SGW-38048
Revision 0

Borehole Summary Report for the 216-A-30 Crib Characterization Borehole C5941 in the 200-SC-1 Operable Unit

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

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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Richland, Washington

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S. S. Lowe
Fluor Hanford, Inc.

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TERMS

AM/PM	morning and afternoon
α	alpha radiation
bgs	below ground surface
β-γ	beta/gamma radiation
CIN	container identification number
dpm/cm^2	disintegrations per minute per square centimeter
DTW	depth to water
Eberline	Eberline Analytical Corporation, Richmond, California
ECM	environmentally controlled material
ESL	PNNL Environmental Science Laboratory
G-M	Geiger-Müller (radiation meter)
HEIS	*Hanford Environmental Information System* database
ID	inside diameter
IDW	investigation-derived waste
IH	industrial hygiene
LEL	lower explosive limit
MSW	miscellaneous solid waste
N/A	not applicable
OD	outside diameter
OU	operable unit
OVM	organic vapor monitor
pCi/g	picocuries per gram
PIN	primary identification number
PNNL	Pacific Northwest National Laboratory
ppm	parts per million
RLNP	Recra LabNet Philadelphia, Pennsylvania
SAP	sampling and analysis plan
Shaw	Shaw Group, Inc., Geotechnical Laboratory, Oak Ridge, Tennessee
TARL	TestAmerica Richland, Washington
TASL	TestAmerica St. Louis, Missouri
TD	total depth
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989)
VOA	volatile organic analysis
VOC	volatile organic compound
WSCF	Waste Sampling and Characterization Facility
WTP	Waste Treatment and Immobilization Plant

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			
Temperature			**Temperature**		
Fahrenheit	(°F-32)*5/9	Centigrade	Centigrade	(°C*9/5)+32	Fahrenheit
Radioactivity			**Radioactivity**		
picocurie	37	millibecquerel	millibecquerel	0.027	picocurie

1.0 INTRODUCTION

1.1 PURPOSE

This report summarizes the activities performed in the characterization of the vadose zone and upper water table at the 216-A-30 Crib located in the 200 East Area of the Hanford Site. Characterization activities conducted at the 216-A-30 Crib during drilling of borehole C5941 were performed in accordance with the work plan and sampling and analysis plan (SAP) (DOE/RL-2007-02, Vols. I and II, *Supplemental Remedial Investigation/Feasibility Study Work Plan for the 200 Areas Central Plateau Operable Units*). The work plan provides detailed sampling design for characterizing chemical and radioactive contamination as well as physical conditions of the waste-site subsurface. Data collected from this borehole will provide supplemental remedial information that will be used to refine the conceptual contamination-distribution model associated with this site. The supplemental remedial information will support the evaluation of remedial alternatives for the 216-A-30 Crib in the 200-SC-1 Operable Unit (OU) and the 200-PO-1 Groundwater OU feasibility studies.

The 216-A-30 Crib is located east of Building 202-A (Plutonium-Uranium Extraction Plant), south of the Waste Treatment and Immobilization Plant (Vitrification Plant), adjacent to the 216-A-37-1 and 216-A-37-2 Cribs, and immediately east of the 216-A-6 Crib. The 216-A-30 Crib is marked with concrete bollards and is posted as an Underground Radioactive Materials Area. The location of borehole C5941 in relation to the 216-A-30 Crib and surrounding infrastructure is shown in Figure 1-1.

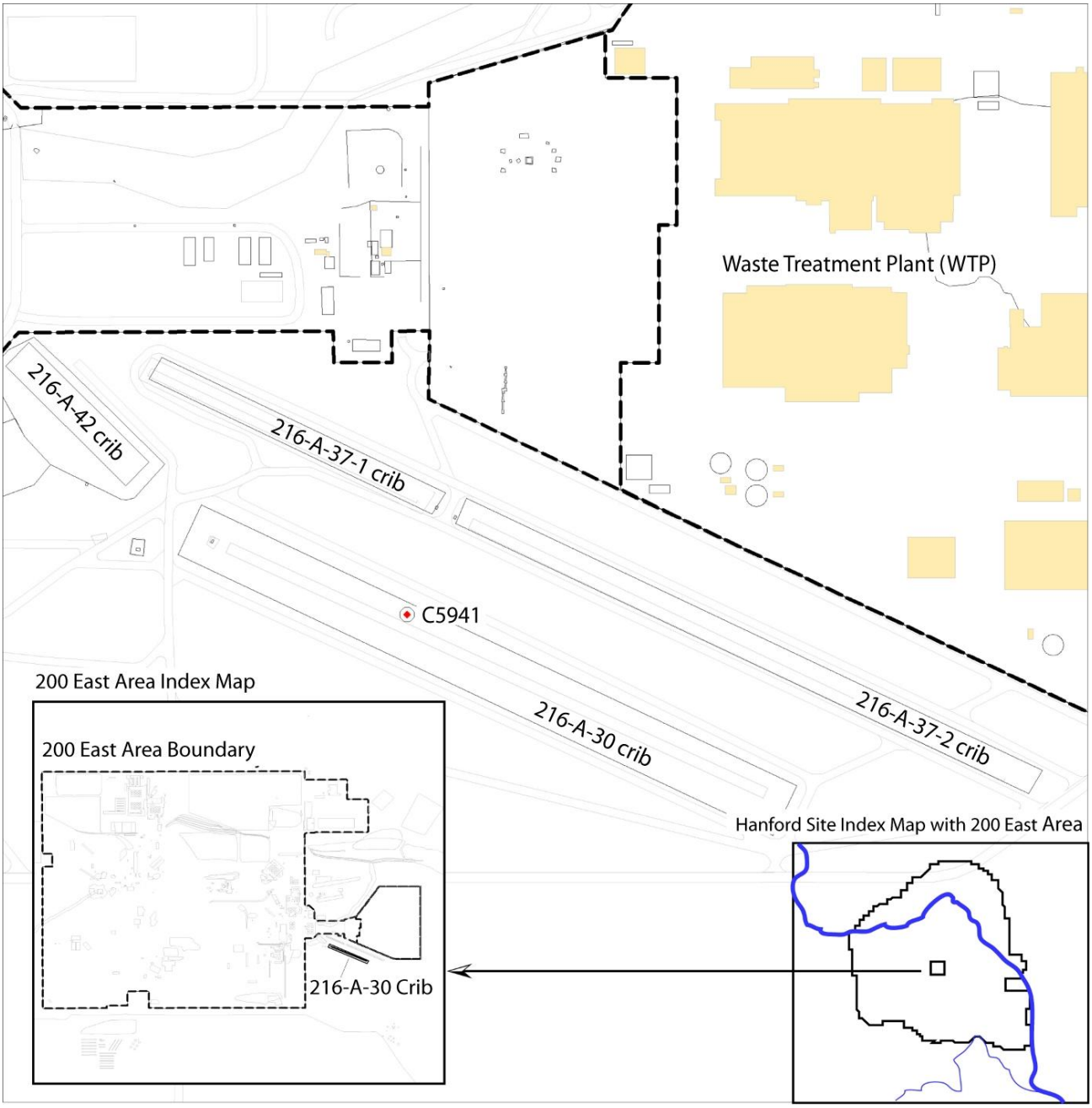
All measurements throughout this document are reported in the English standard units in which they were measured in the field. English standard units within the text of this document are accompanied by equivalent metric units.

1.2 BACKGROUND

The 216-A-30 Crib is an inactive liquid-waste-disposal crib that is 427.7 m (1,400 ft) long by 3.1 m (10 ft) wide at its bottom and is 4.5 m (15 ft) deep. The crib contains two distribution pipes. One pipe is a 38.1 cm (15-in.) corrugated, perforated, galvanized pipe that runs approximately 1.2 m (4 ft) below the original crib cap to the center of the unit. The other pipe is a 40.6 cm (16-in.) steel pipe that runs parallel to the other at the same depth to the center of the crib, then angles 45 degrees downward and transitions to a corrugated, perforated pipe that runs approximately 2.1 to 2.4 m (7 to 8 ft) below the original crib cap (DOE/RL-2007-02, Vol. II).

From 1961 to 1992, the waste site received approximately 7.49 million L (1.98 million gal) of effluent from Plutonium-Uranium Extraction Plant operations (e.g., contaminated steam condensate, equipment disposal tunnel floor and water-filled door drainage, and fuel slug storage basin overflow). In 1972, radioactive salt crust formed on the crib surface and subsequently was covered with sand and polyethylene sheets. The crib also has a history of radioactive tumbleweed growth. The tumbleweeds have been buried by layers of sand, dirt, and gravel, which have added to the depth of the crib cap (DOE/RL-2007-02, Vol. II).

Figure 1-1. Location of the 216-A-30 Crib in the 200 East Area.



2.0 SUMMARY OF DRILLING AND SAMPLING ACTIVITIES

Borehole C5941 is located approximately 100 m (330 ft) from the inlet at the west end of the crib, 16.8 m (55 ft) from the row of bollards marking the presumed surface trace of the north side of the crib and 22.8 m (75 ft) from the row of bollards marking the presumed south side of the 216-A-30 Crib. The borehole was drilled to a total depth (TD) of 90.3 m (296.5 ft). Table 2-1 summarizes the drilling data for borehole C5941. Drilling and logging processes are detailed in Section 3.1. During drilling activities, the borehole, drill cuttings, and samples that were collected were monitored for volatile organic compounds (VOC) and radionuclides as part of the environmental monitoring regimen described in Section 3.5. In support of the 200-SC-1 OU supplemental characterization, 104 soil grab samples and 6 split-spoon soil samples were originally planned as part of the SAP. However, 10 split-spoon soil samples were actually collected at modified depths and 110 soil grab samples were collected at roughly 0.7 m (2.5-ft) intervals during drilling as described in Section 3.3. Additionally, one water sample set was collected from the base of the borehole in support of the 200-PO-1 Groundwater OU.

Table 2-1. Drilling Summary for Borehole C5941.

Borehole	Waste Site	Dates		Civil Survey Data			Total Depth (ft bgs)
		Start	Finish	Northing[a] (m)	Easting[a] (m)	Ground Surface Elevation[b] Brass Cap (m)	
C5941	216-A-30 Crib	2/28/08	5/7/08	135558.22	575883.40	208.30	296.5

[a] Measured at the center of the borehole/well in Washington State Plane Coordinates, NAD83(91), *North American Datum of 1983*.
[b] Measured at the Brass Survey Marker associated with the borehole/well in NAVD88, *North American Vertical Datum of 1988*.

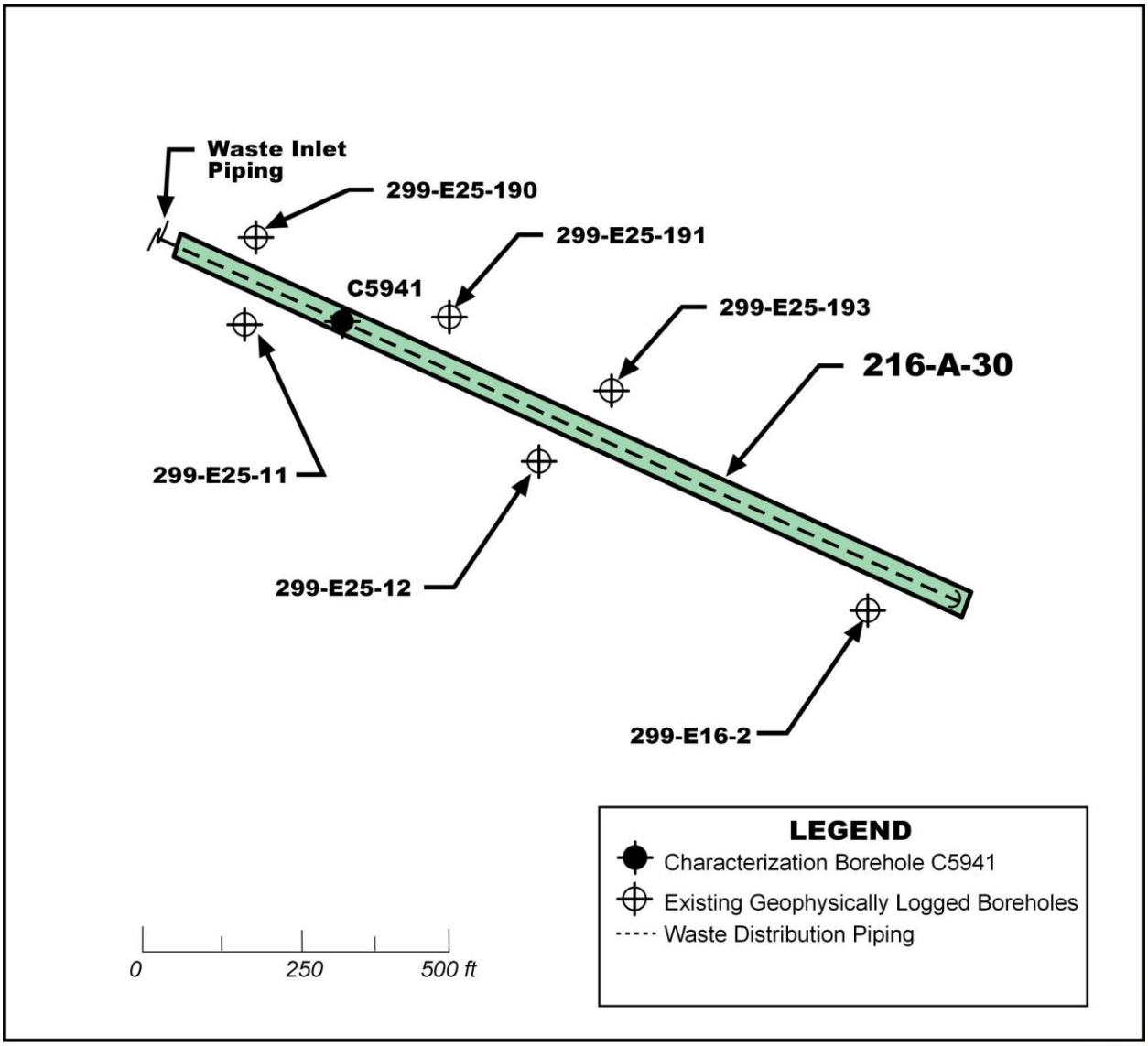
bgs = below ground surface.

Figure 2-1 shows the data collection location within the 216-A-30 Crib. The borehole C5941 location changed from what was shown earlier in the work plan (DOE/RL-2007-02), based on a review of electrical resistivity characterization results. Previously, it was planned to drill the borehole at the west end near the crib inlet. An area of high conductivity was detected midway along the crib axis that was more desirable to sample. The change in location was documented in Ecology et al., 1989, *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) Change Notice TPA-CN-210.

The actual sample collection depths and observed soil characteristics for borehole C5941 are shown in Figure 2-2. For analytical quality control purposes, liquid quality control samples, duplicate samples, and split samples of soil and water samples were acquired for laboratory analysis. Sampling is further discussed in Section 3.3.

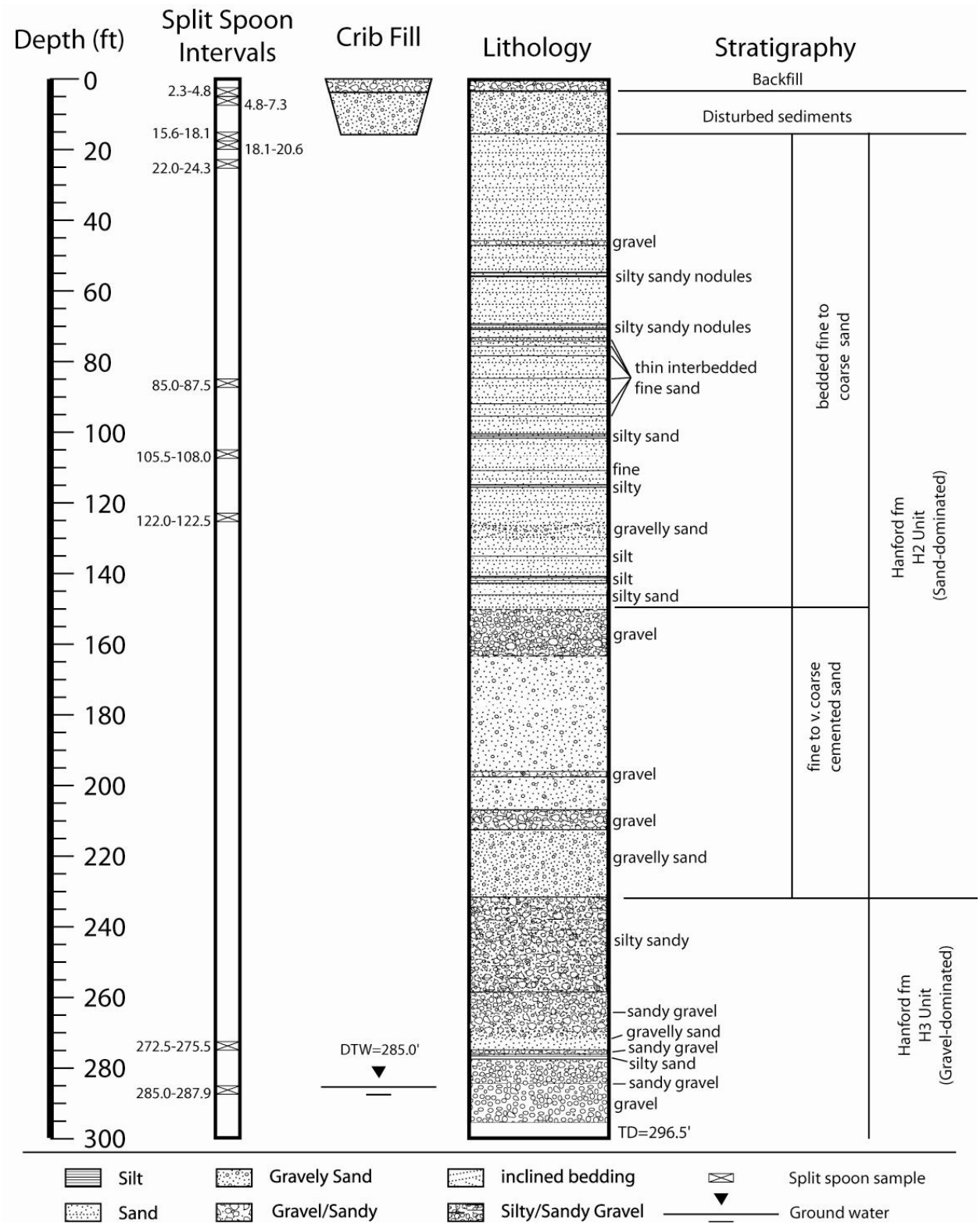
Industrial Hygiene provided air quality sampling on a full-time schedule during drilling operations above 54.4 m (178.5 ft) below ground surface (bgs) and on a morning and afternoon (AM/PM) schedule for activities involved with materials from below this depth. Details of this information are discussed in Section 3.5.1.

Figure 2-1. Data Collection Location in the 216-A-30 Crib.



FG2179.1

Figure 2-2. Sample Collection Depths and Observed Soil Characteristics in the 216-A-30 Crib.



One unplanned soil-vapor sample was collected from the airspace immediately over the borehole tailings drum. The vapor sample was taken to the Waste Sampling and Characterization Facility (WSCF) laboratory for analysis. Details of the sampling are described in Section 3.5.2.

Radiological monitoring was provided on a full-time schedule during drilling, sampling, and decommissioning of the upper portion of the borehole (e.g., above 54.4 m [178.5 ft] bgs) and was provided on an AM/PM schedule for all activities involved with materials from below 54.2 m (178 ft) bgs. Several types of radiation detectors were used during monitoring. Details of this radiological monitoring are discussed in Section 3.5.3.

