft bgs using a 5 ft. split barrel. Becker Hammer – direct push; 8 5/8" OD steel temp. casing drilled to 55.6 ft bgs.
	0.4 min 100% rec		@155': 20% m, ↑ to 80% S, ↓ to T. Brown Sand: VF-VC, poorly to mod. sorted; ↑ to 55% felsic, ↓ to 45% mafic	
160			@160': 20% m, 80% S, T. Brown	
	0.6 min 100% rec			Phase II: Sonic drill – 7" OD steel temp. casing drilled to 200.5 ft bgs; 6" OD steel temp. casing drilled to 274.4 ft bgs. Continuous core samples collected from 55.6 – 275 ft bgs using a 5 ft. split barrel. [Total Depth: 274.3 ft bgs]
165			@165': ↓ to 15% m, 80% S, ↑ to 5% G. Sand: F-VC, well-sorted coarse sand; ↑ to 45% felsic, ↑ to 55% mafic.	
	0.5 min 100% rec		170'-195': silty Sand (mS)	
170			@170': ↑ to 30% m, ↓ to 70% S, ↓ to T. Brown Sand: VF-C, mod. sorted, fine to medium sand; ↑ to 70% felsic; dry	@170': possible $CaCO_3$ concretions [BOC @ TD = 274.4 ft bgs]
	0.8 min 100% rec			
175			@175': ↓ to 25% m, ↑ to 75% S, T. Brown Sand: F-C, poorly to moderately sorted, coarse sand; 50% felsic, ↑ to 50% mafic; dry	@175': Occasional cemented sandy clasts ($CaCO_3$), micas present
	0.6 min 100% rec			
180			@180': 25% m, 75% S, T. Brown	
	0.3 min 100% rec			
185			@185': ↑ m to 30%, ↓ to 65% S, ↑ to 5% G. Sand: VF-C, mod. sorted, medium sand; ↑ to 65% felsic, ↓ to 35% mafic	@185': Micas present
	0.3 min 100% rec			
190			@190': ↑ to 40% m, ↓ to 55% S, 5% G. Sand: VF-C, poorly sorted; ↑ to 75% felsic, ↓ to 25% mafic	@190': micas
	0.7 min 100% rec			

Reported By:

Paul Prevo	Geologist	[signature]	8/30/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 6 of 7

Date: 6/8/2017

Well ID: C94/97 | Well Name: — | Location: ~~216~~ PP 8/30 ~~FFF~~ 216-B-42 Trench

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
195			~~195'-200' Silty Sand (mS)~~ PP 8/29 195'-205': Sandy Silt (SM)	Phase I: Sonic drill - 12" OD steel temp. casing drilled to 10.1 Ft bgs; continuous core samples collected from 0-12 Ft bgs using a 5 Ft. split barrel. Becker Hammer - direct push; 8 5/8" OD steel temp. casing drilled to 55.6 Ft bgs
	0.8 min 100% rec		@195': ~~40% m, 55% S, 5% G~~ PP 8/29 70% m, 30% S, TGS Sand: F-M, mod. sorted, 80% felsic, 20% mafic; dry; Micas present	
200			~~200'-205': Sandy Silt (SM)~~ PP 8/29	@200': Micas present
	0.4 min 100% rec		@200': 70% m, 30% S, TGS Sand: F-M, mod. sorted; 80% felsic, 20% mafic; dry.	Phase II: Sonic drill - 7" OD steel temp. casing drilled to 200.5 Ft bgs; 6" OD steel temp. casing drilled to 274.4 Ft bgs. Continuous core samples collected from 55.6 - 275 Ft bgs using a 5 Ft. split barrel. [Total Depth: 274.3 Ft bgs] [AOC @ TD = 274.4 Ft bgs]
205			205'-210': Silty Sand (mS)	
	1 min 100% rec		@205': 40% m, 55% S, 5% G. Sand: VF-M, poorly sorted; 75% fel, 25% mafic	
210			210'-215': Silty Gravel (mG)	
	1.3 min 100 min		@210': 40% m, 30% S, 30% G. Sand: VF-M, poorly sorted. Gravel: VF-M peb	
215			215'-220': Gravelly Silty Sand (gmS)	@215': Micas present
	1 min 100% rec		@215': 30% m, 55% S, 15% G	
220			@220': 30% m, 55% S, 15% G	@220': Possible $CaCO_3$ concretions
	0.6 min 100% rec			
225			@225': ~~40% m~~ PP 8/29 30% m, 40% S, 1 to 20% G. Sand: VF-C, moderately sorted. Gravel: VF-C peb, moderately sorted; sub ang. to sub rounded	@225': Some micas present
	0.5 min 100% rec			
230			230'-274.3' (TD): Silty Sandy Gravel (msG)	
	1.3 min 100% rec		@230': 30% m, 40% S, 40% G. Sand: VF-C, medium sand; slightly moist	

Reported By:

Print Name	Title	Signature	Date
Paul Prevou	Geologist	[signature]	8/30/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 7 of 7

Date: 6/20/2017

Well ID: C9497 | Well Name: — | Location: ~~216-T-7FP~~ ~~PP 8/30~~ 216-8-42 Trench

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
235	1 min 100% rec		230'-274.3' (TD): Silty Sandy Gravel (GW-G)	Phase I: Sonic drill - 10" OD steel temp. casing drilled to 10.1 ft bgs; continuous core samples collected from 0-12 ft bgs using a 5 ft. split barrel.
			@ 235': 4 to 15% m, 4 to 30% S, ↑ to 55% G. Sand: VF-C. Gravel: VF-VC pebb. Average size is C-VC pebb	
240	1.5 min 100% rec		@240': 15% m, 30% S, 55% G	Becker Hammer - direct push: 8 5/8" OD steel temp. casing drilled to 55.6 ft. bgs.
245	1.6 min 100% rec		@245': 15% m, 30% S, 55% G	Phase II: Sonic drill - 7" OD steel temp. casing drilled to 200.5 ft bgs; 6" OD steel temp. casing drilled to 274.4 ft bgs. Continuous core samples collected from 55.6-275 ft bgs using a 5 ft. split barrel. [Total Depth: 274.3 ft bgs.] 6-26-2017
250	1.8 min 100% rec		@250': 15% m, 30% S, 55% G	[BOC @ TD = 274.4 ft bgs]
255	0.9 min 95% rec		@255': 15% m, 30% S, 55% G	
260	1 min 100% rec		@260': 15% m, 30% S, 55% G	
265	1.5 min 100% rec		@265': 15% m, 30% S, 55% G	
270	1 min 20% rec.		@270': 15% m, 30% S, 55% G	
	1.2 min 18% rec.		@274.3': 15% m, 30% S, 55% G	

Reported By:

Paul Prevou	Geologist	[signature]	8/30/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG

Page 1 of 6
Date: 08-01-2017

Well ID: C9503 | Well Name: — | Location: 216-T-7TF
Project: Four Borings in the 200-OU-1 OU | Reference Measure Point: Ground Surface

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
0			0'-2': Sandy Gravel (SG)	Phase I: Sonic drill - 8 5/8" 10/12" OD steel temp. casing drilled to 34.9 ft bgs; ~~continuous core~~ 8 5/8 10/5/17 samples collected from 0-15 ft bgs, 25-29 ft bgs using a 5 ft split barrel. Becker Hammer = direct push, 8 5/8" OD steel casing drilled to 70.0 ft bgs.
	100% rec	1 min 44 sec	2'-4': Silty Sandy Gravel (msG)	
	100% rec		4'-25': Sandy Gravel (SG)	
5	100% rec		@6'-10': 5% m, 50% S, 45% G. Sand: moist. Gravel: sub-round to round; 25% Felsic, 75% mafic; VFpeb-Cob	@10': 2.5 ppm VOC
	100% rec	45 sec		Phase II: Sonic drill - 7" OD steel temp. casing drilled to 135.3 ft bgs; 4" OD steel temp. casing drilled to 225.3 ft bgs. Continuous core samples collected from 70-225.5 ft bgs using a 5 ft. split barrel.
	100% rec			
10			@10'-12': ↑ to 8% m, ↓ to 42% S, ↑ to 50% G. Sand: moist. Gravel: 40% VFpeb-Mpeb, 50% Cpeb, 10% VCpeb, Trace cobble; mod. to poorly sorted; 20% Felsic, 80% mafic, sub-angular to round	
	100% rec	1 min	@12'-15': ↓ to 5% m, ↑ to 45% S, 50% G. Sand: moist. Gravel: sub-round to round	
	100% rec			
15			@15'-20': 5% m, ↓ to 35% S, ↑ to 60% G. Sand: dry to moist. Gravel: 10% VFpeb-Fpeb, 15% Mpeb, 40% Cpeb, 30% VCpeb, 5% Cob; poorly sorted; 25% Fel, 75% maf; sub-ang. to round.	@11': 4 ppm VOC; @13': 37.6 ppm VOC 17'-18': Slight ↑ in moisture. 2.3 ppm H_2S, 2.4 ppm VOC @ 17'. @15': 5.9 ppm
				@5.5'-6': 10.4 ppm VOC in sample cuttings
20			@20'-25': ↓ to 3% m, ↑ to 42% S, ↓ to 55% G. Gravel: ↓ to 8% VF-Fpeb, ↓ to 12% Mpeb, ↓ Cpeb to 35%, 30% VCpeb, ↑ to 15% Cob	20'-21': ↑ silt to 12% (msG) ↓ Silt to 5% 21'-25'. 6.9 ppm VOC, 1.8 ppm H_2S, 1 ppm NH_3 @ 23'.
25			25'-34.6': Gravel (G)	
	1.3 min 100% rec		@25': 80% G, 17% S, 3% m. Sand: 80% VC; mod-well sorted. Gravel: 40% Cob, 25% VCpeb, 25% Cpeb, 10% Mpeb-VFpeb; poorly to mod. sorted; 80% maf, 20% Fel; Round, sub-round, sub-angular	@28': 2.5 VOC (ppm), 1.7 ppm H_2S, 1 ppm NH_3
30				@29'-30': 2.9 ppm VOC
				[TD = 225.5 ft bgs]

Reported By:

Print Name	Title	Signature	Date
Paul Prevou	Geologist	Paul Prevou	08/31/2017

Reviewed By:

Print Name	Title	Signature	Date
Sarah Springer	Lic. Geologist	Sarah Springer	11-14-2017

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-642 (REV 1)

BOREHOLE LOG (Cont.)

Page 2 of 6

Date: 7/25/2017

Well ID: C9503 | Well Name: — | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
35	15.5 min	Not used	34.6-72.5 unable to determine; no sediment recovered	Phase I: Sonic drill - 12" 10 3/4" OD steel temp. casing drilled to 34.9 ft bgs; continuous core samples collected from 0-15 ft bgs, 24-27 ft bgs using a 5 ft split barrel. Becker Hammer - direct push; 8 5/8" OD steel temp. casing drilled to 70.0 ft bgs.
40	15.5 min			
45	60.8 min	Not used		Phase II: Sonic drill - 7" OD steel temp. casing drilled to 135.3 ft bgs; 6" OD steel temp. casing drilled to 225.3 ft bgs. Continuous core samples collected from 70-225 ft bgs using a 5 ft. split barrel.
50				No cuttings produced from 34.6 - 72.5 ft bgs; unable to describe lithology.
55	30 min			[TD = 225.4 ft bgs]
60	9 min			
65	91.2 min	Not used		5ppm VOC within 1-2 in. of borehole after tripping out drill string from ~70 ft bgs. @70'-72': 9,000 cpm direct beta/gamma in sample. @70'-72.5': due to poor recovery, no field lithologic data recorded. @~70' bgs: 2,000 cpm direct beta/gamma, 1,000 cpm measurable on tip and inner drive rod upon tripping out from ~70 ft bgs.
70	0.5 min 60% rec		72.5'-75': Sandy Gravel (SG)	
	0.9 min 100% rec		@72.5': 10% m, 60% S, 30% G. Sand: well-sorted, med. sand; 75% fel, 25% mafic. Slightly moist. Gravel: Well-sorted, medium gravel	

Reported By:

Paul Prevou	Geologist	Paul Prevou	8/31/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 3 of 6

Date: 7/25/2017

Well ID: C9503 | Well Name: — | Location: 216-T-TTF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
75			75'-85': ~~Sand (S)~~ slightly silty Sand (cmS)	Phase I: Sonic drill - 12" OD steel temp. casing drilled to 34.9 ft bgs; continuous core samples collected from 0-15 ft bgs, 25-27 ft bgs using a 5 ft. split barrel.
	0.5 min 100% rec		@75': Trace G, 85% S, 15% m. Sand: P sorted; VC-VF; 70% fel, 30% maF; moist	
			@80': Trace G, 85% S, 15% m. Sand: P sorted, VC-VF; 70% fel, 30% maF; moist.	
80				Becker Hammer - direct push; 8 5/8" OD steel temp. casing drilled to 70.0 ft bgs.
	0.9 min 100% rec			@ 70'-71': 10,000 dpm beta/gamma in cleanout cuttings
			85'-90': Silty Sand (mS)	Phase II: Sonic drill - 7" OD steel temp. casing drilled to 135.3 ft bgs; 6" OD steel temp. casing drilled to 225.3 ft bgs. Continuous core samples collected from 70-225 ft bgs using a 5 ft. split barrel.
85			@85': 0% G, 65% S, 35% m	
	0.2 min 100% rec			
			90'-95': ~~Sand (S)~~ slightly silty Sand (cmS)	@72.5'-75': 5,000 dpm in cleanout cuttings [TD = 225.4 ft bgs]
90			@90': 0% G, 85% S, 15% m. Moist	
	0.3 min 100% rec			@85'-90': Max of 100K dpm direct beta-gamma in core sample; 1000 dpm smearable; 30K dpm near split barrel shoe; Max 50K dpm direct in 85'-90' cleanout cuttings
	0.3 min 100% rec		95'-100': Sand (S)	
95			@95': ↑ Sand to 90%, ↓ Silt to 10%	@90'-91': 4K dpm direct in cleanout cuttings
	1 min 100% rec			@93'-95': 8K dpm direct in sample (opt. 39)
	0.8 min 100% rec			
100			100'-110': ~~Silty Sand (mS)~~ slightly silty Sand (cmS)	
			@100': 0% G, 80% S, 20% m	
	0.75 min 100% rec			
105			@105': Trace G, 85% S, 15% m. Sand: 95% fel, 5% maF; Well Sorted; Med. Sand	
	0.9 min 100% rec			
			110'-125': silty Sand (mS)	
110			@110': ↓ S to 70%, ↑ m to 30%. Sand: F-VF, well sorted; Moist	@110': Possible clays
	0.4 min 100% rec			

Reported By:

Paul Prevou	Geologist	Paul Prevou	8/31/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 4 of 6

Date: 7/27/2017

Well ID: C9503 | Well Name: — | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
115	0.5 min 100% rec		~~119'~~ 115' 125': Silty Sand (mS) @115': 0% G, 70% S, 30% m. Sand: F-VF; possible clays	Phase I: Sonicdrill – 12" OD steel temp. casing drilled to 34.9 ft bgs; continuous core samples collected from 0-15 ft bgs, 25-27 ft bgs using a 5 ft. split barrel. Becker Hammer – direct push; 8 5/8" OD steel temp. casing drilled to 70.0 ft bgs.
120	0.6 min 100% rec		@120': 0% G, 70% S, 30% m; Sand: F-VF; clays	@125'-130': 7.1 ppm VOC @ split barrel pin
125	0.7 min 100% rec		125'-130': ~~Sand (mS)~~ PP 8-21 Gravelly Sand (gS) @125': 10% G, 80% S, 10% m. Sand: Mod. sorted, C-F; 50% Fel, 50% mafic	Phase II: Sonic drill – 7" OD steel temp. casing drilled to 135.3 ft. bgs; 6" OD steel casing drilled to 225.3 ft bgs. Continuous core samples collected from 70-225 ft bgs using a 5 ft. split barrel. [TD = 225.4 ft bgs]
130	1.4 min 100% rec		130'-190': Silty Sandy Gravel (msG) @130': 40% G, 48% S, 12% m. Gravel: Cob-Mpeb	@128'-130': 5.0 ppm NH_3, 6.7 ppm H_2S, 13.4 ppm VOC at source; follow-up check minutes later found 99 ppm NH_3, 20.8 ppm VOC, 2.8 ppm H_2S at source (☹ in breathing zone)
135	3.8 min 100% rec		@135': ↑ to 65% G, ↑ to 15% m, ↓ to 20% S. Gravel: F-Cpeb, mod. sorted, sub-angular to round; moist	@135': 42.9 ppm VOC, 5.1 ppm H_2S, 7% LEL, 99 ppm NH_3 in cleanout cuttings; @135': Possible clays; @135'-140': 3.5 ppm VOC @ source breaking rods tripping out 135'-140' sample
140	2.5 min 100% rec		@140': 65% G, 20% S, 15% m. Dry.	@145': 192 ppm VOC @ drill rod joint while tripping out 140'-145' cleanout cuttings; 2.1 ppm H_2S, 2.0 ppm NH_3 at top of casing; @145'-150': VOC from 21.7 – 206 ppm at drill rod joints while tripping out sample; 7.5 ppm VOC @ top of split barrel near pin.
145	2.1 min 100% rec		@145': 65% G, 20% S, 15% m. Dry. Gravel: Fpeb-Cob, sub-round to round; 90% mafic, 10% felsic.	
150	1.8 min 100% rec		@150': ↓ to 60% G, 20% S, ↑ to 20% m. Sand: Well-sorted, medium sand; 70% felsic, 30% mafic. Gravel: Cpeb-cob; 15% felsic, 85% mafic.	@150': Possible clays; @155'-160': 3.2 ppm VOC, 1 ppm NH_3 source in 155'-160' sample

Reported By:

Print Name	Title	Signature	Date
Paul Prevour	Geologist	Paul Prevour	8/31/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 5 of 6

Date: 8/8/2017

Well ID: C9503 | Well Name: — | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
155	2.1 min 81% rec		150'-190': Silty Sandy Gravel (GMSG) @155': 60% G, 20% S, 20% m. No clay.	Phase I: Sonic drill - 10 1/4" 40% OD steel temp. casing drilled to 24.7 ft bgs; continuous core samples collected from 0-15 ft bgs, 25-27 ft bgs using a 5 ft split barrel. Becker Hammer - direct push; 8 5/8" OD steel temp. casing drilled to 70.0 ft bgs
160	3.7 min 100% rec		@160': 60% G, 20% S, 20% m	Phase II: Sonic drill - 7" OD steel temp. casing drilled to 135.5 ft bgs; 6" OD steel casing drilled to 225.3 ft bgs. Continuous sonic core samples collected from 70 to 225 ft bgs using a 5 ft split barrel [TD = 225.4 ft bgs]
165	2.1 min 100% rec		@165': 60% G, 20% S, 20% m. Moist.	@160'-165': 5.3 ppm VOC, 1.3 ppm H_2S, 2 ppm NH_3 in sample; 1.9 ppm VOC breathing zone
170	1.2 min 100% rec		@170': 60% G, 20% S, 20% m. Sand: Dry. Gravel: VF-VC pub, sub-round	@165'-170': 12.2 ppm VOC, 2 ppm H_2S, 1.1 ppm NH_3 @ sample source; 3.2 ppm VOC breathing zone. * Max soil temp for 160'-165' sample (core 20) = 225°F
175	2.8 min 100% rec		@175': 60% G, 20% S, 20% m	@170': 49 ppm CO, 19 ppm NH_3, 18.2 ppm H_2S, 19 ppm SO_2, 283.7 ppm VOC @ core barrel from 165'-170' cleanout; once sample truck on, source readings are 1000 ppm VOC, 20 ppm SO_2, 30 ppm NH_3 at core barrel
180	1.7 min 100% rec		@180': 60% G, 20% S, 20% m. Sand: dry. Gravel: VF-VC pub, sub-round to round	@175'-180': 34 ppm VOC source from split barrel
185	1.1 min 100% rec		@185': 60% G, 20% S, 20% m	
190	1 min 100% rec		190'-195': Slightly Silty Gravelly Sand (GW-GM S) 25% g, 15% m, 65% S. Gravel: vf-m pebbles, SR-R. Sand: vf-m	@190'-195': 15 ppm VOC, 23 ppm NH_3, 248 ppm CO source at split barrel

Reported By:

Paul Prevou	Geologist	Paul Prevou	8/31/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 6 of 6

Date: 8/9/2017

Well ID: C9503 | Well Name: — | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
195	1 min 100% rec		195'-210': Silty Sandy Gravel (msG) @195': 60% G, 20% S, 20% m. Dry	Phase I: Sonic drill - 10 1/2" to 12" OD steel temp casing drilled to 34.9 ft bgs; continuous core samples collected from 0-18 ft bgs, 25-27 ft bgs, using a 5 ft split barrel. Becker Hammer - direct push; 8 5/8" OD steel temp casing drilled to 70.0 ft bgs
200	1.7 min 100% rec		@200': 60% G, 20% S, 20% m. Dry	Phase II: Sonic drill - 8" OD steel temp casing drilled to 135.3 ft bgs; 6" OD steel temp casing drilled to 225.3 ft bgs; continuous sonic core samples collected from 70 to 225 ft bgs using a 5 ft split barrel.
205	1.6 min 100% rec		@205': 60% G, 20% S, 20% m	
210	1.3 min 100% rec		210'-220': Sandy Gravel (sG) @210': 40% G, 60% S, 0% m. Sand: VF-C, Gravel: VF-VC, peb, sub-angular to round.	
215	1.3 min 100% rec		@215': 40% G, 60% S, 0% m	@215'-220': 5.6 ppm VOC at core barrel pin following cleanout run
220	1 min 100% rec		220'-225.5' (TD): Gravelly Sand (gS) @220': 20% G, 80% S, 0% m. Sand: VF-VC	
225			Not Used PP 9/5/2017	[TD @ 225.4 ft bgs] 8/10/17
230				

Reported By:

Paul Prevou	Geologist	Paul Prevou	8/31/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG

Page 1 of 7
Date: 07-10-2017

Well ID: C9513 | Well Name: — | Location: 216-S-13 Crib
Project: Four Borings in the 200-OV-1 OU (Phase I and II) | Reference Measure Point: Ground Surface

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
0			0'-15': Backfill/reworked Holocene surficial deposits Sand (s)	Sonic drill, ~~7"~~ PP 7-17 steel temp. casing. ~~Split~~ KS 10/5/17 ~~spoon~~ samples taken at 0-2, 2-4, 4-6, 6-8, 8-10, 10-12, and 12-15 ft bgs using a 5' core barrel ~~split spoon~~; and PP 7-13
		2.5min 100% rec.		from 45-47.5 and from 47.5-50 ft bgs using a 5' core barrel and ~~split spoon~~; and LEXAN liners
5				continuously at 5' intervals from 50 to 240.5 ft. bgs using a 5' core barrel ~~split spoon~~ and LEXAN liners
		1.3min 100% rec.		
10				Drilled with 12" casing from 0-11.9 ft bgs; 8 5/8" casing from 0-~~48.4~~ 43.0 ft bgs; 7" casing from 0-160.3 ft bgs; and 6" casing from 0-240.3 ft bgs.
	0.6min 100% rec.		15'-~~45~~ 43 ft bgs: Direct push drilling; no soil recovery	
15				Direct push w/ Becker Hammer from 11.9 ft bgs to ~~40.15~~ 43.0 ft bgs, ~~and from 40.15 ft bgs to 43.0 ft. bgs.~~ KS 10/5/17 [Total Depth = 240.5 ft bgs]
20				
	66 min			
25		Not used KS 10/5/17		
30				

Reported By:

Print Name	Title	Signature	Date
Paul Prevou	Geologist	Paul Prevou	9-7-2017

Reviewed By:

Print Name	Title	Signature	Date
Sarah Springer	Lic Geologist	Sarah Springer	11-14-2017

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-642 (REV 1)

BOREHOLE LOG (Cont.)

Page 2 of 7

Date: 07-10-2017

Well ID: C9518 | Well Name: — | Location: 216-S-18 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
35	66 min	not used CS 10/18/17	15'-~~45~~ 43': Direct push drilling; no soil recovery	Sonic drill, steel temp. casing. ~~Split spoon~~ samples taken at 0-2, 2-4, 4-6, 6-8, 8-10, 10-12, and 12-15 ft bgs using a 5' core barrel ~~split spoon~~. From 45-47.5 and from 47.5-50 ft bgs using a 5' split ~~spoon~~ core barrel and LEXAN liners and continuously at 5' intervals from 50 to 240.5 ft bgs using a 5' split core barrel ~~spoon~~ and LEXAN liners
40	107 min			
45	1.75 min 100% rec.		43 CS 10/18/17 ~~45~~-47.5': ~~Gravelly~~ Silty Sand ~~(gmS)~~ (mS) TM 10-19-17 30% m, ~~15% G~~ 51% G, 65% S. Gravel: mod. sorted, 85% mafic, 15% felsic, angular to sub-angular, Cpeb-Mpeb; Sand: poorly sorted, 80% mafic.	Drilled with 12" casing from 0-11.9 ft bgs; 8 5/8" casing from 0-~~45~~ 43.0 ft bgs; 7" casing from 0-140.3 ft bgs; and 6" casing from 0-240.3 ft bgs. [Total Depth = 240.5 ft bgs]
	0.5 min 50% rec.		47.5'-50': ~~Sand (S)~~ TM 10-19-17 gravelly Sand (gS) 10% m, 80% S, 10% G. Poorly sorted, C-F sand, 50% mafic, 50% felsic.	
50	1.3 min 100% rec.		50'-65.0': Silty Sand (mS) @50'-~~45~~ 55': ~~10% m, 85% S, 0% G~~ PP 7-18 Well-sorted, medium sand. 90% Felsic, 10% mafic. 30% m, 70% S, 0% G @55'-60': 30% m, 70% S, 0% G. Well-sorted, medium sand. 90% Felsic, 10% mafic	
55	1.7 min 100% rec.			
60	1.5 min 100% rec.		@60'-65': 30% m, 70% S, 0% G. Well-sorted, medium sand. 90% mafic, 10% Mafic 65'-113.5': Slightly Silty Sand ((m)S) @65'-70': ↓m to 15%, ↑S to 85%, 0% G. Well-sorted, medium sand. 90% felsic, 10% mafic.	
65	0.6 min 100% rec.			
70	0.7 min 100% rec.		@70'-75': 15% m, 85% S, 0% G. Well-sorted, medium sand. 90% Felsic, 10% mafic.	

Reported By:

Paul Prevou	Geologist	Paul Prevou	9-7-2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 3 of 7

Date: 8-30-2017

Well ID: C9513 | Well Name: — | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
75			~~50-65.5' - Silty Sand (m-S)~~ pp 9/27 65'-113.5': Slightly Silty Sand (m)S	Sonic drill, ~~7"~~ 8" temp. casing, ~~split spoon~~ pp 7-10
	0.9 min 100% rec.		@75'-80': 15% m, 85% S, 0% G. Well-sorted, medium sand. 90% Felsic, 10% mafic.	samples taken at 0-2, 2-4, 4-6, 6-8, 8-10, 10-12, and 12-15 ft bgs using a 5' core barrel ~~split spoon~~; from 45-47.5 and from 47.5-50 ft bgs using a 5' split core barrel and LEXAN liners ~~spoon~~, and continuously
80			@80'-85': 15% m, 85% S 0% G. Well-sorted, medium sand. 90% felsic, 10% mafic.	at 5' intervals from 50 to 240.5 bgs using a 5' split core barrel and LEXAN liners ~~spoon~~
	0.6 min 100% rec.			Drilled with 12" casing from 0-11.9 ft bgs; 8 5/8" casing from 0-43.0 ft bgs; 7" casing from 0-160.3 ft bgs; and 6" casing from 0-240.3 ft bgs.
85			@85'-90': 15% m, 85% S, 0% G. Well-sorted, medium sand. 90% Felsic, 10% mafic.	[Total Depth: 240.5 ft bgs]
	1.1 min 100% rec.			@~88.5': drill rate ↓
90			@90'-95': 15% m, 85% S, 0% G. Well-sorted, medium sand. 90% felsic, 10% mafic.	@90-95': 139.7 ppm VOC found in split spoon sample; 1881 ppm VOC in cleanout cuttings (07-11-2017) VOC = Methyl isobutyl ketone
	0.6 min 100% rec.			
95			@95'-100': 15% m, 85% S, 0% G. Well-sorted, medium sand. 90% felsic, 10% mafic.	@ 95-100' 414 ppm VOC
	0.7 min 100% rec			
100				@ 100-105' 215 ppm VOC
	0.8 min 100% rec			
105			@105.5': 15% m, 85% S, 0% G. Sand: vF-C; dry	@ 105-110' 212 ppm VOC
	0.9 min 100% rec			
110				@ 110-115' 56 ppm VOC
	0.5 min 100% rec		113.5'-124.8': Silty Sand (m-S) 60% S, 40% m. Sand: VF-F, clay present	

Reported By:

Print Name	Title	Signature	Date
Paul Prevoo	Geologist	Paul Prevoo	9-28-2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 4 of 7

Date: 9-7-17

Well ID: C9513 | Well Name: N/A | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
115			113.5'-124.8': silty Sand (mS) 60%s, 40%m	Sonic drill, steel temp. casing ~~from ppm samples~~ KG 10/18/17
			Sand: vf-f grained, clay present	taken at 0-2, 2-4, 4-6, 6-8, 8-10, 10-12, and
	0.5 min 100% rec			12-15 ft bgs using a 5 ft ~~split spoon~~ core barrel; From
				45-47.5 and from 47.5-50 ft bgs using a core barrel and LEXAN liners KG 10/18/17
				5 ft split ~~spoon~~; and continuously at 5 ft
120				intervals from 50 to 240.5 ft bgs using
				a 5 ft split ~~spoon~~ core barrel and LEXAN liners
	0.6 min 100% rec			@ 115-120' 49 ppm VOC
				Drilled with 12" steel temp. casing from 0-
			124.8'-130.5': slightly silty Sand ((m)S)	11.9 ft bgs; 8 5/8" OD steel temp. casing from
125			85%s, 15%m	0-43.0 ft bgs; 7" OD steel temp. casing KG 10/18/17
			Sand: vf, well sorted, Dry	from 0-160.3 ft bgs; and 6" OD steel
	0.7 min 100% rec			temp. casing from 0-240.3 ft bgs.
				[Total Depth = 240.5 ft bgs]
				@ 120' 344 ppm VOC
130				@ 120-125' 700 ppm V
			130.5'-175.1': silty Sand (mS)	@ 125-130' 74 ppm VOC KG 10/18/17
			130.5'-145.1': 70%s, 30%m	318
	0.5 min 100% rec		Sand: vf, well sorted, Dry	@ 130-135' 278 ppm VOC
				@ 135' 344 ppm VOC
135				135-140' 378 ppm VOC
			135': Sand: vf-f	
	0.8 min 100% rec			
140				140-145' 586 ppm VOC
	0.5 min 100% rec			
145			145.1'-160.7': 60%s, 40%m	145-150' 139 ppm VOC
	0.92 min 100% rec		Sand: vf-f, dry	
150			☒ 150.7-159.9: caliche nodules	150-155' 679 ppm VOC
			present with strong rxn to HCl	
	1.2 min 100% rec		nodules range 5-40mm	
				155' 358 ppm VOC

Reported By:

Tracy Mallgren (Print Name) | Geologist (Title) | [signature] (Signature) | 9-7-17 (Date)

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 5 of 7

Date: 9-7-17

Well ID: C9513 | Well Name: N/A | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
155			130.5'-175.1': silty Sand (mS)	Sonic drill, steel temp. casing. ~~Split spoon~~
			145.1-160.7: 60% s, 40% m	samples taken at 0-2, 2-4, 4-6, 6-8, 8-10, 10-12, and 12-15 ft bgs using a 5 ft ~~split spoon~~ core barrel
	1.7min 100% rec		150.7-159.9: caliche nodules present with strong rxn to HCl nodules range 5-40mm	from 45-47.5 and from 47.5-50 ft bgs using a 5ft split ~~spoon~~ core barrel and LEXAN liner; and continuously at 5ft intervals from 50 to 240.5 ft bgs using a 5ft split ~~spoon~~ core barrel and LEXAN liners
160			160.7'-175.1': 70% s, 30% m	
	0.5min 100% rec		Sand: vf-m grained, dry, weak rxn HCl	~~Becker Hammer: direct push, drilled w/ 12" OD steel temp. casing from~~
				Sonic Phase I: drilled w/ 12" OD steel temp. casing from 0-11.9 ft bgs
165				Becker Hammer Phase I: drilled direct push w/ 8 5/8" OD steel temp. casing from 43.0 to 48.4 ft bgs
	0.4min 100% rec			Sonic Phase II: drilled w/ 7" OD steel temp. casing to 160.3 ft bgs; and with 6" OD steel temp. casing to 240.3 ft bgs
170			170'-175': clay present	[Total Depth = 240.5 ft bgs]
	0.7min 100% rec			155-160' 454 ppm VOC
175			175.1'-195.0: Sand (S)	
			175.1'-180.1': 95% s, 5% m	Sediments from clean out run to 160', 749 ppm VOC
	0.8min 100% rec		Sand: vf-m grained, Dry	
				160-165' 224 ppm VOC
180			180.1'-195.0: 100% s, Tr. m	165-170' 27 ppm VOC
	0.4min 100% rec			170-175' 50 ppm VOC
185				175-180' 24.7 ppm VOC
			185.4: Sand: vf-c grained	@ 180' 86.4 ppm VOC
				180-185' 24 ppm VOC
	1.4min 100% rec			185-190' 164 ppm VOC
				190-195' 101 ppm VOC
190				195-200' 17.6 ppm VOC
				200-205' 7.7 ppm VOC
				@ 205' no VOC
	0.6min 98% rec			

Reported By:

Tracy Mallgren (Print Name) | Geologist (Title) | Signature | 9-7-17 (Date)

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 6 of 7

Date: 9-7-17

Well ID: C9513 | Well Name: W1A | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
195			195.0'-210.5': silty sandy Gravel (msG)	~~Split spoon~~ samples taken from 0-2, 2-4, 4-6, 6-8, 8-10, 10-12, and 12-15 ft bgs; from 45-47.5 and 47.5-50 ft bgs; and continuously at 5 ft intervals from 50 to 240.5 ft bgs using a 5 ft split ~~spoon~~ core barrel.
	1.2 min 100% rec		60% g, 29% s, 11% m Gravel: avg. 30mm coarse pebbles Sand: vf-med. Dry, no rxn HCl	
200				Phase I Sonic: drilled 12" OD casing to 11.9 ft bgs.
	2 min 100% rec			Phase I Becker Hammer: drilled ~~8 5/8~~ 8" OD steel temp. casing to ~~42.4~~ 43.0 ft bgs.
205			205.5': max gravel 45mm, vc pebbles	Phase II Sonic: drilled 7" OD steel temp casing to 160.3 ft bgs, and 6" OD steel temp. casing to 240.3 ft bgs. [Total Depth = 240.5 ft bgs]
	1.6 min 100% rec			
210			210.5'-215.5': sandy Gravel (sG) 55% g, 40% s, 5% m Gravel: no change Sand: vf-c, Moist	210 ft bgs: ~1.25 gal of H_2O added to aid in clean out run. 230-235' 9.4 ppm VOC 235-240' 2.4 ppm VOC @ 240' 16.1 ppm VOC
	1.5 min 100% rec			
215			215.5'-229.7': Sand (S) 100% s, Tr. g Sand: vf-vc	
	1.3 min 100% rec			
220			220': Sand: vf-c	
	0.3 min 100% rec			
225				
	2.4 min 92% rec			
230			229.7'-240.5': sandy Gravel (sG) 65% g, 35% s Gravel: max 45mm, subround-round Sand: no change	
	3 min 100% rec			

Reported By: Tracy Mallgren (Print Name) | Geologist (Title) | [signature] (Signature) | 9-7-17 (Date)

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 7 of 7

Date: 9-7-17

Well ID: C9513 | Well Name: N1A | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
235	1 min 100% rec		229.7-240.5: Sandy Gravel (SG) 65% g, 35% s Gravel: max 45 mm, subround-round 235.5: Increased moisture	~~Split spoon~~ sampler taken from 0-2, 2-4, 4-6, 6-8, 8-10, 10-12, and 12-15 ft bgs; from 45-45.5 and 42.5-50 ft bgs; and continuously from 50 to 240.5 ft bgs using a 5 ft split ~~spoon~~ core barrel. Phase I Sonic: drilled 12" OD steel temp. casing to 11.9 ft bgs. Phase I Becker Hammer: drilled 8 5/8" OD steel temp. casing to ~~45~~ 43.0 ft bgs. Phase II Sonic: drilled 7" OD steel temp. casing to 160.3 ft bgs, and 6" OD steel temp. casing to 240.3 ft bgs. [Total Depth = 240.5 ft bgs]
240				
245				

Not used
PP 9/28/2017

Reported By:

Tracy Mallgren (Print Name) | Geologist (Title) | Signature | 9-7-17 (Date)

A-6006-993 (REV 0)

BOREHOLE LOG

Page 1 of 7
Date: 6/15/2017

Well ID: C9555 | Well Name: — | Location: 216 - T - 3
Project: Four Borings in the 200-BV-1 OU | Reference Measure Point: Ground Surface

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
0				Phase I: Becker Hammer – direct push; 8⅝" OD steel temp. casing drilled to 30.0 ft bgs.
			0'-2': Sand (S)	
			10% m, 90% S, TC. Sand: 60% VF-FS, 40% MS; well-sorted to mod.	
			sorting; 35% Fel, 65% maf; dry to moist. Gravel: 100% VF-Fpeb, well-	#C9555 replaces borehole C9498
			sorted; 20% Fel, 80% maf; sub-round, round.	Phase II: Sonic drill – 7" OD steel temporary
			2'-4': Gravelly Sand (gS)	casing drilled to 160.2 ft bgs; 6" OD steel
5			10% m, 80% S, 10% G. Sand: 60% VF-F, 40% M, TC; mod. to well-sorted;	temp. casing drilled to 250.8 ft bgs.
			35% Fel, 65% maf; dry to moist. Gravel: 10% VF-Fpeb, 10% Mpeb, 80%	Continuous core samples collected from
	34.7 min		Cpeb; 20% Fel, 80% maf; sub-ang to round.	30.1-254.3 ft bgs using a 5 ft split
			4'-8': Slightly Silty Gravelly Sand ((m)gS)	barrel.
10			@4' 11% m, 77% S, 12% G. Sand: 60% VF-F, 40% M, TC; well-to-mod.	
			sorted; 35% Fel, 65% maf; dry to moist. Gravel: 20% VF-Fpeb, 20%	
			Mpeb, 60% Cpeb; 20% Fel, 80% maf; sub-angular to round	
			@6'-8': ↑ to 12% m, ↓ to 73% S, ↑ to 15% G. Sand: dry to moist. Gravel:	
			↑ to 10% VF-Fpeb, ↓ to 10% Mpeb, ↓ 20% Cpeb, ↑ to 60% Cob; bimodal; 20%	
15			Fel, 80% maf.	
			@8'-10': 12% m, ↓ to 68% S, ↑ to 20% G. Gravel: ↑ to 20% VF-Fpeb, ↑ to	
			35% Mpeb, ↑ to 40% Cpeb, ↑ to 5% VCpeb, ↓ TCob; poorly sorted.	
20	94.1 min			
25	61.3 min			
			30.1-34.75: slightly silty Sand (mS)	
30	1 min 100% rec		15% m, 80% S, 5% g (Gravel: f-vf pebble, SA SR	
			Sand: vf-vc, poorly sorted, 75% fel, slightly moist	

Reported By:

Print Name	Title	Signature	Date
Paul Prevou	Geologist	Paul Prevou	10-17-17

Reviewed By:

Print Name	Title	Signature	Date
Sarah Springer	Lic. Geologist	Sarah Springer	11-14-2017

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-642 (REV 1)

BOREHOLE LOG (Cont.)

Page 2 of 7

Date: 10-17-17

Well ID: C9555 | Well Name: — | Location: 216-T-3

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
35	1.1min 100% rec		34.75-39.75: silty sandy Gravel (mSG) 30%-m, 40%G, 30%S Gravel: fine peb-cobble, SR, SA. Sand: ~~vf-vc~~ mainly vf-m mod-sorted, 80% fel, Dry	Phase I: Becker Hammer - direct push: 8 3/4" OD steel temp. casing drilled to 30.0 ft bgs. # C9555 replaces borehole C4498 Phase II: Jonic drill - 7" OD steel temporary casing drilled to 160.2 ft bgs; 6" OD steel temp. casing drilled to 250.8 ft bgs. Continuous core samples collected from 30.1-254.7 ft bgs using a 5 ft split barrel.
40	0.7min 100% rec		39.75-60.4: Sand (S) 90%S, 10%m, T,G Sand: vf-vc, 60% fel, poor sorted	
45	1min. 100% rec			
50	1min. 100% rec			
55	1.4min 100% rec			
60	0.8min 100% rec.		60.4-65.4: slightly silty Sand ((m)S) 80%S, 20%m Sand: vf-vc, 60% fel, poorly sorted	
65	1.4min 100% rec		65.4-75.4: Sand (S) s=90%, g=5%, m=5% Gravel: 2-4mm, SA-SR, Sand: vf-vc, avg m Moist	
70	20sec 100% rec.		@70.4' s=95%, g=5%, m=T Dry	

Reported By:

Paul Prevoo — Print Name | Geologist — Title | Signature | 10-17-17 — Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 3 of 7

Date: 10-17-17

Well ID: C9555 | Well Name: — | Location: 216-T-3

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
75	1.2 min 100% rec		75.4-105.0: gravelly Sand (gS) S=85%, g=10%, m=5%. Gravel: 2-8mm, SA-SR, Sand: vf-vc, avg c-vc, Dry	Phase I: Becker Hammer - direct push 8 5/8" OD steel temp. casing drilled to 20.0 ft bgs. #C9555 replaces borehole C9498 Phase II: Jetting drill - 7" OD steel temp. casing drilled to 1160.2 ft bgs; 6" OD steel temp. casing drilled to 250.8 ft bgs. Continuous core samples collected from 30.1-294.7 ft bgs using a 5ft split spoon.
80	1.1 min 100% rec		@80.4' S=75%, g=20%, m=5%. Gravel: 2-15mm, moist	
85	0.7 min 100% rec			
				RAD Contamination (beta/gamma)
90	0.4 min 100% rec.			90.4-95.4: 39,000 dpm direct
95	0.6 min 100% rec.			94.8-97.8: 10,000 dpm direct
	0.4 min 100% rec.		@98.0' S=70%, g=25%, m=5%. Gravel max ϕ 35mm. Sand: f-vc mod-to strong rxn HCl	
100	0.4 min 100% rec.			100.3-103.3: 24,000 dpm direct
	0.3 min 100% rec.			103.9-104.9: 4,000 dpm direct
105	0.5 min 100% rec.		105.0-108.0': Sand (S) S=90%, g=5%, m=5%. Sand: vf-vc avg. c-vc, Gravel: 2-8mm, SR	105-108': 20,000 dpm direct
				108.1-110.1': 3,000 dpm direct
	0.4 min 100% rec.		108.0-115.4: sandy Silt (sM) 75% m, 25% s Sand: vf-f	
110	0.2 min 100% rec.			
	0.3 min 100% rec.			115.4-120.4: 8,000 dpm direct

Reported By:

Paul Prevou	Geologist	Paul Prevou	10-17-17
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 4 of 7

Date: 10-17-17

Well ID: C9555 | Well Name: — | Location: 216-T-3

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
115	0.6 min 100% rec.		108.0-115.4: sand Silt (sM) 75%m, 25%s · Sand: vf-f	Phase I: Broker Hammer - direct push; 8 5/8" OD steel temp. casing drilled to 30.0 ft bgs. #C9555 replaces borehole C9498 Phase II: Jonis drill - 7" OD steel temp. casing drilled to 160.2 ft bgs; 6" OD steel temp. casing drilled to 250.8 ft bgs. Continuous core samples collected from 30.1-254.7 ft bgs using a 5 ft split barrel.
			115.4-120.4: silty Sand (mS) 25%m, 75%s Sand: vf-f mod rxn HCl	
120	0.4 min 100% rec.		120.4-122.4: slightly silty Sand (mS) m=15% s=85% sand: vf-f	
	0.3 min 100% rec.		122.4-140.5: Sand (S) 95%s, 5%m Sand: vf-c, avg m, 90% fel	
125	0.3 min 100% rec			
130	0.4 min 100% rec			
135	1 min 100% rec		135-137: Caliche nodules present	
140	1.1 min 100% rec		140.5-145.5': slightly silty gravelly Sand (m)gS) S=75%, G=24%, m=1% Sand: vf-vc, avg c, 55% mcf, Gravel: vf-c pebbles, SA-SR	
145	1 min 100% rec		145.5'-150.5': silty sandy Gravel (msG) G=60% S=20%, m=20%. Gravel: f pebble-cobble, SA-SR, 80% mcf. Sand: vf-vc, poorly sorted, 50% mcf. ~1mm in diameter caliche nodules	
150	0.5 min 100% rec		150.5'-155.5': silty Sand (mS) s=75% m=25% Sand: vf-med., well sorted, 85% fel, mica	

Reported By:

Print Name	Title	Signature	Date
Paul Prevoe	Geologist	Paul Prevoe	10-17-17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 5 of 7

Date: 10·17·17

Well ID: C9555 | Well Name: — | Location: 216-T-3

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
155	0.5 min 100% rec		155.5-160.3': slightly silty Sand (m) S) 15% m, 80% s, 5% g Gravel: vf-f pebbles, SA-SR Sand: m-c, 50% mcf, well sorted, micas, Wet	Phase I: Becker Hammer - direct push: 8 5/8" OD steel temp. casing drilled to 30.0 ft bgs. * C9555 replaces borehole C9498 Phase II: Sonic drill - 7" OD steel temp. casing drilled to 160.2 ft bgs; 6" OD steel temp. casing drilled to 250.3 ft bgs. Continuous core samples collected from 30.1-254.7 ft bgs using a 5 ft split spoon.
160	3.3 min 75% rec.		160.3'-~~254~~ 235.7': Gravel (G) g=80%, s=20%. Gravel: 2-80 mm, vf pebble - small cobbles, SR Sand: vf-vc, avg. c, micas, Dry mod rxn HCl until 195.3' bgs	
165	3.2 min 100% rec			
170	2.9 min 90% rec.			
175	2.3 min 100% rec			
180	2.5 min 100% rec			
185	3 min 100% rec			
190	3.3 min 100% rec			190-195': 0.5 gal H_2O added to aid in cleanout 193.4-195': 1.5 gal H_2O added to aid in drilling

Reported By:

Paul Prevau	Geologist	Paul Prevau	10·17·17
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 6 of 7

Date: 10.17.17

Well ID: C9555 | Well Name: N1A | Location: 216-T-3

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
195	2.2 min 100% rec		160.3-235.7': Gravel (G) g=80% s=20% Gravel: 2-80mm, vf pebble - small cobbles, SR Sand: vf-vc, aug. c, micas, Dry mod rxn to HCl until 195.3' bgs - no rxn	Phase I: Becker Hammer - direct push: 8 5/8" OD steel temp. casing drilled to 300 ft bgs. * C9555 replaces borehole C9498. Phase II: Sonic drill - 7" OD steel temp. casing drilled to 160.2' bgs 6" OD steel temp. casing drilled to 250.8 ft bgs. Continuous core samples collected from 301-254.7 ft bgs using a 5 ft split spoon. 195'-200': 1 gal H_2O added to aid with cleanout
200	2.1 min 100% rec.			
205	2.9 min 98% rec			
210	2.5 min 100% rec			
215	1.9 min 100% rec.			
220	1.5 min 100% rec.			
225	2.2 min 100% rec			
230	2.1 min 100% rec			

Reported By:

Tracy Mathgen (Print Name) | Geologist (Title) | Signature | 10.17.17 (Date)

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 7 of 7

Date: 10.17.17

Well ID: C9555 | Well Name: N1A | Location: 216-T-3

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
235	2.5 min 100% rec		235.7-240.7': sandy Gravel (sG) 75% g, 25% s Gravel: 2-80mm, vf pebbles-sm cobbles, avg. f pebbles, Sand: vf-m grained, Dry	Phase I Becker Hammer-direct push 8 5/8" OD steel temp casing drilled to 30.0 ft bgs. *C9555 replaces borehole C9498. Phase II-Sonic drill-7" OD temp steel casing drilled to 160.2 ft bgs. 6" OD Temp steel casing drilled to 250.8 ft bgs. Continuous core samples collected from 30.1-254.7 ft bgs. using a 5 ft split spoon
240	1.9 min 100% rec		240.7-245.4': Gravel (G) 85% g, 15% s Gravel: 2-60mm, 30mm avg. vf-vc pebbles A-SA, Sand: vf-f grained, Dry	
245	1.5 min 100% rec.		245.4-254.7': sandy Gravel (sG) 40% s, 60% g Gravel: 2-40mm, vf-vc pebbles, SA-A Sand: vf-m grained, Dry	
250	3.1 min 100% rec		@ 250.2' g=45%, s=55% Gravel: 2-40mm, vf-vc pebbles, SA, A Sand: vf-m grained, Dry	
255	7 min 100% rec		(mG) 254.7-258.0: silty Gravel 60% g, T s, 40% m Gravel: vf-vc pebbles, 2-40mm, max 40mm, avg 40mm, mod sorted, 70% fel, sub ang-sub round Mud: Clay with mod plasticity, Moist, No rxn Hcl, 2.5Y 4/2 Dark grayish brown	
260			(sG) 258.0-262.0': sandy Gravel 60% g, 40% s, T m Gravel: vf pebbles to small cobbles, 2 mm-100mm, 100mm max, 30mm avg, poorly sorted, 80% fel, ang-sub. rounded, Sand: vf-c sand, mod sorted, 85% fel, sub-ang, Dry, No rxn Hcl, 2.5Y 5/2, Grayish brown.	
265			262-270' unable to determine core barrel was advanced to 270.0' (10/11/17) with no sediment recovery.	
270				

Reported By:

Tracy Mallgren (Print Name) | Geologist (Title) | Signature | 10.17.17 (Date)

A-6006-993 (REV 0)

BOREHOLE LOG

Page 1 of 1

Date: 5-24-2017

Well ID: c9498 | Well Name: — | Location: 216-T-3 ~~5~~ 6 Reverse well

Project: Installation of 4 Borehole in 200-DV-1 OU | Reference Measure Point: Ground Surface

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
0			0-2': Sand (S) 90% s 10% m Tr g Sand: vf-c (60% vff 40% m Tr c, well to mod sort, 35% fel, 65% maf, v. slight moist Gravel: vf-f peb., well sorted, 80% maf Silt: mod plasticity.	Drilled with sonic rig from 0-10.5' bgs 12" casing
5			2-4': gravelly Sand: 10% g 80% s 10% m Sand: No change. Gravel: vf-c pebble, 80% c peb, 80% maf. sub ang-sub rnd-rnd, v. slight moist	
10		Not used to insert	4-10': slightly silty gravelly Sand (m) gS) 4-6': 12% g, 77% s, 11% silt Gravel: vf-c peb., 60% c peb, 80% maf sub ang-rnd Sand: No change - mica 6-8': 15% g, 73% s, 12% m Gravel: vf peb - cobbles, 60% cobbles, 20% fel, 80% maf, subang-rnd. Sand: no change 8-10': 20% g, 68% s, 12% m Gravel: vf-vc peb, Tr. cobble poorly sorted, 80% maf, subang-rnd Sand: No change	Drilled with direct push (Becker Hammer) and 8 5/8" casing from 10.5-18.6'
15				
20				
25			10-18.6: Direct push drilling with no soil recovery.	
30				

Reported By:

Print Name	Title	Signature	Date
Paul Prevou	Geologist	Paul Prevou	5-24-2017

Reviewed By:

Print Name	Title	Signature	Date
Sarah Springer	Lic. Geologist	Sarah Springer	11-14-2017

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-642 (REV 1)

Appendix C

Log Data Reports

This page intentionally left blank.

Huntington Ingalls Industries

Technical Solutions

C9497
Log Data Report

Borehole Information

Log Date	2017-06-22	Filename	C9497_HG-NM_2017-06-22	Site	200-DV-1/216-B-42 Trench

DTW[1] (ft)	DTW Date	DTW Source	Drill Date	Total Depth (ft)	Depth Datum
272.5	06/22/17	HII	06/22/17	274.3	Ground Surface

Casing Information

Casing Type	Drill Type	Stickup (ft)	Diameter (in.) Outer	Diameter (in.) Inside	Thickness (in.)	Top (ft)	Bottom (ft)
TerraSonic steel	Sonic	0.7	12	10.88-11.5	0.25-0.56	-0.7	10.1
Steel	Becker	0.0	8.625	7.511	0.557	0.0	55.6
TerraSonic steel	Sonic	0.1	7.0	6.22-6.5	0.25-0.42	-0.1	200.5
TerraSonic steel	Sonic	1.35	6.0	5-5.5	0.25-0.5	-1.35	274.4

Borehole Notes

The onsite geologist provided the total depth and casing depth. The logging engineer measured casing stick-up. Casing diameters are provided by the driller. The maximum logging depth achieved was 272 ft. Depth to water was determined using the NMLS[2] sonde. Zero reference is ground surface.

Logging was started after the second casing had been drilled. The logged interval to 10 ft was conducted inside two casings.

Logging Equipment Information

Logging System	Gamma 5Tb	**Type**	60% HPGe SGLS[3]
Effective Calibration Date	02/16/17	**Serial No.**	54-TP13441B
Calibration Reference	HGLP-CC-152, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53023, Rev. 0

Logging System	Gamma 5Pb	**Type**	NMLS
Effective Calibration Date	02/27/17	**Serial No.**	H34055445
Calibration Reference	HGLP-CC-153, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53024, Rev. 0

Logging System	Gamma 1Ld	**Type**	60% HPGe SGLS
Effective Calibration Date	01/26/17	**Serial No.**	47-TP-32211A
Calibration Reference	HGLP-CC-150, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53023

Logging System	Gamma 1Hd	**Type**	NMLS
Effective Calibration Date	02/23/17	**Serial No.**	H310700352
Calibration Reference	HGLP-CC-151, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53024

[1] depth to water inside casing
[2] Neutron Moisture Logging System
[3] Spectral Gamma Logging System

SGLS Log Run Information

Log Run	1	2 Repeat	7	8	9 Repeat
HEIS Number	1020050	1020051	1020052	1020053	1020054
Date	05/25/17	05/25/17	06/08/17	06/09/17	06/09/17
Logging Engineer	Felt/McClellan	Felt/McClellan	Felt	Meisner/ McClellan	Meisner/ McClellan
Start Depth (ft)	0.0	17.0	51.0	107.0	182.0
Finish Depth (ft)	52.01	22.0	108.01	202.01	201.01
Count Time (sec)	200	200	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9497FTB20170 525AV00CAB1	C9497FTB20170 525AV00CAB1	C9497ALD2017 0608AV00CAB1	C9497ALD2017 0609AV00CAB1	C9497ALD2017 0609AV00CAB1
Start File	AD000000	BD001700	AD005100	AD010700	BD018200
Finish File	AD005201	BD002200	AD010801	AD020201	BD020101
Post-Verification	C9497FTB20170 525BV00CAA1	C9497FTB20170 525BV00CAA1	C9497ALD2017 0608AV00CAA1	C9497ALD2017 0609BV00CAA1	C9497ALD2017 0609BV00CAA1
Depth Return Error (in.)	N/A	0.5 high	3.0 high	N/A	3.0 high
Comments	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made

SGLS Log Run Information

Log Run	12	13 Repeat			
HEIS Number	1020055	1020056			
Date	06/22/17	06/22/17			
Logging Engineer	Felt	Felt			
Start Depth (ft)	201.0	243.01			
Finish Depth (ft)	272.02	250.0			
Count Time (sec)	200	200			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
Log Speed (ft/min)	N/A	N/A			
Pre-Verification	C9497FTB20170 622AV00CAB1	C9497FTB20170 622AV00CAB1			
Start File	AD020100	BD024301			
Finish File	AD027202	BD025000			
Post-Verification	C9497FTB20170 622BV00CAA1	C9497FTB20170 622BV00CAA1			
Depth Return Error (in.)	N/A	2.0 high			
Comments	No fine gain adjustments made	No fine gain adjustments made			

NMLS Log Run Information

Log Run	3	4 Repeat	5	6 Repeat	10
HEIS Number	1020057	1020058	1020059	1020060	1020061
Date	05/26/17	05/26/17	06/08/17	06/08/17	06/22/17
Logging Engineer	Meisner/ McClellan	Meisner/ McClellan	Meisner/Felt	Meisner/Felt	Meisner/ McClellan
Start Depth (ft)	0.0	46.0	51.01	100.0	201.0
Finish Depth (ft)	52.01	51.17	202.03	114.01	272.5
Count Time (sec)	15	15	15	15	15
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.25	0.25	0.25	0.25	0.25
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9497FPB20170 526AV00CAB1	C9497FPB20170 526AV00CAB1	C9497AHD2017 0608AV00CAB1	C9497AHD2017 0608AV00CAB1	C9497FPB20170 622AV00CAB1
Start File	AD000000	BD004600	AD005101	BD010000	AD020100
Finish File	AD005201	BD005117	AD020203	BD011401	AD027250
Post-Verification	C9497FPB20170 526BV00CAA1	C9497FPB20170 526BV00CAA1	C9497AHD2017 0608BV00CAA1	C9497AHD2017 0608BV00CAA1	C9497FPB20170 622BV00CAA1
Depth Return Error (in.)	N/A	0.0	N/A	4.0 high	N/A
Comments	None	Computer depth jumped 0.16 ft at 48.5 ft	None	None	None

NMLS Log Run Information

Log Run	11 Repeat				
HEIS Number	1020062				
Date	06/22/17				
Logging Engineer	Meisner/ McClellan				
Start Depth (ft)	266.0				
Finish Depth (ft)	272.51				
Count Time (sec)	15				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	0.25				
Log Speed (ft/min)	N/A				
Pre-Verification	C9497FPB20170 622AV00CAB1				
Start File	BD026600				
Finish File	BD027251				
Post-Verification	C9497FPB20170 622BV00CAA1				
Depth Return Error (in.)	2.0 high				
Comments	None				

Logging Operation Notes

A centralizer was not installed on the sondes. The sondes were enveloped in plastic sleeving to prevent potential contamination.

Analysis Notes

Analyst	P.D. Henwood	**Date**	10/12/17
Reference(s)	SGRP-PRO-OP-53040, Rev. 0; SGRP-PRO-OP-53051, Rev. 0		

A combined casing correction of 0.807-in. was applied to the SGLS data to 10 ft and 0.557-in. from 10 to 52 ft. A casing correction for a 1/4-in. thick casing was applied for the remainder of the borehole. No corrections were applied for the thicker casing joints associated with the sonic casing where the maximum thickness varies from 0.42-in. to 0.5-in. and results in lower concentrations at 10-ft intervals.

No water correction was applied in this borehole as groundwater was not reached.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations for the SGLS were calculated in EXCEL templates identified as FTB20170216 and ALD20170126 using an efficiency function and corrections for casing and dead time as determined by annual calibrations.

An interpreted data set was created for this borehole. Depth overlaps from consecutive log runs or where two casings existed were removed from 51 and 52 ft, from 107 and 108 ft, and from 201 and 202 ft. This results in a data set where only one data point is presented for each depth.

NMLS data are reported in counts per second.

HGU[4] is an empirical unit of gamma activity proposed as a means to standardize gamma log response across multiple logging systems with different response characteristics. The HGU is defined in terms of measurements in the Hanford Borehole Calibration Facility, and the magnitude is selected such that 1 HGU is approximately equivalent to typical Hanford background activity, based on data from background samples as reported in *Hanford Site Background: Part 2, Soil Background for Radionuclides* (DOE/RL-96-12).

Results and Interpretations

Cs-137 was the only manmade radionuclide detected in this borehole. Cs-137 was detected at 2 ft and from 18 to 22 ft. The maximum concentration measured was approximately 130 pCi/g at 19 ft.

Although Pa-234m (U-238) and U-235 were not detected, MDLs[5] are plotted in the Manmade Radionuclides plot.

The neutron moisture log primarily responds to moisture present in the surrounding formation. In general, an increase in count rate reflects an increase in moisture content. Moisture content may increase in sediments of relatively high silt or clay content.

The KUT and moisture repeat plots indicate that the respective systems were working properly.

List of Log Plots

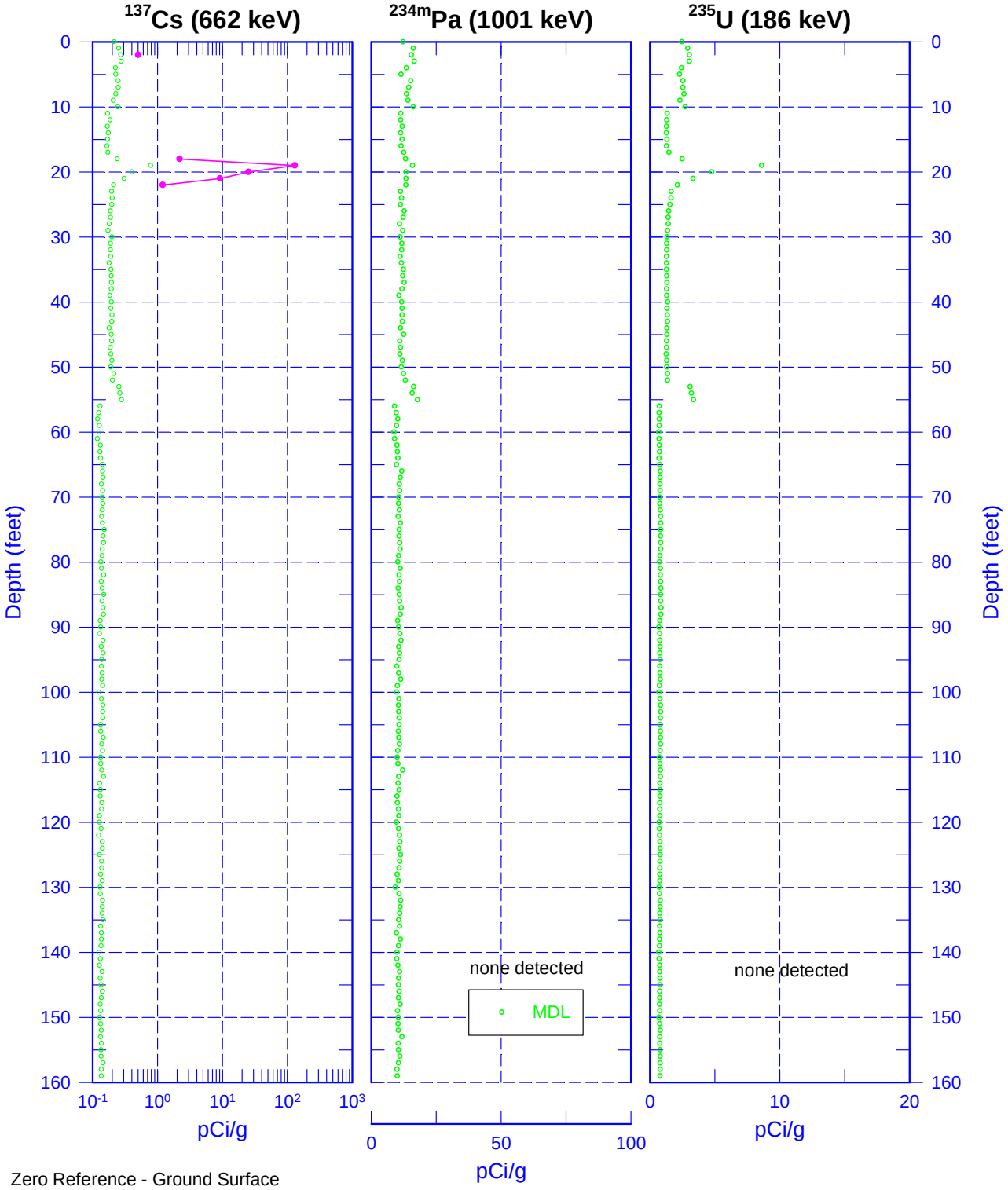
Depth Reference is ground surface.

Manmade Radionuclides (0-160 ft)
Manmade Radionuclides (150-310 ft)
Natural Gamma Logs (0-160 ft)
Natural Gamma Logs (150-310 ft)

[4] Hanford Gamma Unit
[5] Minimum Detection Limit

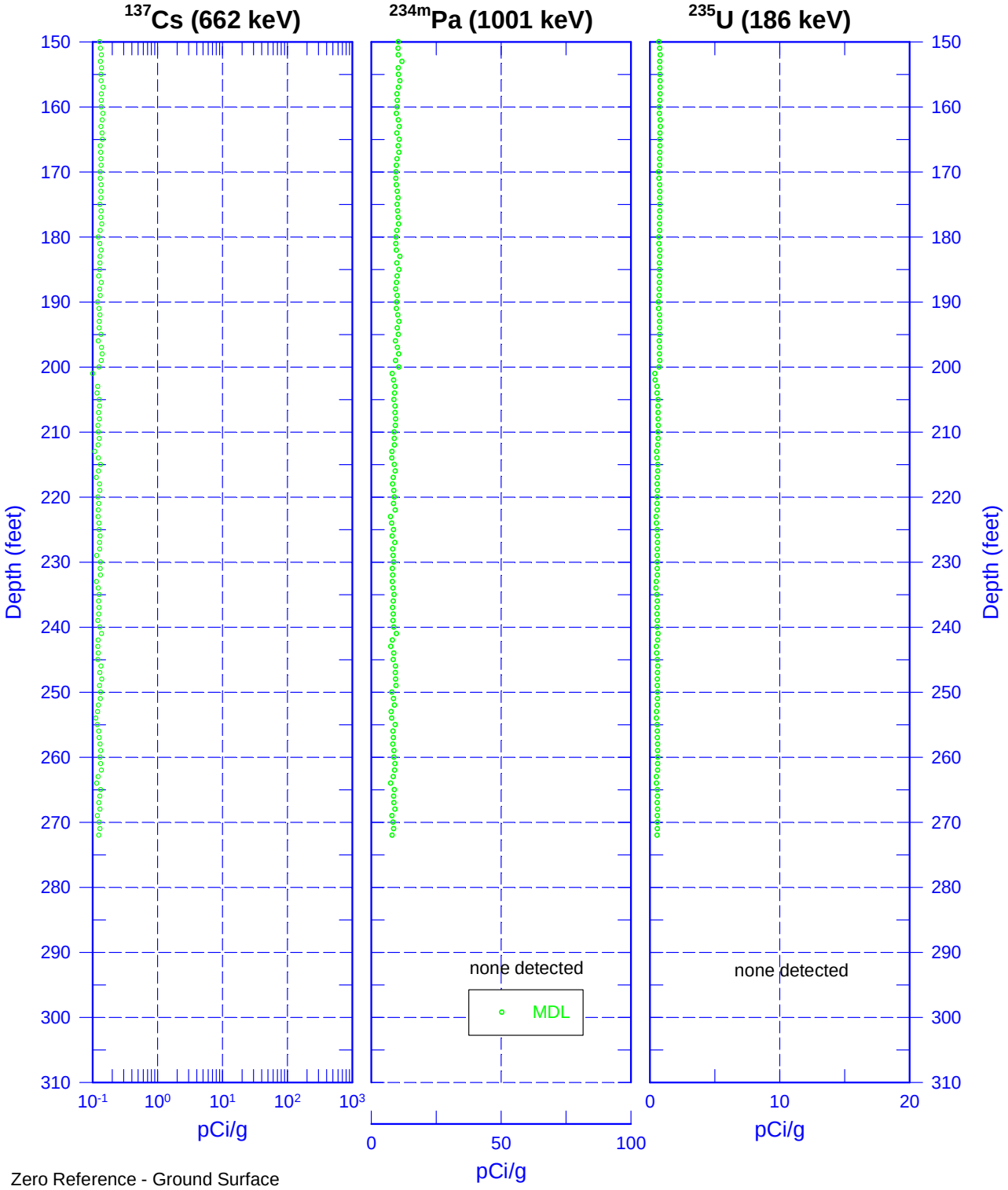
Combination Plot (0-120 ft)
Combination Plot (110-230 ft)
Combination Plot (220-340 ft)
Combination Plot (0-280 ft)
Total Gamma & Moisture (0-160 ft)
Total Gamma & Moisture (150-310 ft)
Total Gamma & Hanford Gamma Unit (0-280 ft)
Repeat Section of Natural Gamma Logs (17-22 ft)
Repeat Section of Natural Gamma Logs (182-201 ft)
Repeat Section of Natural Gamma Logs (243-250 ft)
Moisture Repeat Section (46-51 ft)
Moisture Repeat Section (100-115 ft)
Moisture Repeat Section (266-273 ft)