Geophysical logging using Spectral Gamma, Passive Neutron, and Neutron Moisture Logging systems was conducted on March 19, 2008, from ground surface to 26.5 m (87 ft) bgs. On April 3, 2008, the borehole was logged from 26.5 to 53.9 m (87 to 177 ft) bgs, and on April 22, 2008, the borehole was logged from 53.9 m (177 ft) bgs to TD of 90.3 m (296.5 ft) bgs. Geophysical logging is discussed further in Section 3.6.

Borehole decommissioning began on April 25, 2008, from TD and was completed to ground surface on May 7, 2008. Details are discussed in Section 3.2.

The Well Summary Sheet, the Well Construction Summary Report, and the Borehole Log for borehole C5941 are provided in Appendices A, B, and C, respectively. The Geophysical Log Data Report is provided in Appendix D. Appendix E contains the Well Survey Data Report.

3.0 TECHNICAL DATA

This chapter includes the drilling, sampling, waste management, environmental monitoring, and well decommissioning activities for the 216-A-30 Crib, borehole C5941. All activities were carried out under the procedural guidelines and requirements dictated in GRP-EE-02-14.1, *Drilling, Remediating, and Decommissioning Resource Protection Wells, and Geotechnical Soil Borings*. Drilling and decommissioning of borehole C5941 were carried out in accordance with WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells."

3.1 DRILLING METHOD

Drilling of borehole C5941 began on March 4, 2008, using a Bucyrus-Erie[1] cable-tool drill rig driving hollow drive barrel bits. Drill tailings were brought to the surface using the core barrels and the tailings were placed in 208 L (55-gal), plastic-lined solid waste drums. Additionally, all potentially radiologically contaminated drill tailings were sleeved and bagged using semi-opaque yellow plastic to prevent potential spreading of contamination. Temporary, single wall, carbon steel casing 27.6 cm (10 7/8 in.) outside diameter (OD), 24.4 cm (9 5/8 in.) inside diameter (ID) initially was driven to a depth of 26.8 m (88.0 ft) bgs on March 19, 2008. After geophysical borehole logging was carried out on March 19, 2008, the borehole and temporary casing were downsized to 21.9 cm (8 5/8 in.) OD, 19 cm (7 1/2 in.) ID single wall, carbon steel casing on March 24, 2008. The 21.9 cm (8 5/8 in.) OD casing was driven to a depth of 30.1 m (99.0 ft) and the borehole was advanced to 32.1 m (105.5 ft) bgs on March 24, 2008, where contamination was encountered. The 21.9 cm (8 5/8 in.) OD casing was removed from the borehole and the 27.6 cm (10 7/8 in.) OD casing was driven to a final depth of 54.4 m (178.5 ft) bgs on April 3, 2008. After geophysical logging of the lower section of the borehole had taken place on April 3, 2008, the borehole and temporary 21.9 cm (8 5/8 in.) OD casing were advanced to a TD of 90.3 m (296.5 ft) bgs on April 21, 2008. On April 22, 2008, a final geophysical logging of the lowest portion of the borehole was completed.

3.2 DECOMMISSIONING

The borehole was fully decommissioned from TD to ground surface between April 24 and May 7, 2008. The borehole was decommissioned by removing the temporary casing and simultaneously backfilling the borehole from TD to 84.9 m (278.8 ft) bgs using 10/20 mesh Colorado silica sand to a point that was 1.8 m (6.2 ft) above groundwater. Decommissioning continued from 84.9 m (278.8 ft) bgs to 0.30 m (1 ft) bgs using medium (1.5 cm [5/8 in.] and smaller) bentonite chips. A surface seal of concrete was poured from 0.30 m (1 ft) bgs to the ground surface. The surface seal is 25.4 cm (10 in.) round by 2.54 cm (1 in.) above the surface. A brass survey marker was placed in the north side of the seal, which bears the borehole identification number (C5941) and the date in which the surface seal was poured and the borehole was fully decommissioned (May 7, 2008).

[1] Bucyrus-Erie is a registered trademark of Bucyrus International, Inc., South Milwaukee, Wisconsin.

3.3 SAMPLING FOR LABORATORY ANALYSIS

A total of 121 samples were collected from borehole C5941 for laboratory analysis. Of those, 110 soil grab samples were collected from drill tailings brought to the surface using a drive barrel. The remaining 10 soil samples were collected using a split-spoon. One final water sample was collected from the bottom of the borehole at 90.3 m (296.5 ft) bgs using a stainless steel bailer. The 10 soil samples were collected using a 0.7 m (2.5-ft-) long, 10.1 cm (4-in.-) diameter split-spoon. Split-spoons used to collect samples from intervals I-002, I-004, and I-SSP-001 (Table 3-1) contained four 15.2 cm (6-in.) stainless steel liners. The remaining seven split-spoons contained Lexan[2] liners of the same dimensions as the stainless steel liners. The split-spoons were routinely driven 0.7 m (2.5 ft) to ensure that the split-spoons would provide adequate return to fulfill sample volume requirements. One soil sample (B1TDC0) from sample interval I-004-SP was to be collected from 4.7 to 5.5 m (15.6 to 18.1 ft) bgs, but was not collected due to an insufficient number of available sample containers. This sample was not excluded from the sample acquisition forms, therefore appearing to have been collected. This was documented on NCR-08-SGRP-005 (see Section 3.8, Quality Assurance, for more information). Three additional split-spoon samples were taken at 5.5 to 6.2 m (18.1 to 20.6 ft) (I-SSP-001), 6.7 to 7.4 m (22.0 to 24.3 ft) (I-SSP-002), and 32.1 to 32.9 m (105.5 to 108 ft bgs) (I-SSP-003) where radioactive contamination was detected. A final split-spoon sample set from interval I-110 at 83.1 to 84.0 m (272.5 to 275.5 ft) bgs originally was intended to be driven across the vadose-zone/water-table interface. Because this sample set was taken short of the water table, the samples from interval I-110 were discarded. Subsequently, a special split-spoon sample set (I-ASS-001) was collected from the actual vadose-zone/water-table interface (86.8 to 87.7 m [285 to 287.9 ft] bgs). Six additional soil grab samples (I-AG-150 to I-AG-155) also were taken at 0.7 m (2.5-ft) intervals down to 89.9 m (295 ft) bgs.

A sample for analysis of VOCs was collected from all 10 split-spoon sample intervals. Each VOC sample consisted of a sub-sample collected for analysis at the low calibration range of the laboratory instrument ("volatile organic analysis [VOA]-low"), a sub-sample collected for analysis at the high calibration range of the laboratory instrument ("VOA-high"), and a methanol blank (described below). Methanol was added to the VOA-high sub-samples in the field to preserve them for analysis, as described in U.S. Environmental Protection Agency Method 5035 (SW-846, *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, Third Edition; Final Update III-B*, as amended). The sub-samples collected for analysis at the low calibration range (VOA-low) were not preserved. Initially, only the VOA-low sub-samples were analyzed. If the VOC concentrations in a VOA-low sub-sample exceeded the calibration range, then the associated VOA-high sub-sample and methanol blank were analyzed. All VOC samples were taken in accordance with GRP-EE-01-4.6, *VOC Soil and Sediment Sampling.* However, sample hold times established in GRP-EE-01-4.2, *Sample Storage and Shipping Facility*, were exceeded for some analytes. Information detailing the fate of each sample according to its specific analytes is beyond the scope of this document and will be presented in detail in a data quality assessment report at a later date.

Tables 3-1 and 3-2 include sample interval numbers, associated *Hanford Environmental Information System* database numbers, collection date, sample depth, media sampled, and sampling method employed.

[2] LEXAN is a registered trademark of General Electric Company, New York, New York.

Table 3-1. Soil Sample Summary for Borehole C5941. (7 Pages)

Sample Acquisition Information						Sample HEIS # and Laboratory Identification						
Actual Sample Depth (ft bgs)	**Sample Interval**	**Collection Date**	**Sample Matrix**	**Sample Method**	**Split-Spoon Liner**	**WSCF**	**Eberline**	**RLNP**	**Shaw**	**TARL**	**TASL**	**ESL**
2.3-4.8	I-001	3/4/2008	Soil	Split-Spoon	Lexan	B1TDB4 B1TDC2 B1TDC3 B1TDC4	B1TH01	B1TH27	-	-	-	-
-	I-001-FB	3/4/2008	Water	Field Blank	-	B1TBR5	-	-	-	-	-	-
4.8-7.3	I-002	3/5/2008	Soil	Split-Spoon	Stainless Steel	B1TDB5 B1TDC5 B1TDC6 B1TDC7	B1TH02	B1TH28	-	-	-	-
4.8-7.3	I-002-D	3/5/2008	Soil	Split-Spoon Duplicate	Stainless Steel	B1TDC8 B1TDC9 B1TDD0	B1TH29	B1TH03	-	-	-	-
-	I-002-FB	3/5/2008	Water	Field Blank	-	B1TBR6	-	-	-	-	-	-
15.0	I-003	3/6/2008	Soil	Grab		B1TDF6	-	-	-	-	-	B1TDW0
15.6-18.1	I-004	3/6/2008	Soil	Split-Spoon	Stainless Steel	B1TDB6 B1TDD1 B1TDD2 B1TDD3	B1TH04	B1TH30	-	-	-	-
15.6-18.1	I-004-SP	3/6/2008	Soil-Split	Split-Spoon	Stainless Steel	-	-	B1TDC0	-	B1TDD5	B1TDD4 B1TDD5 B1TDD6	-
-	I-004-FB	3/6/2008	Water	Field Blank	-	B1TBR7	-	-	-	-	-	-
18.1	I-005	3/6/2008	Soil	Grab		B1TDF7	-	-	-	-	-	B1TDW1
18.1-20.6	I-SSP-001	3/11/2008	Soil	Special Split-Spoon	Stainless Steel	B1TV12 B1TV13 B1TV14 B1TV15	B1TV15	B1TV15	B1TV15	-	-	-
20.0-20.5	I-006	3/12/2008	Soil	Grab	-	B1TDF8	-	-	-	-	-	B1TDW2

Table 3-1. Soil Sample Summary for Borehole C5941. (7 Pages)

Sample Acquisition Information						Sample HEIS # and Laboratory Identification						
Actual Sample Depth (ft bgs)	**Sample Interval**	**Collection Date**	**Sample Matrix**	**Sample Method**	**Split-Spoon Liner**	**WSCF**	**Eberline**	**RLNP**	**Shaw**	**TARL**	**TASL**	**ESL**
21.5-22.0	I-007	3/12/2008	Soil	Grab	-	B1TDF9	-	-	-	-	-	B1TDW3
22.0-24.3	I-SSP-002	3/12/2008	Soil	Special Split-Spoon	Lexan	B1TV16 B1TV17 B1TV18 B1TV19	B1TV19	B1TV19	B1TV19	-	-	-
24.5-25.0	I-008	3/13/2008	Soil	Grab	-	B1TDH0	-	-	-	-	-	B1TDW4
27.0-27.5	I-009	3/13/2008	Soil	Grab	-	B1TDH1	-	-	-	-	-	B1TDW5
29.5-30.0	I-010	3/13/2008	Soil	Grab	-	B1TDH2	-	-	-	-	-	B1TDW6
32.0-32.5	I-011	3/13/2008	Soil	Grab	-	B1TDH3	-	-	-	-	-	B1TDW7
34.5-35.0	I-012	3/13/2008	Soil	Grab	-	B1TDH4	-	-	-	-	-	B1TDW8
37.0-37.5	I-013	3/17/2008	Soil	Grab	-	B1TDH5	-	-	-	-	-	B1TDW9
39.5-40.0	I-014	3/17/2008	Soil	Grab	-	B1TDH6	-	-	-	-	-	B1TDX0
41.5-42.0	I-015	3/17/2008	Soil	Grab	-	B1TDH7	-	-	-	-	-	B1TDX1
44.8-45.3	I-016	3/17/2008	Soil	Grab	-	B1TDH8	-	-	-	-	-	B1TDX2
47.0-47.5	I-017	3/17/2008	Soil	Grab	-	B1TDH9	-	-	-	-	-	B1TDX3
50.0-50.5	I-018	3/17/2008	Soil	Grab	-	B1TDJ0	-	-	-	-	-	B1TDX4
52.3-52.8	I-019	3/17/2008	Soil	Grab	-	B1TDJ1	-	-	-	-	-	B1TDX5
54.5-55.0	I-020	3/17/2008	Soil	Grab	-	B1TDJ2	-	-	-	-	-	B1TDX6
57.3-57.8	I-021	3/18/2008	Soil	Grab	-	B1TDJ3	-	-	-	-	-	B1TDX7
59.5-60.0	I-022	3/18/2008	Soil	Grab	-	B1TDJ4	-	-	-	-	-	B1TDX8
62.0-62.5	I-023	3/18/2008	Soil	Grab	-	B1TDJ5	-	-	-	-	-	B1TDX9
64.5-65.0	I-024	3/18/2008	Soil	Grab	-	B1TDJ6	-	-	-	-	-	B1TDY0
67.0-67.5	I-025	3/18/2008	Soil	Grab	-	B1TDJ7	-	-	-	-	-	B1TDY1
69.5-70.0	I-026	3/18/2008	Soil	Grab	-	B1TDJ8	-	-	-	-	-	B1TDY2
72.0-72.5	I-027	3/18/2008	Soil	Grab	-	B1TDJ9	-	-	-	-	-	B1TDY3

Table 3-1. Soil Sample Summary for Borehole C5941. (7 Pages)

Sample Acquisition Information						Sample HEIS # and Laboratory Identification						
Actual Sample Depth (ft bgs)	**Sample Interval**	**Collection Date**	**Sample Matrix**	**Sample Method**	**Split-Spoon Liner**	**WSCF**	**Eberline**	**RLNP**	**Shaw**	**TARL**	**TASL**	**ESL**
74.6-75.0	I-028	3/18/2008	Soil	Grab	-	B1TDK0	-	-	-	-	-	B1TDY4
75.5-76.0	I-029	3/18/2008	Soil	Grab	-	B1TDK1	-	-	-	-	-	B1TDY5
79.5-80.0	I-030	3/18/2008	Soil	Grab	-	B1TDK2	-	-	-	-	-	B1TDY6
82.0-82.5	I-031	3/18/2008	Soil	Grab	-	B1TDK3	-	-	-	-	-	B1TDY7
85.0-85.5	I-032	3/19/2008	Soil	Grab	-	B1TDK4	-	-	-	-	-	B1TDY8
85.0-87.5	I-033	3/19/2008	Soil	Split-Spoon	Lexan	B1TDB7 B1TDD7 B1TDD8 B1TDD9	B1TH05	B1TH31	-	-	-	-
-	I-033-FB	3/19/2008	Water	Field Blank	-	B1TBR8	-	-	-	-	-	-
87.5-88.0	I-034	3/19/2008	Soil	Grab	-	B1TDK5	-	-	-	-	-	B1TDY9
89.6-90.1	I-035	3/20/2008	Soil	Grab	-	B1TDK6	-	-	-	-	-	B1TF00
92.3-92.8	I-036	3/24/2008	Soil	Grab	-	B1TDK7	-	-	-	-	-	B1TF01
94.5-95.0	I-037	3/24/2008	Soil	Grab	-	B1TDK8	-	-	-	-	-	B1TF02
97.0-97.5	I-038	3/24/2008	Soil	Grab	-	B1TDK9	-	-	-	-	-	B1TF03
95.5-100	I-039	3/24/2008	Soil	Grab	-	B1TDL0	-	-	-	-	-	B1TF04
102-102.5	I-040	3/24/2008	Soil	Grab	-	B1TDL1	-	-	-	-	-	B1TF05
104.6-105.1	I-041	3/24/2008	Soil	Grab	-	B1TDL2	-	-	-	-	-	B1TF06
105.5-108	I-SSP-003	3/26/2008	Soil	Special Split-Spoon	Lexan	B1V2L2 B1V2L3 B1V2L4 B1V2L5	B1V2L5	B1V2L5	B1V2L5	-	-	-
-	I-003-FB	3/26/2008	Water	Field Blank	-	B1V2L6	-	-	-	-	-	-
107.5-108	I-042	3/27/2008	Soil	Grab	-	B1TDL3	-	-	-	-	-	B1TF07
109.5-110	I-043	3/27/2008	Soil	Grab	-	B1TDL4	-	-	-	-	-	B1TF08
112-112.5	I-044	3/27/2008	Soil	Grab	-	B1TDL5	-	-	-	-	-	B1TF09

Table 3-1. Soil Sample Summary for Borehole C5941. (7 Pages)

Sample Acquisition Information						Sample HEIS # and Laboratory Identification						
Actual Sample Depth (ft bgs)	**Sample Interval**	**Collection Date**	**Sample Matrix**	**Sample Method**	**Split-Spoon Liner**	**WSCF**	**Eberline**	**RLNP**	**Shaw**	**TARL**	**TASL**	**ESL**
114.5-115	I-045	3/27/2008	Soil	Grab	-	B1TDL6	-	-	-	-	-	B1TF10
117.6-118.1	I-046	3/27/2008	Soil	Grab	-	B1TDL7	-	-	-	-	-	B1TF11
119.5-120	I-047	3/27/2008	Soil	Grab	-	B1TDL8	-	-	-	-	-	B1TF12
122-122.5	I-048	3/31/2008	Soil	Grab	-	B1TDL9	-	-	-	-	-	B1TF13
122.5-125	I-049	3/31/2008	Soil	Split-Spoon	Lexan	B1TDB8 B1TDF0 B1TDF1 B1TDF2	B1TH06	B1TH32	-	-	-	-
-	I-049-FB	3/31/2008	Water	Field Blank	-	B1TBR9	-	-	-	-	-	-
124-124.5	I-050	3/31/2008	Soil	Grab	-	B1TDM0	-	-	-	-	-	B1TF14
127-127.5	I-051	3/31/2008	Soil	Grab	-	B1TDM1	-	-	-	-	-	B1TF15
129.5-130	I-052	3/31/2008	Soil	Grab	-	B1TDM2	-	-	-	-	-	B1TF16
132-132.5	I-053	3/31/2008	Soil	Grab	-	B1TDM3	-	-	-	-	-	B1TF17
134.5-135	I-054	3/31/2008	Soil	Grab	-	B1TDM4	-	-	-	-	-	B1TF18
137-137.5	I-055	4/1/2008	Soil	Grab	-	B1TDM5	-	-	-	-	-	B1TF19
139.3-139.8	I-056	4/1/2008	Soil	Grab	-	B1TDM6	-	-	-	-	-	B1TF20
142-142.5	I-057	4/1/2008	Soil	Grab	-	B1TDM7	-	-	-	-	-	B1TF21
143.1-143.5	I-058	4/1/2008	Soil	Grab	-	B1TDM8	-	-	-	-	-	B1TF22
147-147.5	I-059	4/1/2008	Soil	Grab	-	B1TDM9	-	-	-	-	-	B1TF23
149.5-150	I-060	4/1/2008	Soil	Grab	-	B1TDN0	-	-	-	-	-	B1TF24
152-152.5	I-061	4/1/2008	Soil	Grab	-	B1TDN1	-	-	-	-	-	B1TF25
154.5-155	I-062	4/1/2008	Soil	Grab	-	B1TDN2	-	-	-	-	-	B1TF26
157-157.5	I-063	4/2/2008	Soil	Grab	-	B1TDN3	-	-	-	-	-	B1TF27
160-160.5	I-064	4/2/2008	Soil	Grab	-	B1TDN4	-	-	-	-	-	B1TF28
162-162.5	I-065	4/2/2008	Soil	Grab	-	B1TDN5	-	-	-	-	-	B1TF29

Table 3-1. Soil Sample Summary for Borehole C5941. (7 Pages)