C9497
Manmade Radionuclides



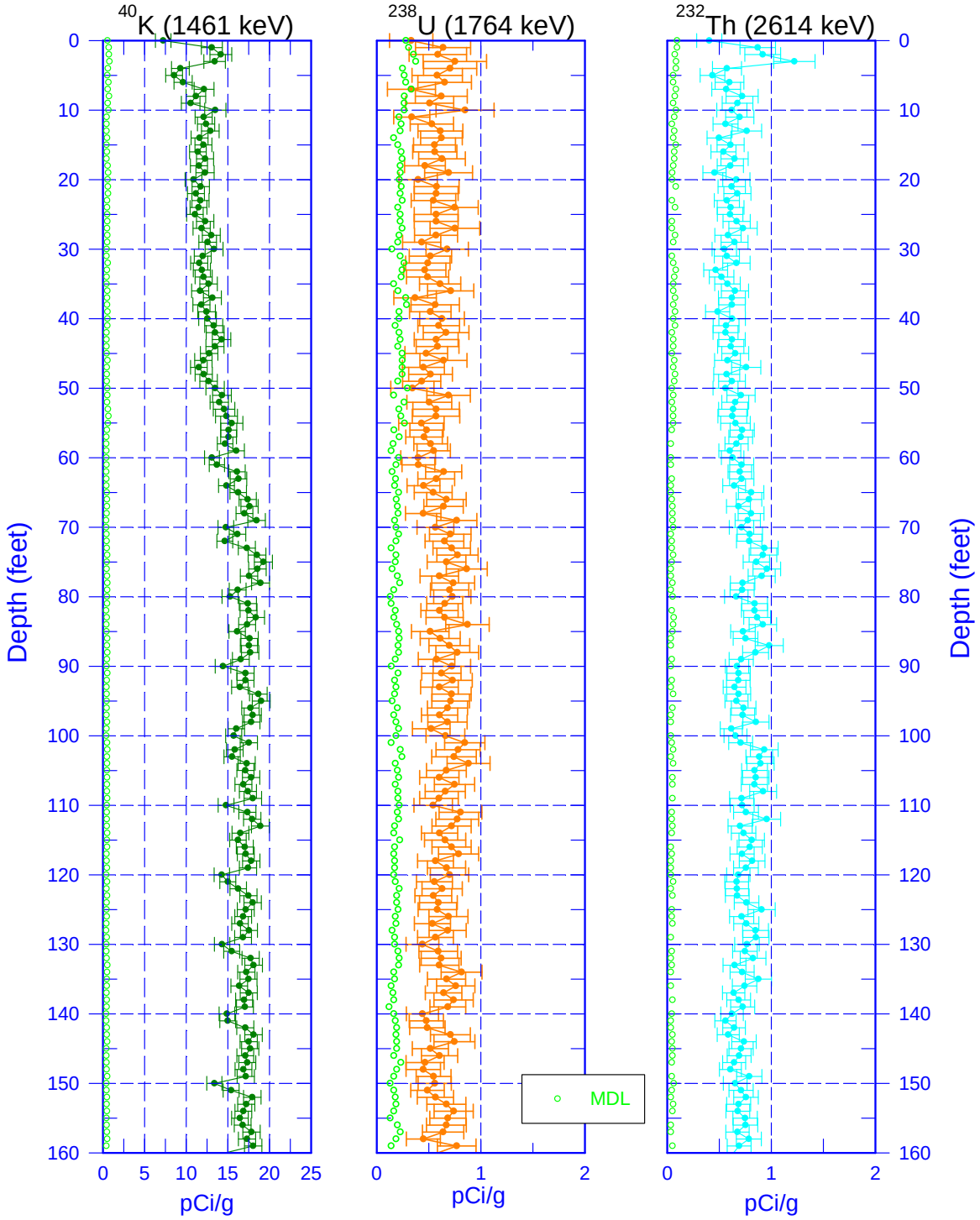
Zero Reference - Ground Surface

C9497
Manmade Radionuclides



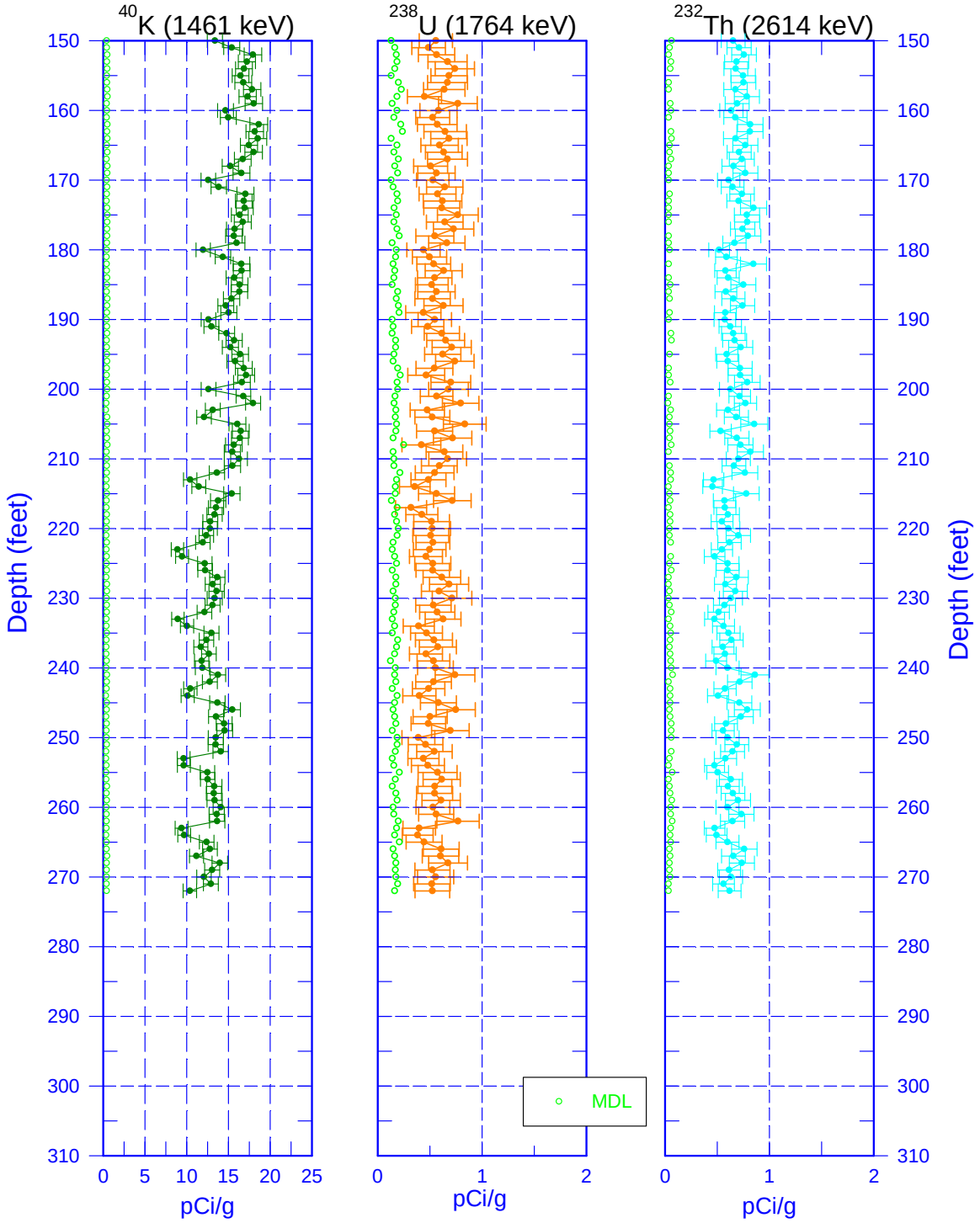
Zero Reference - Ground Surface

C9497
Natural Gamma Logs



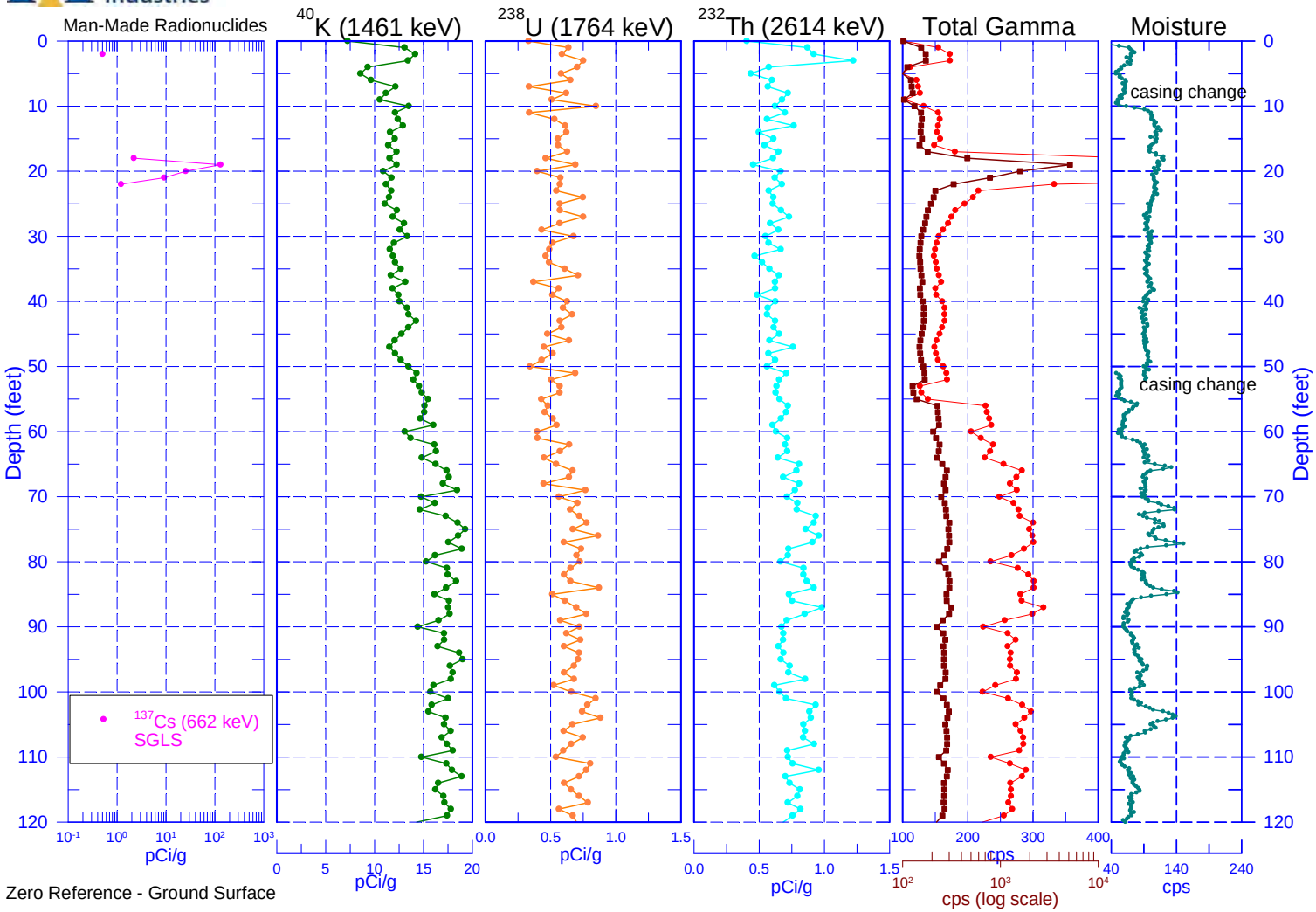
Zero Reference - Ground Surface

C9497
Natural Gamma Logs

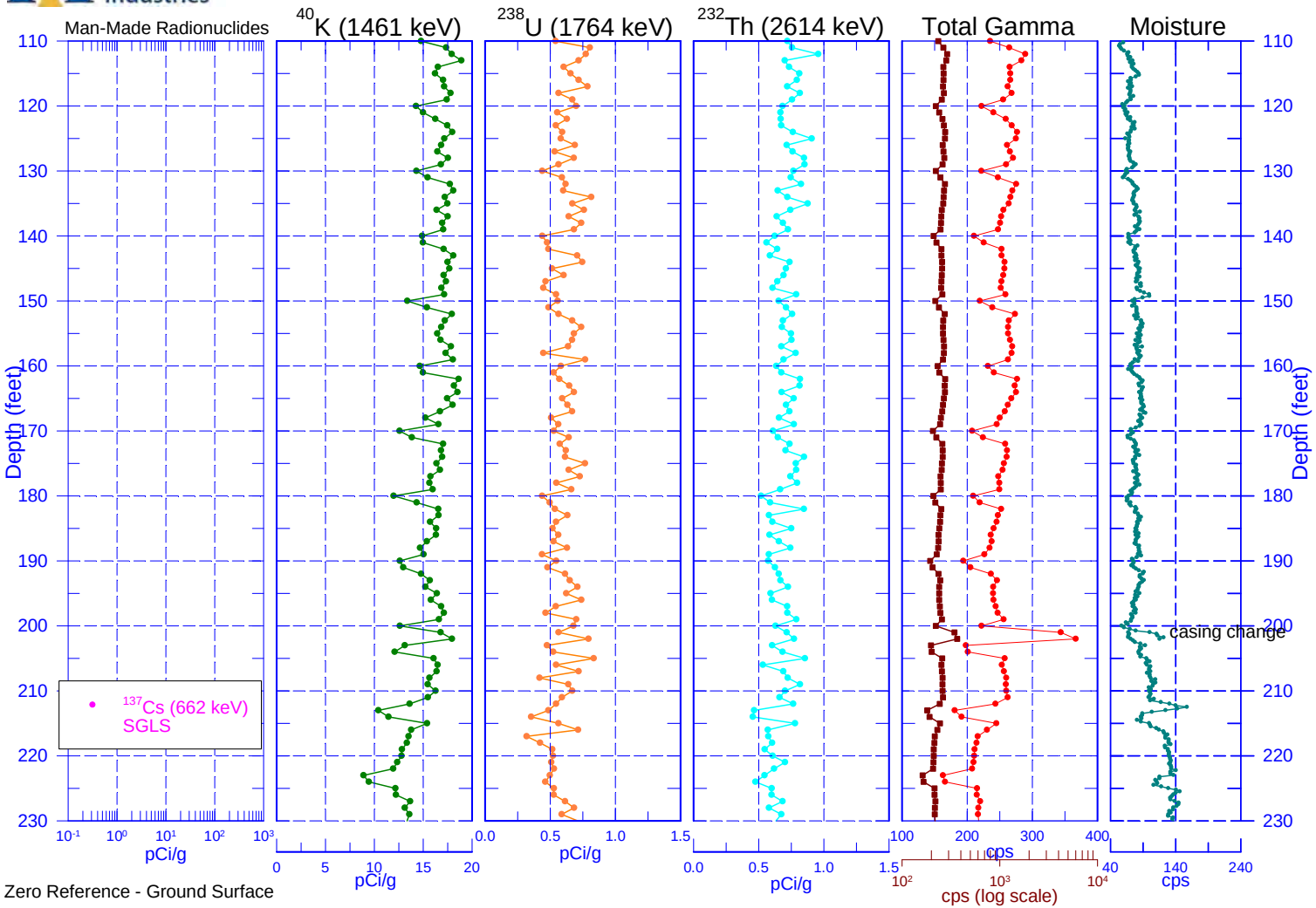


Zero Reference - Ground Surface

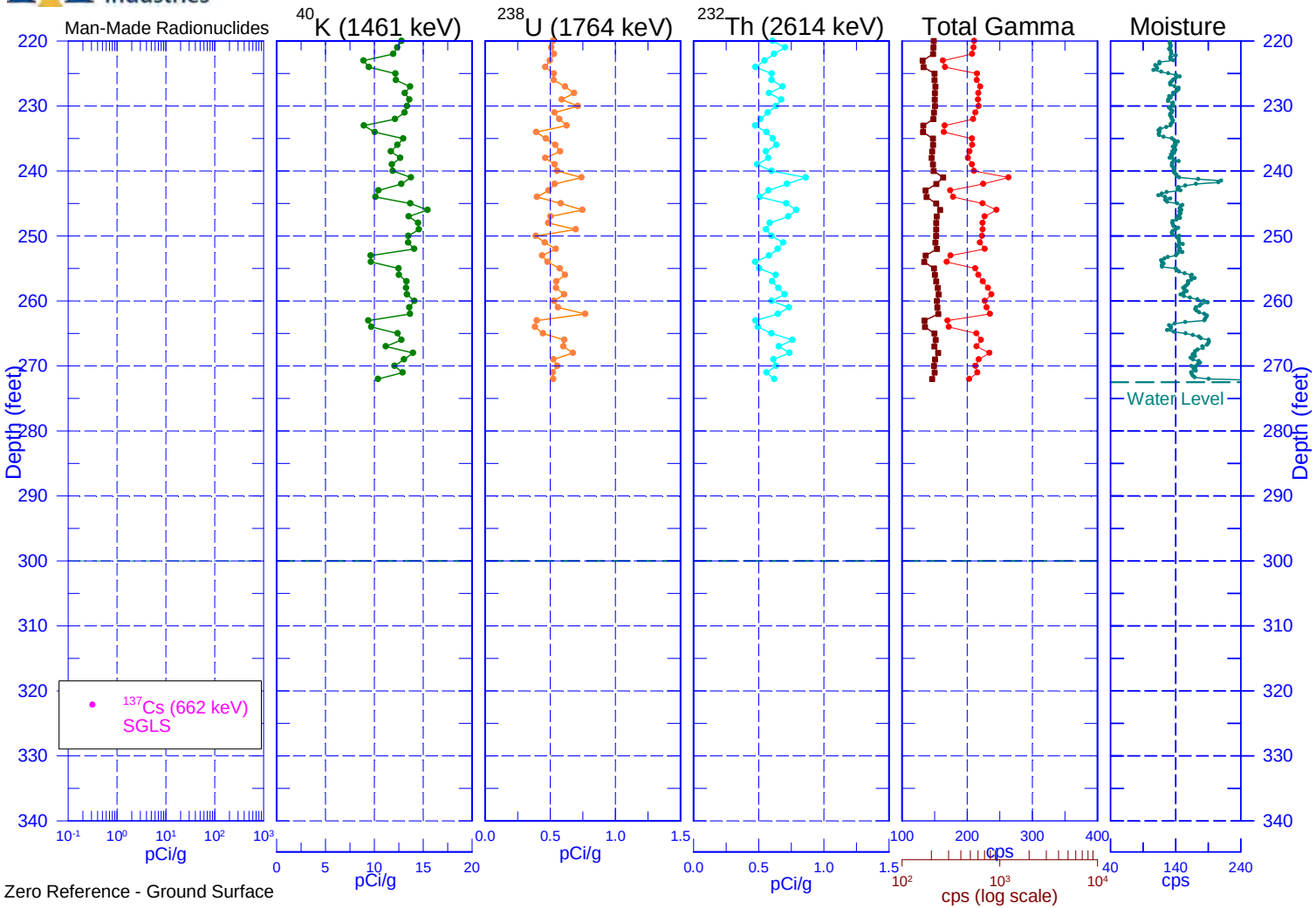
C9497 Combination Plot



C9497 Combination Plot

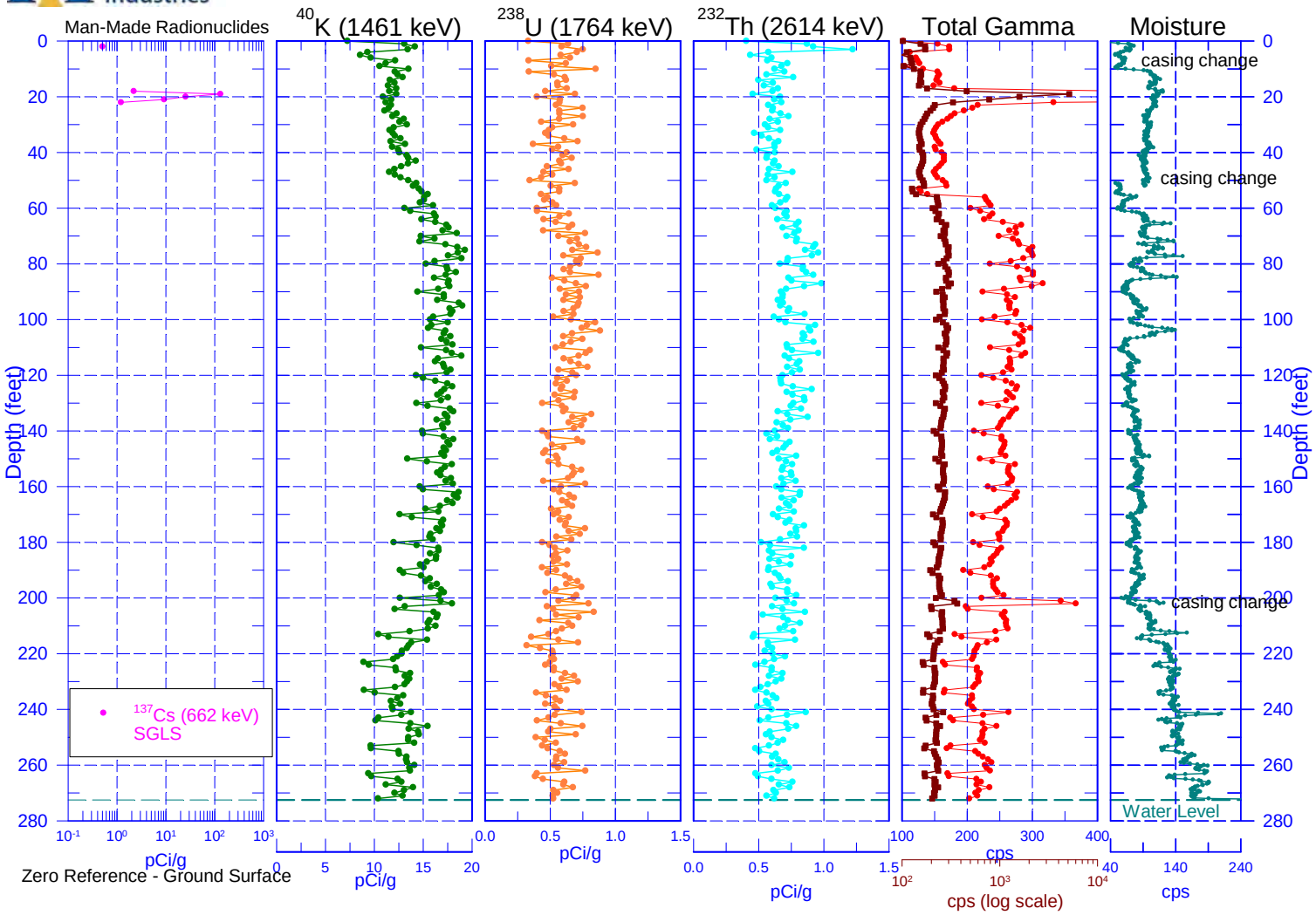


C9497 Combination Plot

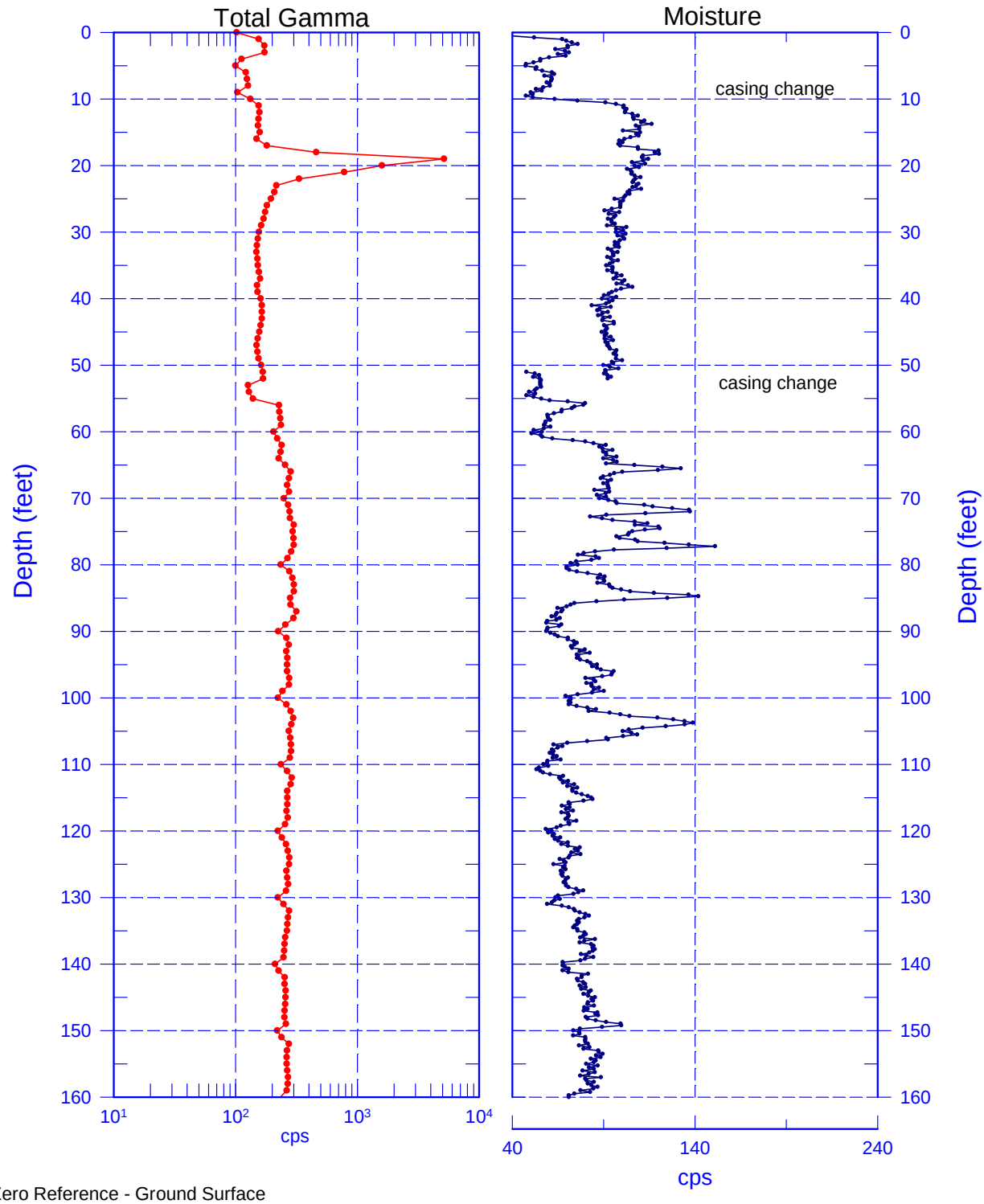


Zero Reference - Ground Surface

C9497 Combination Plot

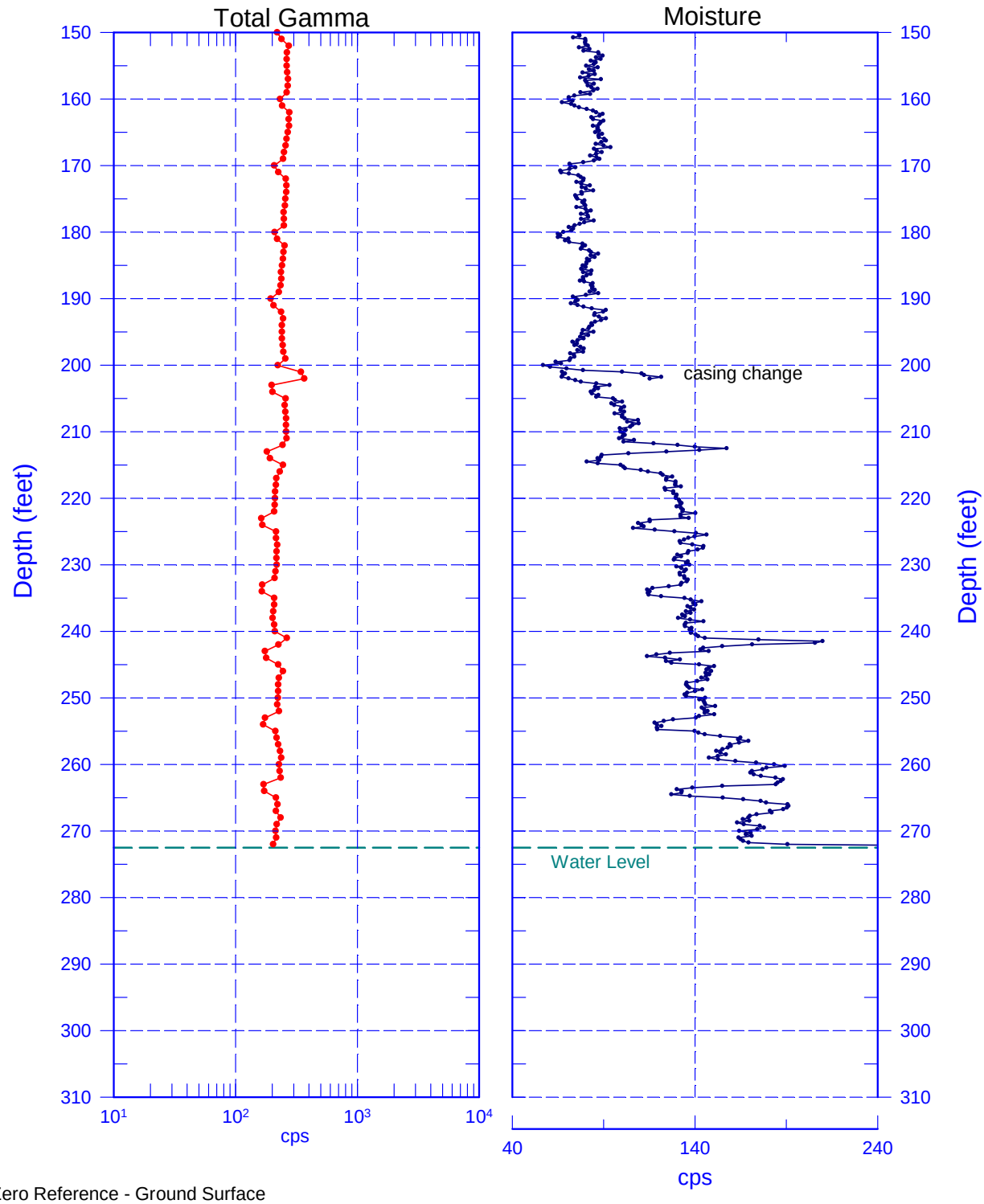


C9497
Total Gamma & Moisture



Zero Reference - Ground Surface

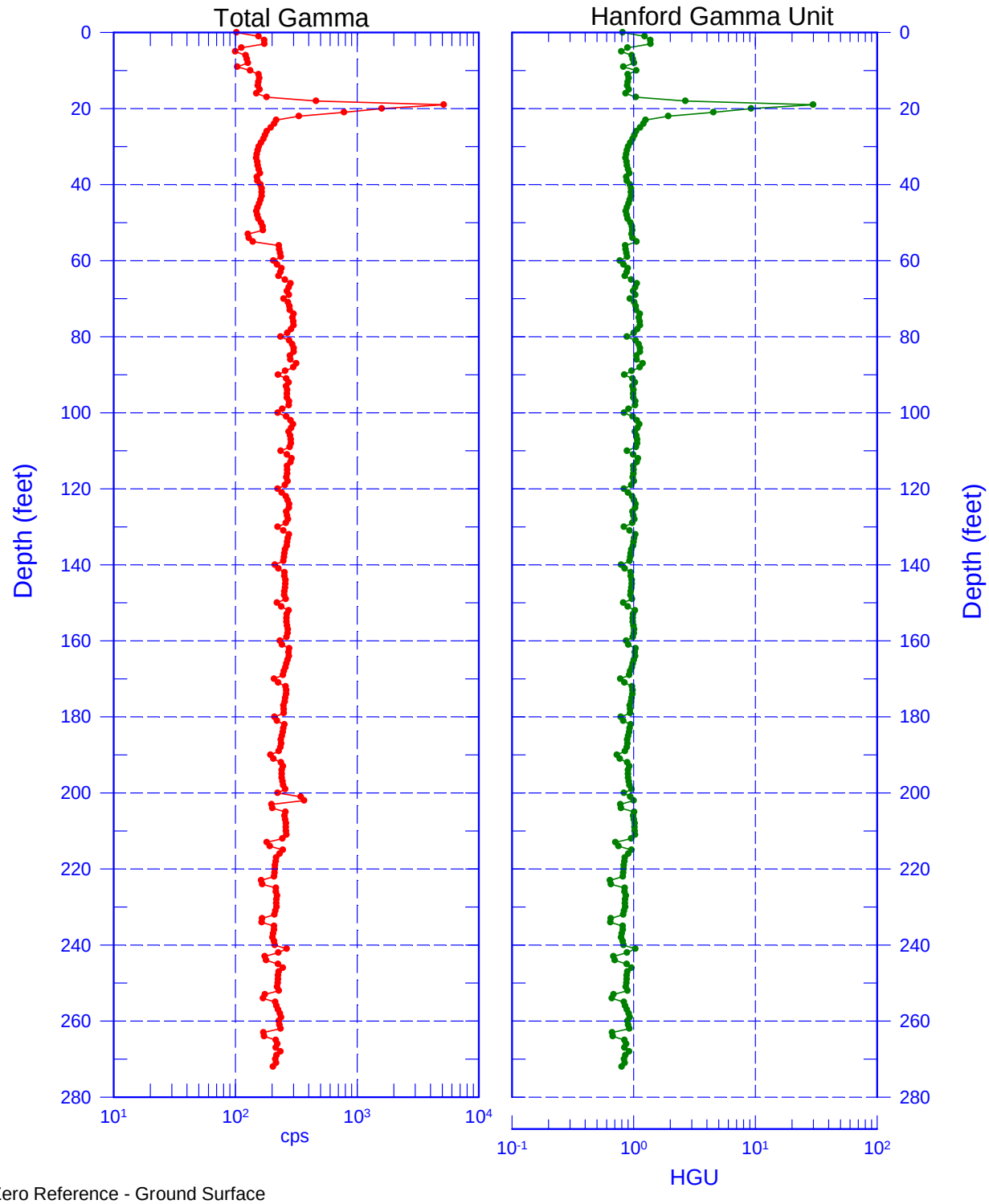
C9497
Total Gamma & Moisture



Zero Reference - Ground Surface

Huntington Ingalls Industries

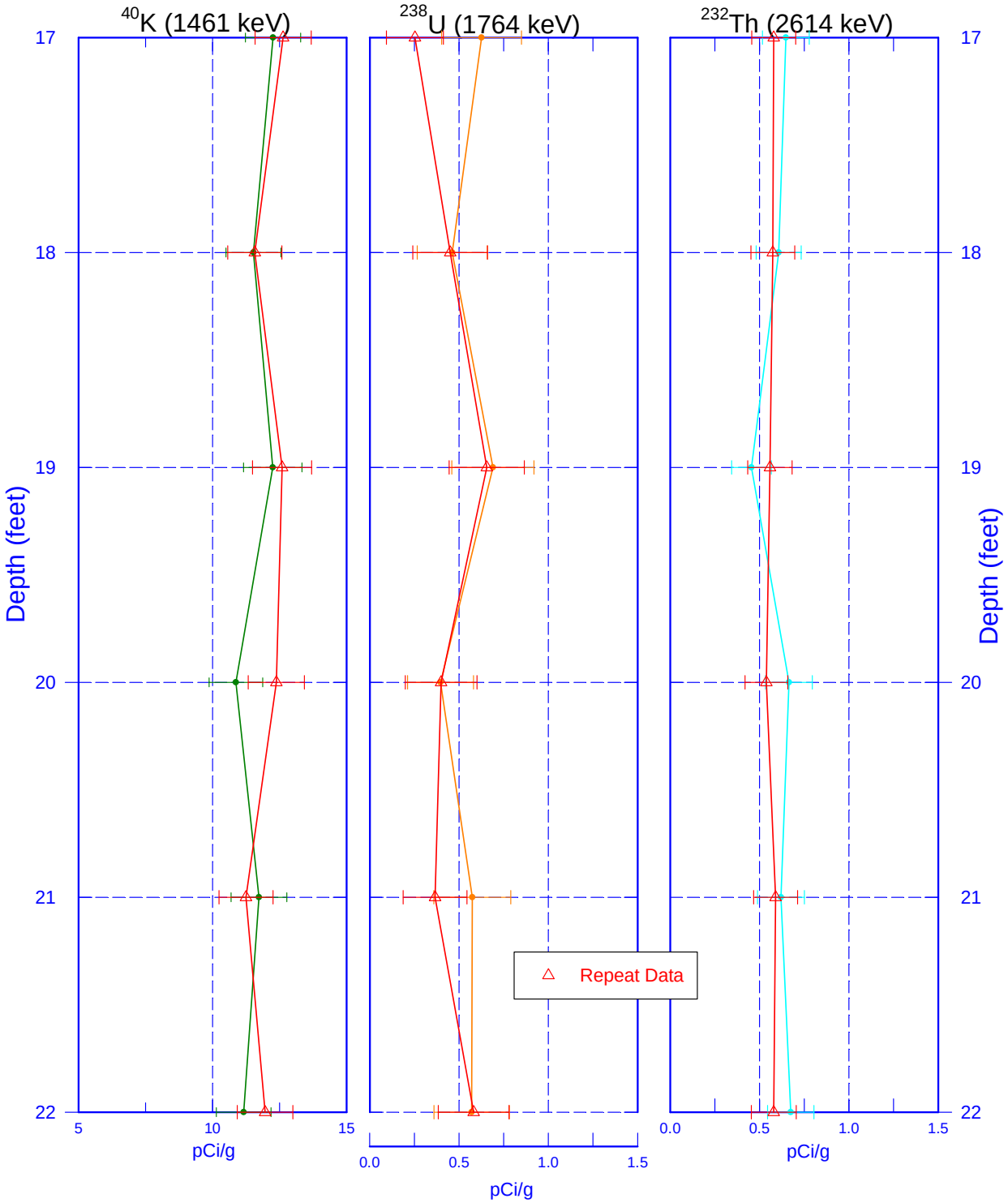
C9497
Total Gamma & Hanford Gamma Unit



Zero Reference - Ground Surface

C9497

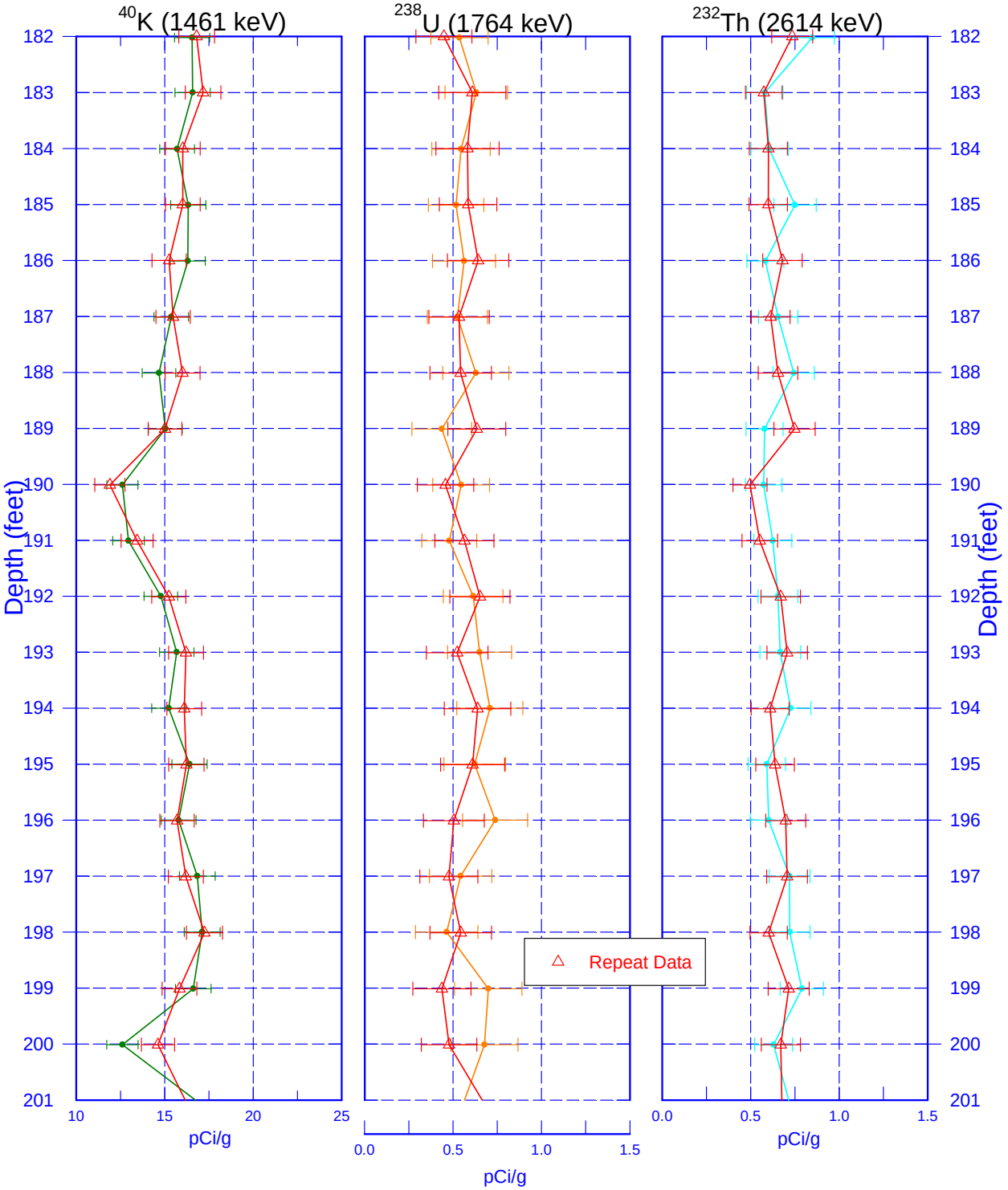
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

C9497

Repeat Section of Natural Gamma Logs

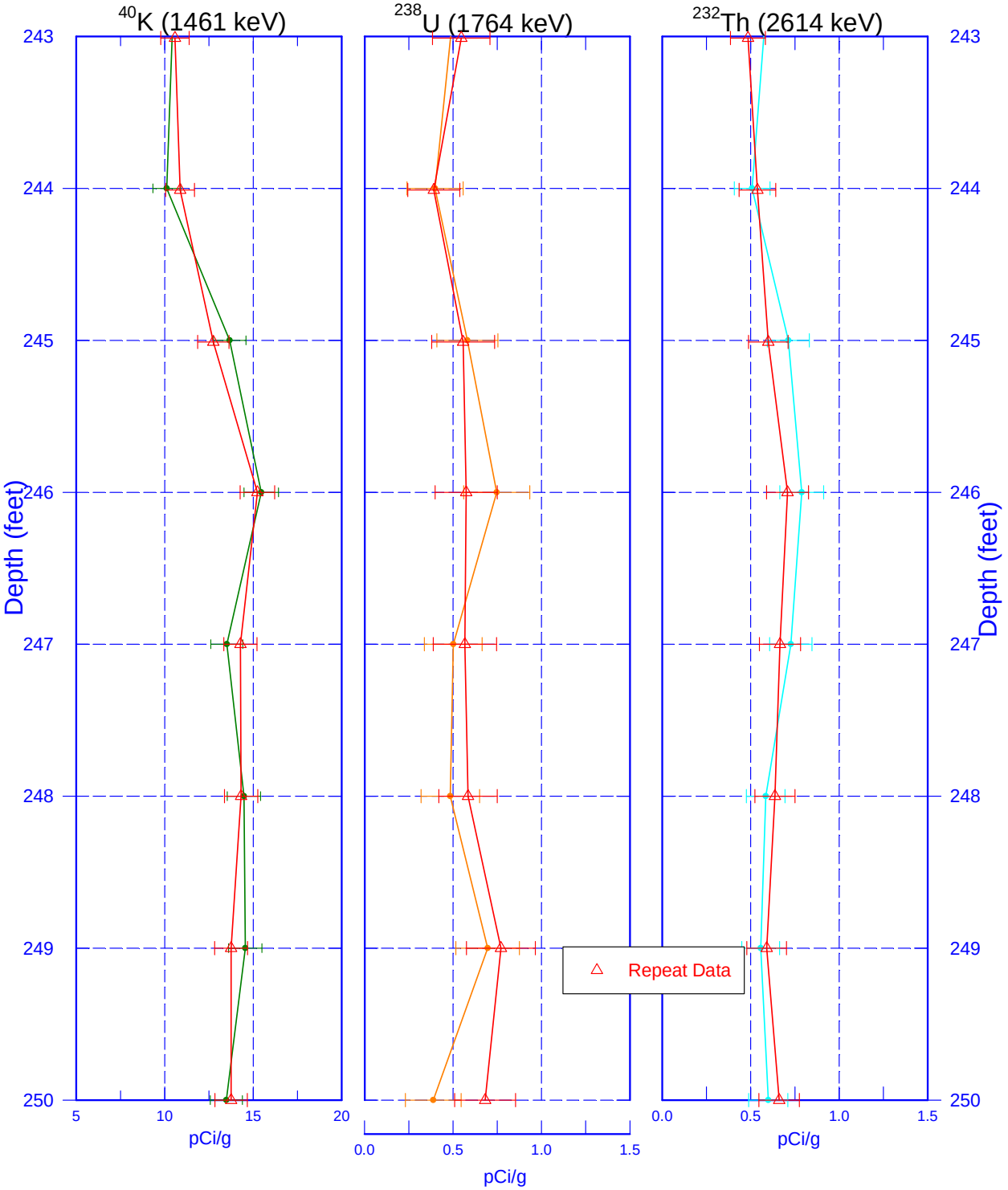


Zero Reference - Ground Surface

Huntington Ingalls Industries

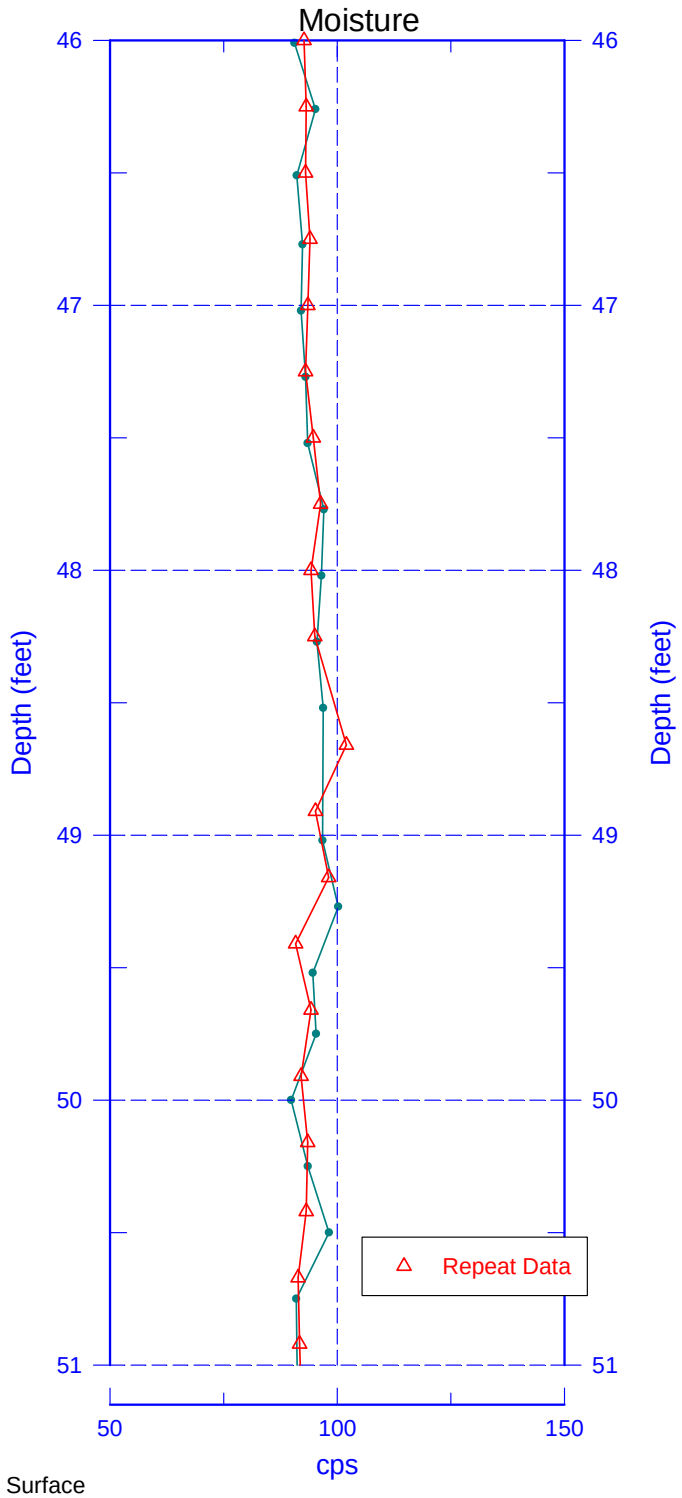
C9497

Repeat Section of Natural Gamma Logs



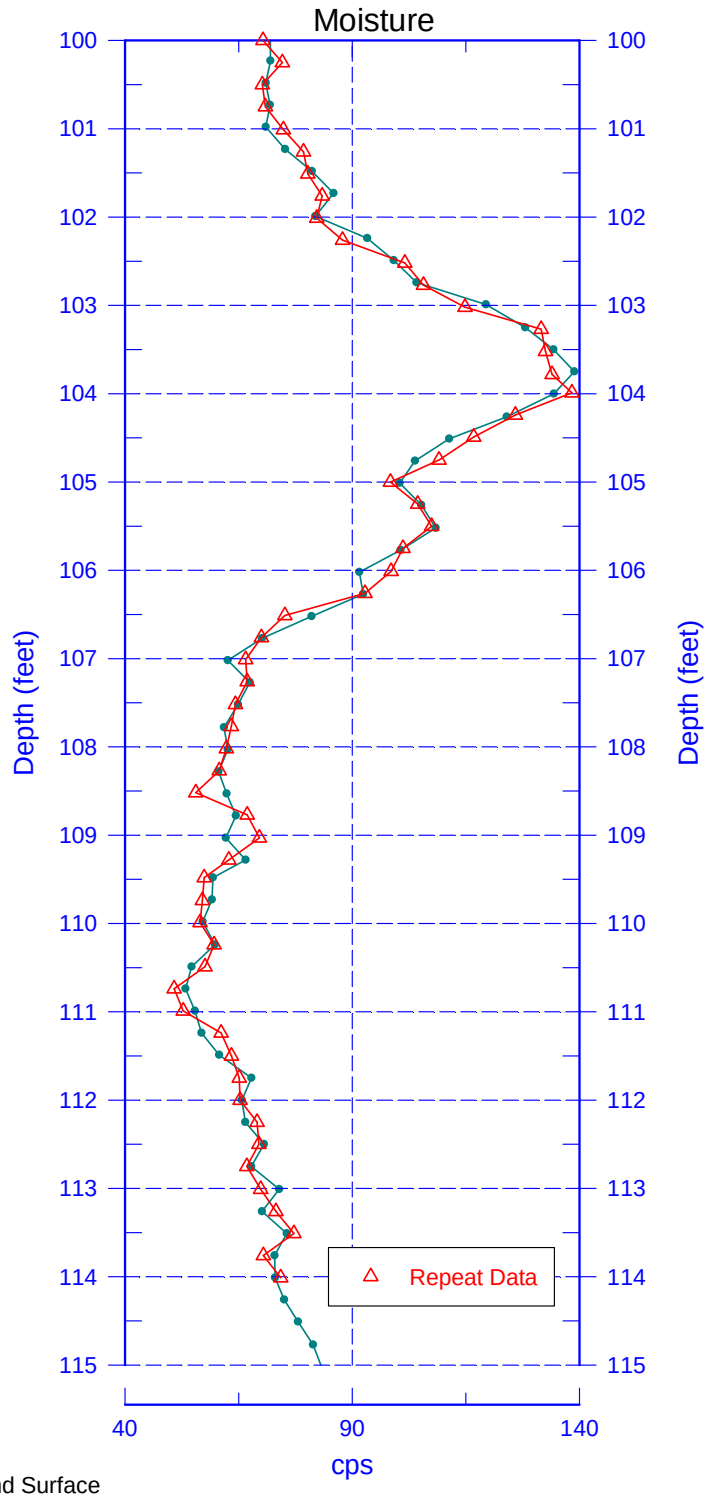
Zero Reference - Ground Surface

C9497
Moisture Repeat Section



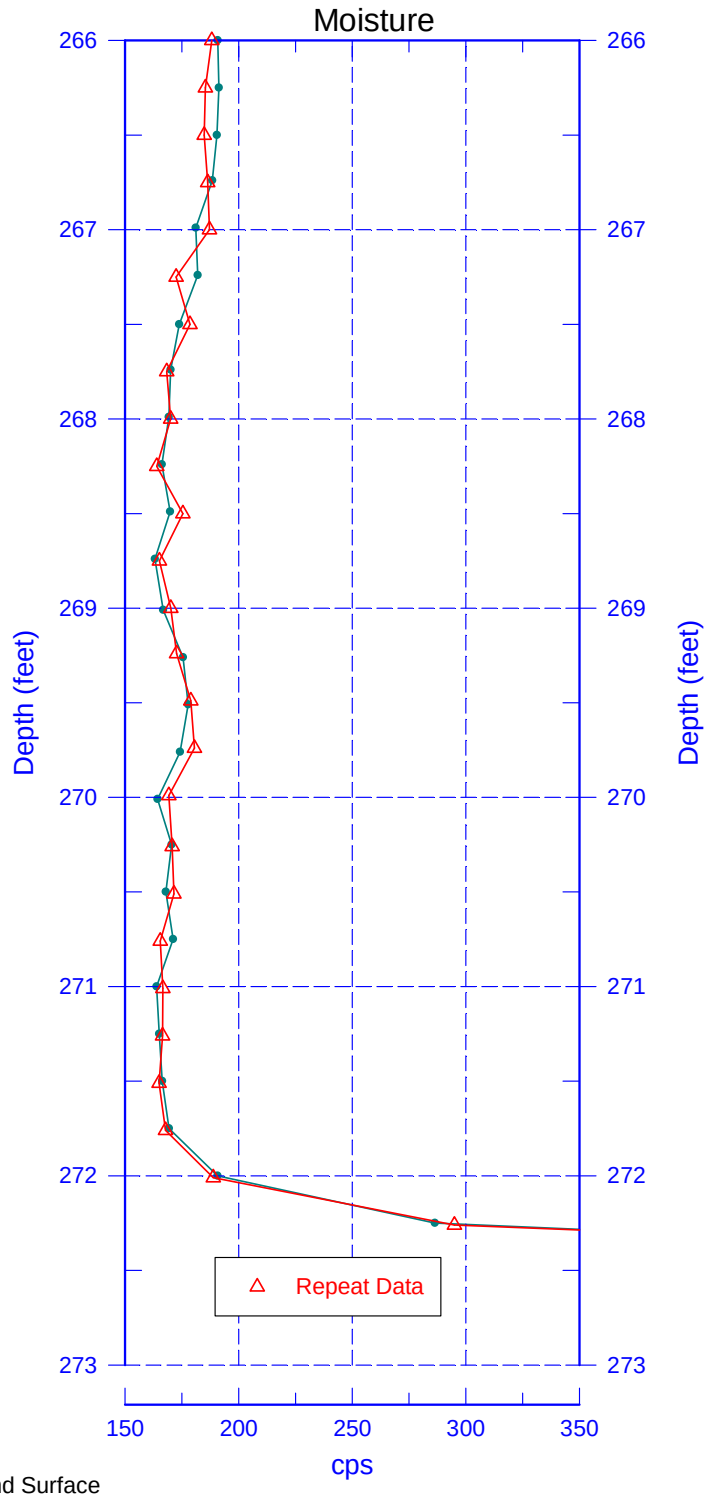
Zero Reference - Ground Surface

C9497
Moisture Repeat Section



Zero Reference - Ground Surface

C9497
Moisture Repeat Section



Zero Reference - Ground Surface

Huntington Ingalls Industries

Technical Solutions

C9503
Log Data Report

Borehole Information

Log Date	2017-08-10	Filename	C9503_HG-NM_2017-08-10	Site	200-DV-1
DTW[1] (ft)	**DTW Date**	**DTW Source**	**Drill Date**	**Total Depth (ft)**	**Depth Datum**
Dry	08/10/17	HII	08/10/17	225.4	Ground Surface

Casing Information

Casing Type	Drill Type	Stickup (ft)	Diameter (in.) Outer	Diameter (in.) Inside	Thickness (in.)	Top (ft)	Bottom (ft)
TerraSonic steel	Sonic	0.65	12	10.88-11.5	0.25-0.56	-0.65	34.9
Steel	Becker	0.0	8.625	7.511	0.557	0.0	70.0
TerraSonic steel	Sonic	0.0	7.05	6.22-6.55	0.25-0.42	0.0	135.5
TerraSonic steel	Sonic	0.0	6.0	5-5.5	0.25-0.5	0.0	225.3

Borehole Notes

The onsite geologist provided the total depth and casing depth. The logging engineer measured casing stick-up. Casing diameters are provided by the driller. The maximum logging depth achieved was 224 ft. Zero reference is ground surface.

Logging was started after the second casing had been drilled. The logged interval to 34.9 ft was conducted inside two casings.

Logging Equipment Information

Logging System	Gamma 5Tb	**Type**	60% HPGe SGLS[2]
Effective Calibration Date	02/16/17	**Serial No.**	54-TP13441B
Calibration Reference	HGLP-CC-152, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53023, Rev. 0

Logging System	Gamma 5Pb	**Type**	NMLS[3]
Effective Calibration Date	02/27/17	**Serial No.**	H34055445
Calibration Reference	HGLP-CC-153, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53024, Rev. 0

Logging System	Gamma 5Pb	**Type**	PNLS[4]
Effective Calibration Date	02/27/17	**Serial No.**	H34055445
Calibration Reference	HGLP-CC-153, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-54002, Rev. 0

Logging System	Gamma 5Cb	**Type**	Coaxial HPGe HRLS[5]
Effective Calibration Date	08/04/16	**Serial No.**	39A314
Calibration Reference	HGLP-CC-142, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53050, Rev. 0

[1] depth to water inside casing
[2] Spectral Gamma Logging System
[3] Neutron Moisture Logging System
[4] Passive Neutron Logging System
[5] High Rate Logging System

SGLS Log Run Information

Log Run	3	4	5	6 Repeat	11
HEIS Number	1020027	N/A	1020028	1020029	1020030
Date	06/08/17	06/08/17	06/08/17	06/08/17	08/01/17
Logging Engineer	Spatz/McClellan	Spatz/McClellan	Spatz/McClellan	Spatz/McClellan	McClellan/ Meisner
Start Depth (ft)	0.0	38.0	47.0	61.0	68.0
Finish Depth (ft)	40.0	48.0	69.0	66.0	134.01
Count Time (sec)	200	20	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9503FTB20170 608AV00CAB1	C9503FTB20170 608AV00CAB1	C9503FTB20170 608AV00CAB1	C9503FTB20170 608AV00CAB1	C9503FTB20170 801AV00CAB1
Start File	AD000000	BD003800	CD004700	DD006100	AD006800
Finish File	AD004000	BD004800	CD006900	DD006600	AD013401
Post-Verification	C9503FTB20170 608DV00CAA1	C9503FTB20170 608DV00CAA1	C9503FTB20170 608DV00CAA1	C9503FTB20170 608DV00CAA1	C9503FTB20170 801BV00CAA1
Depth Return Error (in.)	N/A	N/A	N/A	Not measured	N/A
Comments	No fine gain adjustments made	Not used – High Rate interval	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made

SGLS Log Run Information

Log Run	12 Repeat	15	16 Repeat		
HEIS Number	1020031	1020032	1020033		
Date	08/01/17	08/10/17	08/10/17		
Logging Engineer	Felt/Meisner	Spatz/McClellan	Spatz/McClellan		
Start Depth (ft)	107.0	133.0	204.0		
Finish Depth (ft)	113.01	224.01	212.0		
Count Time (sec)	200	200	200		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
Log Speed (ft/min)	N/A	N/A	N/A		
Pre-Verification	C9503FTB20170 801AV00CAB1	C9503FTB20170 810AV00CAB1	C9503FTB20170 810AV00CAB1		
Start File	BD010700	AD013300	BD020400		
Finish File	BD011301	AD022401	BD021200		
Post-Verification	C9503FTB20170 801BV00CAA1	C9503FTB20170 810BV00CAA1	C9503FTB20170 810BV00CAA1		
Depth Return Error (in.)	0.0	N/A	3.0 high		
Comments	No fine gain adjustments made	Gain adjustment after 220 ft	No fine gain adjustments made		

NMLS Log Run Information

Log Run	1	2 Repeat	13	14 Repeat	17
HEIS Number	1020034	1020035	1020036	1020037	1020038
Date	06/07/17	06/07/17	08/01/17	08/01/17	08/10/17
Logging Engineer	Felt/McClellan	Felt/McClellan	Felt/Meisner	Felt	Felt
Start Depth (ft)	0.0	30.0	69.0	123.0	133.0
Finish Depth (ft)	70.02	40.0	134.02	129.24	224.01
Count Time (sec)	15	15	15	15	15
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.25	0.25	0.25	0.25	0.25
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9503FPB20170 607AV00CAB1	C9503FPB20170 607AV00CAB1	C9503FPB20170 801AV00CAB1	C9503FPB20170 801AV00CAB1	C9503FPB20170 810AV00CAB1
Start File	AD000000	BD003000	AD006900	BD012300	AD013300
Finish File	AD007002	BD004000	AD013402	BD012924	AD022401
Post-Verification	C9503FPB20170 607BV00CAA1	C9503FPB20170 607BV00CAA1	C9503FPB20170 801BV00CAA1	C9503FPB20170 801BV00CAA1	C9503FPB20170 810BV00CAA1
Depth Return Error (in.)	N/A	0.0	N/A	1.0 high	N/A
Comments	None	None	None	None	None

NMLS Log Run Information

Log Run	18 Repeat				
HEIS Number	1020039				
Date	08/10/17				
Logging Engineer	Felt				
Start Depth (ft)	185.0				
Finish Depth (ft)	194.0				
Count Time (sec)	15				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	0.25				
Log Speed (ft/min)	N/A				
Pre-Verification	C9503FPB20170 810AV00CAB1				
Start File	BD018500				
Finish File	BD019400				
Post-Verification	C9503FPB20170 810BV00CAA1				
Depth Return Error (in.)	2.0 high				
Comments	None				

HRLS Log Run Information

Log Run	9	10 Repeat			
HEIS Number	1020040	1020041			
Date	06/12/17	06/12/17			
Logging Engineer	Spatz/McClellan	Spatz/McClellan			
Start Depth (ft)	39.0	44.0			
Finish Depth (ft)	46.0	45.0			
Count Time (sec)	300	300			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
Log Speed (ft/min)	N/A	N/A			
Pre-Verification	C9503FPB20170 612AV00CAB1	C9503FPB20170 612AV00CAB1			
Start File	AD003900	BD004400			
Finish File	AD004600	BD004500			
Post-Verification	C9503FPB20170 612BV00CAA1	C9503FPB20170 612BV00CAA1			
Depth Return Error (in.)	N/A	0.5 high			
Comments	None	None			

PNLS Log Run Information

Log Run	7	8 Repeat			
HEIS Number	1020042	1020043			
Date	06/12/17	06/12/17			
Logging Engineer	Spatz/McClellan	Spatz/McClellan			
Start Depth (ft)	0.0	37.0			
Finish Depth (ft)	70.0	47.0			
Count Time (sec)	60	60			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
Log Speed (ft/min)	N/A	N/A			
Pre-Verification	C9503FPB20170 612AV00CAB1	C9503FPB20170 612AV00CAB1			
Start File	AD000000	BD003700			
Finish File	AD007000	BD004700			
Post-Verification	C9503FPB20170 612BV00CAA1	C9503FPB20170 612BV00CAA1			
Depth Return Error (in.)	N/A	1.0 high			
Comments	None	None			

Logging Operation Notes

A centralizer was not installed on the sondes. The sondes were enveloped in plastic sleeving to prevent potential contamination.

Analysis Notes

Analyst	P.D. Henwood	**Date**	10/03/17
Reference(s)	SGRP-PRO-OP-53040, Rev. 0; SGRP-PRO-OP-53051, Rev. 0		

A combined casing correction of 0.807-in. was applied to the SGLS data to 34.9 ft and 0.557-in. to 69 ft. A casing correction for a 1/4-in. thick casing was applied for the remainder of the borehole. No corrections were applied for the thicker casing joints associated with the sonic casing where the maximum thickness varies from 0.42-in. to 0.5-in. and results in lower concentrations at 10-ft intervals.

No water correction was applied in this borehole as groundwater was not reached.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations for the SGLS were calculated in an EXCEL template identified as FTB20170216, using an efficiency function and corrections for casing and dead time as determined by annual calibrations.

An interpreted data set was created for this borehole. Depth overlaps from consecutive log runs or where two casings existed were removed from 68 and 69 ft and from 133 and 134 ft. This results in a data set where only one data point is presented for each depth.

NMLS data are reported in counts per second.

PNLS data are also reported in counts per second and consist of data acquired by the NMLS without a source. The measurement is qualitative only as there is no calibration available.

HGU[6] is an empirical unit of gamma activity proposed as a means to standardize gamma log response across multiple logging systems with different response characteristics. The HGU is defined in terms of measurements in the Hanford Borehole Calibration Facility, and the magnitude is selected such that 1 HGU is approximately equivalent to typical Hanford background activity, based on data from background samples as reported in *Hanford Site Background: Part 2, Soil Background for Radionuclides* (DOE/RL-96-12).

Results and Interpretations

Cs-137 was the only manmade radionuclide detected in this borehole. Cs-137 was detected from 37 to 71 ft, from 75 to 90 ft, intermittently from 94 to 102 ft, and from 126 to 130 ft. The maximum concentration measured by the HRLS was approximately 51,500 pCi/g at 45 ft.

Although Pa-234m (U-238) and U-235 were not detected, MDLs[7] are plotted in the Manmade Radionuclides plot. Also no Pu-239 or Am-241 were detected above their respective MDLs of approximately 10 to 20,000 pCi/g

A passive neutron log was conducted from the ground surface to 70 ft. No evidence of a neutron flux that could be attributed to transuranic radionuclides was found.

The neutron moisture log primarily responds to moisture present in the surrounding formation. In general, an increase in count rate reflects an increase in moisture content. Moisture content may increase in sediments of relatively high silt or clay content.

The manmade, KUT, and moisture repeat plots indicate that the respective systems were working properly.

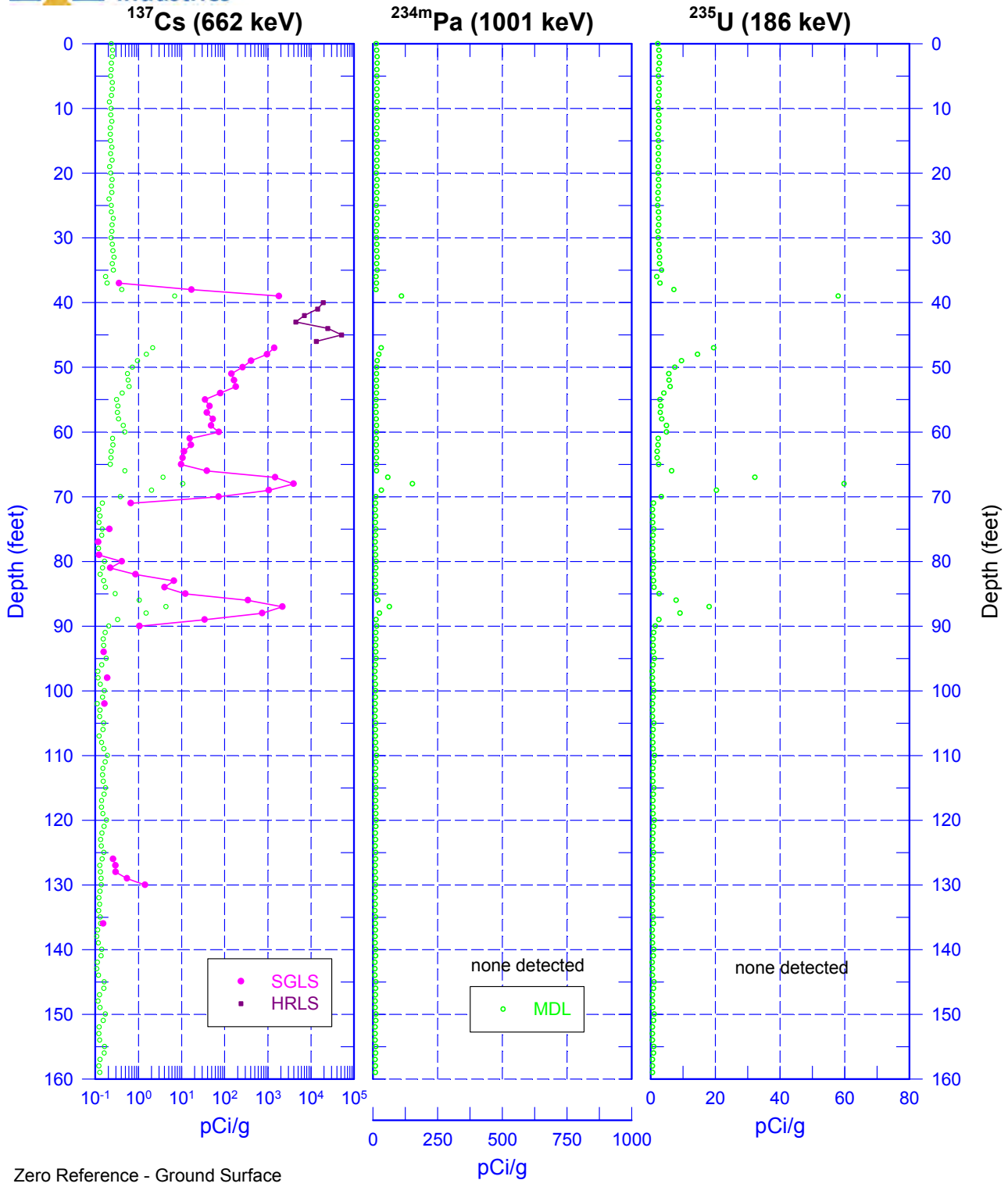
[6] Hanford Gamma Unit
[7] Minimum Detection Limit

List of Log Plots

Depth Reference is ground surface.

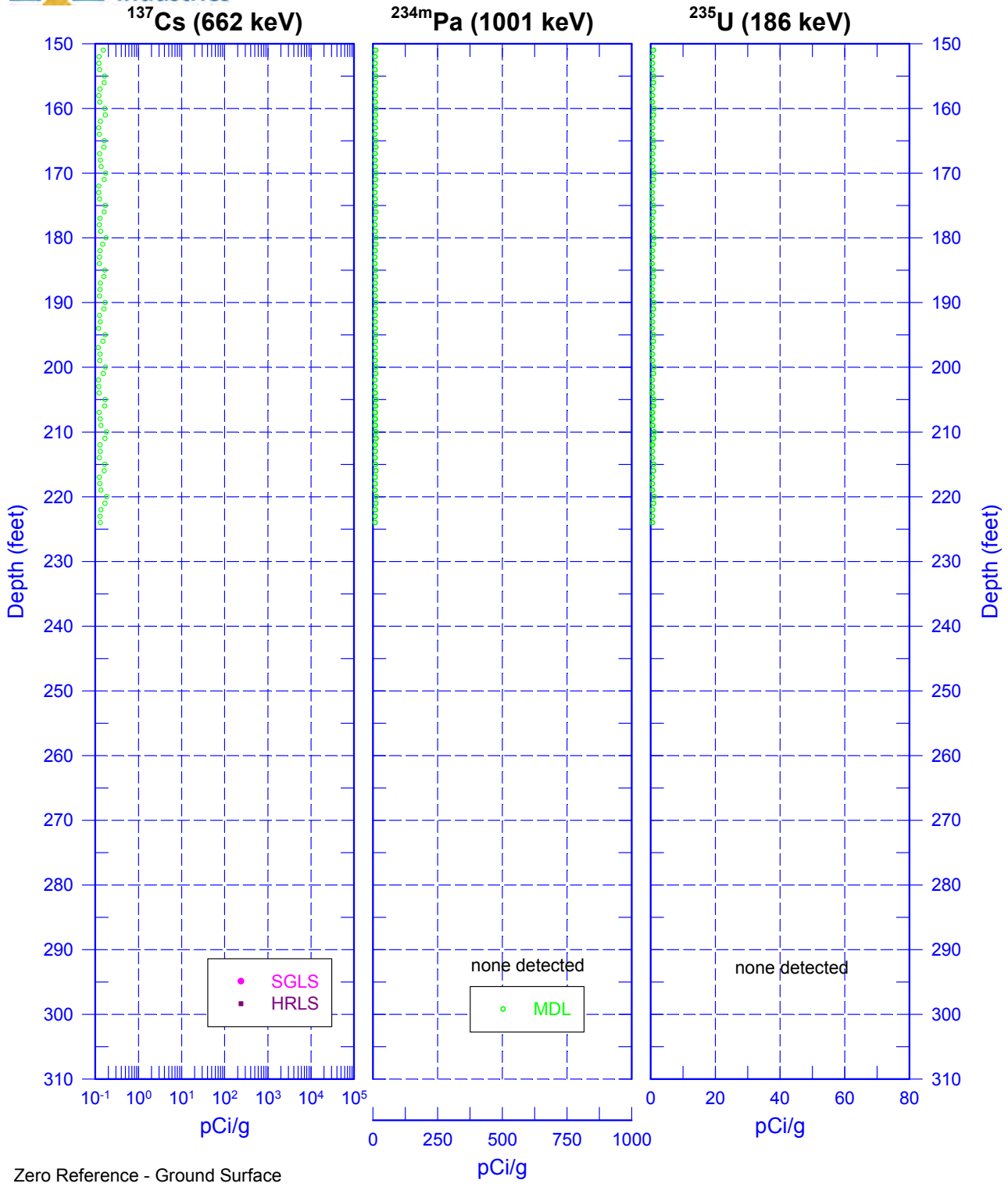
Manmade Radionuclides (0-160 ft)
Manmade Radionuclides (150-310 ft)
Natural Gamma Logs (0-160 ft)
Natural Gamma Logs (150-310 ft)
Combination Plot (0-120 ft)
Combination Plot (110-230 ft)
Combination Plot (0-230 ft)
Passive Neutron (0-80 ft)
Total Gamma & Moisture (0-160 ft)
Total Gamma & Moisture (150-310 ft)
Total Gamma & Hanford Gamma Unit (0-230 ft)
Manmade Radionuclides Repeat Data (61-66 ft)
Repeat Section of Natural Gamma Logs (61-66 ft)
Repeat Section of Natural Gamma Logs (107-113 ft)
Repeat Section of Natural Gamma Logs (204-212 ft)
Moisture Repeat Section (30-40 ft)
Moisture Repeat Section (123-130 ft)
Moisture Repeat Section (185-194 ft)

C9503
Manmade Radionuclides



Zero Reference - Ground Surface

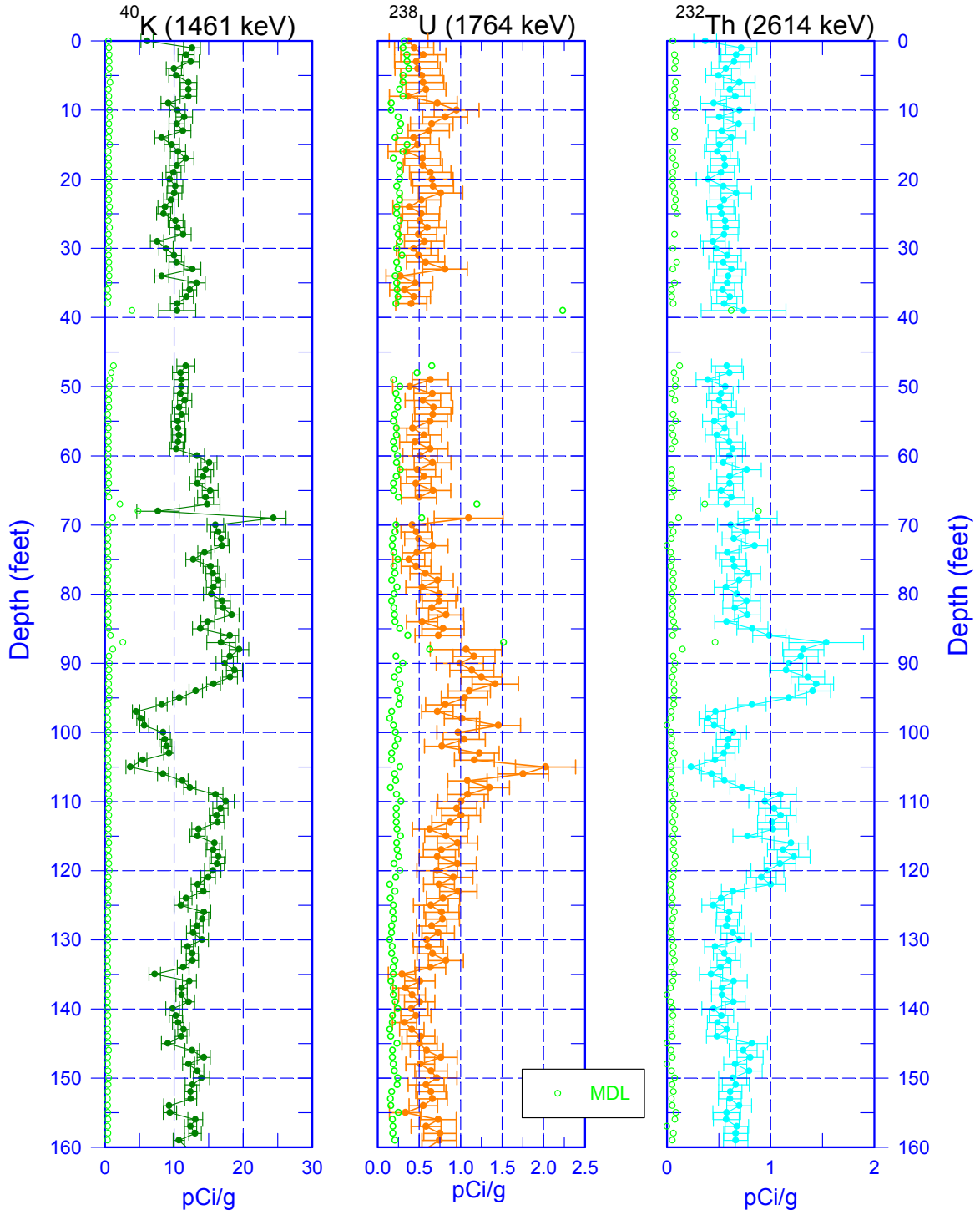
C9503
Manmade Radionuclides



Zero Reference - Ground Surface

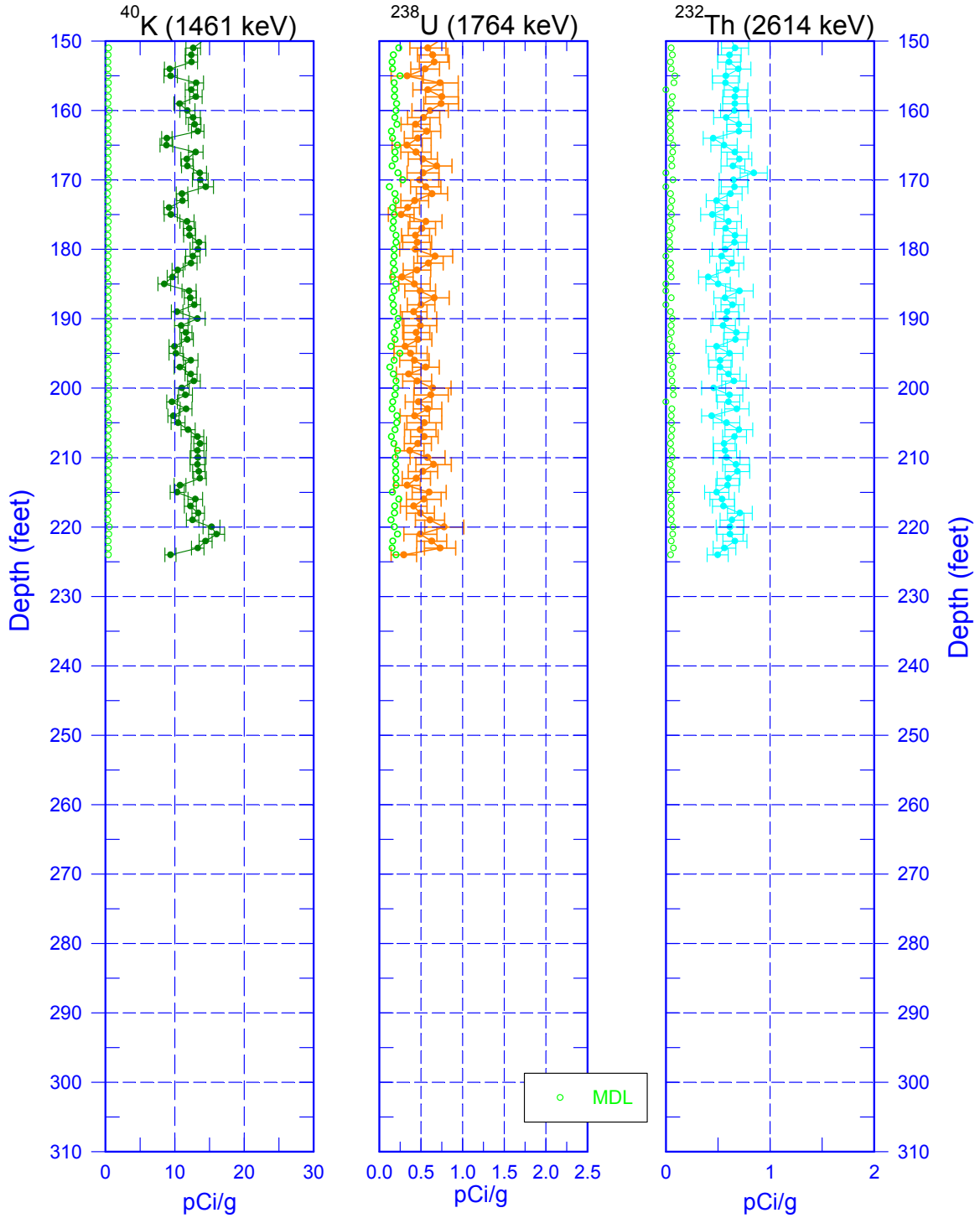
Huntington Ingalls Industries

C9503
Natural Gamma Logs



Zero Reference - Ground Surface

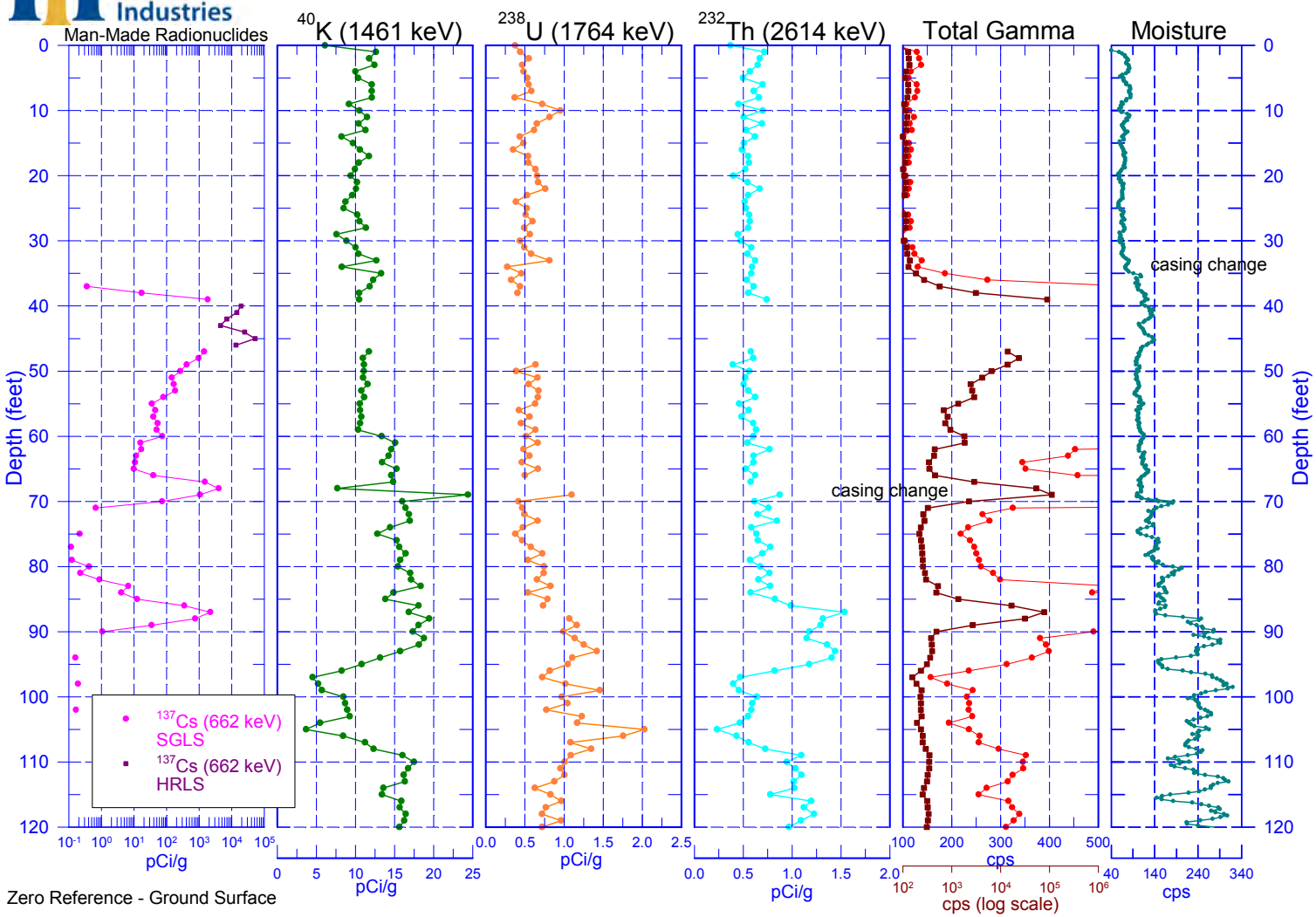
C9503
Natural Gamma Logs



Zero Reference - Ground Surface

Huntington Ingalls Industries

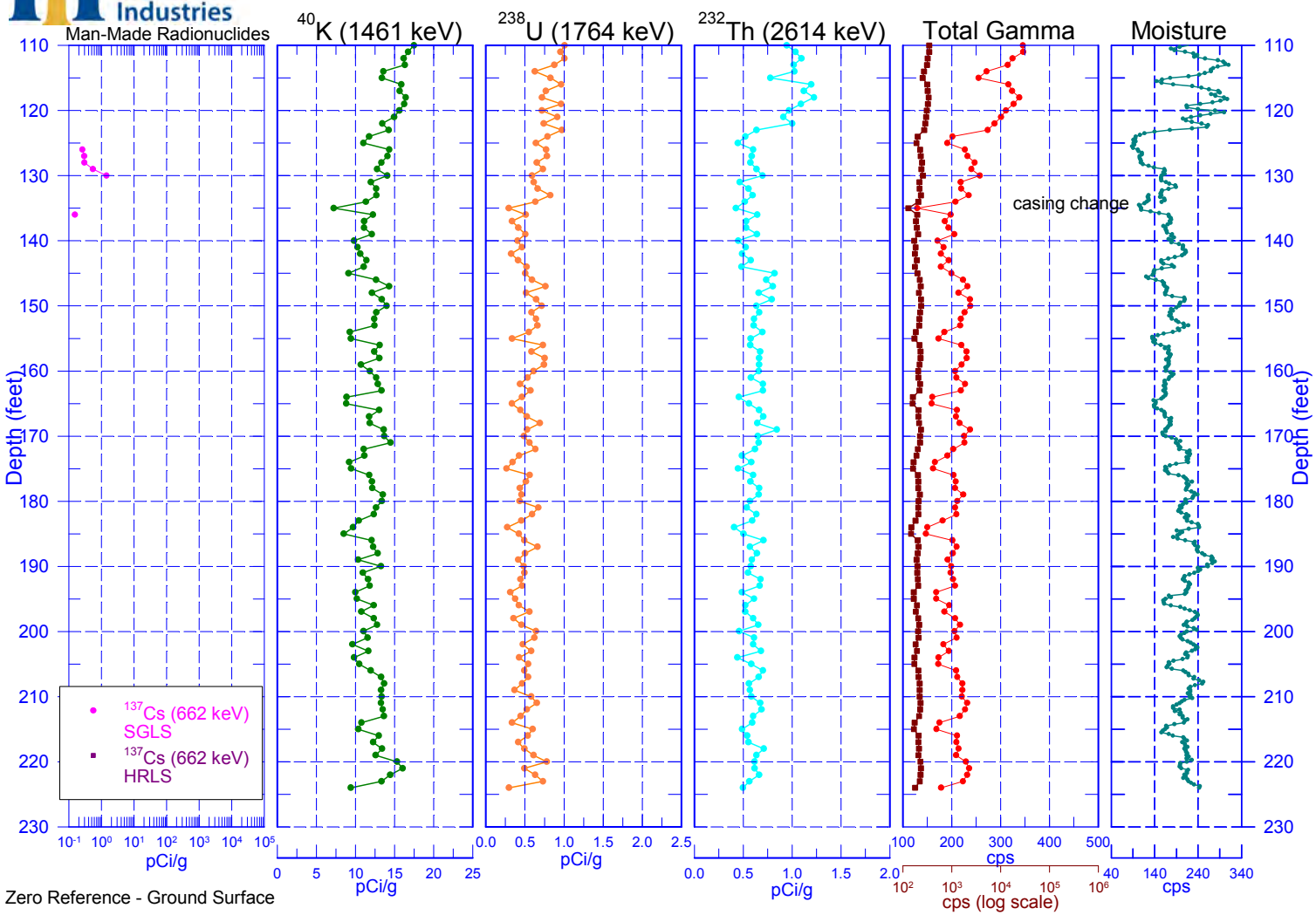
C9503 Combination Plot



Zero Reference - Ground Surface

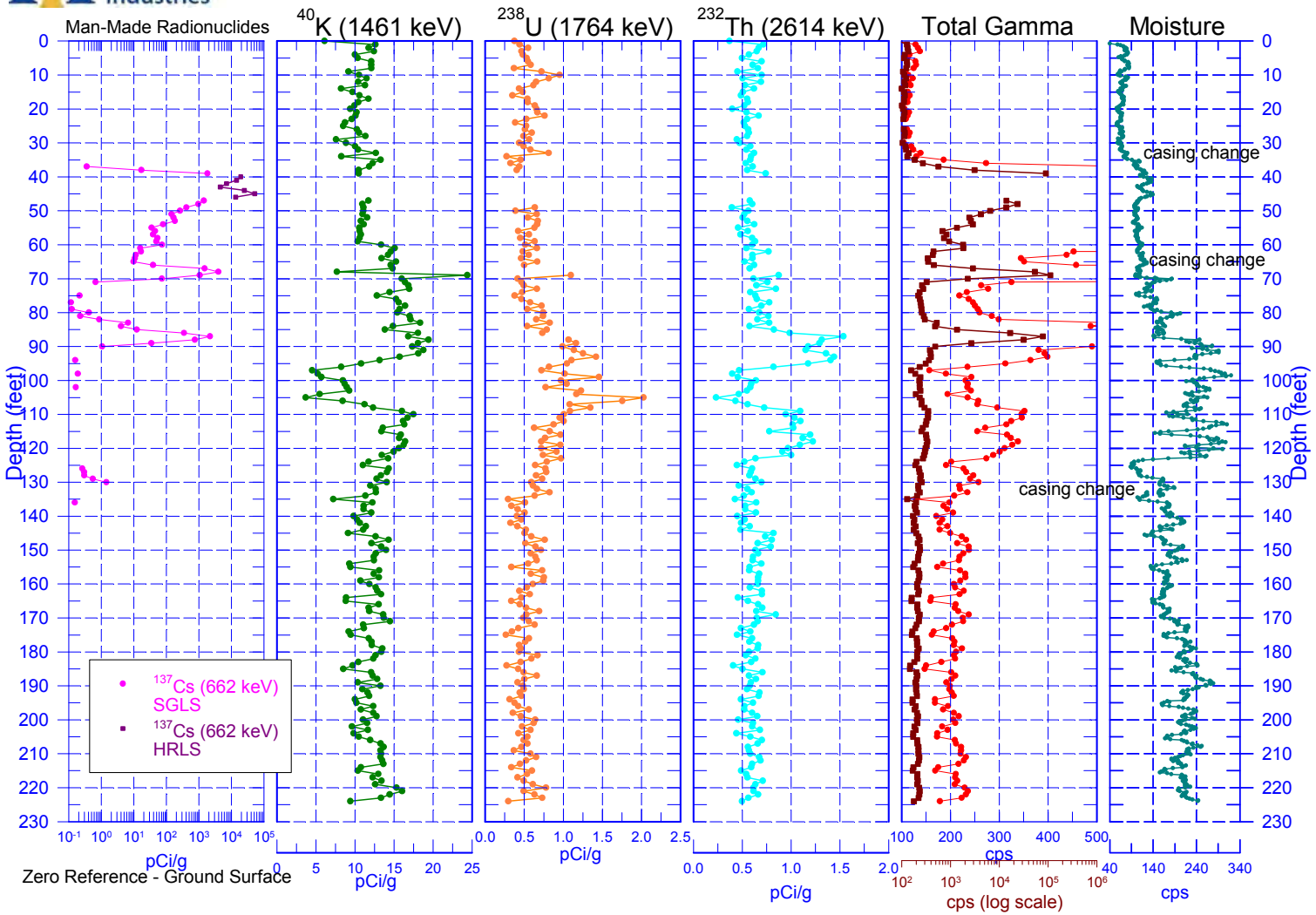
Huntington Ingalls Industries

C9503 Combination Plot

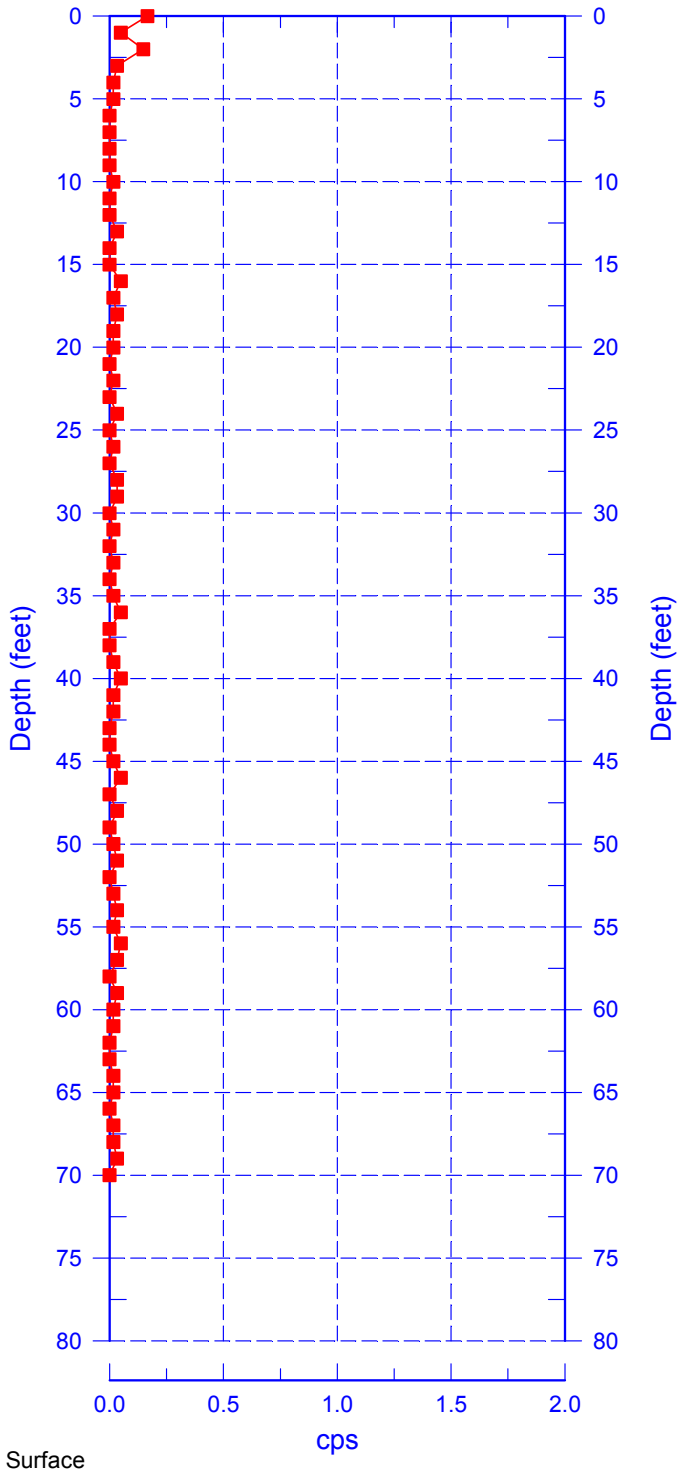


Huntington Ingalls Industries

C9503 Combination Plot



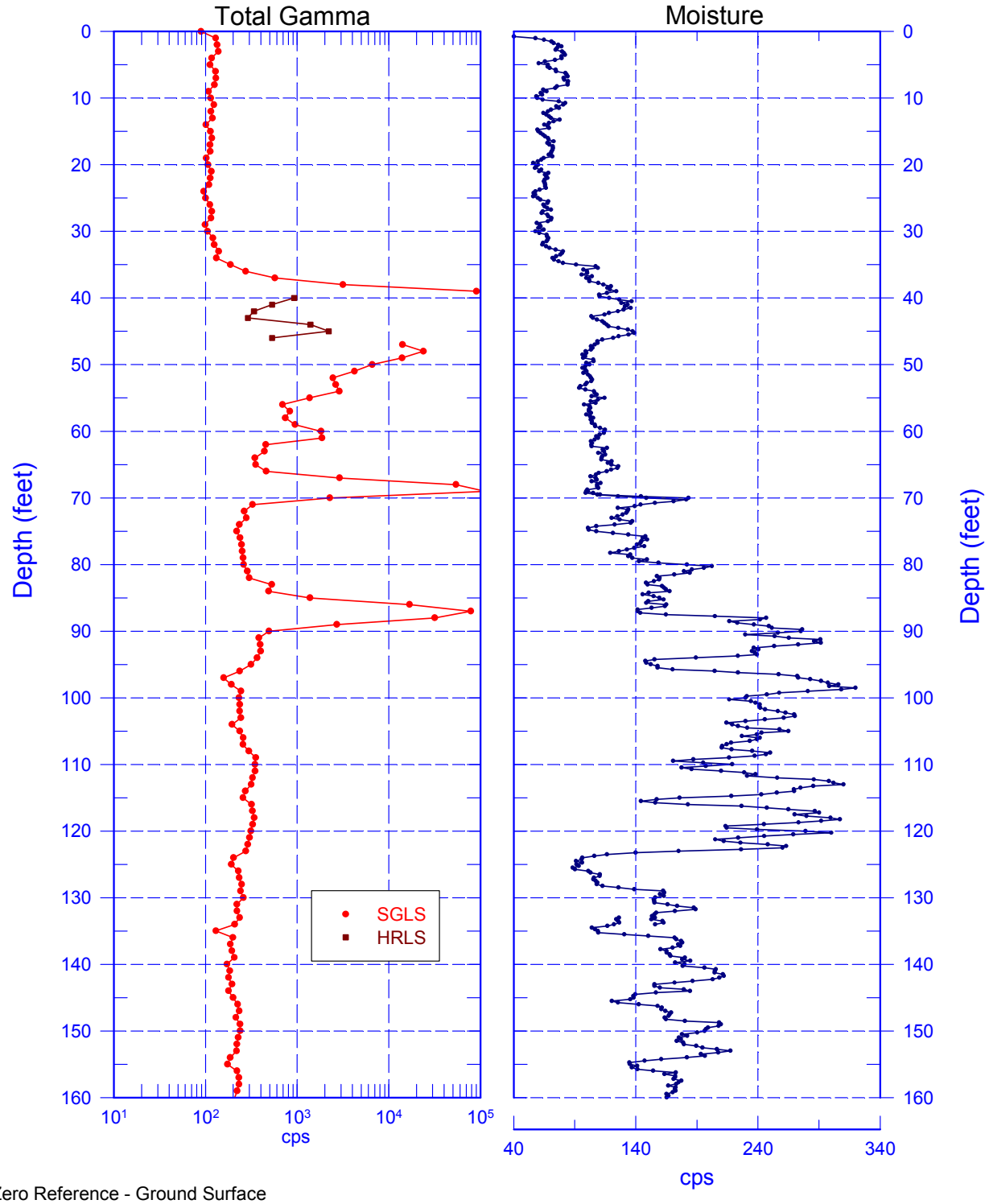
C9503
Passive Neutron



Zero Reference - Ground Surface

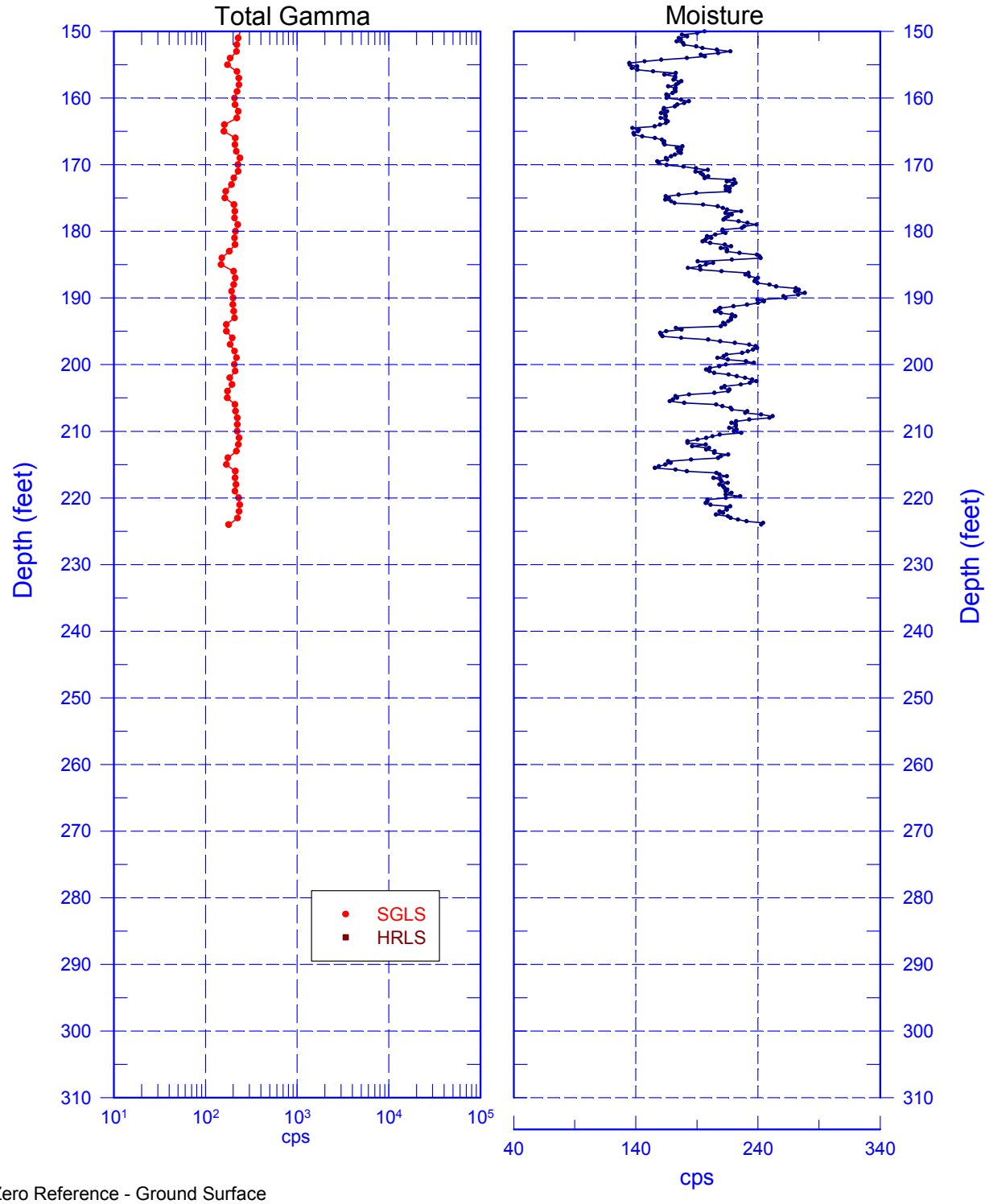
Huntington Ingalls Industries

C9503
Total Gamma & Moisture



Zero Reference - Ground Surface

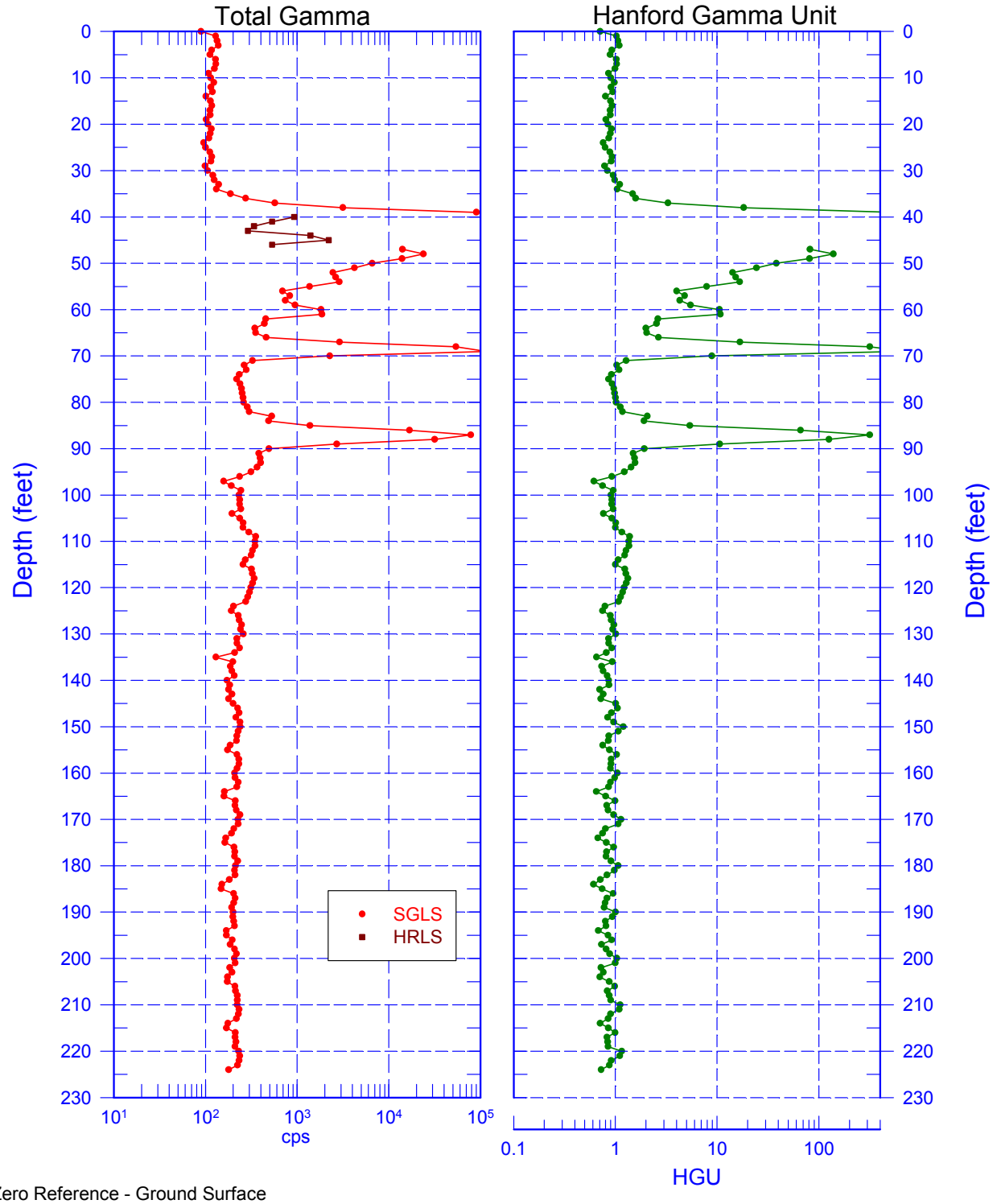
C9503
Total Gamma & Moisture



Zero Reference - Ground Surface

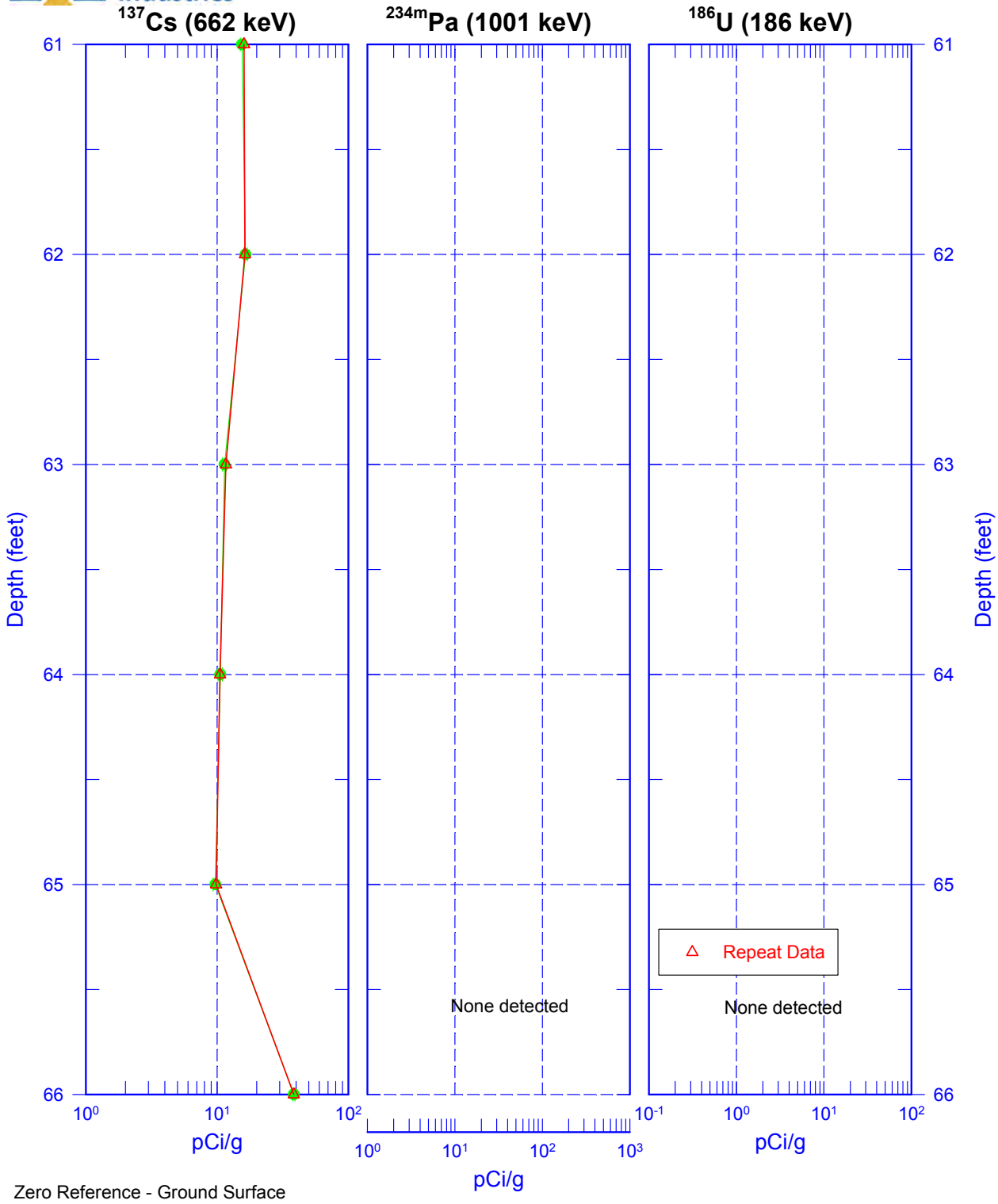
Huntington Ingalls Industries

C9503
Total Gamma & Hanford Gamma Unit



Zero Reference - Ground Surface

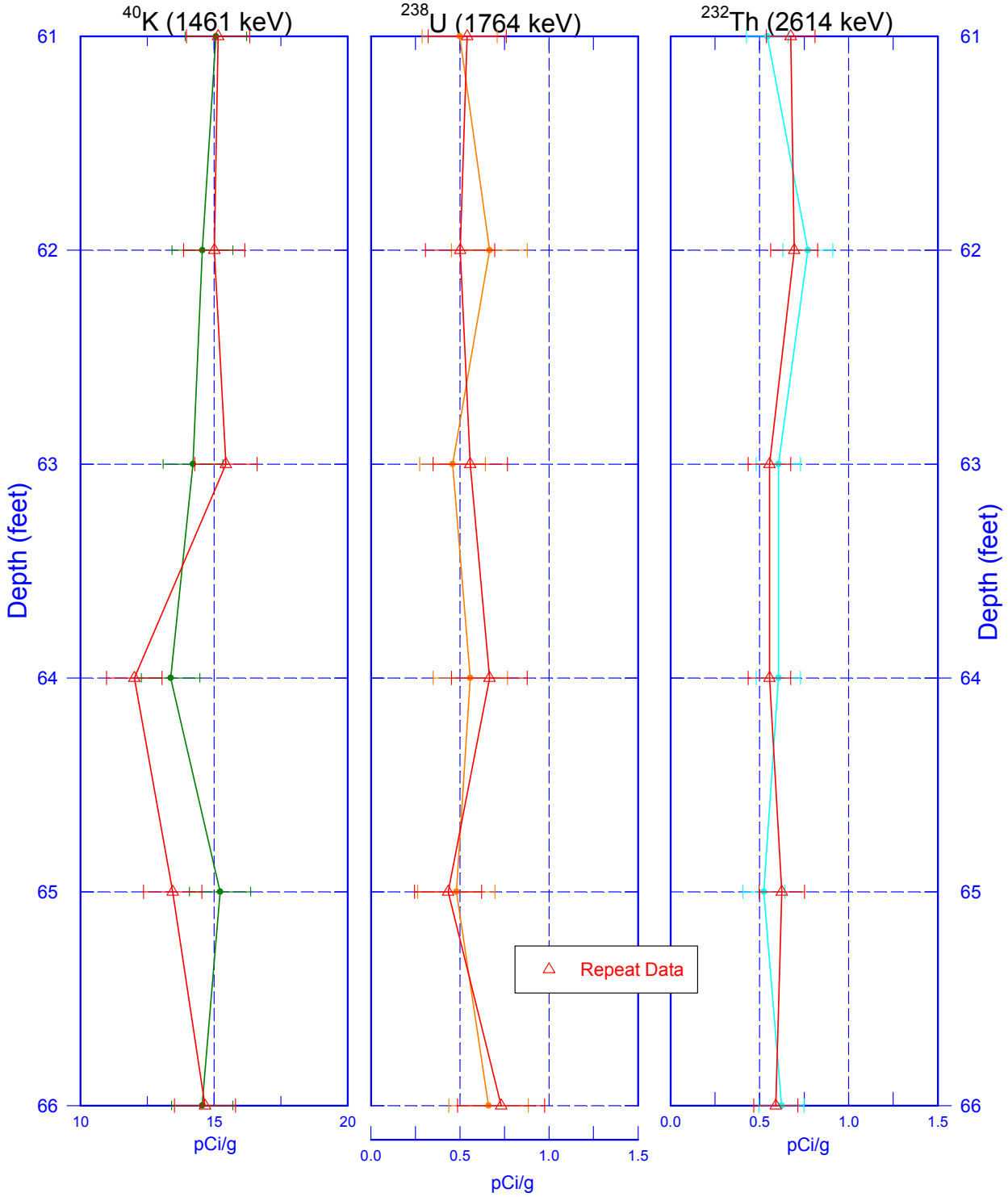
C9503
Manmade Radionuclides Repeat Data



Zero Reference - Ground Surface

C9503

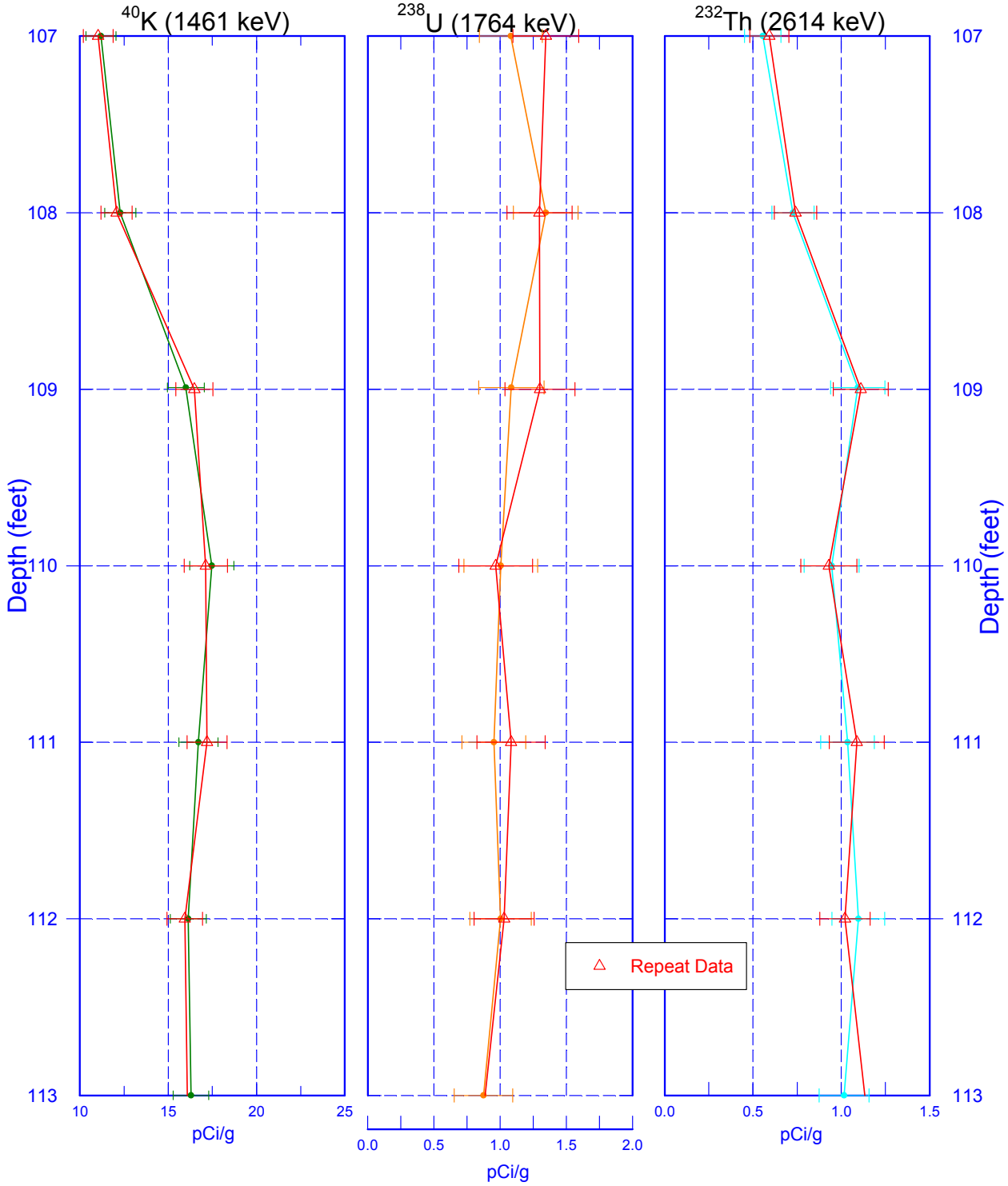
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