Sample Acquisition Information						Sample HEIS # and Laboratory Identification						
Actual Sample Depth (ft bgs)	**Sample Interval**	**Collection Date**	**Sample Matrix**	**Sample Method**	**Split-Spoon Liner**	**WSCF**	**Eberline**	**RLNP**	**Shaw**	**TARL**	**TASL**	**ESL**
165-165.5	I-066	4/2/2008	Soil	Grab	-	B1TDN6	-	-	-	-	-	B1TF30
167-167.5	I-067	4/2/2008	Soil	Grab	-	B1TDN7	-	-	-	-	-	B1TF31
170-170.5	I-068	4/2/2008	Soil	Grab	-	B1TDN8	-	-	-	-	-	B1TF32
172.5-173	I-069	4/2/2008	Soil	Grab	-	B1TDN9	-	-	-	-	-	B1TF33
174.5-175	I-070	4/3/2008	Soil	Grab	-	B1TDP0	-	-	-	-	-	B1TF34
177.5-178	I-071	4/3/2008	Soil	Grab	-	B1TDP1	-	-	-	-	-	B1TF35
180-180.5	I-072	4/3/2008	Soil	Grab	-	B1TDP2	-	-	-	-	-	B1TF36
182-182.5	I-073	4/7/2008	Soil	Grab	-	B1TDP3	-	-	-	-	-	B1TF37
184-184.5	I-074	4/7/2008	Soil	Grab	-	B1TDP4	-	-	-	-	-	B1TF38
187-187.5	I-075	4/7/2008	Soil	Grab	-	B1TDP5	-	-	-	-	-	B1TF39
189.5-190	I-076	4/8/2008	Soil	Grab	-	B1TDP6	-	-	-	-	-	B1TF40
192-192.5	I-077	4/8/2008	Soil	Grab	-	B1TDP7	-	-	-	-	-	B1TF41
194.5-195	I-078	4/8/2008	Soil	Grab	-	B1TDP8	-	-	-	-	-	B1TF42
197-197.5	I-079	4/8/2008	Soil	Grab	-	B1TDP9	-	-	-	-	-	B1TF43
199.5-200	I-080	4/8/2008	Soil	Grab	-	B1TDR0	-	-	-	-	-	B1TF44
202-202.5	I-081	4/8/2008	Soil	Grab	-	B1TDR1	-	-	-	-	-	B1TF45
204.5-205	I-082	4/8/2008	Soil	Grab	-	B1TDR2	-	-	-	-	-	B1TF46
207-207.5	I-083	4/8/2008	Soil	Grab	-	B1TDR3	-	-	-	-	-	B1TF47
209.5-210	I-084	4/8/2008	Soil	Grab	-	B1TDR4	-	-	-	-	-	B1TF48
212-212.5	I-085	4/8/2008	Soil	Grab	-	B1TDR5	-	-	-	-	-	B1TF49
214.5-215	I-086	4/9/2008	Soil	Grab	-	B1TDR6	-	-	-	-	-	B1TF50
217-217.5	I-087	4/9/2008	Soil	Grab	-	B1TDR7	-	-	-	-	-	B1TF51
219.5-220	I-088	4/9/2008	Soil	Grab	-	B1TDR8	-	-	-	-	-	B1TF52
222-222.5	I-089	4/9/2008	Soil	Grab	-	B1TDR9	-	-	-	-	-	B1TF53

Table 3-1. Soil Sample Summary for Borehole C5941. (7 Pages)

Sample Acquisition Information						Sample HEIS # and Laboratory Identification						
Actual Sample Depth (ft bgs)	**Sample Interval**	**Collection Date**	**Sample Matrix**	**Sample Method**	**Split-Spoon Liner**	**WSCF**	**Eberline**	**RLNP**	**Shaw**	**TARL**	**TASL**	**ESL**
224.5-225	I-090	4/9/2008	Soil	Grab	-	B1TDT0	-	-	-	-	-	B1TF54
227-227.5	I-091	4/9/2008	Soil	Grab	-	B1TDT1	-	-	-	-	-	B1TF55
229.5-230	I-092	4/9/2008	Soil	Grab	-	B1TDT2	-	-	-	-	-	B1TF56
232-232.5	I-093	4/9/2008	Soil	Grab	-	B1TDT3	-	-	-	-	-	B1TF57
234.5-235	I-094	4/9/2008	Soil	Grab	-	B1TDT4	-	-	-	-	-	B1TF58
237-237.5	I-095	4/9/2008	Soil	Grab	-	B1TDT5	-	-	-	-	-	B1TF59
239.5-240	I-096	4/10/2008	Soil	Grab	-	B1TDT6	-	-	-	-	-	B1TF60
241.5-242	I-097	4/10/2008	Soil	Grab	-	B1TDT7	-	-	-	-	-	B1TF61
244.5-245	I-098	4/10/2008	Soil	Grab	-	B1TDT8	-	-	-	-	-	B1TF62
247-247.5	I-099	4/10/2008	Soil	Grab	-	B1TDT9	-	-	-	-	-	B1TF63
249.5-250	I-100	4/10/2008	Soil	Grab	-	B1TDT10	-	-	-	-	-	B1TF64
252-252.5	I-101	4/10/2008	Soil	Grab	-	B1TDT11	-	-	-	-	-	B1TF65
254.5-255	I-102	4/10/2008	Soil	Grab	-	B1TDT12	-	-	-	-	-	B1TF66
257-257.5	I-103	4/10/2008	Soil	Grab	-	B1TDT13	-	-	-	-	-	B1TF67
259.5-260	I-104	4/10/2008	Soil	Grab	-	B1TDT14	-	-	-	-	-	B1TF68
262.5-263	I-105	4/10/2008	Soil	Grab	-	B1TDT15	-	-	-	-	-	B1TF69
264.5-265	I-106	4/10/2008	Soil	Grab	-	B1TDT16	-	-	-	-	-	B1TF70
267-267.5	I-107	4/10/2008	Soil	Grab	-	B1TDT17	-	-	-	-	-	B1TF71
269.5-270	I-108	4/10/2008	Soil	Grab	-	B1TDT18	-	-	-	-	-	B1TF72
272-272.5	I-109	4/10/2008	Soil	Grab	-	B1TDT19	-	-	-	-	-	B1TF73
272.5-275.5	I-110	4/15/2008	Soil	Split-Spoon	Lexan	B1TDB9 B1TDF3 B1TDF4 B1TDF5	B1TH07	B1TH33	-	-	-	-
282-282.5	I-AG-150	4/21/2008	Soil	Grab	-	B1V9Y7	-	-	-	-	-	B1V9Y7

Table 3-1. Soil Sample Summary for Borehole C5941. (7 Pages)

Sample Acquisition Information						Sample HEIS # and Laboratory Identification						
Actual Sample Depth (ft bgs)	**Sample Interval**	**Collection Date**	**Sample Matrix**	**Sample Method**	**Split-Spoon Liner**	**WSCF**	**Eberline**	**RLNP**	**Shaw**	**TARL**	**TASL**	**ESL**
284.5-285	I-AG-151	4/21/2008	Soil	Grab	-	B1V9Y8	-	-	-	-	-	B1V9Y8
285-287.9	I-ASS-001	4/21/2008	Soil	Split-Spoon	Lexan	B1VB27 B1VB28 B1VB29 B1VB30	B1VB30	B1VB30	B1VB30	-	-	-
-	I-110-FB	4/21/2008	Water	Field Blank	-	B1VB31	-	-	-	-	-	-
287-287.5	I-AG-152	4/21/2008	Soil	Grab	-	B1V9Y9	-	-	-	-	-	B1V9Y9
289.5-290	I-AG-153	4/21/2008	Soil	Grab	-	B1VBO0	-	-	-	-	-	B1VBO0
292-292.5	I-AG-154	4/21/2008	Soil	Grab	-	B1VBO1	-	-	-	-	-	B1VBO1
294.5-295	I-AG-155	4/21/2008	Soil	Grab	-	B1VB02	-	-	-	-	-	B1VBO2

NOTE: Special split-spoon samples and additional grab samples are samples that were not In the original sampling and analysis plan.

LEXAN is a registered trademark of General Electric Company, New York, New York.

bgs = below ground surface.
Eberline = Eberline Analytical Corporation, Richmond, California.
ESL = PNNL Environmental Science Laboratory.
HEIS = *Hanford Environmental Information System* database.
PNNL = Pacific Northwest National Laboratory.
RLNP = Recra LabNet Philadelphia, Pennsylvania.
Shaw = Shaw Group, Inc., Geotechnical Laboratory, Oak Ridge, Tennessee.
TARL = TestAmerica Richland, Washington.
TASL = TestAmerica St. Louis, Missouri.
WSCF = Waste Sampling and Characterization Facility.

Table 3-2. Groundwater Sample Summary for Borehole C5941.

Sample Acquisition Information					Sample HEIS # and Laboratory Identification			
Actual Sample Depth (ft bgs)	**Sample Interval**	**Collection Date**	**Sample Matrix**	**Sample Method**	**WSCF**	**Eberline**	**TASL**	**Field**
296.5	I-111	4/23/2008	Water	Bailed/ Filter	B1V350 B1V351	B1V351	B1V351	B1V353
296.5	I-111-FB	4/23/2008	Water	Bailed/ Filter	B1V354	-	-	-
296.5	I-111-D	4/23/2008	Water	Bailed/ Filter	B1V352	B1V352	B1V352	-

bgs = below ground surface.
Eberline = Eberline Analytical Corporation, Richmond, California.
HEIS = *Hanford Environmental Information System* database.
TASL = TestAmerica St. Louis, Missouri.
WSCF = Waste Sampling and Characterization Facility.

A number of soil and liquid quality control samples were collected in the field as controls for analysis of soil samples. Soil samples were collected for duplicate analysis, and for split analysis. Liquid quality control samples, including one equipment blank, one field blank, and five methanol blanks, also were collected.

- Duplicate analyses of soil samples were performed on sample pairs taken at the 1.4 to 2.2 m (4.8 to 7.3 ft) bgs depth interval. Field duplicates are collected to provide a measure of the overall precision of the complete sampling and analysis process. The SAP (DOE/RL-2007-02, Vol. I) requirement was to collect one field duplicate sample set. Because one duplicate sample set was collected, the SAP requirement was met.
- Split analyses of soil samples were performed on samples taken from the 4.7 to 5.5 m (15.6 to 18.1 ft) bgs interval. Field split samples are collected and analyzed to detect whether analytical results are consistent among laboratories and analytical methods. The SAP requirement was to collect one field split sample set. Because one split sample set was collected, the SAP requirement was met.
- One equipment water blank sample (sample B1V352) was collected on April 23, 2008, in association with the water samples collected on the same day from 90.3 m (296.5 ft) bgs. The equipment-rinsate blank was analyzed for the same compounds as the associated soil sample to check the potential for sample contamination originating from the field-sampling equipment or from equipment cleansing agents. The SAP requirement for obtaining and analyzing at least one equipment-rinsate blank sample was met.
- One field-blank water sample was collected from each soil-split-spoon sample set with exception of special-soil-split-spoon sample sets (I-SSP-001, I-SSP-002, I-SSP-003-FB, and I-ASS-001). Field blanks normally are obtained to determine whether VOC determinations might be corrupted by organic vapors, such as internal-combustion engine exhaust, in the sampling environment. The SAP requires that the number of field blanks be at least 5 percent of the number of VOC-designated samples and that at least one field blank be taken for every sixth batch of VOC-designated samples. The field blank sample

was collected to satisfy the SAP requirement of the field blank sample. Because analysis of VOC was performed on five soil samples, the SAP requirement was met.

- As described above, methanol was added to selected soil samples in the field to preserve them for analysis of VOCs. All of the VOC samples reserved for analysis at a high calibration range (VOA-high) were treated with methanol. Methanol blank samples were obtained as a control for contamination that might occur in the process of preservation or for contamination that may be present in the methanol source. The blank samples were prepared by injecting methanol into an empty VOA sample bottle that had been opened briefly in the sampling environment. Each methanol blank was collected with a specific VOA-high sub-sample, so each methanol blank was associated with a specific depth. A methanol blank was analyzed only if the associated VOA-high sub-sample also was analyzed, as described earlier.

A total of 110 grab samples were collected from drill tailings for geochemical study by the Pacific Northwest National Laboratory's Environmental Science Laboratory. All the grab samples were photographed and described by a geologist, and had moisture content analysis performed on them. A subset of 28 samples were selected for further analysis at approximately 3.1 m (10-ft) intervals from the shallowest sample down to groundwater. The remaining samples are being stored. Results of the geochemical study were documented (PNNL-61191, *Geochemical Study of Grab Samples Collected from the 216-A-30 Crib*) and entered into the *Hanford Environmental Information System* database.

One groundwater sample set was collected for laboratory analysis (Table 3-2). The sample was collected from the bottom of the borehole (90.3 m [296.5 ft] bgs) using a 5 cm (2-in.) diameter stainless steel sample bailer on April 23, 2008. The sample water was decanted into clean reservoirs and was pumped through 5-micron neoprene filters using a peristaltic pump. The sample set included multiple samples collected for split analyses, field blanks, and equipment blanks.

3.4 WASTE MANAGEMENT

Waste generated by the drilling, sampling, and decommissioning of borehole C5941, including drill tailings (soil) and miscellaneous solid waste (MSW), was managed under the 200-SC-1 OU using the strategy documented in SGW-36088, *Waste Control Plan for the 200-SC-1 Operable Unit*. Waste was packaged in accordance with requirements specified in the site-specific waste packaging/labeling instruction sheet, WPL102. The following waste streams were generated during field operations to drill and decommission borehole C5941.

- Drill cuttings (soil)
- Potentially contaminated MSW
- Environmentally controlled material (ECM).

Additionally, purgewater was generated during the development and sampling of borehole C5941. This purgewater was drummed separately from vadose-zone cuttings and managed in accordance with 90-ERB-040, "Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington." The drill-cuttings (soil) and potentially contaminated MSW streams were containerized as investigation-derived waste (IDW) in accordance with the appropriate waste packaging/labeling instruction sheet. All drill cuttings were classified as suspect-mixed waste/ECM as established under SGW-36088.

Table 3-3 contains details regarding the disposition of the IDW from this borehole. Some variances may occur due to sample returns and decommissioning of enclosures.

Table 3-3. Summary of Investigation-Derived Waste for Borehole C5941. (3 Pages)

PIN	CIN	Waste Type	Waste Description	Container Description	Start Date	Seal Date
SC1-08-001	0048414	Suspect Mixed/ECM	Soil 0-11 ft	55-gal Drum	3/4/2008	3/5/2008
SC1-08-002	0048559	Suspect Mixed/ECM	Soil 11-18 ft	55-gal Drum	3/5/2008	3/6/2008
SC1-08-003	0048471	Suspect Mixed/ECM	MSW 0-18.5 ft	55-gal Drum	3/4/2008	3/12/2008
SC1-08-004	0048558	Suspect Mixed/ECM	Soil 18-24 ft	55-gal Drum	3/6/2008	3/13/2008
SC1-08-005	0048459	Suspect Mixed/ECM	MSW 18.5-140 ft	55-gal Drum	3/12/2008	4/1/2008
SC1-08-006	0048458	Suspect Mixed/ECM	Soil 24-30 ft	55-gal Drum	3/13/2008	3/13/2008
SC1-08-007	0048557	Suspect Mixed/ECM	Soil 30-36 ft	55-gal Drum	3/13/2008	3/17/2008
SC1-08-008	0048472	Suspect Mixed/ECM	Soil 36-42 ft	55-gal Drum	3/17/2008	3/17/2008
SC1-08-009	0048461	Suspect Mixed/ECM	Soil 42-47.5 ft	55-gal Drum	3/17/2008	3/17/2008
SC1-08-010	0048462	Suspect Mixed/ECM	Soil 47.5-56 ft	55-gal Drum	3/17/2008	3/18/2008
SC1-08-011	0048549	Suspect Mixed/ECM	Soil 56-62 ft	55-gal Drum	3/18/2008	3/18/2008
SC1-08-012	0048550	Suspect Mixed/ECM	Soil 62-70.5 ft	55-gal Drum	3/18/2008	3/18/2008
SC1-08-013	0046213	Suspect Mixed/ECM	Soil 70.5-79 ft	55-gal Drum	3/18/2008	3/18/2008
SC1-08-014	0046214	Suspect Mixed/ECM	Soil 79-88 ft	55-gal Drum	3/18/2008	3/19/2008
SC1-08-015	0046238	Suspect Mixed/ECM	Soil 88-105.1 ft	55-gal Drum	3/19/2008	3/20/2008
SC1-08-016	0046237	Suspect Mixed/ECM	Soil 88-104 ft	55-gal Drum	3/24/2008	3/24/2008
SC1-08-017	0045186	Suspect Mixed/ECM	Soil 104-105.1 ft	55-gal Drum	3/24/2008	3/26/2008
SC1-08-018	0045185	Suspect Mixed/ECM	Soil 105.1-112.5 ft	55-gal Drum	3/26/2008	3/27/2008
SC1-08-019	0045729	Suspect Mixed/ECM	Soil 112.5-120 ft	55-gal Drum	3/27/2008	3/31/2008
SC1-08-020	0046201	Suspect Mixed/ECM	Soil 120-127.5 ft	55-gal Drum	3/27/2008	3/31/2008

Table 3-3. Summary of Investigation-Derived Waste for Borehole C5941. (3 Pages)

PIN	CIN	Waste Type	Waste Description	Container Description	Start Date	Seal Date
SC1-08-021	0045730	Suspect Mixed/ECM	Soil 127.5-135 ft	55-gal Drum	3/31/2008	3/31/2008
SC1-08-022	0051467	Suspect Mixed/ECM	Soil 135-141.5 ft	55-gal Drum	3/31/08	4/1/2008
SC1-08-023	0051431	Suspect Mixed/ECM	MSW	55-gal Drum	4/1/2008	5/9/2008
SC1-08-024	0051438	Suspect Mixed/ECM	Soil 141.5-148.0 ft	55-gal Drum	4/1/2008	4/1/2008
SC1-08-025	0051474	Suspect Mixed/ECM	Soil 148-155 ft	55-gal Drum	4/1/2008	4/2/2008
SC1-08-026	0050948	Suspect Mixed/ECM	Soil 155-163 ft	55-gal Drum	4/2/2008	4/2/2008
SC1-08-027	0051475	Suspect Mixed/ECM	Soil 163-171.5 ft	55-gal Drum	4/2/2008	4/2/2008
SC1-08-028	0051005	Suspect Mixed/ECM	Soil 173-180 ft	55-gal Drum	4/3/2008	4/4/2008
SC1-08-035	0049299	Suspect Mixed/ECM	Soil 180-191 ft	55-gal Drum	4/7/2008	4/8/2008
SC1-08-036	0049345	Suspect Mixed/ECM	Soil 191-206 ft	55-gal Drum	4/8/2008	4/8/2008
SC1-08-045	0051439	Suspect Mixed/ECM	Soil 206-221 ft	55-gal Drum	4/8/2008	4/9/2008
SC1-08-046	0051440	Suspect Mixed/ECM	Soil 221-235 ft	55-gal Drum	4/9/2008	4/9/2008
SC1-08-047	0051441	Suspect Mixed/ECM	Soil 235-258 ft	55-gal Drum	4/9/2008	4/10/2008
SC1-08-048	0050902	Suspect Mixed/ECM	Soil 257.5-276 ft	55-gal Drum	4/9/2008	4/15/2008
SC1-08-049	0050901	Suspect Mixed/ECM	Soil 276-295 ft	55-gal Drum	4/15/2008	4/21/2008
SC1-08-056	0051430	Suspect Mixed/ECM	MSW	55-gal Drum	5/7/2008	5/8/2008
SC1-08-057	0051466	Suspect Mixed/ECM	MSW	55-gal Drum	5/7/2008	5/8/2008
SC1-08-076	N/A	Suspect Mixed/ECM	MSW – 5 pcs of Galv Duct Pipe	Double Wrapped and Palletized	5/8/2008	5/8/2008
SC1-08-077	N/A	Suspect Mixed/ECM	MSW – 4 pcs of 5 ft L 10-in. Casing	Double Wrapped and Palletized	5/8/2008	5/8/2008
SC1-08-078	N/A	Suspect Mixed/ECM	MSW – 4 pcs of 5 ft L 10-in. Casing	Double Wrapped and Palletized	5/8/2008	5/8/2008
SC1-08-079	N/A	Suspect Mixed/ECM	MSW – 4 pcs of 5 ft L 10-in. Casing	Double Wrapped and Palletized	5/8/2008	5/8/2008

Table 3-3. Summary of Investigation-Derived Waste for Borehole C5941. (3 Pages)

PIN	CIN	Waste Type	Waste Description	Container Description	Start Date	Seal Date
SC1-08-080	N/A	Suspect Mixed/ECM	MSW – 4 pcs of 5 ft L 10-in. Casing	Double Wrapped and Palletized	5/8/2008	5/8/2008
SC1-08-081	N/A	Suspect Mixed/ECM	MSW – 4 pcs of 5 ft L 10-in. Casing	Double Wrapped and Palletized	5/8/2008	5/8/2008
SC1-08-082	N/A	Suspect Mixed/ECM	MSW – 4 pcs of 5 ft L 10-in. Casing	Double Wrapped and Palletized	5/8/2008	5/8/2008
SC1-08-083	N/A	Suspect Mixed/ECM	MSW – 4 pcs of 5 ft L 10-in. Casing	Double Wrapped and Palletized	5/8/2008	5/8/2008

CIN = container identification number (barcode).
ECM = environmentally controlled material.
N/A = not applicable.
PIN = primary identification number.