C9503

Repeat Section of Natural Gamma Logs

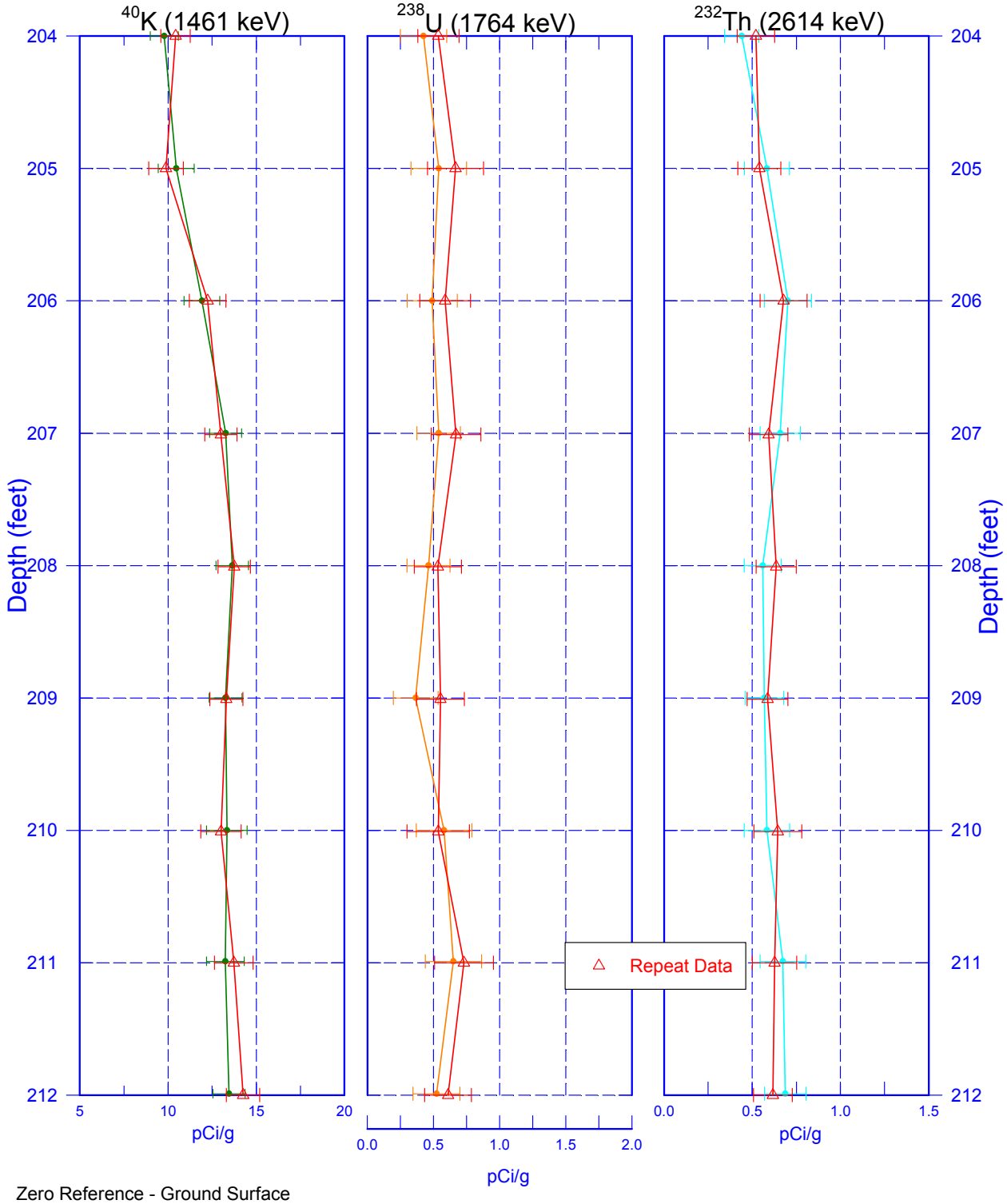


Zero Reference - Ground Surface

Huntington Ingalls Industries

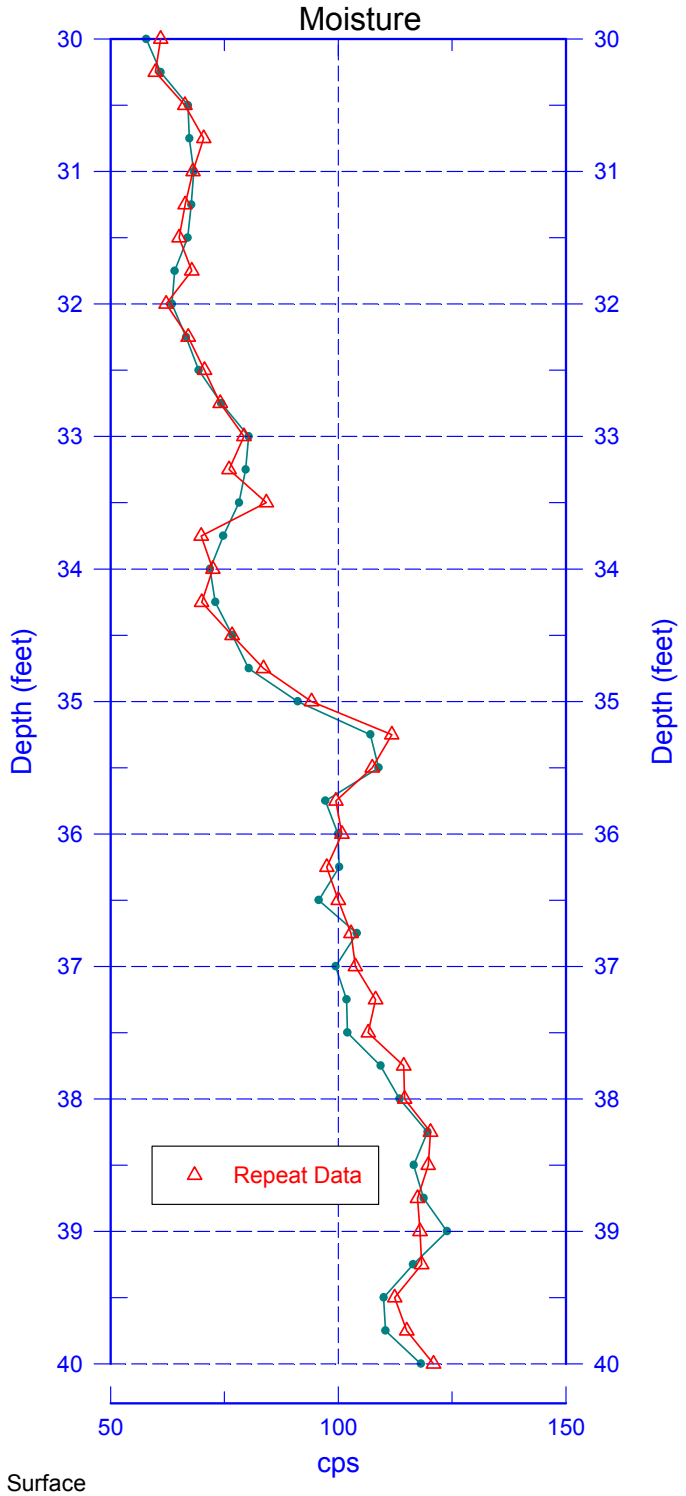
C9503

Repeat Section of Natural Gamma Logs



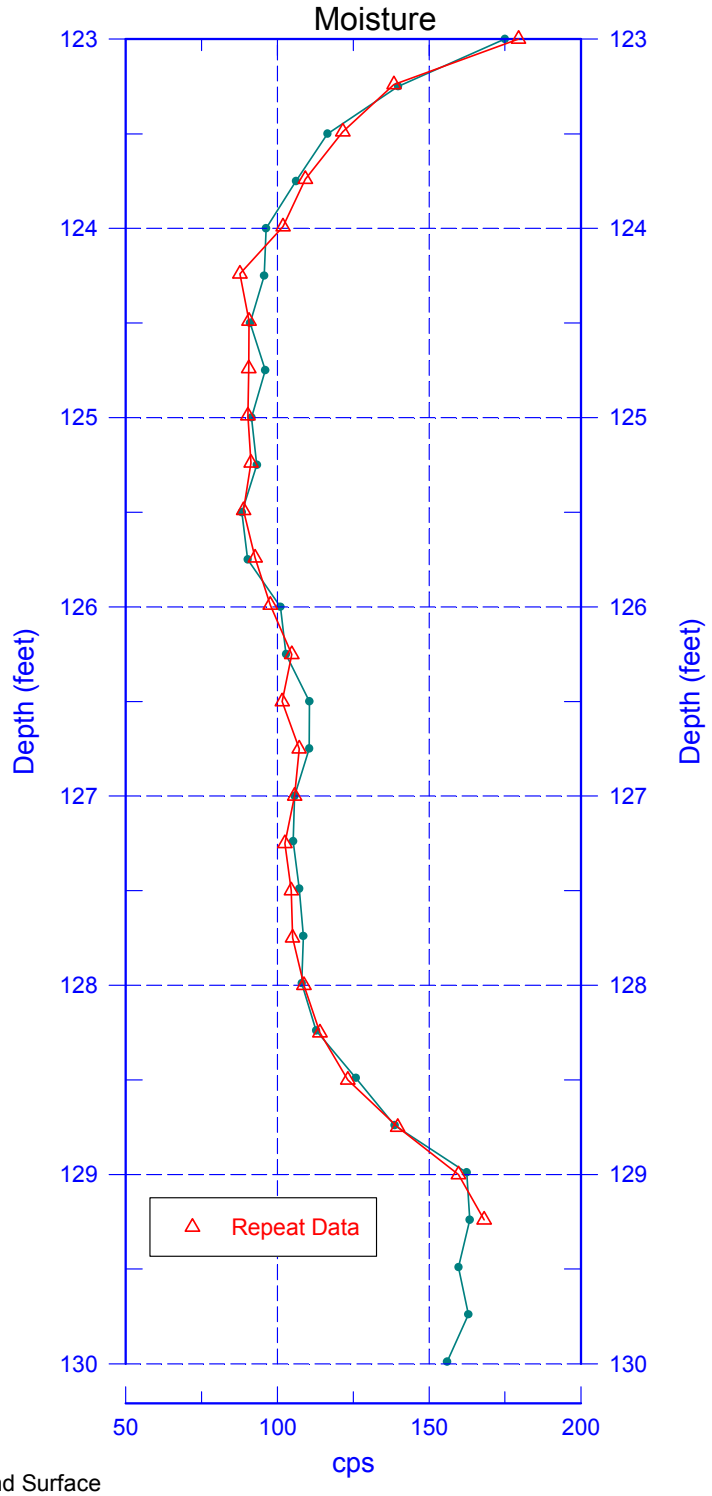
Zero Reference - Ground Surface

C9503
Moisture Repeat Section



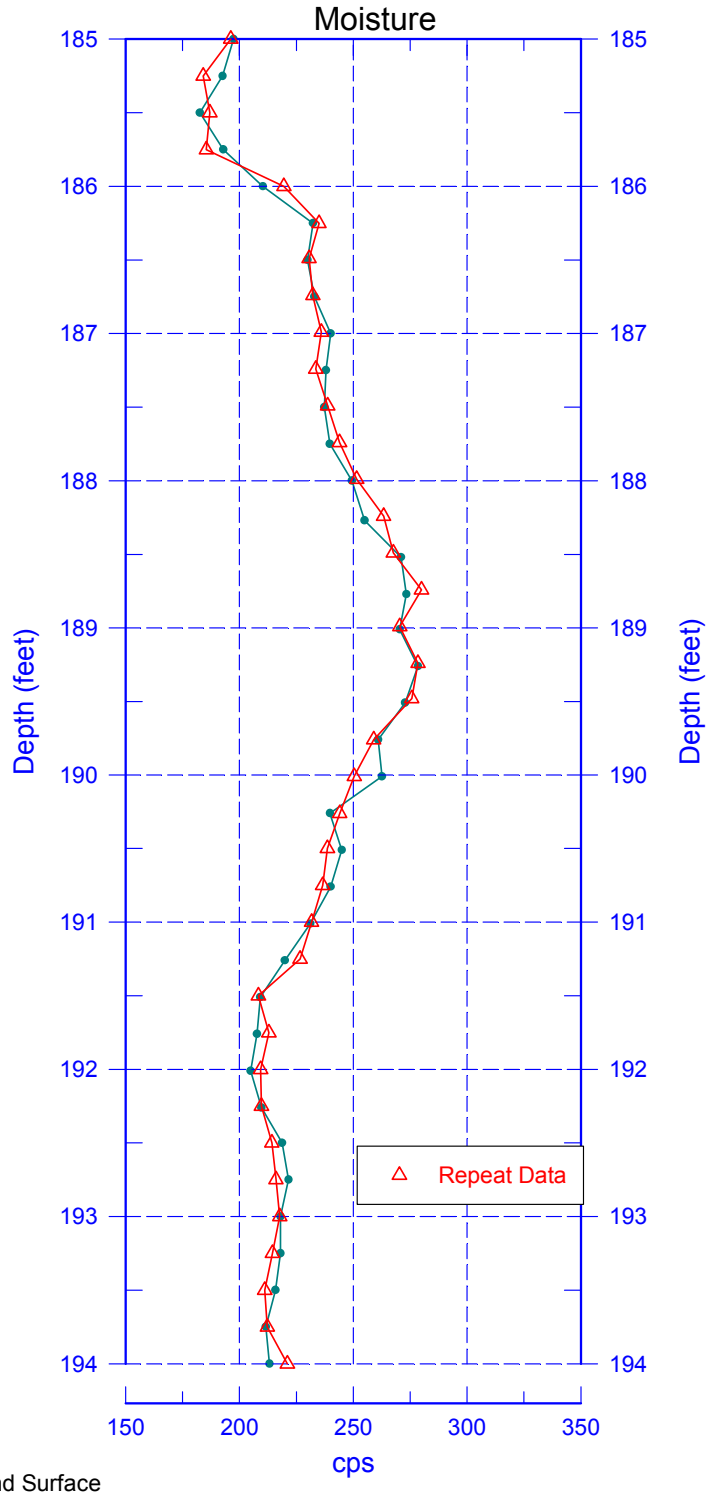
Zero Reference - Ground Surface

C9503
Moisture Repeat Section



Zero Reference - Ground Surface

C9503
Moisture Repeat Section



Zero Reference - Ground Surface

Stoller Newport News Nuclear

C9513
Log Data Report

Borehole Information

Log Date	2017-09-05	Filename	C9513_HG-NM_2017-09-05	Site	200-DV-1

DTW[1] (ft)	DTW Date	DTW Source	Drill Date	Total Depth (ft)	Depth Datum
Dry	09/05/17	SN3	08/31/17	240.2	Ground Surface

Casing Information

Casing Type	Drill Type	Stickup (ft)	Diameter (in.) Outer	Diameter (in.) Inside	Thickness (in.)	Top (ft)	Bottom (ft)
TerraSonic steel	Sonic	0.5	12	10.88-11.5	0.25-0.56	-0.5	11.9
Steel	Becker	0.2	8.625	7.511	0.557	-0.2	42.1
TerraSonic steel	Sonic	0.2	7.05	6.22-6.50	0.25-0.42	-0.2	160.3
TerraSonic steel	Sonic	0.2	6.0	5-5.5	0.25-0.5	-0.2	240.3

Borehole Notes

The onsite geologist provided the total depth and casing depth. The logging engineer measured casing stick-up. Casing diameters are provided by the driller. The maximum logging depth achieved was 239 ft. Zero reference is ground surface.

Logging was started after the second casing had been drilled. The logged interval to 11.9 ft was conducted inside two casings.

Logging Equipment Information

Logging System	Gamma 5Tb	Type	60% HPGe SGLS[2]
Effective Calibration Date	02/16/17	Serial No.	54-TP13441B
Calibration Reference	HGLP-CC-152, Rev. 0	Logging Procedure	SGRP-PRO-OP-53023, Rev. 0

Logging System	Gamma 5Pb	Type	NMLS[3]
Effective Calibration Date	02/27/17	Serial No.	H34055445
Calibration Reference	HGLP-CC-153, Rev. 0	Logging Procedure	SGRP-PRO-OP-53024, Rev. 0

SGLS Log Run Information

Log Run	1	2 Repeat	5	6 Repeat	9
HEIS Number	1020010	1020011	1020012	1020013	1020014
Date	06/01/17	06/01/17	08/24/17	08/24/17	08/31/17
Logging Engineer	Felt/McClellan	Felt/McClellan	Felt/Meisner	Felt	Felt/Meisner
Start Depth (ft)	0.0	37.01	41.0	130.0	158.0
Finish Depth (ft)	42.01	42.01	159.02	142.01	235.01
Count Time (sec)	200	500	200	200	200
Live/Real	R	R	R	R	R

[1] depth to water inside casing
[2] Spectral Gamma Logging System
[3] Neutron Moisture Logging System

Stoller Newport News Nuclear

Log Run	1	2 Repeat	5	6 Repeat	9
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9513FTB2017 0601AV00CAB 1	C9513FTB2017 0601AV00CAB 1	C9513FTB2017 0824AV00CAB 1	C9513FTB2017 0824AV00CAB 1	C9513FTB2017 0831AV00CAB 1
Start File	AD000000	BD003701	AD004100	BD013000	AD015800
Finish File	AD004201	BD004201	AD015902	BD014201	AD023501
Post-Verification	C9513FTB2017 0601BV00CAA 1	C9513FTB2017 0601BV00CAA 1	C9513FTB2017 0824BV00CAA 1	C9513FTB2017 0824BV00CAA 1	C9513FTB2017 0831BV00CAA 1
Depth Return Error (in.)	N/A	0.0	N/A	3.0 high	N/A
Comments	Fine gain adjustment made after 29 ft	No fine gain adjustments made	Gain adjustment after file 56	No fine gain adjustments made	No fine gain adjustments made

Log Run	10	11 Repeat			
HEIS Number	1020015	1020016			
Date	08/31/17	08/31/17			
Logging Engineer	Felt/Meisner	Felt/Meisner			
Start Depth (ft)	235.0	230.0			
Finish Depth (ft)	239.01	238.0			
Count Time (sec)	200	200			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
Log Speed (ft/min)	N/A	N/A			
Pre-Verification	C9513FTB2017 0831AV00CAB 1	C9513FTB2017 0831AV00CAB 1			
Start File	BD023500	CD023000			
Finish File	BD023901	CD023800			
Post-Verification	C9513FTB2017 0831BV00CAA 1	C9513FTB2017 0831BV00CAA 1			
Depth Return Error (in.)	N/A	5.0 high			
Comments	No fine gain adjustments made	No fine gain adjustments made			

NMLS Log Run Information

Log Run	3	4 Repeat	7	8 Repeat	12
HEIS Number	1020017	1020018	1020019	1020020	1020021
Date	06/05/17	06/05/17	08/24/17	08/24/17	09/05/17
Logging Engineer	Spatz/McClellan	Spatz/McClellan	Spatz/McClellan	Spatz/McClellan	Felt
Start Depth (ft)	0.0	36.0	41.0	130.0	158.0
Finish Depth (ft)	42.76	42.0	159.02	142.01	239.02
Count Time (sec)	15	15	15	15	15

Stoller Newport News Nuclear

Log Run	3	4 Repeat	7	8 Repeat	12
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.25	0.25	0.25	0.25	0.25
Log Speed (ft/min)	N/A	N/A	N/A	N/A	N/A
Pre-Verification	C9513FPB20170 605AV00CAB1	C9513FPB20170 605AV00CAB1	C9513FPB20170 824AV00CAB1	C9513FPB20170 824AV00CAB1	C9513FPB20170 905AV00CAB1
Start File	AD000000	BD003600	AD004100	BD013000	AD015800
Finish File	AD004276	BD004200	AD015902	BD014201	AD023902
Post-Verification	C9513FPB20170 605BV00CAA1	C9513FPB20170 605BV00CAA1	C9513FPB20170 824BV00CAA1	C9513FPB20170 824BV00CAA1	C9513FPB20170 905BV00CAA1
Depth Return Error (in.)	N/A	High 0.5	N/A	2.0 high	N/A
Comments	None	None	None	None	None

Log Run	13 Repeat				
HEIS Number	1020022				
Date	09/05/17				
Logging Engineer	Felt				
Start Depth (ft)	225.0				
Finish Depth (ft)	233.0				
Count Time (sec)	15				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	0.25				
Log Speed (ft/min)	N/A				
Pre-Verification	C9513FPB20170 905AV00CAB1				
Start File	BD022500				
Finish File	BD023300				
Post-Verification	C9513FPB20170 905BV00CAA1				
Depth Return Error (in.)	1.0 high				
Comments	None				

Logging Operation Notes

A centralizer was not installed on the SGLS and NMLS sondes. The sondes were enveloped in plastic sleeving to prevent potential contamination.

Analysis Notes

Analyst	P.D. Henwood	Date	09/21/17
Reference(s)	SGRP-PRO-OP-53040, Rev. 0; SGRP-PRO-OP-53051, Rev. 0		

A combined casing correction of 0.807-in. was applied to the SGLS data to 11.9 ft and 0.557-in. to 43 ft. Casing corrections for a 1/4-in. thick casing were applied for the remainder of the borehole. No corrections were applied for the thicker casing joints associated with the sonic casing where the maximum thickness varies from 0.42-in. to 0.5-in and results in lower concentrations at 10-ft intervals.

No water correction was applied in this borehole as groundwater was not reached.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations for the SGLS were calculated in an EXCEL template identified as ftB20170216, using an efficiency function and corrections for casing and dead time as determined by annual calibrations.

An interpreted data set was created for this borehole. Depth overlaps from consecutive log runs or where two casings existed were removed from 41 and 42 ft and from 158 and 159 ft. This results in a data set where only one data point is presented for each depth.

NMLS data are reported in counts per second.

HGU[4] is an empirical unit of gamma activity proposed as a means to standardize gamma log response across multiple logging systems with different response characteristics. The HGU is defined in terms of measurements in the Hanford Borehole Calibration Facility, and the magnitude is selected such that 1 HGU is approximately equivalent to typical Hanford background activity, based on data from background samples as reported in *Hanford Site Background: Part 2, Soil Background for Radionuclides* (DOE/RL-96-12).

Results and Interpretations

Cs-137 and manmade uranium (Pa-234 [U-238] and U-235) were detected in this borehole. Cs-137 was detected at 30, 31, 52, 53 and 55 ft. The maximum concentration was approximately 1 pCi/g at 30 ft.

Pa-234m was detected at 29 and 30 ft, from 36 to 42 ft, and a few other intermittent depth locations deeper in the borehole. The maximum concentration was measured at 34 pCi/g at 38 ft. U-235 was measured at intermittent depths throughout the borehole with a maximum concentration measured at 3 pCi/g at 42 ft in depth.

Radon inside the casing is evident from 115 to 160 ft in depth where the Bi-214 energy peaks (609 and 1764 keV) used to assay naturally occurring uranium diverge in concentration .

The neutron moisture log primarily responds to moisture present in the surrounding formation. In general, an increase in count rate reflects an increase in moisture content. Moisture content may increase in sediments of relatively high silt or clay content. The depth interval from ground surface to 12 ft was logged within two casings.

The manmade, KUT, and moisture repeat plots indicate that the respective systems were working properly. The manmade repeat suggests some variation. The repeat data acquired at 500 seconds rather than 200 seconds probably reflect the most accurate concentrations.

List of Log Plots

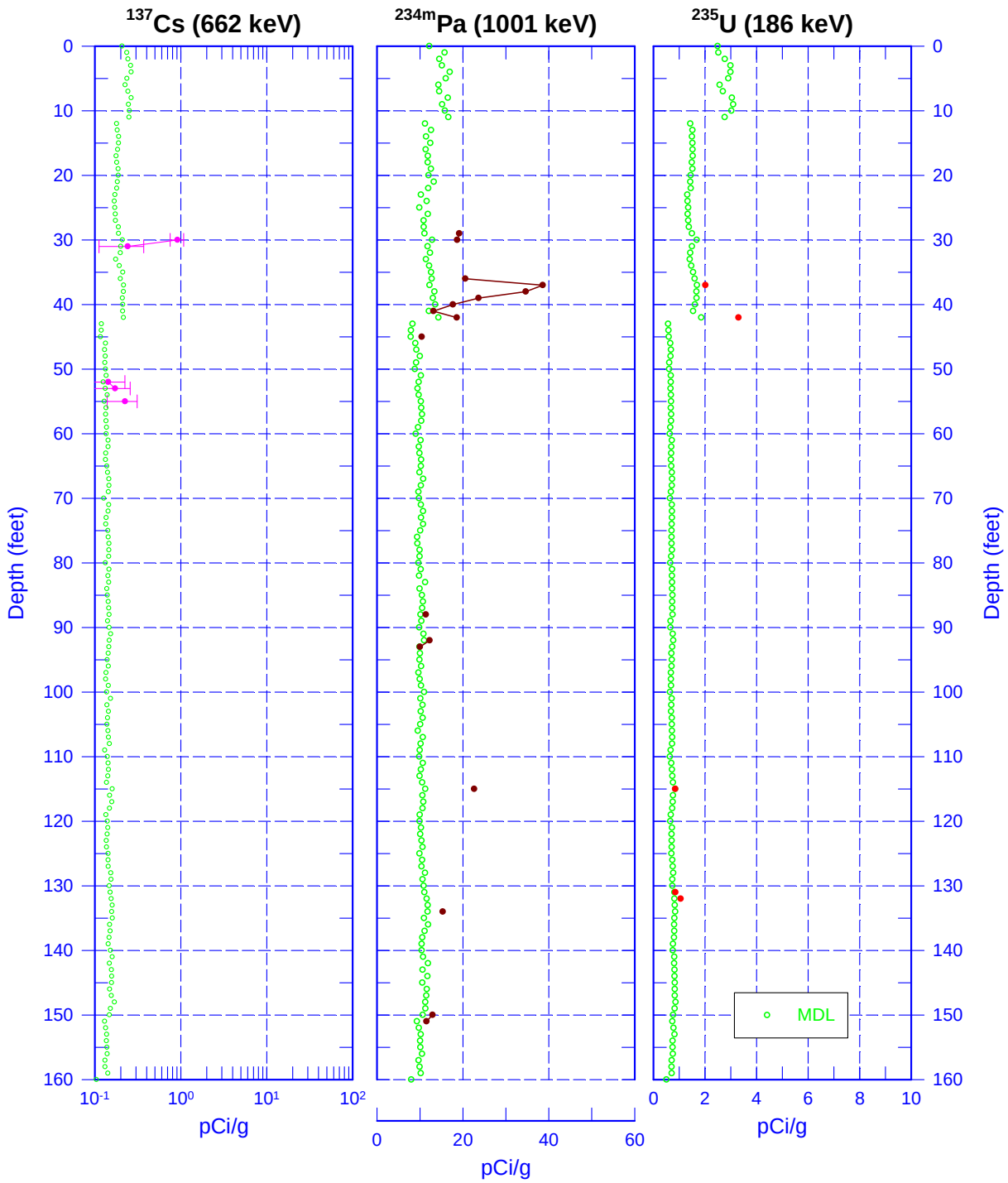
Depth Reference is ground surface.

Manmade Radionuclides (0-160 ft)
Manmade Radionuclides (150-310 ft)
Natural Gamma Logs (0-160 ft)
Natural Gamma Logs (150-310 ft)
Combination Plot (0-120 ft)
Combination Plot (120-240 ft)
Combination Plot (0-250 ft)
Total Gamma & Moisture (0-160 ft)
Total Gamma & Moisture (150-310 ft)
Total Gamma & Hanford Gamma Unit (0-250 ft)
Manmade Radionuclides Repeat (36-43 ft)
Repeat Section of Natural Gamma Logs (37-43 ft)
Repeat Section of Natural Gamma Logs (130-143 ft)
Repeat Section of Natural Gamma Logs (230-238 ft)
Moisture Repeat Section (36-42 ft)
Moisture Repeat Section (130-142 ft)
Moisture Repeat Section (225-233 ft)

[4] Hanford Gamma Unit

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

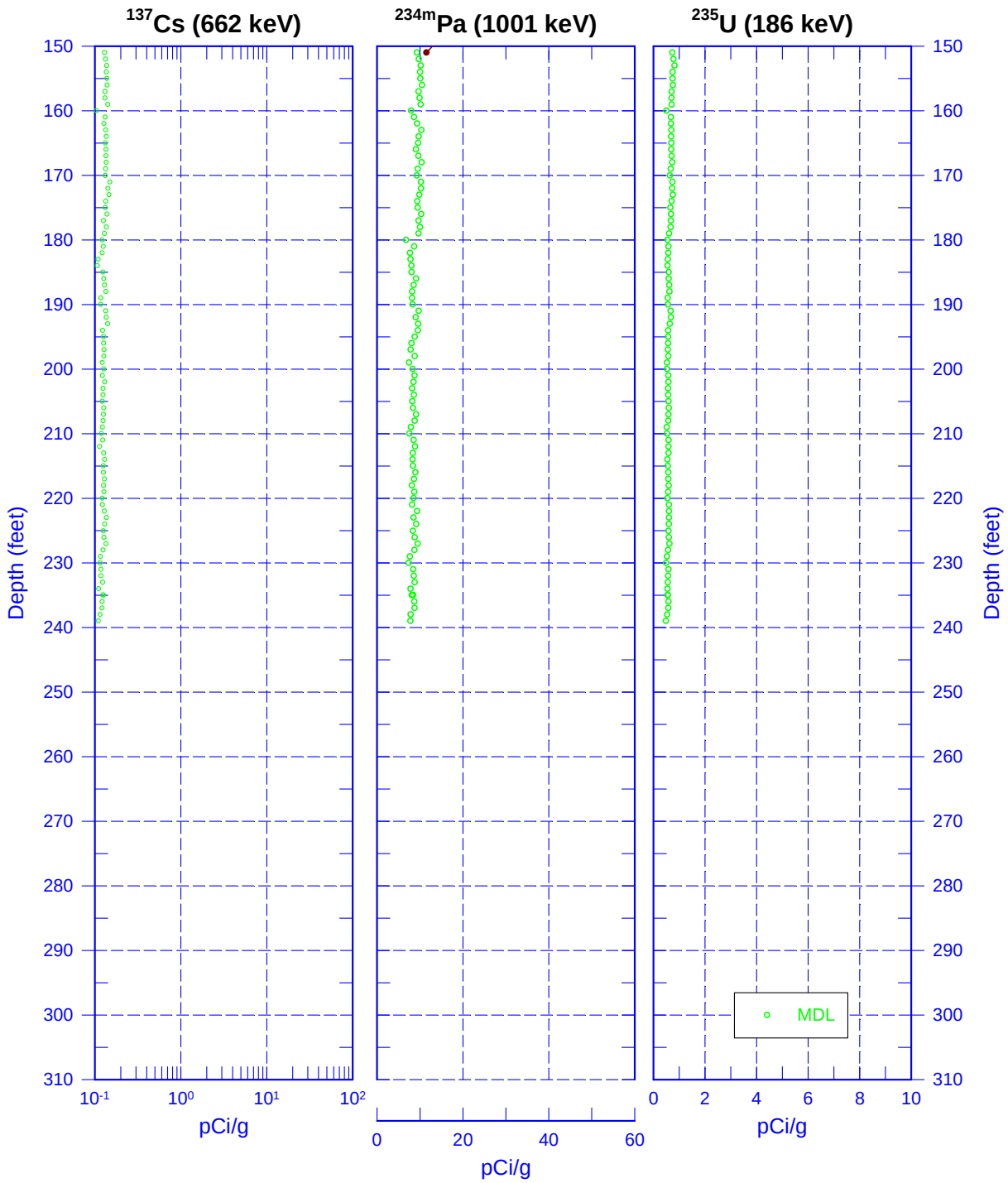
C9513
Manmade Radionuclides



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

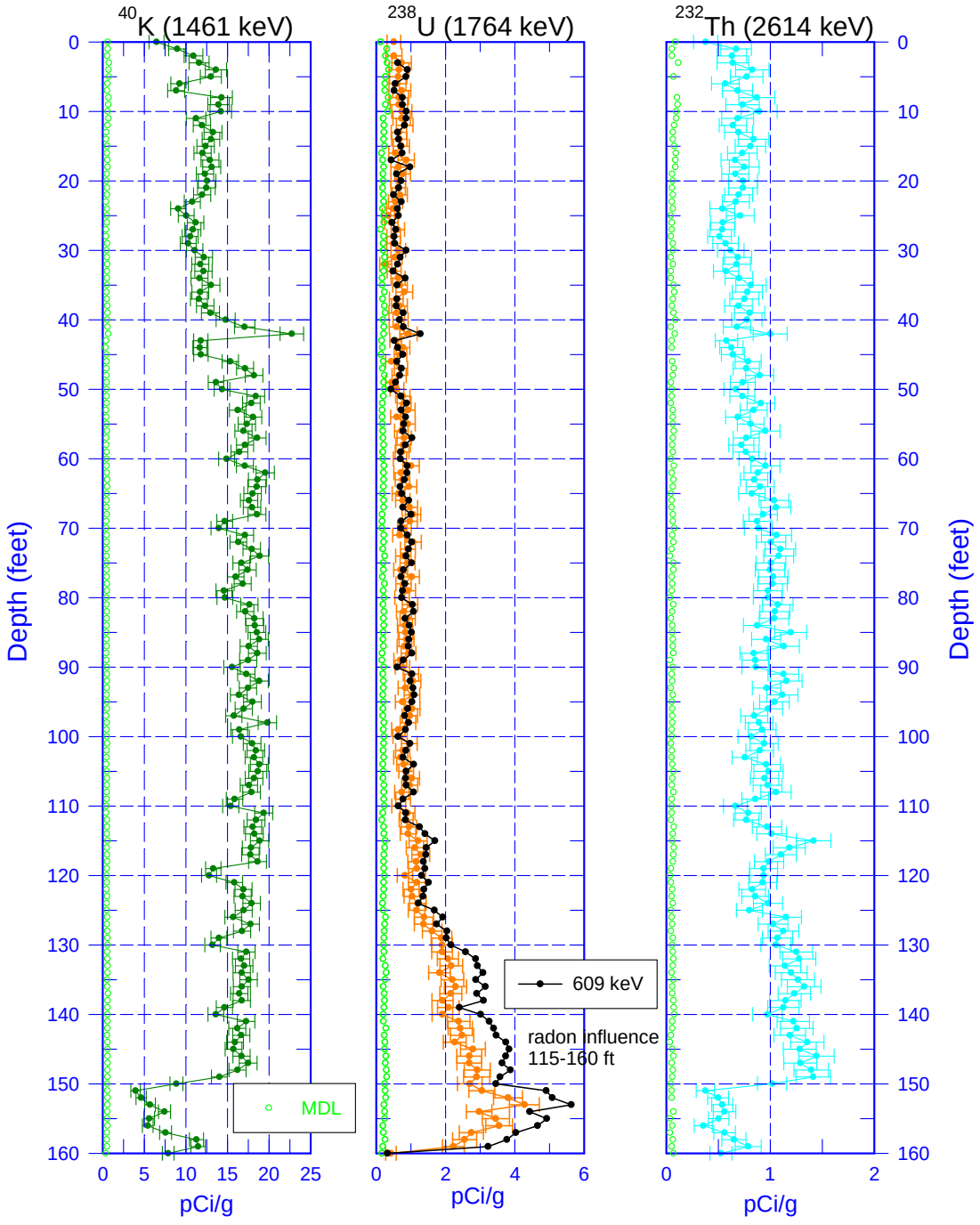
C9513
Manmade Radionuclides



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

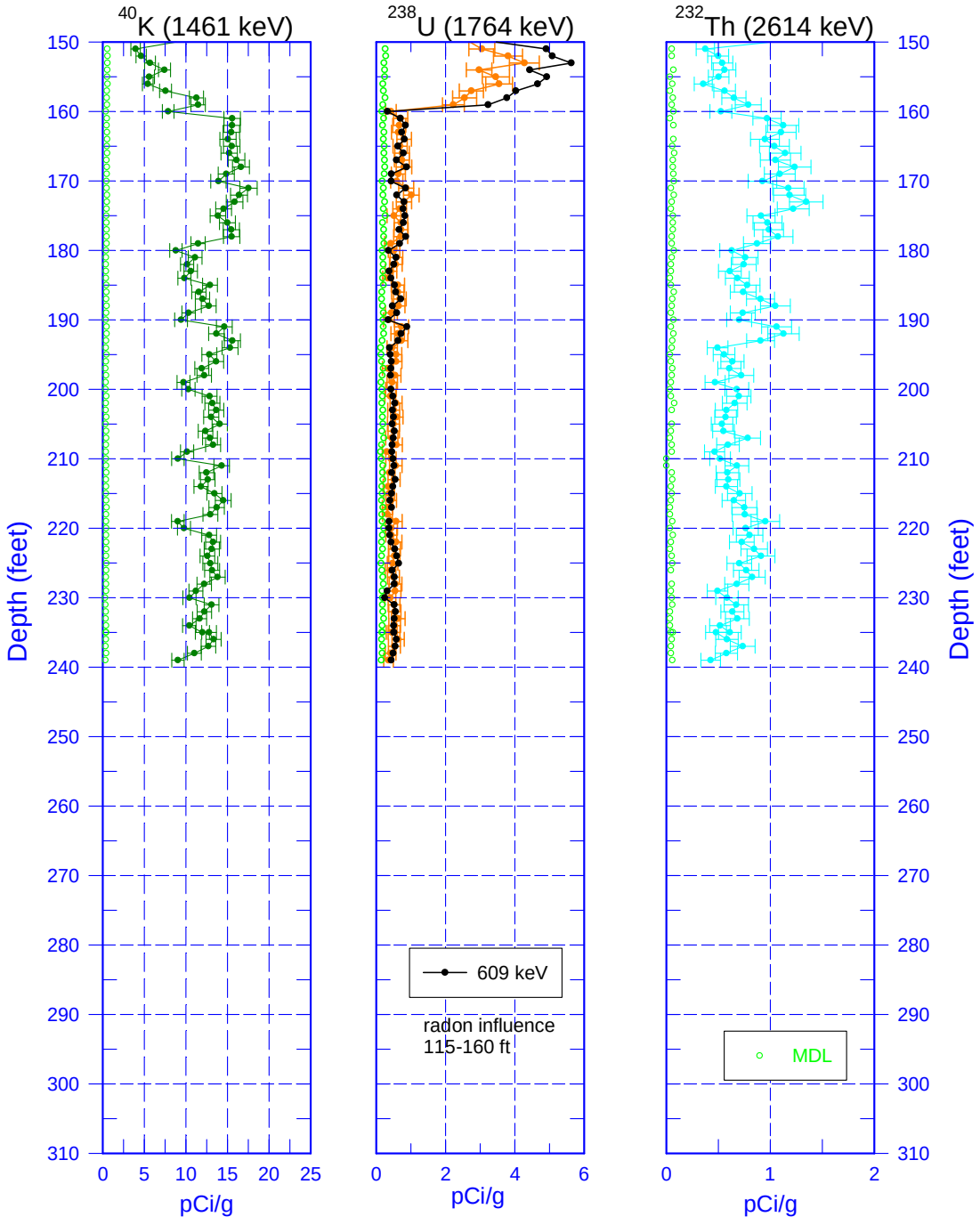
C9513
Natural Gamma Logs



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

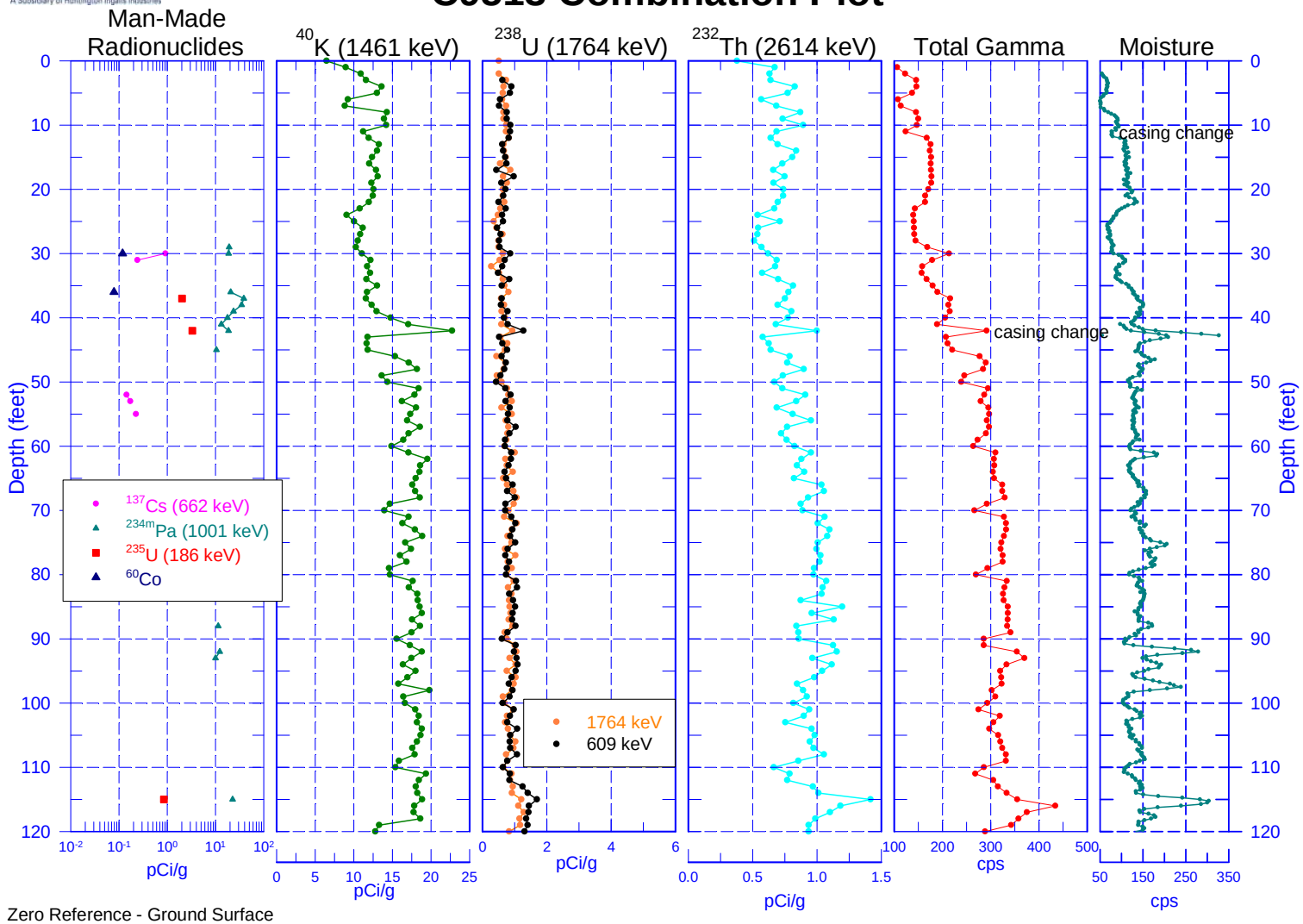
C9513
Natural Gamma Logs



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

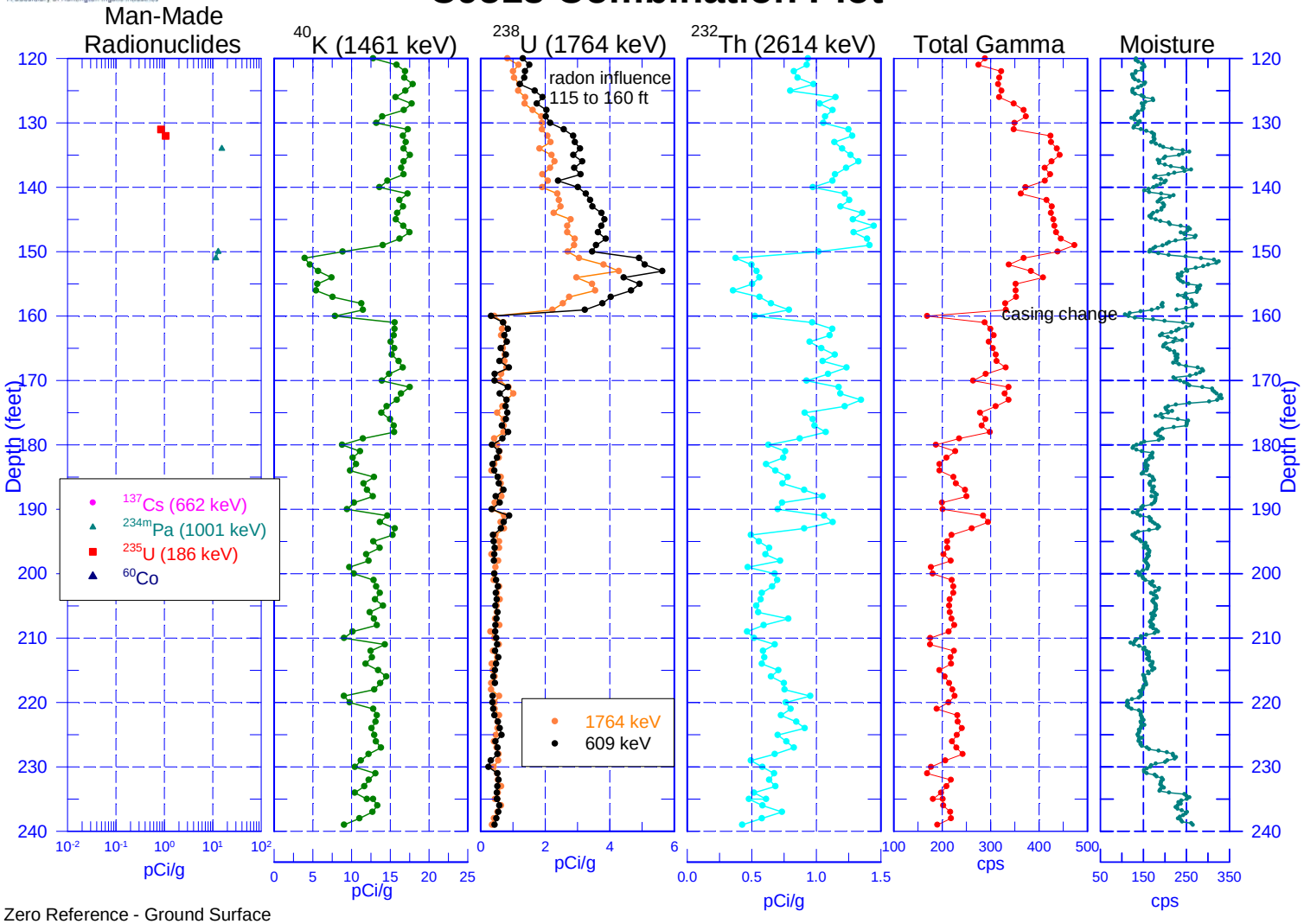
C9513 Combination Plot



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

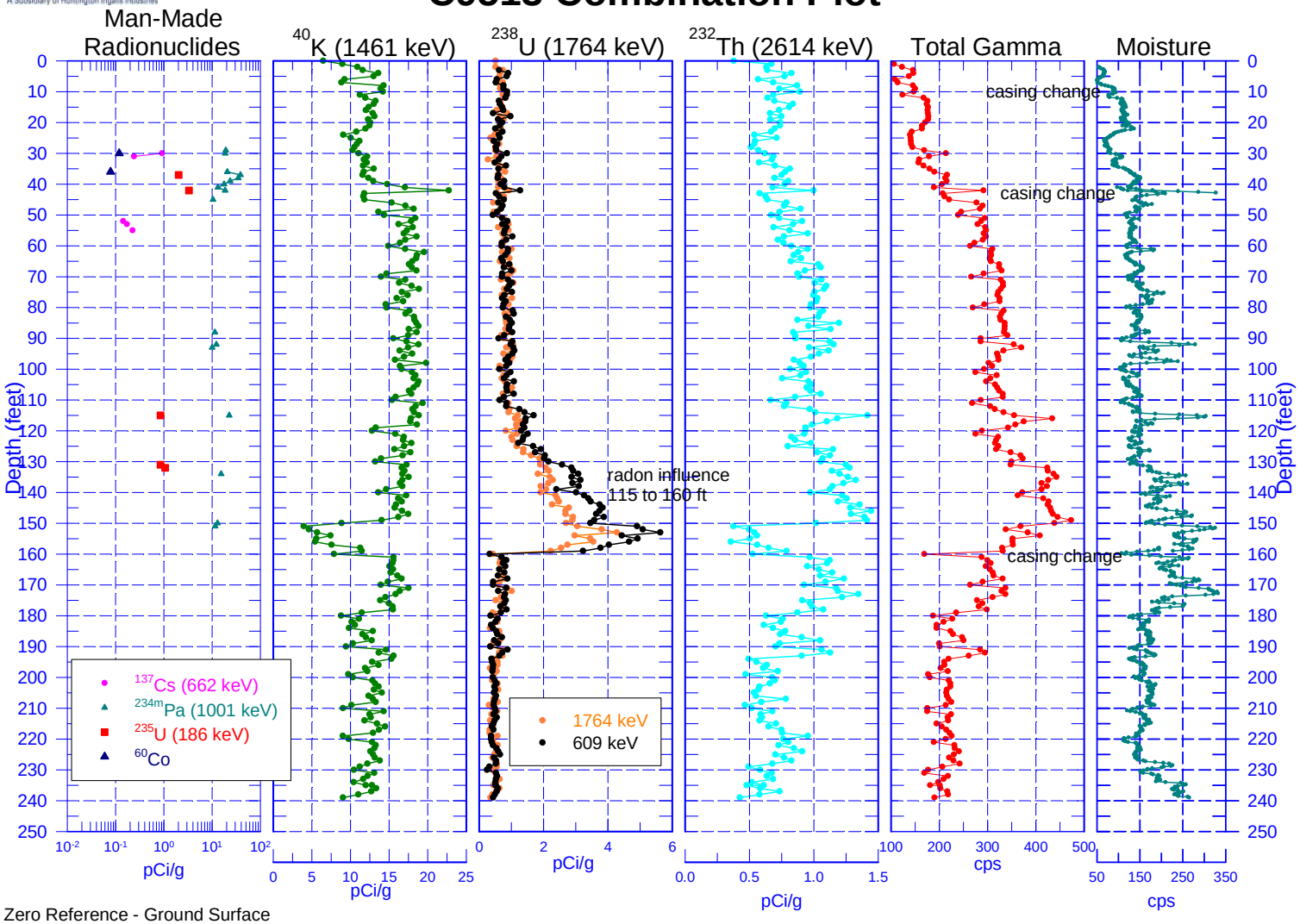
C9513 Combination Plot



Zero Reference - Ground Surface

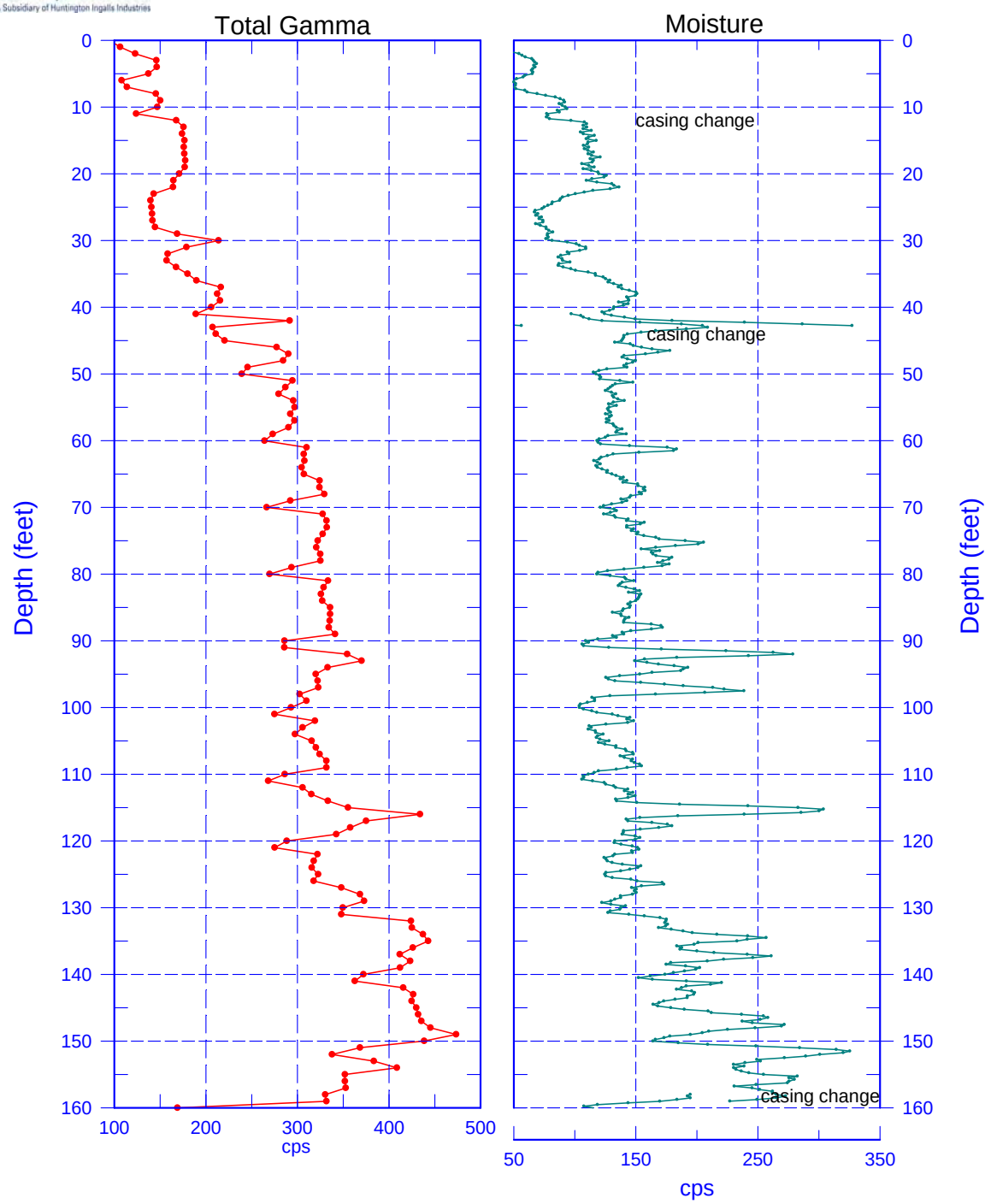
Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

C9513 Combination Plot



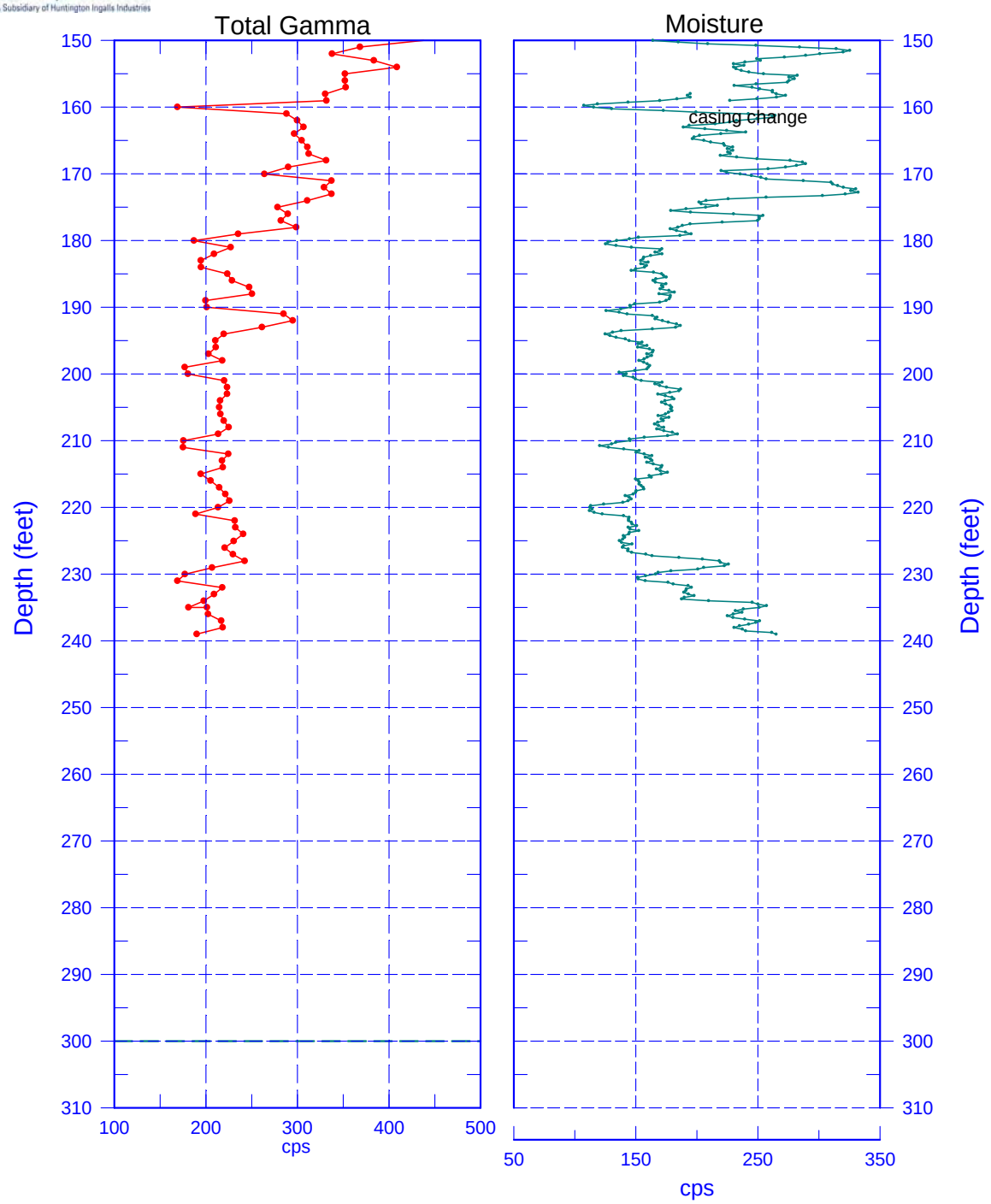
Zero Reference - Ground Surface

C9513
Total Gamma & Moisture



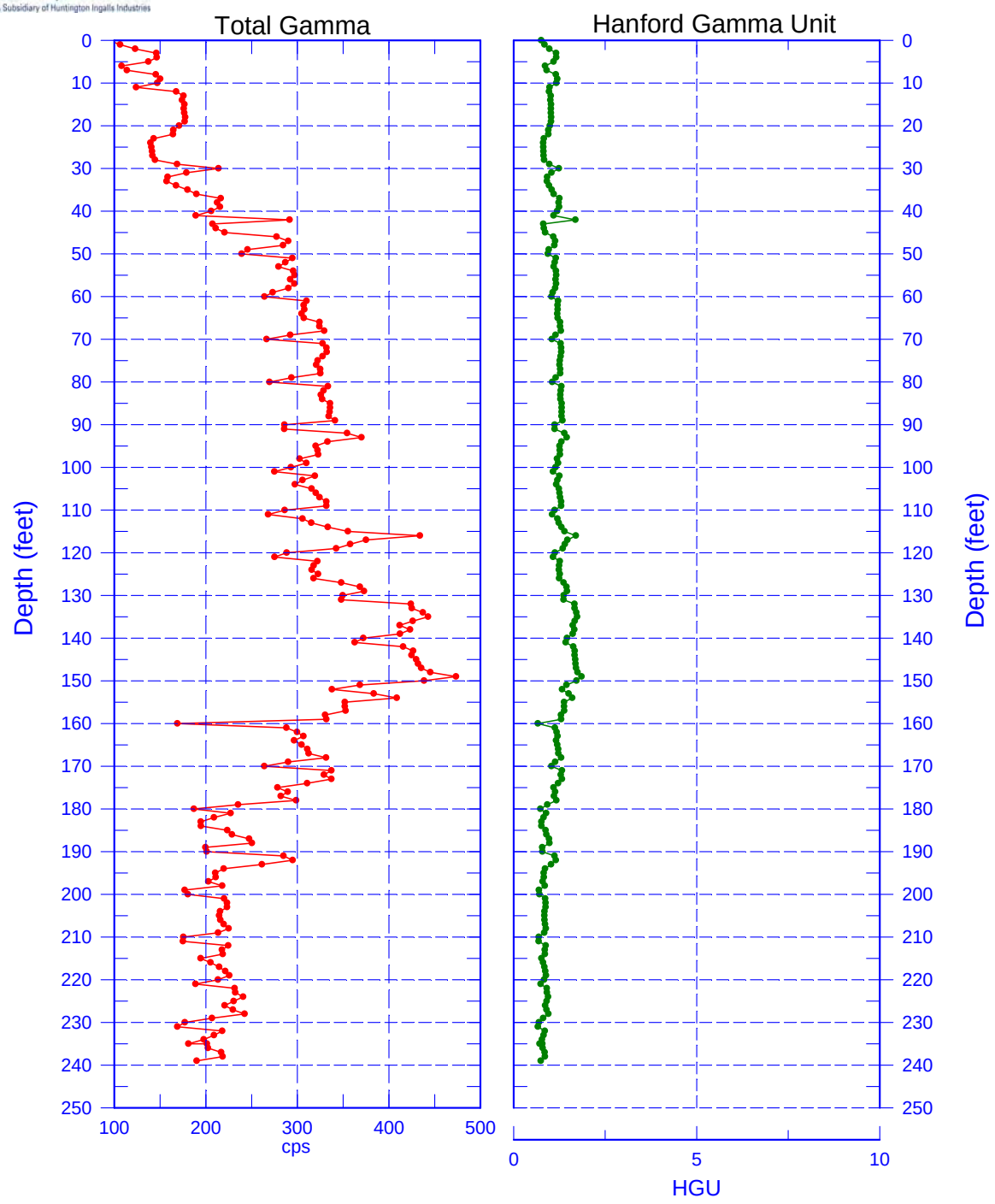
Zero Reference - Ground Surface

C9513
Total Gamma & Moisture



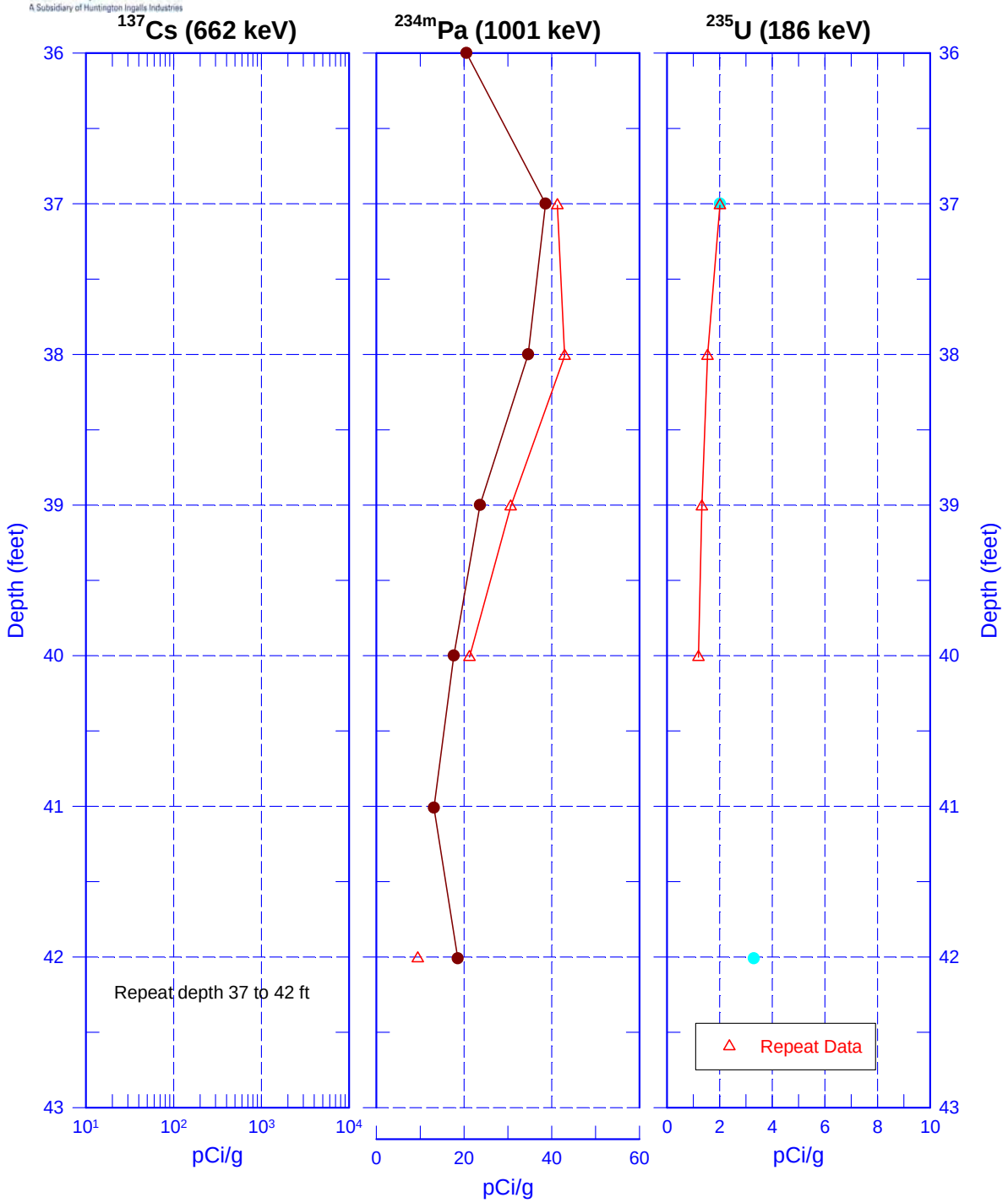
Zero Reference - Ground Surface

C9513
Total Gamma & Hanford Gamma Unit



Zero Reference - Ground Surface

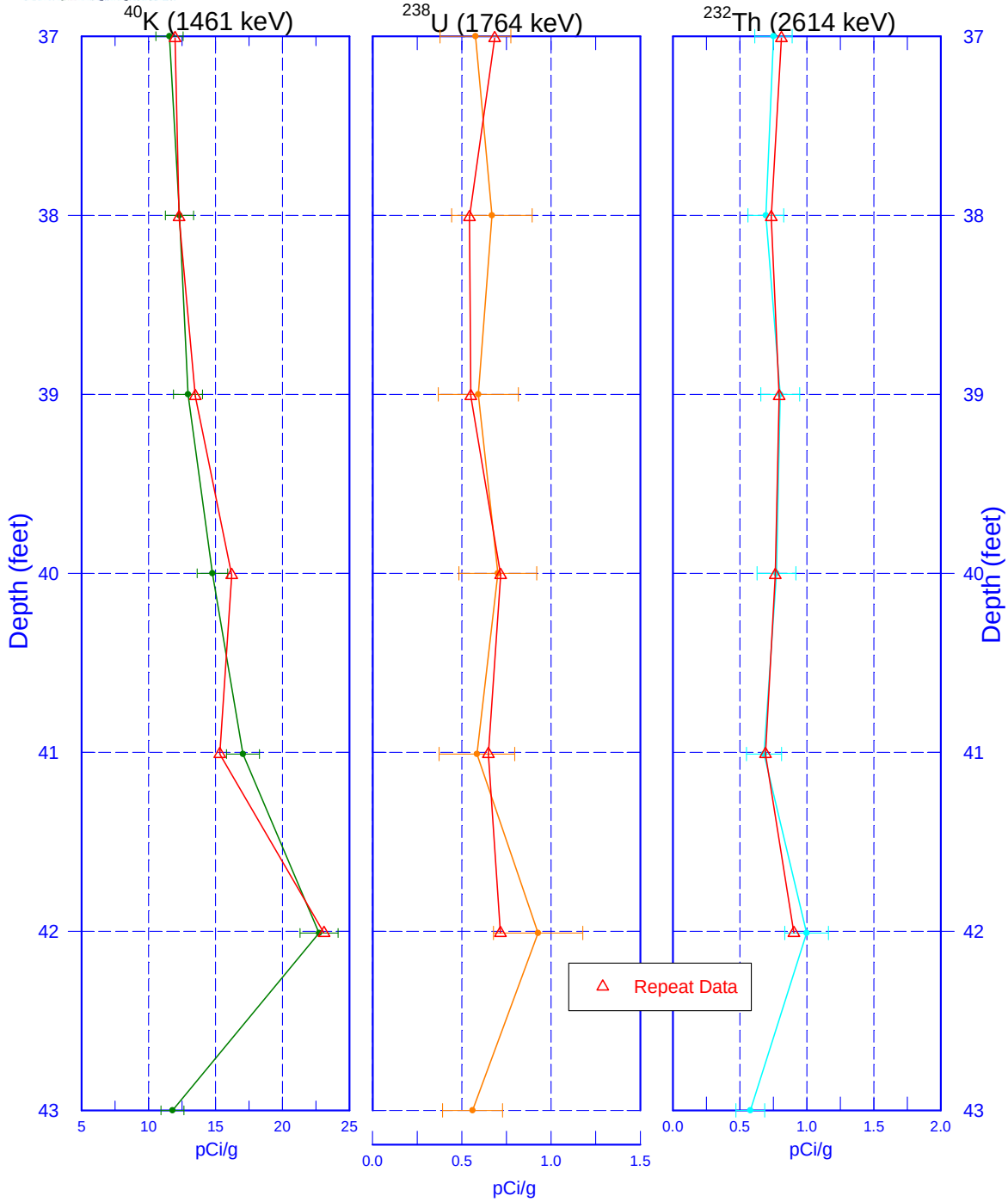
C9513
Manmade Radionuclides Repeat



Zero Reference - Ground Surface

C9513

Repeat Section of Natural Gamma Logs

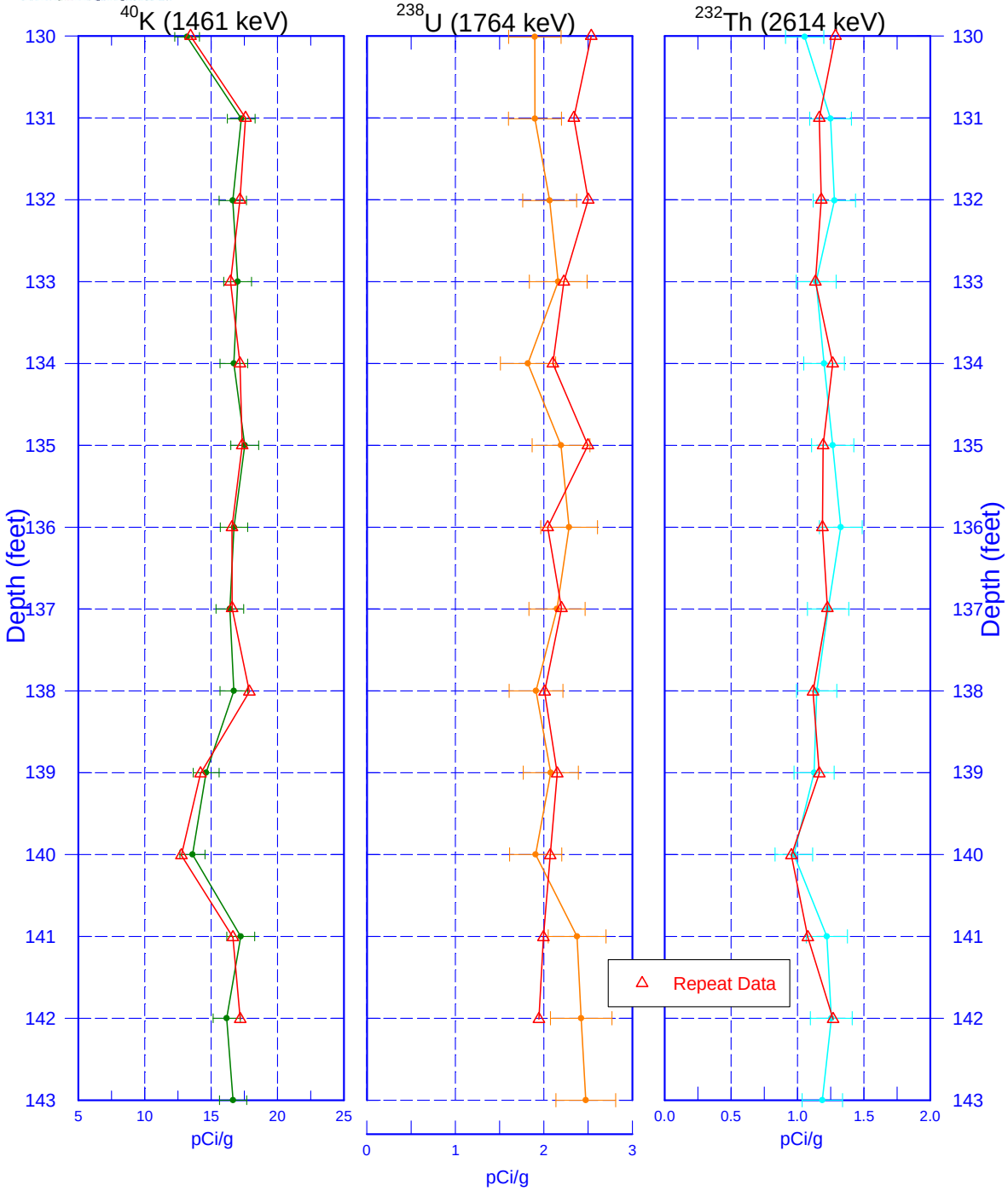


Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

C9513

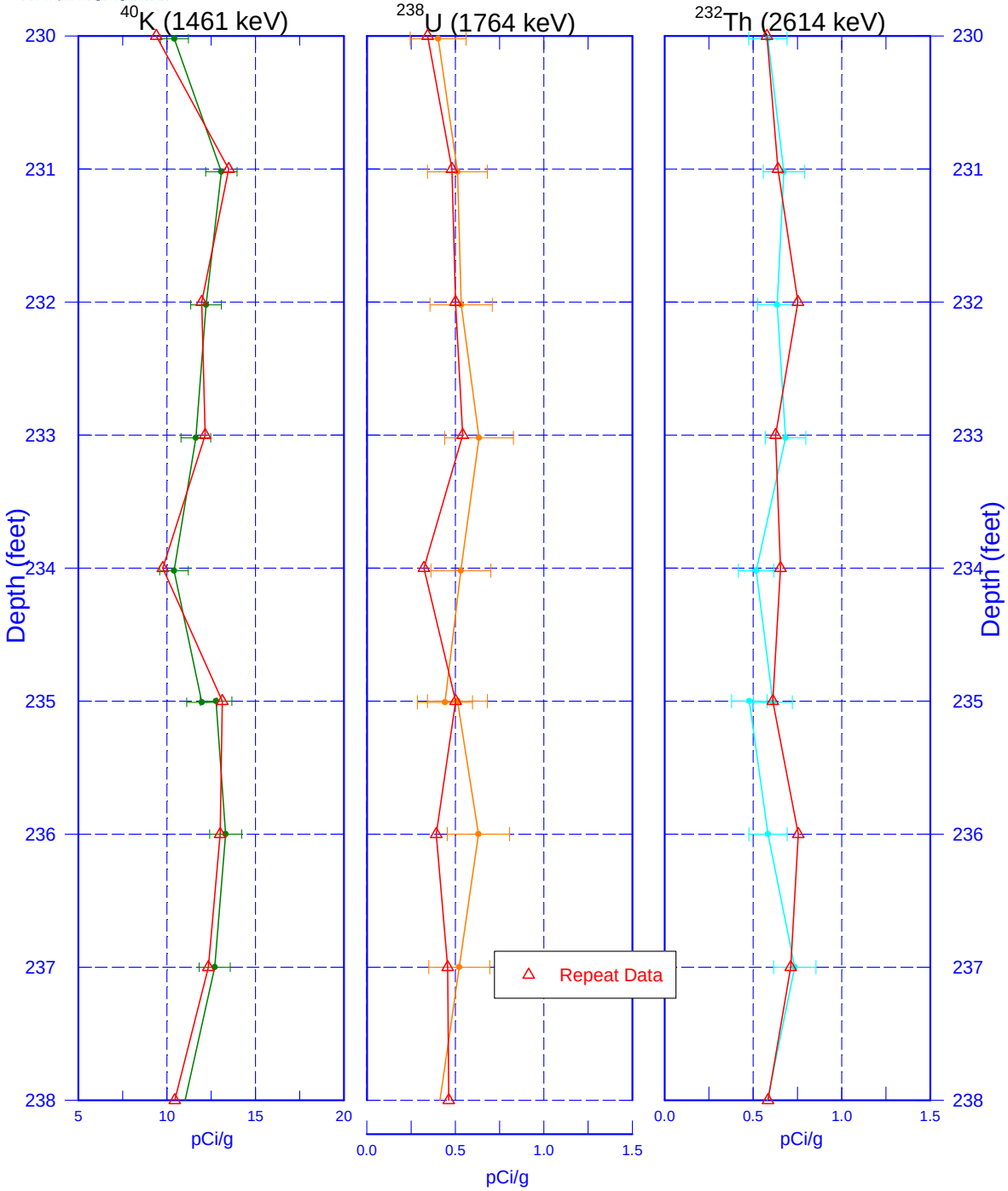
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

C9513

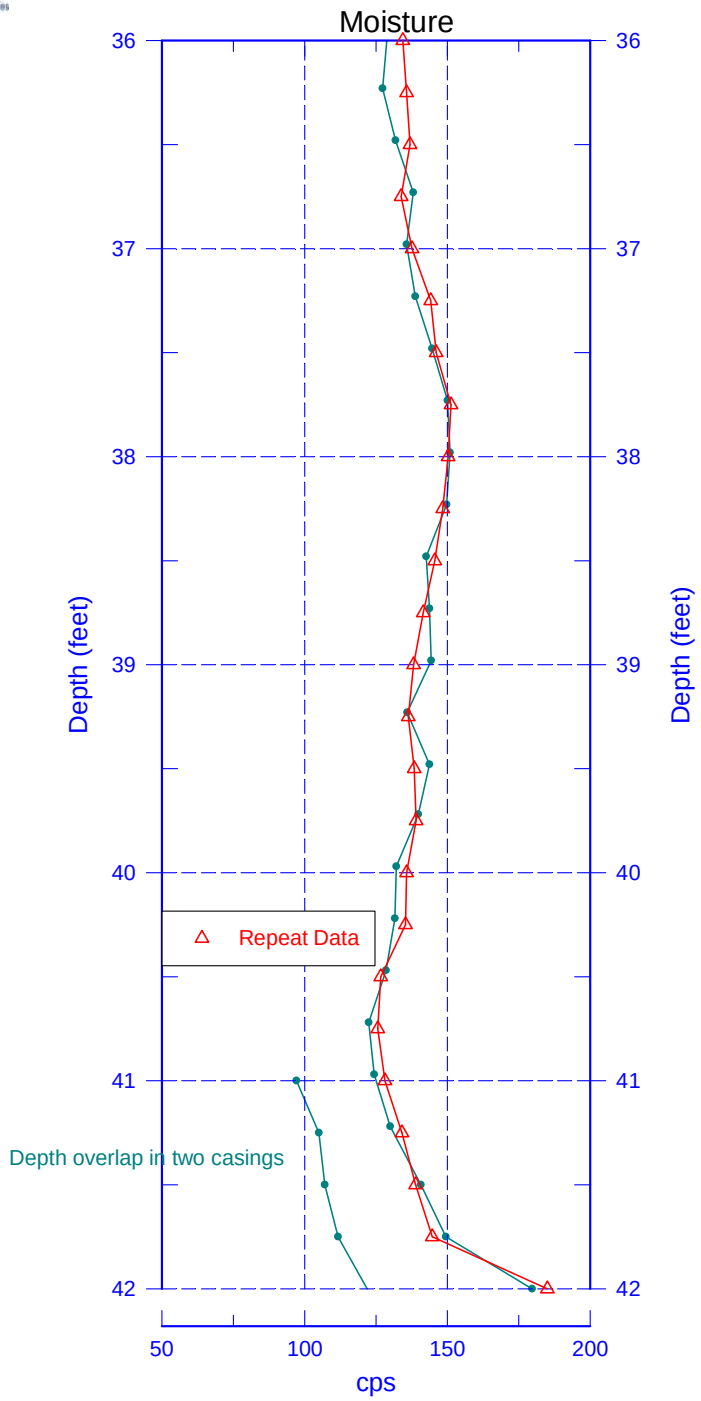
Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

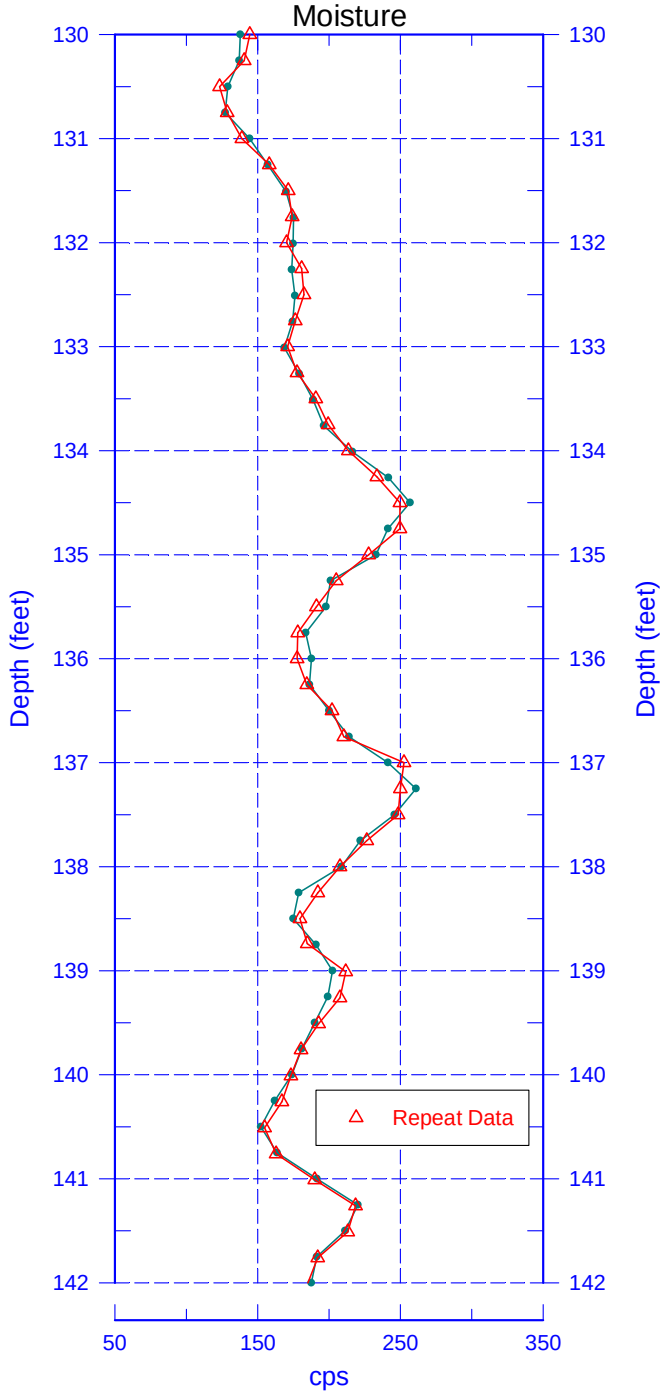
C9513
Moisture Repeat Section



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

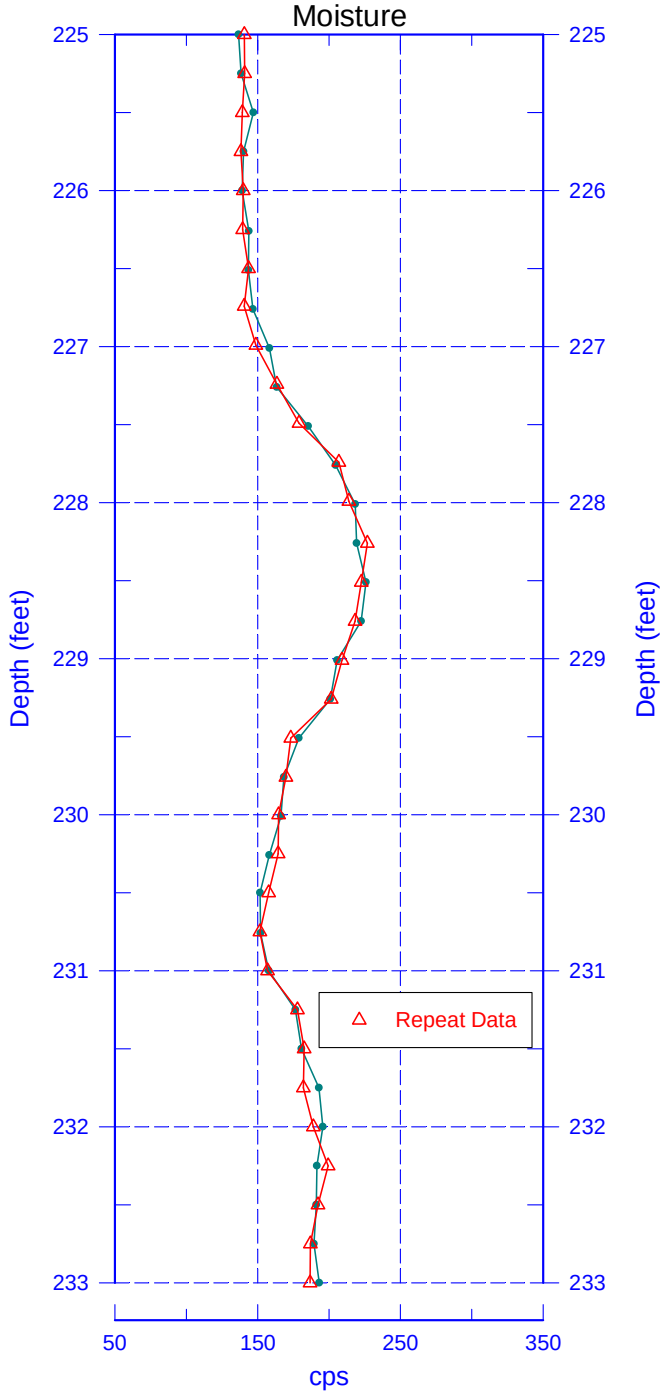
C9513
Moisture Repeat Section



Zero Reference - Ground Surface

Stoller Newport News Nuclear
A Subsidiary of Huntington Ingalls Industries

C9513
Moisture Repeat Section



Zero Reference - Ground Surface

Huntington Ingalls Industries

Technical Solutions

C9555
Log Data Report

Borehole Information

Log Date	2017-10-10	Filename	C9555_HG-NM_2017-10-10	Site	200-DV-1 (T-3 reverse well)
DTW[1] (ft)	**DTW Date**	**DTW Source**	**Drill Date**	**Total Depth (ft)**	**Depth Datum**
None	10/09/17	HII	10/09/17	250.8	Ground Surface

Casing Information

Casing Type	Drill Type	Stickup (ft)	Diameter (in.) Outer	Diameter (in.) Inside	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	Becker	0.4	8 5/8	7 1/2	9/16	-0.4	30
Threaded Steel	Terra Sonic	0.4	7.05	6.22-6.55	0.25-0.42	-0.4	160.2
Threaded Steel	Terra Sonic	0.4	6.0	5.5	0.25-0.5	-0.4	250.2

Borehole Notes

C9555 was drilled as a replacement for C9498.