An inconsistency exists between soil depths recorded on three containers and the coinciding drilling depths recorded in the geologist's daily activity logs. The following explains the discrepancies in labeling (see also Table 3-3).

- Container Identification Number (CIN) 0046238 was labeled to contain soil derived from 26.8 to 32 m (88 to 105.1 ft) bgs. According to the geologist's logs, on March 19, 2008, the borehole was advanced to a maximum depth of 27.4 m (90.1 ft) bgs and on March 20, no drilling activity took place. Upon verification with Waste Services, it was clarified that this drum was sealed with soil derived from 26.8 to 27.4 m (88 to 90.1 ft) bgs.
- Container CIN 0046237 was labeled to contain soil from 26.8 to 32 m (88 to 105 ft) bgs. According to the geologist's log, on March 24, 2008, the borehole was advanced from 27.4 to 32 m (90.1 to 105.1 ft) bgs. It was verified that this container actually contained soil from 27.4 to 32 m (90.1 to 105.1 ft) bgs.
- Container CIN 0045186 was labeled to contain soil from 31.6 to 32 m (104 to 105.1 ft) bgs. According to the geologist's log, on March 25, 2008, the borehole was temporarily decommissioned from 27.3 to 31.6 m (90 to 104 ft) bgs due to an encounter with radiological contamination, and the borehole was then re-drilled from 27.3 to 32 m (90 to 105.1 ft) bgs. Waste Services verified that this drum contained soil from 27.3 to 32 m (90 to 105.1 ft) bgs. More concisely, there were two drums that contained the same interval of soil derived from a re-drilled interval.

3.5 ENVIRONMENTAL MONITORING

This section describes environmental monitoring conducted during drilling and decommissioning activities.

3.5.1 Industrial Hygiene

Industrial hygiene (IH) monitoring was provided on a full-time basis during drilling activities that took place in the upper part of the vadose zone from ground surface to 54.2 m (178 ft) bgs.

After downsizing the casing, IH monitoring was provided on an AM/PM basis. IH data are summarized in Table 3-4 and include direct readings from the drill tailings grab samples and split-spoon samples. Direct readings were measured on site using a direct-reading Thermo Electron Organic Vapor Monitor (OVM), Model 580B[3] (portable photoionization detector), equipped with an 11.8 eV bulb. Carbon monoxide, oxygen, and lower explosive limit were not monitored at this borehole because the work was not being performed in a confined space.

Table 3-4. Industrial Hygiene Vapor Sampling Data for Borehole C5941. (2 Pages)

Date	OVM Organics (ppm)	CO (ppm)	O_2 %	LEL %	Survey #
2/28/2008	< D	-	-	-	-
3/4/2008	0	0	20.9	0	IHSF-02112
3/5/2008	< D	-	-	-	IHSF-02115
3/6/2008	0	0	20.9	0	IHSF-02126
3/10/2008	< D	-	-	-	-
3/11/2008	0	0	20.9	0	IHSF-02140
3/12/2008	0	0	20.9	0	IHSF-02151
3/13/2008	0	0	20.9	0	IHSF-02158
3/17/2008	4	-	-	-	IHSF-02179
3/17/2008	< D	-	-	-	IHSF-02165 SUMMA #047
3/18/2008	< D	-	-	-	IHSF-02181
3/19/2008	0	0	20.9	0	IHSF-02182
3/20/2008	0	0	20.9	0	IHSF-02197
3/24/2008	< D	-	-	-	IHSF-02214
3/25/2008	< D	-	-	-	IHSF-02228
3/26/2008	0	0	20.9	0	IHSF-02230
3/27/2008	0	0	20.9	0	IHSF-02240
3/31/2008	< D	-	-	-	IHSF-02264
3/31/2008	0	0	20.9	0	IHSF-02257
4/1/2008	0	0	20.9	0	IHSF-02266
4/2/2008	0	0	20.9	0	IHSF-02272
4/2/2008	0	0	20.9	0	IHSF-02274
4/3/2008	0	0	20.9	0	IHSF-02279
4/3/2008	0	0	20.9	0	IHSF-02280
4/7/2008	0	0	20.9	0	IHSF-02299
4/8/2008	0	0	20.9	0	IHSF-02311
4/9/2008	0	0	20.9	0	IHSF-02279

[3] Thermo Electron and OVM, Model 580B, are trademarks of Thermo Electron Corporation, Waltham, Massachusetts.

Table 3-4. Industrial Hygiene Vapor Sampling Data for Borehole C5941. (2 Pages)

Date	OVM Organics (ppm)	CO (ppm)	O_2 %	LEL %	Survey #
4/9/2008	0	0	20.9	0	IHSF-02313
4/10/2008	< D	-	-	-	-
4/15/2008	< D	-	-	-	IHSF-02353
4/21/2008	0	0	20.9	0	IHSF-02366
4/21/2008	0	0	20.9	0	IHSF-02381
4/22/2008	0	0	20.9	0	IHSF-02383
4/23/2008	0	0	20.9	0	IHSF-02385
4/24/2008	0	0	20.9	0	IHSF-02400
4/28/2008	< D	-	-	-	-
4/29/2008	< D	-	-	-	-
4/30/2008	< D	-	-	-	-
5/1/2008	< D	-	-	-	-
5/5/2008	< D	-	-	-	-

SUMMA is a trademark of Moletrics, Inc., Cleveland, Ohio.

< D = less than detectable.
LEL = lower explosive limit.
OVM = organic vapor monitor.
ppm = parts per million.

During drilling activities on March 17, 2008, a foul odor was reported emitting from the borehole and drummed drill tailings. The industrial hygienist reported (Industrial Hygiene Direct Reading Instrument Survey IHSF-02179) a maximum of 4 parts per million (ppm) of organic vapors with an OVM emitting from the drummed drill tailings from between 13.6 to 14 m (44.8 to 46.0 ft) bgs and from inside the core barrel, but reported no detection of organic vapors with an OVM from the borehole. The industrial hygienist reported that the organic vapors from all sources were below the detectable limits of the OVM within 2 minutes of primary detection. All other IH readings were reported to be nondetectable for activities carried out at this borehole.

3.5.2 Field Screening

One unplanned soil-vapor sample was collected on March 17, 2008, after personnel noticed a sulfurous odor emanating from sandy sediments encountered from 13.6 to 14 m (44.8 to 46.0 ft) bgs that directly overlie a 15.2 cm (6-in.-) thick normally graded sandy gravel bed. The industrial hygienist reported a detection of 4 ppm of organic vapors using an OVM that reduced to below detectable limits within 2 minutes of the industrial hygienist's initial readings. The soil-vapor sample was collected from the air space over the drummed borehole tailings using a negative pressure SUMMA[4] canister (#047). The sample was collected 2 hours, 22 minutes after the industrial hygienist's initial readings. The sample was taken to the WSCF laboratory for

[4] SUMMA is a trademark of Moletrics, Inc., Cleveland, Ohio.

content analysis using a gas chromatograph-mass spectrometer. The results were all below detection limits for the gas chromatograph-mass spectrometer (WSCF, 2008, *WSCF Analytical Laboratory Report*).

3.5.3 Radiation Control

Because the borehole was located in the immediate proximity of a waste crib with a known history of receiving radioactive contamination, radiological monitoring was provided on a full-time basis for drilling activities that took place in the upper portion of the vadose zone from ground surface to 84.7 m (278 ft) bgs. Radiological control technician coverage was provided on an AM/PM basis for drilling activities that took place below 84.7 m (278 ft) bgs. Upon commencement of decommissioning of the borehole, full-time radiological monitoring was reinstated for the duration of decommissioning activities. Radiological Control operations were performed in accordance with ERSTI-GRP-07-030, *Environmental Radiological Survey Task Instructions*, and radiological postings and controls were upgraded and downgraded appropriately in accordance with radiological work permit GW-07-013.

Several different radiation detectors were used in this work, including the SPA-3[5] and the Geiger-Müller (G-M) gamma radiation meters, the Hanford Site portable alpha meter, and the RO-3B and the RO-20[6] dose meters. The SPA-3 meter is a hand-held, high-sensitivity gamma radiation meter used for measuring the amount of radioactive contamination present in units of counts per minute. The G-M meter is a hand-held, beta-gamma radiation meter also used for measuring the amount of radioactive contamination present in units of counts per minute. The G-M routinely was used to detect and quantify gamma radiation from drill tailings, equipment, tools, personal protective equipment, and other related surfaces in the work area. The portable alpha meter consists of a count-rate detector and a Hanford Site-produced 50 cm^2 (7.7 in^2) alpha scintillation detector. The portable alpha meter periodically was used to detect the presence or absence of alpha radioactive contamination on equipment, personnel, personal protective equipment, and other related surfaces in the work area. Alpha radiation was not detected above background at this site. The RO-3B is a hand-held, beta and gamma radiation detector that is used to measure dose rate in units of milliRoentgen per hour. The RO-20 also is a beta and gamma radiation detector but can seclude low-energy beta radiation. Both were periodically used to quantify dose rate equivalents for radiation emissions within the work area.

Table 3-5 lists data recorded by the onsite radiological control technicians during the drilling of borehole C5941 and consists of data from the direct reading of recovered sediments (as measured with the G-M meter), either from the borehole cuttings after removal from the drive barrel or from sediment captured with a split-spoon sampler. All portable alpha meter direct readings were at background levels throughout the drilling of this borehole with the exception of a periodic detection of radon, and are not included in this document.

[5] SPA-3 is a trademark of Thermo Electron Corporation, Waltham, Massachusetts.

[6] RO-3B and RO-20 are trademarks of Eberline Instruments, a subsidiary of Thermo Electron Corporation, Waltham Massachusetts.

Table 3-5. Radiological Control Direct Measurements for Borehole C5941. (4 Pages)

Sample Depth (ft bgs)	Date	Material Surveyed	Direct Contamination Measurements G-M (β-γ) (dpm/100 cm^2)	Removable Contamination Measurements G-M (β-γ) (dpm/100 cm^2)	Survey #
2.3 - 4.8	3/4/2008	Split-Spoon	0	0	GW-08-0487
4.8 - 7.3	3/5/2008	Split-Spoon	0	0	GW-08-0491
15.0	3/6/2008	Grab	10,000	0	GW-08-0505
15.6 - 18.1	3/6/2008	Split-Spoon	60,000	0	GW-08-0505
18.1	3/6/2008	Grab	100,000	0	GW-08-0505
18.1 - 20.6	3/11/2008	Special Split-Spoon	100,000	5,000	GW-08-0529
20.0 - 20.5	3/12/2008	Grab	300,000	0	GW-08-0556
21.5 - 22.0	3/12/2008	Grab	200,000	0	GW-08-0556
22.0 - 24.3	3/12/2008	Special Split-Spoon	100,000	0	GW-08-0556
24.5 - 25.0	3/13/2008	Grab	200,000	0	GW-08-0571
27.0 - 27.5	3/13/2008	Grab	120,000	0	GW-08-0571
29.5 - 30.0	3/13/2008	Grab	60,000	1,000	GW-08-0571
32.0 - 32.5	3/13/2008	Grab	150,000	1,000	GW-08-0571
34.5 - 35.0	3/13/2008	Grab	450,000	1,000	GW-08-0571
37.0 - 37.5	3/17/2008	Grab	200,000	0	GW-08-0598
39.5 - 40.0	3/17/2008	Grab	0	0	GW-08-0598
41.5 - 42.0	3/17/2008	Grab	0	0	GW-08-0598
44.8 - 45.3	3/17/2008	Grab	0	0	GW-08-0598
47.0 - 47.5	3/17/2008	Grab	2,000	1,000	GW-08-0598
50.0 - 50.5	3/17/2008	Grab	0	0	GW-08-0598
52.3 - 52.8	3/17/2008	Grab	0	0	GW-08-0598
54.5 - 55.0	3/17/2008	Grab	0	0	GW-08-0598
57.3 - 57.8	3/18/2008	Grab	0	0	GW-08-0612
59.5 - 60.0	3/18/2008	Grab	0	0	GW-08-0612
62.0 - 62.5	3/18/2008	Grab	0	0	GW-08-0612
64.5 - 65.0	3/18/2008	Grab	50,000	0	GW-08-0612
67.0 - 67.5	3/18/2008	Grab	10,000	0	GW-08-0612
69.5 - 70.0	3/18/2008	Grab	45,000	0	GW-08-0612
70.0 - 72.0	3/18/2008	Observation	450,000	0	GW-08-0612
72.0 - 72.5	3/18/2008	Grab	20,000	0	GW-08-0612
74.6 - 75.0	3/18/2008	Grab	0	0	GW-08-0612
75.5 - 76.0	3/18/2008	Grab	0	0	GW-08-0612
79.5 - 80.0	3/18/2008	Grab	0	0	GW-08-0612

Table 3-5. Radiological Control Direct Measurements for Borehole C5941. (4 Pages)

Sample Depth (ft bgs)	Date	Material Surveyed	Direct Contamination Measurements G-M (β-γ) (dpm/100 cm^2)	Removable Contamination Measurements G-M (β-γ) (dpm/100 cm^2)	Survey #
82.0 - 82.5	3/18/2008	Grab	0	0	GW-08-0612
85.0 - 85.5	3/19/2008	Grab	0	0	GW-08-0630
85.0 - 87.5	3/19/2008	Split-Spoon	0	0	GW-08-0630
87.5 - 88.0	3/19/2008	Grab	0	0	GW-08-0630
89.6 - 90.1	3/20/2008	Grab	0	0	GW-08-0635
92.3 - 92.8	3/24/2008	Grab	0	0	GW-08-0663
94.5 - 95.0	3/24/2008	Grab	0	0	GW-08-0663
97.0 - 97.5	3/24/2008	Grab	0	0	GW-08-0663
95.5 - 100	3/24/2008	Grab	0	0	GW-08-0663
102 - 102.5	3/24/2008	Grab	0	0	GW-08-0663
104.6 - 105.1	3/24/2008	Grab	400	0	GW-08-0663
105.5 - 108	3/26/2008	Special Split-Spoon	6,000	0	GW-08-0689
107.5 - 108	3/27/2008	Grab	15,000	0	GW-08-0707
109.5 - 110	3/27/2008	Grab	40,000	0	GW-08-0707
112 - 112.5	3/27/2008	Grab	8,000	0	GW-08-0707
114.5 - 115	3/27/2008	Grab	15,000	0	GW-08-0707
115 - 117.6	3/27/2008	Observation	20,000	0	GW-08-0707
117.6 - 118.1	3/27/2008	Grab	10,000	0	GW-08-0707
119.5 - 120	3/27/2008	Grab	15,000	0	GW-08-0707
122 - 122.5	3/31/2008	Grab	4,000	0	GW-08-0727
122.5 - 125	3/31/2008	Split-Spoon	5,000	0	GW-08-0727
124 - 124.5	3/31/2008	Grab	1,000	0	GW-08-0727
127 - 127.5	3/31/2008	Grab	0	0	GW-08-0727
129.5 - 130	3/31/2008	Grab	2,000	0	GW-08-0727
130 - 132	3/31/2008	Observation	15,000	0	GW-08-0727
132 - 132.5	3/31/2008	Grab	2,000	0	GW-08-0727
134.5 - 135	3/31/2008	Grab	15,000	0	GW-08-0727
137 - 137.5	4/1/2008	Grab	10,000	0	GW-08-0738
139.3 - 139.8	4/1/2008	Grab	10,000	0	GW-08-0738
142 - 142.5	4/1/2008	Grab	5,000	0	GW-08-0738
143.1 - 143.5	4/1/2008	Grab	8,000	0	GW-08-0738
147 - 147.5	4/1/2008	Grab	0	0	GW-08-0738
149.5 - 150	4/1/2008	Grab	1,000	0	GW-08-0738
152 - 152.5	4/1/2008	Grab	1,000	0	GW-08-0738

Table 3-5. Radiological Control Direct Measurements for Borehole C5941. (4 Pages)

Sample Depth (ft bgs)	Date	Material Surveyed	Direct Contamination Measurements G-M (β-γ) (dpm/100 cm^2)	Removable Contamination Measurements G-M (β-γ) (dpm/100 cm^2)	Survey #
154.5 - 155	4/1/2008	Grab	4,000	0	GW-08-0738
157.0 - 157.5	4/2/2008	Grab	0	0	GW-08-0752
160 - 160.5	4/2/2008	Grab	0	0	GW-08-0752
162 - 162.5	4/2/2008	Grab	0	0	GW-08-0752
165 - 165.5	4/2/2008	Grab	0	0	GW-08-0752
167 - 167.5	4/2/2008	Grab	0	0	GW-08-0752
170 - 170.5	4/2/2008	Grab	0	0	GW-08-0752
172.5 - 173	4/2/2008	Grab	0	0	GW-08-0752
174.5 - 175	4/3/2008	Grab	0	0	GW-08-0764
177.5 - 178	4/3/2008	Grab	0	0	GW-08-0764
180 - 180.5	4/3/2008	Grab	0	0	GW-08-0764
182 - 182.5	4/7/2008	Grab	0	0	GW-08-0764
184 - 184.5	4/7/2008	Grab	0	0	GW-08-0764
187 - 187.5	4/7/2008	Grab	0	0	GW-08-0764
189.5 - 190	4/8/2008	Grab	0	0	GW-08-0806
192 - 192.5	4/8/2008	Grab	0	0	GW-08-0806
194.5 - 195	4/8/2008	Grab	0	0	GW-08-0806
197 - 197.5	4/8/2008	Grab	0	0	GW-08-0806
199.5 - 200	4/8/2008	Grab	0	0	GW-08-0806
202 - 202.5	4/8/2008	Grab	0	0	GW-08-0806
204.5 - 205	4/8/2008	Grab	0	0	GW-08-0806
207 - 207.5	4/8/2008	Grab	0	0	GW-08-0806
209.5 - 210	4/8/2008	Grab	0	0	GW-08-0806
212 - 212.5	4/8/2008	Grab	0	0	GW-08-0806
214.5 - 215	4/9/2008	Grab	0	0	GW-08-0822
217 - 217.5	4/9/2008	Grab	0	0	GW-08-0822
219.5 - 220	4/9/2008	Grab	0	0	GW-08-0822
222 - 222.5	4/9/2008	Grab	0	0	GW-08-0822
224.5 - 225	4/9/2008	Grab	0	0	GW-08-0822
227 - 227.5	4/9/2008	Grab	0	0	GW-08-0822
229.5 - 230	4/9/2008	Grab	0	0	GW-08-0822
232 - 232.5	4/9/2008	Grab	0	0	GW-08-0822
234.5 - 235	4/9/2008	Grab	N/A	N/A	GW-08-0822
237 - 237.5	4/9/2008	Grab	N/A	N/A	GW-08-0822

Table 3-5. Radiological Control Direct Measurements for Borehole C5941. (4 Pages)

Sample Depth (ft bgs)	Date	Material Surveyed	Direct Contamination Measurements G-M (β-γ) (dpm/100 cm^2)	Removable Contamination Measurements G-M (β-γ) (dpm/100 cm^2)	Survey #
239.5 - 240	4/10/2008	Grab	0	0	GW-08-0839
241.5 - 242	4/10/2008	Grab	0	0	GW-08-0839
244.5 - 245	4/10/2008	Grab	0	0	GW-08-0839
247 - 247.5	4/10/2008	Grab	0	0	GW-08-0839
249.5 - 250	4/10/2008	Grab	0	0	GW-08-0839
252 - 252.5	4/10/2008	Grab	0	0	GW-08-0839
254.5 - 255	4/10/2008	Grab	0	0	GW-08-0839
257 - 257.5	4/10/2008	Grab	0	0	GW-08-0839
259.5 - 260	4/10/2008	Grab	0	0	GW-08-0839
262.5 - 263	4/10/2008	Grab	0	0	GW-08-0839
264.5 - 265	4/10/2008	Grab	0	0	GW-08-0839
267 - 267.5	4/10/2008	Grab	0	0	GW-08-0839
269.5 - 270	4/10/2008	Grab	0	0	GW-08-0839
272 - 272.5	4/10/2008	Grab	0	0	GW-08-0839
272.5 - 275.5	4/15/2008	Split-Spoon	0	0	GW-08-0881
272.5 - 275.5	4/15/2008	Split-Spoon	0	0	GW-08-0881
282 - 282.5	4/21/2008	Grab	0	0	GW-08-0910
284.5 - 285	4/21/2008	Grab	0	0	GW-08-0910
285 - 287.9	4/21/2008	Split-Spoon	0	0	GW-08-0910
287 - 287.5	4/21/2008	Grab	0	0	GW-08-0910
289.5 - 290	4/21/2008	Grab	0	0	GW-08-0910
292 - 292.5	4/21/2008	Grab	0	0	GW-08-0910
294.5 - 295	4/21/2008	Grab	0	0	GW-08-0910

bgs = below ground surface.
dpm = disintegrations per minute.
G-M = Geiger-Müller.
N/A = not applicable.

3.6 BOREHOLE GEOPHYSICAL LOGGING

Borehole geophysical logging surveys were conducted by S. M. Stoller Corporation.[7] Borehole geophysical logging records the vertical distribution of gamma-emitting radionuclides in the soil within and beneath the waste site as a means of locating and quantifying contamination, in addition to aiding in interpretation of subsurface stratigraphy. Borehole logging equipment is

[7] Stoller is a trademark of S. M. Stoller Corporation, Lafayette, Colorado.

calibrated annually, with standardized calibration data used to calculate casing attenuation factors that convert measured peak-area count rates to radionuclide concentrations. The logging system provides a continuous radiometric signature of the soils, standardized and calibrated to measure through a single thickness of carbon-steel casing.

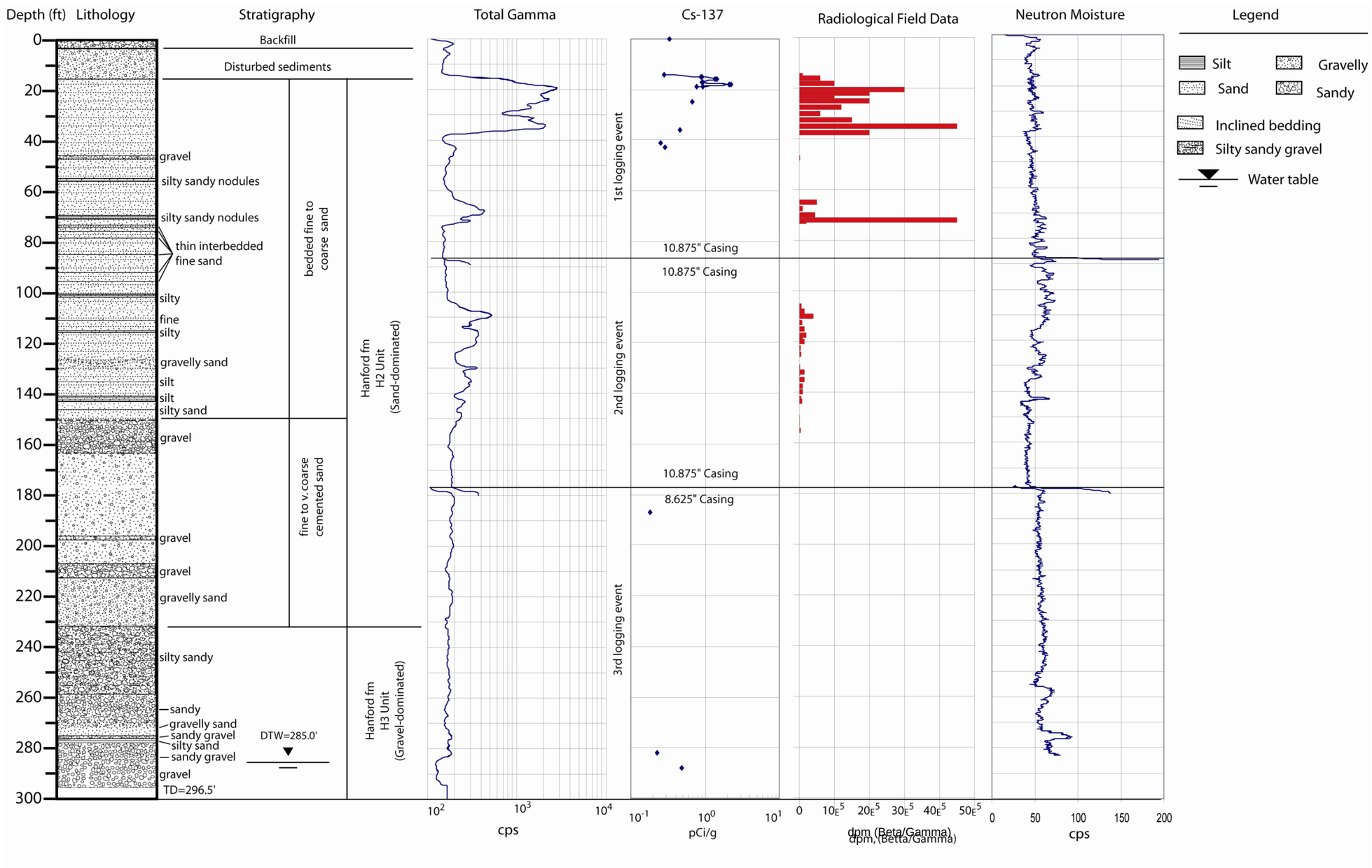
Geophysical logging surveys were conducted using a Spectral Gamma Logging System, a Passive Neutron Logging System, and a Neutron Moisture Logging System on March 19, 2008, from ground surface to 26.5 m (87 ft) bgs. On April 3, 2008, the borehole was logged from 26.5 to 53.9 m (87 to 177 ft) bgs, and on April 22, 2008, the borehole was logged from 53.9 m (177 ft) bgs to TD of 90.3 m (296.5 ft) bgs. The geophysical log data report for this borehole is included as Appendix D.

According to the geophysical log report (HGLP-LDR-204), Cs-137 was the only manmade radionuclide detected throughout the borehole. Cesium-137 was detected above background levels at the following depths: 0 ft, 4.2 to 5.7 m (14 to 19 ft), and 7.6 m (25 ft) bgs, with a maximum concentration of 2.14 pCi/g at 5.4 m (18 ft) bgs. Non-anthropogenic-derived radon was detected from 26.5 to 54.8 m (87 to 180 ft) bgs during the April 22, 2008, logging session. Additionally, passive gamma-ray logging identified three zones of elevated total gamma including 4.5 to 11.2 m (15 to 37 ft), 19.5 to 22.2 m (64 to 73 ft), and 32.3 to 37.1 m (106 to 122 ft) bgs. Spectroscopy identified no signature of corresponding gamma-emitting radionuclides. This anomaly was attributed to the presence of the Bremsstrahlung Effect (GJO-2002-322-TAR, *Correlation of Spectral Gamma Log Response and Sr-90 Concentrations for a Steel-Cased Borehole*) related to the presence of high-energy beta-emitting radionuclides such as Sr-90.

Figure 3-1 shows borehole lithology, radiological field survey data, and geophysical data. In addition, the figure compares sediments encountered during drilling to a logarithmic scaled total gamma log showing counts per second, logarithmic scaled spectral gamma log of Cs-137, neutron moisture (measured in counts per second), and radiological field survey data in disintegrations per minute. Radiological field data represent the vertical distribution of beta and gamma contamination of soils collected during drilling using a G-M. Alpha radiation is not shown because results are sporadic.

Total gamma logs and neutron moisture logs show that anomalous spikes in the gamma and moisture logs exist at 26.5 m (87 ft) and from 54.2 to 54.8 m (178 to 180 ft) bgs. The anomalous high spikes at 26.5 m (87 ft) and 54.2 (178 ft) bgs are related to the logging sonde passing below the shielding of the 27.6 cm (10 7/8-in.) casing during logging events one and two. The anomalous low spike from 54.2 to 54.8 m (178 to 180 ft) bgs is related to the logging sonde passing through a zone of overlapping casings during logging event three.

Figure 3-1. Combination Plot of Lithology, Spectral Gamma (Cesium-137), Total Gamma, Radiological Field Survey Data, and Neutron Moisture Logs.



3.7 CIVIL SURVEY

A civil survey of Borehole C5941 was carried out on July 1, 2008, in accordance with GRP-EE-01-1.6, *Survey Requirements and Techniques*, and HNF-PRO-090, *Excavating, Trenching, and Shoring*. The survey was performed using a Trimble[8] 5800 global positioning system receiver under NAD83(91), *North American Datum of 1983*. Elevations were measured also using a Trimble 5800 global positioning system receiver under NAVD88, *North American Vertical Datum of 1988*. Coordinates have been entered into the *Hanford Well Information System* database and are summarized in Table 2-1 of this document. A copy of the Well Survey Data Report is provided in Appendix E.

3.8 QUALITY ASSURANCE

No quality assurance surveillance activities were to be performed in the field during drilling of this borehole. However, quality assurance surveillance was performed in the capacity of technical oversight for sampling activities and geologic support for drilling activities. All work was performed in accordance with HNF-23333, *Fluor Hanford Environmental Quality Assurance Program Plan*, and HNF-20635, *Soil & Groundwater Remediation Project Quality Assurance Project Plan (GRP-QA-001)*. Work performed under these plans was governed in accordance with HNF-MP-599, *Quality Assurance Program Description*.

NCR-08-SGRP-005 was issued to document the apparent failure to collect the split IC anion analysis aliquot for sample number BITDC0. Material from the same interval, sample BITDD3, was substituted for the missing.

NCR-08-SGRP-007 was issued to document the failure to ship samples BITDD7, BITDD8, and BITDD9 in a timely manner resulting in exceeded hold times for sulfide and VOA analysis.

[8] Trimble is a trademark of Trimble Navigation Limited, Sunnyvale, California.

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4.0 SUBSURFACE DESCRIPTION

This chapter includes the generalized stratigraphy as well as a detailed subsurface description of borehole-specific geology and hydrogeology of the 200 East Area of the Hanford Site located 41.8 km (26 mi) northeast of Richland, Washington.

4.1 GEOLOGY OF THE 200 EAST AREA

Generalized stratigraphy in the 200 East Area near the 216-A-30 Crib includes a thin veneer of surficial sediments consisting of unconsolidated and unweathered Holocene aeolian sands and loess overlying unconsolidated sediments of the Hanford formation. The Hanford formation consists of Pleistocene-age, cataclysmic flood and inter-flood deposits consisting of a basal gravel-dominated sequence (Unit 3) and an overlying sand-dominated sequence (Unit 2). Hanford formation sediments disconformably overlie sands and gravels of the Miocene to Pliocene age Ringold Formation. Pleistocene cataclysmic flooding removed portions of the Ringold Formation over much of the 200 East Area. Where the entire Ringold Formation is present, in descending order, it consists of the Upper Ringold Unit (primarily gravelly sand), Unit "E" of the Ringold Formation (primarily sandy gravel), the Ringold Lower Mud (primarily silt and fine sand), and Unit "A" of the Ringold Formation (primarily sandy gravel). The Ringold Formation overlies flood basalt flows of the Miocene Columbia River Basalt Group. Basalt flows of the Elephant Mountain Member of the Saddle Mountains Basalt form the base of the suprabasalt aquifer (DOE/RL-2002-39, *Standardized Stratigraphic Nomenclature for Post-Ringold Formation Sediments Within the Central Pasco Basin*).

4.2 GEOLOGY AT 216-A-30 CRIB, BOREHOLE C5941

All radiologically contaminated drill tailings were sleeved and bagged using semi-transparent yellow plastic to prevent the spread of contamination. Field personnel also minimized their exposure time to these sediments. Observations of sediments were made through the semi-transparent plastic at a distance greater than 0.27 m (0.9 ft). Therefore, details of radiologically contaminated drill tailings such as angularity, grain size, and percent composition are not directly observed and are inferred where plastic sleeving was used.

At borehole C5941, a drill pad of crushed gravel extends from the surface to 0.22 m (0.75 ft) bgs and overlies crib cap material. The crib cap material consists of non-native sandy gravel that extends from 0.22 to 0.76 m (0.75 to 2.5 ft) bgs. A sheet of black plastic is present at the base of the crib cap material. Below the plastic, an interval of poorly sorted gravelly sand exists from 0.76 to 4.7 m (2.5 to 15.6 ft) bgs consisting of very fine to very coarse sand with 10 to 20 percent gravel content.

Sediments encountered from 4.7 to 47 m (15.6 to 154.5 ft) bgs generally consist of well-stratified beds of very fine to very coarse salt and pepper-colored sand (30 to 60 percent mafic, 40 to 70 percent felsic content) of the Hanford formation sand-dominated facies. Occurring intermittently throughout the unit are several thin beds and stringers of silt, silty sand, and very fine sand. They are present as the following:

- Very fine mafic sand from 5.0 to 5.1 m (16.7 to 16.9 ft) bgs

- Gravelly sandy silt nodules from 16.7 to 55.0 to 17.2 m (56.5 ft) bgs
- Silty sand nodules at 21.1 m (69.5 ft) bgs
- Very fine sand from 21.70 to 21.79 m (71.2 to 71.5 ft) bgs, 21.9 to 22 m (72.0 to 72.5 ft) bgs, 23.0 to 23.1 m (75.5 to 76.0 ft) bgs, 23.7 to 23.8 m (78.0 to 78.2 ft) bgs, 25.4 to 25.5 m (83.5 to 83.7 ft) bgs, 27.12 to 27.15 m (89.0 to 89.1 ft) bgs, 27.5 to 27.6 m (90.5 to 90.7 ft) bgs, 31.6 to 31.7 m (104 to 104.3 ft) bgs, and 33.6 to 33.7 m (110.5 to 110.6 ft) bgs
- Very fine sandy silt at 34.9 and 41.1 m (114.8 and 135 ft) bgs, and from 43.6 to 43.7 m (143.1 to 143.5 ft) bgs
- Sandy silt from 44.6 to 44.7 m (146.5 to 146.7 ft) bgs.

Toward the top of the sand-dominated facies of the Hanford formation, a sandy gravel interbed of sub-round medium pebble gravel is present from 14.1 to 14.3 m (46.5 to 47.0 ft) bgs with a very fine mafic sand veneering the top of the interbed. From 32 to 43.5 m (105 ft to 143 ft) bgs, the sands contain sparse well-rounded, coarse pebbles of mixed lithology. Below 27.8 m (91.5 ft), the sands are slightly indurated and possess a small percentage of mica. Locally, sands exhibit slightly inclined bed forms that are typically less than 1.2 cm (1/2 in.) thick.

The interval from 47 to 49.9 m (154.5 to 164.0 ft) bgs includes basalt-dominated sandy gravel with sub-angular to sub-rounded clasts. The gravel is normally graded and becomes clast-supported toward its base. From 48.7 to 49.5 m (160.0 to 162.5 ft) bgs, carbonate rinds are present on the largest of the clasts.

Sediments encountered from 49.9 to 63 m (164.0 to 207.0 ft) bgs include cohesive, slightly indurated gravely sands with sparse very fine to very coarse pebbles of basalt and quartzite. Interbeds of sandy basaltic gravel are present from 59.5 to 60 m (195.5 to 197.0 ft) bgs and from 62.63 to 62.69 m (205.5 to 205.7 ft) bgs.

The gravelly sands transition into a sandy gravel interval from 63 to 64.6 m (207.0 to 212.0 ft) bgs. The gravel consists of well-rounded, basalt-dominated coarse cobbles to 20.3 cm (8-in.) boulders. The sand matrix consists of pale brown (10YR6/3) very fine to fine cohesive sand that sticks to clasts. The matrix decreases with depth, leaving clast-supported gravel at the base of the interval.

The sandy gravel unit has a relatively sharp contact with underlying sediments encountered from 64.6 to 70.8 m (212.0 to 232.5 ft) bgs. These sediments consist of cohesive, weakly cemented pebbly sands that are similar to the pebbly sand interval located above the above-noted gravel unit. The percentage and size of gravel within this unit increase toward the base of the interval where 25.4 cm (10-in.) boulders of quartzite and gneiss are seen.

Sediments encountered from 70.7 to 74.5 m (232.0 to 244.5 ft) bgs include matrix-supported silty sandy gravels consisting of poorly sorted sub-round to sub-angular clasts of mixed lithology with a cohesive gray (10YR3/2) silty sandy matrix.

Silty sandy matrix-supported gravel grades to poorly sorted, clast-supported sandy gravel from 74.5 to 79 m (244.5 to 259.5 ft) bgs that contains larger clasts of up to 25.4 cm (10 in.) in diameter.

From 79 to 84.5 m (259.5 to 277.5 ft) bgs, a normally graded sandy gravel interval was encountered. The top 1.5 m (5 ft) of the interval consists of felsic dominant, dark olive gray (5YR3/2) matrix-supported, sandy gravel with very fine to very coarse pebbles. At 80.6 m (264.5 ft) bgs, the gravel transitions to a clast-supported sandy gravel of sub-rounded to sub-angular medium pebbles to cobbles of mixed lithology. From 83.5 to 84.5 m (274.0 to 277.5 ft) bgs, gravels grade into a light olive brown (2.5Y5/3), mafic dominant silty sand that contains pale yellow (2.5YR7/4) nodules of sandy silt. A gravel interbed that matches the above clast-supported interval exists between 83.9 and 84.2 m (275.5 and 276.5 ft) bgs. The lowermost sand interval shares a sharp contact with sediments below.

The above sand interval sharply overlies poorly sorted silty sandy gravel from 84.5 to 86.8 m (277.5 to 285.0 ft) bgs. These sediments consist of matrix and clast-supported, rounded, very fine to very coarse pebbles of roughly equal proportions of basalt, quartz, metamorphics, granitoids, and sparse purple and gray dacites. The matrix is dark brown (10YR3/3) to dark grey (10YR4/1) silty sand. This interval also includes 10 to 20 percent sandy silt nodules up to 10.1 cm (4 in.) in diameter.