The onsite geologist provided the total depth and casing depth. The logging engineer measured casing stick-up and casing diameter for the Becker casing. The Terra Sonic casing diameter information is provided by the vendor. Maximum logging depth achieved was 249 ft. Zero reference is ground surface.

Logging Equipment Information

Logging System	Gamma 5Tb	**Type**	60% Coaxial HPGe (SGLS[2])
Effective Calibration Date	02/16/2017	**Serial No.**	54-TP134441B
Calibration Reference	HGLP-CC-152, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53023, Rev. 0

Logging System	Gamma 1Hd	**Type**	He-3 (CPN 503DR) NMLS[3]
Effective Calibration Date	02/23/2017	**Serial No.**	H310700352
Calibration Reference	HGLP-CC-151, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53024, Rev. 0

Logging System	Gamma 5Pb	**Type**	He-3 (CPN 503DR) NMLS
Effective Calibration Date	02/27/2017	**Serial No.**	H34055445
Calibration Reference	HGLP-CC-153, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53024, Rev. 0

Logging System	Gamma 5Pb (NMLS without source)	**Type**	He-3 (CPN 503DR) PNLS[4]
Effective Calibration Date	02/27/2017	**Serial No.**	H34055445
Calibration Reference	HGLP-CC-153, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-54002, Rev. 0

[1] depth to water inside casing
[2] Spectral Gamma Logging System
[3] Neutron Moisture Logging System
[4] Passive Neutron Logging System

Huntington Ingalls Industries

Technical Solutions

C9555
Log Data Report

Borehole Information

Log Date	2017-10-10	Filename	C9555_HG-NM_2017-10-10	Site	200-DV-1 (T-3 reverse well)
DTW[1] (ft)	DTW Date	DTW Source	Drill Date	Total Depth (ft)	Depth Datum
None	10/09/17	HII	10/09/17	250.8	Ground Surface

Casing Information

Casing Type	Drill Type	Stickup (ft)	Diameter (in.) Outer	Diameter (in.) Inside	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	Becker	0.4	8 5/8	7 1/2	9/16	-0.4	30
Threaded Steel	Terra Sonic	0.4	7.05	6.22-6.55	0.25-0.42	-0.4	160.2
Threaded Steel	Terra Sonic	0.4	6.0	5.5	0.25-0.5	-0.4	250.2

Borehole Notes

C9555 was drilled as a replacement for C9498.

The onsite geologist provided the total depth and casing depth. The logging engineer measured casing stick-up and casing diameter for the Becker casing. The Terra Sonic casing diameter information is provided by the vendor. Maximum logging depth achieved was 249 ft. Zero reference is ground surface.

Logging Equipment Information

Logging System	Gamma 5Tb	**Type**	60% Coaxial HPGe (SGLS[2])
Effective Calibration Date	02/16/2017	**Serial No.**	54-TP134441B
Calibration Reference	HGLP-CC-152, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53023, Rev. 0

Logging System	Gamma 1Hd	**Type**	He-3 (CPN 503DR) NMLS[3]
Effective Calibration Date	02/23/2017	**Serial No.**	H310700352
Calibration Reference	HGLP-CC-151, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53024, Rev. 0

Logging System	Gamma 5Pb	**Type**	He-3 (CPN 503DR) NMLS
Effective Calibration Date	02/27/2017	**Serial No.**	H34055445
Calibration Reference	HGLP-CC-153, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-53024, Rev. 0

Logging System	Gamma 5Pb (NMLS without source)	**Type**	He-3 (CPN 503DR) PNLS[4]
Effective Calibration Date	02/27/2017	**Serial No.**	H34055445
Calibration Reference	HGLP-CC-153, Rev. 0	**Logging Procedure**	SGRP-PRO-OP-54002, Rev. 0

[1] depth to water inside casing
[2] Spectral Gamma Logging System
[3] Neutron Moisture Logging System
[4] Passive Neutron Logging System

SGLS Log Run Information

Log Run	1	2 Repeat	5	6 Repeat	15
HEIS Number	1020100	1020101	1020102	1020103	1020104
Date	06/19/17	06/19/17	09/21/17	09/21/17	10/10/17
Logging Engineer	McClellan/Spatz	Spatz	Meisner/Felt	Meisner	McClellan/Spatz
Start Depth (ft)	0.0	24.0	28.0	92.0	156.0
Finish Depth (ft)	29.0	28.99	157.01	104.0	249.01
Count Time (sec)	200	200	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
Log Speed (ft/min)	NA	NA	NA	NA	NA
Pre-Verification	C9555FTB20170 619AV00CAB1	C9555FTB20170 619AV00CAB1	C9555FTB20170 921AV00CAB1	C9555FTB20170 921AV00CAB1	C9555FTB20171 010AV00CAB1
Start File	AD000000	BD002400	AD002800	BD009200	AD015600
Finish File	AD002900	BD002899	AD015701	BD010400	AD024901
Post-Verification	BV00CAA1	BV00CAA1	BV00CAA1	BV00CAA1	BV00CAA1
Depth Return Error (in.)	N/A	N/A	N/A	1.5 low	N/A
Comments	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made	No fine gain adjustments made

SGLS Log Run Information

Log Run	16 Repeat				
HEIS Number	1020105				
Date	10/10/17				
Logging Engineer	Spatz				
Start Depth (ft)	175.0				
Finish Depth (ft)	185.0				
Count Time (sec)	200				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
Log Speed (ft/min)	NA				
Pre-Verification	C9555FTB20171 010AV00CAB1				
Start File	BD017500				
Finish File	BD018500				
Post-Verification	BV00CAA1				
Depth Return Error (in.)	3.5 high				
Comments	No fine gain adjustments made				

NMLS Log Run Information

Log Run	3	4 Repeat	7	8 Repeat	9
HEIS Number	1020106	1020107	1020108	1020109	1020110
Date	06/19/17	06/19/17	09/22/17	09/22/17	10/09/17
Logging Engineer	Spatz	Spatz	Felt	Felt	Spatz/Felt
Start Depth (ft)	0.0	24.0	28.0	130.0	156.0
Finish Depth (ft)	29.49	28.0	157.02	143.0	250.27
Count Time (sec)	15	15	15	15	15
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	0.25	0.25	0.25	0.25	0.25
Log Speed (ft/min)	NA	NA	NA	NA	NA
Pre-Verification	C9555AHD2017 0619AV00CAB1	C9555AHD2017 0619AV00CAB1	C9555FPB20170 922AV00CAB1	C9555FPB20170 922AV00CAB1	C9555FPB20171 009AV00CAB1
Start File	AD000000	BD002400	AD002800	BD013000	AD015600
Finish File	AD002949	BD002800	AD015702	BD014300	AD025027
Post-Verification	BV00CAA1	BV00CAA1	BV00CAA1	BV00CAA1	BV00CAA1
Depth Return Error (in.)	N/A	1.0 high	N/A	1.0 high	N/A
Comments	None	None	None	None	None

NMLS Log Run Information

Log Run	10 Repeat				
HEIS Number	1020111				
Date	10/09/17				
Logging Engineer	Felt				
Start Depth (ft)	210.0				
Finish Depth (ft)	219.0				
Count Time (sec)	15				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	0.25				
Log Speed (ft/min)	NA				
Pre-Verification	C9555FPB20171 009AV00CAB1				
Start File	BD021000				
Finish File	BD021900				
Post-Verification	BV00CAA1				
Depth Return Error (in.)	2.0 high				
Comments	None				

PNLS Log Run Information

Log Run	11	12 Repeat	13	14 Repeat	
HEIS Number	1020112	1020113	1020114	1020115	
Date	09/22/17	09/22/17	10/09/17	10/09/17	
Logging Engineer	Felt	Felt	Felt	Felt	
Start Depth (ft)	28.0	130.0	156.0	192.0	
Finish Depth (ft)	157.01	143.0	250.02	201.0	
Count Time (sec)	60	60	60	60	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	
Log Speed (ft/min)	NA	NA	NA	NA	
Pre-Verification	C9555FPB20170 922AV00CAB1	C9555FPB20170 922AV00CAB1	C9555FPB20171 009AV00CAB1	C9555FPB20171 009AV00CAB1	
Start File	AD002800	BD013000	AD015600	BD019200	
Finish File	AD015701	BD014300	AD025002	BD020100	
Post-Verification	BV00CAA1	BV00CAA1	BV00CAA1	BV00CAA1	
Depth Return Error (in.)	N/A	2.0 high	N/A	2.0 high	
Comments	None	None	None	None	

Logging Operation Notes

A centralizer was not installed on the sondes. A plastic sleeve was placed over the sondes for the log runs to 157 ft.

Analysis Notes

Analyst	P.D. Henwood	Date	11/02/17
Reference(s)	SGRP-PRO-OP-53040, Rev. 0; SGRP-PRO-OP-53051, Rev. 0		

A casing correction for a 0.5625-in. thick casing was applied to the log data to 30 ft and 0.25-in. for the remainder of the borehole.

A water correction was not applied in this borehole.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations for the SGLS were calculated in an EXCEL template identified as FTB20170216 using an efficiency function and corrections for casing and dead time as determined by annual calibrations.

An interpreted data set was created for this borehole. Depth overlaps from consecutive log runs or where two casings existed were removed from 28 and 29 ft and from 156 and 157 ft. This results in a data set where only one data point is presented for each depth.

NMLS data are reported in counts per second.

HGU[5] is an empirical unit of gamma activity proposed as a means to standardize gamma log response across multiple logging systems with different response characteristics. The HGU is defined in terms of measurements in the Hanford Borehole Calibration Facility, and the magnitude is selected such that 1 HGU is approximately equivalent to typical Hanford background activity, based on data from background samples as reported in *Hanford Site Background: Part 2, Soil Background for Radionuclides* (DOE/RL-96-12).

[5] Hanford Gamma Unit

Results and Interpretations

Cs-137 was the only manmade radionuclide detected in this borehole. It was detected intermittently from 12 to 29 ft, from 90 to 120 ft, and at a few depth locations from 128 to 145 ft. The maximum Cs-137 concentration was measured at 1443 pCi/g at 92 ft. Because this borehole had the potential to encounter Pu-239 and Am-241, MDLs[6] are plotted with the Cs-137 on the Manmade Radionuclides plot. No Pu-239 or Am-241 were detected.

The neutron moisture log primarily responds to moisture present in the surrounding formation. In general, an increase in count rate reflects an increase in moisture content. Moisture content may increase in sediments of relatively high silt or clay content.

PNLS consists of an NMLS sonde deployed without a source and is a qualitative measurement only for the detection of neutrons. No counts were observed that would indicate the potential for neutrons being emitted from transuranic radionuclides.

The manmade, KUT, and moisture repeat plots indicate that the respective systems were working properly.

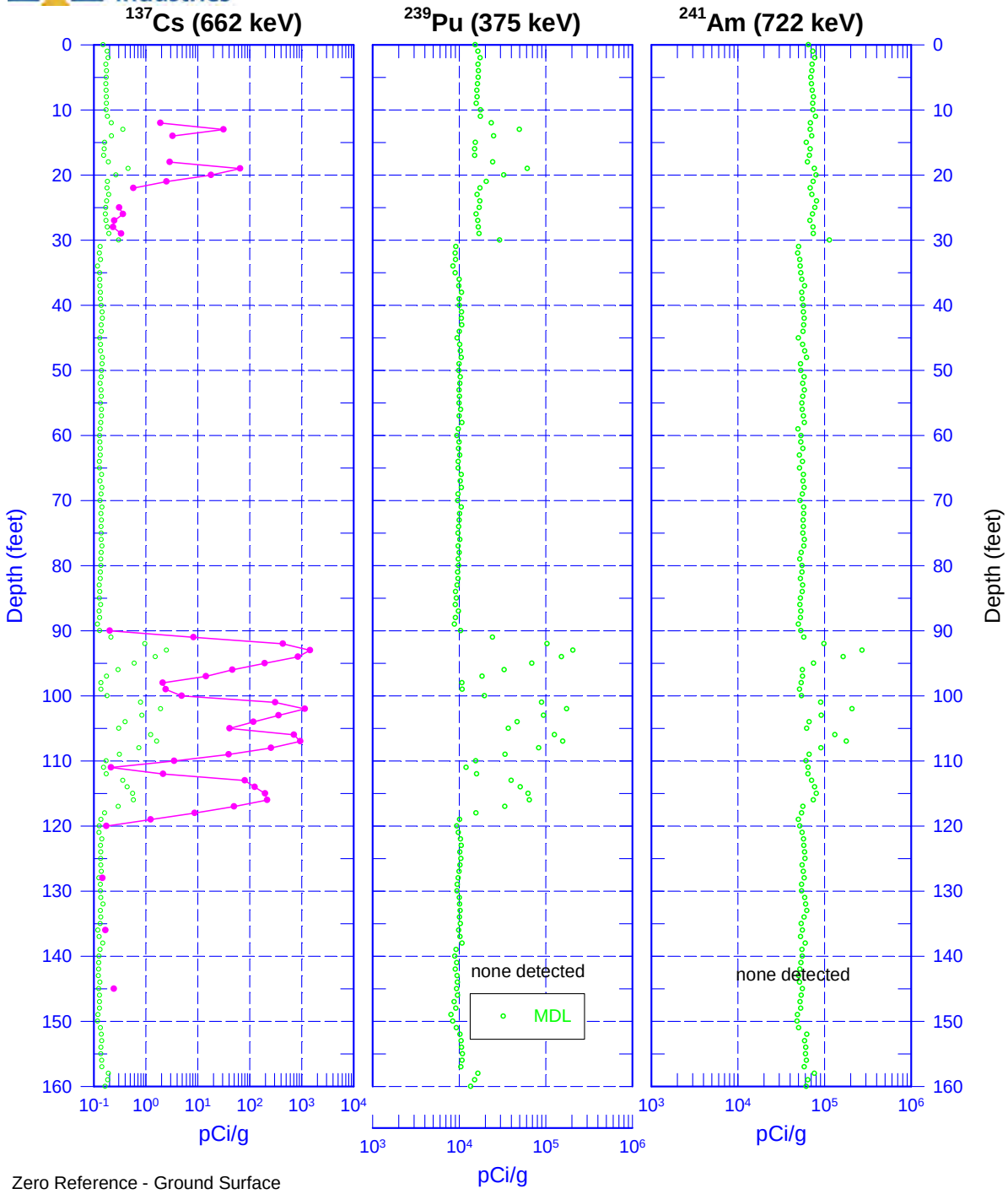
List of Log Plots

Depth Reference is ground surface.

Manmade Radionuclides (0-160 ft)
Manmade Radionuclides (150-310 ft)
Natural Gamma Logs (0-160 ft)
Natural Gamma Logs (150-310 ft)
Combination Plot (0-120 ft)
Combination Plot (110-230 ft)
Combination Plot (220-340 ft)
Combination Plot (0-260 ft)
Total Gamma & Moisture (0-160 ft)
Total Gamma & Moisture (150-310 ft)
Passive Neutron (0-260 ft)
Total Gamma & Hanford Gamma Unit (0-260 ft)
Manmade Radionuclides Repeat Data (24-29 ft)
Manmade Radionuclides Repeat Data (92-104 ft)
Repeat Section of Natural Gamma Logs (24-29 ft)
Repeat Section of Natural Gamma Logs (92-104 ft)
Repeat Section of Natural Gamma Logs (175-185 ft)
Moisture Repeat Section (24-28 ft)
Moisture Repeat Section (130-143 ft)
Moisture Repeat Section (210-219 ft)

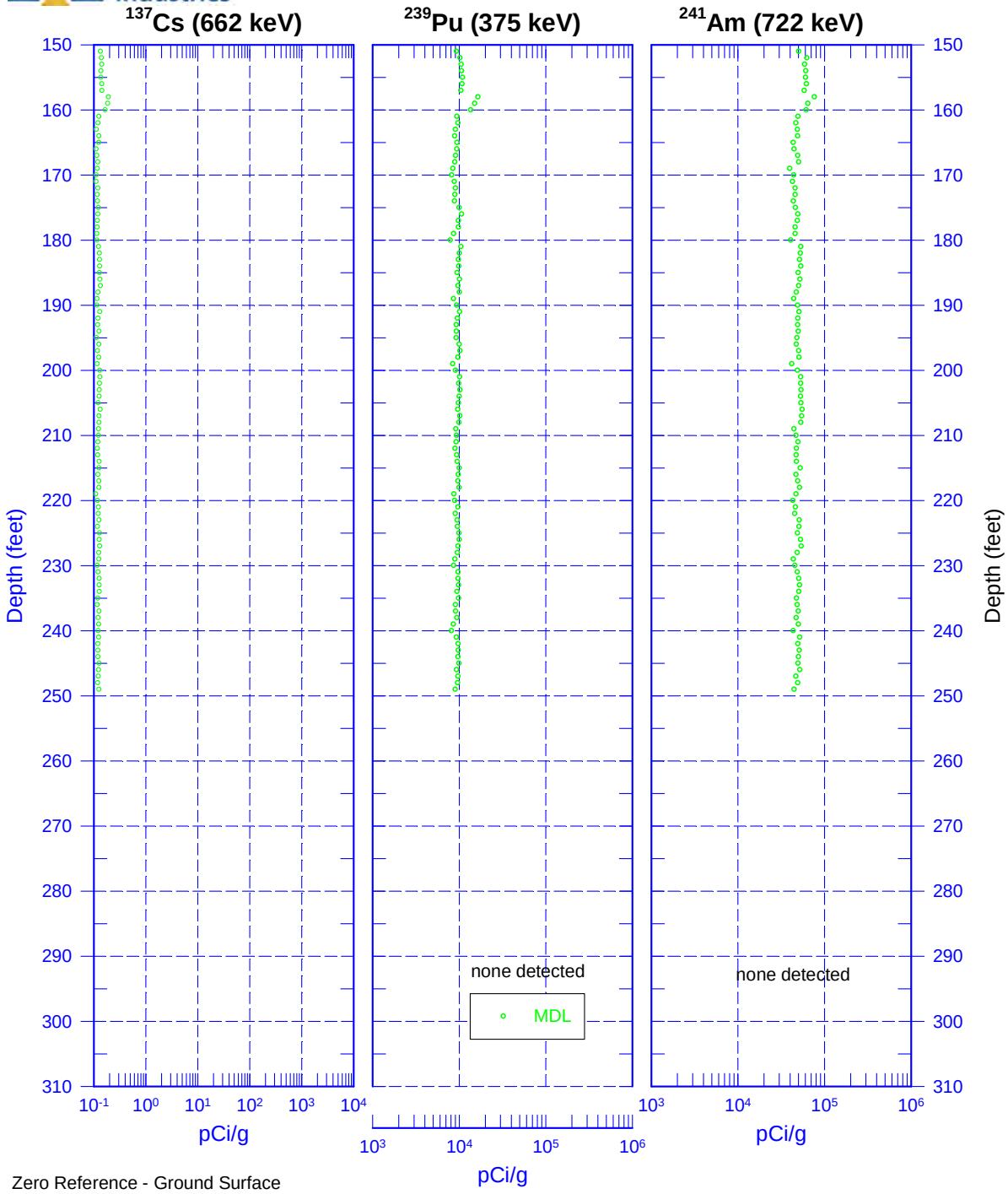
[6] minimum detection limits

C9555
Manmade Radionuclides



Zero Reference - Ground Surface

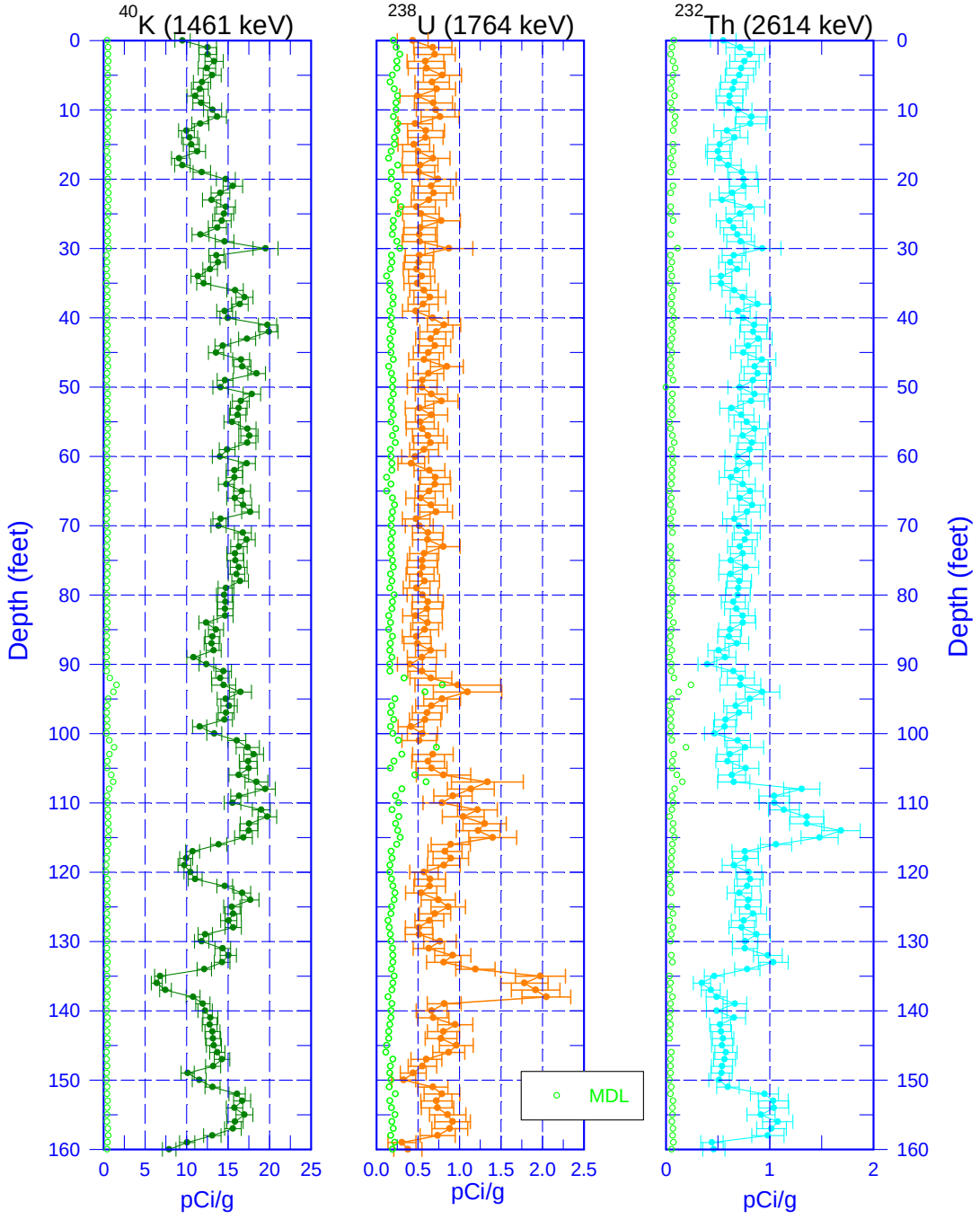
C9555
Manmade Radionuclides



Zero Reference - Ground Surface

Huntington Ingalls Industries

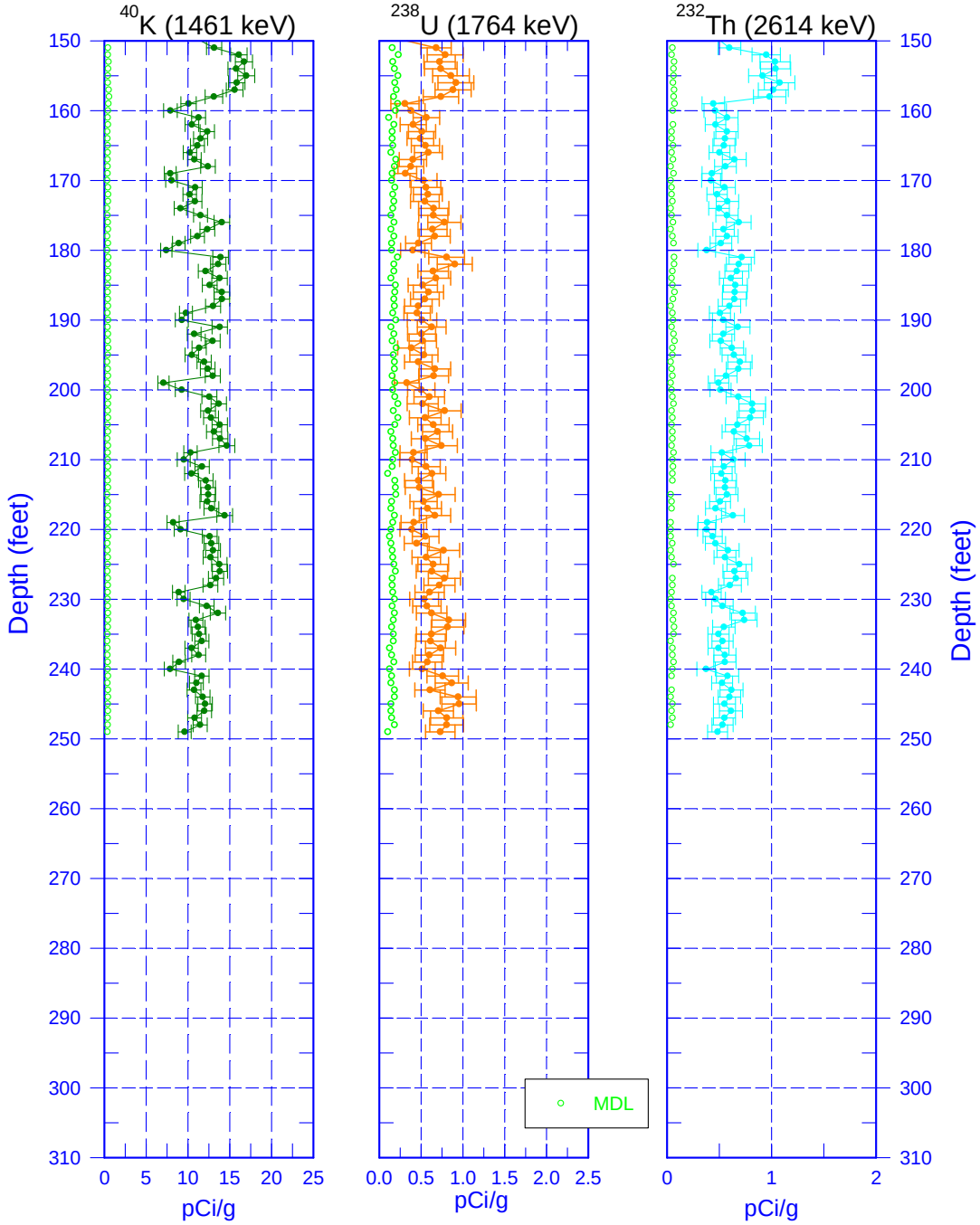
C9555
Natural Gamma Logs



Zero Reference - Ground Surface

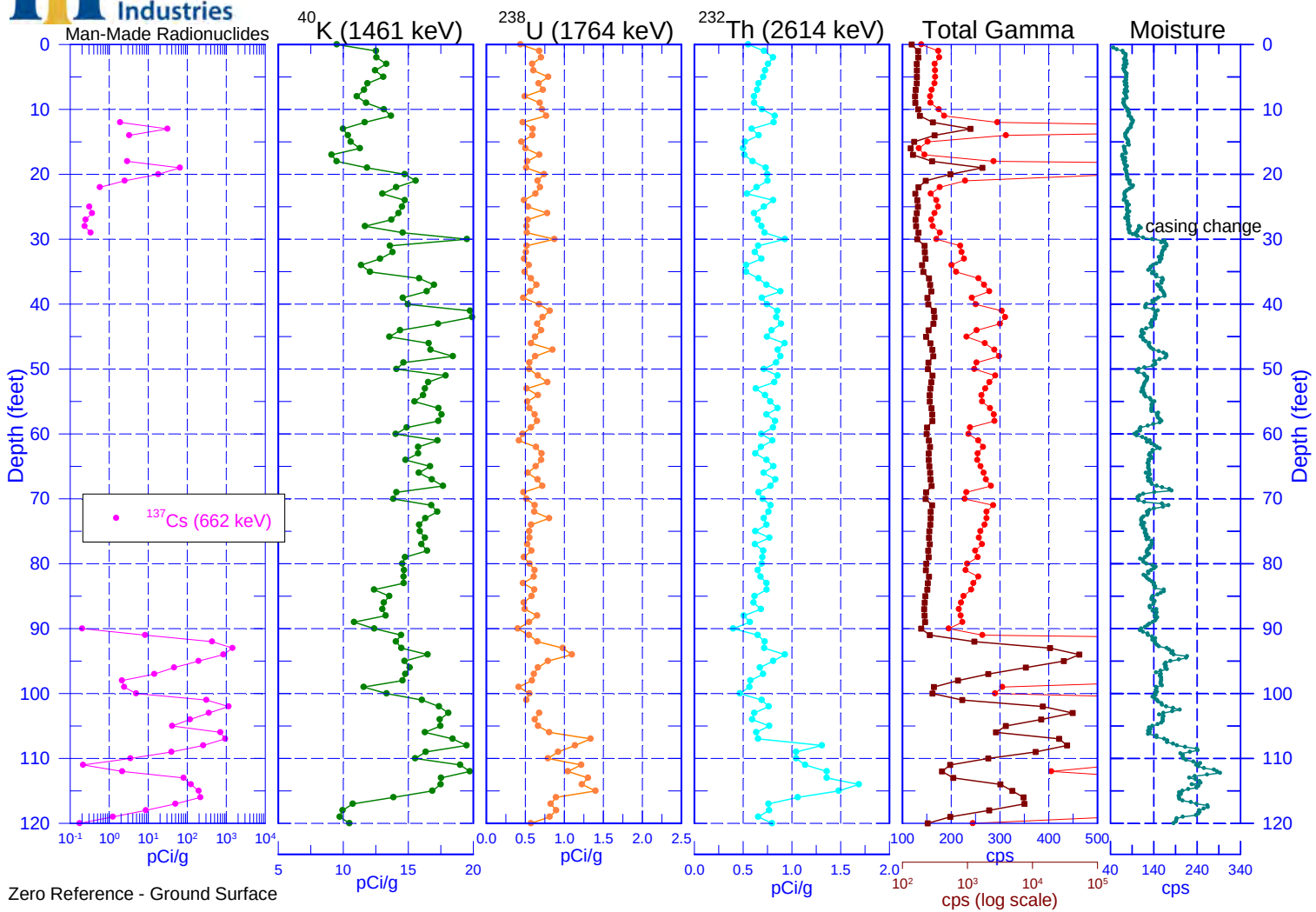
Huntington Ingalls Industries

C9555
Natural Gamma Logs

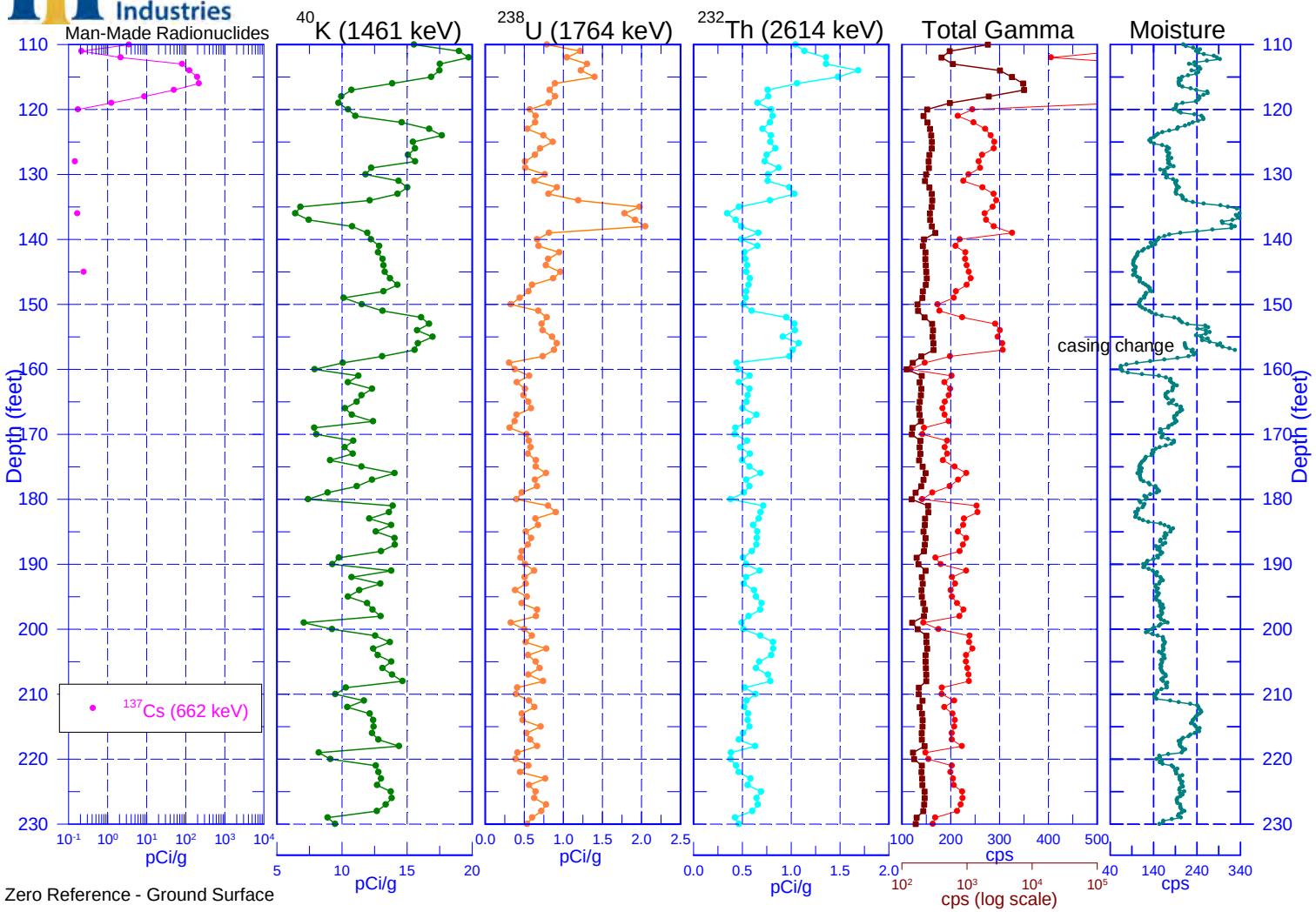


Zero Reference - Ground Surface

C9555 Combination Plot

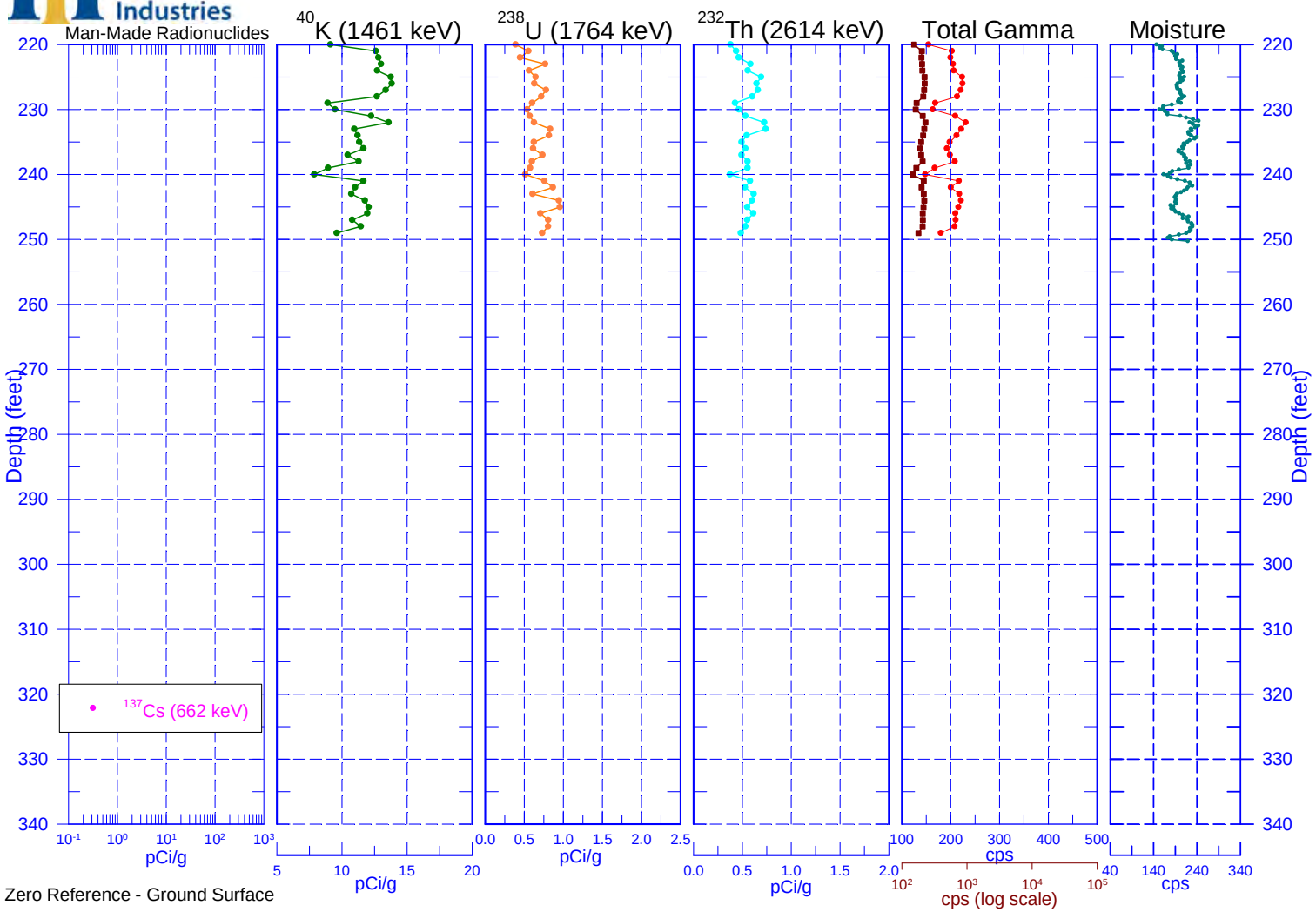


C9555 Combination Plot



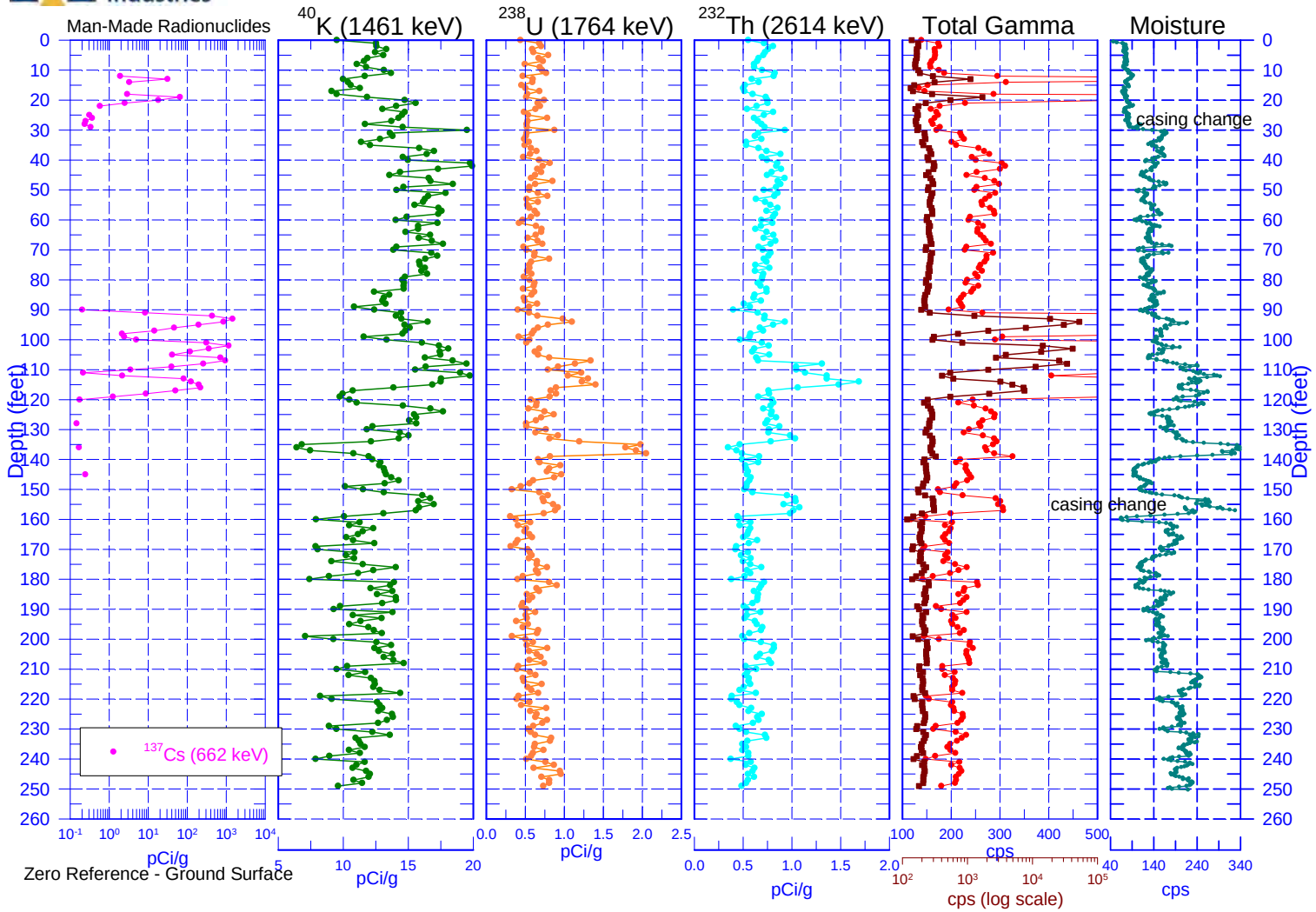
Zero Reference - Ground Surface

C9555 Combination Plot



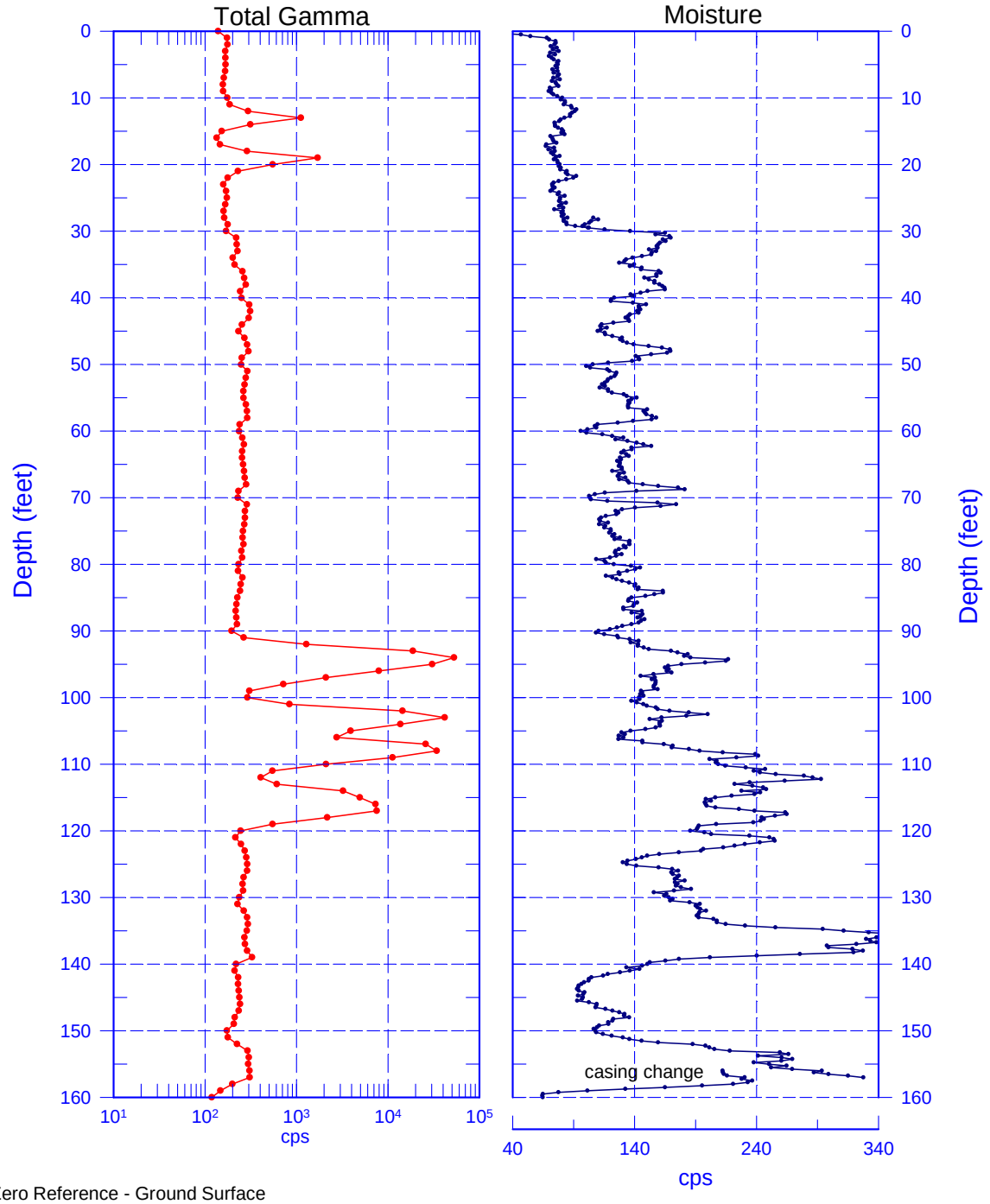
Zero Reference - Ground Surface

C9555 Combination Plot



Huntington Ingalls Industries

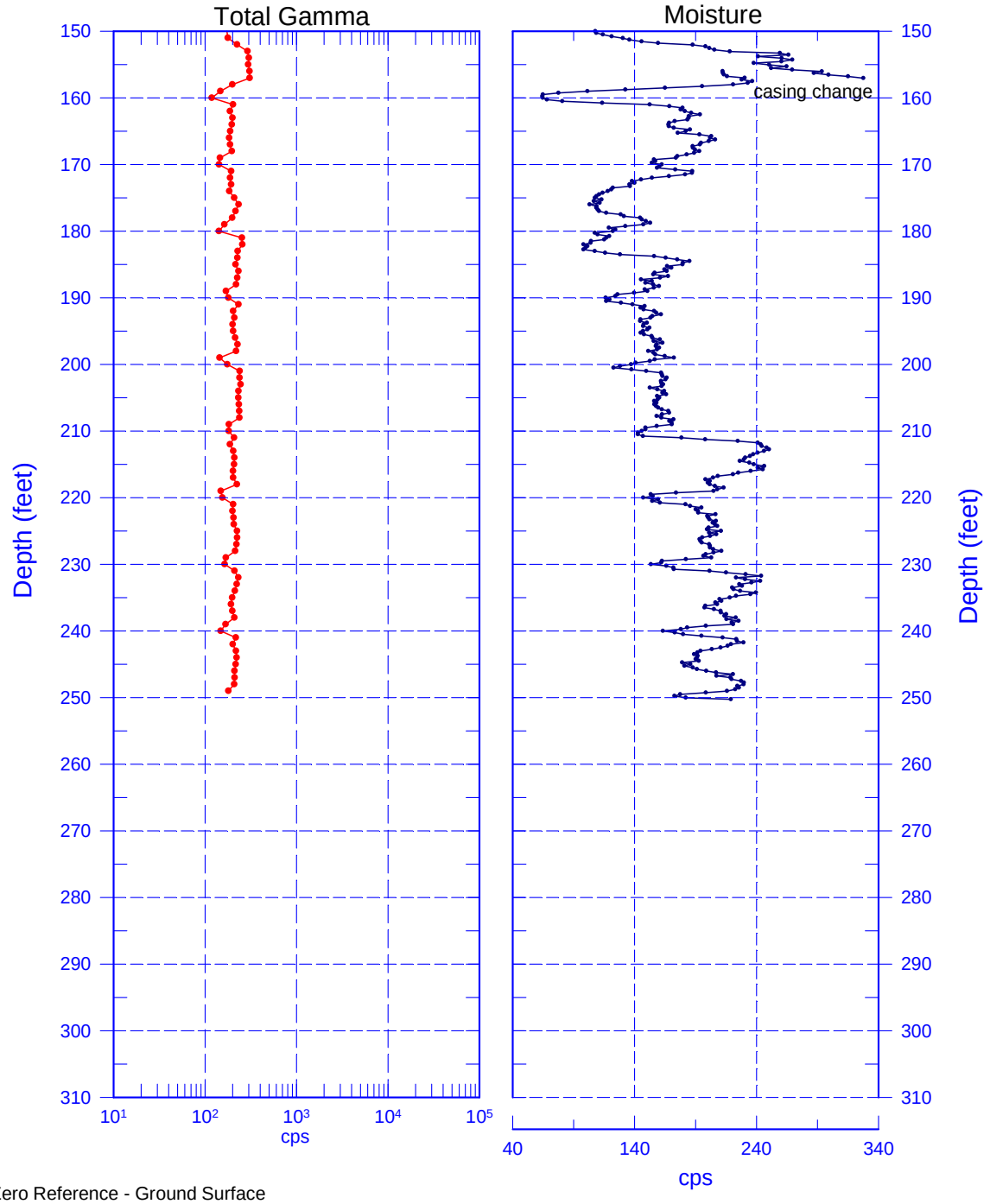
C9555
Total Gamma & Moisture



Zero Reference - Ground Surface

Huntington Ingalls Industries

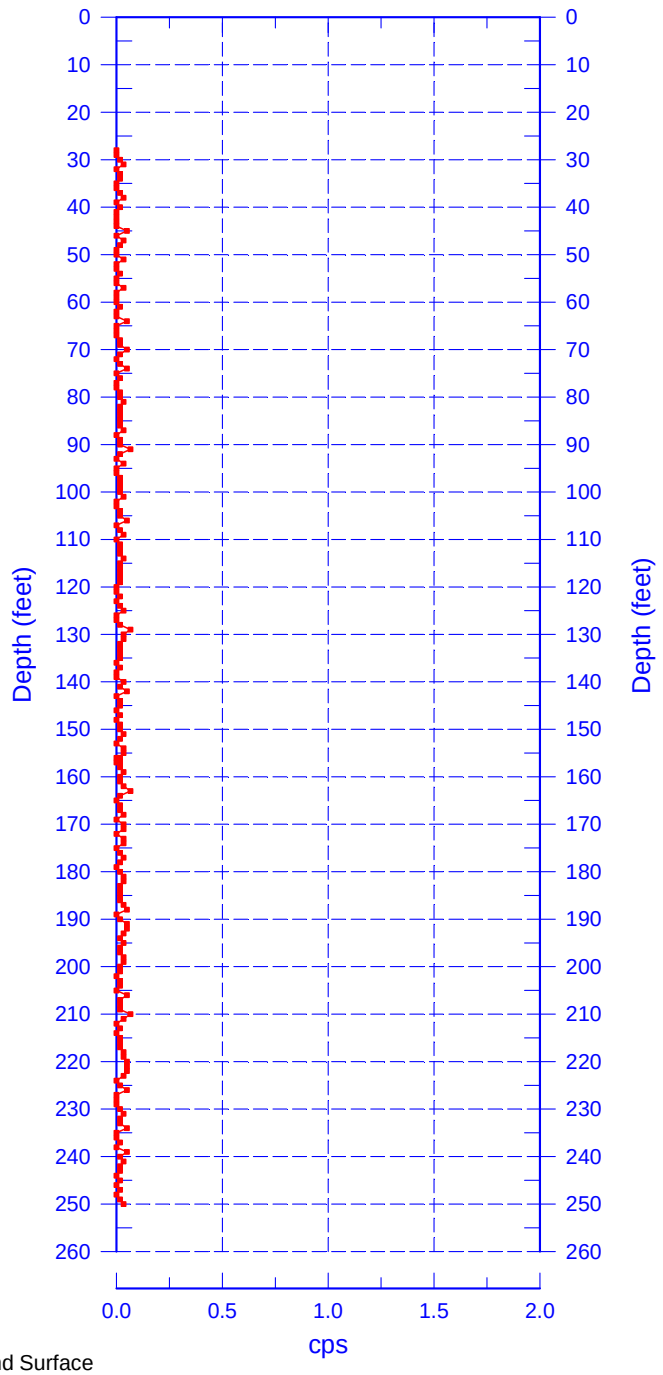
C9555
Total Gamma & Moisture



Zero Reference - Ground Surface

Huntington Ingalls Industries

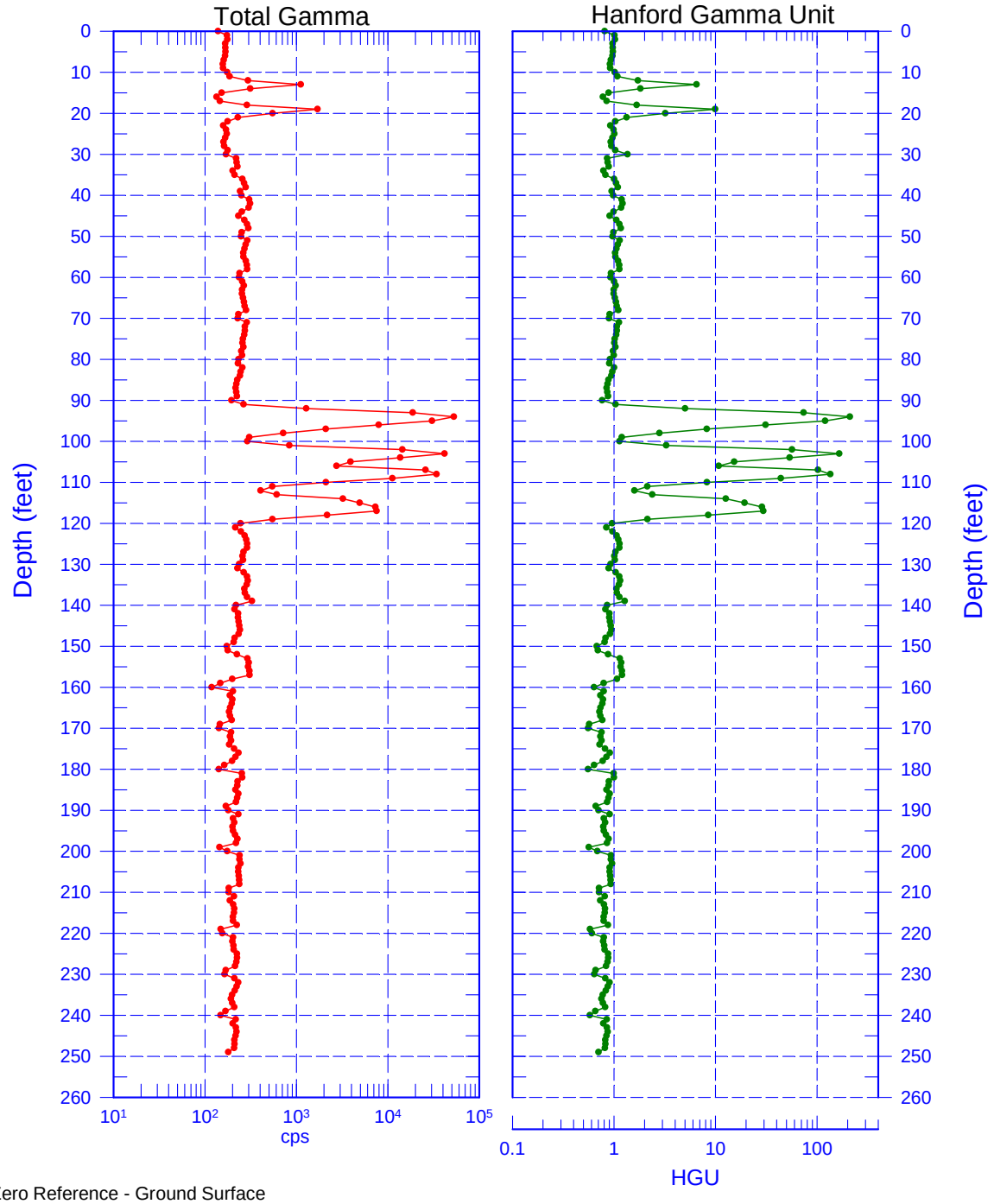
C9555
Passive Neutron



Zero Reference - Ground Surface

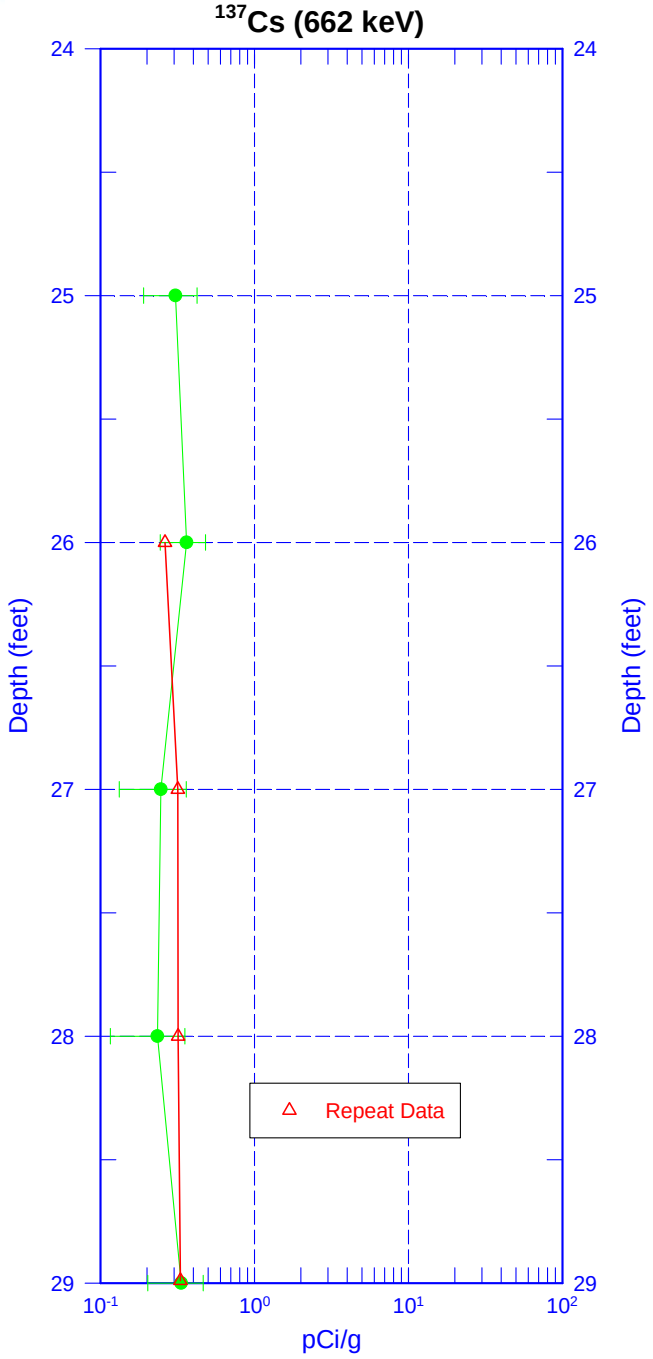
Huntington Ingalls Industries

C9555
Total Gamma & Hanford Gamma Unit



Zero Reference - Ground Surface

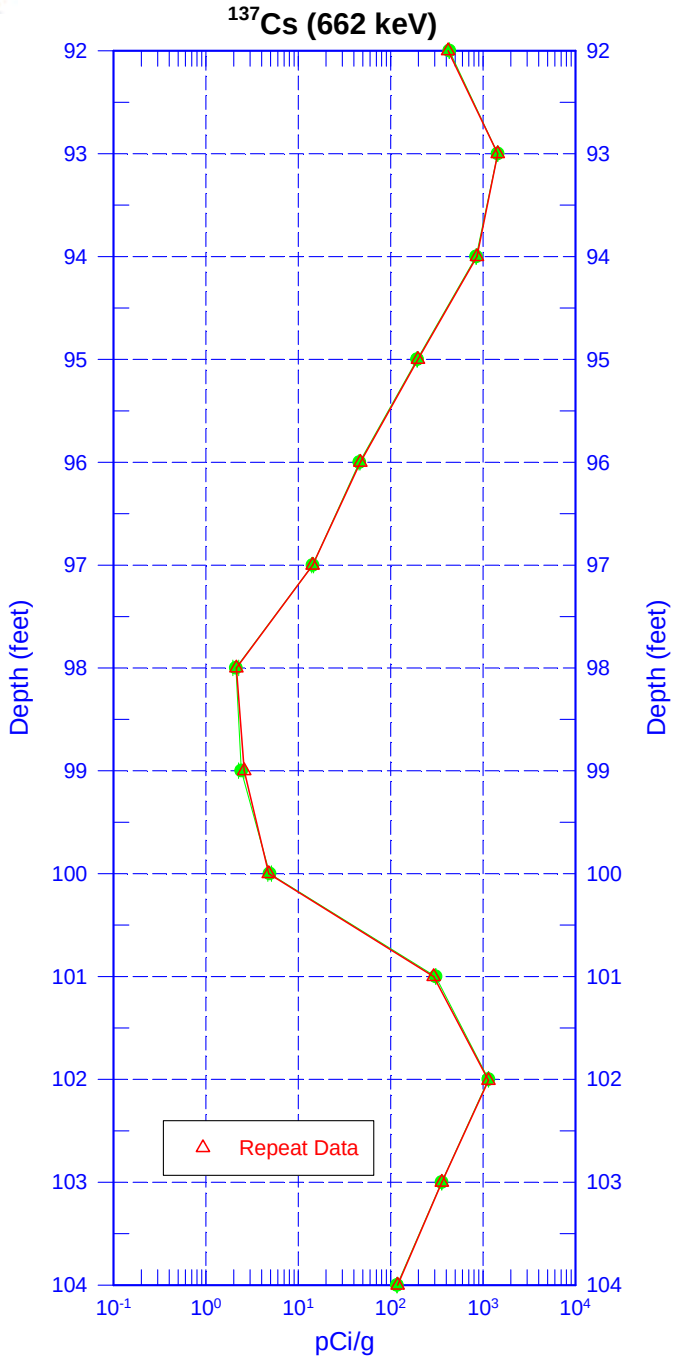
C9555
Manmade Radionuclides Repeat Data



Zero Reference - Ground Surface

Huntington Ingalls Industries

C9555
Manmade Radionuclides Repeat Data

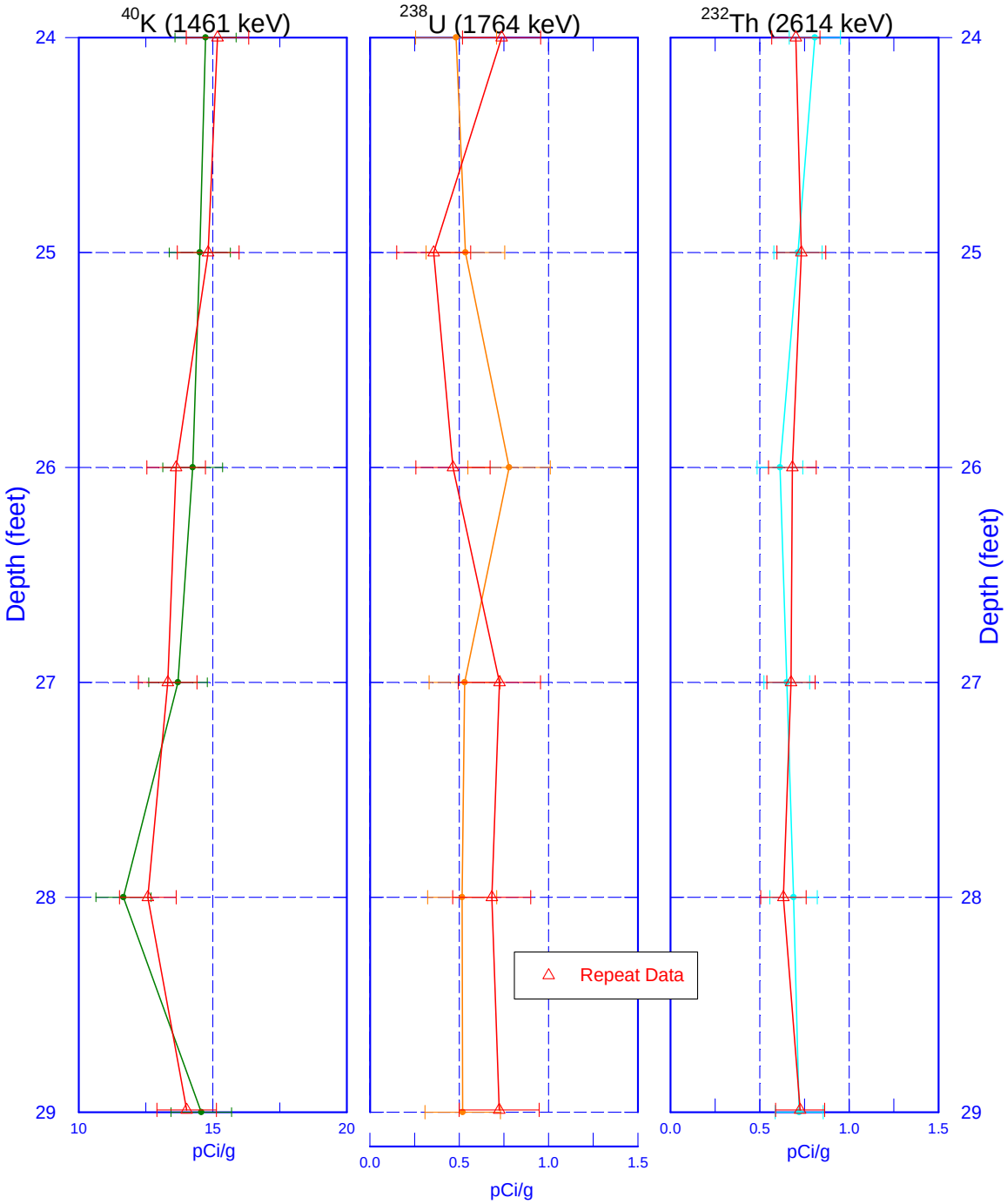


Zero Reference - Ground Surface

Huntington Ingalls Industries

C9555

Repeat Section of Natural Gamma Logs

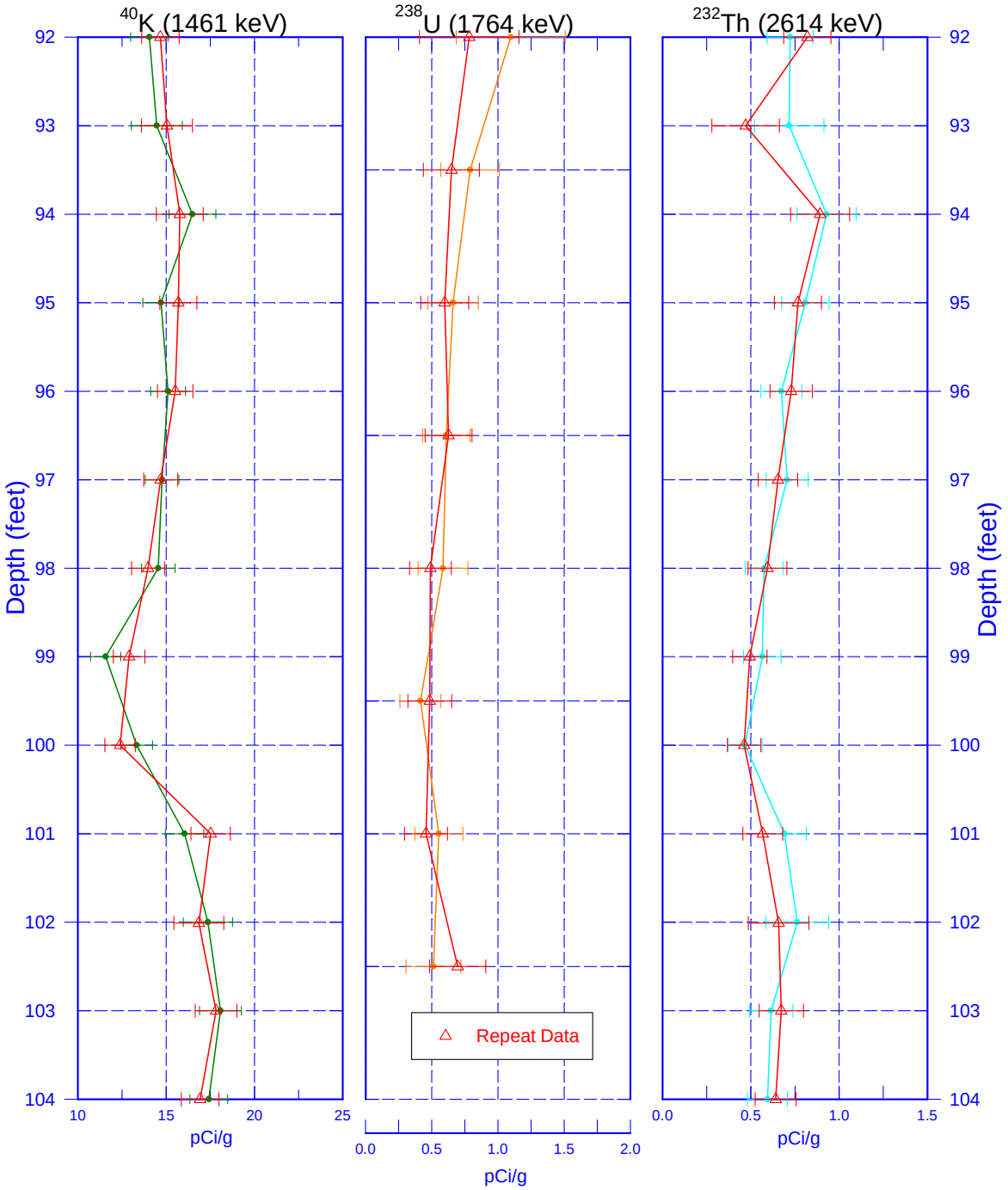


Zero Reference - Ground Surface

Huntington Ingalls Industries

C9555

Repeat Section of Natural Gamma Logs

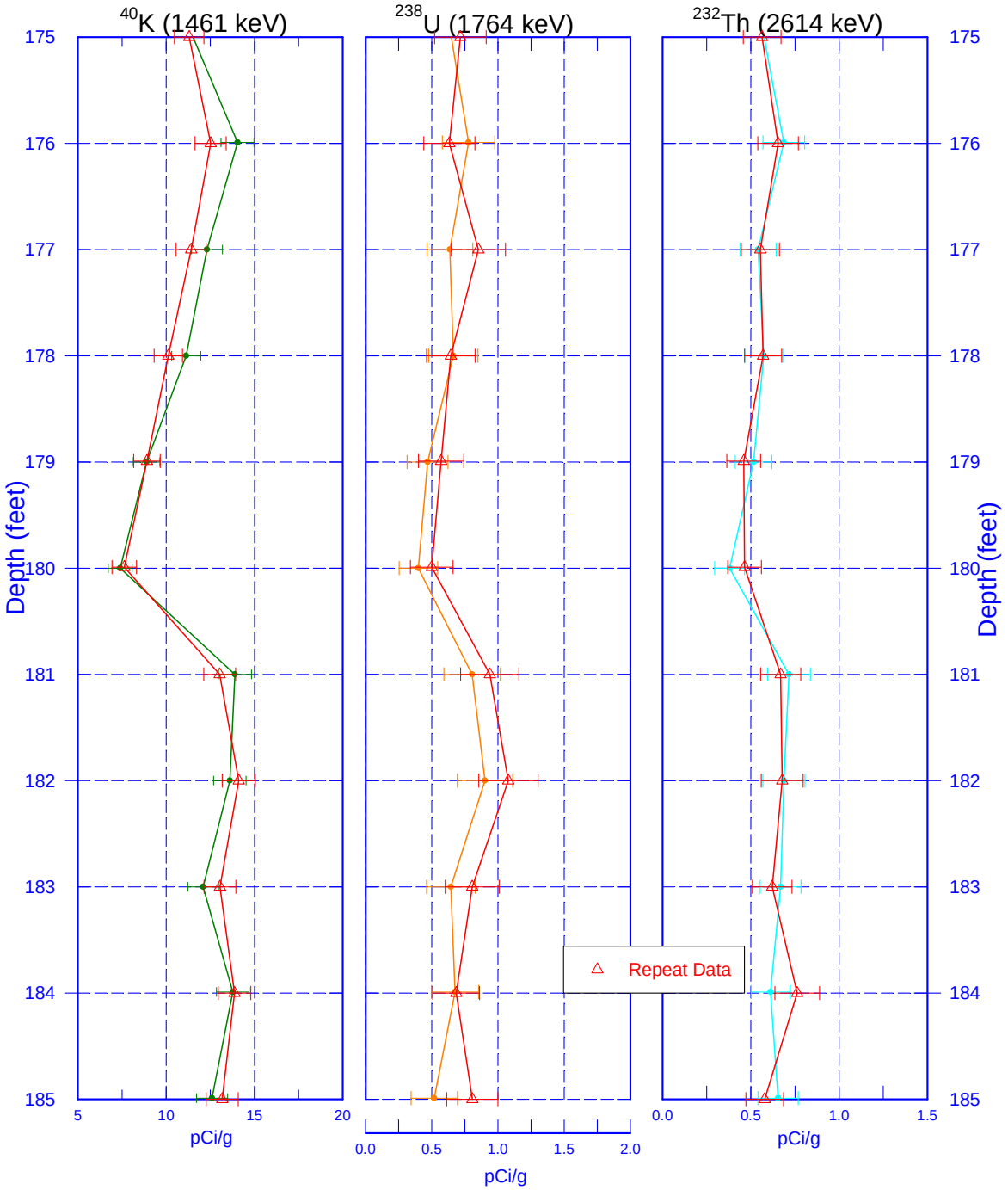


Zero Reference - Ground Surface

Huntington Ingalls Industries

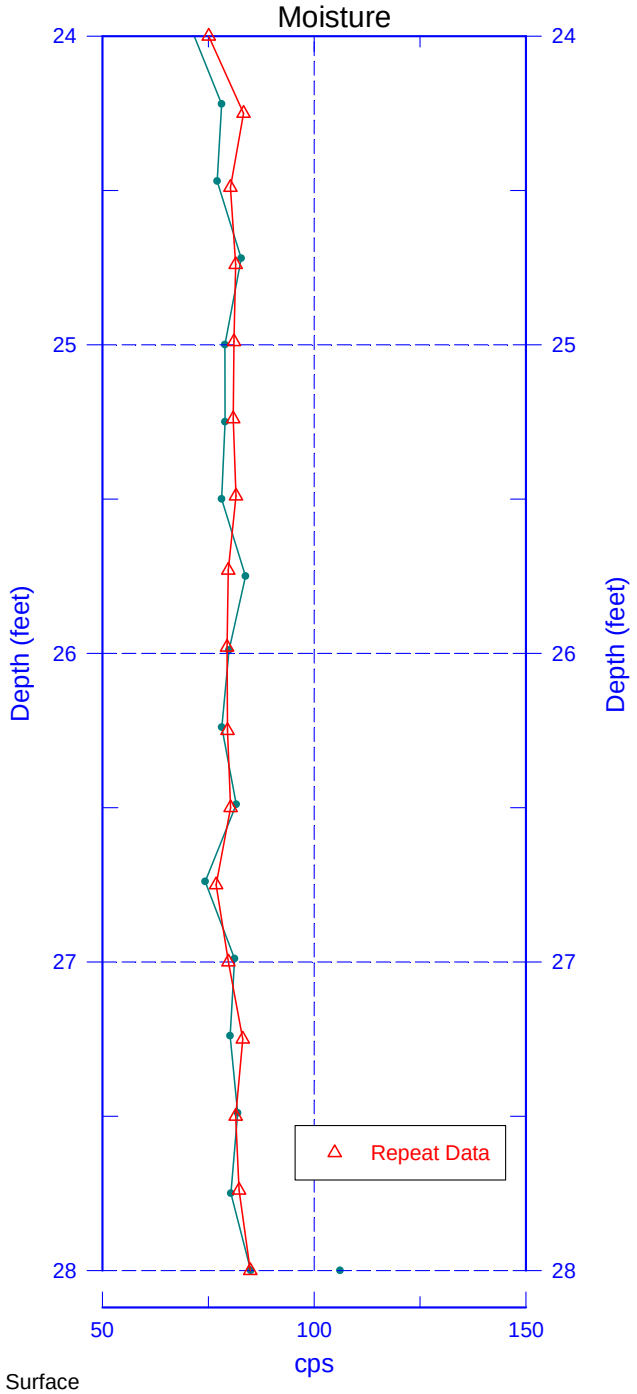
C9555

Repeat Section of Natural Gamma Logs



Zero Reference - Ground Surface

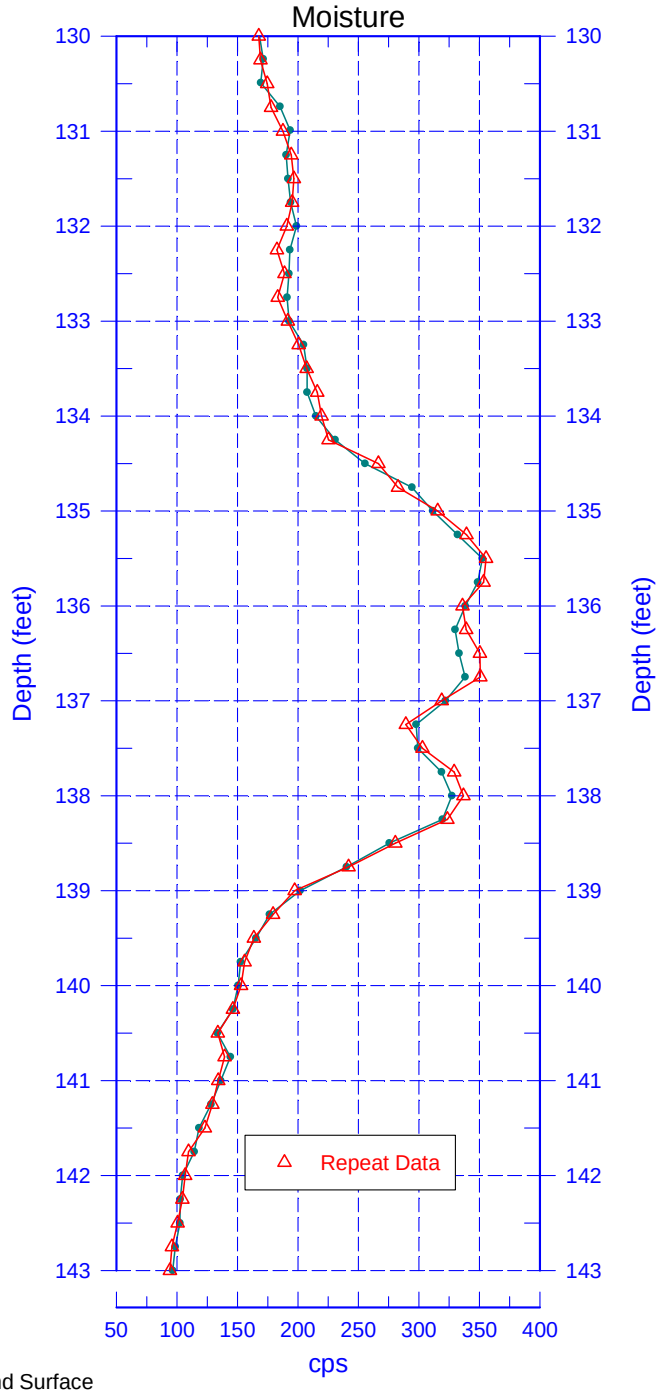
C9555
Moisture Repeat Section



Zero Reference - Ground Surface

Huntington Ingalls Industries

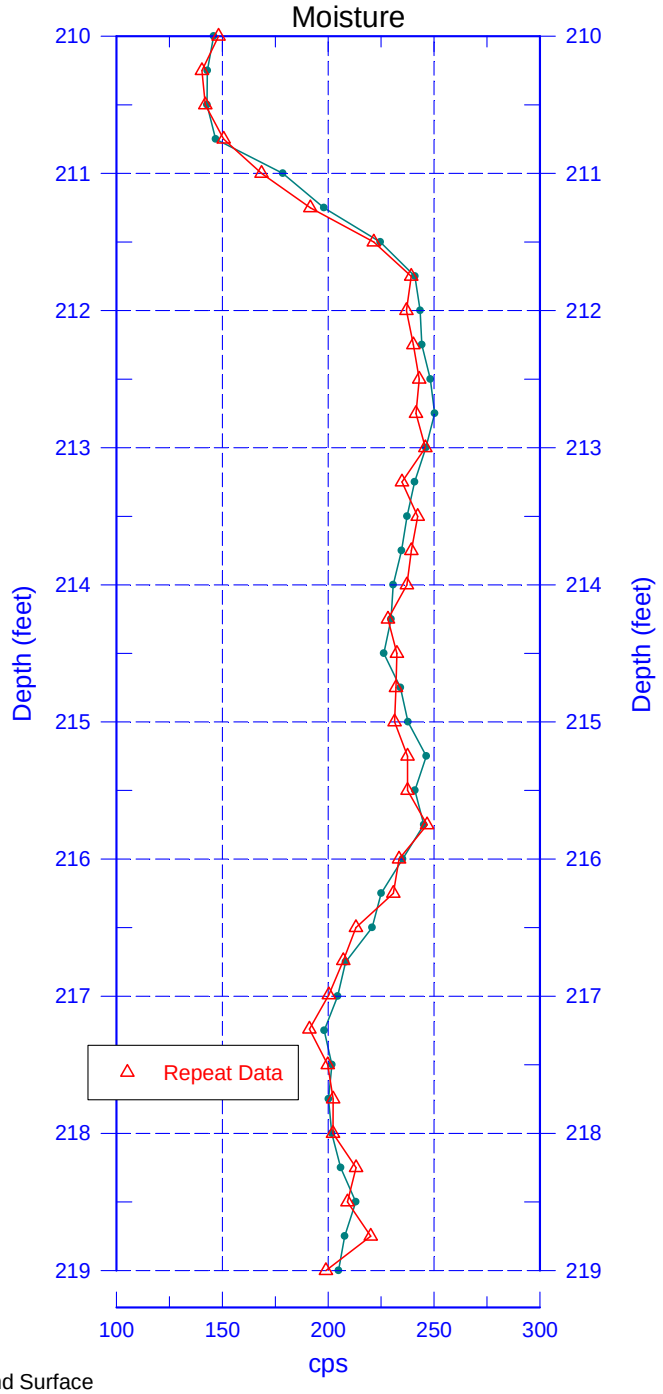
C9555
Moisture Repeat Section



Zero Reference - Ground Surface

Huntington Ingalls Industries

C9555
Moisture Repeat Section



Zero Reference - Ground Surface

Appendix D

Civil Survey

This page intentionally left blank.