From 86.8 to 90.3 m (285.0 to 296.5 ft) bgs, sediments include matrix-supported, felsic-dominated, sandy gravels and gravels. The gravels consist of rounded, fine to medium pebbles that express yellow weathering rinds. A 7.6 cm (3-in.) thick, gray (2.5Y6/1) gravelly silt layer exists within this interval at 89.8 m (294.8 ft) bgs.

Detailed descriptions also can be found in the borehole log in Appendix C.

4.3 HYDROGEOLOGY

Throughout the Hanford formation, soil moisture was observed in sandy gravel, gravely sands, and sands from ground surface to 11.4 m (37.5 ft) bgs. Moisture content of these sediments varies between slightly moist to moist with no free water.

Moisture also was observed in beds of fine sand, sandy silt nodules, and silt layers that occur intermittently within a sand unit from 11.4 to 47.2 m (37.5 to 155.0 ft) bgs. Depths of these layers are identified in the borehole logs in Appendix C.

Additional moisture was encountered at the base of the gravelly sand unit from 70.1 to 70.2 m (230.0 to 230.5 ft) bgs. The moist interval continues downward throughout the underlying silty sandy gravel interval from 70.2 to 74.6 m (230.5 to 245.0 ft) bgs. Sediments from 83.6 to 85.3 m (274.5 to 280.0 ft) bgs possess a moisture content ranging from slightly moist to moist.

The capillary fringe was encountered approximately at 85.3 m (280.0 ft) bgs, with moisture content increasing with depth to the point of saturation at 86.8 m (285.0 ft) bgs at groundwater.

The geologist’s borehole log located in Appendix C contains detailed soil-moisture observations for the borehole sediments recovered from this well.

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APPENDIX A
WELL SUMMARY SHEET

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WELL SUMMARY SHEET

Start Date: 3/4/08
Finish Date: 5-7-08
Page 1 of 3

Well ID: C5941	Well Name: NA
Location: 216-A-30 crib, S.W. of W.T.P.	Project: 216-A-30 Crib Investigation
Prepared By: Aaron Lontau Date: 5-7-08	Reviewed By: L. D. Walker Date: 5-15-08
Signature: Aaron Lontau	Signature: [signature]

CONSTRUCTION DATA

Description

0.0'-1.0': Neat Cement w/ Concrete aggregate, Seal
~~1.0-278~~ AI 5-5-08
1.0'-278.0': Bentonite Seal of Medium (3/8" minus) chips.

Temporary Casing: 0.0'-179.5' 10 3/8 OD, 9 5/8 ID, C.S.

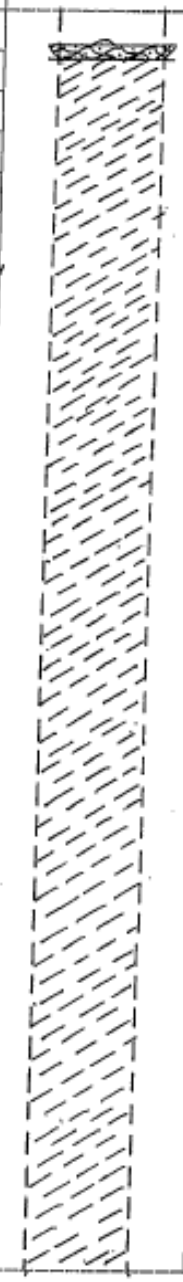
Temporary Casing: 178.5'-296.5' 8 5/8" OD, 7 1/2" ID, C.S.

Water Table: 185.0'

Borehole T.D.: 296.5'

Notes:
- All measurements in feet "below ground surface" (bgs)
- Borehole fully decommissioned to ground surface.
- All temporary casing removed from borehole.

Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 20, 40, 60, 80, 100

Graphic Log

Lithologic Description

0.0'-0.75': Crushed Gravel of Drill Pad.
0.75'-2.5': Non-Native Sandy Gravel
- 2.5': Plastic Sheet

2.5'-15.6': Gravely Sand (Disturbed)
15.6'-154.5': Native Sand

- 46.5'-47.0': Sandy Gravel Bed
- 55.0'-55.6': Sandy Silt Nodules
- 69.5'-69.8': Silty Sand Nodules
- 91.5'-115.0': Indurated Sediments.
- ~~96.0': Indurated Sediments.~~ AI 5-5-08
- 115.0': Silty Sand Bed

A-6003-643 (03/03)

WELL SUMMARY SHEET

Start Date: 3/4/08
Finish Date: 5/7/08
Page 2 of 3

Well ID: C5941	Well Name: NA
Location: 216-A-30 crib S.W. of W.T.P.	Project: 216-A-30 Crib Investigation
Prepared By: A. Lanton — Date: 5-7-08	Reviewed By: L.D. Walker — Date: 5-15-08
Signature: Aaron Lanton	Signature: [signature]

CONSTRUCTION DATA

Description	Diagram
Temporary Casing: 178'-296.5' 8 5/8" OD, 7 3/4" ID, C.S.	
178.5': Borehole Downsize from 10 7/8" Diameter to 8 5/8" Diameter.	

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
120		• 120.0-232.0': Indurated Sediments.
140		
		154.5'-164.0': Sandy Gravel
160		
		164.0'-207.0': Sand Indurated.
180		
		196.5': Gravel Bed
200		
		207.0'-212.5': Gravel to Indurated Sandy Gravel
		212.5'-232.0': Gravely Sand Indurated
220		
		232.0'-245.0': Silty Sandy Gravel Indurated.

A-6003-643 (03/03)

WELL SUMMARY SHEET

Start Date: 3/4/08
Finish Date: 5/7/08
Page 3 of 3

Well ID: C5941
Well Name: ~~216-1~~ LW 5/15/08 N/A
Location: 216-A-30 crib, S.W. of W.T.P.
Project: 216-A-30 Crib Investigation
Prepared By: A. Lanfow
Date: 5-7-08
Reviewed By: L.B. Walker
Date: 5/15/08
Signature: Aaron Lanfow
Signature:

CONSTRUCTION DATA

Description	Diagram
278.0'-296.5': 10/20 Mesh Colorado silica sand.	

Notes:
- All Measurements are in feet "below ground surface" (bgs)
- Core barrel borehole fully decommissioned.
- All temporary casing removed from ground.

GEOLOGIC/HYDROLOGIC DATA

Depth in Feet	Graphic Log	Lithologic Description
240		245.0'-285': Sandy Gravel
260		
280		•276.5'-277.5': Silty Sand Bed
		285.0': Water Table
		285.0'-296.5': Sandy Gravel
300	T.D.	296.5': T.D.
320		
340		

A-6003-643 (03/03)

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APPENDIX B
WELL CONSTRUCTION SUMMARY REPORT

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WELL CONSTRUCTION SUMMARY REPORT

Start Date: 2/28/08
Finish Date: 5-7-08
Page 1 of 1

Well ID: C5941	Well Name: -NA-	Approximate Location: 216-A-30 crib, S.W. of
Project: 216-A-30 Crib Investigation.		Other Companies: FLUOR, GRAM Inc.
Drilling Company: FLUOR Hanford. (In House)		Geologist(s): Aaron Lantow, Nathan Bowles,
Driller: Jim Noonan	License #: 0362	

TEMPORARY CASING AND DRILL DEPTH			DRILLING METHOD	HOLE DIAMETER (in.) / INTERVAL (ft)
*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.	Auger:	Diameter 10 3/8" From 0.0 to 178.5
10 3/8" O.D, 9 5/8" I.D; C.S.	0.0 - 178.5	10 3/8 OD/9 5/8" I.D.	Cable Tool: X	Diameter 8 5/8" From ~~0.0~~ 178.5 to 296.5
8 5/8" OD, 7 1/2 ID; C.S.	0.0 - 296.5	8 5/8" OD/7 1/2 ID	Air Rotary: —	Diameter ____ From ____ to ____
—	—	—	A.R. w/Sonic: —	Diameter ____ From ____ to ____
—	—	—	—	Diameter ____ From ____ to ____
—	—		—	Diameter ____ From ____ to ____
*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design			—	Diameter ____ From ____ to ____

Threaded - Left hand

Drilling Fluid: NA (no water)

Total Drilled Depth: 296.5	Hole Dia @ TD: 8 5/8"	Total Amt. Of Water Added During Drilling: NA
Well Straightness Test Results: NA		Static Water Level: ~~284.0'~~ 285' LW 5-15-08 Date: 4-22-08

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral γ, Passive neutron,	0.0 - ~~88.0~~ 97.0'	3/19/08		____ - ____	NA
& Neutron moisture.	97.0 - 105	3/24/08	Not used	____ - ____	
For all 3 intervals.	105 - 296	4/22/08		____ - ____	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annular Seal/Filter Pack	Volume	Mesh Size
	____ - ____			—	____ - ____		
-NA-	____ - ____			—	____ - ____		
All Rods Removed.	____			Cement Seal	0.0 - 1.0		
	____ - ____			5/8" minus "Medium" Bentonite Chips.	1.0 - 178.5		5/8"-
	____ - ____			10/20 Mesh Colorado Silica Sand	178.5 - 296.5		10/20

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Decommission:	Yes: ✓	No:	Date: 5-7-08
Description: -NA- Not used.		Description:			

WELL SURVEY DATA (if applicable)

	Protective Casing Elevation: N.A
Washington State Plane Coordinates:	Brass Survey Marker Elevation:

COMMENTS / REMARKS

All Rods Removed from ground on 5-5-08

Reported By:	Title:	Signature:	Date:
A. Lantow	Geologist	Aaron Lantow	5-7-08

A-6003-658 (04/03)

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APPENDIX C
BOREHOLE LOG

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BOREHOLE LOG

Page 1 of 16
Date: 2/4/08 / 3-6-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 Crib, W. of W.T.P. 3/11/08 - Finish

Project: 216-A-30 Crib Investigation | Reference Measuring Point: Ground Surface.

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
0				0.0'-0.75': Crushed gravel drill pad.	Cable tool drilling w/
				0.75'-3.5': Sandy Gravel (sG) 40% S 60% G, m.-c.	hollow drive barrel.
				sand in subrnd s. pebs-boulders (8") of crib cover.	
					2.3': RCT ⇒ Double bkgrnd.
					(w/spl 3)
2.5		I-001		2.5': Plastic sheet	2.3-4.8: Split Spoon vols. HEIS#:
				2.5'-5.8': Gravely Sand (gS)	BITDB4, BITDC3, BITDC4, BITD
				3.5' Plastic sheet	BITHD1, BITH27
				3.5'-5.8': Gravely Sand (gS) 15% g, 75% S, vf.-	RCT = < Bkgrnd, IH = no detect
				c. Sand w/ subrnd gravel of m. pebs-s. cobs. (3")	
				Sample is moist (no free water) (crib fill)	4.8-7.3: Split Spoon HEIS#:
5		I-002			BITDB5, BITDC5, BITDC6,
				5.8-7.5: Gravely Sand (gS) 10% g, 90% S	BITDC7, BITHD2, BITH28
				vf.-c. Sand w/ angular cobbles (3"). Sample is moist	DUP: BITDC8, BITDC9, BITDD0
				(no free water)	BITHD3, BITH29
7.5				7.5'-10.0': Gravely Sand (gS) 20% g, 80% S	RCT < Bkgrnd, IH = no detect
				vf.-v.c. Sand w/ angular-subrnd round m. pebs-10" boulders.	
				Sample is moist	
				9.0'-13.0': Gravely Sand (gS) ~~15% g 75% S~~	
				10% g, 90% S, m.-v.c. angular sand w/ ~~med~~ sub-	
10				round med pebs. Sample is dry & unconsolidated.	10.0: RCT: < Bkgrnd, IH: no detect.
				13.0'-15.6': Gravely Sand (gS) 10% g 90% S	
				Sediments are similar to above interval	
12.5					12.0': RCT: < Bkgrnd, IH: no detect.
15	BITF6	HEIS# Grab		15.6'-18.1': Sand m(S) m.-c. Sand 90% Mafic, 10% Felsic	15.0-15.5': Grab for archive
				15.6-16.9': Sand m(S) m.-c. Sand 90% Mafic,	15.6-18.1: Split spoon, IH: no detect.
		I-003		10% Felsic.	RCT: 60 kdpm β(G/G.M) non removable
					on soil ~~18.9~~ ⇒ 50 kdpm β(G/G.M)
				16.7'-16.9': Sand(S) v.f. Sand 90% mafic, 10% Felsic, moist	HEIS#: BITDB6, BITDD1, BITDD2,
17.5		I-004		16.9'-18.1': m.-v.c. Sand 85% mafic, 15% Felsic	BITDD3 BITHD4, BITH30
				⇒18.1: Same material (~~like w/ salt~~ salt &	SS ⇒ HEIS# BITDC0, BITDD5,
				pepper Hanford Fm. Sand).	BITDD7, BITDD8, BITDD6 vols.
		100% Rec.			See p. 2 →

Reported By: Aaron Lantau / N. Bowles | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Aaron Lantau / [illegible] Date: 3-6-08 3/11/08 | Signature: [illegible] Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 2 of 16
Date: 3/11/08 – start

Well ID: C5941 | Well Name: -Nk- | Location: 216-A-30 Crib, W. of W.T.P.

Project: 216-A-30 Crib Investigation | Reference Measuring Point: Ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
20	SS (WB) 3/11/08 cont'd from p.1 I-SS1-001 (cont'd)			(S) cont'd from p.1 (from 16.9') → @ 20.0' bgs: ↓, sparse ↓ clse pebbles (max ≤2.5"), sub rd. to sub ang.	(See p.1)
	Grab I-006	HEIS# I-007		20.0'–22.0': Sand (S) m.-v.f. sand 50% Mafic, 50% Felsic. w/sparse pebs. (1" max)	SS. soil sample from 18.1' bgs to 20.6' bgs (WB) 3/11/08 @ 1250, 3/11/08; HEIS# B1TV12, B1TV13, B1TV14, B1TV15, RCT ⇒ Nealpha; – 100k dpm @ 18.5' bgs; – 300k dpm @ 20.0' bgs; – 200k dpm @ 20.5' bgs (all w/ G-M, totally). IHT ⇒ < D. (I-SSP-001)
22.5	SSP-002 (WB) 3/11/08			22.0–24.3': Sand (S) m.-v.c. sand 50% Mafic, 50% Felsic w/sparse f.-m. pebs.* angular. moist	also: RCT ⇒ ~2 mR/hr SOE on contact w/ RO-20 on composited SS sample (18.1 → 20.6')
25	Grab I-008				Grab: 20'–20.5' HEIS# B1TDF8 B1TDW1. (I-006) RCT: 200K dpm (w/G.M) direct
27.5	Grab I-009			24.3–27.5: Sand (S) m-v.c sand 50% Mafic, 50% Felsic 75% Mafic, 25% Felsic sample is moist	Grab: 21.5'–22.0': HEIS# B1TDF9, B1TDW3 RCT: 200k dpm direct (w/G.M) IHT: no detect.
					*SS soil samples from 22.0'–24.3' @ 1255, 3/11/08; HEIS# B1TV16, B1TV17 B1TV18, B1TV19. 100 Kdpm β,γ w/G.M. Top-bottom.
				Continue on next page	24.5–25.0': Grab soil sample HEIS# B1TDH8, B1TDW4 RCT ⇒ 200 K dpm w/G-M. IH: no detect volital vapors.
					27.0–27.5': Grab soil sample HEIS# B1TDH1, B1TDW5 RCT: 120 K dpm w/GM direct. IH: no detect

Reported By: N. Bowles / A. Lantow | Reviewed By: L.D. Walker
Title: Geologist / Geologist | Title: Geologist
Signature: [illegible] / [illegible] Date: 3/13/08 | Signature: LD Walker Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 3 of 16
Date: 3-13-08 / 3/17/08

Well ID: C 5941 | Well Name: -NA- | Location: 216-A-30 Crib, W. of W.T.P.
Project: 216-A-30 Crib Investigation | Reference Measuring Point: Ground Surface

Depth (FL)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
27.5	Grab	I-009 Prev. page		27.5'-30.0': Sand (S) f.-V.C sand subangular-angular (75% Mafic, 25% Felsic) Moist	See pg (1.)
					29.5-30.0': Soil Grab HEIS# AL 3-13-08
30	Grab	I-010 HEIS# BITDH2 BITDW6		30.0'-32.5': Sand (S) f.-C. sand (75% Mafic, 25% Felsic) Sample similar to above. Moist	RCT: 60 Kdpm direct (w/G-M) 1 Kdpm removable (w/G-M) < 0.5 mR/hr (w/RO-20)
					32.0-32.5': Grab soil
32.5	Grab	I-011 HEIS# BITDH3 BITDW7		32.5'-35.0': Sand (S) M-C. sand (80% Mafic, 20% Felsic) moist. Sample similar to above interval (27.5-30.0)	RCT: 150 Kdpm direct w/G-M, 1 Kdpm removable w/G-M < 0.5 mR/h (w/RO-20)
35	Grab	I-012 HEIS# BITDH4 BITDW8		35.0'-37.5': Sand (S) f.-V.C. subangular-angular Sand (80% Mafic, 20% Felsic) sample is moist	34.5-35.0': Soil Grab RCT: 450 Kdpm direct (w/G-M) 1 K removable (w/G-M) < 0.5 mR/h (w/RO-20)
37.5	Grab	I-013 HEIS# BITDH5 BITDW9		37.5'-40.0': Sand (S) f.-V.C. sub-angular to angular sand (80% Mafic, 20% Felsic). Sample is moist.	37.0-37.5 Grab soil RCT: 200 Kdpm direct (w/G-M) 60 Kdpm remov. (w/G-M) < 0.5 mR/h (w RO-20)
40	Grab	I-014 HEIS# BITDH6 BITDW10		40.0'-42.0': Sand (S) v.f.-V.C. subangular-angular sand (75% Mafic, 25% Felsic) Sample is Dry & lightly consolidated, easily friable w/ fingers.	39.5-40.0': Soil Grab RCT: < bkgrnd direct/removable (w/G-M); IH: no detect a.v.
	Grab	I-015 HEIS# BITDH7 BITDX1			41.5-42.0': Soil Grab
42.5				42.0-45.0': Sand (S); similar to above interval.	RCT: ≤ Bkgrnd (w GM)
45	Grab	I-016 HEIS# BITDH8 BITDX2		45.0-46.5: Sand (S), similar to 40'-42' interval	44.8-45.3': Soil Sample RCT: ≤ Bkgrnd IH: 4 ppm volitile organic vapor.
				46.5'-47.0': Sandy Gravel (SG) 80% G, 20% S Subrnd, Felsic 2.5" cobbles, w/ v.f.-fn. sand.	45.8': SAS SUMMA canister #047 vapor air sample.

Reported By: A. Lantow | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: [signature] Date: 3/17/08 | Signature: [signature] Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 4 of 16
Date: 3/17/08 / 3-18-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 crib, SW of W.T.P.

Project: 216-A-30 crib Investigation | Reference Measuring Point: Ground Surface.