SURVEY DATA REPORT				Page 1 of 3 Request No. 174-136
Project No.	Title DV-1 Boreholes C9497 and C9503 Final Surveys			File No. 2EWA-060
Job. No. CACN: 302632-JPRC	Prepared By N.P. Fastabend	Date 8/22/17	Reviewer	

DESCRIPTION OF WORK	DISTRIBUTION	SDR	PLOT	DWG
Obtain final coordinates and elevations of brass cap markers for completed DV-1 Boreholes C9497 located west of 241-BX Farm in 200E Area and C9503 located outside west fence of 241-T Farm in 200W Area.	Survey File	OR		
	J.D. Mehrer	1		
	K.M. Whitley	1		
	J.B. Geiger	1		
	A.J. Green	1		
Horizontal Coordinate System: WCS83S/91 (Meters) Vertical Datum: NAVD88 (Meters)				

SURVEY RESULTS AND COMMENTS

See Attached Well Survey Data Report Sheets

FOR OFFICE USE ONLY

OR Doc Type:	WMU Code(S):

A-6006-495 (REV 1)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Neil P. Fastabend
	Company: CHPRC
Date Requested: 08/16/17	Requestor: James D. Mehrer (CHPRC)
Date of Survey: 08/22/17	Surveyor / Company: Neil P. Fastabend / CHPRC
Description of Work: Obtained final survey coordinates and elevation of Brass Cap Marker for DV-1 Borehole C9497 located west of 241-BX Tank Farm in 200E Area.	Horizontal Datum: NAD83 (91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
Washington State Reference Network

Vertical Control Monuments:
Washington State Reference Network

Well ID	Well Name	Easting	Northing	Elevation	
C9497	C9497	573371.07	137276.54	204.82	Brass Cap Survey Marker in Concrete

Notes:

Surveyed location on top center of Brass Cap in Concrete.

Equipment Used: Trimble R8 RTK GPS

Surveyor Statement:

Page 1 of 1

A-6003-659 (REV 1)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Neil P. Fastabend
	Company: CHPRC
Date Requested: 08/16/17	Requestor: James D. Mehrer (CHPRC)
Date of Survey: 08/22/17	Surveyor / Company: Neil P. Fastabend / CHPRC
Description of Work: Obtained final survey coordinates and elevation of Brass Cap Marker for DV-1 Borehole C9503 located outside west fence line of 241-T Tank Farm in 200W Area.	Horizontal Datum: NAD83 (91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
Washington State Reference Network

Vertical Control Monuments:
Washington State Reference Network

Well ID	Well Name	Easting	Northing	Elevation	
C9503	C9503	566699.92	136658.31	205.73	Brass Cap Survey Marker in Concrete

Notes:

Surveyed location on top center of Brass Cap in Concrete.

Equipment Used: Trimble R8 RTK GPS

Surveyor Statement:

Page 1 of 1

A-6003-659 (REV 1)

SURVEY DATA REPORT				Page 1 of 4 Request No. 181-005
Project No.	Title DV-1 Boreholes C9498, C9513 and C9555 Final Surveys			File No. 2EWA-060
Job. No. CACN: 302632-JPRC	Prepared By N.P. Fastabend	Date 10/16/17	Reviewer	

DESCRIPTION OF WORK	DISTRIBUTION	SDR	PLOT	DWG
Obtain final coordinates and elevations of brass cap markers for completed DV-1 Boreholes C9498, C9513, and C9555 located in 200W Area.	Survey File	OR		
	J.D. Mehrer	1		
	K.M. Whitley	1		
	J.B. Geiger	1		
	A.J. Green	1		
Horizontal Coordinate System: WCS83S/91 (Meters) Vertical Datum: NAVD88 (Meters)				

SURVEY RESULTS AND COMMENTS

See Attached Well Survey Data Report Sheets

FOR OFFICE USE ONLY

OR Doc Type:	WMU Code(S):

A-6006-495 (REV 1)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Neil P. Fastabend
	Company: CHPRC
Date Requested: 10/09/17	Requestor: James D. Mehrer (CHPRC)
Date of Survey: 10/16/17	Surveyor / Company: Neil P. Fastabend / CHPRC
Description of Work: Obtained final survey coordinates and elevation of Brass Cap Marker for DV-1 Borehole C9513 located at the 216-S-21 Waste Site in 200W Area.	Horizontal Datum: NAD83 (91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200W

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
Washington State Reference Network

Vertical Control Monuments:
Washington State Reference Network

Well ID	Well Name	Easting	Northing	Elevation	
C9513	C9513	567160.18	134013.30	205.00	Brass Cap Survey Marker in Concrete

Notes:

Surveyed location on top center of Brass Cap in Concrete.

Equipment Used: Trimble R8 RTK GPS

Surveyor Statement:

A-6003-659 (REV 1)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Neil P. Fastabend
	Company: CHPRC
Date Requested: 10/09/17	Requestor: James D. Mehrer (CHPRC)
Date of Survey: 10/16/17	Surveyor / Company: Neil P. Fastabend / CHPRC
Description of Work: Obtained final survey coordinates and elevation of Brass Cap Marker for DV-1 Borehole C9555 located at the 216-T-3 Waste Site in 200W Area.	Horizontal Datum: NAD83 (91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200W

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
Washington State Reference Network

Vertical Control Monuments:
Washington State Reference Network

Well ID	Well Name	Easting	Northing	Elevation	
C9555	C9555	567258.75	136667.49	216.75	Brass Cap Survey Marker in Concrete

Notes:

Surveyed location on top center of Brass Cap in Concrete.

Equipment Used: Trimble R8 RTK GPS

Surveyor Statement:

A-6003-659 (REV 1)

WELL SURVEY DATA REPORT

Project:	**Prepared By:** Neil P. Fastabend
	Company: CHPRC
Date Requested: 10/09/17	Requestor: James D. Mehrer (CHPRC)
Date of Survey: 10/16/17	Surveyor / Company: Neil P. Fastabend / CHPRC
Description of Work: Obtained final survey coordinates and elevation of Brass Cap Marker for DV-1 Borehole C9498 located at the 216-T-3 Waste Site in 200W Area.	Horizontal Datum: NAD83 (91)
	Vertical Datum: NAVD88
	Units: Meters
	Hanford Area Designation: 200W

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments:
Washington State Reference Network

Vertical Control Monuments:
Washington State Reference Network

Well ID	Well Name	Easting	Northing	Elevation	
C9498	C9498	567259.27	136668.74	216.72	Brass Cap Survey Marker in Concrete

Notes:

Surveyed location on top center of Brass Cap in Concrete.

Equipment Used: Trimble R8 RTK GPS

Surveyor Statement:

Page 1 of 1

A-6003-659 (REV 1)

Appendix E

Core Borehole Geologic Logs for 200-DV-1 Operable Unit Boreholes

BOREHOLE LOG

Page 1 of 12
Date: 7/13/17

Well ID: C9497	Well Name: NA	Location: 216-B-42
Project: Four Boreholes in the 200-DV-1 OU		Reference Measure Point: Ground Surface

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
55	Core 1		55.0-57.5: Sandy Gravel (SG) 50% Gravel, 40% Sand, 10% Silt; Gravel: 60% Mafic, 40% Felsic, vfpeb-5.0 cm, SA-R, dom. basalt; Sand: 30% Mafic, 70% Felsic, vf-vc, SA, qtz, feldspar, trace mica; Silt: non-plastic; 2.5Y 5/1 gray, dry, rxn w/ HCl, PS, massive	Core 1 B39LN2 55-57.5 60 cpm Beta/gamma
57.5				No Core 2 (57.5-60.0)
60	Core 3		60.0-63.3: Sandy Gravel (SG) 40% Gravel, 60% Sand; Gravel: 70% Mafic, 30% Felsic, vfpeb-8cm, predom 0.5cm, SR-R, qtzite, basalt; Sand: 60% Felsic, 40% Mafic, vf-vc, SA; 2.5Y 7/2 light gray, dry, no rxn w/ HCl, PS, massive.	Core 3 B39LN6 60.0-65.0 trace mica JR 7/13/17
62.5			63.3-65.0: Slightly silty gravelly Sand (m) gs: 15% Gravel, 65% Sand, 20% Silt; Gravel: 60% Mafic, 40% Felsic, vfpeb-9cm, R, predom. basalt; Sand: 50% Mafic, 50% Felsic, SA, vf-vc, qtz, trace mica, feldspar; Silt: non-plastic; 2.5Y 7/2 light gray, dry, strong rxn w/ HCl, PS.	Aliquot 60.7-63.2
65	Core 4		JR 7/13/17 65.0-69.1: Sandy Gravel (SG) 30% Gravel, 70% Sand; Gravel: 80% Mafic, 20% Felsic, vfpeb-6cm, SR-R, predom. basalt; Sand: 60% Felsic, 40% mafic, trace mica, vf-vc, SA, lens of vf; 2.5Y 6/2 light brownish gray, dry, no rxn w/ HCl, PS, JR 7/13/17 Silt lamina @ 66.7' bgs	Core 4 B39LN8 65.0-~~70.0~~ 70.0 JR 7/13/17 to vc sand lamina bgs & @ 68.7' bgs and fine grained bed from 65.2-65.5
67.5			69.1-70.0: ~~Silty Sand (mS)~~ 7/14/17 ACM 10% Gravel, 70% Sand, 20% Silt; Gravel: 30% Mafic, 70% Felsic, ~~vfp-3cm~~, SR-R, qtzite, basalt; Sand: 20% Mafic, 80% Felsic, vf-vc, SA-SR, qtz, feldspar; Silt: non-plastic, 2.5Y 6/2 light brownish gray, dry, strong rxn w/ HCl, PS	Slightly silty gravelly sand (m) gs ACM 7/14/17 Aliquot 65.3-68.8
70	Core 5		70.0-71.4: Sand (S) 90% Sand, 10% Silt, Sand: 70% Felsic, 30% Mafic, vf-f, SR-SA, qtz, feldspar, trace mica; Silt: non-plastic, 2.5Y 5/3 light olive brown, dry, no rxn w/ HCl, WS, v. thin bed of silt at 71.3 bgs	Core 5 B39LP0 70.0-75.0
			71.4-73.2: Sandy Gravel (SG) 30% Gravel, 70% Sand, Gravel: 30% Felsic, 70% Mafic, vfpeb-12 cm,	

Reported By:			
Jen Russell	Geologist	Jen Russell	8/25/17
Print Name	Title	Signature	Date
Reviewed By:			
Tessa Clark	Geologist	[signature]	9/05/17
Print Name	Title	Signature	Date

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-642 (REV 1)

BOREHOLE LOG (Cont.)

Page 2 of 12

Date: 7/14/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
72.5	Core 5		A-R, basalt; Sand: 60% Felsic, 40% Mafic, m-vc, SA, qtz, feldspar, trace mica; 2.5Y5/2 dark grayish brown, dry, no rxn w/ HCl, PS	
			73.2-75.0 Sand (S) 90% Sand, 10% Silt; Sand: 80% Felsic, 20% Mafic, vf-f, SA-SR, qtz, feldspar, trace mica; 2.5Y5/3 light olive brown, dry, no rxn w/ HCl, WS, Silt: non-plastic, present as	
75	Core 6		rhythymites spaced 0.5 cm repeating throughout	Core 6 B39LP2 75-80
			75.0-76.8 Sand (S) 95% Sand, 5% Silt, Sand: 85% Felsic, 15% Mafic, vf-m, SA, qtz, feldspar, trace mica; silt: non-plastic, 2.5Y5/3 light olive brown, dry, no rxn to HCl, WS, rhythymites of vf sand + silt throughout	
77.5			76.8-79.1 Sand (S) 5% Gravel, 95% Sand, Gravel: 50% Felsic, 50% Mafic, vf-peb-1cm, R; Sand: 60% Felsic, 40% Mafic, f-vc, dom c-vc, SA, qtz, feldspar, trace mica, 2.5Y4/2 dark grayish brown, dry, no rxn w/ HCl, MS	
			79.1-80.0 Sand (S) 95% Sand, 5% silt; Sand: 90% Felsic, 10% Mafic, vf-c, SA, qtz, trace mica;	
80	Core 7		80.0 - 83.8: Sand (S) 95% Sand, 5% silt; Sand: 80% Felsic, 20% Mafic, trace mica, vf-c, predom m, SA-SR, qtz, feldspar; rhythymites of ~~silt~~ 7/14/17 ACM vf-f sand ~~at~~ 7/14/17 ACM 2-5 mm	Silt - non-plastic; 2.5Y5/3 light olive brown, dry, no rxn w/ HCl, WS, laminae repeating between 79.1-79.4
			Silt: non-plastic; 2.5Y 6/3 light yellowish brown, dry, no rxn with HCl, WS	Core 7 B39LP4 80-85
82.5			83.8 - 85.0: Slightly silty sand (m) S 80% Sand 20% silt; Sand: Felsic 85%, Mafic 15%, vf-m, predom f, SA-SR, qtz, feldspar, trace mica, laminae of vfs or silt throughout; Silt: non-plastic, 2.5Y6/2 light brownish grey, dry, no rxn with HCl, WS	Aliquot 80.3-83.8
85	Core 8		85.0-89.4: Sand (S): 5% Gravel, 90% Sand, 5% silt; Gravel: 70% felsic, 30% mafic, vfpeb, SA; Sand: 60% Felsic, 40% Mafic, vf-vc, SA, qtz, feldspar, trace mica; silt: non-plastic; 2.5Y5/2 grayish brown, dry, no rxn w/ HCl, WS, slightly coarser from 85.0-86.7, v. thin laminae of Fe-staining at 85.5, 86.2, 86.6, 86.9 bgs.	Core 8 B39LP6 85-90
87.5			89.4-90.0: Sandy silt (SM): 40% Sand, 60% Silt; Sand: 70% felsic, 30% mafic, f-c, SA, qtz, feldspar, trace mica; Silt: non-plastic; 2.5Y6/2 light brownish gray, dry, rxn w/ HCl, MS, v. thin rhythymites throughout.	
90	Core 9		90.0-94.1: Gravelly sand (GS) 15% Gravel, 85% Sand, Gravel: 60% mafic, 40% felsic, vfpeb-1.0cm, SA, basalt dom; Sand: 40% mafic, 60% felsic, vf-vc, SA, qtz, feldspar, trace mica; 2.5Y5/1 gray, dry, no rxn, PS,	Core 9 B39LP8 90-95

Reported By:

Print Name	Title	Signature	Date
Len Russell	Geologist	Len Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 3 of 12

Date: 8/2/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
92.5	Core 9		90.0-94.1: Gravelly sand (gS) 15% Gravel, 85% Sand; Gravel: 60% mafic, 40% felsic, vfpeb-1.0 cm, SA, basalt dom; Sand: 40% mafic, 60% felsic, vf-vc, SA, qtz, feldspar, trace mica; 2.5Y5/1 gray, dry, no rxn, PS; slightly coarser from 92.5-92.6, 92.8-93.3, otherwise massive	Core 9 B39LP8 90-95
95	Core 10		94.1-95.0: Silty Sand (MS) 70% Sand, 30% silt; Sand: 70% felsic, 30% mafic, vf-vc, SA, qtz, trace mica; 2.5Y6/2 light brownish gray, dry, no rxn w/ HCl, MS, rhythymites throughout. 8/2/17 ACM Silt: non-plastic	
			95.0-96.4: Gravelly Sand (gS): 10% Gravel, 90% Sand; Gravel: 80% mafic, 20% felsic, vfpeb-1.0 cm, SA-SR, basalt dom; Sand: 30% mafic, 70% felsic, vf-vc, SA, qtz, feldspar, mica; 2.5Y5/1 gray; dry, no rxn w/ HCl, MS, massive;	Core 10-B39LR0 95-100
97.5			96.4-98.6: Sand (S): 8/2/17 ACM 5% Gravel, 95% Sand, Gravel: 50% mafic, 50% felsic, vfpeb-fpeb, SR; Sand: 30% mafic, 70% felsic, vf-vc, dom m-c, SA, qtz, feldspar, mica; 2.5Y5/2 grayish brown; no rxn, dry, massive; 98.6-100.0 Slightly silty sand (m)S: 2% Gravel, 78% Sand, 20% silt; Gravel: 50% mafic, 50% felsic, vfpeb-fpeb, SA; Sand: 25% m, 75% f, vf-vc, dom m, SA, qtz, feldspar, mica; dry, no rxn, 2.5Y6/2 light brownish gray, MS, v. fine silt laminae at 99.1, 99.3, 99.4, 99.7, 99.8 bgs.	8/2/17 ACM Silt-non-plastic
100	Core 11		100-101.8: Sandy gravel (sG) 30% Gravel 70% Sand; Gravel: 50% Mafic, 50% Felsic, vf peb-1.0 cm, SA, basalt dom in mafics; Sand: 20% Mafic, 80% Felsic, qtz, feldspar, trace mica, ~~vfs~~ ACM 7-11-17 vf-vc, SA; 2.5Y5/2, grayish brown, dry, no rxn w/ HCl, MS	Core 11 B39LR2 100-105 Aliquot 102.0-104.0
102.5			101.8-104.0: Sand (S) 90% Sand 10% silt; Sand: 20% Mafic, 80% Felsic, vf-f, SR, quartz, feldspar, trace mica, v. thin bedding throughout, deformation at 103.5-103.7 bgs; Silt: non-plastic; 2.5Y 5/3 light olive brown, no rxn w/ HCl, WS; 104.0-105.0: Slightly silty gravelly sand (m)gS	ACM 7-11-17
105	Core 12		15% gravel, 70% sand, 15% silt; gravel: 50% mafic, 50% felsic, vf peb-f peb, SA; sand: 80% felsic, 20% mafic, vf-vc, predom fine, qtz, feldspar, trace mica. Silt: non-plastic; 2.5Y5/3 light olive brown, ~~no~~ slight ACM 7-14-17 rxn w/ HCl, MS, thin bed c sand at 104.0 bgs, grains coarsen downwards at 104.4 bgs-105.0 bgs, dry	Core 12-B39LR4 105-110
107.5			105.0-105.6: Gravelly ~~silty sand~~ 8/2/17 ACM sandy silt (gsM): 10% Gravel, 40% Sand, 50% Silt; Gravel: 50% mafic, 50% felsic, vfpeb, SA; Sand: 40% mafic, 60% felsic, m-vc, SA, qtz, feldspar, trace mica; Silt: non-plastic; 2.5Y4/3 olive brown, dry, no rxn w/ HCl; Gravel/Sand alternate with silt laminae from 105.4-~~106~~ 8/2/17 ACM 105.6 bgs.	
110	Core 13		105.6-109.2 Gravelly Sand (gS): 10% Gravel, 85% Sand, 5% silt; Gravel: 60% mafic, 40% felsic, vf-fpeb, SA-SR, basalt, qzite; Sand: 30% mafic, 70% felsic, f-vc, SA, qtz, feldspar, trace mica; 8/2/17 ACM Silt: non-plastic; 2.5Y6/1 gray, dry, no rxn w/ HCl, ms, massive except for v. thin lamina of silt/f. sand at 109.9 bgs. 8/2/17 ACM	
			109.2-110.0 Silty Sand (mS): 50% Sand, 50% Silt; Sand: 60% felsic, 40% mafic, vf-vc, SA, qtz, feldspar, trace mica; Silt: non-plastic; 2.5Y7/1 light gray, dry, no rxn w/ HCl; rhythymites ranging in size from 1-8 mm throughout, MS 8/2/17 ACM	

8/2/17 ACM

8/25/17

Reported By:

Print Name	Title	Signature	Date
Jen Russell	Geologist	Jen Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 4 of 12

Date: 8/4/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
112.5	Core 13		112.5 8/2/17 ACM 110.0-~~110.9~~: Sand(S): 5% Gravel, 95% sand; Gravel: 50% mafic, 50% felsic, vfpeb, SA; Sand: 30% mafic, 70% felsic, vf-vc, SA, qtz, feldspar, trace mica; 2.5Y5/2 olive gray, dry, no rxn w/ HCl, slight coarsening downwards; ~~110.9-112.5 Sand(S)~~ 8/2/17 ACM: Until 110.9 band of coarser sand/gravel at 110.7 bgs, 8/2/17 ACM Fe staining throughout and from 112.1-112.5 bgs, MS	Core 13 - B39LR6 110 - 115
115	Core 14		112.5-115.0: Sand(S): 2% Gravel, 93% sand, 5% Silt; Gravel: 50% mafic, 50% felsic, vf-fpeb, SA-SR; Sand: 40% mafic 60% felsic, vf-vc, dom. m-c, SA-SR, qtz, feldspar, trace mica; 2.5Y6/2 light brownish gray, dry, no rxn w/ HCl, MS, 1.0cm band of silt at 114.1 bgs, v. thin lamina at 114.3 bgs 115.0-120.0: Gravelly sand (gS): 10% Gravel, 80% Sand, 10% Silt; Gravel: 80% mafic, 20% felsic, vf-fpeb, SA, dom. basalt, Sand: 30% mafic, 70% felsic, vf-vc, SA-SR, qtz, feldspar, trace mica; Silt: Non-plastic; 2.5Y5/2 grayish brown, dry, no rxn w/ HCl, MS; areas of coarser gravel/sand from 115.0-115.7, 116.1-116.3, 116.8-117.2, silt/fine sand laminae at 115.8, 116.3, 116.6, 118.2, 118.5 and 118.9 bgs., Fe staining present throughout.	Silt: non plastic Core 14 - B39LR8 115-120
117.5				
120	Core 15		120.0-125.0: Sand(S): 40% Mafic, 60% Felsic, vf-vc, SA, MS, dry, 2.5Y4/2 dk grayish brn, 100% Sand, vf-m ~~121.1-~~ 123.3, qtz, feldspar, basalt, massive, no rxn w/ HCl JR 8/4/17	Core 15 B39LT0 120 - 125
122.5				
125	Core 16		125.0-130.0: Sand(S) 100% Sand; trace mica, vf-vc, predom. c, SA-A, 50% Mafic, 50% Felsic, iron staining, qtz, feld, basalt, WS, no rxn w/ HCl, 2.5Y4/2 dk grayish brn, massive, dry	Core 16 B39LT2 125-130
127.5				
130	Core 17		130.0-135.0 Gravelly Sand (~~G~~ gS): 8/2/17 ACM 20% Gravel, 75% sand, 5% silt; Gravel: 60% Mafic, 40% Felsic, vfpeb-1.0 cm, SR, dom. basalt in mafics; Sand: 30% mafic, 70% Felsic, f-vc, SA, qtz, feldspar, trace mica; Silt: Non-plastic;	Core 17 B39LT4 130-135

Reported By:

Print Name	Title	Signature	Date
Len Russell	Geologist	Len Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 5 of 12

Date: 7/21/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
132.5	Core 17		2.5Y 4/2 dark grayish brown, dry, no rxn w/ HCl, PS, repeating laminae of silt/vf sand btw. ~~158.9-159.3~~ bgs and ~~158.7~~ bgs, minor iron 133.9-134.3 7/21/17 ADM 134.7 7/21/17 ADM staining throughout.	Aliquot 132.0-134.0
135	Core 18		135.0-140.0: Sand(S) 100% Sand, 30% Mafic, 70% Felsic, vf-m, m-c from 137.6-137.8, varying grain sizes 137.8-140.0 (not well defined rhythmites), trace mica, SA, WS, no rxn w/HCl, 2.5Y 6/2 light brnish gray, dry, minor iron staining	Core 18 B39LT6 135-140
137.5				
140	Core 19		140.0-145.0: Sand(S) 100% Sand, 30% Mafic, 70% Felsic, trace mica, dry, vf-m, fines downward, vf sand 3mm lamina @ 143.7, 142 JR 8/4/17 144.2-144.4 interbedded silt-no rxn w/HCl, WS, SA, light yellowish brn 2.5Y 6/3	Core 19 B39LT8 140-145
142.5				
145	Core 20		145.0-150.0: Sand(S): 100% Sand, 30% Mafic, 70% Felsic, trace mica, SA, WS, vf-vc, predom. med, coarsening downward @ 147.2', silt bed (2cm thick) @ 149.2', dry, no rxn w/HCl, light brnish gray ~~2.5Y 6/3~~ KVE 8/25/17 2.5Y 6/2	Core 20 B39LV0 145-150
147.5				
150	Core 21		150.0-155.0: Sand(S): 100% Sand, 30% Mafic, 70% Felsic, trace mica, quartzite, vf-vc, MS, rhythmites throughout, dry, no rxn w/HCl, 2.5Y 6/2 light brnish gray, SA, rhythmites not well-defined	Core 21 B39LV2 150-155

Reported By:

Print Name	Title	Signature	Date
Jen Russell	Geologist	Jen Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 6 of 12

Date: 7/21/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
152.5	Core 21		150.0-155.0 (cont.) Sand(S): 100% Sand, 30% M, 70% F, trace mica, quartzite, vf-vc, MS, rhythmites throughout, dry, no rxn w/ HCL, 2.5Y 6/2 light brnish gray, SA, rhythmites not well defined	Core 21 B39LV2 150-155
155	Core 22		JR 8/4/17 155.0-160.0 Sand(S): 100% Sand, 40% Mafic, 60% Felsic, iron staining (minor amt.), f-vc, predom. coarse, MS, SA, trace mica, quartzite, massive w/ 4mm lamina @ 158.2 & interbedded silt @ 159.0' bgs, dry, no rxn w/ HCL, 2.5Y 5/2 grayish brn, <5% vf peb throughout, finer grained @ 158.5-160.0'	Core 22 B39LV4 155.0-160.0
157.5				
160	Core 23		160.0-165.0: Sand(S): 5% Gravel, 90% Sand, 5% Silt; Gravel: 50% Mafic, 50% Felsic, vf peb-4mm, SA; Sand: 25% Mafic, 75% Felsic, vf-vc, SA, qtz, feldspar, trace mica; Silt: Non-plastic; 2.5Y 6/2 light brownish gray, dry, no rxn w/ HCl until 164.5 bgs, rxn from 164.5-165.0, possible deformation or other effect from drilling, MS, massive	Core 23 B39LV6 160-165
162.5				Aliquot 161.0-163.5
165	Core 24		165.0 (gS) JR 8/10/17 165.0-170.0: Gravelly Sand 10% Gravel, 90% Sand, Gravel: 80% Mafic, 20% Felsic, SA, vf peb-1cm, basalt, qtzite; Sand: 70% Felsic, 30% Mafic, vf-vc, predom C, SA-A; PS, dry, no rxn w/ HCL, 2.5Y 5/2 grayish brn, minor iron staining throughout, trace mica, massive	Core 24 B39LV8 165-170
167.5				
170	Core 25		170.0-175.0: Sand(S): JR 8/10/17 ~~10%~~ C 5% Gravel, 95% Sand; Gravel: vf peb-fine peb, 90% Mafic, 10% Felsic, SA-A, basalt; Sand: vf-vc, predom med, SA, 70% Felsic, 30% Mafic, trace mica; dry, no rxn w/ HCL, 2.5Y 5/2 grayish brn, MS, 171.8-173.0 coarse grained, vf-f peb, 171.0-171.8 rhythmites, fining downward	

Reported By:

Print Name	Title	Signature	Date
Jen Russell	Geologist	Jen Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 7 of 12

Date: 8/10/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
172.5	Core 25		170.0-175.0 Sand(S): 5%G, 95%S; G: vf peb-f peb, 90% M, 10% F, SA-A, basalt; S: vf-vc, predom med, SA, 70% F, 30% M, trace mica; dry, no rxn w/ HCl, 2.5Y 5/2 grayish brn, MS, 171.0-171.8: rhythmites ~~173.8~~ 171.8 - 173.0: coarse sand & vf-f peb JR 8/10/17	Sonic Core Core 25 170-175 fining downward B39LW0
175	Core 26		175.0-180.0: Gravelly Sand (gS): 20% Gravel, 80% Sand; Gravel: vf-~~f~~ med peb, SA, basalt, qtzite, 70% Mafic, 30% Felsic; Sand: vf-vc, 70% Felsic, 30% Mafic, SA; minor iron staining; trace mica, no rxn w/ HCl, dry, 2.5Y 6/2 light brn gray JR 8/10/17	Core 26 175-180 B39LW2
177.5			175.0-176.5: predom f-m sand	
			176.5-176.7: predom. cs & vf-f peb	
			176.7-177.1: vf-f sand bed	
			177.1-178.4: vf peb - med peb & c sand	
			178.4-180.0: predom. vf-m sand	
180	Core 27		180.0-185.0: Gravelly Sand (gS): 10% Gravel, 90% Sand; Gravel: vf peb - 3cm, predom f peb, 80% Mafic, 20% Felsic, SA; Sand: 70% Felsic, 30% Mafic, vf-c, predom fine, SA; dry, MS, 2.5Y 4/1 gray, no rxn w/ HCl, trace mica JR 8/10/17	Core 27 B39LW4 180-185
182.5	JR 8/10/17		182.3: vf sand, 3cm bed	
			183.1: vc sand & fine peb, 5cm bed	
			183.3: vf sand, 8 cm bed	
			183.~~8~~ 5 - 185.0: c, WS, massive JR 8/10/17	
185	Core 28		185.0 - 189.7: Gravelly Sand (gS): 10% gravel, 90% Sand; Gravel: 70% Mafic, 30% Felsic, vf peb - 30 cm, SA-SR basalt + ~~qtzite~~ quartzite JR 8/25/17 ACM; Sand: 30% Mafic, 70% Felsic, vf-vc, SA, qtz, feldspar, trace mica; 2.5Y 4/2 dark grayish brown, dry, no rxn w/ HCl, MS, Massive	Core 28 B39LW6 185.0-190.0 Aliquot: 186.5-188.5
187.5			189.7 - 190.0: Sandy silt (sM): 5% gravel, 25% Sand, 70% silt; gravel: 50% Mafic, 50% Felsic, vf peb, R; Sand: 50% Mafic, 50% Felsic, m-vc, SR-SA, feldspar; Silt: Non-plastic; 2.5Y 6/2 light brownish gray, dry, strong rxn w/ HCl, PS, thin laminae but possibly related to drilling @ 189.7	
190	Core 29		190.0-192.2 Gravelly Sand (gS): 25% Gravel, 75% Sand; Gravel: f peb - 2cm, 60% Mafic, 40% Felsic, SA; Sand: vf-vc, predom vc, SA, trace mica, 60% Felsic, 40% Mafic, dry, massive, no rxn w/ HCl, 2.5Y 4/1 dark gray, PS	Core 29 B39LW8 190-~~195~~ 195 JR 8/10/17

Reported By:

Print Name	Title	Signature	Date
Jen Russell	Geologist	Jen Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 8 of 12

Date: 8/10/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
192.5	Core 29		192.5-193.4 Sand(S): 5% Gravel, 95% Sand; Gravel: 80% Mafic, 20% Felsic, SA-A, vf peb-f peb; Sand: vf-vc, predom. c, SR; dry, no rxn w/HCl, laminas throughout, 2.5Y7/1 light gray, PS	Sonic Core Core 29 B39LW8 190-195
193.4			193.4-195.0 ~~Gravelly Silty Sand (mS)~~ JR 8/25/17: 20% Silt, 15% Gravel, 65% Sand; Gravel: vf-f peb, 80% Mafic, 20% Felsic, SA; Sand: vf-c, 60% Felsic, 40% Mafic, SA, trace mica; non-plastic, mod rxn w/HCl, dry, 2.5Y7/1 light gray, laminae throughout	Slightly Silty Gravelly Sand (m)gS
195	Core 30		195.0-196.4 Sand(S) 100%, vf-c, predom med, 70% Felsic, 30% Mafic, trace mica, WS, no rxn w/HCl, dry, 2.5Y4/2 lgr brn, massive	Core 30 B39LX0 195-200
196.4			196.4-198.0 Sand(S) 5% Silt, 95% Sand; Sand: vf, WS, 90% Felsic, 10% Mafic, SA-SR; no rxn w/HCl, dry, 2.5Y7/2 light gray, massive, non-plastic	
198.0			198.0-200.0 ~~Silty Sand (m) S~~ JR 8/25/17 (mS) JR 8/10/17: 5% Gravel, 75% Sand, 20% Silt; Gravel: f peb, SA, 80% Mafic, 20% Felsic; Sand: vf-vc, predom c, trace mica, SA; dry, mod rxn w/HCl, non-plastic, 2.5Y7/1 light gray, PS, silt laminae from 198.8-199.3	Slightly Silty Sand (m)S JR 8/25/17
200	Core 31		~~200.0-205.0 Silty Sand (mS) JR 8/10/17: 50% Silt, 50% Sand, 85% Felsic, 15% Mafic, vf, WS, SA, massive (m)S JR 8/10/17 JR 8/10/17 JR 8/10/17~~	Core 31 B39LX2 200-205
200.0			200.0-205.0 Silty Sand (mS): 50% Sand, 50% Silt; Sand: 25% Mafic, 75% Felsic, vf-m, SA, qtz, feldspar, trace mica; Silt: non-plastic; 2.5Y6/2 light brownish gray, dry, no rxn w/HCl, WS, massive	
205	Core 32		205.0-205.5 Silty Sand (mS): 50% Sand, 50% Silt; Sand: 25% Mafic, 75% Felsic, vf-m, SA, qtz, feldspar, trace mica; Silt: non-plastic; 2.5Y6/2 light brownish gray, dry, strong rxn w/HCl, MS, massive except v. thin lamina of lighter colored silt at contact, unconsolidated.	Core 32 B39LX4 205.0-210.0 Aliquot: 206.5-208.0
205.5			205.5-210.0 Sand (S): 100% Sand: 30% Mafic, 70% Felsic, vf-m, SA-SR, qtz, feldspar, mica; 2.5Y6/2 light brownish gray, dry, no rxn w/HCl, WS, massive, unconsolidated.	
210	Core 33		210.0-210.9 Silt (M): 15% sand, 85% silt; Sand: 25% Mafic, 75% Felsic, vf-f, SA, qtz, trace mica; Silt: non-plastic; 2.5Y6/2 light brownish gray, dry, strong rxn w/HCl, WS, massive, unconsolidated.	Core 33 - B39LX6 210.0-215.0
210.9			210.9-213.1 Sand (S): 100% Sand, 15% Mafic,	

Reported By:

Print Name	Title	Signature	Date
Jen Russell	Geologist	Jen Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 9 of 12

Date: 7/25/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
212.5	Core 33		85% Felsic, vf-f, SA, feldspar, qtz, trace mica; 2.5Y 5/2 grayish brown, dry, no rxn w/ HCl WS, massive, JR 8/25/17, unconsolidated.	Core 33 B39LX6 Aliquot: 211.0-213.0
215	Core 34		213.1-215.0 Sandy Gravel (SG): 70% Gravel, 20% Sand, 10% Silt; Gravel: 80% Mafic, 20% Felsic, vf peb-4.0 cm, SR-R, basalt & minor qtzite; Sand: 50% Mafic, 50% Felsic, f-vc, SA, qtz, mica; silt: non-plastic; 2.5Y 5/1 gray, dry, strong to weak rxn w/ HCl throughout, Fe staining throughout, PS, massive, unconsol.	
217.5			215.0-220.0 ~~Sandy Gravel (SG)~~: 80% Gravel, 20% Sand; Gravel: fpeb-C peb, SR, 80% Mafic, 20% Felsic; Sand: vf-vc, predom. C, qtz, feldspar, trace mica, SA; PS, dry, no rxn w/ HCL from 215.7-219.0, wk rxn from 215.0-215.7 & mod rxn from 219.0-220.0, 2.5Y 4/2 dk grayish brn, silty (10%) from 219.0-220.0, unconsolidated.	→ Gravel (G) JR 8/25/17 Core 34 B39LX8
220	Core 35		220.0-220.6: ~~Sandy Gravel (SG) 80% Gravel, 20% Sand~~; Silty Sandy Gravel (msG): Gravel: fpeb-C peb, SR, 80% Mafic, 20% Felsic; Sand: vf-vc, predom C, qtz, feldspar, trace mica, SA; PS, dry, mod rxn w/ HCL, light grayish brn, unconsolidated. ~~Gravel (G)~~. JR 8/25/17	20% Silt 20% Sand 60% Gravel JR 8/10/17
222.5			220.6-225.0: ~~Sandy Gravel (SG)~~: 80% Gravel, 20% Sand; Gravel: 80% Mafic, 20% Felsic, SA-SR, vf peb-4cm; Sand: vf-vc, predom C, 60% Felsic, 40% Mafic, SA; dry, no rxn w/ HCL, PS, 2.5Y 4/1 dk gray, layer of iron staining @ 221.2' (4cm thick), unconsolidated.	Core 35 ~~B39LX~~ JR 8/11/17 B39LY0 220-225
225	Core 36		225.0-230.0: Sandy Gravel (SG): 75% Gravel, 25% Sand; Gravel: 80% Mafic, 20% Felsic, SA-SR, Basalt, qtzite, vf peb-4cm, fewer vc peb than above (220-225), Sand: vf-vc, predom C, 50% Mafic, 50% Felsic, SA; dry, PS, no rxn w/ HCL, 2.5Y 4/1 dk gray, C-VC peb from 227.6-229.1, unconsolidated.	Core 36 B39LY2 225-230
227.5				
230	Core 37		230.0-233.6: Gravelly Sandy Silt (gSM): 30% Sand, 20% Gravel, 50% Silt; Gravel: 70% Mafic, 30% Felsic, SR-R, vf peb-2cm; Sand: f-vc, predom med, SA, 60% Felsic, 40%; 2.5Y 7/1 light gray, dry, strong rxn w/ HCL, PS.	Core 37 B39LY4

Reported By:

Print Name	Title	Signature	Date
Jen Russell	Geologist	Jen Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 10 of 12

Date: 8/11/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
232.5	Core 37		230.0-233.6 Gravelly Sandy Silt (gsM): 30% Sand, 20% Gravel, 50% Silt; Gravel: 70% Mafic, 30% Felsic, SR-R, vfpeb-2cm; Sand: f-vc, predom med, SA, 60% Felsic, 40% Mafic; 2.5Y 7/1 light gray, dry, strong rxn w/ HCl, PS, rip-up clast (clay) @ 231.3', NP, consolidated	Core 37 B39LY4 Aliquot 231-233'
			233.6-235.0: Sandy Gravel (SG); 60% Gravel, 40% Sand; Gravel: 60% Mafic, 40% Felsic, SR, vfpeb-3cm; Sand: f-vc, predom C., SA, 60% Felsic, 40% Mafic; drg, no rxn w/ HCl, 2.5Y 4/2 light brnish gray, PS, unconsolidated.	
235				
237.5				
240	NO CORES (TO PNNL)		NOT USED JR 8/11/17	
242.5				
245				
247.5				
250	Core 42		JR 8/11/17 250.0 ~~255.0~~ ~~253.7~~ - 251.8: Sandy Gravel (SG) Gravel 80% JR 8/11/17 75%, Sand 25%; Gravel: vfpeb-8cm, SR, 70% Mafic, 30% Felsic; Sand: vf-vc, predom med, SA, 70% Felsic, 30% Mafic, dry, slight rxn w/ HCl, PS, 2.5Y 5/2 grayish brn, consolidated.	Core 42 B39M116 250-255

Reported By:

Print Name	Title	Signature	Date
Jen Russell	Geologist	Jen Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 11 of 12

Date: 8/11/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
252.5	Core 42		251.8-253.7: Gravelly Sand (gS): 25% Gravel, 75% Sand; Gravel: vf peb-3cm, 40% Felsic, 60% Mafic, SR; Sand: vf-vc, predom. m/c, SA, 70% Felsic, 30% Mafic, trace mica; dry, PS, no rxn w/ HCl, 2.5Y5/2 grayish brn, 252.5-253.1 gravel content → consolidated.	Sonic Core Core 42 ~~B39LHA~~ JR 8/11/17 B39M16 250-255
	JR 8/11/17		253.7-255.0: Silty Gravel (mG): 70% Gravel, 10% Sand, 20% Silt/clay; Gravel: 1cm-6cm, SR-R, 70% Felsic, 30% Mafic; Sand: vf, can't see details; moist, slight rxn w/ HCl, non-plastic, 2.5Y4/1 dk gray, consolidated.	
255	Core 43		255.0-255.3 Sandy silt (SM) 5% gravel, 20% Sand, 75% Silt; Gravel: vf-f peb, SR, 50% Mafic, 50% Felsic; Sand: vf-f, JR 8/11/17 - vc, 50% Mafic, 50% Felsic, SA, difficult to see detail; dry, non-plastic, mod rxn w/ HCl, laminae in silt, 2.5Y4/1 dk gray, consolidated.	Core 43 B39M18 255-260
257.5			255.3-260.0: Silty Gravel (mG): 70% Gravel, 10% Sand, 20% Silt; Gravel: 70% M, 30% F, SR-R, vf peb-8cm; Sand: can't see detail - vf/f; slight rxn w/ HCl, moist, non-plastic, 2.5Y4/3 olive brn, PS, consol. 5% ACM 7/31/17 ~~90~~ 7/31/17 5% gravel	
260	Core 44		260.0-260.9: Silt (M): 3% Sand, ~~97%~~ silt/clay; ~~Sand:~~ Gravel: 80% Mafic, 20% Felsic, vf peb-1.0cm, SR; Sand: 40% Mafic, 60% Felsic, f-vc, SA, feldspar, mica; Clay: Non-plastic; 2.5Y3/2 very dark grayish brown, damp, mod rxn w/ HCl, WS, v. thin laminae, consolidated.	7/31/17 ACM Core 44 260.0-265.0 B39M20 Aliquot: 260.0-261.2
262.5			260.9-261.2: Silt (M): 5% Gravel, 95% silt/clay; Gravel: 100% Mafic, 0% Felsic, vf peb-1.0cm, SR, basalt; Silt/Clay: Non-plastic; 5Y ~~4/1~~ 4/1 dark gray, dry, no rxn w/ HCl, MS, massive, consolidated	
265	Core 45		261.2-264.1: Silty gravel (mG): 70% Gravel, 10% Sand, 20% clay/silt; Gravel: 70% Mafic, 30% Felsic, vf peb-10cm, SR-R, qtzite, basalt; Sand: 30% Mafic, 70% Felsic, m-vc, SR, qtz, ~~S~~ feldspar; Clay/Silt: Non-plastic; 2.5Y4/2 dark grayish brown, damp, slight rxn w/ HCl on cobble surfaces, PS, massive, finer gravel btw. 261.2-261.4 bgs, white-grey sand layer at 262.4 bgs; 264.1-265.0: No recovery, unconsolidated.	
267.5			265.0-268.7: Silty gravel (mG): 70% Gravel, 10% Sand, 20% Clay/Silt; Gravel: 70% Mafic, 30% Felsic, vf peb-10cm, SR-R; Sand: 30% Mafic, 70% Felsic, vf-vc, predom m; silt/clay: non-plastic; moist, PS, slight rxn w/ HCl, massive, slight odor, unconsolidated	Core 45 Optional 265-270 B39M22
	JR 8/11/17		268.7-~~270.0~~ 269.0: No recovery (overlap? (270/269.0)	
270	JR 8/11/17		~~269.0-274.0:~~ JR 8/11/17 JR 8/11/17 269.0-269.8: Silty Gravel (mG): 70% Gravel, 10% Sand, 20% Silty Gravel: 70% M, 30% F, vf peb-10cm, SR-R; Sand: 30% M, 70% F, vf-vc; Silt: non-plastic, dry, PS, no/slight rxn w/ HCl, 269.8-274.0: No recovery	Core 46 Optional 269-274 B39M24

Reported By:

Print Name	Title	Signature	Date
Jen Russell	Geologist	Jen Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 12 of 12

Date: 8/11/17

Well ID: C9497 | Well Name: NA | Location: 216-B-42

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
272.5			269.8-274.0: No recovery - overlap?	Sonic Core
				Core 47 Optional
			272.3-273.0: Silty Gravel (mG): 70% Gravel, 5% Sand, 25% Silt; Gravel: 70% M, 30% F, vf peb-10cm, SR-R; Sand: 30% M, 70% F, vf-vc, SA; Silt: non-plastic; dry, PS, no/very slight rxn w/ HCL, massive, unconsolidated.	B39M24
				272.3 - 275.0
275	Core 46 Optional		273.0-275.0: No recovery	Total Depth 275.0' bgs
277.5				
280				
282.5				
285				
287.5				
290				

NOT USED 8/25/17 JR

Reported By:

Print Name	Title	Signature	Date
Jen Russell	Geologist	Jen Russell	8/25/17

A-6006-993 (REV 0)

BOREHOLE LOG

Page 1 of 8
Date: 9/1/17

Well ID: C9503	Well Name: NA	Location: 216-T-7TF
Project: Four Boreholes in the 200-DV-1 OU		Reference Measure Point: Ground Surface

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
70	Core 1		70.0-71.0: No recovery	Core 1 B39VP1 70.0-72.5
			71.0-71.5: Silt (M): 15% Sand, 85% Silt; Sand: f-m, unable to identify mafic/felsic content & angularity; non-plastic, moist, 2.5Y 3/2 very dk grayish brn, wk-mod rxn w/ HCl	60 cpm
72.5	Core 2		71.5-72.5: Sand (S): 100% Sand, vf-vc, predom. m-c, 35% mafic, 65% felsic, moist, no rxn w/ HCl, MS, 2.5Y 5/2 grayish brn, SA	Core 2 B39VP3 72.5-75.0
			72.5-73.5: Sand (S): 90% Sand, 10% Silt; Sand: vf-m, predom. m, 75% felsic, 25% mafic, qtz, feldspar, SA; Silt: non-plastic, 2.5Y 5/2 grayish brown, MS, no rxn w/ HCl, massive except fine lamina of Fe-stained silt at 73.4 bgs. 73.5-75.0: Sand (S): 100% Sand; Sand: m-vc, 70% felsic, 30% mafic, SA, qtz, trace mica, 2.5Y 5/2 grayish brown, dry, WS, massive, no rxn w/ HCl	10/12/17 AEM
75			77.5 — 105.0 No core	No Core 3
77.5			AEM 10/12/17	
80				No Core 4
82.5				
85				No Core 5

Reported By:			
Angela McGuire (Print Name)	Geologist (Title)	Angela McGuire (Signature)	10/12/17 (Date)
Reviewed By:			
Tessa Clark (Print Name)	Geologist (Title)	(Signature)	10/20/17 (Date)

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-642 (REV 1)

BOREHOLE LOG (Cont.)

Page 2 of 8

Date: 9/1/17

Well ID: C9503 | Well Name: NA | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
87.5			77.5-105.0- No Core	No Core 5
90				No Core 6
92.5			AGM 10/12/17	
95				No Core 7
97.5				
100				No Core 8
102.5				
105	Core 9		105-110: Slightly silty sand (m) S: 85% Sand, 15% Silt; Sand: vf-c, predom med; 30% ~~Felsic~~ Mafic, 70% Felsic, trace mica; Silt: non-plastic; Strong rxn w/ HCl, no rxn from 108.7-109.0 & 109.4-110.0, 2.5Y 3/3 light olive brn & white (2.5Y 8/1), dry, PS.	Core 9 B39VW1 105-110'

Reported By:

Angela McGuire	Geologist	Angela McGuire	10/12/17
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 3 of 8

Date: 9/1/17

Well ID: C9503 | Well Name: NA | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
107.5	Core 9		105-110: Slightly silty sand (m) S: 85% Sand, 15% Silt; Sand: vf-c, predom m, 30% Fel Mafic JR 9/1/17, 70% Felsic, nonplastic, $CaCO_3$ cem throughout, strong rxn w/ HCl, no rxn from 108.7-109.0 & 109.4-110.0, 2.5Y5/3 light olive brn & white (2.5Y 8/1), dry, PS. @ 108.7 - fining downward to vf sand; 107.7-108.7 strong cem. 109.0-~~110~~ JR 9/1/17 109.4 strong/v.st. cem $CaCO_3$	SA Core 9 B39VW1 105-110' Aliquot 108-110'
110	Core 10		109.0-109.25 - silty/laminated ~~110-113.3 Sand (S) 100% 50% Mafic 50% Felsic, SA, trace mica, WS, dry, iron staining, m-c.~~ 10/3/17 ACM 110.0-111.5: Silty Sand (mS): 70% Sand, 30% Silt; sand: vf-f, 85% felsic, 15% mafic, too fine to distinguish angularity, trace mica; silt: mod plastic; 2.5Y 6/3 lt yellowish brown, WS, dry, no rxn w/ HCl except at light-colored lamina 110.5, 110.7, 111.5, bedding of silt/clay and minor sand from 110.5-110.8, ~~110.8-~~ 111.1	®very little sediment to use for samples = strong cementation Core 10 B39VW3 110-115'
112.5			111.5-115.0: Silt (M): 10% Sand, 90% silt/clay; Sand: f-c ~~VC~~ 10/3/17 ACM, 50% mafic, 50% felsic, SA, qtz, trace mica, some sand throughout but mainly in beds at 111.9, 113.8-114.0; silt: mod plasticity; 2.5Y 6/4 lt yellowish brown, dry, mod-strong rxn w/ HCl throughout except within sand beds, WS, lighter-colored silt/clay at 111.5-111.6, 114.2-114.4 bgs.	10/4/17 ACM ~~Core 11 B39VW5 115-120'~~
115	Core 11		115.0-120.0: Silty Sand (mS): 50% Sand, 50% Silt/clay Sand: vf-f, too fine to tell mafic v. felsic or angularity, trace mica visible; 2.5Y 5/3 lt olive brown, dry, 10/3/17 ACM slight rxn to HCl throughout, beds of coarser sand at 115.3-115.5, 117.7; area of lighter colored clay/silt from 115.6-115.8 bgs, nodule of slightly more cemented silt at ~~115.6~~ 10/3/17 ACM 117.0, v. fine laminae at 119.2 to 120.0, possibly due to drilling	Core 11 B39VW3 115-120' Silt: mod. plastic
117.5			120.0-120.3: Silty Sand (mS): 50% Sand, 50% silt; sand: vf-f, too fine to tell m v.f, angularity, trace mica; Silt: mod. plastic, 2.5Y 3/2 lt olive brown, dry, massive, WS; 120.3-121.5: Sand (S): 90% Sand, 10% Silt; Sand: vf-vc, vc concentrated in lens at 120.3 and at contact at 121.4-121.5, m in bed at 121.0, vf-f throughout, 80% felsic, 20% mafic, more mafic (30%) in coarse areas, SA; Silt: non-plastic, conc in lenses at 120.3, 120.7 bgs, 2.5Y 6/2 lt brownish grey, dry, no rxn w/ HCl except slight rxn in silty lenses; 121.5-122.8: Silty Sand (mS): 50% Sand, 50% silt; sand: vf-f, c-vc in alternating beds at 121.9, 122.1, 122.2, 122.3, 122.4, 122.6 bgs, 50% m, 50% f in c-vc sand, SA, too fine to distinguish m v.f/angularity in vf-f; silt: mod plastic; 2.5Y 3/2 lt olive brown, WS and massive except for coarse layers described, slight rxn to HCl	Core 12 - B39VW7 120-125'
120				
122.5	Core 12			
125	Core 13		125-128.3: Sand (S): 100% Sand, 60% Felsic, 40% Mafic, trace mica, SA, WS, no rxn w/ HCl, 2.5Y 4/2 dk g brn, m-c, dry, iron staining @ 125.5	Core 13 B39VW9 125-130' Aliquot 126-128'
JR 9/1/17			122.8-125.0: Sand (S): 100% Sand, 60% Felsic, 40% Mafic, m-vc qtz, trace mica, SA, WS, 2.5Y 4/2 dark gray brown, dry, no rxn w/ HCl, massive, slight coarsening downwards.	

Reported By: Angela McGuire 10/3/17 ACM (Print Name) | Signature | Date

Geologist: Angela McGuire 10/12/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 4 of 8

Date: 9/1/17

Well ID: C9503 | Well Name: NA | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
127.5	Core 13		125.0-128.3: Sand(S): 100% Sand, 60% Felsic, 40% Mafic, trace mica, SA, WS, no rxn w/ HCl, 2.5Y 4/2 dk gy brn, m-c, dry, iron staining layer @ 125.5	Core 13 B39VW9 125-130' Aliquot 126-128'
130	Core 13		128.3-130.0: Silty Gravel (mG): 70% Gravel, 30% Silt; Gravel: vf p-7cm, SR, 70% Mafic, 30% Felsic, silt: non plastic; CaCO3 cem throughout, Strong rxn w/ HCl, 2.5Y 7/3 pale brn, dry, PS, basalt, qtzite; 130.0-131.7: Silty Gravel (mG): 70% Gravel, 30% Silt; Gravel: vfp-8 cm, 70% Mafic, 30% Felsic, SR, Silt: non-plastic; mod. rxn w/ HCl, 2.5 6/3 lt yellowish brown, dry, PS;	Core 14 B39VX1 130-135'
132.5	Core 14		131.7-132.7: Sandy Gravel (sG): 40% Gravel, 50% Sand, 10% Silt, Gravel: fpeb-10 cm, 80% m, 20% f, SR-SA, basalt, quartzite; Sand: f-m, 80% f, 20% m, SA, trace mica; silt: non-plastic; 2.5Y 5/2 grayish brown, silt becomes grayer after 132.2 bgs, dry, no rxn w/ HCl, PS, massive; 132.7-133.4: Gravel (G) 80% Gravel, 20% Sand; Gravel: vfpeb-8 cm, 85% m, 15% f, SA-SR; Sand: vf-vc, SA 75% m, 25% f, 2.5Y 6/2 lt brownish grey, no rxn w/ HCl, PS, massive; 133.4-133.7: Silt (M): 95% Silt, 5% Sand; Sand-vf-f, too fine to dist. m/f, angularity) Silt: non-plastic 2.5Y 7/1 lt gray, CaCO3 cem;	
135	Core 15	10/20/17 ACM	135.0-136.4: Sandy Gravel (sG): 50% Gravel, 45% Sand, 5% Silt; Gravel: vfpeb-5cm, SR, 40% mafic, 60% felsic, basalt and quartzite; Sand: f-m, SA-SR, 20% mafic, 80% felsic, quartz, trace mica; silt: non-plastic; 2.5Y 6/3 light yellowish brown, dry, PS, no rxn w/ HCl, v. thin silt laminae at 136.1, 136.2, dark staining from 135.0-135.3, possibly related to drilling. ACM 9/7/17	Core 15 B39VX3 135-140' 133.7-135.0: Silty Sandy gravel (mG): Gravel: vfpeb-10 cm, 75% m, 25% f, SR; Sand: f-c, 30% m, 70% f, SA; silt: non-plastic; 2.5Y 6/2 lt brownish grey, PS, massive, mod rxn w/ HCl
137.5	Core 15		136.4-136.9: Silty Gravel (mG): 50% Gravel, 50% clay/silt; Gravel: mpeb-8 cm, SR, 30% ~~fels~~ mafic, 70% felsic, basalt and qtzite; silt/clay: non-plastic; 2.5Y 8/1 white, dry, PS, no rxn w/ HCl, ~~cemented~~ consolidated 9/7/17 ACM 136.9-137.9: Sandy Gravel (sG): 55% Gravel, 40% Sand, 5% Silt; Gravel: vfpeb-6cm, SR, 50% mafic, 50% felsic, basalt + qtzite; sand: vf-vc, SA, 40% mafic, 60% felsic, trace mica; silt: non-plastic, 2.5Y 6/3 lt yell ~~brown~~ brown, dry, PS, no rxn w/ HCl, thin silt lamina at 137.8, layer of black staining at 137.5 bgs; 137.9-138.3: Silty Gravel (mG): 50% Gravel, 50% clay/silt; Gravel: mpeb-8 cm, SR, 30% mafic, 70% felsic, qtzite; silt: non-plastic, 2.5Y 8/1 white, dry, no rxn w/ HCl, clay cemented; 138.3-140.0: Sandy Gravel (sG): 65% gravel, 25% Sand, 10% silt; Gravel: vfpeb-7 cm, 30% mafic, 70% felsic, SR-R, qtzite, Sand: f-c, 20% mafic, 80% felsic, SA-SR, silt: non-plastic, 2.5Y 6/3 lt yell brown, dry, PS, no HCl rxn, clay/silt laminae at 138.6, 138.7, 138.8 ACM 9/7/17	30% Gravel, 35% Sand, 35% silt 10/3/17 ACM; Core 15 ~~B39VX3 135-140'~~ ACM 9/7/17
140	Core 16		140.0-141.4 ~~Silty Sandy~~ Gravel (msG): Gravel 40%, silt/clay 40%, 20% Sand, Gravel: vfpeb-6 cm, SA-R, 90% mafic, 10% felsic, basalt dom; Sand: vf-vc, SA, 50% mafic, 50% felsic; Silt: non-plastic, 2.5Y 5/3 lt olive brown, dry, PS, no rxn w/ HCl, gray clay laminae at 140.4 bgs, 141.1 bgs; 141.4-143.3: Silty Gravel (mG), Gravel 55%, 5% Sand, 40% clay/silt; Gravel: vfpeb-10cm, SA-SR, 60% mafic, 40% felsic, Sand: vf-m, SA, 60% felsic, 40% mafic; silt/clay: non-plastic, 2.5Y 6/4 lt yell brown, dry, PS, no rxn w/ HCl, dark staining in silt/clay around cobble at 142.3 bgs; 143.3-144.0: Silty Sand gravel (msG) 70% Gravel, 15% Sand, 15% Silt; Gravel: 40% mafic, 60% felsic, vfpeb-8 cm, SR-R, Sand: f-vc, 50% m, 50% f, SA; silt: non-plastic; 2.5Y 6/2 lt brownish grey, dry, PS, no rxn w/ HCl, massive; 144.0-145.0: Silty Gravel (mG): Gravel 50%, Silt 50%; Gravel: mpeb-10 cm, SA-SR, 90% mafic, 10% felsic; silt: non-plastic; 10/20/17 ACM 5Y 6/1 gray, dry, no rxn w/ HCl, PS, massive.	Core 16 B39VX5 140-145' Core 16 Aliquot: 140-145'
145	Core 17			Core 17 145-150'

Reported By: Angela McGuire (Print Name) | Title: Geologist | Signature: Angela McGuire | Date: 10/12/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 5 of 8

Date: 9/15/17

Well ID: C9503 | Well Name: NA | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
147.5	Core 17		145.0-149.6: Sandy Gravel (SG): 70% Gravel, 20% Sand, 10% Silt; Gravel: 80% Felsic, 20% Mafic, m peb - sm. cobble, R; Sand: vf, 80% Felsic, 20% Mafic, SA; non-plastic, dry, wk rxn w/HCL, 2.5Y 7/3 pale brn, PS.	Core 17 B39VX7 145-150'
			149.6-150.0: Silty Gravel (mG): 75% Gravel, 25% Clay	
150			Gravel: m peb-sm cob, R, 80% Felsic, 20% Mafic; low plasticity, no rxn w/HCL, 2.5Y 5/3 light olive brn, dry.	
			150.0-165.0 - No Core	No Core 18 150-155'
152.5				
155				No Core 19 155-160'
			10/2/17 ACM	
157.5				
160				No Core 20 160-165'
162.5				
			10/3/17 ACM (mSG)	
165	Core 21		165.0-170.0: Silty Sandy Gravel: 35% Gravel, 50% Sand, 15% Silt; Gravel: vfpeb-10cm, 60% mafic, 40% felsic, SR; Sand: f-m, 75% ~~mafic~~ felsic, 25% mafic, quartz, trace mica, SA; silt: non-plastic; 2.5Y 6/2 lt brownish grey 10/3/17 ACM	Core 21-B39W07 165-170'

Reported By:

Print Name	Title	Signature	Date
Angela McGuire	Geologist	angela McGuire	10/12/17

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 6 of 8

Date: 10/10/17

Well ID: C9503 | Well Name: NA | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
167.5	Core 21		165.0-170.0-Silty Sandy Gravel (msG): 35% Gravel, 50% Sand, 15% Silt; Gravel: vfpeb-10 cm, 60% mafic, 40% felsic, SR; Sand: f-m, 75% felsic, 25% mafic, qtz, trace mica, SA; Silt: non-plastic, 2.5Y 6/2 lt brownish gray, PS, no rxn w/ HCl, siltier bed from 165.3-165.5 bgs, lt pink bed (1.0 cm) K-feldspar gravel, SA-A, at 166.4 bgs, 0.5 cm-thick silt beds surrounding cobble at 168.1 and 168.5 bgs	Core 21 B39W07 165-170'
170	10/20/17 ACM		170.3-174.3: Silty Sand Gravel (msG): 30% Gravel, 50% Sand, 20% Silt; Gravel: fpeb-8 cm, SR-R, 50% mafic, 50% felsic, basalt, qtzite; Sand: f-c, SA, 20% mafic 80% felsic; clay/ 10/18/17 ACM Silt: non-plastic, 2.5Y 6/4 lt yellowish brown, moist, inc. in moisture content from 172.6-174.3 bgs, PS, no rxn w/ HCl.	Core 22-B39W09 170.3-175.3 Aliquot: 171.3-174.1
172.5	Core 22		174.3-175.3: Silty Gravel (mG): ~~50%~~ 10/18/17 ACM Gravel, 50% silt/clay; Gravel: fpeb-9 cm, SA-SR, 60 70% mafic, 30% felsic; silt/clay: non-plastic; 2.5Y 7/1 lt gray, dry, no rxn w/ HCl, PS, massive	40
175	10/20/17 ACM		175.4-180.4: Sandy Gravel (sG): 40% Gravel, 50% Sand, 10% silt; Gravel: fpeb-9 cm, 50% mafic, 50% felsic, basalt, quartzite, SR; Sand: f-m, 85% felsic, 15% mafic, SA, qtz, feldspar, Silt: Non-plastic; 2.5Y 6/4 light yellowish brown, dry, PS, no rxn w/ HCl, unconsolidated but some cementation around large cobbles, mostly massive, silt lamina at 176.5, 176.7, band of Fe-staining at 179.8 bgs	10/18/17 ACM 3 grantic cobbles at 177.4 bgs. Core 23-B39W11 175.4-180.4
177.5	Core 23			
180			180.2-185.2: Sandy Gravel (sG): 40% Gravel, ~~50%~~ 55% 10/10/17 ACM Sand, ~~10%~~ 5% 10/10/17 ACM Silt; Gravel: fpeb-8 cm, 70% felsic, 30% mafic, concentration of basaltic cobbles at 183.2-183.5, very consolidated here; otherwise dominated by qtzite SR; Sand: m-vc, 80% felsic, 20% mafic quartz, feldspar, trace mica. SA; Silt: non-plastic, scattered in ~~finely~~ 10/10/17 ACM thin lenses ~~throughout~~ 10/10/17 ACM at 181.8, 183.0, 184.0; 2.5Y 6/4 light yellowish brown, dry, PS, massive, no rxn w/ HCl, somewhat consolidated especially around large cobbles, Fe staining throughout; areas of black staining at 180.2, 182.9 bgs	Core 24-B39W13 180.2-185.2
182.5	Core 24			
185	10/20/17 ACM Core 25		185.2-186.2: Silty Gravel (mG): 40% Gravel, 10% sand, 50% silt/clay 9/18/17 ACM clay; Gravel: vfpeb-9 cm, 40% mafic, 60% felsic, SR; Sand: vf-c, 30% mafic, 70% felsic, SA; Silt/Clay: non-plastic; 2.5Y 7/1 light grey, dry, PS, no rxn w/ HCl;	Core 25-B39W15 185.2-190.2 Aliquot: 186.2-189.2

Reported By:

Angela McGuire	Geologist	Angela McGuire	10/12/17
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Page 7 of 8

Date: 9/13/17

Well ID: C9503 | Well Name: NA | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
187.5	Core 25		185.2-186.2: Silty Gravel (mG): 40% Gravel, 10% Sand, 50% silt/clay; Gravel: vfpeb-9 cm, 40% mafic, 60% felsic, SR; Sand: vf-c, 30% mafic, 70% felsic, SA; silt/clay: non-plastic; 2.5Y 7/1 light grey, dry, PS, no rxn w/ HCl, some dark green staining around 185.0; 186.2-190.2: Sandy Gravel (sG): 35% Gravel, 55% Sand, 10% Silt; Gravel: vfpeb-9 cm, 50% mafic, 50% felsic, SR; Sand: f-vc, 20% mafic, 80% felsic, SA-SR, trace mica, 2.5Y 7/4 pale brown, mostly dry, some moisture around cobbles at base btw. 188.5-190.2 bgs, no rxn w/ HCl, of coarse sand at ~~187.8~~ 187.8 bgs, v. thin laminae clay/silt at ~~187.9, 188.7~~ 186.9, 187.7 bgs, somewhat consolidated, PS.	Core 25 - B39W15 185.2-190.2 Aliquot: 186.2-189.2 silt/clay: non-plastic bed (1cm) 9/13/17 ACM
190				
192.5	Core 26		190.5-195.5: Sandy Gravel (sG): 60% Sand, 40% Gravel; Gravel: fpeb-10cm, 60% felsic, 40% mafic, SR; basalt, qtzite; Sand: f-vc, 85% felsic, 15% mafic, trace mica, qtz, feldspar, SA; 2.5Y 6/4 lt yellowish brown, PS, massive, no rxn w/ HCl, dry, unconsolidated but ~~cemented~~ more consolidated around clusters of cobbles	Core 26 - B39W17 190.5-195.5
195			Sandy Gravel 195.4-200.4: Sandy Sg Gravel (sG): 45% Gravel, 50% Sand, 5% Silt; Gravel: vfpeb-9cm, 50% mafic, 50% felsic, quartzite, basalt, SR, concentration of fpeb ~~195.5-198~~ ~~195.8~~ bgs 198.5-198.8 bgs; Sand: f-c, 85% felsic, 15% mafic, quartz, feldspar, mica, SA; Silt: non-plastic, 0.5 cm-thick lamina at 199.4 bgs; 2.5Y 6/4 lt yellowish brown, PS, massive, dry, no rxn w/ HCl in sand matrix, slight rxn w/ HCl on cobble surfaces, some Fe-staining associated with cobbles and pebbles, somewhat consolidated throughout.	Core 27 - B39W19 195.4-200.4
197.5	Core 27			
200			200.2-205.2: Sandy Gravel (sG): 50% Gravel, 50% Sand, Silt 5%; Gravel: 70% felsic, 30% mafic, fpeb-9 cm, SR, quartzite, basalt; Sand: f-c, 80% felsic, 20% mafic, SA, qtz, trace mica; Silt: non-plastic, thin laminae at ~~208.6, 208.7~~ bgs 203.6, 208.7 bgs 2.5Y 6/4 lt yellowish brown, dry, PS, massive, large cobbles throughout; Fe staining in sand associated with cobbles, somewhat consolidated, no rxn w/ HCl in sand matrix, slight rxn w/ HCl on some cobble surfaces	Core 28 - B39W21 200.2-205.2
202.5	Core 28			
205	Core 29		205.1-207.8: Sandy Gravel (sG): 45% Gravel, 45% Sand, 10% Silt; Gravel: fpeb-7cm, 40% mafic, 60% felsic, SR, basalt, qtzite; Sand: vf-c, 20% mafic, 80% felsic, SA; Silt: non-plastic; 2.5Y 6/4 lt yellowish brown, slightly damp,	Core 29 - B39W23 205.1-210.1 Aliquot: 206.1-209.1

Reported By:

Print Name	Title	Signature	Date
Angela McGuire	Geologist	Angela McGuire	10/12/17

A-6006-993 (REV 0)

BORELOG (Cont.)

Page 8 of 8

Date: 10/10/17

Well ID: C9503 | Well Name: NA | Location: 216-T-7TF

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
207.5	Core 29		205.1 - 207.8: Sandy Gravel (SG): 45% Gravel, 45% Sand, 10% Silt, Gravel: fpeb - 7 cm, 40% mafic, 60% felsic, basalt, qtzite, SR; Sand: vf-c, 20% mafic, 80% felsic, SA; silt: non plastic, 2.5Y 6/4 lt yellowish brown, slightly damp, PS, no rxn w/ HCl, 8 cm band of clay surrounding cobbles 206.0-206.5, 9/13/17 ACM pink/tan clay band at contact 207.8 bgs. 9/13/17 ACM Fe staining throughout; 207.8 - 209.1: Silty Sandy Gravel (mSG): 40% Gravel, 30% Sand, 30% clay/silt; Gravel: mpeb - 6cm, 30% mafic, 70% felsic, qtzite, basalt, SR, Sand: vf-c, 9/13/17 ACM - m, 20% mafic, 80% felsic, SA, trace mica, silt/clay: non-plastic; 2.5Y 6/3 lt yellowish brown, damp, no rxn w/ HCl, PS, massive, Fe staining throughout, somewhat consolidated; 209.1 - 210.1: Silty Sand, Gravel (mSG): 45% Gravel, 35% Sand, 20% Silt; Gravel: vfpeb - 5 cm, 50% mafic, 50% felsic, SA-SR, basalt, qtzite; Sand: vf-m 9/13/17 ACM vc, 20% mafic, 80% felsic, SA, qtz, feldspar, trace mica, silt/clay: non-plastic; 2.5Y 7/3 pale brown, dry, PS, no rxn w/ HCl, massive	Core 29 - B39W23 205.1 - 210.1' Aliquot: 206.1 - 209.1'
210	10 20/17 ACM			
212.5	Core 30		210.4 - 215.4: Sandy Gravel (SG): 35% Gravel, 65% Sand; Gravel: 90% Felsic, 10% Mafic; fpeb - 5 cm, SR-R, dominantly qtzite, few granite; Sand: f-m, 75% felsic, 25% mafic, SA, quartz, mica; 2.5Y 6/2 lt brownish gray, dry, massive, no rxn w/ HCl, PS, Fe staining throughout, dark prominent band of staining 212.5-212.7 bgs, dark staining around cobbles 219.8 bgs.	Core 30 - B39W25 210.4 - 215.4'
215				
217.5	Core 31		215.3 - 220.3: Sandy Gravel (SG): 35% Gravel, 65% Sand; Gravel: 90% Felsic, 10% Mafic; fpeb - 10cm, SR, larger cobbles from 215.3 - 216.6 bgs, f-coarse pebbles below this; Sand: f-m, 75% felsic, 25% mafic, SA, qtz, mica; 2.5Y 6/2 lt brownish gray, dry, massive, PS, no rxn w/ HCl, Fe staining throughout, dark staining 215.3 - 215.7 bgs	Core 31 - B39W27 215.3 - 220.3'
220				
222.5	Core 32		220.5 - 221.5: Sand (S) 100%: vf-f, 20% Mafic, 80% Felsic, WS, dry, no rxn w/ HCl, SA, 2.5Y 4/2 light brnish gray 221.5 - 225.5: Sandy Gravel (SG): 30% Sand, 70% Gravel; Gravel: m peb - 6cm, SR, 90% Felsic, 10% Mafic; Sand: vf-f, 20% Mafic, 80% Felsic, SA; dry, no rxn w/ HCl, significant iron staining throughout, PS, 2.5Y 5/6 light olive brn	Core 32 B39W29 220.5 - 225.5' Aliquot JR 9/15/17 ~~220.5 - 222.5~~ 220.5 - 221.5'
225			Total Depth 225.5 ft bgs	

Reported By:

Angela McGuire	Geologist	Angela McGuire	10/12/17
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG

Date: 9/21/17

Well ID: C9513	Well Name: NA	Location: 216-S-13 Crib
Project: 200-DV-1 Operable Unit		Reference Measure Point: Ground Surface

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
45	Core 1		45.0-45.2: Sandy Gravel (sG): 30%g, 60%s, 10%m. G: v.fn to crse. pebbs (2cm), A to SR, 70%m, 30%s. Sand: vfn-vc, 60%f, 40%m, SA-SR, qtz; 2.5Y 4/3 olv. brn, no rxn w/HCl, PS, massive;	Core 1 B39WV0 45.0-47.5
			45.2-46.4: Sand (s): 95%s, 5%g: G: v.fn pebs, A to SA, 50%m, 50%fels; Sand: fn to v. crse, 50%m, 50%fels, SA-SR, 2.5Y 4/3 olv. brn, no rxn w/HCl; PS, massive; v.fn-m s. interbed (1.0-1.5cm) @ 45.5, 45.6, 45.9, 46.1, + 46.3; v. crs s./v.fn peb. interbed (1.5cm) @ 46.0.	
47.5	Core 2		46.4-47.5: Slightly Silty Sand ((m)S): 80%s, 20%m: S: v.fn-crs, 75%f, 25%m, SA-SR, 2.5Y 5/2, grayish brn, dry, no rxn w/HCl, PS, interbedded/coarsens downward; rhythmites, v.fn s/m laminae (~1mm).	
			47.5-48.8: Gravelly Sand (gS): 10%g, 90%s; G: v.fn-m pebs (10mm max), A-SA, 80%m, 20%f; S: v.fn-vc, 50%m, 50%f, SR-A, 2.5Y 4/2, dark grayish brn, dry, no rxn w/HCl; WS; massive; fn sand interbed @ 48.3' bgs (3cm)	Core 2 B39WV4 (TC) 10-13-17 47.5-50.0
50	Core 3		50.0-50.2: Silty Sand (mS): 50%s, 50%m; S: v.fn-m, 50%m, 50%fels, SA-SR; m: non-plastic; 2.5Y 4/2 dark gray brown; moist, comp, massive, mod rxn w/HCl.	Core 3 B39WV6 50-55
52.5			50.2-54.5: Sand (S): 5%g, 95%s; G: v.fn-m pebs (max 9mm), A-SA, 60%m, 40%f; S: v.fn-vc, 50%m, 50%fels, SR-A, 2.5Y 4/1, dark gray, dry, no rxn w/HCl; WS; massive; fn-fn. s. interbeds @ 50.3 (1mm), 50.4 (3mm) + 50.5 (2cm); Fe-staining @ s. interbeds; gmd. contact @ 54.5.	
			54.5-55.0: Sand (s): 5%g, 95%s; G: v.fn-m pebs (max 9mm), A-SA, 60%m, 40%f; S: v.fn-vc, 50%m, 50%fels, SR-A, 2.5Y 4/1, dark gray, dry, strong rxn w/HCl; WS, mass; Ca-cementation.	
			55-57.8: Sand (s): 5%g, 95%s; G: v.fn-m pebs, A-SA, 60%m, 40%f; S: v.fn-vc, 50%m, 50%fel, SR-A, 2.5Y 4/1, dark gray, dry, no rxn w/HCl; WS; massive; micas; gmd. contact @ 57.8.	
55	Core 4		57.8-58.3: Silty Sand (mS): 75%s, 25%m. S: v.fn-c, predom v.fn-m, 60%m, 40%m, SR-A; m: non-p, cementation; 2.5Y 6/2 lt. brnish gray; dry; ~~mass cem~~ (TC) 10-13-17 fels; strong rxn w/HCl; minor rhythmites; cemented; PS.	Core 4 B39WV8 55-60
57.5			58.3-59: Sand (s): 5%g, 95%s; G: v.fn-m pebs (9mm), A-SA, 60%m, 40%fel; S: v.fn-vc, 50%m, 50%fels, SR-A, 2.5Y 4/1 dark gray; dry, no rxn w/HCl (mod @ 58.3 + 59 contacts); WS, massive; micas; gmd contact @ 59'.	
57.2 (TC) 10-13-17			59.0-60.0: Silty Sand (mS): 50%s, 50%m; S: v.fn-vc, 70%f, 30%m, SA; m: non-plast; 2.5Y 6/1, gray, dry, strong (TC) 10-13-17 mod rxn w/HCl; silt (85%m, 15% v.fn mafic s.) dike ends @ 59.6; silt interbeds and nodules present throughout; all silt = v. strong rxn w/HCl; lower 2" of liner = melted/warped.	
60	Core 5		60.0-61.1: Sandy Silt (sM): 30% Sand, 70% Silt; Sand: vf-vc, predom vf, SA, 30%M, 70%F; Silt lamina @ 60.5', Sand rhythmites 60.7-61.1, Silt dike (1cm), non plastic, moist, no rxn w/HCl, 2.5Y 5/2 grayish brn	Core 5 B39WW0 60-65' Aliquot
			61.1-63.3: Sand (S): 100%, vf-m, 30%M, 70%F, trace mica, WS, SA, 2.5Y 5/2 grayish brn, massive w/ 1 cm silt dike, no rxn w/ HCl	61.0-63.0'
			63.3-63.8: Silt (M) 100%, non-plastic, dry, 2.5Y 7/3 pale brn, strong rxn w/ HCl	

Reported By:

Print Name	Title	Signature	Date
T. Clark / Jen Russell	Geologist / ~~Jen Russell~~ Geologist JR 10/27/17	T. C. / Jen Russell	10-26-17 / 10-27-17

Reviewed By:

Print Name	Title	Signature	Date
Sarah Springer	geologist (PG)	Sarah Springer	10-31-17

For Office Use Only

OR Doc Type:	WMU Code(s):

BOREHOLE LOG (Cont.)

Date: 9/21/17

Well ID: C9513 | Well Name: NA | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
62.5	Core 5		63.8-65.0: Sand(S) 100%: m-c, 10%M, 90%F, no rxn w/HCl, dry, SA, WS, 4cm silt dike ~~→strong rxn w/HCl~~	Core 5 B39WW0 60-65' Aliquot 61.0-63.0'
65	Core 6		65-65.4: Sand(S): 90%cs, 10%m; v.fn-c, predom vf-m; SA, 70% fels, 30% maf, PS, dry, 2.5Y 5/2 grayish brn, no rxn w/HCl, massive; silt nodules @ corners @65' top of core (strong rxn w/HCl); ~1cm.	Core 6 B39WW2 65-70
67.5			65.4-69.0: Slightly Silty Sand((m)S): 80%cs, 20%m; S: v.fn-m, 30% mf, 70% fels, trace mica, WS, SA, 2.5Y 5/3, lt. olive brn, no rxn w/HCl, dry; rhythmites throughout; grad. contact @69.	
70	Core 7	(TD) 10-13-17	69.0-~~Sand~~ 69.8 (TD) 10-13-17: sand(S): 90%cs, 10%m; S: v.fn-vc, 50% fels, 50% maf, SA-SR, mica, PS; 2.5Y 5/2 grayish brn, dry, no rxn w/HCl; massive; dark gray silty sand interbed (0.6cm) @ 69.3; lt. ol brn (m)S interbed (2.5cm) @69.6, 1.0cm @69.7; strong rxn w/HCl.	
72.5			69.8-73.1: ~~Sand(S)~~ (TD) 10-13-17 Slightly Silty, Sand((m)S): 80%cs, 20%m; S: vfn-m, 30% mf, 70% fels, mica, WS, SA, 2.5Y 5/3 lt. olive brn, dry, no rxn w/HCl; rhythmites throughout; 2cm thick c. sand interbed @ 72.9 (2.5Y 6/2).	Core 7 B39WW4 70-75 No Core 8 or 9.
75	Core 10		73.1-74.5: Slt. Silty Sand((m)S): 80%cs, 20%m; S: vfn-c, predom vf-m; SA; 60%F, 40%M; MS; 2.5Y 6/2 lt. brnish gray; moist upper 2cm to dry; ~~to~~ wk rxn to HCl. (TD) 10-13-17 ← (TD) 10-13-17	
			74.5-75.0: Sandy Slt(sM): 30%S, 70%m; S: vf-c, predom vf, 90%F, 10%m, SA; m: non-plast; wk-str rxn w/HCl; moist, massive; 2.5Y 4/3 ol. brn, MS (minor rhythmites 73.1-73.3; grad contact @ 74.5)	
			75.0-80.0: Sandy Silt(sM): 30% Sand, 70% Silt; Sand: vf-c, predom vf, 90%F, 10%M, SA; non-plastic, wk-strong rxn w/HCL, moist, platy structure from 76.5-80.0, 2, MS	Core 10 B39WX0 75-80'
77.5			75.0-76.5: 2.5Y 4/3 olive brn	Aliquot 76-79.0'
			75.9-76.2: c. sand 76.4-76.5: c. sand	
			75.8-76.5: iron staining, prominent @ 76.2	
			76.5-79.0: 2.5Y 6/2 light brnish gray w/f sand laminae throughout	
			79.0-80.0: 2.5Y 6/2 grayish brn, decreased sand content	
80	Core 11		80.0-85.0: Silty Sand(mS): 50%S, 50%m; Sand: vf-c, predom vf-f, 75% fels, 25% mf, SA; m: non-plast; no rxn w/HCl; dry; platy structure ~~(80-80.4)~~ (TD) 10-26-17 (80-80.4)(82.7-85.0); laminae throughout (80.4-82.7); MS; 2.5Y 5/3 light olive brn; Fe staining on laminae (80.4-81.6); silt laminae @81.1, 81.3, 81.4, 81.6; Fe-stained ~~m.f~~ (TD) 10-26-17.	Core 11 80.0-85.0'

Reported By:

Print Name	Title	Signature	Date
T. Clark / Jen Russell	Geologist / Geologist	T. Clark / Jen Russell	10-26-17 / 10-27-17

BOREHOLE LOG (Cont.)

Date:

Well ID: C9513 | Well Name: NA | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
82.5	Core 11		80.0-85.0: Silt, Sand (mS): 50% m, 50% cs; Sand: vf-c, predom vf-f, 75% fels, 25% m, SA; m: non-plast; no rxn w/ HCl; dry; platy structure @ 80-80.4 + 82.7-85.0; laminae @ 80.4-82.7; mS; 2.5Y 5/3 light olive brn; Fe staining on laminae (80.4-81.6); silt laminae @ 81.1, 81.3, 81.6 (+ Fe stained).	Core 11 80.0-85.0'
85			85.0-88.1: Silty Sand (mS): 75% cs, 25% m; S: vf-m, SA, 75% fels, 25% mafs; m: non-plast; no rxn w/ HCl; dry; massive; mS; 2.5Y 5/3 lt olive brn; mica present.	
	Core 12		→ 87.1-87.6: S. coarsens downward to vfn-v.crse (to 2.5Y 6/2 lt brnish gray).	Core 12 85.0-90.0
			→ 87.6-88.1: S. coarsens down from vf-m to vfn-v.crse (to 2.5Y 6/2).	
			88.1-88.9: Silt (m): 90% m, 10% cs; S: 75% m, 25% f, v.fn-f; m: non-plast; wk rxn w/ HCl; dry; cross-bedded; silt lamina dipping 20° from 88.1-88.3; ~~lateral beds 88.3-88.6, massive~~ (@ 10.26.17); 2.5Y 4/3 olive brn; ~~88.6-88.9~~ (10.26.17); → lateral beds 88.3-88.6; 2.5Y 5/3 lt. olive brn; inc. sand % to 20%; m: 80%.	
87.5			→ Massive 88.6-88.9; 2.5Y 4/3 olive brn; graded contact @ 88.9.	
			88.9-90: Silty Sand (mS): 70% cs, 30% m; S: vfn-vc; 70% fels, 30% mafs; SA; m: non-plast; no rxn w/ HCl; dry; massive to 89.3; wS; 2.5Y 6/2 lt brnish gray.	
			→ 89.3-90: interbedded (1.5-2cm) sand beds w/ silt (2-5mm) laminae; silt: strong rxn w/ HCl; 2.5Y 4/3 olive brn.	
90			90.0-90.4: Sand (S): 100%, vf-f, WS, SA, 90% Felsic, 10% Mafic, small rhythmites moist, no rxn w/ HCL, 2.5Y 6/2 light brn gray, strong VOC odor (MIBK)	
			90.4-91.9: Silt (M) 100%; non-plastic, wk rxn w/ HCL, moist, 2.5Y 5/4 light olive brn from 90.4-90.8, 2.5Y 5/1 gray from 90.8-91.9, clay nodule (5cm diameter) @ 90.9, strong MIBK odor	
92.5	Core 13		91.9-93.3: Sand (S): 100%, vf-m, predom f, trace mica, 25% mafic, 75% felsic, WS, silt cross bedding from 92.5-92.7; strong MIBK odor, 2.5Y 6/2 light brnish gray, no rxn w/ HCL	Core 13 B39WX9 90.0-95.0'
			93.3-95.0: Silty Sand (mS): 60% Sand, 40% Silt; Sand: vf-f, 90% felsic, 10% Mafic, trace mica, SA, WS; v. wk rxn w/ HCL, laminae throughout, med. gr. ~~Sand~~ (10.26.17) ~~94.8~~ (10.26.17) 93.8-94.1, 2.5Y 5/1 gray, strong MIBK odor	Aliquot 90.5-92.0'
95	Core 14A		95.0-97.5: Silty Sand (mS): 75% cs, 25% m; S: vf-c, predom vf-m, 80% fels, 20% mafs; SA; trace mica; PS; no rxn w/ HCl; dry; 2.5Y 5/1 gray, minor silt laminae @ 97.4-97.5 (poss. altered by drilling), rhythmites @ 95.0-95.3; strong MIBK odor.	Core 14 A 95.0-97.5
97.5	Core 14B		97.5-99.7: Silty Sand (mS): 50% cs, 50% m; S: vf-f, 85% fels, 15% mafs, trace mica, SA, WS; m: non-plat; no rxn w/ HCl; dry to moist; laminae throughout (silt); 5Y 5/1 gray, v. strong MIBK odor.	Core 14B 97.5-100
			99.7-100: Silty Sand (mS): 60% cs, 40% m; S: vf-m, 75% f, 25% mafs, SA, WS; massive; m: non-plat; no rxn w/ HCl; dry; 2.5Y 5/2 grayish brn; strong MIBK odor.	
100	Core 15		100-101.9: Silty Sand (mS): 70% cs, 30% m; S: vf-crse, 70% f, 30% m; SA, mS; m: non-plat; no rxn w/ HCl; dry; 2.5Y 5/2 grayish brn; strong MIBK odor.	Core 15 100-105
			→ Interbeds of predom. m-crse sand @ 100.4, 100.6, 100.7, 100.9, + 101.1; (1.5-2cm thick)	
			→ Silt lamina (4mm) @ 101.7'.	

Reported By:

Print Name	Title	Signature	Date
T. Clark / J. en Russell	Geologist / Geologist	T. Clark / J. en Russell	10.26.17 / 10.27.17

BOREHOLE LOG (Cont.)

Date:

Well ID: C9513 | Well Name: NA | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
102.5	Core 15		101.9-103.9: Slightly Silty Sand ((m)S): 80% os, 20% om; S: vfn-v.crse (predom m-crse); 60% sf, 40% sm; SA-SR; no rxn w/ HCl, dry; 2.5Y 5/2 grayish brn; mIBK odor	Core 15 100-105 (massive). @ 10:26:17
			103.9-105: Silty Sand (mS): 60% os, 40% om; S: v.fn-crse (predom. fn-med); 70% sf, 30% mf, SA, WS; m: non-plast/cementation; wk-mod rxn w/ HCl; dry; 2.5Y 6/2 lt brnish gray; mIBK odor; massive.	
105			105.5-110.5: Silty Sand (mS): 70% os, 30% om; S: vfn-crse, predom. vfn-med; SA, 70% sf, 30% sm; MS; m: non-plast; no rxn w/ HCl; dry; 2.5Y 5/3 light olive brown; strong mIBK odor; rhyolites throughout; mica present; → Silt laminae (1mm) @ 109.4-109.5.	Core 16 105.5-110.5
107.5	Core 16			
110				
112.5			CORES TO PNNL	
115			JR 10/27/17	
117.5				
120				

Reported By:

Print Name	Title	Signature	Date
T. Clark / Jen Russell	Geologist / Geologist	Jen Russell	10-26-17 · 10-27-17

BOREHOLE LOG (Cont.)