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
47.5	Grab	I-017 HEIS# BITDH9 BITDX3		47.0'-50.0': Sand, (S) 80% Mafic 20% Felsic. m.-v.c sand, subangular-angular, Sediment is Dry, semi-consolidated, easily friable. no rxn w/ HCl	47.0-47.5': Soil Grab RCT: 2 kdpm direct w/GM 1 k dpm removable w/G-M
50	Grab	I-018 HEIS# BITDJ0 BITDX4		50.0'-52.5': Sand (S) v.f-v.c sub-angular sand ~~60% Mafic, 40% Felsic~~ 60% Mafic, 40% Felsic • Alternating beds of c. & f. sands., Sediment is dry, semi-consolidated (ron), no rxn w/ HCl	50.0-50.5': Soil Grab RCT: < Bkgrnd direct, no remov. w/G-M IH: not on site.
52.5	Grab	I-019 HEIS# BITDJ1 BITDX5		52.5'-56.0': Sand (S) f.-v.c. sub-angular sand 70% Mafic, 30% Felsic, Dry, mod. rxn w/ HCl	52.3-52.8: Soil Grab RCT: < Bkgrnd w/GM IH: not on site
55	Grab	I-020 HEIS# BITDJ2 BITDX6		56.0'-56.5': Gravelly Sand (gS) 85% S, 15% g f.-c. angular sand (85% Mafic) w/ sub-round m.-v.f. pebbles (Mixed composition). silty sandy clay nodules w/ mixed & mottled colors found. slight rxn w/ HCl. RCT: < Bkgrnd, IH: no detect Dry	54.5-55.0': Soil Grab RCT: ≤ Bkgrnd. IH: not on site. 57.3-57.8: Soil Grab (0850) Time
57.5	Grab	I-021 HEIS# BITDJ3 BITDX7		56.5'-57.5': Sand (S) 85% Mafic, 15% Felsic f.-v.c sand w/ fine pebbles & fragments of consolidated cemented sand mod. rxn. w/ HCl Dry	RCT: < Bkgrnd w/GM IH: no detect.
60	Grab	I-022 HEIS# BITDJ4 BITDX8		57.5'-60.0': Sand (S) similar to above interval 60.0'-62.5': Sand (S) similar to (56.5-57.5) interval Dry	59.5'-60.0': Soil Grab (Time: 0905) RCT: < Bkgrnd w/GM IH: no detect.
62.5	Grab	I-023 HEIS# BITDJ5 BITDX9		62.5'-65.0': Sand (S) similar to (56.5-57.5) interval Dry	62.0-62.5: Soil Grab (Time 0936) RCT: < Bkgrnd w/G-M IH: off site
65	Grab	I-024 HEIS# BITDJ6 BITDY0		65.0'-67.5': Sand (S) similar to (56.5-57.5) ~~66.0': Silt (M) 1-2mm thick color is lt. orange~~ no clay, only calcified v.f. sand 3-18-08 mod. rxn to HCl Dry 66.5': RCT: 2600 dpm. w/GM	64.5-65.0: Soil Grab (Time 0965) RCT: 50 k dpm direct w/GM removable: < Bkgrnd w/ G-M 66.0: 65 kdpm direct w/GM removable: < Bkgrnd w G-M

Reported By: A. Landon | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [illegible] | Date: 3/18/08 | Signature: [illegible] | Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 3-15-08/3-19-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 crib, S.U. of U.T.P

Project: 216-A-30 crib, Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)
67.5	Grab	I-025 HE15# BITDJ7 BITDY1		67.5-70.0': Sand (S) f.-C. Sand w/ sparse Bolt. coarse pebbles. (85% Mafic, 15% Felsic) sed. is moist w/ mod. rxn w/ HCl	67.0'-67.5': Soil Grab RCT: 10 K dpm direct (w/GM) no α (w/PAM), no removable (rem)
				• 69.5': Silty Sand nodules ~2"-4" thick color: 2.5Y 6/6 olive yellow ~~Sand~~ f-C. sand w/ 2.5Y 4/3	68': 40 kdpm (w/G-M)
70.0	Grab	I-026 BITDJ8 BITDY2		olive brown. silt mottling. oxidized plagioclase (100% Felsic) 70.0-72.5. Sand (S) f.-C. Sand (85% Mafic, 15% Felsic)	69.5'-70.0': Soil Grab RCT: 45 kdpm (w/G-M) no rem.
				• 71.2'-71.5': v.f. sand bed. (95% Mafic) RCT: 450 dpm	71.5: 450 kdpm (w/G-M) no rem.
				• 72.2'-72.5': v.f. sand (95% Mafic) (100% Mafic) 10% silt. v. dark brown.	
72.5	Grab	I-027 BITDJ9 BITDY3		72.5'-75.0': Sand. (S) 90% Mafic, moist m.-C. Sand.	72.2'-72.7': Soil Grab RCT: 20 kdpm (w/G-M) no rem.
75	Grab	I-028 BITDK0 BITDY4		75.0'-75.5': Sand (S) f.-v.c. Sand (90% Mafic) (10% Felsic). moist, no rxn w/ HCl	74.6'-75.1': Soil Grab RCT: ≤ Bkgrnd
	Grab	I-029 BITDK1 BITDY5		• 75.5'-76.0': v.f. sand (< 10% silt) note: sed. will not smear nor bend (not flexible) Sample is moist, no rxn w/ HCl *(darker than surrounding sed)	75.5'-76.0': Soil Grab RCT: ≤ Bkgrnd.
77.5				77.5'-80.0': Sand (S) f.-v.c. Sand (75% Mafic, 25% Felsic. moist	
				• 78.0': 2" thick v.f.-c Sand (80% Felsic) mod. rxn w/ HCl. color 2.5Y 6/6 olive yellow (oxidized plag.)	
80	Grab	I-030 BITDK2 BITDY6		80.0'-82.5': Sand (S) m.-v.c. Sand angular (80% Mafic, 20% Felsic) mod. rxn w/ HCl, Dry.	79.5'-80.0': Soil Grab RCT: ≤ Bkgrnd (w/G-M) no rem.
82.5	Grab	I-031 BITDK3 BITDY7		82.5'-85.0': Sand (S) f.-m. micaceous sand. (60% Fe Mafic, 40% Felsic) dry	82.0'-82.5': Soil Grab RCT: < Bkgrnd (w/GM) no rem.
				• 83.5'-83.7': v.f. sand (60% Mafic, 40% Felsic) moist	
		I-032 BITDK4 BITDY8			85.0'-87.5': Soil split Spoon RCT: ≤ Bkgrnd (w/GM) + PAM IH: no detect organic vapors.
85	Grab / Split Spoon	I-033 BITDB7 BITDD7 BITDD8 BITDD9 BITH05 BITH31		85.0'-87.5': Sand (S) v.f.-c. subrnd.-sub-ang. Sand. (70% Mafic, 30% Felsic.)	85.0'-85.5': Soil Grab RCT: ≤ Bkgrnd.

Reported By: Aaron Fatton		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: Aaron Fatton	Date: 5-15-08	Signature: L.D. Walker	Date: 5-15-08

A-6003-642 (03/03)

BOREHOLE LOG

Page 6 of 16
Date: 3/19/08 / 3/26/08

Well ID: C6941 | Well Name: -NA- | Location: 216-A-30 crib, S.W. of W.T.P.

Project: 216-A-30 crib Investigation. | Reference Measuring Point: Ground Surface.

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
87.5	Sp. ↑	↑			
	Grab	I-034 HEIS# BTDK6 BTDY9		87.5-90.0: Sand (S) f-c. subangular micaceous. (75% Mafic, 25% Felsic) poorly cemented, easily friable w/ fines, mod. rxn w/ HCl ~~moist~~ Dry	87.5-88.0 Grab soil RCT< Bkgrnd IH: offsite
				• 89.0': 1" bed of v.f-f. sand 90% Mafic, v. moist	
90	Grab	I-035 HEIS# BTDK6 BTF00		90.0'-92.5: Sand (S) f-c. subangular ~~to sub~~ Mafic sand (80% mafic) sand. is dry.	89.6-90.1': Soil Grab RCT< bkgrnd
				• 90.5': 2" thick v.f. Sand <10% m. micaceous. moist from surface exposure	IH: no detect o.v. Sample is moist from exposure, over night.
				• 91.5': Cementation ↑ strong rxn w/ HCl	
92.5	Grab	I-036 HEIS# BTDK7 BTF01		92.5-95.0: Sand m.-c. micaceous Sand (S) mod. cemented, strong rxn w/ HCl ~~(80% Mafic)~~ (90% Felsic, 10% Mafic; Qtz > both. samp. is moist	92.3-92.8: Soil Grab RCT< Bkgrnd IH: no detect o.v.
95	Grab	I-037 HEIS# BTDK8 BTF02		95.0-95: Silty gravelly Sand, (10%m, 10%g, 90%S) (MgS) lt. yellow brown, f.-m. sand micaceous w/ Felsic f.-m. pebs. (max: 1") samp is moist mod-well cement strong rxn w/ HCl mod. friable must use finger nail. (Gravelly)	94.5-95.0: Soil Grab RCT< bkgrnd
97.5	Grab	I-038 HEIS# BTDK9 BTF03		97.5-100': Silty ~~Sand~~ Sand (mgS) (15%m, 10%g, 85%S) f.-m. micaceous Sand lt. yellowish brown. w/ sparse m. pebs. (Sand: 85% Felsic) pebs. max (discoidal 3" max size) small cobble.	97.0-97.5: Soil Grab RCT< Bkgrnd
100	Grab	I-039 HEIS# BTDL0 BTF04		100.0'-102.5': Silty gravely Sand (mgS) (10%m, 15%g, 75%S) f.-m. micaceous Sand. lt. yellowish brown. w/ mix. lith. of m. pebs & c. Pebs. Qtz > both. Sand (90% Felsic) F.M. is mod-well consolidated/cemented. mod. friable, mod. rxn w/ HCl	99.5-100.0: Soil Grab RCT< Bkgrnd
102.5	Grab	I-040 HEIS# BTDL1 BTF05		102.5'-105.0': Silty gravely Sand (mgS) Similar to above interval (100'-102.5')	102.0-102.5: Soil Grab RCT< Bkgrnd
				* • 104': Silty Sand (mgS). 20%m, 80%S. Dark gray v.f. sand. w/ stringers of Felsic sand m-c sand. spars med. pebs. sample is moist.	
105	Grab	I-041 HEIS# BTDL2 BTF06		105.0-105.4': Sand v.f-c. sand (S) ≤ 10%m w/ spars pebs. (sand: 90% Felsic 10% Mafic) w/ pure Felsic stringers.	104.6-105.1: Soil Grab RCT< Bkgrnd. for α, β, γ @ 40k dpm (w/ G-M) IH: not available
				← Continue on next pg →	

Reported By: A. Lantau | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: [signature] | Date: 3/26/08 | Signature: [signature] | Date: 5/15/08

A-6003-642 (03/03)

7 LW 5-15-08

BOREHOLE LOG

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Date: 3/26-08/3-31-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 crib

Project: 216-A-30 Crib Investigation | Reference Measuring Point: ground surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
105	Grab Split Spoon SSP-003-BV	I-041 BIV2L2 BIV2L3 BIV2L4 BIV2L5 BIV2L6		105.5'-108': Sand (S) v.f-c. angular sand (60% Felsic, 40% mafic) w/ sparse cobbles & pebs. of bslt. & Felsic sed. is mod. well cemented w/ mod. rxn w/ HCl. w/ stringers of Pure c. Felsic sand.	105.5-108.0: Split Spoon soil 105.5: 2K dpm p, y (w/G-M), no α 107: 4K dpm p, y (w/G-M), no α 108: 5K dpm p, y (w/G-M), no α
107.5	Grab	I-042 BITDL4 BITF07 BITDL3		108'-110': Sand (S) f-c. Sand (70% Mafic 30% Felsic) "Salt & Pepper", strong rxn w/ HCl sed. contains sparse m. pebs. of mixed lith.	107.5-108: Soil Grab sample RCT: 15K direct, no rxn α (w/G-M) no detectable α ≤ Bkgrnd. (w/PAM) 109': 30K dpm direct (w/G-M), no α
110	Grab	I-043 BITDL4 BITF08		110'-112.5: Sand (S) m-c sand (70% Mafic 30% Felsic), moist, no rxn w/ HCl • 110.5': 1" layer of v.f. sand (90% Mafic)	110': 40 K dpm direct (w/G-M), no α HT 111.5': 9 K dpm direct (w/G-M), no α
112.5	Grab	I-044 BITDL5 BITF09		112.5-115: Sand (S) m-c. sand (85% Felsic, 15% Mafic) w/ sparse m. pebs. of mixed. lith. mod. rxn w/ HCl, moist. • 115': Sand (v.f.-S) v.f. w/ silt (10-20%) color - 2.5Y 4/3 (moist)	112.0-112.5: Soil Grab sample 8 K dpm (w/G-M) 114.0: 15 K dpm (w/G-M)
115	Grab	I-045 BITDL6 BITF10		115-117.5: Sand (S) m-v.c. Sand (80% Felsic 20% Mafic) Dry, no rxn w/ HCl	114.5-115: Soil Grab sample RCT: <1 K dpm (w/G-M) 116: 20K dpm (w/G-M)
117.5	Grab	I-046 BITDL7 BITF11		117.5-120': Sand (S) m-v.c. angular Sand (90% Felsic, 10% Mafic)	117.5-118.1: Soil Grab sample RCT: 10K dpm (w/G-M)
120	Grab	I-047 BITDL8 BITF12		120-122.5: Sand (S) m-c. angular Sand (90% Felsic, 10% Mafic), Dry, ~~no rxn w/ HCl~~ HL 3-31-08 • Dry, weak rxn w/ HCl • 122': Sand (S) m-c-Sand (80% Felsic, 20% Mafic) Dry	119.5-120.0: Soil Sample RCT: 15K dpm (w/G-M) RCT: @ 122: 20 K dpm
122.5	Grab Split Spoon	I-048 → I-049 BITDL8 BITDF0 BITDF1 BITDF2 (6) BITH32		122.5-125.0: Sand (S) m-c. Sand (90% Felsic, 10% Mafic) angular sand. Dry, weak rxn w/ HCl w/ sparse m. pebs. of bslt.	122.0-122.5: Soil Grab KGS# BITDL9, BITF13, RCT: 4 K dpm 122.5-125: Soil Split Spoon 123.5: RCT: 5K dpm (w/G-M) 125.0: RCT: ≤ Bkgrnd.

Reported By: A. Lantow		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: Aaron Lantow	Date: 3/31/08	Signature: LD Walker	Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 8 of 16
Date: 3-31-05/4-1-05

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 crib, S.W. of W.T.P.

Project: 216-A-30 crib Investigation | Reference Measuring Point: Ground Surface.

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
125	3.5 ft ↑ Grab	BITM06 I-050 BITDM0 BITF14		Splitspoon Cont. from prev. page. micaceous	125: RCT: ≤ Bkgrnd.
				125'-127.5': Sand (S) m.-c. angular Sand	124-124.5: Soil Grab
				w/ sparse m.-c. pebs of mixed lith. (90% Felsic, 10% Mafic)	RCT: 1 kdpm (w/G-M)
				sediment is dry, w/ ~~no rxn w/ HCl~~. mild rxn w/ HCl	
				(visable inclined bedding)	127.0-127.5: Soil Grab
127.5	Grab	I-051 BITDM1 BITF15		127.5'-130.0': Sand (S) m.-c. micaceous Sand	RCT: ≤ Bkgrnd.
				(90% Felsic, 10% Mafic) large chips of muscovite.	
				Sed. is dry w/ weak rxn w/ HCl	
130	Grab	I-052 BITDM2 BITF16		~~127.5-130~~ 3-31-05	129.5-130.0: Soil Grab
				130.0'-132.5' bgs.: Sand (S) m.-c. Sand	RCT: 2 kdpm
				(90% Felsic, 10% Mafic) have mica. Sed. is	131': 16 kdpm (w/G-M) direct
				dry w/ weak-mod. rxn w/ HCl	
				• 132.0'-132.5': v.f.-f. sand 100% Felsic.	
132.5	Grab	I-053 BITDM3 BITF17		32.5'-135': Sand (S) f.-m. sand (90% Felsic)	132.0-132.5: Soil Grab
				w/ sparse bslt. pebs. (micaceous), Dry. mild rxn w/ HCl	RCT: 2 kdpm (w/G-M) direct
				sand	
				* • 135: 1" thick silt layer, color: 2.5Y 3/ very dk. gray, moist	
135	Grab	I-054 BITDM4 BITF18		135.0'-137.5': Sand (S) m.-c. Sand (angular)	134.5-135.0: Soil Grab
				(75% Felsic, 25% Mafic), moist, weak rxn w/	RCT: 15 kdpm
				HCl	
				50% Mafic	
137.5	Grab	I-055 BITDM5 BITF19		137.5'-140': Sand (S) c. Sand (70% Mafic,	137'-137.5': Soil Grab
				30% Felsic) Salt & Pepper. not consolidated, weak rxn.	RCT: 10 kdpm (w/G-M)
				w/ HCl. Sample is moist	≤ Bkgrnd (w/SPA-3)
				• 138': sparse med. angular bslt. pebs. in sand.	138': RCT: 7 kdpm (w/G-M)
					139': RCT: 2 kdpm (w/G-M)
140	Grab	I-056 BITDM6 BITF20		140'-142.5': Sand (S) m.-c. Sand, angular to	139.3'-139.8': Soil Grab
				subangular frosted, w/ f. pebs. of bslt. color is	RCT: 10 kdpm direct (w/G-M) no α
				lite gray (70% Felsic, 30% Mafic) Sample is moist.	141': RCT: 2 kdpm (w/G-M)
				142.5'-143.1': Sand (S) similar to above*	
					142'-142.5': Soil Grab
142.5	Grab	I-057 BITDM7 BITF21		143.1': 4" thick silt layer w/ 2mm thick v.c. sand	RCT: 5 kdpm (w/G-M)
				beds within it. Sand is (50% Mafic, 50% Felsic), Silt	
				color is: 10YR 4/4. exists in 1mm layers, no clay content	143.1'-143.5': Soil Grab
	Grab	I-058 BITDM8 BITF22		no rxn w/ HCl, Sample is damp - no free water.	RCT: 8 kdpm (w/G-M), near (w/Pm)
					≤ Bkgrnd (w/SPA-3)

Reported By: Aaron Lanham | Reviewed By: L.A. Walker

Title: Geologist | Title: Geologist

Signature: Aaron Lanham | Date: 4-1-05 | Signature: L.A. Walker | Date: 5/15/05

A-6003-642 (03/03)

BOREHOLE LOG

Page 9 of 16
Date: ~~3~~-1-08 / 4-2-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 crib, S.W. of W.T.P.

Project: 216-A-30 Crib Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
145				143.5'-145.0': Sand (S) m.-c. sub-ang sand to subround sand. (70% Felsic, 30% Mafic) dry Mod. ~~FR~~ strong rxn w/ HCl.	
				145.0'-147.5': Sand (S) c.-v.c. subround-angular sand (50% Mafic, 50% Felsic) "Salt & Pepper"	
147.5	Grab	I-059 HIS# BITDM9 BITF23		Dry, mod. rxn w/ HCl	147'-147.5': Soil Grab
				*147.5': 2" thick silt bed 10YR 9/3 brown (no sand) moist, no rxn w/ HCl	RCT: ≤ Bkgrnd w/ G-M neck
				147.5'-150': Sand (S) c-v.c. sand similar to above interval. (50% Mafic)	
150	Grab	I-060 BITDN0 BITF24			149.5'-150.0': Soil Grab
				150.0'-152.5': Sand (S) ~~f.-c.~~ c-v.c. sand similar to interval (145'-147') (50% Mafic) moist, mod. rxn w/ HCl	RCT: ≤ 1k dpm (w/G-M)
152.5	Grab	I-061 BITN1 BITF25		152.5'-~~155.0~~ 154.5': Sand (S) f.-c. sub-round-angular sand (frosted grains) (60% Felsic, 40% Mafic), moist mod. rxn w/ HCl	152-152.5': Soil Grab RCT: ≤ 1k dpm (w/G-M)
155	Grab	I-062 BITN2 BITF26		154.5'-157.5' Sandy Gravel (SG) ~~(G)~~ f.-v.c. sub-round Pebbles of Bslt. > Gr. w/ ~~10%~~ 30% f.-m. Mafic Sand. (90% G, 10% s) (40% Gravel 30% Sand) max clast size 2", Poorly sorted.	154.5'-155.0': Soil Grab. RCT: 4k dpm (w/G-M)
157.5	Grab	I-063 BITN3 BITF27		157.5'-160: Sandy Gravel (SG) f.-v.c. angular sand matrix of Bslt. in v.f. pebs (round-subang) — sub-angular small cobbles of Bslt. > Metamorphics > Granitoids. Poorly sorted (40% G, 60% s)	157.0'-157.5': Soil Grab RCT: ≤ Bkgrnd (w/G-M) IH: no detect
160	Grab	I-064 BITN4 BITF28		160'-162.5': Sandy Gravel ~~(S)~~ (SG) f.-v.c. sand matrix in v.f.-v.c. pebs. ~~(60% G, 40% G)~~ (60% G, 40% s). Sed. is similar to above interval. Carbonate rinds evident. mod-strong rxn w/ HCl	160'-160.5': Soil Grab RCT: ≤ bkgrnd
162.5	Grab	I-065 BITN5 BITF29		162.5'-~~165~~ 164.0': Sandy Gravel (SG) (70% G, 30% s) m-c angular sand in f. pebs-boulder gravel, sub angular, of Bslt > Metamorphics, > Granitoids.	162'-162.5': bag Soil Grab RCT: ≤ Bkgrnd
				AL 4-2-08 Correction on next pg	

Reported By: A. Lantow		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: Aaron Lantow	Date: 4/2/08	Signature: LD Walker	Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 4-2-08 / 4-7-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 crib, S.W. of W.T.P.