Date:

Well ID: C9513 | Well Name: NA | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
122.5			124.8-125.3: Sandy Silt (sM): 60% m, 40% s; s: v.f-m-f; 70% f, 30% m; trace mica, SA; m: non-plastic; no rxn w/HCl; dry; 2.5Y 6/2 lt. brownish gray; platy, struct; strong mIBK odor; clay @ 10-26-17 silt nodule @ 125.0; v-shaped contact @ 125.3'.	
			125.3-125.8: Silt (m): 90% m, 10% s @ 10-26-17; s: vfn-fn (too small to determine mat/feld %); m: non-plastic; wk-mod rxn w/HCl, dry; 2.5Y 5/4 light olive brn; mIBK odor; bedded @ 10-26-17 silt; silt beds/laminae dip w/contact @ 125.3 + 125.8 (v-shape), laminae dip @ 10° @ 125.6.	
125	Core 20B @ 10-26-17		125.8-126.1: Sandy Silt (sM): 80% m, 20% s; s: vfn-m; 80% f, 20% m, SA; m: non-plastic; no rxn w/HCl; dry; 2.5Y 5/3 lt. olive brn; mIBK odor; platy structure; grad. contact @ 126.1'; v-shaped.	Core 20B
			126.1-127.3: Silty Sand (mS): 60% s, 40% m; s: vfn-m; 80% f, 20% m; SA-SR; m: non-plast; no rxn w/HCl, dry, platy; 2.5Y 5/3 lt. olive brn; mIBK odor; sand fines downward to vfn-fn @ 127.3.	@ 10-26-17 ~~127.3~~ 124.8-127.3
			→ med. sand interbed (2cm) @ 127.0, angles 10°.	
127.5	Core 20A @ 10-26-17		127.3-127.7: Sand, Silt (sM): 80% m, 20% s; s: vfn-m; 80% f, 20% m-f; SA; m: non-plast; no rxn w/HCl; dry, 2.5Y 5/3 lt. olive brn; PS, platy structure; strong mIBK odor; silt @ 10-26-17 sand lens (2cm) @ 127.6.	Core 20A
			127.7-128.5: Silty Sand (mS): 50% s, 50% m; s: vf-c; 70% f, 30% m; SA; PS; no rxn w/HCl; dry; 2.5Y 5/3 grayish brn; massive; mIBK @ 10-26-17 odor; silt lens @ 127.7' contact.	127.3-129.8
			128.5-129.8: Sand, Silt (sM): 80% m, 20% s; s: v.f-m, 80% f, 20% m, SA; m: non-plast; no rxn w/HCl to mod @ depth; dry; 2.5Y 5/3 lt. olive brn; PS; platy structure; mIBK odor; silt laminae (1mm) @ 128.6'.	increase @ 10-26-17
130			130.5-135.5: Sandy Silt (sM): 25% Sand, 75% Silt; Sand: vf-f, 90% felsic, 10% Mafic, SA; no rxn w/HCL; Silt: non-plastic, mod-strong rxn w/ HCL; 2.5Y 6/4 light yellowish brn, moist, MS, platy structure, iron staining from 131.8-132.6, strong acetone odor, interbedded silt and sand laminae; v. thin beds	Core 21 B39X41 130.5-135.3 Aliquot 131.5-133.5
132.5	Core 21		135.2-136.0: Sandy Silt (sM): 25% s, 75% m; s: vf-f; 90% f, 10% m, SA; dry; wk to strong rxn w/HCl @ 10-27-17, Silt: low plast; 2.5Y 6/4 lt. yellowish brn; platy structure; mIBK odor, silt + sand interbedded lamina + v. thin beds.	
			136.0-138.8: Silty Sand (mS): 60% s, 40% m; s: vf-f, SA; 70% f, 30% m; m: non-plastic; dry; no rxn w/HCl; 2.5Y 6/3 lt. yellowish brn; MS; platy structure, mIBK odor; → folded silt lamina @ 135.5 @ 10-27-17	
			→ 5% increases w/ depth to 75% s, 25% m @ 138.8.	
135			→ 137.2-138.8: silt/clay nodules + deformaties; rip-up clasts (?), match unit from 138.8-140.2: banded/bedded silt; 2.5Y 5/4 lt. olive brn, strong rxn w/HCl.	Core 22 135.2-140.2
137.5	Core 22		138.8-140.2: Sandy Silt (sM): 80% m, 20% s; s: vf-f; 90% f, 10% m; SA; s% inc. w/ depth to 40% s, 60% m; PS; m: clay nodule @ 138.8 (mod plast); silt is low plast; wk to strong rxn w/HCl (dec. w/ depth); dry; 2.5Y 5/3 lt. olive brn to 2.5Y 6/2 lt brownish gray w/ depth; interbedded silt + sand lamina + v. thin beds,	
140			140.5-140.9: Silt/Clay (m): 100% m; high plasticity; massive; dry; strong rxn w/HCl; 2.5Y 4/3 olive brn; strong mIBK odor. trace mica @ 10-27-17	Core 23B
	Core 23		140.9-142.0: Sandy Silt (sM): 70% m, 30% s; s: vf-f; SA; 80% f, 20% m; m: low plast; platy; dry; no rxn w/HCl; 2.5Y 5/3 lt. olive brn; mIBK odor.	140.5-143.0
			→ silt laminae (1mm) @ 141.9.	

Reported By:

Print Name	Title	Signature	Date
T. Clark / Jen Russell	Geologist / Geologist	[illegible] / Jen Russell	10-26-17 / 10-27-17

BOREHOLE LOG (Cont.)

Date:

Well ID: C9513 | Well Name: NA | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
142.5	Core 23B		142.0-143.0: Silt(m): 90%m, 10%s; S: vf-m (too small to determine distribution); m: low plast; platy structure; dry; mod. rxn w/ HCl, 2.5Y 5/3 lt. olive brn; mIBK odor; clay nodule (2.5Y 4/3 dk. brn) @ 142.6 (2cm).	Core 23B 140.5-143.0
	Core 23A		143.0-145.5: Sandy Silt(sM): 20%s, 80%m; S: vf-f, 90% fels, 10% mafs, SA; PS; m: non-plast; low to mod rxn w/ HCl; dry; 2.5Y 5/3 lt. dk. brn; mIBK odor; platy; (Fe) 10-5-17	Core 23A 143.0-145.5
145			145.1-145.5: ~~20%~~ Sandy Silt(sM): 20% S, 80% m; Sand: vf-f, 90% fels, 10% mafs, SA; Silt: non-plastic, mod rxn w/ HCl; 2.5Y 5/3 lt. olive brn; dry; MS; platy structure; strong mIBK odor. Trace mica in sand. (Fe) 10-5-17	(Fe) 10-27-17 Core 24 1339 X50 145.1-150.1 Aliquot 146.1-148.8
147.5	Core 24		145.5-148.8: Silt(m): 10% sand, 90% silt; Sand: vf-f predom vf; 90% f, 10% m, SA; Silt: non-plastic, MS; mod rxn w/ HCl; 2.5Y 4/3 olive brn; dry; platy structure; strong mIBK odor; Fe-staining @ 148.7-148.8. → 2cm sandy silt (20%s, 80%m) interbeds @ 146.9 + 148.3; 2.5Y 5/3 lt. olive brn	• Clastic sand dike (2cm max) from 143.0-145.0: 100%s; vf-f; 80% fels, 20% mafs; SA-SR; 2.5Y 6/2 lt. brownish gray; PS; brown clay btw sand and sandy silt unit. → clay lamina (1mm) @ 145.2, + nodule @ 145.3. (Fe) 10-27-17
150			148.8-150.1: Sandy Silt(sM): 20%s, 80%m; Sand: vf-f, predom vf; 90% f 10% m, SA-SR; Silt: non-plastic; no rxn w/ HCl, 2.5Y 5/2 grayish brn; dry, MS; platy structure; strong mIBK odor; → @ 149.5: 3cm interbed silt (100%), non-plastic, 2.5Y 4/2 dk grayish brn.	
152.5				
155				
157.5				
160				

Cores to PNNL (Fe) 10-27-17

Reported By:

Print Name	Title	Signature	Date
T. Clark / Jen Russell	Geologist / Geologist	T. Clark / Jen Russell	10-5-17 / 10-27-17

BOREHOLE LOG (Cont.)

Date:

Well ID: C9513 | Well Name: NA | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
162.5				
			165.3-167.0: Sand, Silt (sM): 80%m, 20%s; S: vf-m-fn, 80%f, 20%m; SA, PS; m: low plast; dry; mod. rxn w/HCl; platy structure; 2.5Y 6/3 lt. yellowish brn; strong mIBK odor.	
165			→ Sand dike @ 165.7-167.0: 100%s (vf-m; 90%f, 20%m, SA, trace mica, no rxn w/HCl) with sandy silt rip-up clasts throughout; 2.5Y 6/3 lt. yellowish brn. @ 10.27.17	
	Core 28		167.0-167.8: Sand, Silt (sM): 60%m, 40%s; S: vfn-fn, 90%f, 10%m, SA, PS; m: low plast; no rxn w/HCl; platy; 2.5Y 5/4 lt. olive brn; dry; mIBK odor. @ 10.27.17	Core 28 165.3-170.3
			167.8-170.3: ~~100%~~ silt/clay (m): 100%m; high plasticity; strong rxn w/HCl, dry, mIBK odor; @ 10.27.17	
167.5			→ 167.8-168.6: 2.5Y 5/3 lt. olive brn, platy structure; clay ball (dry, v. strong HCl rxn, 2.5Y 6/3 lt. yellowish brn @ 167.8, 7cm diameter).	
			→ 168.6-169.3: 2.5Y 5/4 lt. olive brn, platy structure + wood(?) chips throughout.	
			→ 169.3-169.9: 2.5Y 4/3 olive brn, massive	
170			→ 169.9-170.3: 2.5Y 5/3 lt. olive brn, platy; clay nodule (2.5Y 6/3 lt. yell. brn) @ 169.9 (5mm).	
	Core 29B		170.5-172.0: Silt (m): 95%m, 5%s; S: vf-f, SA, 90%fels, 10%mf; mod rxn w/HCl; 2.5Y 5/4 lt. olive brn; moist; massive; mIBK odor.	silt = low plasticity. Core 29B B39X76 @ 10.5.17
			172.0-173.0: Silt (m): 90%m, 10%s; S: vf-f, SA; trace mica; silt: low-plast; mod rxn w/HCl; 2.5Y 4/3 ol. brn; moist; platy; mIBK odor; grad. contact; gray clay nodule @ 172.1; @ 10.5.17 wood @ 172.2'.	Aliquot @ 171-172
172.5			173.0-173.8: Silt (m): ~~S~~ 100%s silt; non-plastic, mod rxn w/HCl; 2.5Y 4/3 olive brn; moist; massive; strong mIBK odor.	
	Core 29A		173.8-173.9: Sand (s): 100%s, vf-m, predom m, WS, SA, 40%m, 60%f, moist, no rxn w/HCl, 10YR 4/2 dark grayish brn, massive; mIBK odor.	Core 29A B39X74 173.0-175.5 Aliquot @ 173.6-175.0
175			173.9-174.2: Silty Sand (mS): 70%s, 30%m; S: vf-f, 80%fels, 20%mf (mf inc. w/ depth to 50%) @ 10.5.17 trace mica, SA, WS, no rxn w/HCl, 2.5Y 4/2 dark grayish brn, laminae throughout; S. size inc to predom f; strong mIBK odor.	
	Core 30		174.2-174.3: Silt (m): 100%m, non-plast, mod rxn w/HCl, 2.5Y 4/2 dark grayish brn; moist, massive, strong mIBK odor. (Sand, silt (sM)) @ 10.5.17	Core 30 175.1-180.1
177.5			174.3-174.5: ~~Silt (m)~~ ~~@ 10.5.17~~: 80%m, 20%s; S: vf-f, predom f, SA, 90%f, 10%m; Silt: non-plast; no rxn w/HCl; 2.5Y 5/3 lt. olive brn; ~~moist~~ dry @ 10.5.17; platy; strong mIBK odor	
			174.5-174.7: Sand (s): 90%s, 10%m; S: vf-m, predom f; WS, SA, 40%mf, 60%f, moist, no rxn w/HCl, 10YR 4/2 dark grayish brn, laminae; mIBK odor. @ 10.5.17	
			174.7-175.5: Sand, Silt (sM): 70%m, 30%s; Sand: vf-f, ~~80%~~ 90%fels, 10%mafx, SA; size inc to predom m. w/ depth. Silt: non-plastic; no rxn w/HCl; 2.5Y 5/3 lt. olive brn; dry; platy; strong mIBK odor. @ 10.5.17 @ 10.5.17	
180			→ clay nodules (0.5cm) @ 174.7, 174.9, 175.0 + 175.3'; mod rxn w/HCl.	@ 10.27.17 • Unconformity @ 175.9 contact
	Core 31		175.1-175.9: Silt/Clay (m): 100%m; high plasticity; strong rxn w/HCl; moist; platy; 2.5Y 4/3 olive brown; no odor.	
			175.9-176.9: Sand, Silt (sM): 70%m, 30%s; S: vf-f, 90%f, 10%m; SA, PS; m: mod plast; mod rxn w/HCl, 2.5Y 5/3 lt. olive brown; platy; moist; no odor; @ 176-176.4: 100%s dike (3cm), 60%f, 40%m, vf-m, 2.5Y 4/3 olive brn, no rxn w/HCl;	
			→ @ 176.6-176.7: silty sand dike (nodule?), 2.5Y 5/3 lt. olive brn; silt laminae btw sand dikes. @ 10.27.17 → unconformity @ 176.9 contact.	

Reported By:

Print Name	Title	Signature	Date
T. Clark / Jen Russell	Geologist / Geologist	[illegible] / Jen Russell	10.5.17 10.27.17

BOREHOLE LOG (Cont.)

Date: 10/12/17

Well ID: C9513 | Well Name: NA | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
182.5	Core 31		176.9-180.1: Sandy Silt (sM): 60% m, 40% s; s: vf-f; SA, PS, 70% f, 30% m; m: low plast; platy; dry; 2.5Y 5/3 lt olive brn; no rxn w/ HCl; → 100% sand lens (1cm) bed @ 170: ~~70%~~ 70% sm @ 10.27.17, 30% f; sandy silt fine grain size to vf-m; s = 50% to 178.3'.	Core 31 180.6-185.6
			→ Platy, sandy silt to 180.1 (60% m, 40% s).	
			180.6-185.6: Sand (s): 90% s, 10% m; sand: vfn-med; 60% f/s, 40% mf, SA, trace mica; m: non-plastic; moist; no rxn w/ HCl; 2.5Y 4/3 olive brn, no odor, minor rhythmites throughout	
185	31			
			184.9-189.9: Sand (s): 90% s, 10% m; sand: vfn-med, 60% f/s, 40% mf, SA, PS; trace mica; m: non-plastic; moist; no rxn w/ HCl; 2.5Y 4/3 olive brn; ~~no~~ slight m TBK odor; rhythmites throughout.	Core 32 184.9-189.9
187.5	Core 32		→ Top 3" altered by drilling (TC 10.27.17) ~~(184.9)~~ 184.9-185.21.	
			→ @ 188.8-189.9: silt bedding (1cm) + laminae (2mm) present: 100% m, wk rxn w/ HCl, 2.5Y 4/1 dark gray; trace gravels in sand interbeds (felsic, SA-SR, vfn pebbs)	
190				
	Core 33 B		190.4-192.9: Slightly silty Sand (m) S): 80% s, 20% m; sand: vf-m, predom vf-f; 60% f/s, 40% mf, SA, trace mica; m: non-plast; trace gravels (v.fn pebs); dry to slt. moist; no rxn w/ HCl; 2.5Y 5/3 lt. olive brn, no odor; minor rhythmites @ ~191.2'.	Core 33 B 190.4-192.9; aliquot @ 190.9-192.5 (TC 10.5.17)
192.5	Core 33 A		192.9-194.9: Sand (s): 100% s; 60% f, 40% m, vf-c, predom f-m, c. grains = mica; ~~rrg~~ (TC 10.5.17) no rxn w/ HCl; moist 192.9-193.4, dry 193.4-194.9; 2.5Y 5/2 grayish brn; mod m TBK odor; small rhythmites throughout.	Core 33 A 192.9-195.4; aliquot @ 193.4-194.7
195			194.9-195.2: Sandy Gravel (sG): 50% G, 40% s, 10% m; Gravel: v.fn peb-4cm; SR; 60% m, 40% f; sand: vfn-vc, predom f-m; 70% m, 30% f/s, SR-SA; mica; m: non-plast; 2.5Y 5/3 lt. ol. brn; dry; PS; no Rxn w/ HCl; consolidated/semi-cem.	
197.5	Core 34		194.7-195.7: Slightly silty Sand (m) S: 5% Gravel, 80% Sand, 15% Silt; Gravel: m peb - 5 cm, 75% felsic, 25% mafic, SR; Sand: f-m, 75% 80% mafic, 20% felsic, SA, trace mica quartz; Silt: non-plastic; 2.5Y 6/2 lt brownish gray, dry, no rxn w/ HCl, PS, ~~coarsen~~ (10/12/17 ACM) fines downward, v. thin laminae of silt throughout and increasing in number toward contact at 195.7; silt laminae somewhat deformed.	Core 34 - B39X90 194.7 - 199.7
			195.7-199.7: Sandy Gravel (sG) ~~G~~ (10/12/17 ACM) 50% Gravel, 50% Sand; Gravel: vf peb-10 cm, 70% felsic, 30% mafic, SR-R, dom. qtzite; Sand: f-vc, 70% felsic, 30% mafic, SA, qtz, trace mica; 2.5Y 6/3 lt olive brown, dry, no rxn w/ HCl, PS, massive, Fe staining throughout, dark blackish staining around cobbles at ~~190~~ (10/12/17 ACM) 196.2-196.6 bags.	
200	Core 35		200.5-205.5 Sandy Gravel (sG): 40% gravel, 60%	Core 35 - B39X92 200.5-205.5

Reported By:

Print Name	Title	Signature	Date
T. Clark / A. McGuire	Geologist / Geologist	Angela McGuire	10.5.17 / 10.27.17

BOREHOLE LOG (Cont.)

Date: 10/12/17

Well ID: C9513 | Well Name: NA | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
202.5	Core 35		200.5-205.5-Sandy Gravel(SG): 40% Gravel, 60% Sand; Gravel: fpeb-10 cm, 70% felsic, 30% mafic, SR, med-coarse peb dominate especially through 202.0-209.5 bgs; sand: f-c, dom. m, 80% felsic, 20% mafic, SA, qtz, trace mica; 2.5Y 6/2 H brownish gray, PS, dry, massive, no rxn w/ HCl, slight Fe staining 209.2, unconsolidated, band of red clay/mud at 203.0	Core 35 - B39X92 2005-205.5
205			~~208.0~~ 10/12/17 AEM 205.5-208.8: Sandy Gravel(SG): 50% Gravel, 50% Sand; Gravel: fpeb-9 cm, 90% Felsic, 10% mafic, quartzite, SR; Sand: vf-c, dom. med, 85% felsic, 15% mafic, SA; 2.5Y 6/2 H brownish grey, dry, massive, PS, Fe staining around pebbles/cobbles	Core 36 - B39X94 205.5-210.5
207.5	Core 36		208.8-210.5: Sandy Gravel (SG): 30% Gravel, 70% Sand; Gravel: fpeb-4 cm, 75% felsic, 25% mafic, SA-SR, dom. SR; Sand: 80% felsic, 20% mafic, vf-m, trace mica, SA; 2.5Y 6/2 H brownish grey, dry, massive, PS, Fe staining at 209.2, Fe staining at transitional contact at 208.8 bgs;	
210	X 10/12/17 AEM		layer of pink gravel (f. peb) size at 210.2 bgs.	
212.5				
215				
217.5				
220				

Cores to PNNL (TL) 10-27-17

Reported By:

Print Name	Title	Signature	Date
A. McGuire	Geologist	Angela McGuire	10-27-17

BOREHOLE LOG (Cont.)

Date:

Well ID: C9513 | Well Name: NA | Location: 216-S-13 Crib

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
222.5			Cores to PNNL (TC) 10.27.17	
225	Core 40		224.7-226.6: Sand(s): 100% S, vfn-m, predom f; 70% f, 30% m, WS, SA, 2.5Y 6/2 lt. brnish gray, dry, no rxn w/HCl, rhythmites from 225.5-226.6.	Core 40 224.7-229.7; aliquot @ 225.0-227.0
227.5			226.6-229.7: Silty Sand, Gravel (mSG): 40% g, 30% s, 30% m; Gravel: v.fn peb-10cm, SR-A, 50% fels, 50% mafic (qtz, basalt); sand: v.fn-vc, ~~predom~~ (TC) 10.6.17 60% f, 40% m, SA, PS; m: non-plast; dry; no rxn w/HCl, 2.5Y 6/3 lt. yel. brn; v. consolidated. → @227.2-227.3: thin sand bed (5cm); 70% f 30% m, vf-m, 2.5Y 6/2 lt. brn gray, dry, rhythmites	
230	Core 41		230.4-235.4: Silty Sand, Gravel (mSG): 40% g, 30% s, 30% m; Gravel: v.fn peb-10cm, SR-A, 50% fels (qtz), 50% mafic (bas); sand: vf-vc, SA, PS, 60% fels, 40% mafic; m: non-plast; dry, no rxn w/HCl, 2.5Y 6/3 lt. yel brn; v. consolidated; minor Fe-staining. → @232.1-232.3: thin (6cm) sand interbed: 100% s, 70% f, 30% m, vfn-m, 2.5Y 6/2 lt. brnish gray; dry; massive.	Core 41 230.4-235.4 Aliquot @ 231.4-234.4
235	Core 42		235.5-240.5: Sandy Gravel (SG): 40% gravel, 55% sand, 5% silt; Gravel: fpeb-7cm, 70% felsic, 30% mafic, SR, qtzite, basalt; Sand: f-c, 75% felsic, 25% mafic, SA, qtz, trace mica; Silt: non-plastic, present at lens at 237.5 bgs: 2.5Y 6/3 lt yellowish brown, dry, massive, no rxn w/HCl, PS, Fe staining throughout especially around cobbles 235.5-236.2 and ~~235~~ 10/12/17 AGM 238.5-240.5 bgs.	Core 42 - B39XD0 235.5-240.5
237.5				
240			Total Depth 240.5 bgs	

Reported By:

Print Name	Title	Signature	Date
T. Clark / A. McGuire	Geologist / Geologist	[illegible] / Angela McGuire	10-6-17 / 10-27-17

BOREHOLE LOG

Page 1 of 43
Date: 11-21-2017

Well ID: C9555	Well Name: N/A	Location: 216-T-3 I/R Well
Project: 200-DV-1 Operable Unit		Reference Measure Point: Ground Surface

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
30	CORE 1		30-39': Gravelly Sand (gS) (70% S, 20% G, 10% M); Sand: crse - v. crse (50% crse, 50% v. crse), ang. - sub. ang., poor sort, damp-wet, 90% m / 10% f, mafic: basalt, felsic: quartz, quartzite, feldspar, no rxn to HCl, 2.5Y 3/1 v. dark gray; Gravel: 5-30mm (fine - crse pebble), predom. fine pebble, poor sort, 60% m / 40% f, mafic: basalt, felsic: quartzite, sub. ang. - rnd.; Silt: damp-wet, compact, non-plastic, no rxn to HCl, predom. mafic, v. well sort, matrix when wet & compacted.	Sonic Core Hanford fm. CORE 1 B3BKW3 30 - 35' bgs.
32.5				
35	CORE 2		@ 35-39': Gravelly Sand (65% S, 25% G, 10% M); Sand: med - v. crse (10% med, 20% crse, 70% v. crse), 60% m / 40% f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, sub. ang - sub. rnd., damp-wet (dry in places), 2.5Y 4/2 d. grayish brown (wet), 2.5Y 5/1 gray (dry), no rxn to HCl; Gravel: 5-15mm (v. fine - med. pebbles), predom. v. fine pebbles, mod. sort, sub. ang. - rnd., 70% m / 30% f, mafic: basalt, felsic: quartzite, feldspar, damp-wet (dry in places); Silt: mod rxn to HCl, 2.5Y 4/1 d. gray, damp, massive & compact (when wet), loose (when dry), matrix when wet, v. well sort., non. plastic.	CORE 2 B3BKW5 35 - 40' bgs.
37.5				
40	CORE 3			CORE 3 B3BKW7 40 - 45' bgs.
42.5				
45	CORE 4		39 - 40': Silty Sand (mS) (60% S, 35% M, 5% G); Sand: med - v. crse (40% med., 40% crse., 20% v. crse), 60% m / 40% f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, sub. ang., 2.5Y 5/2 grayish brown, no rxn to HCl; Silt: weak - mod. rxn to HCl, matrix, massive, compact, non. plastic; Gravel: 10-30mm (med. - crse pebbles), predom. med. pebble,	CORE 4 B3BKW9 45 - 50' bgs.

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist	[signature]	11/28/2017

Reviewed By:

Print Name	Title	Signature	Date
Sarah Springer	Geologist (PG)	[signature]	12/05/17

For Office Use Only

OR Doc Type:	WMU Code(s):

A-6003-642 (REV 1)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			39-40' (cont'd):	Sonic Core
			poor sort, sub. ang. - rnd., 70% m / 30% f, mafic: basalt, felsic: quartzite, damp.	
			40 - 45': Sand (S)	
			(98% S, 2% G); Sand: med. - crse (50% med, 50% crse), sub. ang., well sort, 70% m / 30% f, mafic: basalt, felsic: quartz, quartzite, mica, slt. damp, no rxn to HCl, 10YR 4/2 d. grayish brown; Gravel: 20-50mm (crse - v. crse pebble), 100% m, mafic: basalt, sub. rnd. - rnd., poor sort.	
			@ 41.1-41.2': v. fine grn. lens:	
			(95% S, 5% M); Sand: v. fine - fine (50% v. fine, 50% fine), v. well sort, 60% m / 40% f, mafic: basalt, felsic: quartz, quartzite, mica, slt. damp, no rxn to HCl, 2.5Y 4/3 olive brown; Silt: loose, minor, non. plastic, v. well sort., predom. felsic, slt. damp.	
			@ 41.2-41.7': Sand	
			(100% S); Sand: crse - v. crse (50% crse, 50% v. crse), well sort, sub. ang., 50% m / 50% f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, no rxn to HCl, 10YR 5/1 gray, slt. damp.	
			@ 41.7-41.9': v. fine grn. lens:	
			(95% S, 5% M); Sand: v. fine - med (10% v. fine, 40% fine, 50% med.), well sort, sub. ang., 60% m / 40% f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, no rxn to HCl, slt. damp, 2.5Y 4/3 olive brown; Silt: loose, non. plastic, v. well sort, predom. felsic, slt. damp.	
			@ 41.9-42.3': Sand	
			(98% S, 2% M); Sand: fine - crse (40% fine, 40% med., 20% crse), slt. damp, sub. ang., well sort, 50% m / 50% f, mafic: basalt, felsic: quartz, quartzite, mica, feldspar, no rxn to HCl,	

NOT USED

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		41.9 - 42.3' (cont'd.):	Sonic Core
			10YR 5/1 gray; Silt: loose, slt. damp, non-plastic, v. well sort, predom. felsic.	
			@ 42.3': v. fine grn. lens: (95% S, 5% M); Sand: v. fine (100%), slt. damp, sub. ang., v. well sort, predom. felsic, no rxn to HCl, 10YR 4/3 brown; Silt: compact, minor, non plastic, v. well sort, predom. felsic.	
			@ 42.3 - 42.5': Sand (98% S, 2% M); Sand: fine - crse (40% fine, 40% med, 20% crse), slt. damp, sub. ang., well sort, 50% m / 50% f, mafic: basalt, felsic: quartz, quarteite, mica, feldspar, no rxn to HCl, 10YR 5/1 gray; Silt: loose, slt. damp, non plastic, v. well sort, predom. felsic.	
			@ 42.5 - 44.6': Sand (95% S, 5% M); Sand: v. fine - v. crse (5% v. fine, 5% fine, 20% med, 30% crse, 40% v. crse), no rxn to HCl, mod. sort, slt. damp., 60% m / 40% f, mafic: basalt, felsic: quartz, quarteite, feldspar, sub. ang., 2.5Y 4/2 d. grayish brown; Silt: loose, slt. damp, non plastic, v. well sort, predom. felsic.	
			@ 42.9': dark spot observed, 2.5Y 2.5/1 black, no rxn to HCl.	
			@ 44.6 - 45': Sand (90% S, 10% M); Sand: v. fine - crse (30% v. fine, 30% fine, 20% med., 20% crse), 2.5Y 4/2 d. grayish brown, no rxn to HCl, mod. sort, slt. damp, 60% m / 40% f, mafic: basalt, felsic: quartz, quarteite, feldspar, sub. ang.; Silt: loose, slt. damp, non. plastic, v. well sort, predom. felsic.	

11/28/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
47.5	CORE 4		45 - 47.45' : Sandy Gravel (sG) (55% S, 40% G, 5% M); Sand: med. - v. crse (20% med., 40% crse, 40% v. crse), ang. - sub. ang., poor sort, 80% m / 20% f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, slt. damp - dry, no rxn to HCl, 2.5Y 5/1 gray; Gravel: 3 - 15mm (v. fine - med. pebble), v. poor sort, sub. ang. - sub rnd, 90% m / 10% f, mafic: basalt, felsic: quartzite, dry; Silt: loose, minor, v. well sort, predom felsic, dry.	Sonic Core Hanford fm.
50	CORE 5		47.45 - 48.6': slightly Silty Gravelly Sand ((m) g S) (75% S, 15% M, 10% G); Sand: v. fine - crse (10% v. fine, 40% fine, 40% med., 10% crse), sub. ang, mod. - well sort, 55% f / 45% m, felsic: quartz, quartzite, feldspar, mica, mafic: basalt, slt. damp - dry, no rxn to HCl, 2.5Y 5/2 grayish brown; Silt: loose - compact, v. well sort, predom. felsic, dry; Gravel: 2 - 5 mm (v. fine - fine pebbles), predom. v. fine pebbles, dry, v. poor sort, sub ang - sub. rnd., 95% m / 5% f, mafic: basalt, felsic: quartzite.	CORE 5 B3BKY1 50 - 55' bgs.
52.5				
55	CORE 6			CORE 6 B3BKY3 55 - 60' bgs.
57.5				
60	CORE 7	SAMPLE	48.6 - 49.2': Silty Sand (mS) (50% S, 50% M); Sand: v. fine - fine (50% v. fine; 50% fine), sub. ang., v. well sort, v. weak rxn to HCl, 60% f / 40% m, felsic: quartz, quartzite, feldspar, mica, mafic: basalt, damp, 10YR 4/2 d. grayish brown; Silt: damp, massive, compact, v. well sort, predom. felsic, non. plastic.	CORE 7 B3BKY5 60 - 65' bgs. Sample Collected: 60.2 - 62.0' bgs. HEIS: B3FCK3, B3FCJ9, B3FCK0, B3FCK1, B3FCK2, B3FCK7, B3FCK4, B3FCK5, B3FCK6
62.5			49.2 - 50.25': slightly Silty Sand ((m) S) (85% S, 15% M); Sand: v. fine - fine (50% v. fine, 50% fine), no rxn to HCl, v. well sort, 2.5Y 5/2 grayish brown, sub. ang., 60% f / 40% m, felsic: quartz, quartzite, feldspar, mica, mafic: basalt, damp; Silt: slt. damp - dry, massive, compact, v. well sort, predom. felsic, non. plastic.	
65	CORE 8			

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist	[signature]	11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		@ 50.2 - 50.25': v. fine grn. lens: (50% S, 50% M). Sand: v. fine (100%), v. well sort, slt. damp, sub ang., no rxn to HCl, 10YR 4/3 brown; Silt: slt. damp, minor, compact, non-plastic, predom. felsic, no rxn to HCl.	Sonic Core
			50.25 - 54.5': Gravelly Sand (gS) (80% S, 15% G, 5% M): Sand: fine - v. crse (30% fine, 50% med, 10% crse, 10% v. crse), 2.5Y 4/2 d. grayish brown, mod. sort, sub. ang, slt. damp-dry, no rxn to HCl, 55% m / 45% f, mafic: basalt, felsic: quartz, quartzite, mica; Gravel: 2-4mm (v. fine pebbles), 50% m / 50% f, mafic: basalt, felsic: quartzite, sub. ang., poor sort, dry; Silt: loose, dry, predom. felsic, non-plastic, v. well sort.	
			@ 51.5': Gravelly Sand Sand change: med. - v. crse (20% med, 40% crse, 40% v. crse), 65% m / 35% f, mafic: basalt, felsic: quartz, quartzite, mica, mod-poor sort, sub. ang., slt. damp-dry, no rxn to HCl, 2.5Y 4/2 d. grayish brown.	
			@ 52.0': Gravelly Sand Color change: 2.5Y 5/2 grayish brown.	
			@ 52.4': Gravelly Sand Gravel change: 2-20mm (v. fine - crse pebbles), predom. v. fine pebbles, sub. ang. - rnd., v. poor sort, dry, predom. mafic, mafic: basalt.	
			54.5 - 55': Gravelly Silty Sand (gmS) (65% S, 25% M, 10% G). Sand: v. fine - v. crse (20% v. fine, 40% fine, 5% med., 30% crse, 5% v. crse), v. weak rxn to HCl, mod. sort, predom. felsic: quartz, quartzite, mica, mafic: basalt (55% f / 45% m), 2.5Y 4/1 gray; Silt: dry, compact, massive, v. well sort, non plastic, predom. felsic; Gravel: 2-40 mm (v. fine - v. crse	

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			54.5 - 55' (cont'd.):	Sonic Core
			pebbles), predom. v. fine pebbles, sub. ang. - rnd., v. poor sort, dry, predom. felsic: quartzite.	
			55 - 55.4': Sand (S)	
			(90% S, 10% M); Sand: med - v. crse (25% med, 50% crse, 25% v. crse), sub. ang. - ang., mod sort, no rxn to HCl, 2.5Y 5/2 grayish brown, slt. damp - dry, 60% m / 40% f, mafic: basalt, felsic: quartz, quartzite, feldspar; Silt: loose, slt. damp - dry, non plastic, no rxn to HCl.	
			55.4 - 55.8': Sandy Gravel (sG)	
			(60% S, 40% G); Sand: med - v. crse (10% med, 40% crse, 50% v. crse), sub. ang - ang., poor sort, no rxn to HCl, 2.5Y 3/1 v. dark gray, slt. damp - dry, 80% m / 20% f, mafic: basalt, felsic: quartz, quartzite, feldspar; Gravel: 2-10mm (v. fine - med. pebbles), predom. v. fine pebbles, sub. ang. - sub. rnd., 90% m / 10% f, mafic: basalt, felsic: quartzite.	
			55.8 - 56.85': Gravelly Sand (gS)	
			(80% S, 20% G); Sand: med. - v. crse (40% med, 40% crse, 20% v. crse), sub. ang - ang., mod. sort, no rxn to HCl, 10YR 4/2 d. grayish brown, slt. damp - dry, 50% m / 50% f, mafic: basalt, felsic: quartz, quartzite, feldspar, trace mica; Gravel: 2-20mm (v. fine - crse pebbles), predom. v. fine - fine pebbles, sub. ang. - sub. rnd., 50% m / 50% f, mafic: basalt, felsic: quartzite.	
			56.85 - 65': Sand (S)	
			(98% S, 2% G); Sand: fine - med (50% fine, 50% med.), well sort, slt. damp - dry, no rxn to HCl, 2.5Y 5/2 grayish brown, 60% f / 40% m, felsic: quartz, quartzite, feldspar, trace mica, mafic: basalt, sub. ang.; Gravel: v. fine - med. pebbles (2-10mm), sub. ang - sub. rnd, v. poor sort, 100% m, mafic: basalt.	

NOT USED

11/28/17

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		@ 58.3-58.5': v. fine grn. lens: (60% S, 40% M); Sand: v. fine-fine (45% v. fine, 55% fine), v. well sort, slt. damp-damp, weak rxn to HCl, 2.5Y 4/3 olive brown, 70% f / 30% m, felsic: quartz, quartzite, trace mica, mafic: basalt, sub. ang.; Silt: slt. damp-damp, compact, v. well sort, non. plastic	Sonic Core
			@ 59.3': concentration of v. crse sand - v. fine pebbles (1-4 mm), v. poor sort, predom. mafic: basalt w/ sparse felsic: quartzite, sub. ang.-ang.	
			@ 59.7-59.9': v. fine grn. lens: (98% M, 2% S); Silt: non. plastic, no rxn to HCl, v. well sort, massive, 2.5Y 4/3 olive brown; Sand: v. fine (100%), v. well sort, sub. ang., predom. felsic: quartz, quartzite, trace mica, slt. damp-damp.	
			@ 60-65': Sand (95% S, 5% G); Sand: med-v. crse (5% med, 10% crse, 85% v. crse), mod. sort, 60% m / 40% f, mafic: basalt, felsic: quartz, quartzite, feldspar, trace mica, ang.-sub. ang., dry, no rxn to HCl, 2.5Y 2.5/1 black; Gravel: 6-10 mm (fine-med. pebbles), sub. ang., 100% m, mafic: basalt.	
			@ 60.8': Rust stained sediment, 5YR 5/6 yellowish red.	
			@ 61.7': Sand Sand change: fine-crse (5% fine, 25% med, 70% crse), 2.5Y 4/1 d. gray, 55% m / 45% f, mafic: basalt, felsic: quartz, quartzite, feldspar, ang.-sub. ang., mod. sort.	
			@ 62.05-62.2': Compacted v. fine sand / silt lens: (95% S, 5% M); Sand: v. fine (100%), ang.-sub ang., predom. felsic: quartz, feldspar, mica, trace mafic: basalt, 2.5Y 5/3 lt. olive brown, no rxn to HCl	

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
67.5	CORE 8		62.05 - 62.2' (cont'd.):	Sonic Core
			, v. well sort; Silt: compact, dry, v. well sort, non-plastic, no rxn to HCl.	Hanford fm.
				CORE 8 B3BKY7 65 - 70' bgs.
			@ 62.2 - 62.5': Sand	
70			Sand change: fine - crse (5% fine, 25% med, 70% crse), 2.5Y 4/1 d. gray, 55%m/45%f, mafic: basalt, felsic: quartz, quartzite, feldspar, dry, no rxn to HCl, ang. - sub. ang.	CORE 9 B3BKY9 70.4 - 75.4' bgs.
72.5	CORE 9		@ 62.5 - 65': Sand	
			Sand change: med - v. crse (5% med, 40% crse, 10% v. crse), mod sort, 60%m / 40%f, mafic: basalt, felsic: quartz, quartzite, feldspar, trace mica, no rxn to HCl, 2.5Y 2.5/1 black, dry.	CORE 10 B3BL01 74.7 - 79.7' bgs.
75			65 - 67.7': Gravelly Sand (gS)	
	CORE 10		(80%S, 20%G); Sand: med - v. crse (50% med, 40% crse, 10% v. crse), mod. sort, sub. ang., slt. damp - dry, 70%m / 30%f, mafic: basalt, felsic: quartz, quartzite, feldspar, trace mica, no rxn to HCl, 2.5Y 5/2 grayish brown; Gravel: 2 - 15mm (v. fine - med. pebbles), predom. v. fine pebbles, 60%m / 40%f, mafic: basalt, felsic: quartzite, v. poor sort, sub. ang. - sub. rnd.	
77.5				
80				CORE 11 B3BL03 80.4 - 85.4' bgs.
			67.7 - 69.8': Sand (S)	
	CORE 11		(95%S, 5%G); Sand: fine - crse (50% fine, 45% med., 5% crse), well sort, sub. ang., slt. damp - dry, 55%f / 45%m, felsic: quartz, quartzite, feldspar, mica, mafic: basalt, no rxn to HCl, 2.5Y 5/3 lt. olive brown; Gravel: 2 - 10mm (v. fine - med. pebbles), predom. v. fine pebble, 95%m / 5%f, mafic: basalt, felsic: quartzite, v. poor sort, sub. ang. - sub. rnd.	
82.5				
85				CORE 12 B3BL05 84.8 - 89.8' bgs.
	CORE 12		@ 69': Sand	
			(100%S); Gravel no longer present.	

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			69.8 - 70.0': Silty Sand (mS) (50% S, 50% M); Sand: v. fine (100%), v. well sort, sub. ang., 70%f / 30%m, felsic: quartz, quartzite, mafic: basalt, slt. damp - damp, no rxn to HCl, 2.5Y 4/3 olive brown; Silt: slt. damp - damp, compact, v. well sort, non plastic, 1-3mm lamina present.	Sonic Core
			70.4 - 70.9': Silty Sand (mS) (50% S, 50% M); Sand: v. fine (100%), v. well sort, sub. ang., 70%f / 30%m, felsic: quartz, quartzite, mafic: basalt, slt. damp - damp, no rxn to HCl, 2.5Y 4/3 olive brown; Silt: slt. damp - damp, compact, massive, v. well sort, non plastic.	
	NOT USED		70.9 - 74.7': Sand (S) (98% S, 2% G); Sand: med - crse. (80% med, 20% crse), sub ang., well sort, 55%m / 45%f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, damp, no rxn to HCl, 2.5Y 4/2 d. grayish brown; Gravel: v. fine pebbles (2-4mm), predom. 2mm, pebbles concentrated @ 71.5' (not present anywhere else), predom. mafic: basalt, w/some felsic: quartzite mixed in., sub. ang., well sort.	
			@ 71.5 - 71.55': v. fine grn. lens: (50% M, 50% S). Silt: compact, v. well sort, no rxn to HCl, slt. damp - damp, minor; Sand: v. fine (100%), sub. ang., predom. felsic: quartz, quartzite, no rxn to HCl, slt. damp - damp, v. well sort, 2.5Y 4/3 olive brown.	
			@ 71.55 - 72.7': Sand (95% S, 5% M); Sand: med - v. crse (10% med, 50% crse, 40% v. crse), mod sort, sub. ang., no rxn to HCl, slt. damp - dry, 50%m / 50%f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, 2.5Y 5/2 grayish brown; Gravel: 2-4mm (v. fine pebbles), predom. 2mm, 90%m / 10%f, mafic: basalt,	

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			71.55 - 72.7' (cont'd):	Sonic Core
			felsic: quartzite, sub. ang. - sub. rnd., v. poor sort.	
			@ 72.7 - 73.0': Rhyfmite:	
			Silt: compact, damp, minor, v. well sort,	
			2.5Y 4/3 olive brown, weak rxn to HCl; Sand:	
			v. fine (100%), v. well sort, sub. ang., predom.	
			felsic: quartz, quartzite, mica, slt. damp - damp,	
			weak rxn to HCl, 2.5Y 4/3 olive brown.	
			@ 73.0 - 74.7': Sand	
			(95% S, 5% G): Sand: med - v. crse (10% med,	
			50% crse, 40% v. crse), mod sort, sub. ang.,	
			mod. rxn to HCl, slt. damp - dry, 50% m / 50% f,	
			mafic: basalt, felsic: quartz, quartzite, feldspar,	
			mica, 2.5Y 5/2 grayish brown; Gravel: 2-4mm	
			(v. fine pebbles), predom. 2mm, 90% m / 10% f,	
			mafic: basalt, felsic: quartzite, sub. ang - sub.	
			rnd, v. poor sort.	
			74.7 - 78.6': Gravelly Sand (gS)	
			(90% S, 10% G, Trace M): Sand: med- crse	
			(50% med, 50% crse), mod. sort, dry, sub. ang.,	
			55% f / 45% m, felsic: quartz, quartzite, mica	
			(biotite), mafic: basalt, no rxn to HCl, 2.5Y	
			6/1 gray; Gravel: 2-4mm (v. fine pebbles),	
			predom. 2mm, sub. ang. - sub. rnd., v. poor sort,	
			90% m / 10% f, mafic: basalt, felsic: quartzite;	
			Silt (trace): slt. damp, minor, v. well sort,	
			no rxn to HCl.	
			@ 76.2': v. fine grn. lens:	
			Silt: slt. damp, minor, v. well sort, no rxn to	
			HCl; Sand: v. fine (100%), v. well sort, no rxn to	
			HCl, damp - slt. damp, predom. felsic: quartz,	
			quartzite, mafic: basalt, 2.5Y 4/3 olive brown,	
			sub. ang.	

NOT USED

11/21/17

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			@ 77.8': concentration of 2-4 mm (v. fine pebbles), 95% m / 5% f, mafic: basalt, felsic: quartzite, well sort, sub. ang. - sub. rnd., dry.	Sonic Core
			78.6 - 79.7': Silt (M) (95% M, 5% S); Silt: compact, massive, dry, v. well sort, 2.5 Y 6/2 lt. brownish gray, non-plastic, 100% f; Sand: v. fine (100%), v. well sort, sub. ang, dry, strong rxn to HCl, 100% f, felsic: quartz, quartzite.	
			80.4 - 89.8': Gravelly Sand (gS) (80% S, 20% G); Sand: med- crse (90% med, 10% crse), well sort, 60% m / 40% f, mafic: basalt, felsic: quartz, quartzite, feldspar, trace mica, sub. ang., dry, v. weak rxn to HCl, 2.5 Y 5/2 grayish brown; Gravel: 5-40 mm (fine - v. crse pebbles), predom. fine pebbles, 70% m / 30% f, mafic: basalt, felsic: quartzite, sub. ang. - sub. rnd.; ~~Silt: loose, dry~~ MJH 11-21-17	
			@ 83.8 - 84.8': Gravelly Sand (85% S, 10% G, 5% M); Sand: fine - crse (50% fine, 45% med, 5% crse), well sort, 60% f / 40% m, felsic: quartz, quartzite, feldspar, mica, mafic: basalt, sub. ang., slt. damp - dry, no rxn to HCl, 2.5 Y 5/2 grayish brown; Gravel: 2-20 mm (v. fine - med. pebbles), predom. fine pebbles, 95% m / 5% f, mafic: basalt, felsic: quartzite, sub. ang - sub. rnd.; Silt: loose, dry, v. well sort, no rxn to HCl.	
			@ 84.8 - 89.8': Gravelly Sand (70% S, 25% G, 5% M); Sand: med- v. crse (30% med, 50% crse, 20% v. crse), mod. sort, sub. ang., slt. damp - dry, no rxn to HCl, 80% m / 20% f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, 2.5 Y 3/1 v. dark gray; Gravel: 2-10 mm (v. fine - med. pebbles), predom. v. fine pebbles,	

Not used

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-21-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			84.8 - 89.8' (cont'd.):	Sonic Core
			sub. ang. - sub. rnd., v. poor sort, 90% m / 10% f, mafic: basalt, felsic: quartzite, slt. damp - dry; Silt: loose, slt. damp - dry, non plastic, mod. rxn to HCl, 2.5Y 5/2 grayish brown.	
			@ 84.5 - 84.95': concentration of 2-10 mm (v. fine - med. pebbles), predom. fine pebbles, 90% m / 10% f, mafic: basalt, felsic: quartzite, sub. ang. - sub. rnd.	
			@ 84.95 - 85.4': Gravelly Sand Silt change: loose, dry, compact, massive, v. well sort, 5Y 5/2 olive gray; Sand change: v. fine (100%), v. well sort, 95% f / 5% m, felsic: quartz, quartzite, mafic: basalt, dry, strong rxn to HCl, sub. ang.; Gravel change: v. fine pebbles (2-4 mm), sub. ang - sub. rnd., 100% m, mafic: basalt.	
			@ 85.7 - 86.0': Gravelly Sand (90% S, 10% G); Sand: med. - crse (50% med, 50% crse), well sort, sub. ang., slt. damp - dry, no rxn to HCl, 60% m / 40% f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, 2.5Y 5/3 lt. olive brown; Gravel: 2-4 mm (v. fine pebbles), predom. 2mm, sub. ang., poor sort, 80% m / 20% f, mafic: basalt, felsic: quartzite, slt. damp - dry.	
			@ 86.0 - 87.9': Gravelly Sand (70% S, 25% G, 5% M); Sand: med - v. crse (30% med, 50% crse, 20% v. crse), mod sort, sub. ang., slt. damp - dry, no rxn to HCl, 80% m / 20% f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, 2.5Y 3/1 v. dark gray; Gravel: 2-20 mm (v. fine - crse pebbles), predom. v. fine pebbles, 80% m / 20% f, mafic: basalt, felsic: quartzite; Silt: loose, slt. damp - dry, non-plastic, mod. rxn to HCl, 2.5Y 5/2 grayish brown.	

NOT USED

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-22-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
87.5	CORE 12		@ 87.3': Rust staining present around some basalt gravels.	Sonic Core Hanford fm.
			@ 87.65': Sand / Silt rxn to HCl = mod.	
90			@ 87.9 - 89.1': Gravelly Sand (80% S, 15% G, 5% M); Sand: fine-crse (40% fine, 50% med., 10% crse), well sort, sub. ang., 60% f / 40% m, felsic: quartz, quartzite, feldspar, trace mica, mafic: basalt, no rxn to HCl, slt. damp - dry, 2.5Y 5/1 gray; Gravel: 2-10 mm (v.fine - med. pebbles), predom. v.fine pebbles, sub. ang. - sub. rnd., poor sort, 90% m / 10% f, mafic: basalt, felsic: quartzite, slt. damp - dry; Silt: loose, dry, non plastic, minor.	CORE 13 B3BL07 90.4 - 95.4' bgs. Sample Collected: 93.9 - 95.4' bgs HEIS: B3FCL3, B3FCL4, B3FCK8, B3FCK9, B3FCL0, B3FCL1, B3FCL2
92.5	CORE 13			
	SAMPLE			
95			@ 88.55': Rust staining present around some basalt gravels.	RAD: @ 92.4' = 1200 cpm β/γ @ 93.4' = 2000 cpm β/γ @ 94.4' = 4000 cpm β/γ @ 95.4' = 6000 cpm β/γ
97.5			@ 89.1 - 89.25': v. fine grn. lens: (50% S, 50% M); Sand: v.fine (100%), predom. felsic: quartz, quartzite, trace mica, slt. damp, mod. rxn to HCl, v. well sort, 2.5Y 5/3 lt. olive brown; Silt: dense, compact, massive, v. well sort, non plastic, mod. rxn to HCl.	CORES 14, 15, 16 SENT TO PNNL AND WERE NOT LOGGED.
100			@ 89.25 - 89.8': Gravelly Sand (70% S, 25% G, 5% M); Sand: med - v. crse (30% med, 50% crse, 20% v. crse), mod sort, sub. ang., slt. damp - dry, no rxn to HCl, 80% m / 20% f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, 2.5Y 3/1 v. dark gray; Gravel: 2-10 mm (v.fine - med. pebbles), predom. v.fine pebbles, sub. ang. - sub. rnd., v. poor sort, 90% m / 10% f, mafic: basalt, felsic: quartzite, slt. damp - dry; Silt: loose, slt. damp - dry, non plastic, mod. rxn to HCl, 2.5Y 5/2 grayish brown.	
102.5				
105				

NOT USED

11/28/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-22-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
107.5	NOT USED		90.4 - 95.4': slightly Silty Gravelly Sand ((m)gS) (80% S, 15% M, 5% G); Sand: v. fine - crse (10% v. fine, 10% fine, 80% crse), ang. - sub. ang., sll. damp - dry, poor sort, 50% m / 50% f, mineralogy = uknwn., 2.5Y 4/1 dk. gray, rxn to HCl = uknwn.; Silt:	Sonic Core Cold Creek Unit - upper
110			clumping visible (90.4 - 91.1'), loose - compact, massive, sll. damp - dry, 2.5Y 4/1 gray, rxn to HCl = uknwn., plasticity = uknwn.; Gravel: 2-4mm (v. fine pebbles), 90% f / 10% m, well sort, ang. - sub. rnd., felsic: quartzite, mafic: basalt; Sediment between 92.4' & 95.4' = RAD. CONTAM.	CORE 17 B3BL27 110.4 - 112.9' bgs Sample Collected: 110.4 - 111.15' bgs. HEIS: B3FCM0, B3FCL5, B3FCL6, B3FCL7, B3FCL8, B3FCL9
112.5	CORE 17	SAMPLE		
	CORE 18		110.4 - 114.9': Silt (M) (98% M, 2% S); Silt: massive, compact, sll. damp - damp, 2.5Y 4/4 olive brown, v. well sort, strong rxn to HCl, low plasticity, 100% f; Sand: v. fine (100%), sub. ang., 100% f, felsic: quartz, quartzite, v. well sort.	CORE 18 B3BL29 112.9 - 114.9' bgs
115				
117.5	CORE 19		@ 111.1': Silt (95% M, 5% S); Silt: massive, compact, dry - sll. damp, 2.5Y 5/3 lt. olive brown, v. well sort, no rxn to HCl, 100% f, non plastic; Sand: sub. ang., felsic: quartz, quartzite, mica, 100% f, v. fine (100%), v. well sort.	CORE 19 B3BL31 115.4 - 120.4' bgs RAD: @ 115.4' = 1000 cpm β/γ
120				
	CORE 20		@ 111.9': Silt (98% M, 2% S); Silt: massive, compact, sll. damp - damp, non plastic, 2.5Y 4/3 olive brown, v. well sort, strong - mod. rxn to HCl, 100% f; Sand: sub. ang., 100% f, felsic: quartz, quartzite, v. fine (100%), v. well sort; ~ 23 cm of laminar bedding present @ the btm. of core 17.	CORE 20 B3BL39 120.4 - 122.4' bgs.
122.5	CORE 21			CORE 21 B3BL41 122.4 - 125.4' bgs.
125	CORE 22		@ 112.9': Silt (98% M, 2% S); Silt: massive, mod. compact, - loose, sll. damp - dry, non plastic, 2.5Y 5/2 grayish brown, weak - no rxn to HCl, 100% f, v. well sort; Sand: v. fine (100%), 100% f, felsic: quartz,	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-22-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		@ 112.9' (cont'd): quartzite, mica, v. well sort, sub. ang.; DUE TO HACKLY TEXTURE (from opening the core) - it's hard to determine if bedding from core 17 extends into core 18...	Sonic Core
			115.4 - 118.1': Silt (M) (80% M, 20% S); Silt: loose - massive ÷ compact, damp - dry, plasticity = uknwn., rxn to HCl = uknwn., v. well sort, 95% f / 5% m, 2.5 Y 5/3 lt. olive brown; Sand: v. fine (100%), v. well sort, 95% f / 5% m, mineralogy = uknwn., rxn to HCl = unknwn., sub. ang.; Sediment @ 115.4' = RAD. CONTAM.	
			@ 116.7 - 117.4': med. laminar bedding present.	
			118.1 - 118.5': Caliché (cemented Sandy Silt) (55% M, 45% S); Silt: massive, compact, slt. damp - dry, plasticity = unknwn., rxn to HCl = unknwn., v. well sort, 100% f, 2.5 Y 7/1 lt. gray; Sand: v. fine (100%), v. well sort, slt. damp - dry, 98% f / 2% m, sub. ang., rxn to HCl = unknwn., mineralogy = unknwn.; Sediment part of core 19, sediment @ 115.4' = RAD. CONTAM.	
			118.5 - 120.4': Silty Sand (mS) (55% S, 45% M); Sand: v. fine - fine (50% v. fine, 50% fine), well sort, slt. damp - damp, 95% f / 5% m, sub. ang., rxn to HCl = unknwn, mineralogy = unknwn., 2.5 Y 5/2 grayish brown; Silt: massive, compact, slt. damp - damp, plasticity = unknwn., rxn to HCl = unknwn, v. well sort, 95% f / 5% m, 2.5 Y 5/2 grayish brown, chunks of cemented silt also present.; Sediment part of core 19, sediment @ 115.4' = RAD. CONTAM.	

11/22/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist	J. Hocking	11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-22-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			120.4 - 123.0': Sandy Silt (sM) (55% M, 45% S); Silt: dense, massive, compact, non. plastic, strong rxn to HCl, 2.5Y 5/3 lt. olive brown, chunks of cemented silt present, v. well sort, damp; Sand: v. fine (100%), v. well sort, sub. ang., 90% f / 10% m, felsic: quartz, quartzite, mica, mafic: basalt, damp.	Sonic Core
			@ 120.4 - 120.8': ~ 12.2 cm of med. laminar bedding (tightly packed).	
			@ 120.9 - 121.2': Sandy Silt (Caliché) (90% M, 10% S). Silt: dense, massive, compact, weak plasticity, strong rxn to HCl, 2.5Y 7/2 lt. gray, heavily cemented w/ $CaCO_3$, v. well sort, slt. damp; Sand: v. fine (100%), v. well sort, slt. damp, sub. ang., 95% f / 5% m, felsic: quartz, quartzite, mafic: basalt.	
			@ 121.9': caliché stringer.	
			@ 122.0': caliché stringer.	
			@ 122.1': caliché stringer.	
			@ 122.2 - 122.5': ~ 9.1 cm of thinly laminar bedding (loosely packed).	
			@ 122.25': caliché stringer.	
			@ 122.4 - 123.0': Sandy Silt (55% M, 45% S); Silt: dense, compact, slt. damp, v. well sort, 2.5Y 5/3 lt. olive brown, mod. plasticity, predom. felsic: quartz, quartzite, sub. ang.; Sand: v. fine (100%), v. well sort, sub. ang., slt. damp-dry, 90% f / 10% m, felsic: quartz, quartzite, trace mica, mafic: basalt, v. weak rxn to HCl.	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist	[signature]	11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-22-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
127.5	CORE 22		123.0 - 125.4' Silty Sand (mS) (55% S, 45% M); Sand: v. fine - fine (50% v. fine, 50% fine), v. well sort, 2.5Y 6/2 lt. brownish gray, sub. ang., slt. damp - dry, 90% f / 10% m, felsic: quartz, quartzite, trace mica, mafic: basalt, v. weak rxn to HCl; Silt: loose, dry, v. well sort, non plastic, predom. felsic: quartz, quartzite, sub. ang.	Sonic Core Cold Creek Unit - UPPER CORE 22 B3BL43 125.5 - 130.5' bgs
130				CORE 23 B3BL45 129.8 - 134.8' bgs.
132.5	CORE 23		125.5 - ~~130.5~~ 134.8': Sandy Silt (sM) (50% M, 45% S, 5% G); Silt: damp, dense, massive, compact, v. well sort, predom. felsic: quartz, quartzite, sub. ang., 10YR 4/3 brown, v. weak rxn to HCl; Sand: damp, v. fine (100%), 95% f / 5% m, felsic: quartz, quartzite, mafic: basalt, v. well sort, sub. ang.; Gravel: 2-4mm (v. fine pebbles), predom. 2mm, sub. ang., predom. mafic: basalt, poor sort, dry.	
135	SAMPLE			CORE 24 B3BL47 135.4 - 140.4' bgs Sample Collected: 135.4 - 136.4' bgs HEIS: B3FCM6, B3FCM7, B3FCM1, B3FCM2, B3FCM3, B3FCM4, B3FCM5
137.5	CORE 24		@ 129.2 - 129.65': Sandy Silt Color change: 2.5Y 4/3 olive brown	
140			@ 129.65': v. fine grn. lens: (100% M); Silt: compact, minor, v. well sort, predom. felsic, sub. ang., too small to determine plasticity, 2.5Y 3/3 d. olive brown, no rxn to HCl.	CORE 25 B3BL49 140.0 - 145.0' bgs
142.5	CORE 25		@ 129.65 - 130.5': Sandy Silt Silt changes: 2.5Y 5/4 lt. olive brown, mod. cemented; Sand changes: mod. cemented; Strong rxn to HCl, cemented chunks of sand/silt present. @ 130.2 - 130.5': ~ 9.1cm thin laminar bedding (tightly packed).	Cold Creek Unit - lower
145	CORE 26		@ 130.5 - 131.15': Sandy Silt (60% M, 40% S, trace Gravel); Silt: dense, massive, compact, v. well sort., slt. damp - damp, mod. - strong rxn to HCl, v. weak plasticity;	CORE 26 B3BL51 145.0 - 150.0' bgs

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		130.5 - 131.15 (cont'd): Sand: v. fine (100%), predom. felsic: quartz, quartzite, sub. ang., v. well sort, slt. damp - damp; Trace Gravel: 2-4 mm (v. fine pebbles), predom. 2mm, scattered through out section, sub. ang., predom. mafic, mafic: basalt, 10YR 5/2 grayish brown.	Sonic Core
			@ 130.9 - 131.05': nodule of Sandy Silt (65% M, 35% S, trace G).	
			@ 131.15 - 133.45': Sandy Silt (65% M, 35% S, trace G); Silt: dense, massive, compact, v. well sort, slt. damp - damp, mod. rxn to HCl, weak plasticity; Sand: v. fine (100%), predom. felsic: quartz, quartzite, sub. ang., v. well sort, slt. damp - damp, 10 YR 4/3 brown; Gravel: 2-4 mm (v. fine pebbles), predom. 2mm, scattered throughout section, sub. ang., predom. mafic: basalt.	
			@ 132.9': Color change: 2.5Y 4/3 olive brown	
			@ 133.45 - 133.75': Sandy Silt (65% M, 30% S, 5% G); Silt: dense, massive, compact, v. well sort, v. weak plasticity, slt. damp - dry, strong rxn to HCl, caliché speckled through out section; Sand: v. fine (100%), predom. felsic: quartz, quartzite, sub. ang., v. well sort, slt. damp - dry, 10YR 6/2 lt. brownish gray; Gravel: 2-4mm (v. fine pebbles), predom. 2mm, sub. ang., predom. mafic: basalt.	
			@ 133.75 - 134.8': Sandy Silt (60% M, 35% S, 5% G); Silt: dense, massive, compact, v. well sort, slt. damp - damp, strong - v. strong rxn to HCl, v. weak plasticity; Sand: v. fine (100%), predom. felsic: quartz, quartzite, sub. ang., v. well sort, slt. damp - damp,	

11/28/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			133.75 - 134.8' (cont'd):	Sonic Core
			2.5 Y 5/3 lt. olive brown; Gravel: 2-4mm (v. fine pebbles), predom. 2mm, sub. ang., predom. mafic: basalt, scattered throughout section, chunks of cemented silt/sand also intermixed through section.	
			135.4 - 140.5': Caliché (cemented sM) (70% M, 28% S, 2% G); Silt: massive, compact, strong rxn to HCl, dry - slt. damp, well sort, 98% f / 2% m; Sand: v. fine (100%), 98% f / 2% m, felsic: quartz, quartzite, mica, mafic: basalt, sub. ang., well sort; Gravel: 3mm (v. fine pebbles), predom. mafic: basalt, poor sort, cemented w/ $CaCO_3$ + siliceous cement, 10-20 mm cemented chunks of silt/sand present, 7.5 YR 6/2 pinkish gray.	@ 140.5' Cold Creek Unit - upper / Cold Creek Unit - lower contact; 2.5Y 7/1 lt. gray, strong rxn to HCl.
			@ 137.6': Caliché (cemented mS) (65% S, 35% M, 5% G); Sand: fine - crse (80% fine, 20% crse), well sort, 70% f / 30% m, felsic: quartz, quartzite, feldspar, mafic: basalt, sub. ang.; Silt: massive, mod. compact - loose, dry, strong rxn to HCl, v. well sort, cemented, 100% f; Gravel: 10-20mm (med. - crse pebbles), quartzite + basalt, v. poor sort, cemented, 10 YR 5/2 grayish brown.	
			@ 139.3 - 139.5': caliché / silt banding, strong rxn to HCl.	
			@ 140 - 140.5': Caliché (cemented mG) (60% G, 30% M, 10% S); Gravel: 5-65mm (fine pebble - sm. cobble), predom. crse pebbles, 100% m, mafic: basalt, v. poor sort, sub. ang - sub. rnd., slt. damp - dry; Silt: compact, loose - dense, matrix, cemented, predom. mafic, slt. damp - dry, v. well sort, mod - strong rxn to HCl, 2.5Y 4/3 olive brown -	

NOT USED

11/26/17

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		140 - 140.5' (cont'd):	Sonic Core
			- 2.5Y 4/2 d. grayish brown; Sand: fine - v. crse (20% fine, 0% med., 30% crse, 50% v. crse), poor sort, sub. ang - sub. rnd., slt. damp - dry, predom. mafic: basalt, 2.5Y 4/2 d. grayish brown.	
			140.5 - 149.3': Sandy Gravel (SG) (65% S, 30% G, 5% M); Sand: crse - v. crse (50% crse, 50% v. crse), sub. ang., well sort, slt. damp - dry, 80% m / 20% f, mafic: basalt, felsic: quartz, quartzite, no rxn to HCl, 2.5Y 4/3 olive brown; Gravel: 2-65mm (v. fine pebbles - sm. cobble), predom. crse pebbles, sub. ang. - rnd., v. poor sort, 95% m / 5% f, mafic: basalt, felsic: quartzite, slt. damp - dry; Silt: loose, dry, v. well sort, minor, predom. felsic.	
			@ 140.8 - 145': Color change: 2.5Y 5/2 grayish brown.	
			@ 145 - 149.3': Sandy Gravel (65% S, 30% G, 5% M); Sand: fine - v. crse (5% fine, 0% med., 50% crse, 45% v. crse), sub. ang., well sort, 80% m / 20% f, mafic: basalt, felsic: quartz, quartzite, slt. damp, 2.5Y 5/1 gray, no rxn to HCl; Gravel: 2-65mm (v. fine pebbles - sm. cobbles), predom. v. fine - med. pebbles, sub. ang. - rnd., v. poor sort, 70% m / 30% f, mafic: basalt, felsic: quartzite, slt. damp - dry; Silt: loose, dry, minor, v. well sort, non plastic.	
			@ 145.7': Color change: 2.5Y 4/2 d. grayish brown.	
			@ 148.1': Color change: 2.5Y 5/2 grayish brown.	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
147.5	CORE 26		149.3 – 150': Sandy Silt (sM) (50%M, 45% S, 5%G); Silt: loose - compact, dry, v. well sort, massive, non. plastic, predom. mafic, 2.5Y 6/1 gray; Sand: v.fine - v. crse (80% v.fine, 0% fine, 0% med., 10% crse, 10% v. crse), sub. ang - sub. rnd., v. well sort, 55% f/45% m, felsic: quartz, quartzite, mafic: basalt, dry; Gravel: 2-20 mm (v.fine - crse pebbles), predom. v. fine pebbles, sub. ang - sub. rnd., poor sort, 100% m, mafic: basalt, dry; no rxn to HCl.	Sonic Core Cold Creek Unit - lower
150	CORE 27		150 - 151.3': Sand (S) (95% S, 5% G); Sand: med - crse (70% med, 30% crse), v. well sort, sub. ang., 60%m/40%f, mafic: basalt, felsic: quartz, quartzite, feldspar, slt. damp - damp, no rxn to HCl, 2.5Y 3/1 v. dark gray; Gravel: 2-50mm (v. fine - v. crse pebbles), predom. v. crse pebbles, 90% m/10% f, mafic: basalt, felsic: quartzite, ang. - rnd., slt. damp - damp, v. poor sort.	CORE 27 B3BL53 150. – 155.5' bgs @ 151.5': Cold Creek Unit - lower / Ringold Fm. - Taylor Flats contact.
152.5				
155	CORE 28	SAMPLE	151.3 - 151.6': slightly Silty Sand ((m)S) (75% S, 20% M, 5% G); Sand: fine - crse (10% fine, 50% med, 40% crse), v. well sort, sub. ang., 55% f/45% m, felsic: quartz, quartzite, mafic; basalt, slt. damp - damp, mod. rxn to HCl, 2.5Y 4/2 d. grayish brown; Silt: loose - compact, cemented in places, v. well sort, predom. felsic, slt. damp - damp, non. plastic; Gravel: 10-20mm (med - crse pebbles), predom. med. pebbles, 100% m, mafic: basalt, slt. damp - damp, well sort.	CORE 28 B3BLB9 155.3 - 160.3' bgs Sample Collected: 156.7' - 158.2' bgs HEIS: B3FCN3, B3FCM8, B3FCM9, B3FCN0, B3FCN1, B3FCN2
157.5				
160	CORE 29			CORE 29 B3BLC1 160.3 - 165.3' bgs Ringold Fm., Unit E
162.5				
165	CORE 30		151.6 - 151.75': Silt (M) (100% M); Silt: compact, dense, massive, cemented in places, v. well sort, 100% f, slt. damp - damp, med. plasticity, mod rxn to HCl, 2.5Y 4/3 olive brown.	CORE 30 B3BLC3 165.3 - 170.3' bgs.

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		151.75 - 153.2': Silty Sand (mS) (55% S, 45% M); Sand: v. fine (100%), v. well sort, sub. ang., 95% f / 5% m, felsic: quartz, quartzite, mica, mafic: basalt, damp, no rxn to HCl, 2.5Y 5/2 grayish brown; Silt: loose, massive, v. well sort, 100% f, sub. ang.	Sonic Core
			@ 152.4 - 152.45': Silt lens: (100% M); Silt: dense, compact, v. well sort, damp, 100% f, med. plasticity, no rxn to HCl, 2.5Y 4/3 olive brown.	
			@ 152.45 - 153': Silty Sand (55% S, 45% M); Sand: v. fine - fine (50% v. fine, 50% fine), v. well sort, sub. ang., 95% f / 5% m, felsic: quartz, quartzite, mica, mafic: basalt, damp, no rxn to HCl, 2.5Y 4/2 d. grayish brown; Silt: loose, massive, v. well sort, damp, 100% f.	
			@ 153 - 153.05': Sand lens: (95% S, 5% M); Sand: v. fine - med. (50% v. fine, 35% fine, 15% med.), v. well sort., sub. ang., 80% m / 20% f, mafic: basalt, felsic: quartz, quartzite, trace mica, damp, no rxn to HCl, 2.5Y 3/2 v. dark grayish brown; Silt: loose, v. well sort, damp, predom. felsic, minor.	
			@ 153.05 - 153.2': Silty Sand (55% S, 45% M); Sand: v. fine - fine (50% v. fine, 50% fine), v. well sort, sub. ang., 95% f / 5% m, felsic: quartz, quartzite, mica, mafic: basalt, damp, no rxn to HCl, 2.5Y 4/2 d. grayish brown; Silt: loose, massive, v. well sort, damp, 100% f	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		153.2 - 153.7': Sandy Silt (sM) (55%M, 45% S); Silt: loose - dense, compact, massive, low - no plasticity, damp, 100% f, no rxn to HCl, 2.5 Y 4/3 olive brown; Sand: v. fine (100%), v. well sort, damp, 95%f / 5%m felsic: quartz, quartzite, mica, mafic: basalt, sub. ang.	Sonic Core
			153.7 - 154.1': Sand (S) (100% S); Sand: fine - med (55% fine, 45% med.), 50% m / 50% f, mafic: basalt, felsic: quartz, quartzite, feldspar, v. well sort, slt. damp - dry, sub. ang., no rxn to HCl, 2.5 Y 5/1 gray.	
			154.1 - 155.3': Silt (M) (85% M, 15% S); Silt: dense, massive, compact, low plasticity, damp, 100% f, no rxn to HCl, 2.5 Y 4/4 olive brown; Sand: v. fine (100%), v. well sort, 100% f, felsic: quartz, quartzite, sub. ang., damp.	
			155.3 - 156.2': Silty Sand (mS) (60% S, 40% M); Sand: v. fine - fine (50% v. fine, 50% fine), 100% f, felsic: quartz, quartzite, mica, sub. ang., damp, v. well sort; Silt: massive, compact, damp, v. well sort, low rxn to HCl, 2.5 Y 5/2 grayish brown.	
			156.2 - 157.7': Silt (M) (98% M, 2% S); Silt: massive, compact, slt. damp - saturated, v. well sort, low rxn to HCl, 2.5 Y 5/4 lt. olive brown; Sand: v. fine (100%), v. well sort, 100% f, felsic: quartz, quartzite, mica, sub. ang.; low plasticity; possible perched H_2O zone.	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			157.7 - 158.1': Silty Sand (mS) (50% S, 50% M); Sand: v. fine (100%), 100% f, felsic: quartz, quarteite, mica, sub. ang., v. well sort; Silt: massive, compact, damp, v. well sort, low rxn to HCl, 2.5Y 4/2 d. grayish brown.	Sonic Core
			158.1 - 159.15': Sandy Silt (sM) (60% M, 40% S); Silt: massive, compact, v. well sort, damp; Sand: v. fine - fine (100% v. fine grading down to 50% v. fine, 50% fine), 100% f, felsic: quartz, quarteite, mica, sub. ang., v. well sort, low rxn to HCl; 158.1 - 158.8': 2.5Y 4/3 olive brown, 158.8 - 159.15': 2.5Y 3/1 v. dark gray.	
	NOT USED		159.15 - 159.25': Silt (M) (100% M); Silt: damp, v. well sort, compact, tight small zone, low plasticity, low - no rxn to HCl, 2.5Y 5/4 lt. olive brown.	
			159.25 - 159.65': Sand (S) (95% S, 5% M); Sand: 95% f / 5% m, felsic: quartz, quartzite, mica, mafic: basalt, mod. sort, fine - med (30% fine, 70% med.); Silt: loose, damp - slt. damp, v. well sort, 100% f, no rxn to HCl, 2.5Y 3/1 v. dark gray	
			159.65 - 159.75': Silt (M) (100% M); Silt: damp, v. well sort, compact, tight small zone, non. plastic, no rxn to HCl, 2.5Y 4/2 d. grayish brown.	
			159.75 - 160.3': Sand (S) (98% S, 2% M); Sand: med - crse (50% med, 50% crse), 50% m / 50% f, "salt & pepper" sand, felsic: quartz, quartzite, feldspar, mica, mafic: basalt, poor sort, damp, ang. - sub ang., no rxn to HCl, 2.5Y 2.5/1 black; Silt: same as above.	

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			160.3 - 161': NO RECOVERY	Sonic Core
			161 - 162.8': Silty Sandy Gravel (msG) (55% S, 30% G, 15% M); Sand: crse - v. crse (60% crse, 40% v. crse), well sort, sub. ang., damp - wet, 90% m / 10% f, mafic: basalt, felsic: quartz, quartzite, 2.5Y 2.5/1 black, strong rxn to HCl; Gravel: 2-50 mm (v. fine - v. crse pebbles), sub. rnd. - rnd., v. poor sort, 100% m, mafic: basalt, damp - wet; Silt: wet, coating sand / gravel, sticky, predom. mafic, low plasticity.	
	NOT USED		@ 161.9 - 162.8': Silty Sandy Gravel (40% S, 40% G, 20% M); Sand: dry, crse - v. crse (60% crse, 40% v. crse), well sort, sub. ang., 90% m / 10% f, mafic: basalt, felsic: quartz, quartzite, 2.5Y 4/1 d. gray, mod rxn to HCl 161.9 - 162.6'; no rxn to HCl 162.6 - 162.8'; Gravel: 2-50 mm (v. fine - v. crse pebbles), sub. rnd - rnd., v. poor sort, 100% m, mafic: basalt, dry; Silt: dry, loose, predom. mafic, non. plastic.	
			162.8 - 165.3': Silty Gravel (mG) (45% G, 40% M, 15% S); Gravel: 5-100 mm (fine pebble - sm. cobble), predom. fine - med pebbles, sub. ang. - rnd., 95% m / 5% f, mafic: basalt, felsic: quartzite (@ 164.3' = sm. rnd. cobble); Silt: loose, dry, massive, compact in places, cemented in places, predom. mafic, non. plastic, flour consistency, v. well sort, no rxn to HCl 162.8 - 163.3'; mod. rxn to HCl 163.3 - 165.3', 5Y 5/1 gray; Sand: v. crse (100%), sub. ang., poor sort, 90% m / 10% f, mafic: basalt, felsic: quartz, quartzite, dry.	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
167.5	CORE 30		165.3 – 169.6': Silty Sandy Gravel (msG) (70% G, 20% M, 10% S); Gravel: 2-65mm (v. fine pebbles – sm. cobbles), ang.-rnd., v. poor sort, predom. v.fine-med pebbles, predom. cemented w/ $CaCO_3$, places cemented w/ siliceous cement, dry, 90%m/10%f, mafic: basalt, felsic: quartzite; Silt: loose, dry, v. well sort, predom. mafic, sub. ang., massive, dense in places; Sand: v. fine – crse (60% v.fine, 10% f, 10% med, 20% crse), mod-well sort, sub. ang., 60%m/40%f, mafic: basalt, felsic: quartz, quartzite, mica, weak-strong rxn to HCl (varying $CaCO_3$ cementation throughout section), 10YR 5/1 gray.	Sonic Core Ringold Fm., Unit E
170				CORE 50 B3BL97 170.3 – 175.3' bgs Sample Collected: 170.3 – 171.8' bgs HEIS: B3FLP9, B3FLR0, B3FLR1, B3FLR2
172.5	CORE 50	SAMPLE		
175			@ 166.8 – 167.2': Color change: 10YR 6/1 gray; Silt: predom felsic.	CORE 51 B3BL99 175.4 – 180.4' bgs
177.5	CORE 51		@ 167.2': Gravels highly cemented w/ siliceous cement (no rxn to HCl); 10YR 4/1 d. gray.	
			@ 168.4': 10YR 4/2 d. grayish brown.	
			@ 169.3': 10YR 5/1 gray	
180			169.6 – 170.3': NO RECOVERY	CORES 31, 32, 33 SENT TO PNNL AND WERE NOT LOGGED.
182.5	NOT USED		170.3 – 172.9': Gravelly Silt (gM) (65%M, 20%S, 15%G); Silt: dry-slt. damp, compact-loose, matrix, strong rxn to HCl, v. well sort, predom. felsic, 2.5Y 6/2 lt. brownish gray; Sand: v.fine-fine (50% v.fine-50% fine), sub. ang., dry, 80% f/20%m, felsic: quartz, quartzite, mafic: basalt, no rxn to HCl; Gravel: 5-50mm (fine-v.crse pebbles), predom. crse pebbles, ang.-rnd., dry, v. poor sort, 100% m: basalt; appears to be weathered caliché...	
185				

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist	J. Hocking	11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		@ 170.8 - 171.3': Gravelly Silt (70% M, 25% G, 5% S); Silt: dry, loose, v. well sort, predom. mafic, weak rxn to HCl, 5Y 6/1 gray; Gravel: 5-50mm (fine- v. crse pebbles), predom. crse pebbles, ang.-rnd., dry, v. poor sort, 100% m: basalt; Sand: v. fine (100%), dry, sub. ang., predom. mafic, weak rxn to HCl, v. well sort.	Sonic Core
			@ 171.3 - 172.9': Gravelly Silt (80% M, 15% G, 5% S); Silt: massive, compact, dry, matrix, v. well sort, predom. felsic, 2.5Y 5/2 grayish brown, no rxn to HCl, non plastic; Gravel: 5-50mm (fine- v. crse pebbles), predom. crse pebbles, 100% m: basalt, v. poor sort, matrix supported w/silt, sub. ang- sub. rnd., conglomerate; Sand: v. fine (100%), dry, sub. ang., predom. felsic, no rxn to HCl, v. well sort.	
			172.9 - 173.8': Silty Sandy Gravel (msG) (40% S, 30% G, 30% M); Sand: med.-crse (50% med, 50% crse), sub. ang., 80%m/20% f, mafic: basalt, felsic: quartz, quartzite, mica, 5Y 4/1 d. gray, no rxn to HCl, mod. sort; Gravel: 5-60mm (fine - v. crse pebbles), predom. med. pebbles, sub. ang.-rnd., 100% m: basalt, v. poor sort, conglomerate 172.9-173.5', loose 173.5-173.8', dry; Silt: loose, slt. damp-dry, v. well sort, 50%m /50%f, no rxn to HCl, non plastic.	
			173.8 - 174.8': Sandy Gravel (sG) (60% S, 30% G, 10% M); Sand: fine-crse (60% fine, 30% med., 10% crse), well sort, dry, no rxn to HCl, 5Y 6/1 gray, sub. ang., predom. felsic (70%f/30%m), felsic: quartz, quartzite, mafic: basalt; Gravel: 5-50mm (fine- v. crse pebbles), predom. crse. pebbles, ang.-rnd., poor sort, 95%m/5%f,	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			173.8 - 174.8' (cont'd):	Sonic Core
			mafic: basalt, felsic: quartzite, conglomerate 173.8 - 174.3', loose 174.3 - 174.8'; Silt: dry, massive, compact, 173.8 - 174.3' matrix, 174.3 - 174.8' loose, v. well sort, 174.3 - 174.8' weathered, non plastic, no rxn to HCl.	
			174.8 - 175.3': NO RECOVERY	
			175.4 - 176.3': Silty Sandy Gravel (msG) (40% G, 30% S, 30% M); Gravel: 2-50 mm (v. fine - v. crse pebbles), predom. crse - v. crse pebbles, mod. sort, sub. ang. - rnd., matrixed w/silt, 100% m: basalt; Sand: v. fine - crse (40% v. fine, 10% fine, 10% med, 40% crse), well sort, dry, sub. ang., predom. felsic: quartz, quartzite, no rxn to HCl, 2.5 Y 4/2 d. grayish brown.; Silt: loose - compact, dense in places, dry, non plastic, v. well sort, matrix w/ gravels, predom. mafic.	
	NOT USED		176.3 - 176.95': Silty Gravel (mG) (50% G, 40% M, 10% S); Gravel: 2-70 mm (v. fine pebbles - sm. cobbles), predom. v. crse pebbles - sm. cobbles, v. poor sort, ang. - sub. rnd, loose, 100% m: basalt; Silt: dry, loose - compact, non. plastic, v. well sort, predom. mafic; Sand: v. fine (100%), v. well sort, dry, sub. ang, predom. mafic, 5Y 4/1 d. gray, no rxn to HCl.	
			176.95 - 179.05': Silty Sandy Gravel (msG) (40% S, 30% G, 30% M). Sand: v. fine - v. crse (80% v. fine, 10% fine, 2.5% med, 5% crse, 2.5% v. crse), well sort, sub. ang., 95% m / 5% f, mafic: basalt, felsic: quartz, quartzite, dry, no rxn to HCl, 176.95 - 177.9': 2.5Y 4/2 d. grayish brown, 177.9 - 179.05': 2.5Y 5/1 gray; Gravel: 2-70 mm (v. fine pebbles - sm. cobbles),	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			176.95 - 179.05' (cont'd): predom. v. crse pebbles - sm. cobbles, mod sort, dry, loose, sub. ang. - rnd., 100% m: basalt; Silt: dry, loose - compact, dense, massive in small zones, non plastic, predom. mafic, v. well sort.	Sonic Core
			179.05 - 180.1': Sandy Gravel (sG) (60% S, 30% G, 10% M); Sand: v. fine - v. crse (50% v. fine, 5% fine, 2.5% med., 2.5% crse, 40% v. crse), well sort, sub. ang., predom. felsic (60% f / 40% m), felsic: quartz, quartzite, mafic: basalt, 10YR 6/2 lt. brownish gray, no rxn to HCl; Gravel: 2-50mm (v. fine - v. crse pebbles) predom. med. pebbles, poor sort, dry, sub. ang. - rnd., 60% m / 40% f, mafic: basalt, felsic: quartzite; Silt: dry, loose - compact, dense, massive, non. plastic, predom. felsic, v. well sort.	
			180.1 - 180.4': Silty Gravel (mG) (55% M, 30% G, 15% S); Silt: dry, compact, dense, low - no plasticity, predom. mafic, v. well sort; Gravel: 2-50mm (v. fine - v. crse pebbles), predom. crse pebble, sub. ang - sub rnd, 100% m: basalt, poor sort, dry; Sand: v. fine (100%), v. well sort, sub. ang., predom. mafic, dry, loose, no rxn to HCl, 2.5Y 5/1 gray.	
			195.3 - 195.45': Gravelly Silt (gM) (70% M, 20% G, 10% S); Silt: low plasticity, dense, compact, massive, matrix, v. well sort, damp; Gravel: 2-60mm (v. fine - v. crse pebbles), predom. v. fine - fine pebbles, sub. ang - rnd., v. poor sort, slt. damp - damp, 100% m: basalt; Sand: v. fine (100%), sub. ang., v. well sort, damp, predom. felsic, 2.5Y 4/2 d. grayish brown, no rxn to HCl.	

NOT USED

11/28/17

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
187.5	NOT USED		195.45 – 196.9': Silty Sandy Gravel (msG) (50% G, 35% S, 15% M); Gravel: 2-50mm (v.fine – v.crse pebbles), predom. med-crse pebbles, dry, sub.ang – rnd., v. poor sort, 90%m / 10%f, mafic: basalt, felsic: quartzite; Sand: v.fine - fine (50% v.fine, 50% fine), sub. ang., well sort., slt. damp - dry, 80%m / 20%f, mafic: basalt, felsic: quartz, quartzite, feldspar, 2.5Y 5/2 grayish brown, no rxn to HCl; Silt: non plastic, loose, dry, v. well sort, minor.	Sonic Core Ringold Fm., Unit E
190				
192.5			196.9 – 197.7': Silty Gravel (mG) (55% G, 40% M, 5% S); Gravel: 2-60 mm (v.fine - v.crse pebbles), predom. crse pebbles, dry, ang.- sub. rnd., v. poor sort, 90%m / 10%f, mafic: basalt, felsic: quartzite; Silt: non plastic, dry, loose, v. well sort, massive, flour-like consistency; Sand: v. fine (100%) sub. ang., v. well sort, dry, predom. mafic, 5Y 5/1 gray, no rxn to HCl.	
195				CORE 34 B3BL73 195.3 – 200.3' bgs.
	CORE 34			
197.5			199.2' 197.7 – ~~198.7~~ msh 199.2': Sandy Gravel (sG) (60% G, 40% S); Gravel: 2-60mm (v.fine - v.crse pebbles), predom. med. pebbles, ang.- rnd., v. poor sort, dry, 50%m / 50%f, mafic: basalt, felsic: quartzite; Sand: v.fine - fine (50% v.fine, 50% fine), sub. ang., v. well sort, dry, 85%f / 15%f, mafic: basalt, felsic: quartz, quartzite, feldspar, mica, 2.5Y 5/2 grayish brown, no rxn to HCl	
200				CORE 35 B3BL75 200.3 – 204.8' bgs. Sample Collected: 200.3 – 202.8' bgs. HEIS: B3FLR6, B3FLX1, B3FLR3, B3FLR4, B3FLR5
	CORE 35			
202.5			@ 198.7 – 199.2': Sandy Gravel (60% S, 30% G, 10% M); Sand: v.fine - med. (50% v.fine, 40% fine, 10% med), sub. ang., v. well sort, dry, 60%m / 40%f, mafic: basalt, felsic: quartz, quartzite, mica; Gravel: 2-90mm (v.fine pebbles - sm. cobbles) predom. v.fine - med pebbles, v. poor sort, sub. ang - sub. rnd., dry, 80%m / 20%f, mafic: basalt, felsic: quartzite; Silt: loose, dry, minor, non plastic, v. well sort,	
205				
	CORE 36			

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			198.7 – 199.2' (cont'd): predom. mafic, 10YR 5/1 gray, no rxn to HCl.	Sonic Core
			199.2 – 200.3': Silty Gravel (mG) (55% M, 35% G, 10% S); Silt: damp – wet, coating sand & gravel, matrix w/ gravel, dense, massive, low plasticity; Gravel: 2-50 mm (v.fine – v.crse pebbles), predom. med. pebbles, poor sort, sub ang – rnd., damp, 95% m / 5% f, mafic: basalt, felsic: quartzite, matrixed w/ silt (conglomerate); Sand: v. fine (100%), v. well sort, sub. ang., damp – wet, predom. mafic, felsics: quartz, quartzite, 2.5Y 3/2 v. dark grayish brown, no rxn to HCl.	
	NOT USED		200.3 – 204.8': Sandy Gravel (sG) (55% S, 45% G); ~~Sandy~~ MJH 11/28/17 Sand: fine – med (60% fine, 40% med), ang – sub ang, 80% f / 20% m, felsic: quartz, quartzite, feldspar, mica, mafic: basalt, dry, 2.5Y 6/2 lt. brownish gray, well sort, no rxn to HCl, highly compacted; Gravel: 5-65mm (fine pebbles – sm. cobbles), predom. crse pebbles, ang – rnd., 50% m / 50% f, mafic: basalt, felsic: quartzite, dry, no rxn to HCl, v. poor sort.	
			@ 203.2': Rust staining.	
			@ 203.85': Rust staining.	
			205.4 – 210.15': Silty Sandy Gravel (msG) (50% S, 35% G, 15% M); Sand: v. fine – fine (50% v. fine, 50% fine), v. well sort, sub. ang., 90% f / 10% m, felsic: quartz, quartzite, feldspar, mafic: basalt, dry, no rxn to HCl, 205.4 – 208.4': 2.5Y 6/2 lt. brownish gray, 208.4 – 210.15': 2.5Y 6/1 gray; Gravel:	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
207.5	CORE 36		205.4 – 210.15' (cont'd):	Sonic Core
			2-65mm (v. fine pebbles – sm. cobbles), predom.	Ringold Fm., Unit E
			med. pebbles, sub. ang. – rnd., poor sort,	CORE 36 B3BL77
			70% m / 30% f, mafic: basalt, felsic: quartzite,	205.4 – 210.4' bgs
			dry; Silt: dry, loose, v. well sort, non plastic,	
210			predom. felsic.	
	CORE 37		@ 206.8 – 210.15': Silty Sandy Gravel	CORE 37 B3BL79
			(50% G, 30% S, 20% M); Gravel:	210.4 – 215.4' bgs.
			2-50mm (v. fine – v. crse pebbles) predom.	Sample Collected:
212.5			crse pebbles, sub. ang – rnd., v. poor sort,	210.4 – 212.4' bgs
			60% m / 40% f, mafic: basalt, felsic:	HEIS: B3FLT0,
			quartzite, granite (or granodiorite),	B3FLR7, B3FLR8,
			cemented (siliceous cement); Sand:	B3FLR9
			v. fine – fine (50% v. fine, 50% fine), v. well	
215			sort, sub. ang., 90% f / 10% m, felsic:	
	CORE 38		quartz, quartzite, feldspar, mica, mafic:	CORE 38 B3BL81
			basalt, dry, no rxn to HCl; Silt:	215.4 – 220.4' bgs.
			loose, dense, massive, matrix, non plastic,	
			v. well sort, predom. felsic.	
217.5				
			210.15 – 210.4': NO RECOVERY	
			210.4 – 214.9': Sandy Gravel (sG)	
			(60% S, 35% G, 5% M); Sand: v. fine – fine	
220			(50% v. fine, 50% fine), v. well sort, slt.	CORE 39 B3BL83
			damp – dry, 95% f / 5% m, felsic: quartz,	220.5 – 225.5' bgs.
			quartzite, mica, mafic: basalt, weak –	
			no rxn to HCl, 2.5Y 5/1 gray, sub. ang.;	
			Gravel: 5-65 mm (fine pebble – sm. cobble),	
222.5	CORE 39		predom. crse pebble, v. poor sort, 60% m / 40%	
			f, mafic: basalt, felsic: quartzite, sub. rnd –	
			rnd.; Silt: loose, dry.	
			@ 211.3 – 212.6': Sandy Gravel	CORE 40 B3BL85
225			(60% S, 35% G, 5% M); Sand: v. fine – crse	225.3 – 230.3' bgs.
			(70% v. fine, 20% fine, 0% med., 10% crse),	
	CORE 40		60% m / 40% f, mafic: basalt, felsic: quartz,	
			quartzite, mica, slt. damp – dry, weak – no	
			rxn to HCl, 2.5Y 4/1 d. gray; Gravel:	

Reported By:

Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-26-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			211.3 - 212.6' (cont'd): 5-65 mm (fine pebble - sm. cobble), predom. med. pebble, v. poor sort, 80% m/20% f, mafic: basalt, felsic: quartzite, sub. ang - rnd.; Silt: loose, dry.	Sonic Core
			@ 212.6 - 213.2': Sandy Gravel (65% G, 30% S, 5% M); Gravel: ang.-sub. ang., poor sort, 80% m/20% f, mafic: basalt, felsic: quartzite, feldspar, 5-40 mm (fine - v. crse pebble); Sand: strong rxn to HCl, v. fine - fine (60% v. fine, 40% fine), sub. ang., 70% m/30% f, mafic: basalt, felsic: quartz, quartzite, 2.5 Y 4/1 d. gray, dry; Silt: loose, dry.	
			@ 212.95': Granitic rock that has been destroyed within the core (37), rock flour; 2.5 Y 7/1 lt. gray.	
			@ 213.2 - 214.90': Sandy Gravel (60% G, 30% S, 10% M); Gravel: ang.-rnd. conglomerate w/ silt matrix, v. poor sort, 90% m/10% f, mafic: basalt, felsic: quartzite, slt. damp - dry, 5-70 mm (fine pebble - sm. cobble), predom. fine pebbles; Sand: weak rxn to HCl, v. fine - med. (80% v. fine, 10% fine, 10% med.), sub. ang., slt. damp - dry, 80% f / 20% m, felsic: quartz, quartzite, mafic: basalt, 2.5 Y 5/2 grayish brown; Silt: massive, compact, slt. damp, matrix.	
			214.9 - 215.4': Silty Gravel (mG) (60% G, 30% M, 10% S); Gravel: 5-65 mm (fine pebble - sm. cobble), predom. med. pebble, 100% m: basalt, ang. - sub. rnd., v. poor sort, dry; Silt: loose, dry, no rxn to HCl; Sand: v. fine (100%), 100% m: basalt, sub. ang., v. well sort, dry, no rxn to HCl, 5 Y 4/1 d. gray.	

NOT USED

11/26/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			215.4 - 215.9': Sandy Gravel (sG) (60% G, 30% S, 10% M); Gravel: 2-60mm (v. fine - v. crse pebbles), sub. ang - rnd., v. poor sort, slt. damp - dry, 50% m / 50% f, mafic: basalt, felsic: quartzite; Sand: med (100%), v. well sort, sub. ang., predom. felsic (quartz, quartzite), slt. damp - dry, no rxn to HCl, 2.5 Y 5/3 lt. olive brown; Silt: loose, dry, v. well sort, minor, non. plastic.	Sonic Core
			@ 215.6': RUST STAINING: no rxn to HCl, 7.5 YR 2.5/3 v. dark brown.	
	NOT USED		215.9 - 219.4': Silty Sandy Gravel (msG) (65% G, 20% S, 15% M); Gravel: 2-65mm (v. fine pebbles - sm. cobbles), predom. med. pebble, ang - rnd., dry, 100% m: basalt, poor sort; Sand: v. fine (100%), v. well sort, sub. ang., predom. mafic, dry, no rxn to HCl, 5Y 5/1 gray; Silt: loose, dry, v. well sort, massive, dense, non. plastic.	
			@ 216.5 - 217.6': Silty Sandy Gravel (60% G, 25% S, 15% M); Gravel: 2-70mm (v. fine pebbles - sm. cobble), predom. med. pebble, ang. - rnd., dry, cemented (siliceous cement), poor sort, 100% f: quartzite; Sand: v. fine - med. (50% v. fine, 40% fine, 10% med.), v. well sort, sub. ang., 100% f: quartz, quartzite, dry, no rxn to HCl, 10 YR 8/1 white; Silt: loose, dry, v. well sort, massive, dense, non plastic, matrix.	
			@ 217.6 - 218.7': Silty Sandy Gravel (60% G, 25% S, 15% M); Gravel: 2-60 mm (v. fine - v. crse pebbles), predom. v. crse pebbles, ang. - sub. rnd., v. poor sort, dry, 80% m / 20% f, mafic: basalt, felsic: quartzite; Sand: fine (100%), 90% f / 10% m, felsic: quartz, quartzite,	

11/27/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		217.6 - 218.7' (cont'd): feldspar, mafic: basalt, v. well sort, dry, sub. ang.; Silt: loose, dry, non-plastic, massive, v. well sort, no rxn to HCl; 2.5Y 5/3 lt. olive brown.	Sonic Core
			@218.7 - 219.05': Silty Sandy Gravel (60% G, 25% S, 15% M); Gravel: 2-70mm (v. fine pebbles - sm. cobble), predom. med. pebbles, ang-rnd, dry, cemented (siliceous cement), poor sort, 100% f: quartzite; Sand: v. fine - fine (50% v. fine, 50% fine), v. well sort, sub. ang., 100% f: quartz, quartzite, dry, no rxn to HCl, 10YR 8/1 white.; Silt: loose, dry, v. well sort, massive, dense, non-plastic, matrix.	
			@ 219.05 - 219.4': Silty Sandy Gravel (60% G, 25% S, 15% M); Gravel: 2-60mm (v. fine - v. crse pebbles), predom. v. crse pebbles, ang. - sub. rnd., v. poor sort, dry, 80% m/20% f, mafic: basalt, felsic: quartzite; Sand: fine (100%), 90% f/10% m, felsic: quartz, quartzite, feldspar, mica, mafic: basalt, v. well sort, dry, sub. ang., no rxn to HCl, 2.5Y 6/4 lt. yellowish brown; Silt: loose, dry, non-plastic, massive, v. well sort.	
			219.4 - 220.4': Silty Gravel (mG) (50% G, 40% M, 10% S); Gravel: 2-70mm (v. fine pebble - sm. cobble), predom. sm. cobble, dry, sub. rnd. - sub. ang., poor sort, 50% m/50% f, mafic: basalt, felsic: quartzite, cemented (siliceous cement); Sand: v. fine (100%), dry, sub. ang., v. well sort, 55% f/45% m, felsic: quartz, quartzite, trace mica, mafic: basalt, slt. damp - dry, no rxn to HCl, 2.5Y 6/1 gray; Silt: loose, dry, dense, massive, cemented (siliceous cement), v. well sort.	

11/27/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
				Sonic Core
	NOT USED		220.5 - 221.7' : Silty Sandy Gravel (msG) (50% S, 30% G, 20% M); Sand: fine - med (45% fine, 55% med.), v. well sort, 95% f / 5% m, felsic: quartz, quartzite, feldspar, mafic: basalt, sub. ang., dry, no rxn to HCl, 2.5Y 5/3 lt. olive brown; Gravel: 2-50 mm (v. fine - v. crse pebbles), predom. med. pebbles, v. poor sort, sub. ang - sub. rnd., dry, 50% m / 50% f, mafic: basalt, felsic: quartzite; Silt: loose, dry, predom. felsic, massive, v. well sort, non. plastic, 2.5Y 6/2 lt. brownish gray.	
			@ 220.8 - 221.2' : Silty Sandy Gravel (50% S, 30% G, 20% M); Sand: v. fine - fine (50% v. fine, 50% fine), v. well sort, predom. mafic, sub. ang., dry, no rxn to HCl, 10YR 7/1 lt. gray; Gravel: 2-60 mm (v. fine - v. crse pebbles), predom. fine pebbles, v. poor sort, ang. - rnd., dry, 100% m: basalt; Silt: loose, dry, predom. mafic, v. well sort, non. plastic.	
			@ 221.2 - 221.7': Silty Sandy Gravel (50% S, 30% G, 20% M); Color change: 2.5Y 5/3 lt. olive brown.	
			221.7 - 225.3' : Sandy Gravel (sG) (65% S, 30% G, 5% M); Sand: med (100%), v. well sort, 90% f / 10% m, felsic: quartz, quartzite, feldspar, mafic: basalt, slt. damp - dry; no rxn to HCl, 2.5Y 5/3 lt. olive brown; Gravel: 3-70 mm (v. fine pebble - sm. cobble), predom. v. crse pebbles, well sort, ang - sub. rnd., slt. damp - dry, 50% m / 50% f, mafic: basalt, felsic: quartzite; Silt: loose, slt. damp - dry, predom. felsic, v. well sort, minor.	

11/27/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		@ 222.0' : weak rxn to HCl.	Sonic Core
			@ 222.3' : horizontal rust streaks : 5Y 5/6 yellowish red.	
			@ 222.8 - 223' : Rust staining : 7.5 YR 3/4 d. brown.	
			@ 223.1 - 225.3' : Sandy Gravel (50% G, 40% S, 10% M); Gravel : 10-50mm (med - v. crse pebbles), predom. med. pebbles, poor sort, sub. ang. - rnd., 60% f / 40% m, felsic: quartzite, mafic: basalt, cemented (siliceous cement); Sand: med (100%), v. well sort, 90% f / 10% m, felsic: quartz, quartzite, feldspar, mafic: basalt, slt. damp - dry, no rxn to HCl, 223.1-225.25': 2.5Y 5/3 lt. olive brown, 225.25-225.3': 2.5Y 5/3 lt. olive brown; Silt: loose - compact, dry, massive, matrix, v. well sort, non. plastic, 223.1-225.25': 2.5Y 8/1 white, 225.25-225.3': 2.5Y 7/1 lt. gray, white = predom. felsic, gray = predom. mafic.	
			225.3 - 226.2' : Silty Gravel (mG) (45% G, 40% M, 15% S); Gravel : 2-70mm (v. fine pebble - sm. cobbles), predom med-crse pebbles, v. poor sort, sub. ang. - rnd., dry, 50% m / 50% f, mafic: basalt, felsic: quartzite; Silt: loose, dry, massive, non. plastic, v. well sort; Sand: v. fine (100%), dry, v. well sort, 100% f, no rxn to HCl, 2.5Y 6/2 lt. brownish gray.	
			226.2 - 227.6' : Silty Sandy Gravel (msG) (55% G, 30% S, 15% M); Gravel : 3-70mm (v. fine pebble - sm. cobble), predom. crse pebbles, mod sort, ang. - rnd., slt. damp - dry, 80% f / 20% m, felsic: quartzite, mafic: basalt, cemented (siliceous cement); Sand: med.	

11/27/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
227.5	CORE 40		226.2 - 227.6' (cont'd):	Sonic Core
			(100%), slt. damp - damp, v. well sort, 60% f / 40% m, felsic: quartz, quartzite, feldspar, mafic: basalt, no rxn to HCl, 2.5Y 4/3 olive brown; Silt: loose, compact, dense; massive in places, dry, non-plastic, v. well sort, matrix in places, 5Y 8/1 white.	Ringold Fm., Unit E
230		SAMPLE		CORE 41 B3BL87 230.2 - 235.2' bgs
	CORE 41		@ 226.4 - 226.6': 2.5YR 4/3 reddish brown, dense, compact, silt/clay nodule, no rxn to HCl, non plastic.	Sample Collected: 230.2 - 232.2' bgs HEIS: B3FLT4, B3FLT1, B3FLT2, B3FLT3
232.5			227.6 - 229.5': Sandy Gravel (sG) (50% G, 40% S, 10% M); Gravel: 3-70mm (v.f pebble - sm. cobbles), predom. crse pebbles, mod sort, ang.-rnd., slt. damp - dry, 80% f / 20% m, felsic: quartzite, mafic: basalt, cemented (siliceous cement); Sand: med (100%), slt. damp - damp, v. well sort, 60% f / 40% m, felsic: quartz, quartzite, feldspar, mafic: basalt, no rxn to HCl, 2.5Y 4/3 olive brown; Silt: loose - compact, dense; massive in places, dry, non. plastic, v. well sort, matrix in places, 5Y 8/1 white.	
235				CORE 42 B3BL89 235.7 - 240.7' bgs
237.5	CORE 42			
240			229.5 - 230.8': Silty Gravel (mG) (45% G, 45% M, 10% S); Gravel: 2-65mm (v. fine pebbles - sm. cobbles), predom. crse. pebble, poor sort, matrixed w/ silt, dry, ang.-rnd., 50% m / 50% f, mafic: basalt, felsic: quartzite; Silt: loose - compact, dense, massive, non. plastic, v. well sort, matrix; Sand: v. fine (100%), dry, v. well sort, predom. felsic, no rxn to HCl, 2.5Y 6/1 gray.	CORE 43 B3BL91 240.4 - 245.4' bgs
242.5	CORE 43			
245		SAMPLE	@ 230.2 - 230.8': Silty Gravel (40% M, 30% G, 30% S); Silt: loose, dry, 5Y 7/1 lt. gray; Gravel: 10-65 mm (med. pebble - sm. cobble), predom. med. pebble, ang-sub.rnd.,	
	CORE 44			

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		230.2 - 230.8' (cont'd): v. poor sort, 95% f / 5% m, felsic: quartzite, mafic: basalt; Sand: v. fine - fine (50% v fine, 50% fine), 95% f / 5% m, felsic: quartz, quartzite, mafic: basalt, sub. ang., dry, no rxn to HCl.	Sonic Core
			230.8 - 234.6': Silty Sandy Gravel (msG) (50% G, 30% S, 20% M); Gravel: 10-60 mm (med. pebble - v. crse pebble), 90% f / 10% m, felsic: quartzite, mafic: basalt, sub. ang. - rnd., poor sort; Sand: v. fine - fine (40% v. fine, 60% fine), weak rxn to HCl, 2.5Y 5/2 grayish brown, sub. ang., 70% f / 30% m, felsic: quartz, quartzite, mafic: basalt, slt. damp; Silt: loose, dry.	
			@ 231.7': Rust staining.	
			@ 233.05': Black material: 2.5Y 2.5/1 black, no rxn to HCl, smears 10R 2.5/1 reddish black - 10R 2.5/2 v. dusky red.	
			234.6 - 235.2': Silty Gravel (mG) (50% G, 40% M, 10% S); Gravel: 10-75 mm (med. pebble - sm. cobble), predom. med. pebble, 80% m / 20% f, mafic: basalt, felsic: quartzite, sub. rnd. - rnd., poor sort; Silt: no rxn to HCl, massive, compact, dry, 5Y 4/1 d. gray; Sand: v. fine (100%), sub. ang., 80% f / 20% m, felsic: quartz, quartzite, mafic: basalt, dry.	
			235.7 - 236.45': Silty Gravel (mG) (55% G, 35% M, 10% S); Gravel: 2-50 mm (v. fine - v. crse pebbles), sub. ang. - rnd., predom crse pebbles, mod sort, dry, 80% m / 20% f, mafic: basalt, felsic: quartzite; Silt: loose, dry, v. well sort, predom. mafic, non plastic;	

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			235.7 - 236.45' (cont'd):	Sonic Core
			Sand: v.fine - fine (50% v.fine, 50% fine), dry, well sort, sub. ang., predom. felsic, no rxn to HCl, 2.5Y 6/2 lt. brownish gray.	
			@ 235.7 - 236.1': Black material: 2.5Y 2.5/1 black, no rxn to HCl.	
			236.45 - 240.4': Silty Sandy Gravel (msG) (55% G, 30% S, 15% M); Gravel: 2-65mm (v.fine pebbles - sm. cobbles), predom med. pebbles, ang.-rnd., dry, 80% f/20% m, felsic: quartzite, mafic: basalt, cemented in places (siliceous cement); Sand: med. (100%), v. well sort, slt. damp - dry, sub. ang., 70% f/30% m, felsic: quartz, quartzite, feldspar, mafic: basalt, cemented in places (siliceous cement), no rxn to HCl, 2.5Y 5/3 lt. olive brown; Silt: dry, loose - compact, dense in areas, v. well sort, non-plastic, predom. felsic, 2.5Y 8/1 white.	
			@ 239.3 - 240.4': Silty Sandy Gravel Color change: 2.5Y 6/2 lt. brownish gray (silt & sand), 239.4': weak rxn to HCl.	
			240.4 - 240.6': Gravelly Silt (gM) (70% M, 25% G, 5% S); Silt: loose, dry, massive, semi-compact, v. well sort, predom. mafic, non-plastic; Gravel: 2-50mm (v.fine - v. crse pebbles), predom. v. fine - fine pebbles, v. poor sort, sub. ang - sub. rnd., 100% m: basalt; Sand: v. fine (100%), dry, v. well sort, sub. ang, predom. mafic, no rxn to HCl, 2.5Y 5/1 gray.	
			240.6 - ~~245.0'~~ 250.0': Silty Sandy Gravel (msG) (50% G, 25% S, 25% M); Gravel: 2-60mm (v.fine - v.crse pebbles), predom crse pebbles, v. poor sort, sub. ang.-rnd., 70% f/30% m,	

NOT USED

11/27/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
	NOT USED		240.6 - ~~245.0'~~ 250.0' (cont'd): MSH 11/29/17	Sonic Core
			felsic: quartzite, mafic: basalt, dry; Sand: v.fine - med. (80% v.fine, 10% fine, 10% med.), sub. ang., well sort, 90% f / 10% m, felsic: quartz, quartzite, mafic: basalt, dry, no rxn to HCl, med. sand: 2.5Y 5/3 lt. olive brown, v.fine - fine sand: 2.5Y 6/1 gray; Silt: loose, dense & compact in places, matrix from 242.7 - 245.0', dry - slt. damp, v. well sort, predom. felsic where white & mafic where gray, non.plastic, 2.5Y 8/1 white - 2.5Y 6/1 gray.	
			@ 242.7 - 245.0': conglomerate	
			@ 245.0 - 250.0': Silty Sandy Gravel (45% G, 40% S, 15% M); Gravel: v. poor sort, ang - rnd., 90% f / 10% m, felsic: quartzite, mafic: basalt, damp - dry, 10 - 65 mm (med. pebble - sm. cobble), predom. v. crse pebbles; Sand: no rxn to HCl, fine - med. (50% fine, 50% med.), 90% f / 10% m, felsic: quartz, quartzite, feldspar, mica, mafic: basalt, sub. ang - sub. rnd, 2.5Y 5/2 grayish brown predom., 2.5Y 8/1 white in places, damp - dry, v. well sort; Silt: no rxn to HCl, non plastic, compact & massive where damp, loose where dry, 2.5Y 5/2 grayish brown, damp - dry, predom. felsic, v. well sort.	
			@ 247.6': Concentration of mafic material: 2.5Y 2.5/1 black, highly weathered or altered basalt.	
			@ 248.65': Rust staining.	
			250.2 - 250.6': Gravelly Silt (gM) (70% M, 25% G, 5% S); Silt: loos - compact, dry, v. well sort, matrix, non. plastic, predom.	

11/27/17

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
247.5	CORE 44		250.2 - 250.6' (cont'd): mafic; Gravel: 5-30mm (fine-crse pebbles) predom. med-crse pebbles, well sort, ang-sub. rnd 50%m / 50%f, mafic: basalt, felsic: quartzite, dry, matrixed w/silt; Sand: v. fine-crse (10% v.fine, 40% fine, 40% med, 10% crse), mod. sort, dry, 90%m / 10%f, mafic: basalt, felsic: quartz, quartzite, sub. ang, no rxn to HCl, 2.5Y 4/1 d. gray.	Sonic Core Ringold Fm., Unit E CORE 44 B3BL93 245 - 250' bgs. Sample Collected: 245 - 247.6' bgs HEIS: B3FLT5, B3FLT6, B3FLT7, B3FLT8, B3FLX2
250			250.6 - 251.0': Silt (M) (90%M, 5%G, 5%S); Silt: loose-compact, dense, massive, non plastic when dry - med. plasticity when wet, predom. mafic, 5Y 6/1 gray; Gravel: 2-4mm (v. fine pebbles), predom. 2mm, v. well sort, dry, predom. mafic: basalt, sub ang. - sub. rnd.	CORE 45 B3BL95 250.2 - 254.7' bgs.
252.5	CORE 45		251 - 253.5': Silty Gravel (mG) (40%M, 35%G, 25%S); Silt: loose-compact, dense in places, non plastic, dry, predom. felsic, 10YR 8/1 white, strong rxn to HCl; Gravel: 2-50mm (v.fine - v. crse pebbles), predom. crse pebbles, poor sort, dry, sub. ang-rnd., 80% f / 20% m, felsic: quartzite, mafic: basalt, cemented ($CaCO_3$ cement); Sand: v. fine (100%), v. well sort, dry, predom. felsic (quartz, quartzite), sub. ang., strong rxn to HCl.	TD = 254.7' bgs.
255			@ 251.5 - 251.7': Sand / gravel lens: (75%S, 20%G, 5%M), cemented w/ $CaCO_3$, 2.5Y 4/2 d. grayish brown.	
257.5			@ 252.5 - 253.3': Silty Gravel (60%M, 35%G, 5%S); cemented w/ $CaCO_3$, 2.5Y 3/1 v. dark gray, rock is highly weathered.	
260				
262.5				
265				

Reported By:

Print Name	Title	Signature	Date
Jess Hocking	Sr. Geologist		11/28/2017

A-6006-993 (REV 0)

BOREHOLE LOG (Cont.)

Date: 11-27-2017

Well ID: C9555 | Well Name: N/A | Location: 216-T-3 I/R Well

Depth (ft)	Sample	Graphic Log	Sample Description: Sediment Classification, Grain Size Distribution, Color, Moisture Content, Sorting, Angularity, Mineralogy, Particle Size, Reaction to HCl, Other	Comments: Depth of Casing, Drilling Method, Sampling Method, Sampler Size, Water Level, Other
			253.5 - 254.7' : Silty Sandy Gravel (msG) (40% G, 35% S, 25% M); Gravel : 2-60mm (v. fine - v. crse pebbles), predom. med. pebbles, v. poor sort, dry, loose, 50% m / 50% f, mafic: ~~bas~~ basalt, felsic: quartzite; Sand : v. fine - crse (70% v. fine, 20% fine, 5% med, 5% crse), sub. ang., well - v. well sort, dry, predom. felsic where lt. gray & brown (quartz, quartzite), predom. mafic where gray, loose, strong rxn to HCl, 2.5Y 7/1 lt. gray (upper core #45), 2.5Y 6/1 gray (lower core #45), 2.5Y 6/2 lt. brownish gray (btm. of core #45); Silt: loose, massive, dry, predom. felsic where lt. gray & brown, predom mafic where gray, v. well sort, non. plastic.	Sonic Core

NOT USED

11/27/17

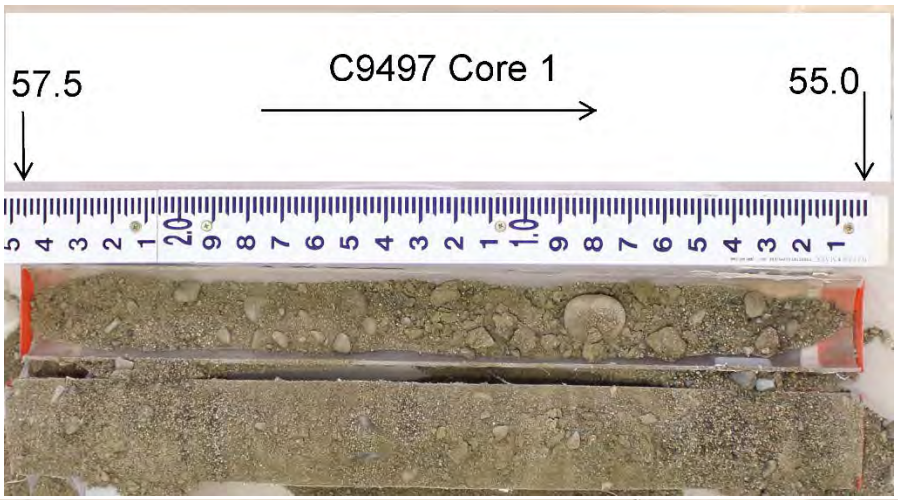
Reported By:

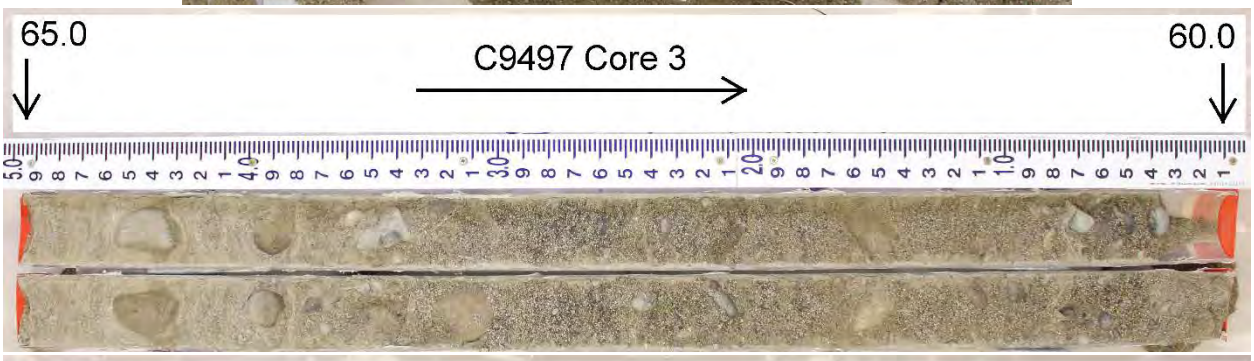
Jess Hocking	Sr. Geologist		11/28/2017
Print Name	Title	Signature	Date

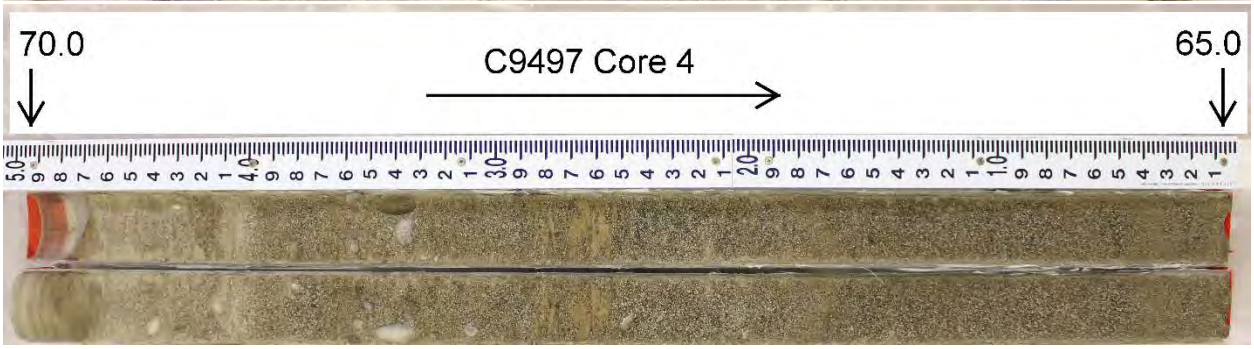
A-6006-993 (REV 0)

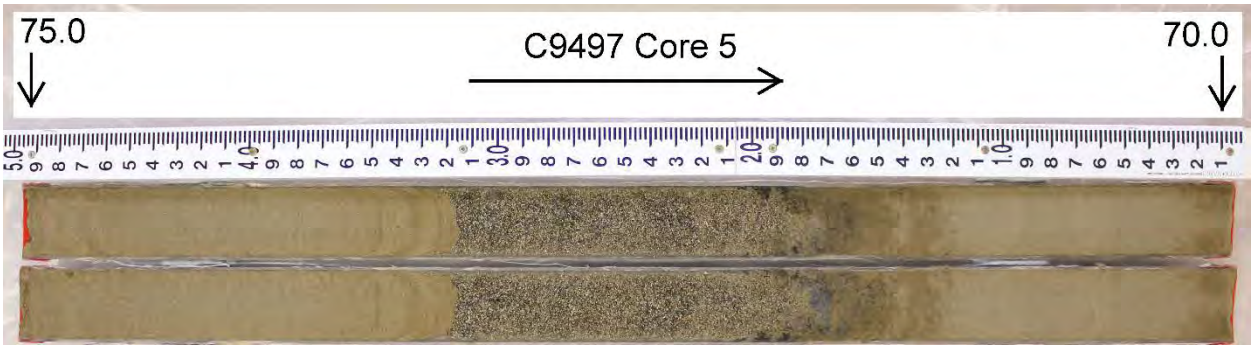
Appendix F

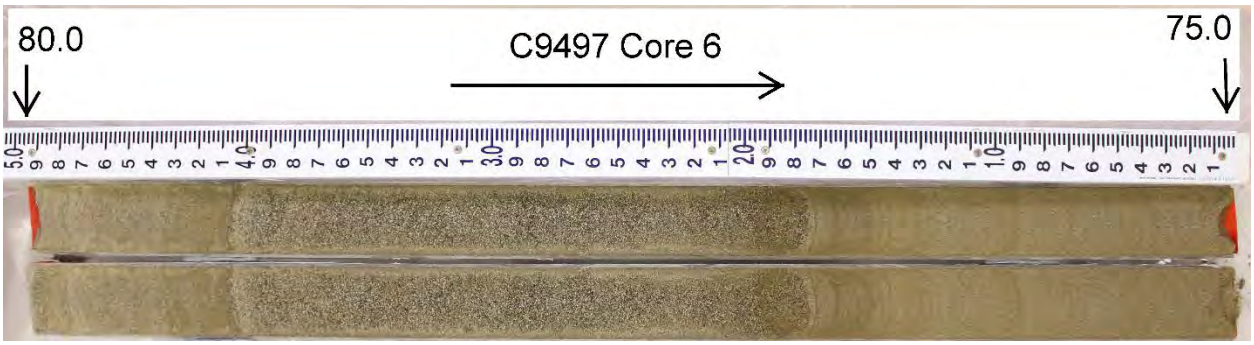
Core Photos for 200-DV-1 Operable Unit Boreholes

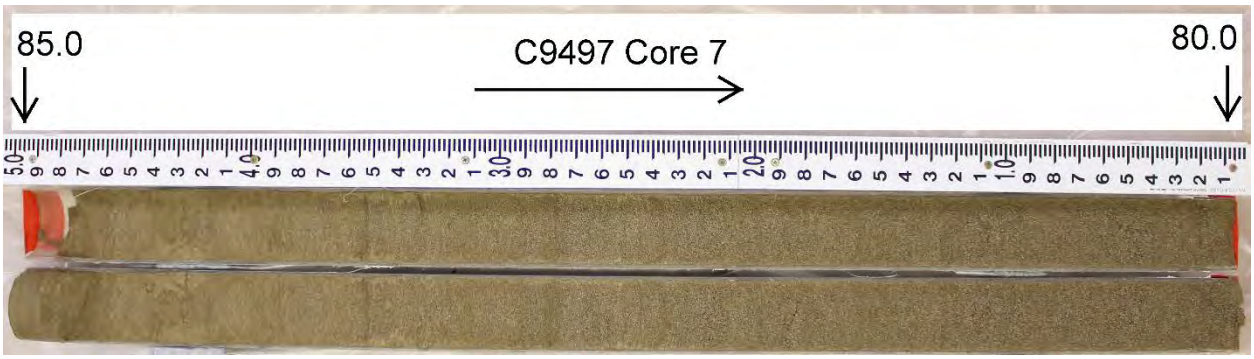

57.5
C9497 Core 1
55.0

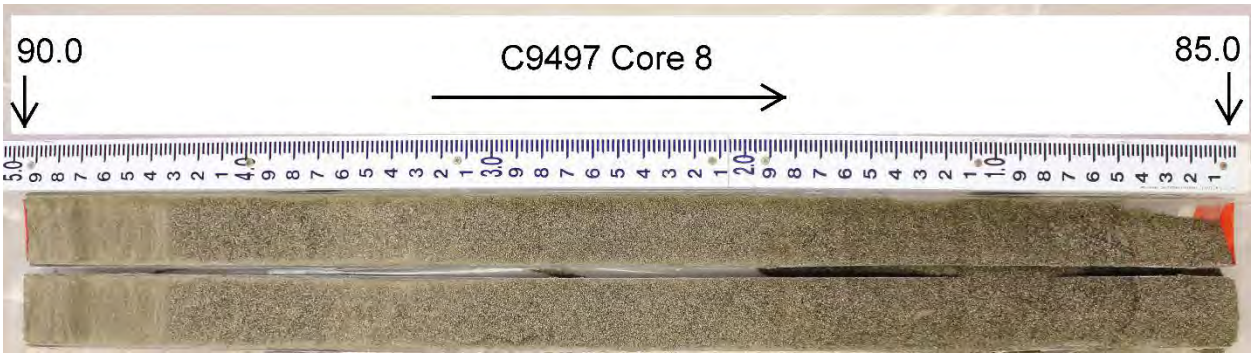

65.0
C9497 Core 3
60.0

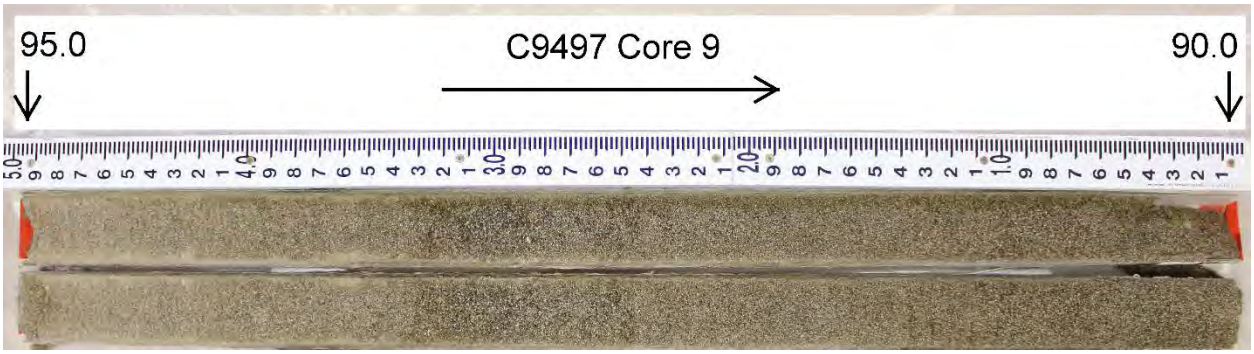

70.0
C9497 Core 4
65.0

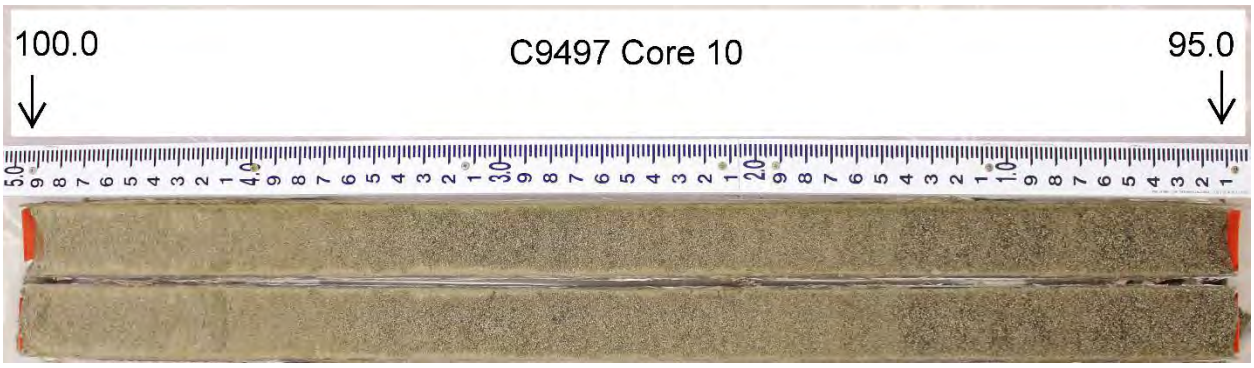

75.0
C9497 Core 5
70.0

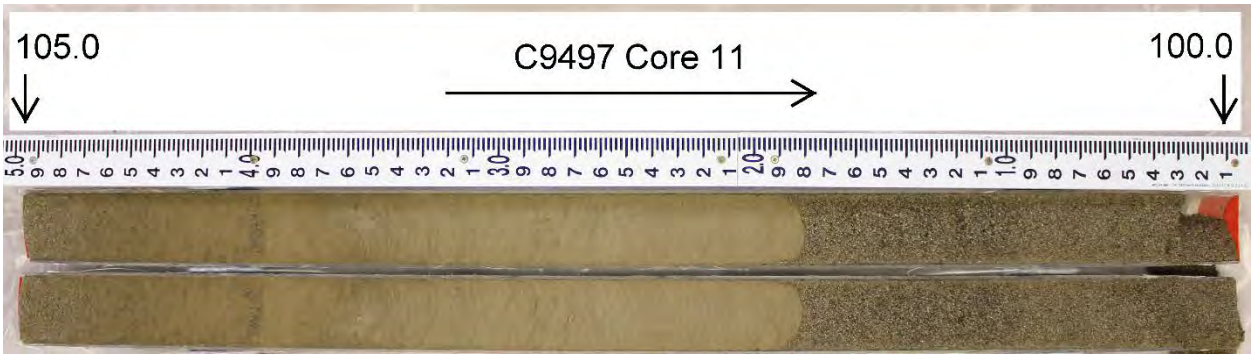

80.0
C9497 Core 6
75.0

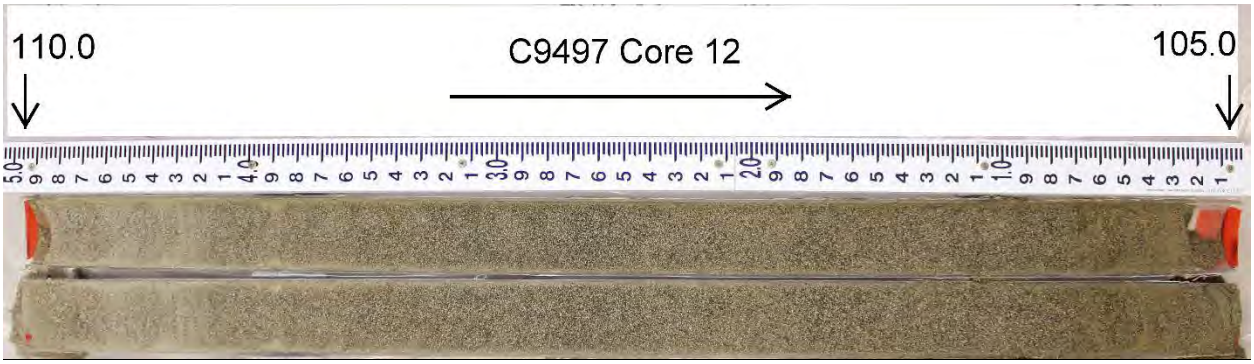

85.0
C9497 Core 7
80.0

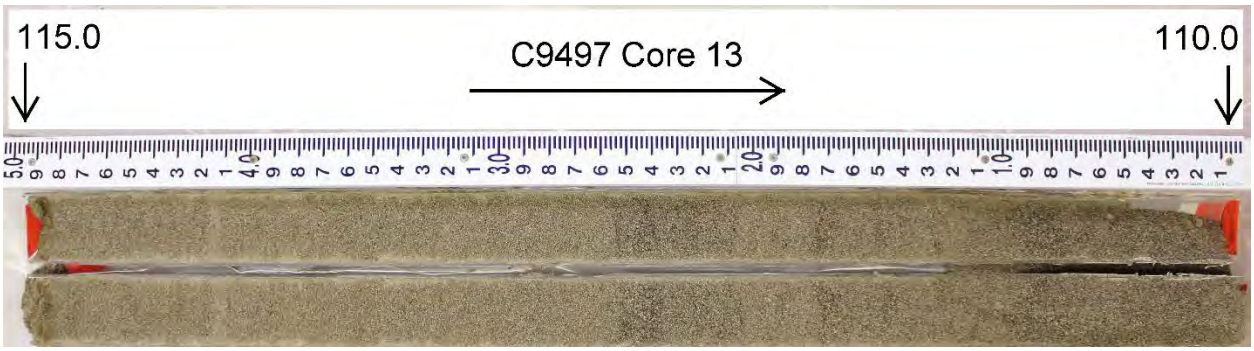

90.0
C9497 Core 8
85.0

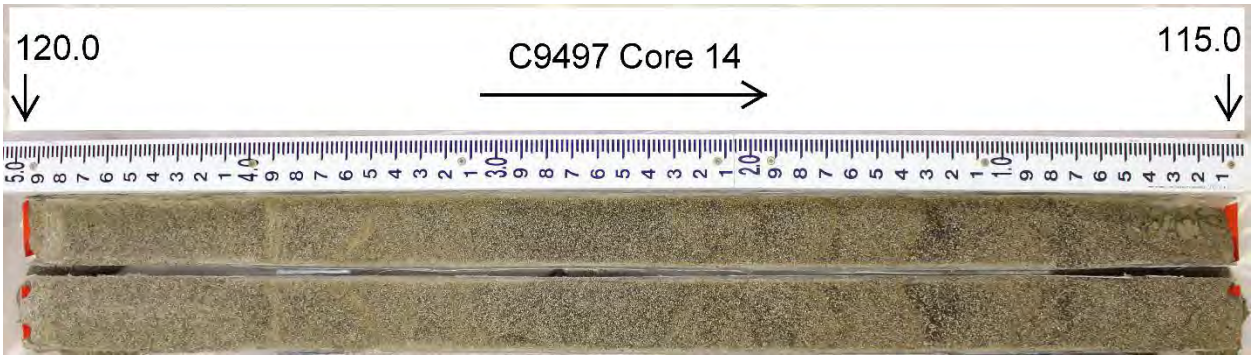

95.0
C9497 Core 9
90.0

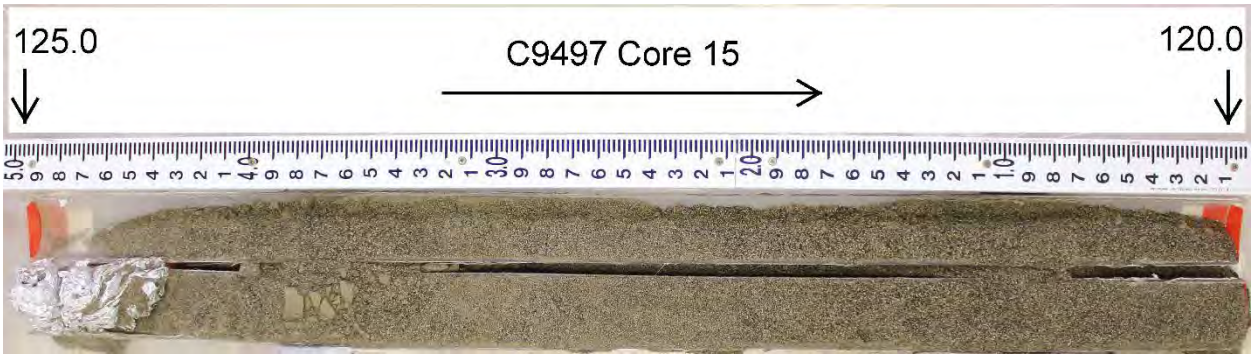

100.0
C9497 Core 10
95.0

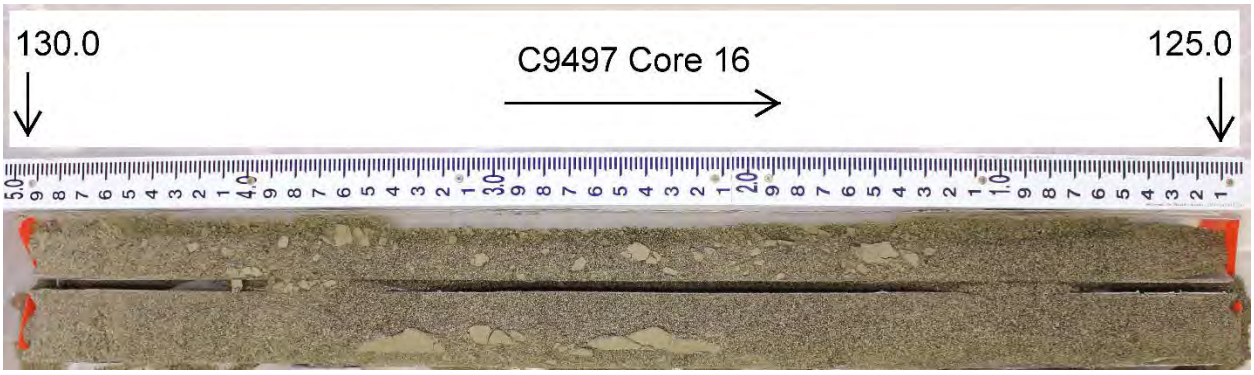

105.0
C9497 Core 11
100.0

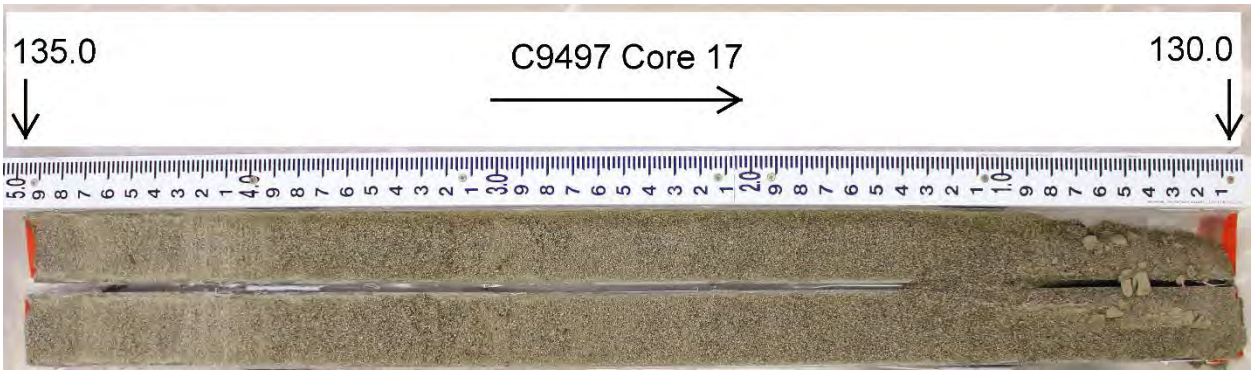

110.0
C9497 Core 12
105.0

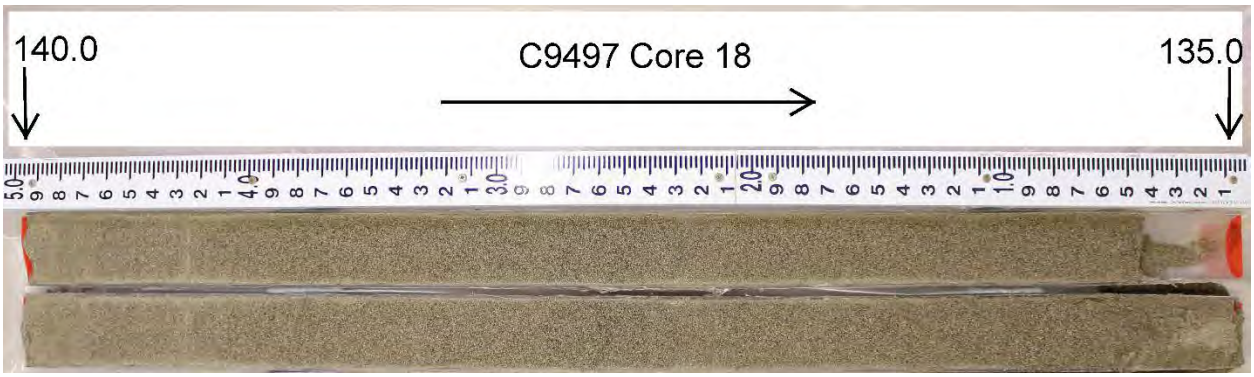

115.0
C9497 Core 13
110.0

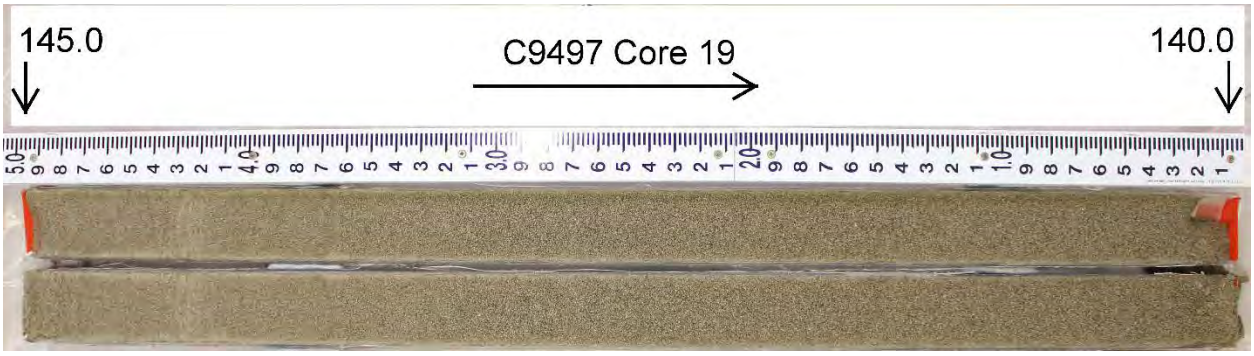

120.0
C9497 Core 14
115.0

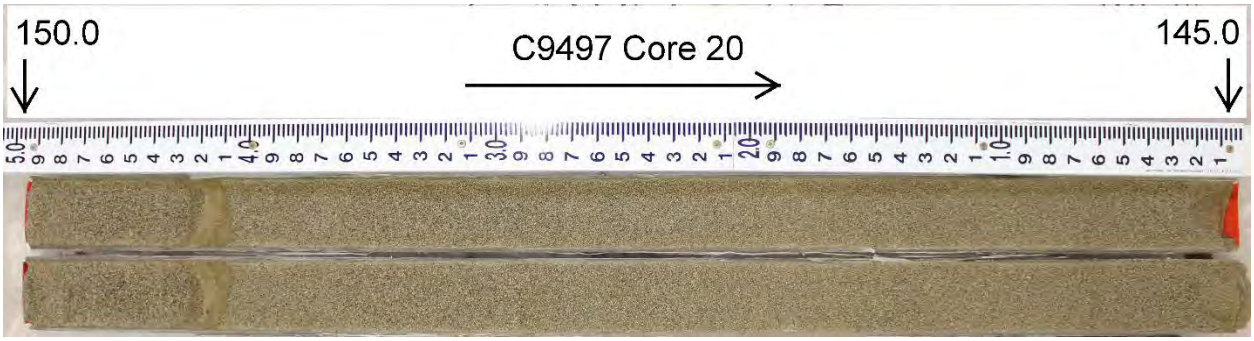

125.0
C9497 Core 15
120.0

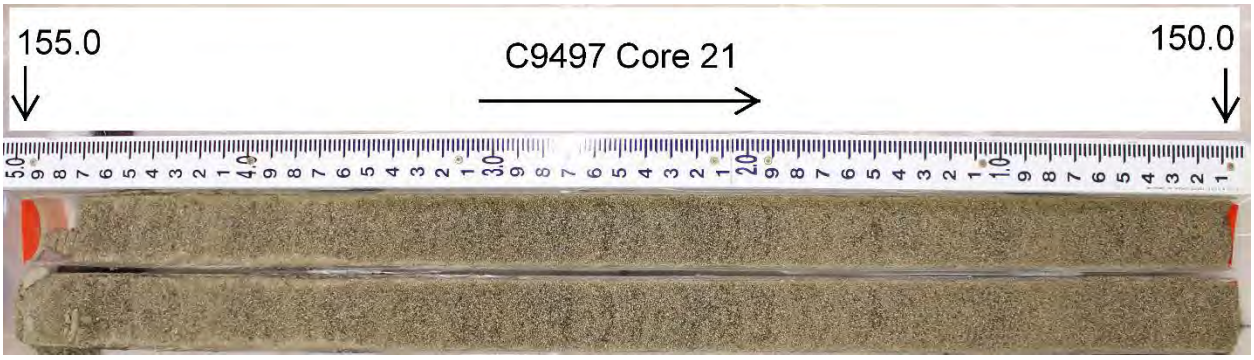

130.0
C9497 Core 16
125.0

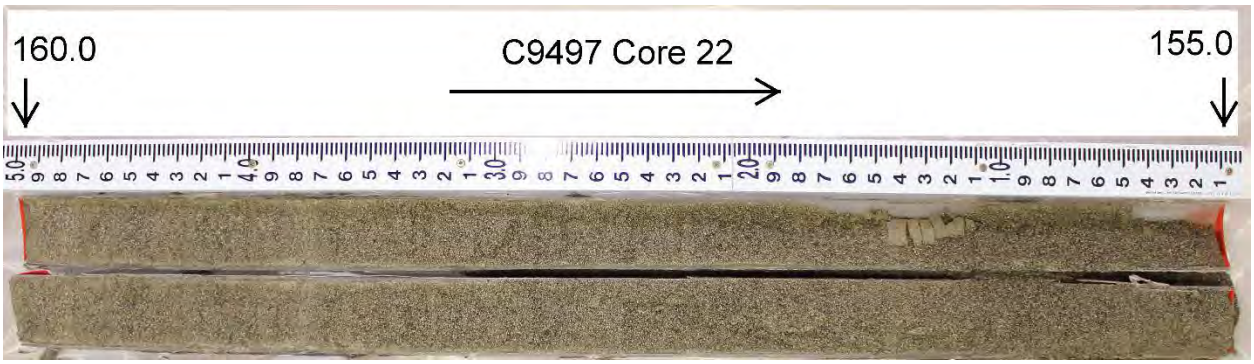

135.0
C9497 Core 17
130.0

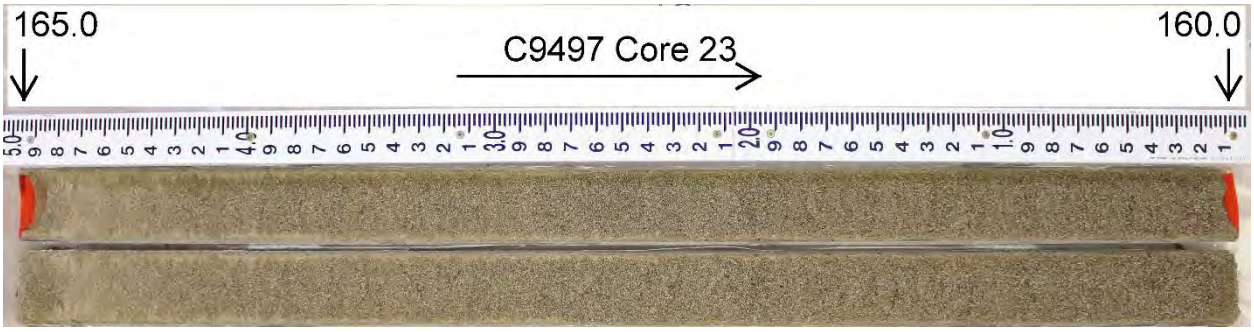

140.0
C9497 Core 18
135.0

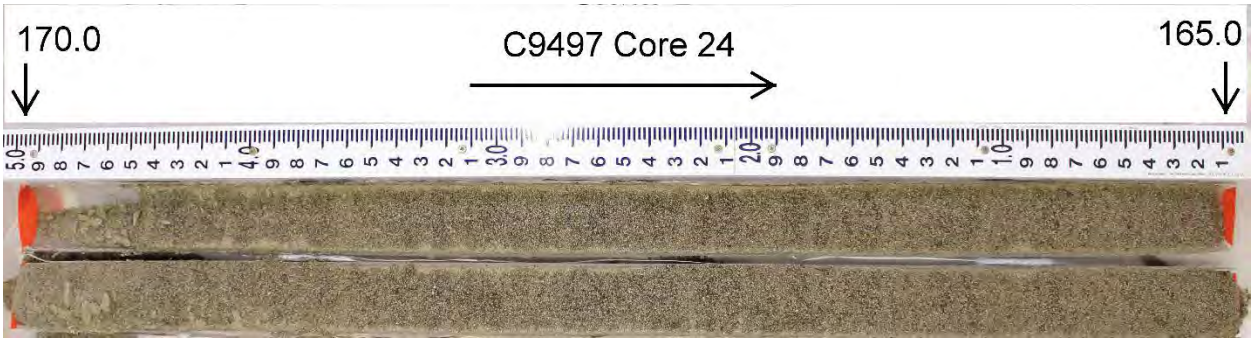

145.0
C9497 Core 19
140.0

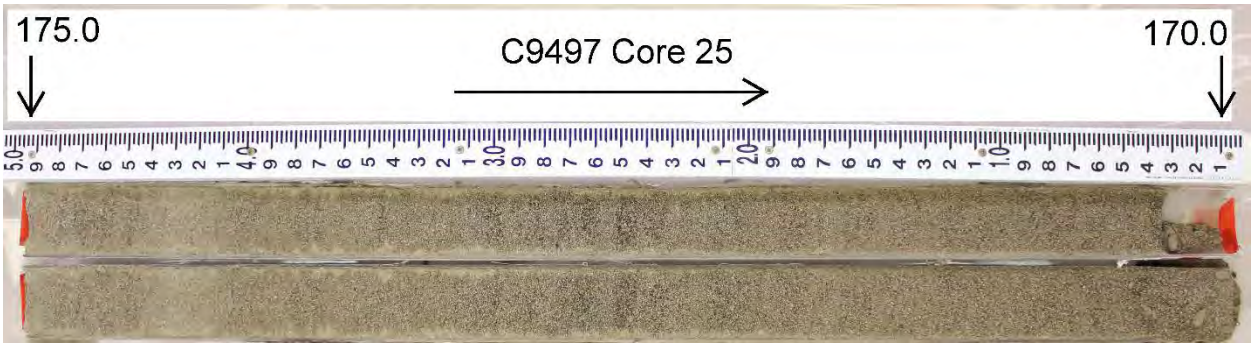

150.0
C9497 Core 20
145.0

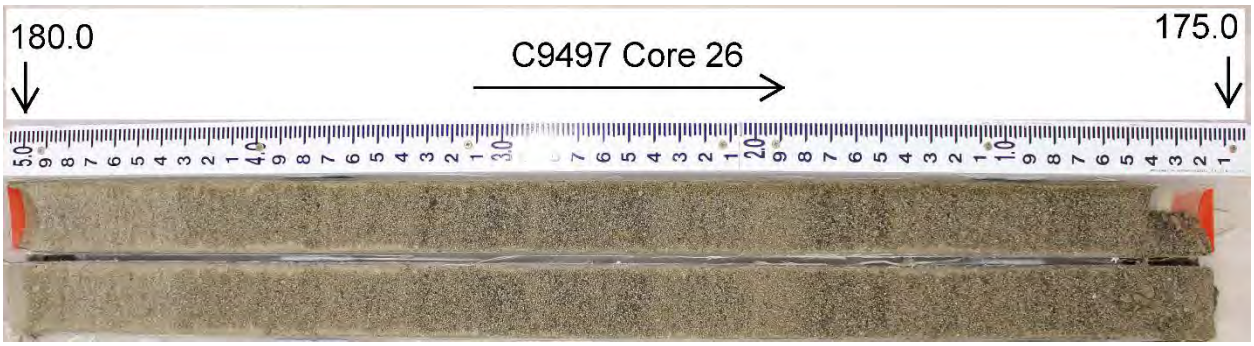

155.0
C9497 Core 21
150.0

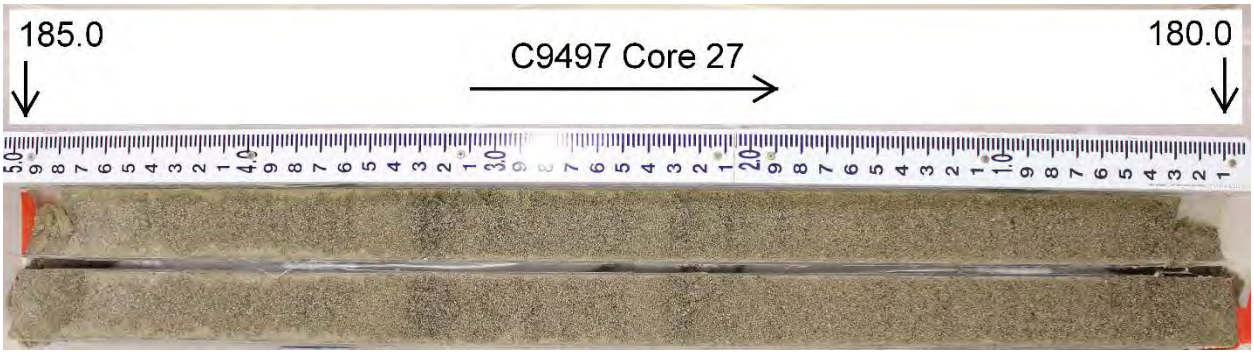

160.0
C9497 Core 22
155.0

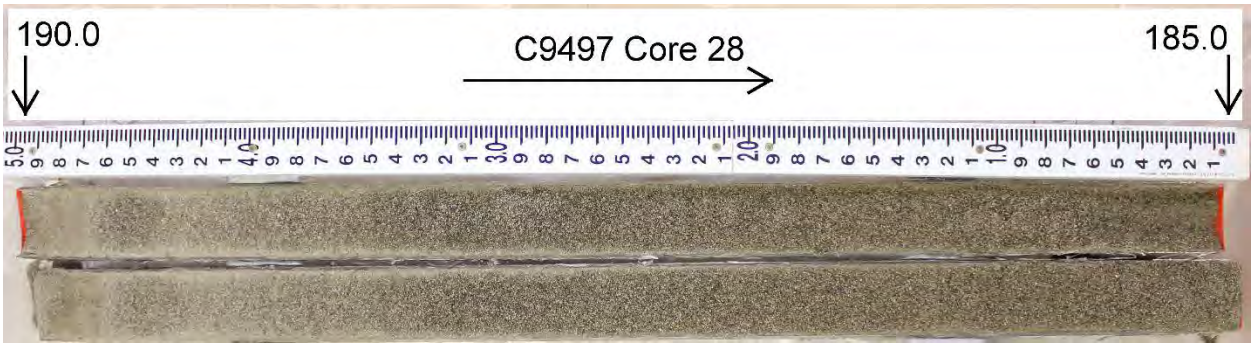

165.0
C9497 Core 23
160.0

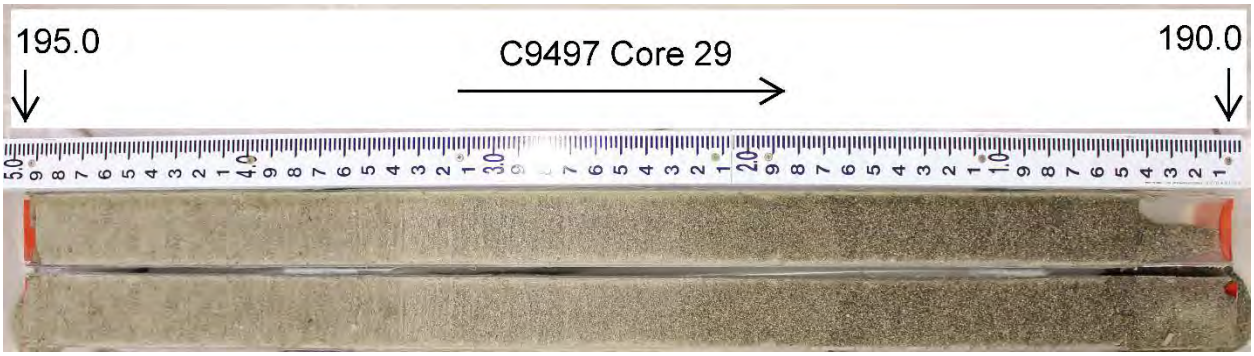

170.0
C9497 Core 24
165.0

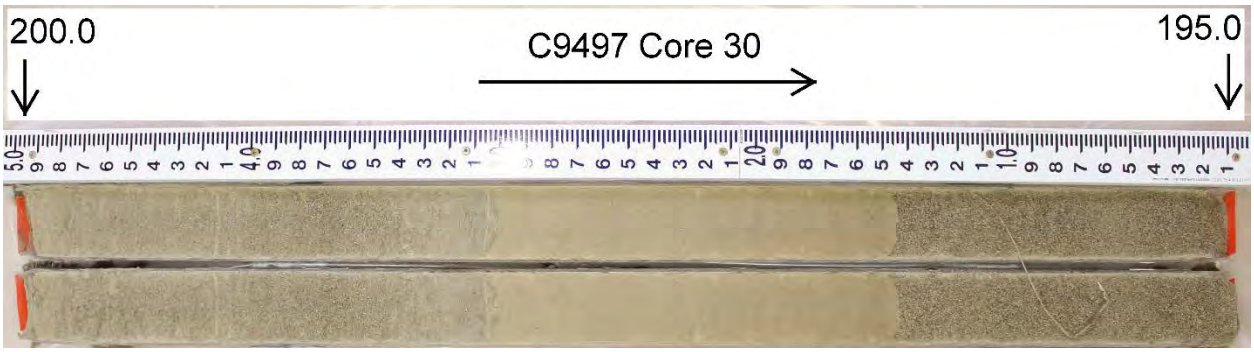

175.0
C9497 Core 25
170.0

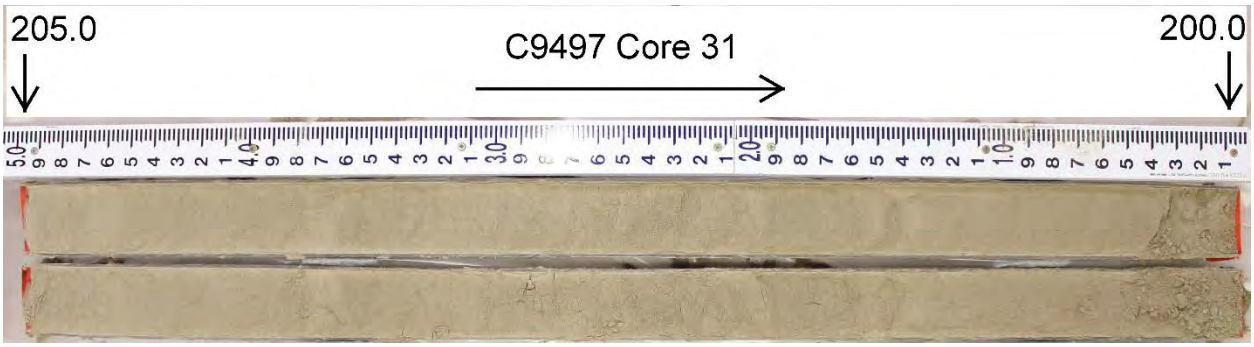

180.0
C9497 Core 26
175.0

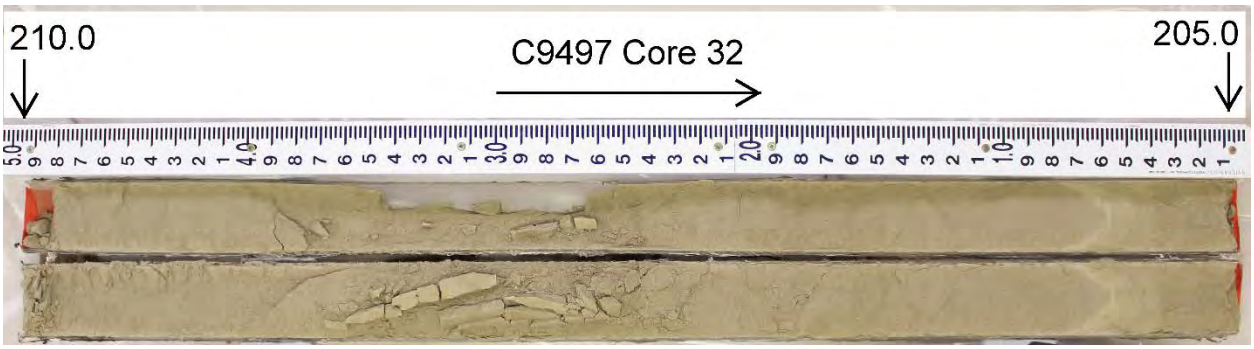

185.0
C9497 Core 27
180.0

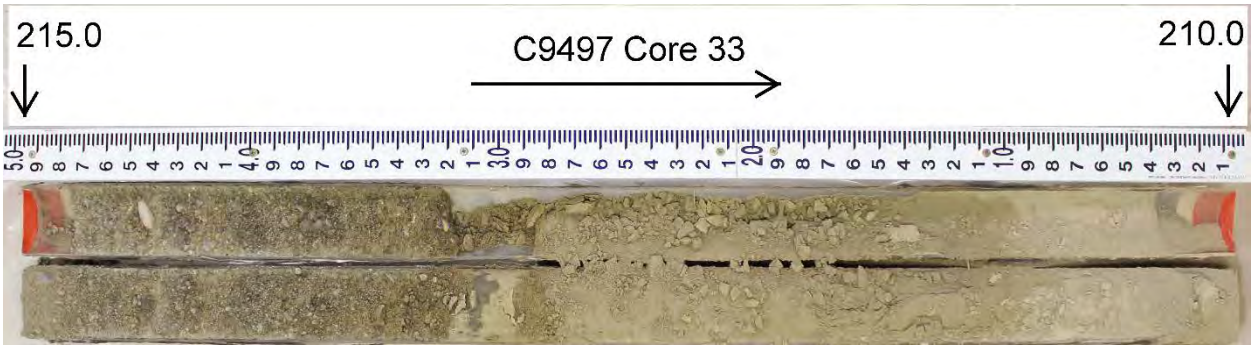

190.0
C9497 Core 28
185.0

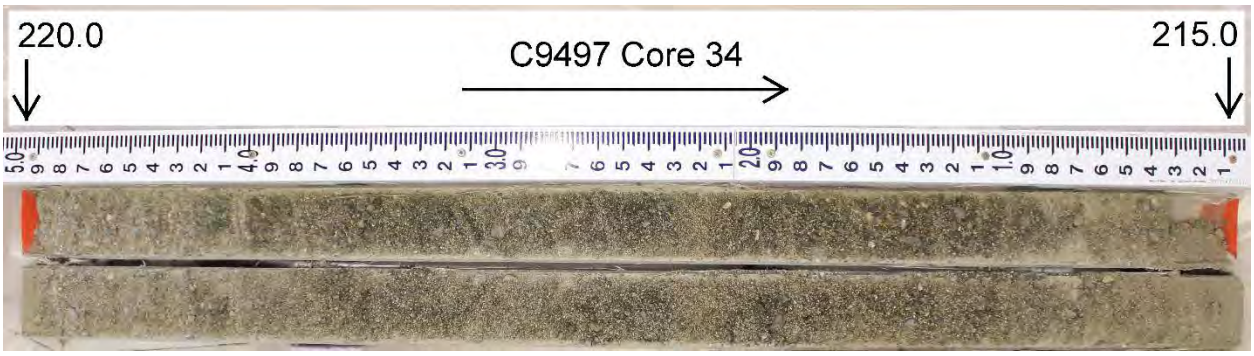

195.0
C9497 Core 29
190.0

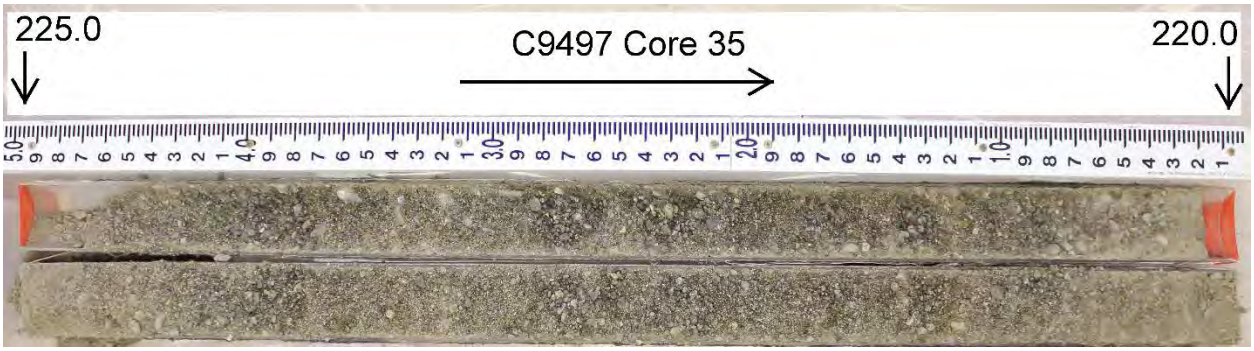

200.0
C9497 Core 30
195.0

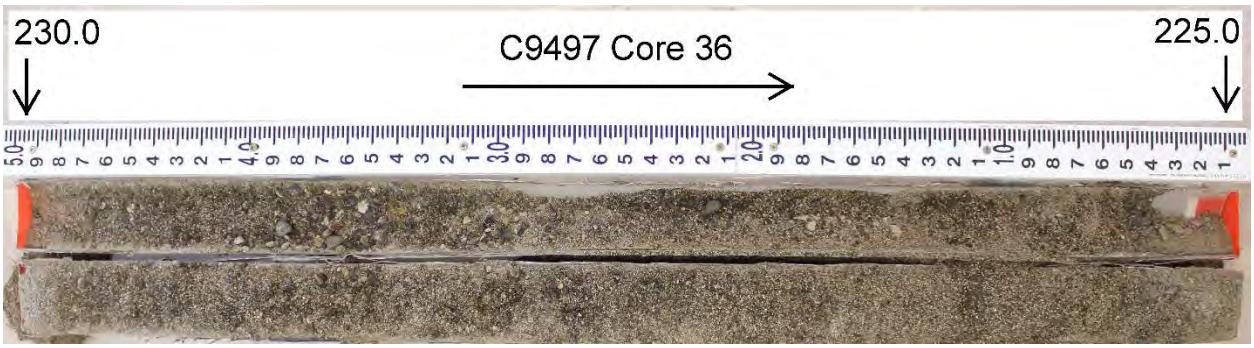

205.0
C9497 Core 31
200.0

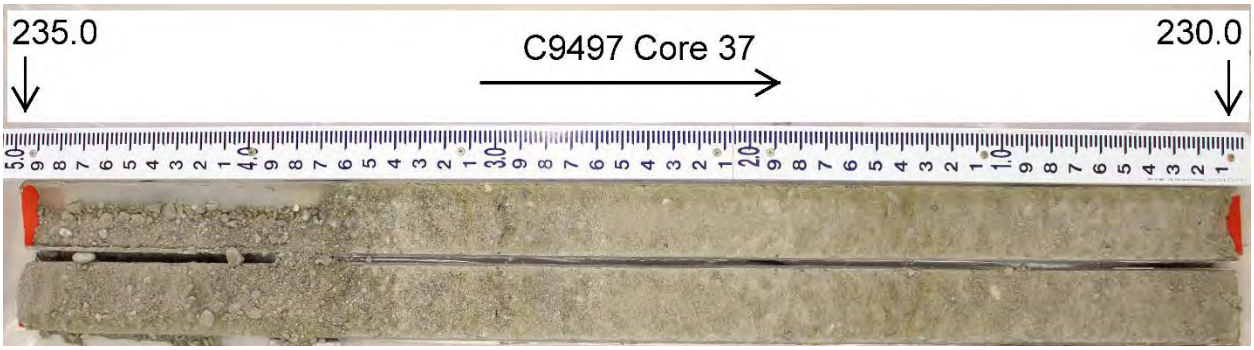

210.0
C9497 Core 32
205.0

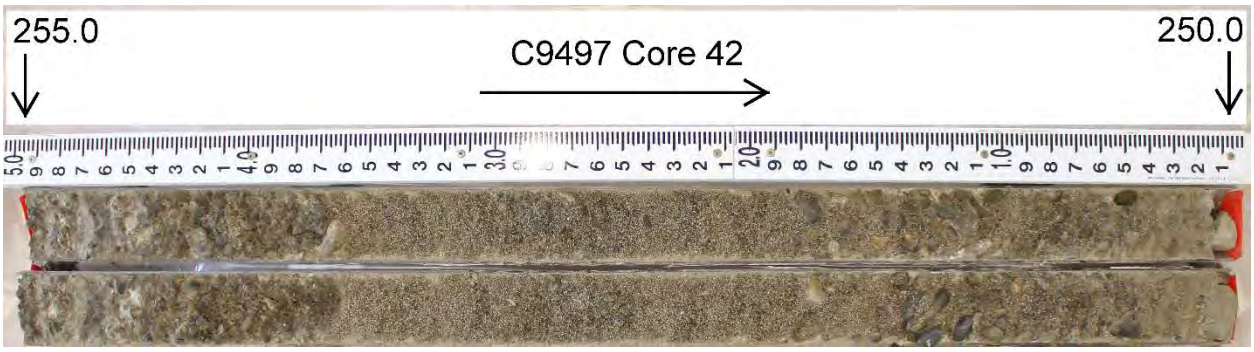

215.0
C9497 Core 33
210.0

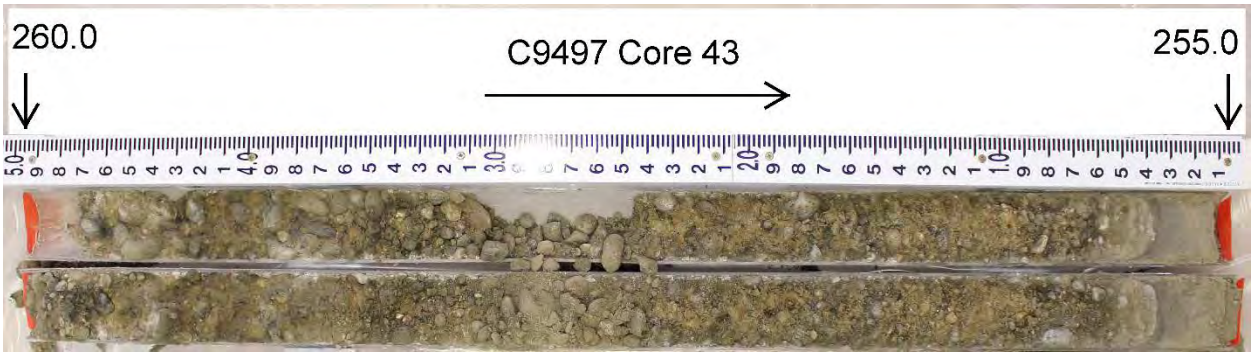

220.0
C9497 Core 34
215.0

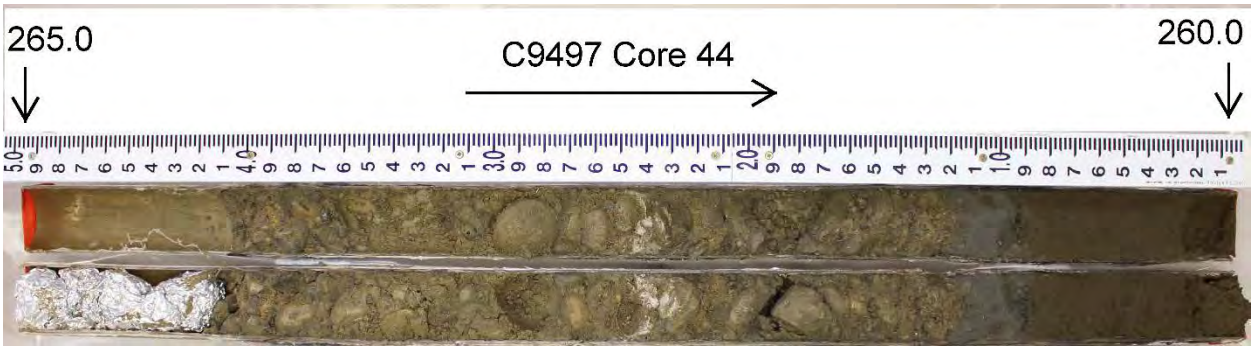

225.0
C9497 Core 35
220.0

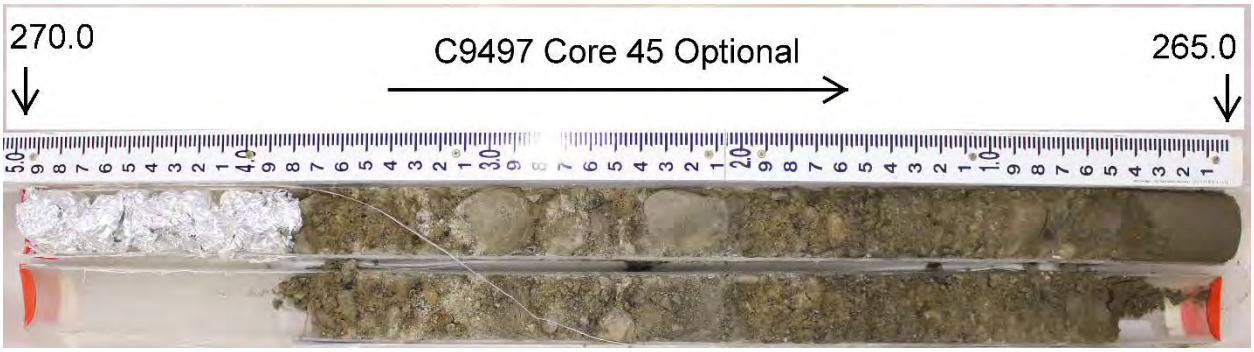

230.0
C9497 Core 36
225.0

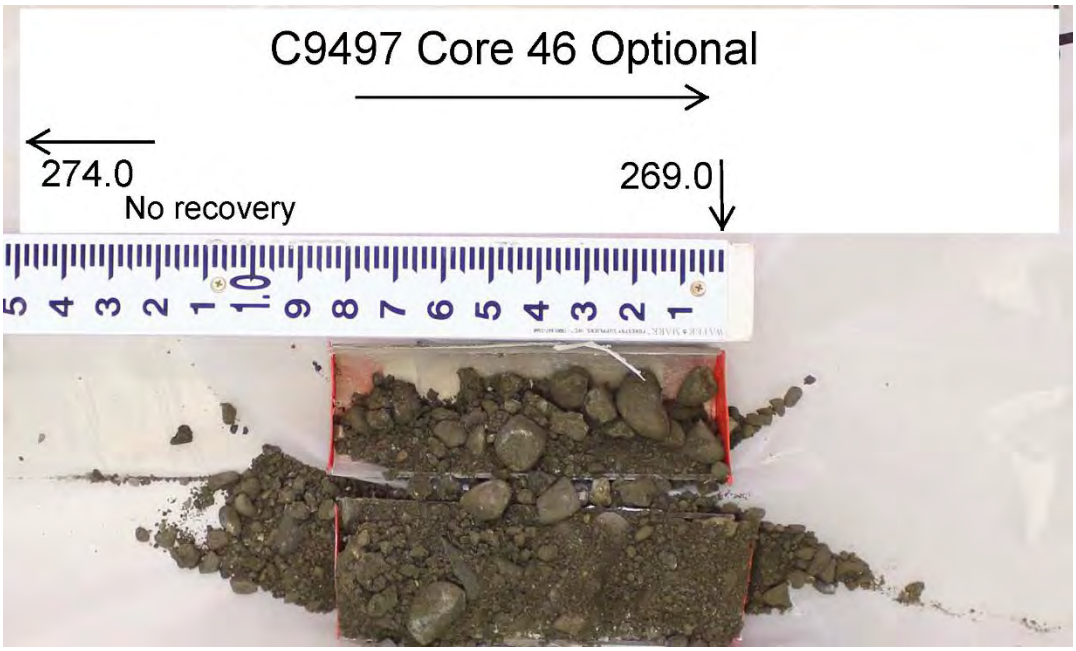

235.0
C9497 Core 37
230.0

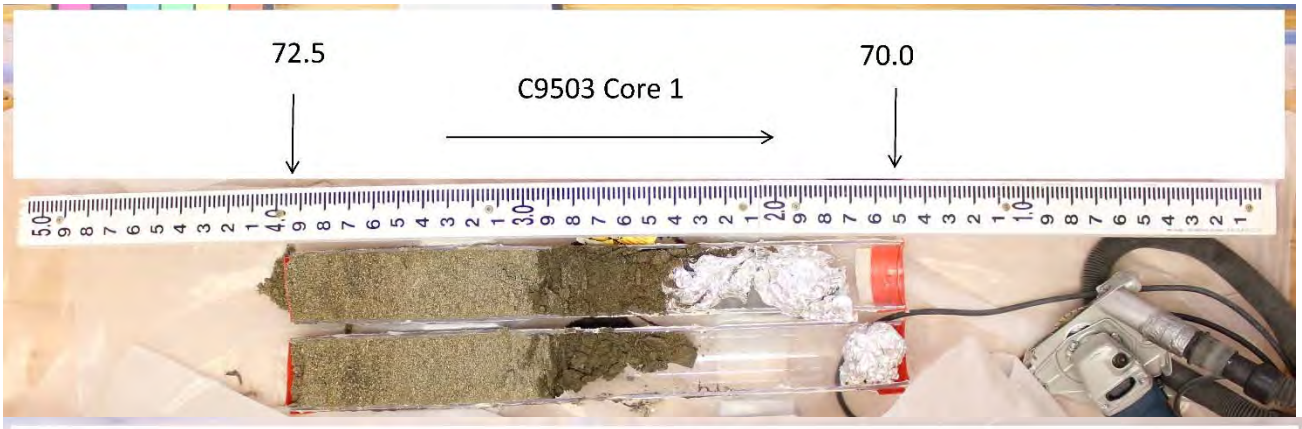

255.0
C9497 Core 42
250.0

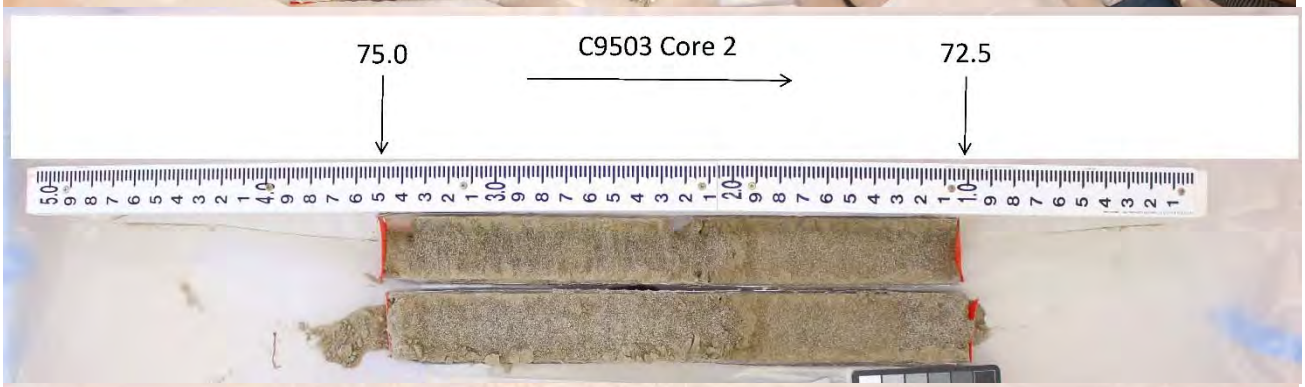

260.0
C9497 Core 43
255.0

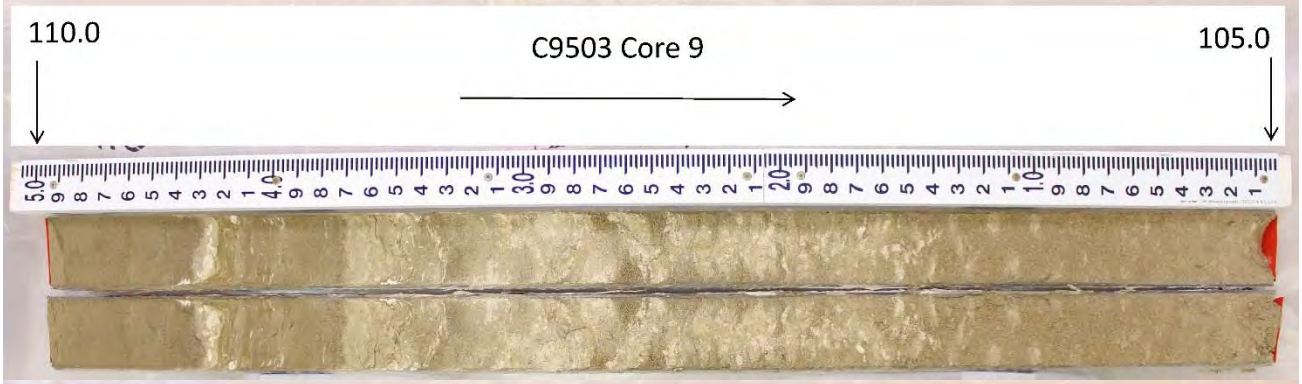

265.0
C9497 Core 44
260.0

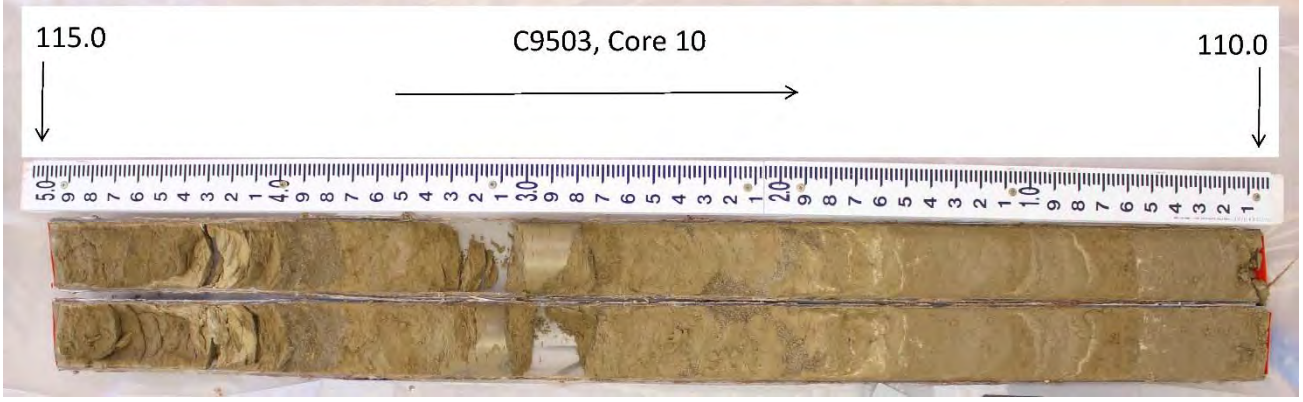

270.0
C9497 Core 45 Optional
265.0

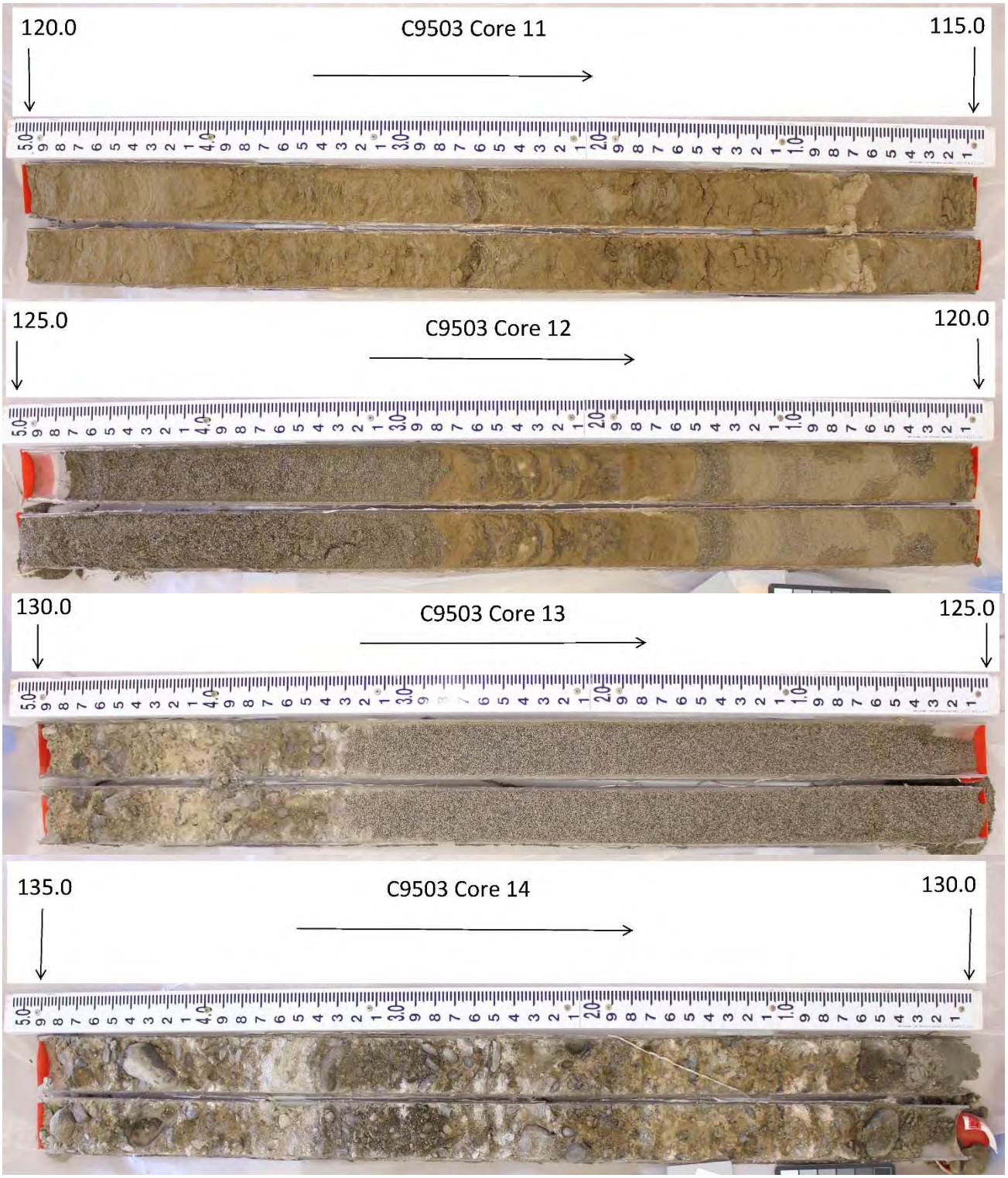

C9497 Core 46 Optional
274.0
No recovery
269.0

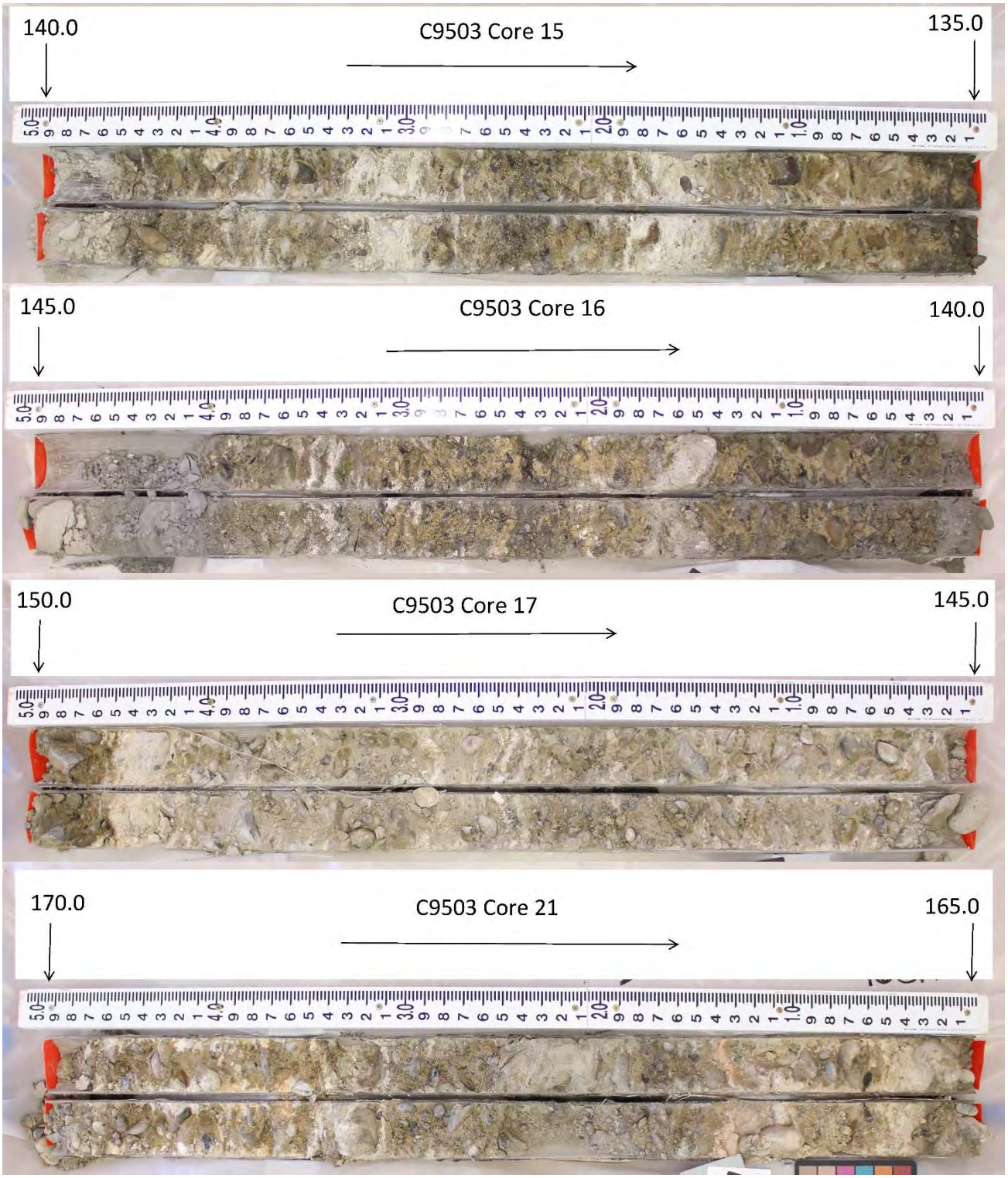

72.5
C9503 Core 1
70.0

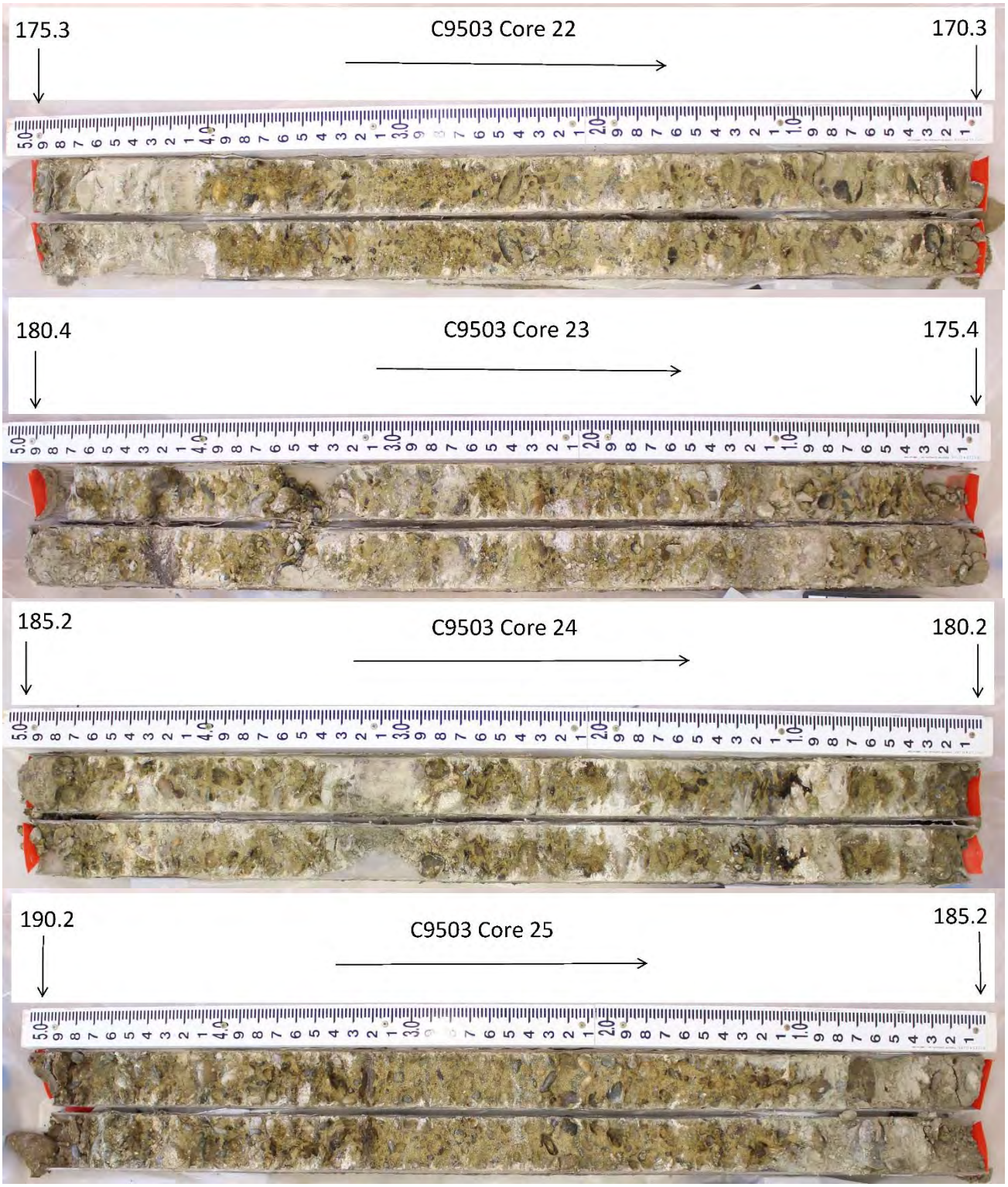

75.0
C9503 Core 2
72.5

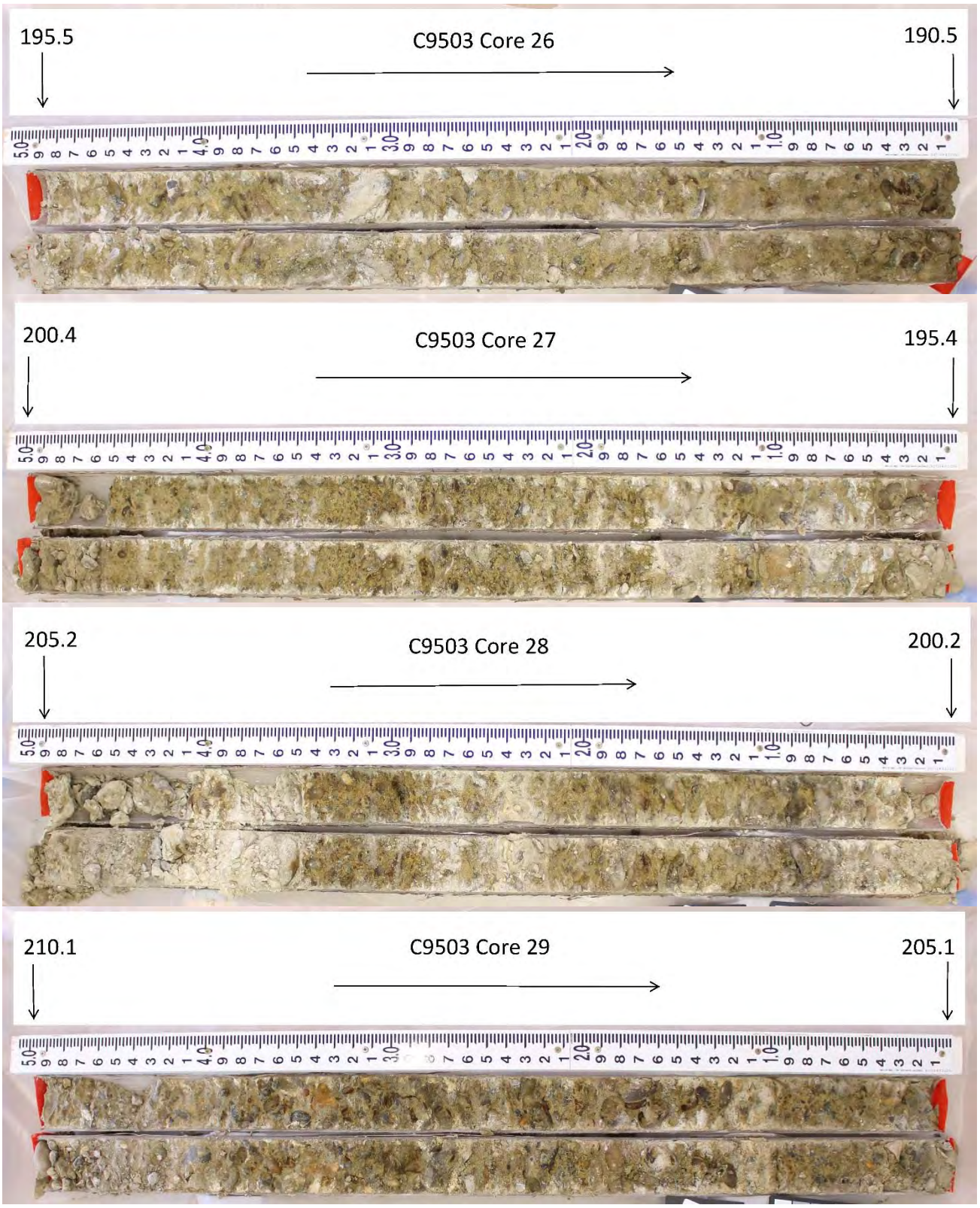

110.0
C9503 Core 9
105.0

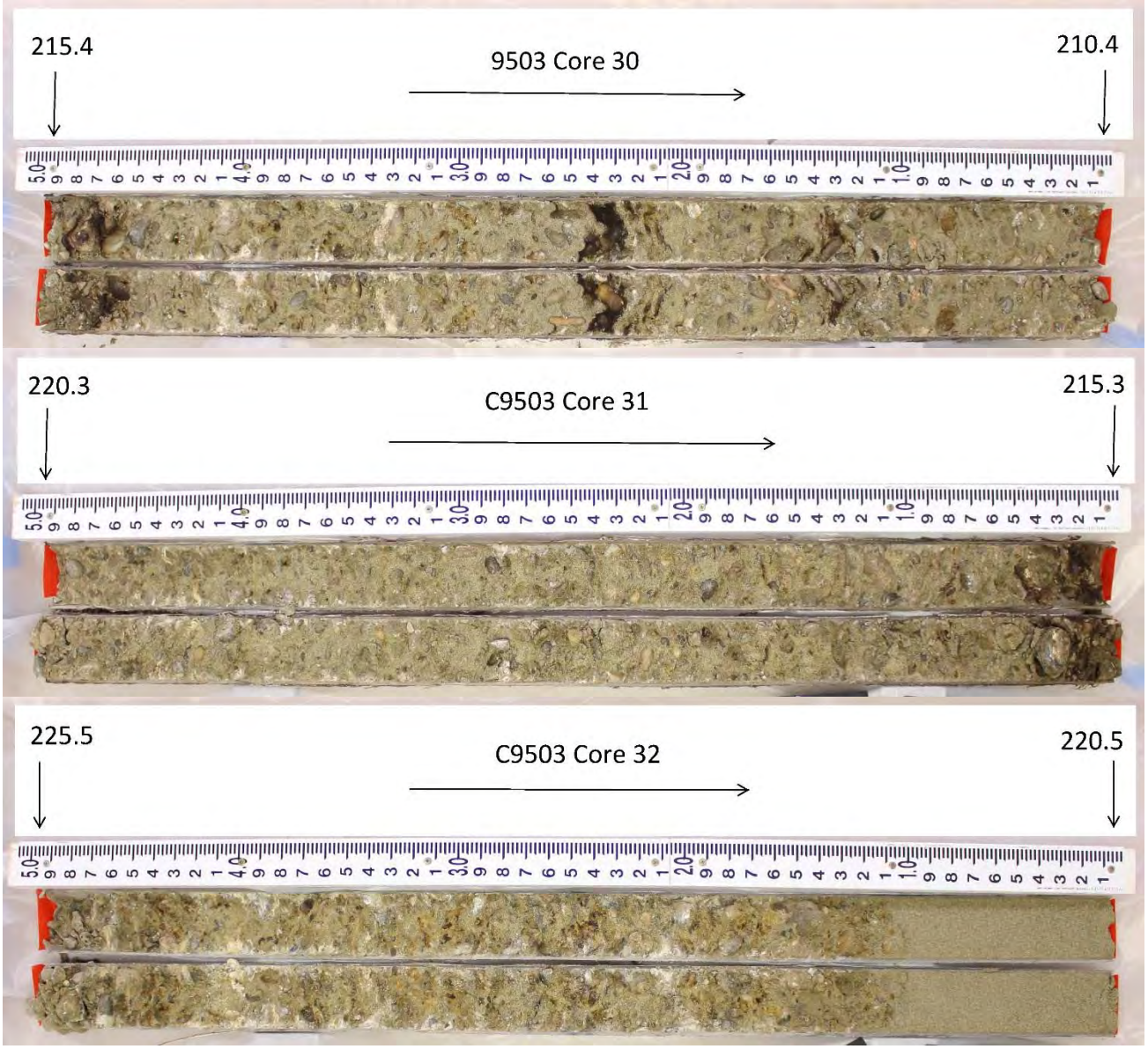

115.0
C9503, Core 10
110.0

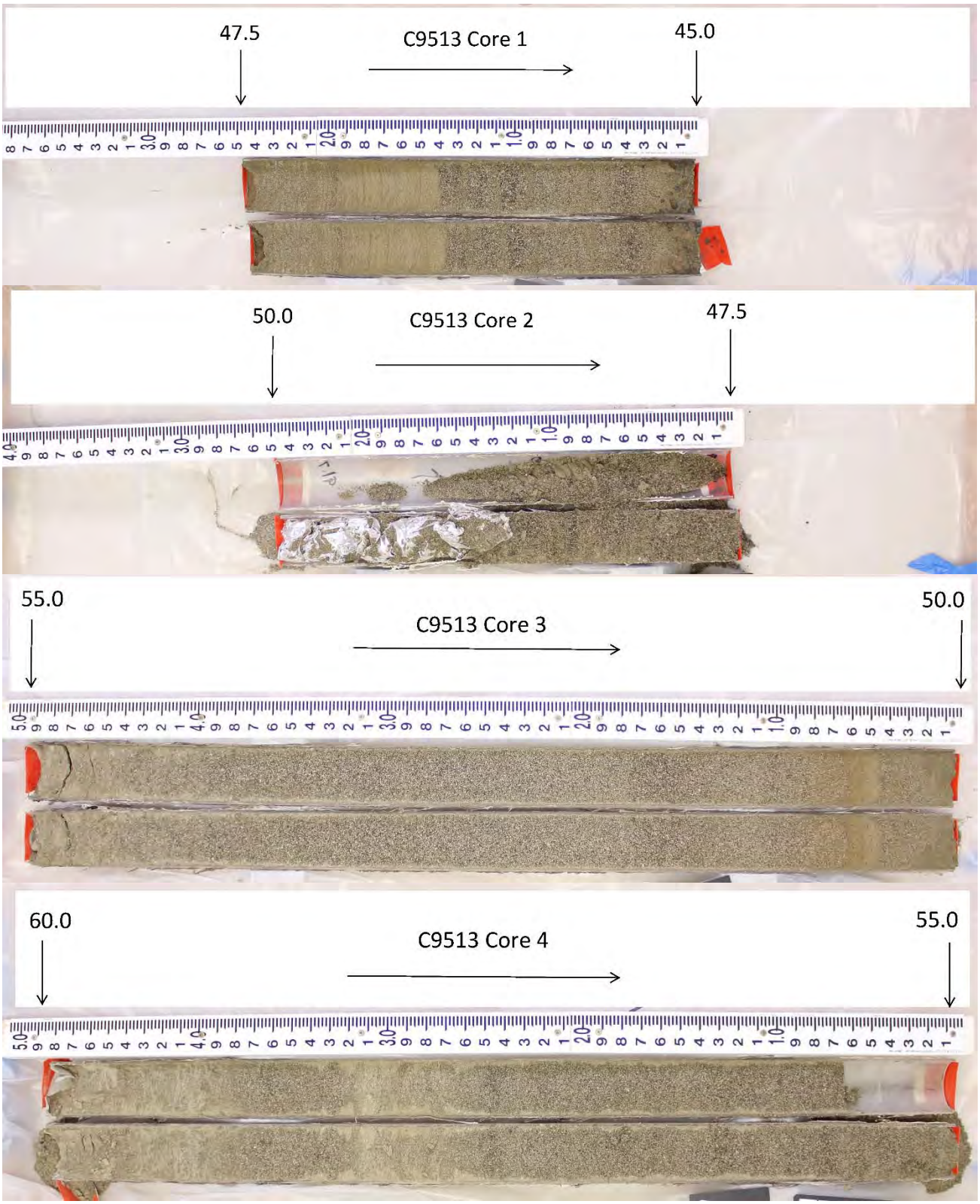

120.0
C9503 Core 11
115.0
125.0
C9503 Core 12
120.0
130.0
C9503 Core 13
125.0
135.0
C9503 Core 14
130.0

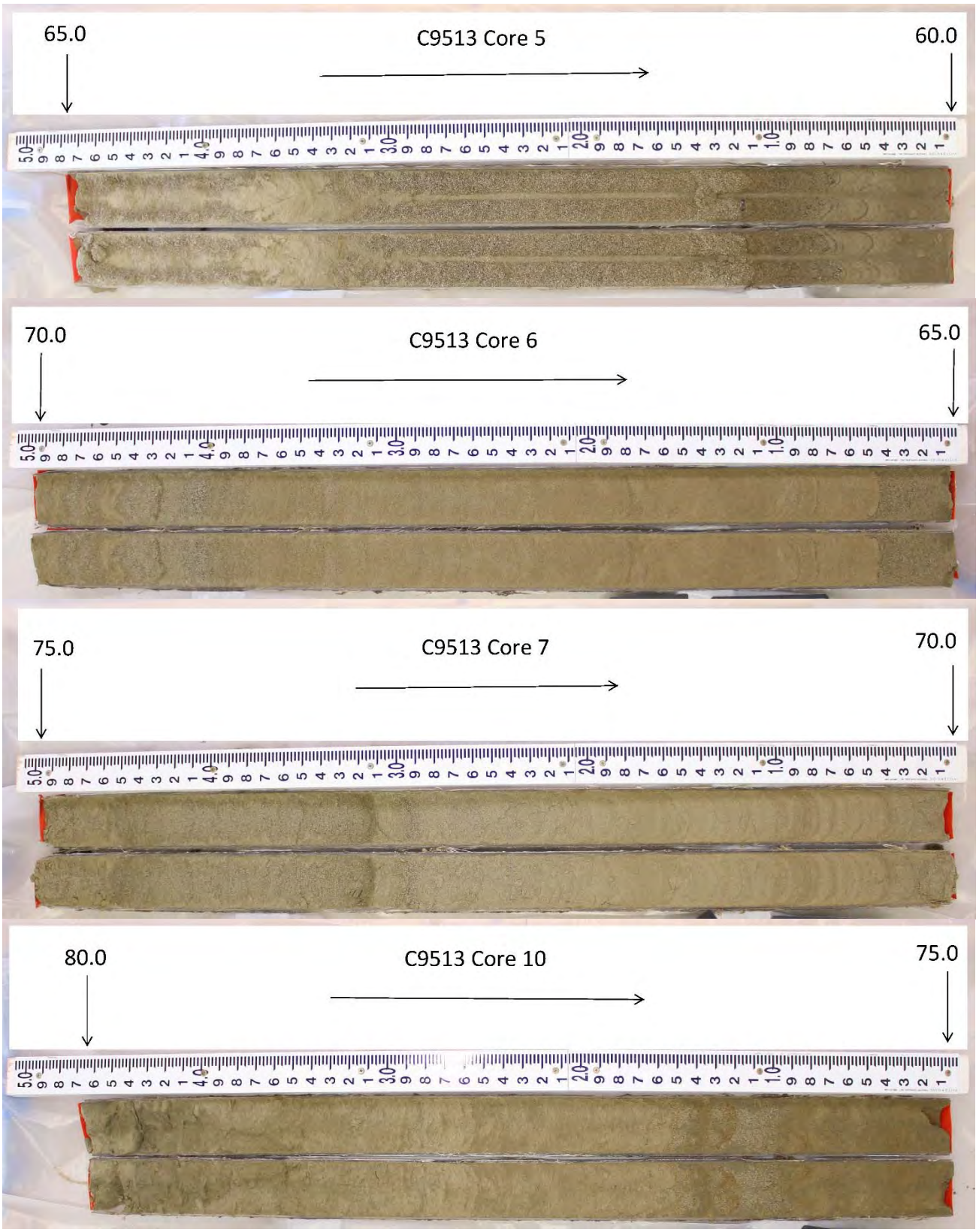

140.0
C9503 Core 15
135.0
145.0
C9503 Core 16
140.0
150.0
C9503 Core 17
145.0
170.0
C9503 Core 21
165.0

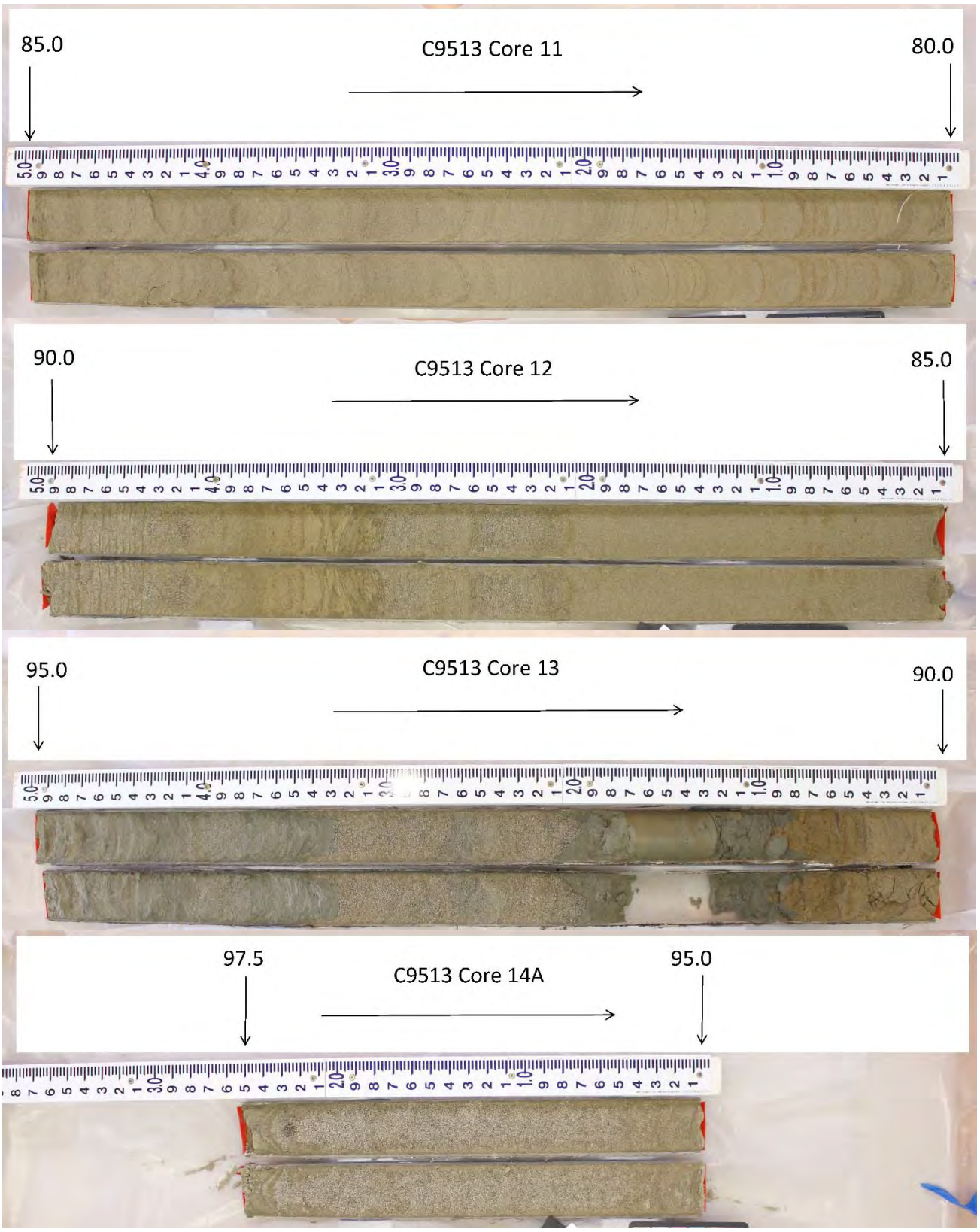

175.3
C9503 Core 22
170.3
180.4
C9503 Core 23
175.4
185.2
C9503 Core 24
180.2
190.2
C9503 Core 25
185.2

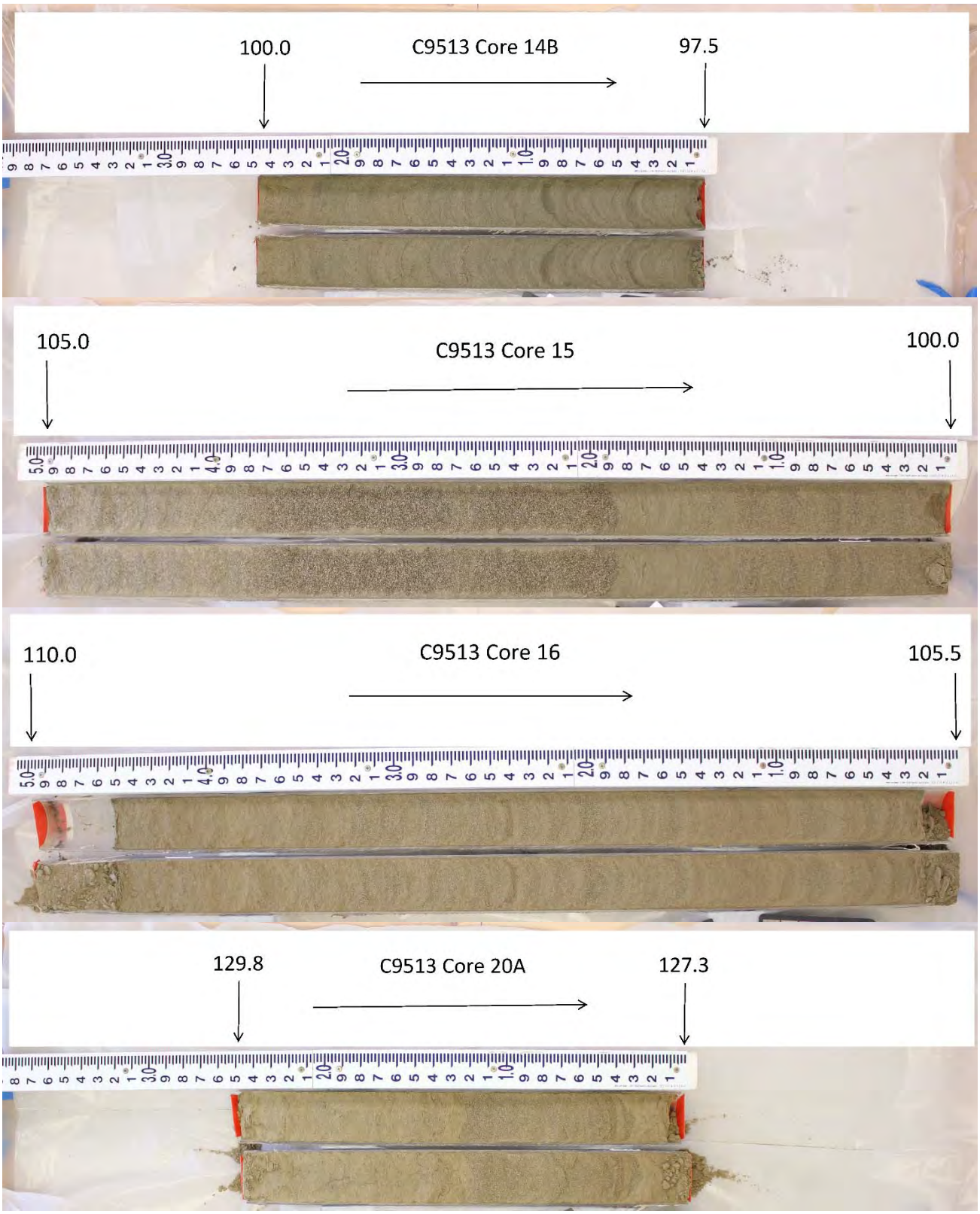

195.5
C9503 Core 26
190.5
200.4
C9503 Core 27
195.4
205.2
C9503 Core 28
200.2
210.1
C9503 Core 29
205.1

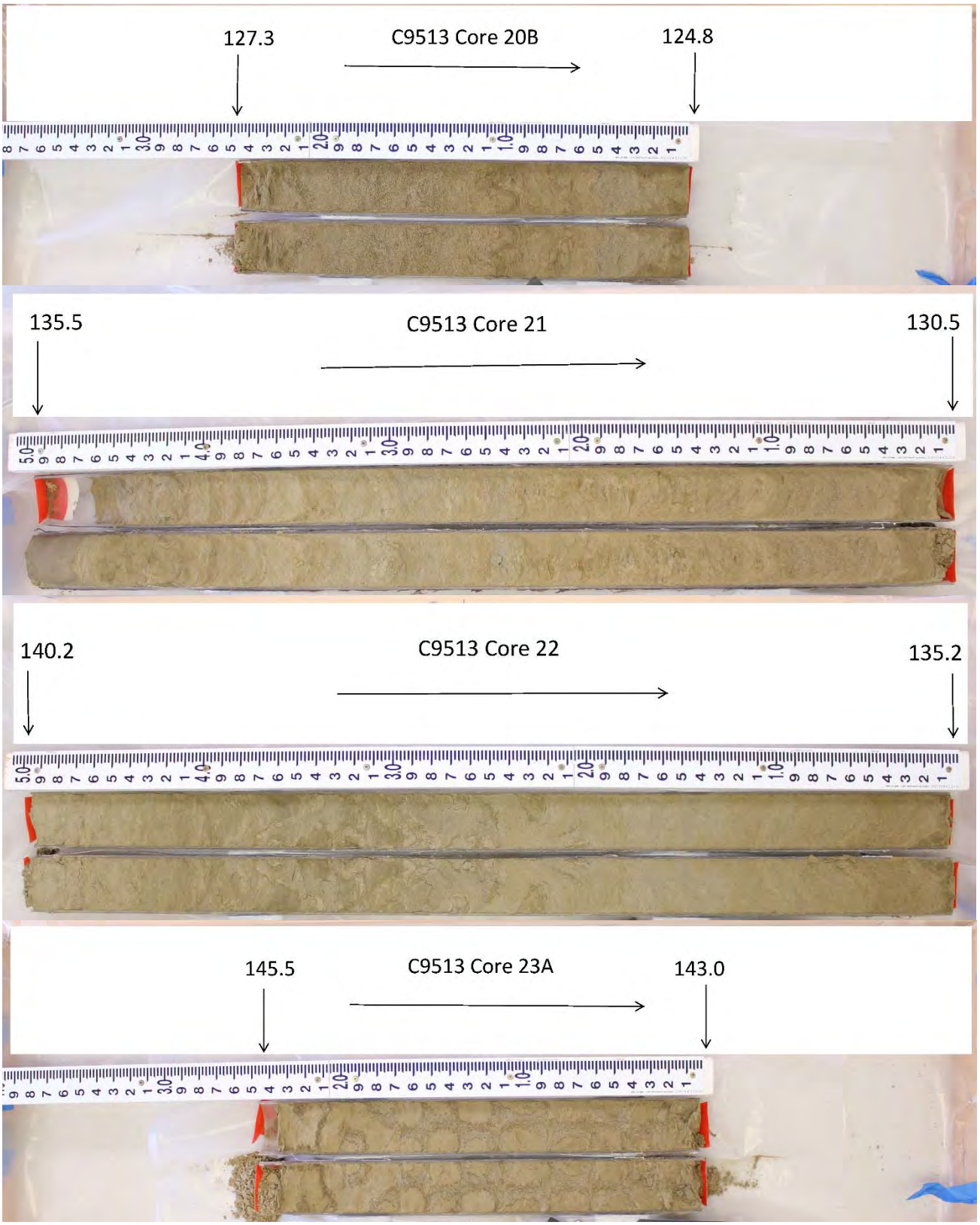

215.4
9503 Core 30
210.4
220.3
C9503 Core 31
215.3
225.5
C9503 Core 32
220.5

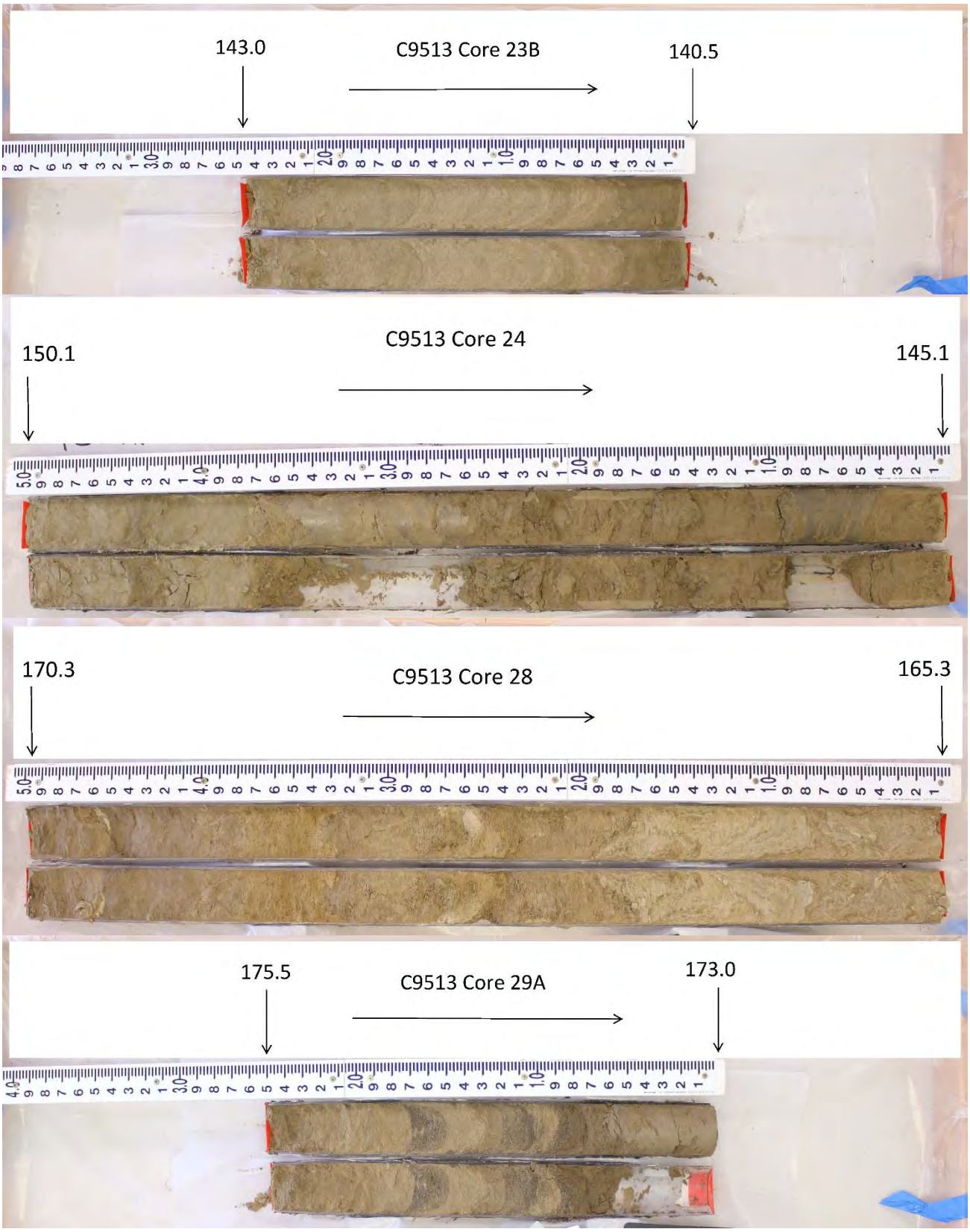

47.5
C9513 Core 1
45.0
50.0
C9513 Core 2
47.5
55.0
C9513 Core 3
50.0
60.0
C9513 Core 4
55.0

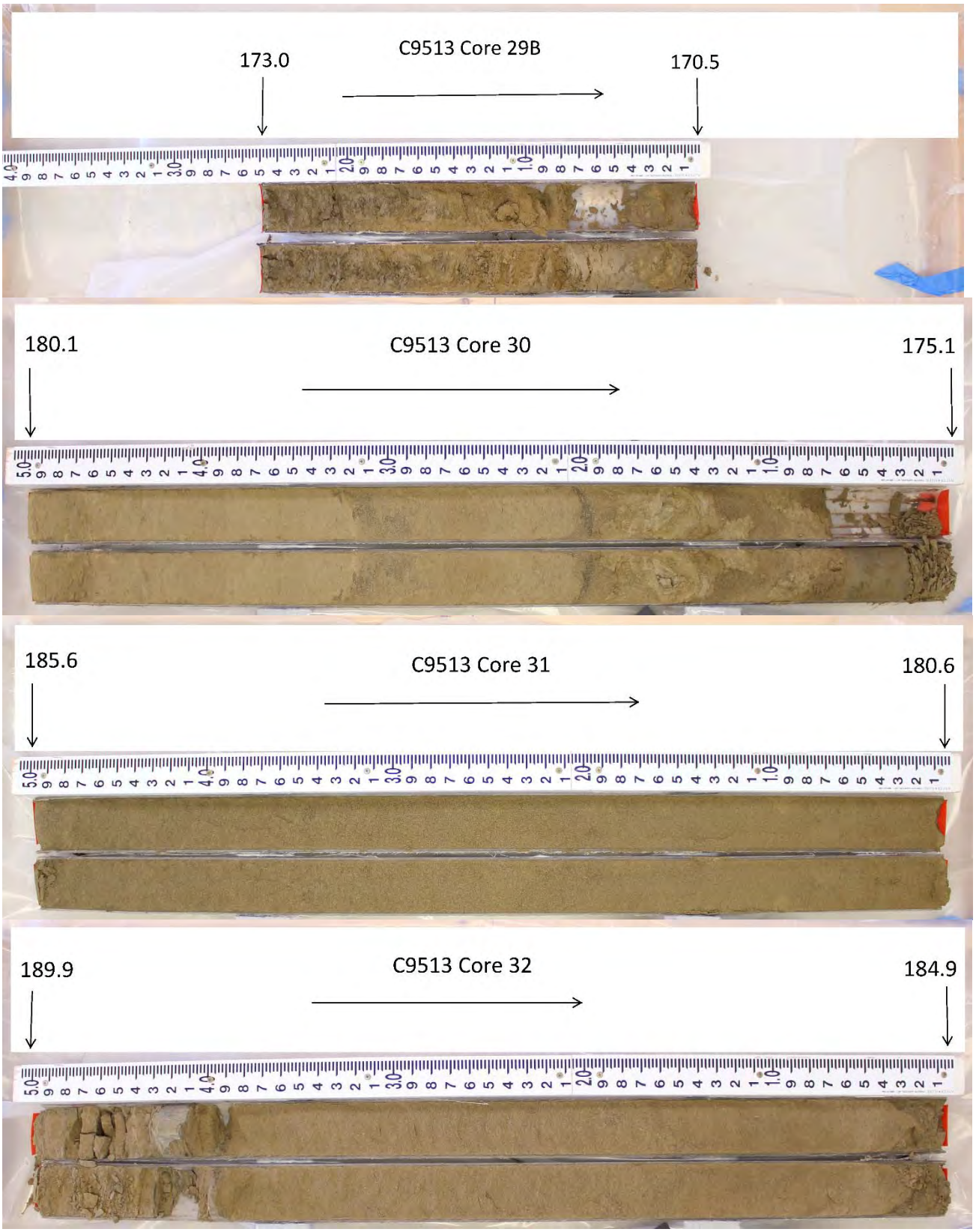

65.0
C9513 Core 5
60.0
70.0
C9513 Core 6
65.0
75.0
C9513 Core 7
70.0
80.0
C9513 Core 10
75.0

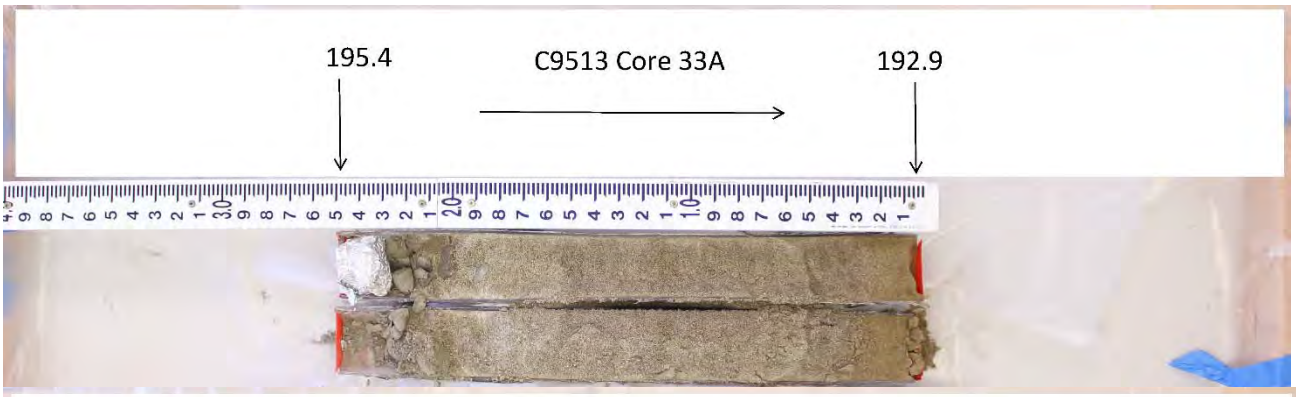

85.0
C9513 Core 11
80.0
90.0
C9513 Core 12
85.0
95.0
C9513 Core 13
90.0
97.5
C9513 Core 14A
95.0

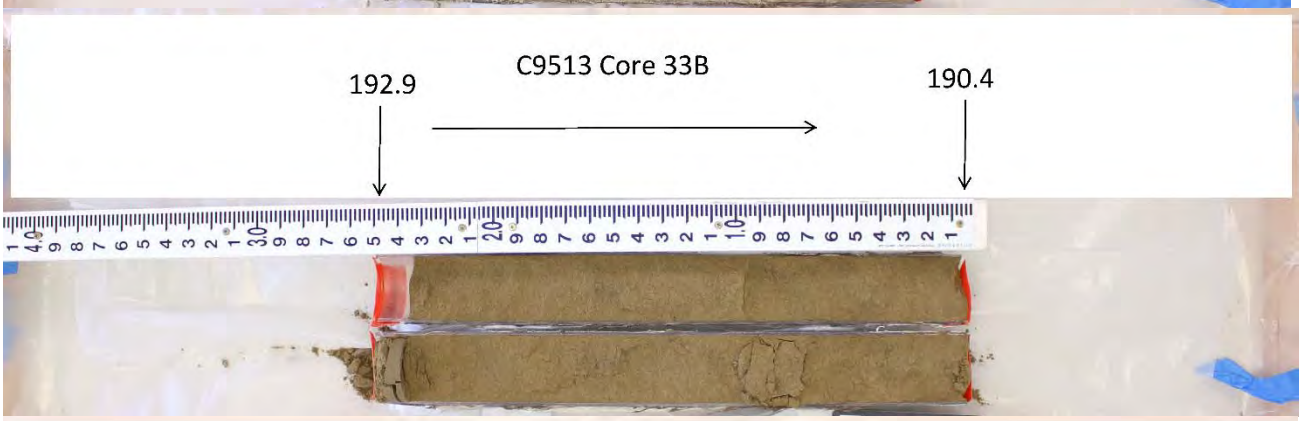

100.0
C9513 Core 14B
97.5
105.0
C9513 Core 15
100.0
110.0
C9513 Core 16
105.5
129.8
C9513 Core 20A
127.3

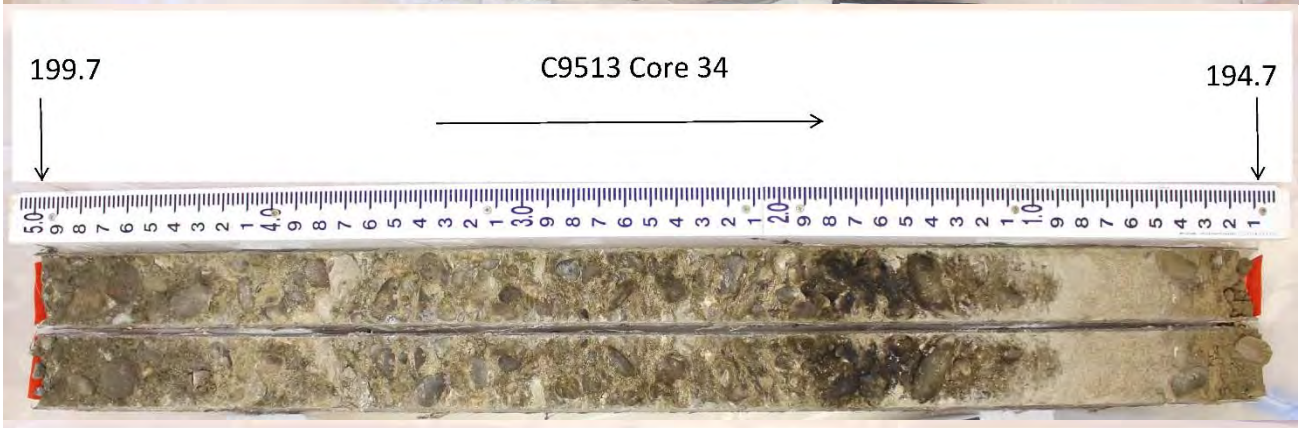

127.3
C9513 Core 20B
124.8
135.5
C9513 Core 21
130.5
140.2
C9513 Core 22
135.2
145.5
C9513 Core 23A
143.0

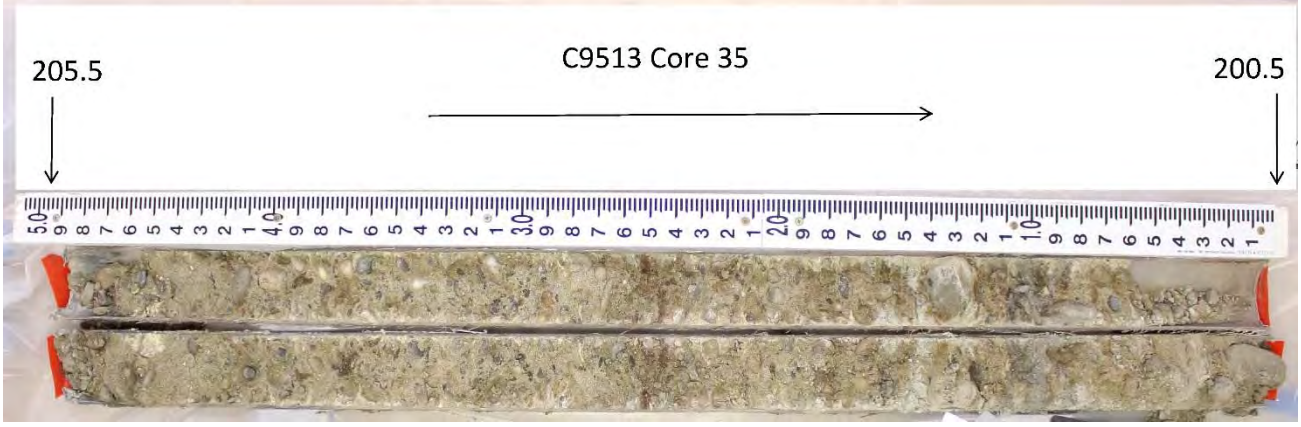

143.0
C9513 Core 23B
140.5
150.1
C9513 Core 24
145.1
170.3
C9513 Core 28
165.3
175.5
C9513 Core 29A
173.0

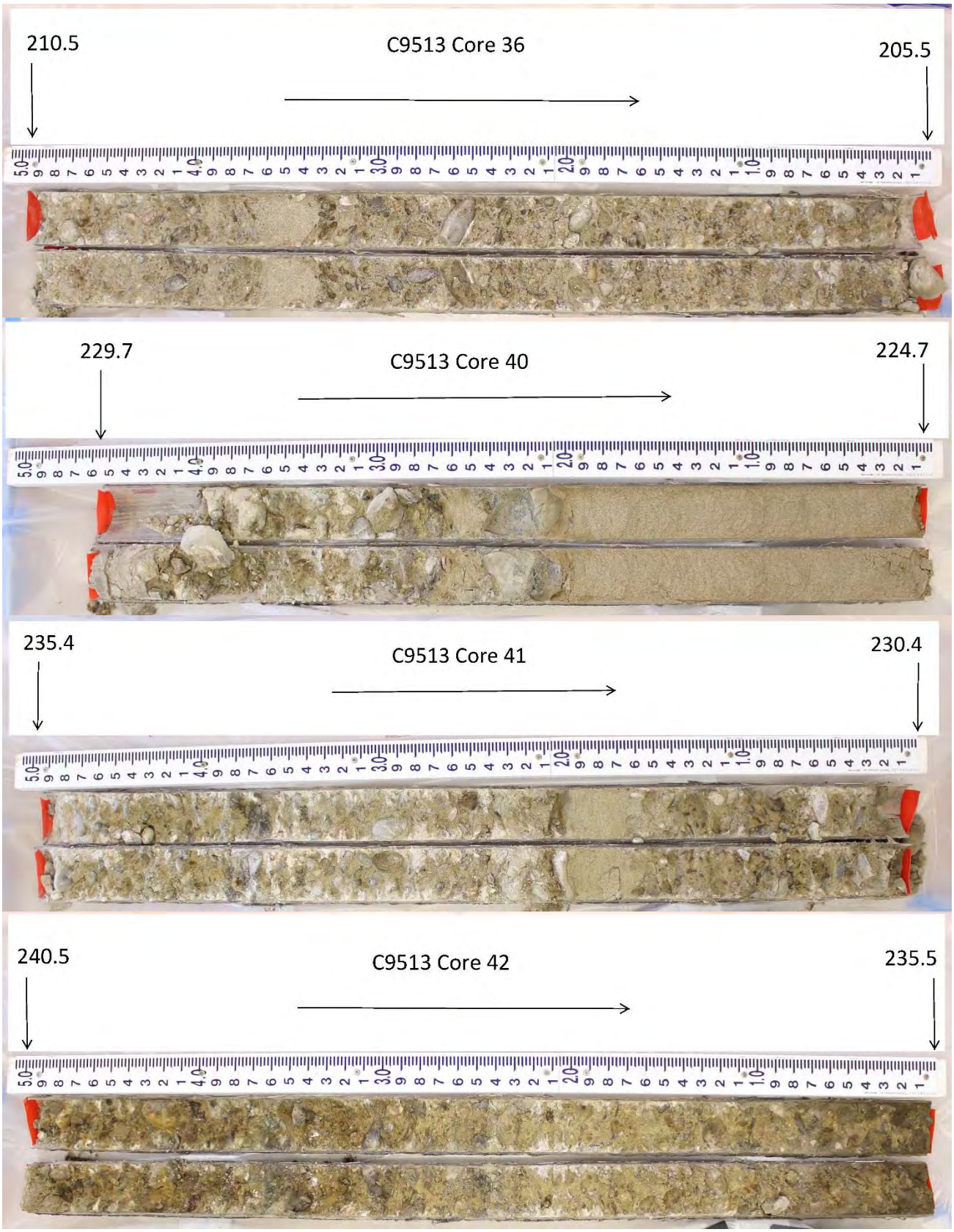

173.0
C9513 Core 29B
170.5
180.1
C9513 Core 30
175.1
185.6
C9513 Core 31
180.6
189.9
C9513 Core 32
184.9


195.4
C9513 Core 33A
192.9


192.9
C9513 Core 33B
190.4


199.7
C9513 Core 34
194.7


205.5
C9513 Core 35
200.5

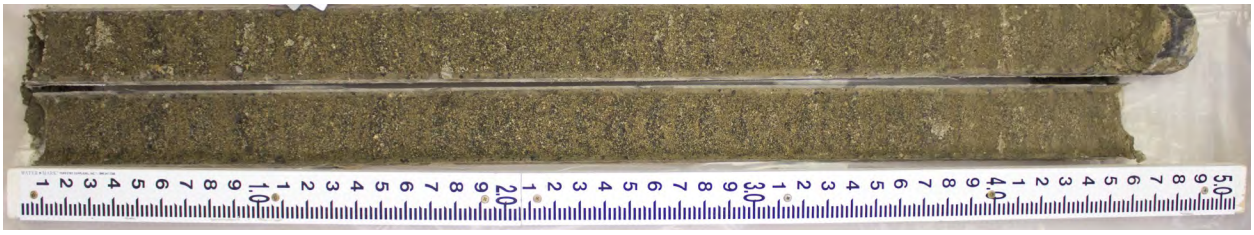

210.5
C9513 Core 36
205.5
229.7
C9513 Core 40
224.7
235.4
C9513 Core 41
230.4
240.5
C9513 Core 42
235.5

C9555, Core 1

30 ft. → 35 ft.

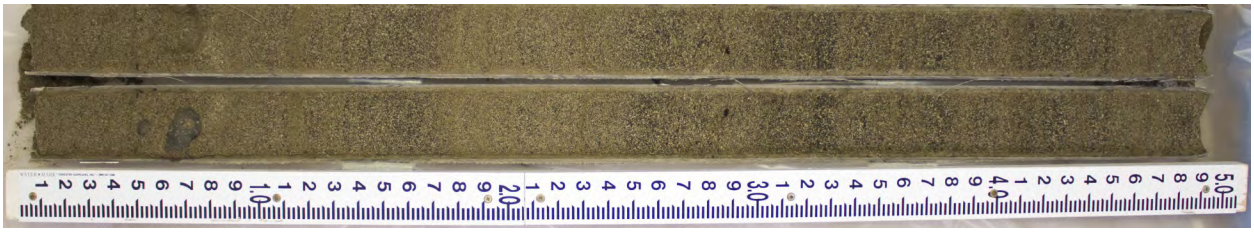
C9555, Core 2

35 ft. → 40 ft.



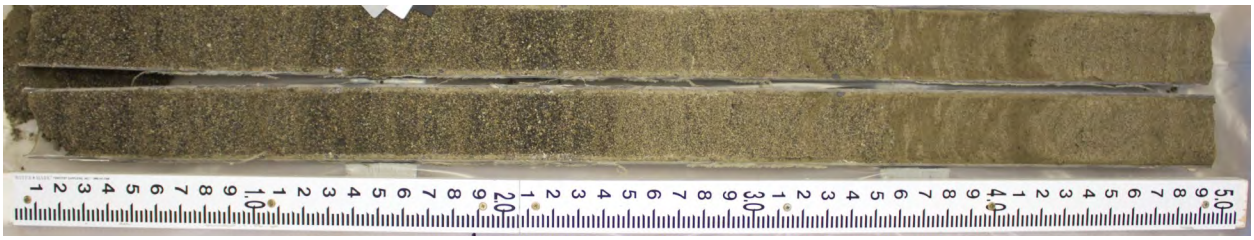
C9555, Core 3

40 ft. → 45 ft.



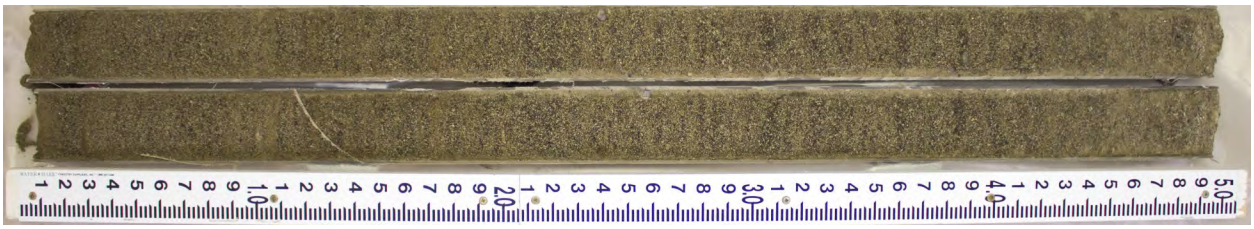
C9555, Core 4

45 ft. → 50 ft.



C9555, Core 5

50 ft. → 55 ft.

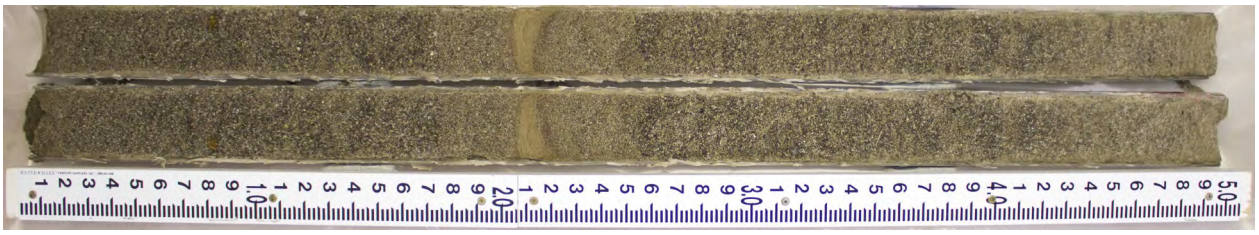


C9555, Core 6

55 ft. → 60 ft.

C9555, Core 7

60 ft. → 65 ft.

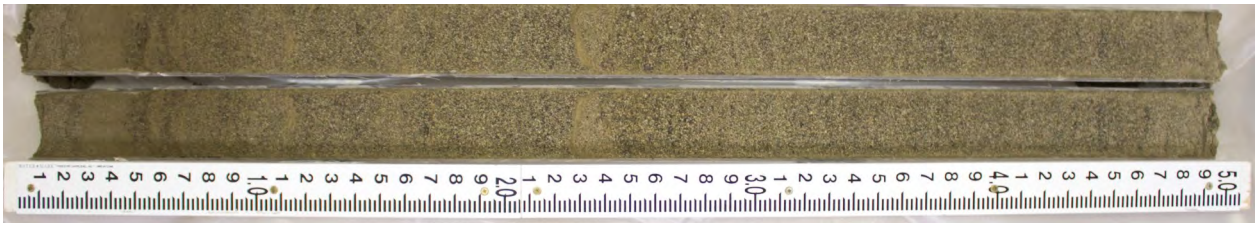


C9555, Core 8

65.4 ft. → 70.4 ft.

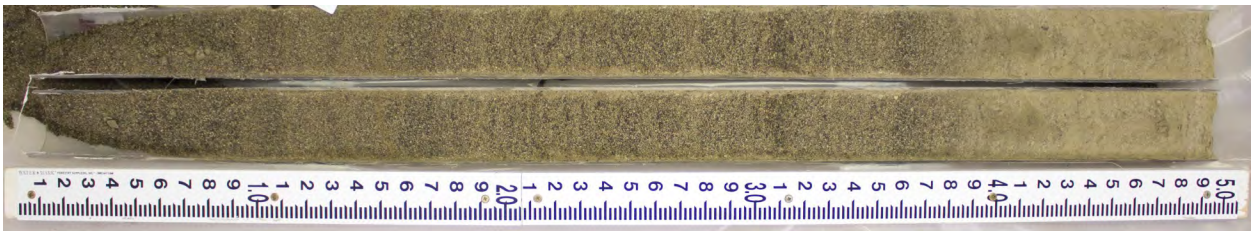
C9555, Core 9

70.4 ft. → 75.4 ft.



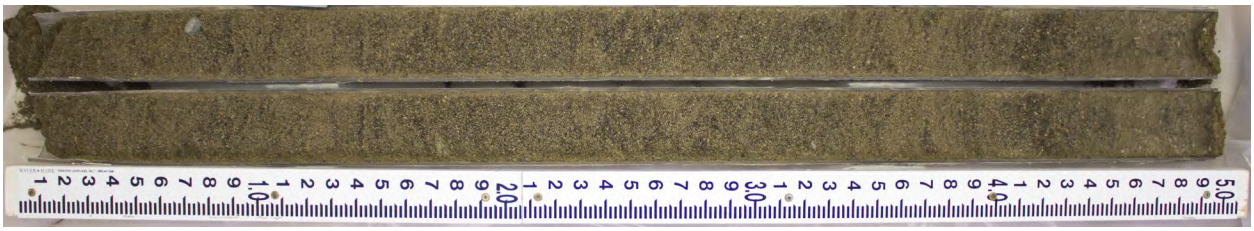
C9555, Core 10

74.7 ft. → 79.7 ft.



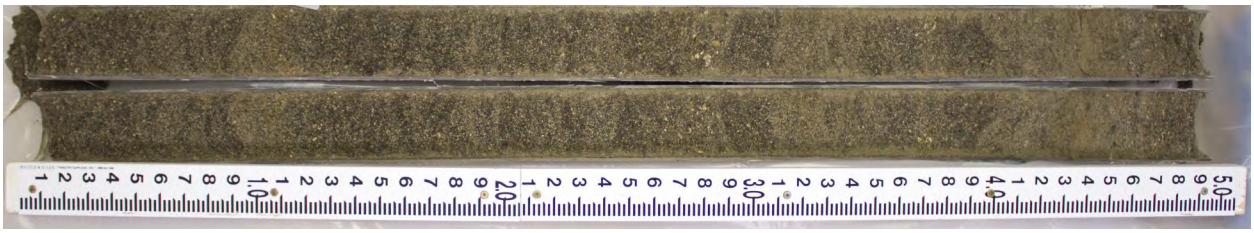
C9555, Core 11

80.4 ft. → 85.4 ft.



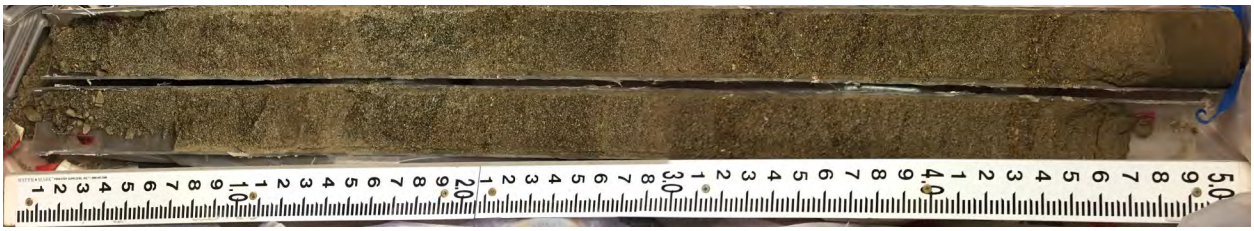
C9555, Core 12

84.8 ft. → 89.8 ft.



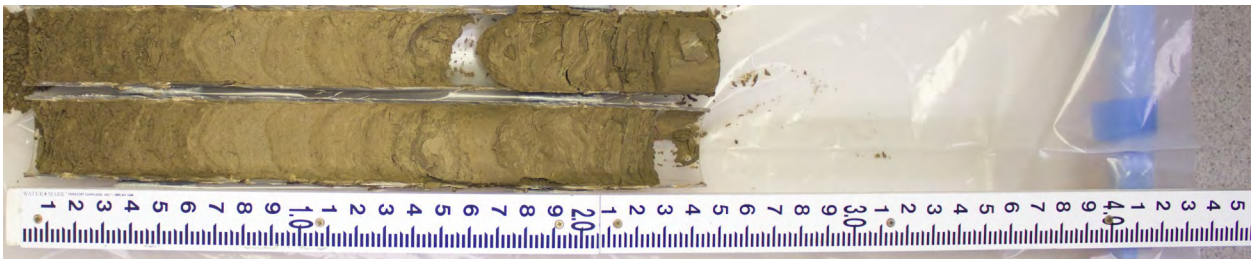
C9555, Core 13

90.4 ft. → 95.4 ft.



C9555, Core 17

110.4 ft. → 112.9 ft.



C9555, Core 18

112.9 ft. → 114.9 ft.

C9555, Core 19

115.4 ft. → 120.4 ft.

C9555, Core 20

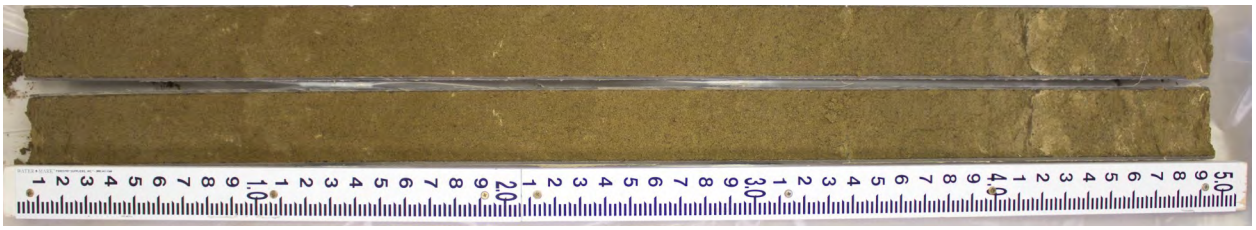
120.4 ft. → 122.4 ft.

C9555, Core 21

122.4 ft. → 125.4 ft.

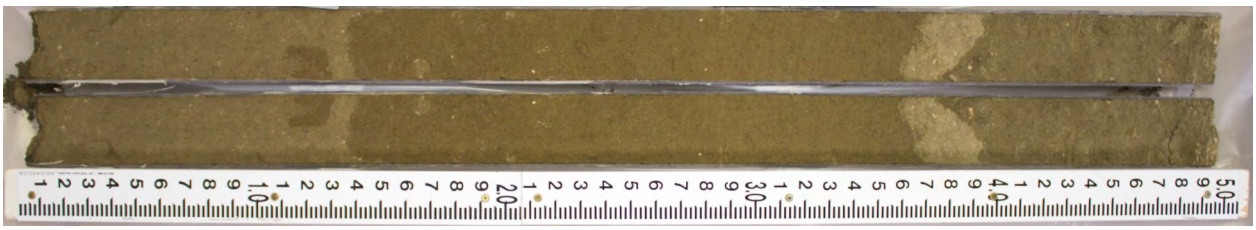
C9555, Core 22

125.5 ft. → 130.5 ft.



C9555, Core 23

129.8 ft. → 134.8 ft.

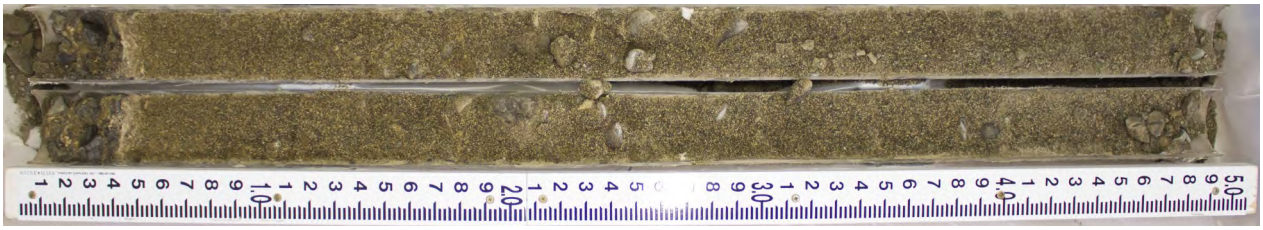


C9555, Core 24

135.4 ft. → 140.4 ft.

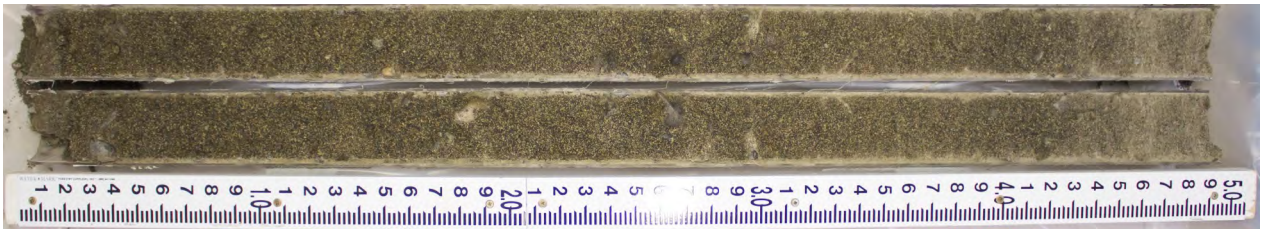
C9555, Core 25

140 ft. → 145 ft.



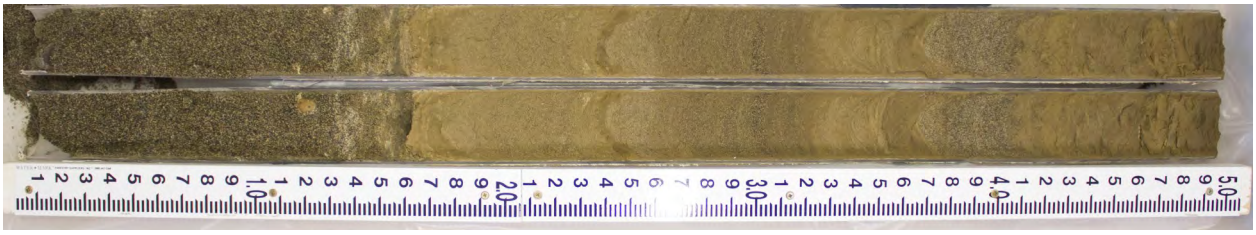
C9555, Core 26

145 ft. → 150 ft.



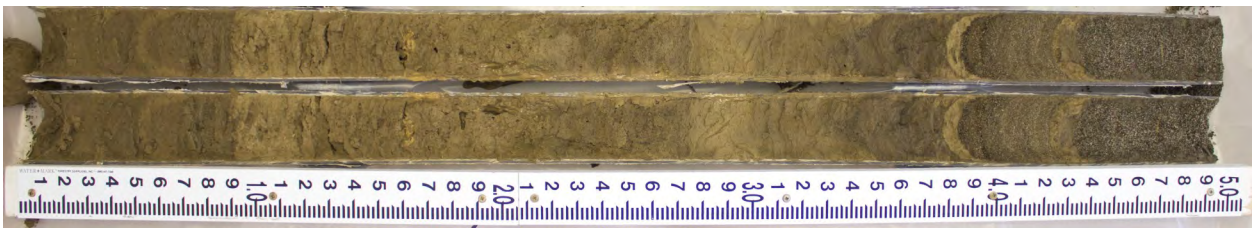
C9555, Core 27

150 ft. → 155.5 ft.



C9555, Core 28

155.3 ft. → 160.3 ft.



C9555, Core 29

160.3 ft. → 165.3 ft.

C9555, Core 30

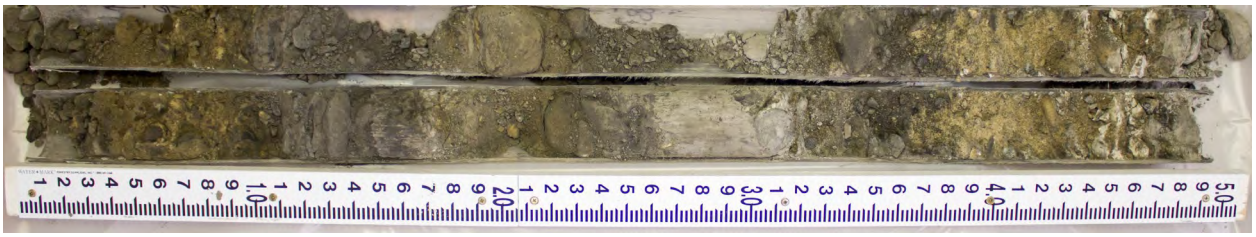
165.3 ft. → 170.3 ft.

C9555, Core 50

170.3 ft. → 175.3 ft.

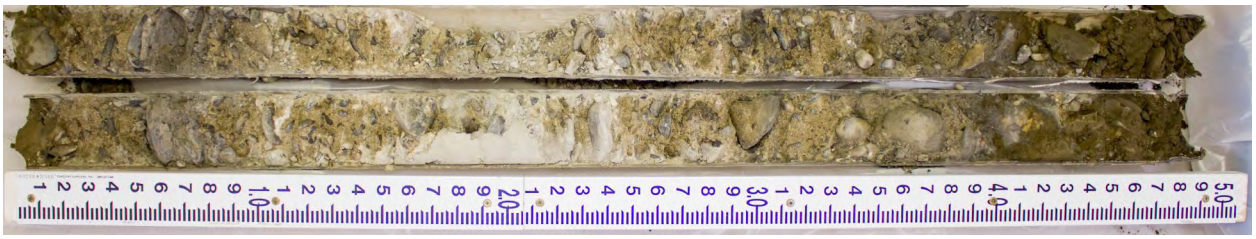
C9555, Core 51

175.4 ft. → 180.4 ft.



C9555, Core 34

195.3 ft. → 200.3 ft.

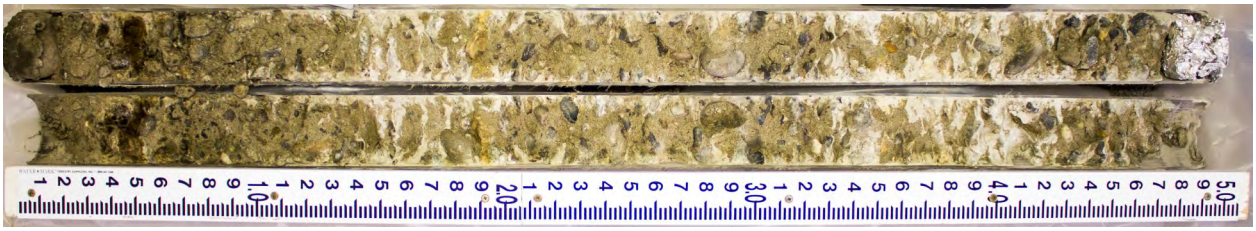


C9555, Core 35

200.3 ft. → 204.8 ft.

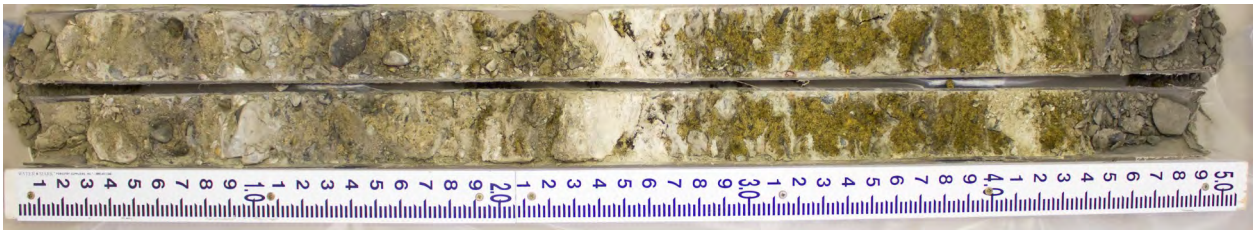
C9555, Core 36

205.4 ft. → 210.4 ft.



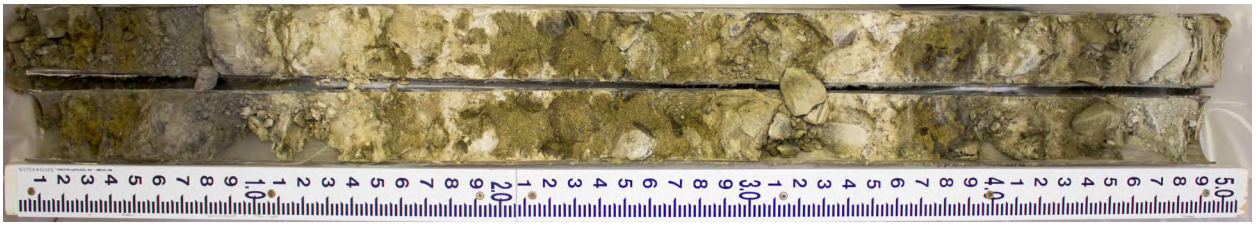
C9555, Core 37

210.4 ft. → 215.4 ft.



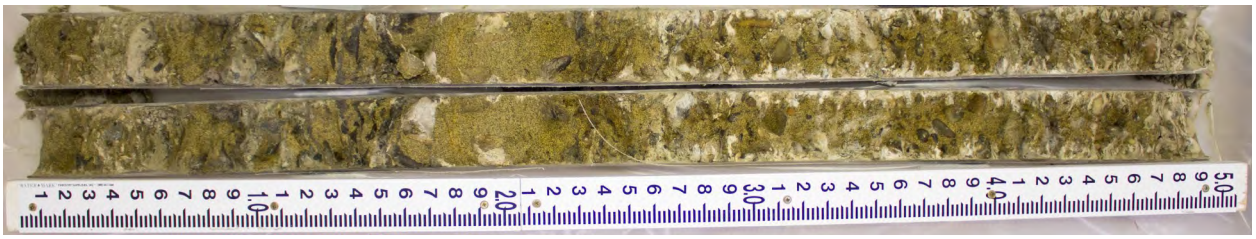
C9555, Core 38

215.4 ft. → 220.4 ft.



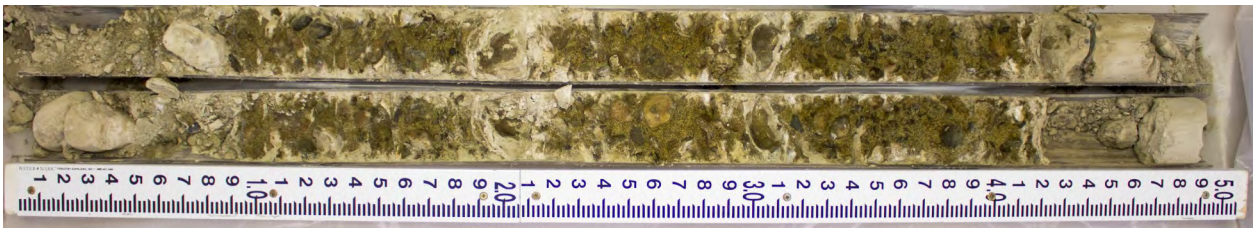
C9555, Core 39

220.5 ft. → 225.5 ft.



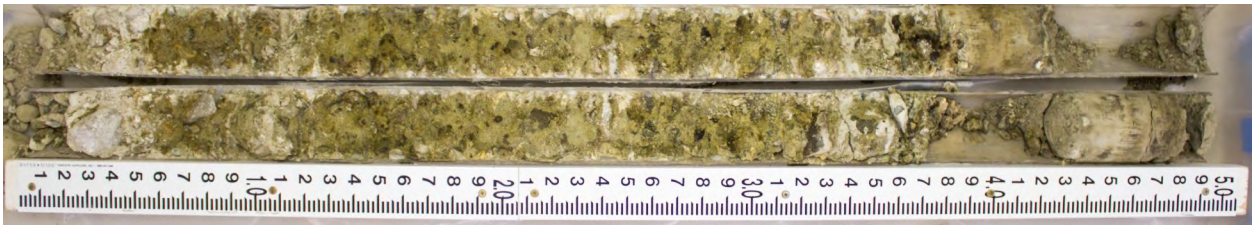
C9555, Core 40

225.3 ft. → 230.3 ft.



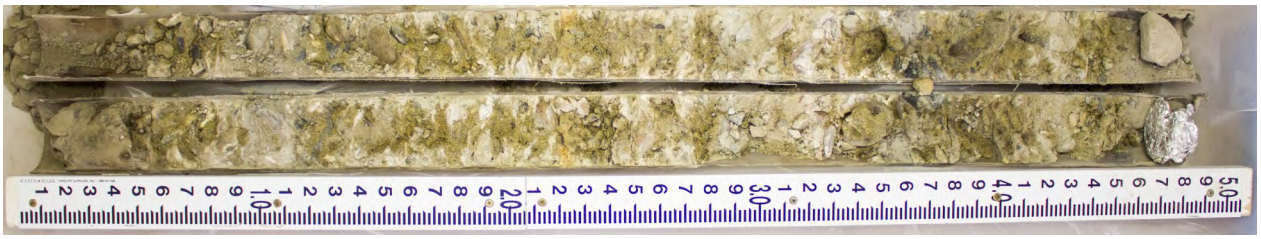
C9555, Core 41

230.2 ft. → 235.2 ft.



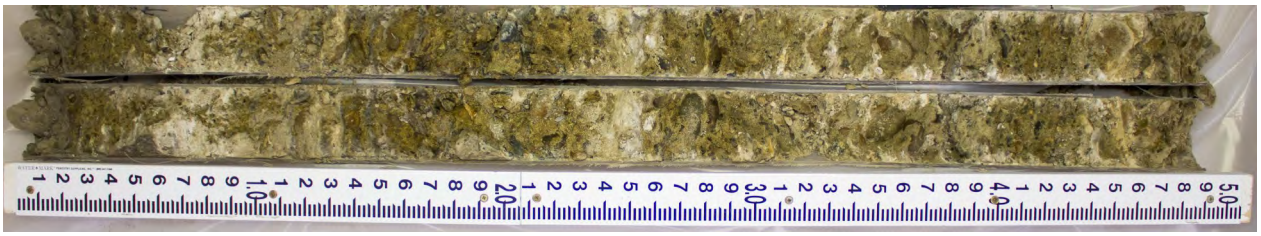
C9555, Core 42

235.7 ft. → 240.7 ft.



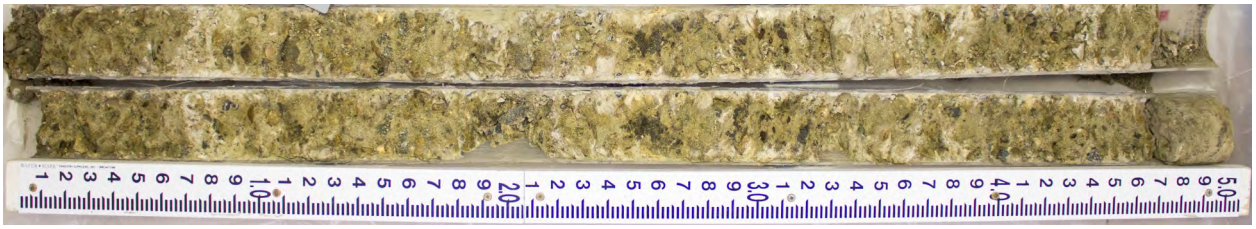
C9555, Core 43

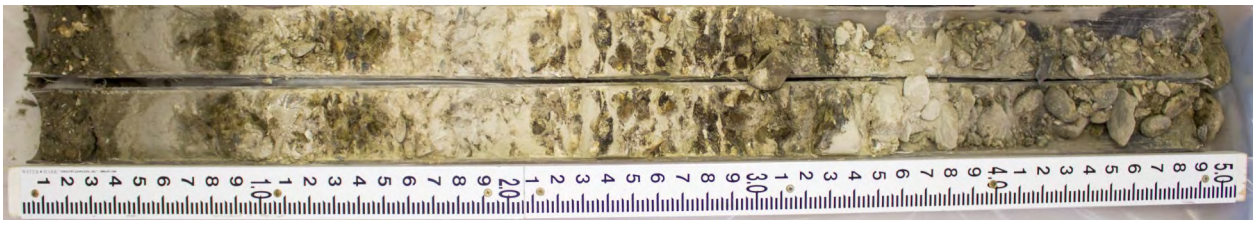
240.4 ft. → 245.4 ft.



C9555, Core 44

245 ft. → 250 ft.



C9555, Core 45

250.2 ft. → 254.7 ft.