Project: 216-A-30 crib Investigation | Reference Measuring Point: Ground Surface.

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
				164.0' 4-2-08	
165	Grab	I-066 BITDN6 BITF30		165'-167.5': Sand (S) f.-vc. subangular to ang. sand (frosted) (60% Felsic, 40% Mafic), strong rxn w/ HCL, (10% angular m. pebs.), Dry.	165'-165.5': Soil Grab RCT: ≤ Bkgrnd w/G-M
167.5	Grab	I-067 BITDN7 BITF31		167.5'-170.0': Sand (S) f.-vc. sub-rnd. sand frosted, (60% Mafic, 40% Felsic) w 10% sub rnd f. pebs. of metamorphics. Dry, mod. rxn w/ HCl	167.0'-167.5': Soil Grab RCT: ≤ Bkgrnd w/G-M
				Mafic content increase w/ depth to (80% Mafic)	
170	Grab Grab	I-068 BITDN8 BITF32		170.0'-172.5': Sand (S) m-vc. sub-rnd. sand frosted (80% Mafic), Dry	170-170.5': Soil Grab RCT: ≤ Bkgrnd w/G-M
172.5	Grab	I-069 BITDN9 BITF33		172.5'-175': Sand (S): sub-rnd f.-vc. sand f. sand is Felsic, v.c. sand is Mafic, (60% Mafic, 40% felsic), Dry, mild rxn w/ HCl. mild rxn w/ HCl Sed: contains spars C. pebs. of Bslt. Sed. is frosted (cemented)	172.5'-173': Soil Grab RCT: ≤ Bkgrnd (w/G-M)
175	Grab	I-070 BITDP0 BITF34		175.0'-177.5': Sand (S): sub-rnd-sub-ang. f-VC Sand (frosted) similar to above interval. degree of induration increas, strong rxn w/ HCl Sed. contains m. pebs, sub-rnd. of Bslt. (spars)	Soil Grab: 174.5'-175.0' RCT: ≤ Bkgrnd
177.5	Grab	I-071 BITDP1 BITF35		177.5'-180.0': Sand (S) (10% gravel, 90% Sand) f.-vc. sub-rnd. Sand (60% Mafic) w/ vc. pebbs. sub-rnd. of Bslt > Qtzite. Cemented w/ strong rxn w/ HCl.	177.5-178.0' bgs. Soil Grab RCT: ≤ Bkgrnd
180	Grab	I-072 BITDP2 BITF36		180'-182.5': Sand (S) sub-rnd. f.-c. sand (40% Mafic) w/ 10-15% m-vc. pebs. sub-rnd. (mixed lith.) Sed. is frosted. mod. rxn w/ HCl	180'-180.5': Soil Grab RCT: ≤ Bkgrnd IH: no detect V.O.C. 180.5': 8" casing w/ 7" diameter x 3.05' long drive barrel.
182.5	Grab Grab	I-073 BITDP3 BITF37 BITF38 BITDP4 I-074		182.5'-185.0': Sand (S) sub-rnd. m-C. sand (30% mafic) consolidated, strong rxn w/ HCl Dry.	182'-182.5': Soil grab. RCT: ≤ Bkgrnd 184'-184.5': Soil grab. RCT: ≤ Bkgrnd

Reported By: A. Lanton		Reviewed By: L. D. Walker	
Title: Geologist		Title: Geologist	
Signature: Aaron Lanton	Date: 4-7-08	Signature: [signature]	Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 4-7-08/4-8-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 Crib, SW of W.T.P.
Project: 216-A-30 Crib Investigation. | Reference Measuring Point: Ground Surface.

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
185				185.0'-187.5': Sand (S) v.f.-v.c. sub-rnd Sand 70% Mafic w/ m. pebs. (discoidal shape of bslt.) 10% pebs. mod. rxn w/ HCl, Dry • 186.5': Sed is damp. w/ spars v.c. pebs.	7" Drive barrel
187.5	Grab	I-075 BITDP5 BITF39		187.5'-190': Sand (S) m. Sand sub-rnd. frosted, w. 10% m. pebbles. of mixed lithology. Sed. is dry & reacts strongly w/ HCl spars v.c. pebbles of bslt. sub. round.	Soil Grab 187.0'-187.5' bgs. RCT ≤ Bkgrnd
190	Grab	I-076 BITDP6 BITF40		190.0'-192.5': Sand (S) m-c. Sand sub-rnd. w/ 10% v.f. pebbles - v.c. pebbles. of BsH > Qtzite (60% Mafic) content. Sed. is dry w/ strong rxn w/ HCl	189.5-190': Soil Grab RCT: ≤ Bkgrnd.
192.5	Grab	I-077 BITDP7 BITF41		192.5-195.0': Sand (S) m-v.c. sub-rnd. Sand (70% Mafic) frosted grains w/ spars small cobbles. Sed. is dry w/ mod. rxn w/ HCl	192-192.5': Soil Grab RCT ≤ Bkgrnd
195	Grab	I-078 BITDP8 BITF42		195.0'-197.5': Sand (S) sub-rnd f-v.c. Sand (70% Mafic) frosted grains. w/ sparse boulders of Quartzite. (8" max). Sed. is dry w/ mod rxn w/ HCl (well sorted) • Note: 4"-6" beds of v.c. clean Sand of BsH. dominant mat'l.	194.5-195.0': Soil Grab RCT ≤ Bkgrnd.
197.5	Grab	I-079 BITDP9 BITF43		197.5'-198.5': Sand (S) sub-rnd v.c. Sand v. well sort. ~~(80% Mafic)~~ 4-9-08 (80% Mafic) 198.5'-200': Sand (S) sub-rnd f-v.c. sand, 60% Mafic, frosted grains w/ 10% rounded f-m. pebbles of BsH > Qtzite.	197'-197.5': Soil Grab RCT: ≤ Bkgrnd. 199.5-200': Soil Grab RCT: ≤ Bkgrnd.
200	Grab	I-080 BITDP10 BITF44		200.0'-202.5': Sand (S) sub-rnd. f-v.c. sand 60% Mafic w/ 10% rounded m-pebs of metamorphics. * sed. is Dry, mod rxn w/ HCl	IH: no detect.
202.5	Grab	I-081 BITDP11 BITF45		202.5'-205': Sand (S) ~~sub-rnd sed. similar to above interval~~ 4-9-08 sub-rnd-subang. m-v.c. Sand (70% mafic), frosted grains w/ 10% c. rounded pebbles. of BsH > Qtzite, > Metamorphics. Sed. is dry w/ mod rxn w/ HCl	202'-202.5': Soil Grab RCT ≤ Bkgrnd

Reported By: A. Lantow | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: Aaron Lantow | Date: 4/8/08 | Signature: LD Walker | Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 4-8-08/4-9-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 crib

Project: 216-A-30 crib Investigation. | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
205	Grab	I-082 ~~BITFR2~~ BITF46 BITDR2		205'-207.5' Sand, f.-v.c. sub-round Sand. 70% Mafic, 10% Bslt dominant m. pebs. sub-round. Dry, w/ mod. rxn w/ HCl • 206.5 Sandy Gravel bed (sG) of rounded 2% c.-vc. pebs of Bslt>Qtz.>Metamorphics.	204.5-205: Soil Grab RCT: ≤ Bkgrnd
207.5	Grab	I-083 BITDR3 BITF47		207.5'-210.0': Gravely Sand (gS) vc. Sand sub-rnd-sub-ang. (60% Mafic) sand, w/ 30-40% round-well-round gravel of Bslt>Qtz.>metamorphics. Gravel is sub-well-rnd c. cobbles-boulders 8" max. (30%G, 70%S) mod rxn w/HCl, Dry sediment.	207-207.5: Soil Grab RCT: ≤ Bkgrnd
210	Grab	I-084 BITDR4 BITF48		210.0'-212.5': Gravel (G) sub-rnd m. pebs-boulders (9" max) of Bslt>Qtzite>metamorphics w/ 10%-15% Sand. (70% Bslt, to 30% Felsic) mod. rxn w/ HCl, consolidated. matrix fixed to clasts. Sed. is dry.	209.5-210': Soil Grab RCT ≤ Bkgrnd.
212.5	Grab	I-085 BITDR5 BITF49		212.5'-215': Gravely Sand (gS) sub-rnd-subang. f-vc. Sand of 70% Mafic comp. w/ 10-20% sub-rnd. m-vc. pebs of mixed lithology. Bslt>Qtz>metamorphics. mild rxn w/ HCl sed. is dry.	212-212.5: Soil Grab RCT: ≤ Bkgrnd no removable, no ∝ w/ PAM
215	Grab	I-086 BITDR6 BITF50		215'-217.5': Gravely Sand (gS) sub-rnd. m-vC Sand of 50% Mafics w/ 20% m. pebs.-large. cobbles of Bslt>Qtz>Meta. Dry, mod. rxn w/ HCl (80% S, 20% g)	214.5-215.0': Soil Grab RCT: ≤ Bkgrnd (w/ GM)
217.5	Grab	I-087 BITDR7 BITF51		217.5'-220': Gravely Sand (gS) sub-rnd m-vc. Sand of 40%-50% Mafic content w/ 20% m. pebs.-small cobs of Metamorphics>Bslt>Qtz. mod. rxn w/HCl (80% S, 20% g)	217-217.5': Soil Grab RCT ≤ Bkgrnd no removable
220	Grab	I-088 BITDR8 BITF52		220'-222.5': Gravely Sand (gS) sub-rnd f.-v.c. Sand of 40% Mafics-35% Mafics, w/ 10-15% sub-rnd. v.c. Pebbles. of ~~Bslt>Metamorphics>Qtz~~ Metamorphics>Qtz.>Bslt., Sed. is dry. w/ mild rxn w/ HCl	219.5-220': Soil Grab RCT: ≤ Bkgrnd
222.5	Grab	I-089 BITDR9 BITF53		222.5'-225.0': Gravely Sand (gS) sub-rnd f-vc. sand of 30% Mafics w/ 10-15% sub-rnd m. pebs. of Metamorphics>Qtz>Bslt.	222.0'-222.5' bgs: Soil Grab RCT ≤ Bkgrnd (w/ G-M)

Reported By: Aaron Lantow | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Aaron Lantow | Date: 5-15-08 | Signature: LD Walker | Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

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Date: 4-9-08 / 4-10-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 crib, SW of W.T.P.

Project: 216-A-30 crib Investigation | Reference Measuring Point: Ground Surface

Depth (FL)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
225	Grab	I-09D ~~BITDT~~ BITDT0 BITF54		225'-227.5': Gravelly Sand (gS) 15%g, 85%S sub-ang.-sub-rnd. m.-v.c. sand of 35% Mafic lith. w/ 15% sub-rnd. m-v.c. pebs. of Metamorphics > Bslt. Sed. is dry w/ mild rxn w/ HCl	224.5-225: Soil grab RCT: ≤ Bkgrnd
227.5	Grab	N 4-9-08 I-~~09~~ BITDT1 BITF55		227.5-230': Gravelly Sand (gS) 15%g, 85%S sub-rnd.-subang. f.-v.c. Sand (60% Mafic) w/ 10% sub-rnd. m. cobbs. of Bslt. > Metamorphics & spars 10" max diameter boulders of Qtzite > Metamorphics. Sed is Dry w/ mild rxn w/ HCl	227.0-227.5: Soil Grab ~~228.0-227.5~~ RCT ≤ Bkgrnd IH: no detect v.o.
230	Grab	I-092 ~~I-093~~ BITDT2 BITF56		230'-232.0' Gravelly Sand (gS) 25%g, ~~75%~~ 75%S sub-angular m-vc. sand (60% Mafic) w/ 25% Granite v.f. pebs - s. Cobs. of Metamorphics > Bslt > Qtz. Sed is slightly moist w/ v. mild rxn w/ HCl	229.5-230': Soil Grab RCT ≤ Bkgrnd
232.5	Grab	I-093 ~~I-094~~ BITDT3 ~~BITF55~~ BITF57		232.0'-235.0': silty sandy Gravel (msG) 10%m, 20%S 70%G, matrix is 10YR 3/4 v. dark grayish brown silt & f-v.c. sand (40% Mafic) w/ sub-rnd. v.f. pebs - v. lrg. cobs. of Bslt > Meta. > Qtz. sed. is moist. w/ no rxn to HCl. cemented w/ matrix attached to clasts.	232-232.5': Soil Grab RCT ≤ Bkgrnd. Poorly sttd.
235	Grab	I-094 ~~I-095~~ BITDT4 BITF58		235'-237.5': silty sandy Gravel (msG) 10%m, 20%S, 70%G. · Sed. is similar to above. Cobbles increase to 6" Boulders of Qtzite > Metamorphics > Bslt	234.5-235: Soil Grab no RCT available
237.5	Grab N 4-10-08	I-095 BITDT6 ~~BITF58~~ BITF59		237.5'-238': silty Sandy Gravel (msG) sed. is similar to 232.0'-235.0' interval. 238.0'-240': silty sandy Gravel (msG) 20%m, 40%S, 40%G. Matrix is 2.5Y 4/1 gray silty sand w/ f-m sand. in sub-rnd-subang. f. pebs - 6" boulders of Bslt. sed. is moist, no rxn. w/ HCl. (overall 80% Bslt)	237-237.5': Soil Grab no RCT available Sulfur smell.
240	Grab	I-096 BITDT6 BITF60 BITDT7		240'-242.5': silty Sandy Gravel (msG) sed. is similar to above. Bslt. > Metamorphics. "like above."	239.5-240': Soil grab RCT: ≤ Bkgrnd. IH: no detect. v.o.
242.5	Grab N 4-10-08	I-097 ~~BITDT8~~ BITF61		242.5'-245': bgs. Silty Sandy Gravel (msG) sed. is similar to 238'-240' interval.	241.5-242: Soil Grab RCT: ≤ Bkgrnd w/ G-M.

Reported By: A. Lantow | Reviewed By: L. D. Walker

Title: Geologist | Title: Geologist

Signature: Aaron Lantow | Date: 4/10/08 | Signature: LD Walker | Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 14 of 16
Date: 4-10-08/4-10-08

Well ID: C5941 | Well Name: -NA- | Location: 216-A-30 crib, S.W. of WTP
Project: 216-A-30 crib, S.W. of WTP Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
245	Grab ~~A1 4-10-08~~	BITDT8 I-098 ~~BITDT9~~ BITF62 BITDT9		245.0'-247.5': Sandy Gravel (sG) 20% S, 80% G. Matrix is F.-M. sand in sub-ang.-sub-rnd. vf. pebs - large cobs. of Qtzite > metamorphics > Bslt. max clast size is 5". Sed. is dry, w/ no rxn w/ HCl	244.5'-245.0': Soil Grab RCT ≤ Bkgrnd
247.5	Grab ~~A1 4-10-08~~	I-099 ~~BITDT~~ ~~BITDV6~~ BITF63		247.5'-250': Sandy Gravel (sG) 10-15% S, 80% G. Matrix is v.f.-m. felsic sand in sub-angular-angular vf. pebs - l. cobbles. of Bslt > Qtzite > metamorph. matrix fixed to clasts w/ oxide orange + Tan. no rxn w/ HCl Poorly Srtd. Matrix supported.	247'-247.5': bgs. Soil Grab. RCT ≤ Bkgrnd.
250	Grab	I-100 BITDV0 BITF69		250'-251.5': Sandy Gravel (sG) sed. is similar to above interval.	249.5-250': Soil Grab RCT: ≤ Bkgrnd.
		BITDV1		251.5'-255. Sandy Gravel (sG) 10% S 90% G Matrix is ang. felsic sand f-m. sand in vf. pebs - 10" boulders, sub-rnd - angular, of Qtzite > Felsic volcanics > Metamorphics > Bslt. Sed. is Clast suported, dry w/ slight rxn w/ HCl lots of f. dust from ground matl. by drilling.	
252.5	Grab ~~A1 4-11-08~~	I-101 ~~BITDV2~~ BITF65			252-252.5': Soil Grab RCT ≤ Bkgrnd.
					254.5-255': Soil Grab RCT ≤ Bkgrnd.
255	Grab	I-102 BITDV2 BITF66		255'-257': Sandy Gravel (sG) sed. similar to above	
				257.5'-257.5': silty Sandy Gravel (sG) 30% S ~~60%~~ G (M.S.G. 10% M, Poorly srtd. Matrix is sub-angular to vC Sand (40% Mafic) in sub-rnd - sub ang. v.f. pebs - small cobbles. of Metamorph > Bslt. Sed. is moist, HOY 5Y 3/2 Drk. olive Gray. Mild rxn. to HCl	
257.5	Grab	I-103 BITDV3 BITF67		257.5'-259.5': Sandy Gravel ~~(sG)~~ (SG) sed. similar to interval 251.5'-255'.	257-257.5': Soil Grab RCT: Bkgrnd
260	Grab	I-104 BITDV4 BITF68		259.5'-262.5': Sandy Gravel (sG) 60% S, 30% G. Matrix is v.f.-vC. sand (angular) ~~to~~ / sub-rnd - round vf. pebs - vC. pebs. of Felsics > Mafics. of Schist, Qtzite, > Bslt. sand is 80% c-vC sub ang. grains of Bslt + 20% m-vf. Felsics. 264.5 - A1 4-10-08	259.5-260': Soil Grab RCT: ≤ Bkgrnd.
262.5	Grab	I-105 I-105 BITDV5 BITF69		262.5'-265': Sandy Gravel (sG) sediment is similar to above interval	262.5'-263': Soil Grab. RCT ≤ Bkgrnd.

Reported By: A. Lanton | Reviewed By: L.D. Walker
Title: Geologist | Title: Geologist
Signature: Aaron Lanton | Date: 4/10/08 | Signature: LD Walker | Date: 5/15/08

A-6003-642 (03/03)

BOREHOLE LOG

Page 15 of 16
Date: 4-10-08 / 4-21-08

Well ID: C6941 | Well Name: -NA- | Location: 216-A-30 crib, S.W. of W.T.P.

Project: 216-A-30 crib Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description: Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl	Comments: Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level
265	Grab	I-106 BITDV6 BITF70		264.5' 265-267.5': Sandy Gravel (SG) 40%S/60%G. Matrix is f.-vc. angular Sand (Mafic dominant) w/ f.m.-vc. pebs. of Bslt>Felsics. ~~no metamorphics~~ Sed. is dry. w/ sparse 6" boulders. AL 4-10-08 20-30% AL 4-10-08	264.5-265': Soil Grab RCT ≤ Bkgrnd
267.5	Grab	I-107 BITDV7 BITF71		267.5-270': Sandy Gravel (SG) ~~35%S~~, 65%G Matrix is f.-vc. angular sand (Mafic dominant.) w/ round-sub-round. m-pebs - l. cobbs. of Bslt>Qtzite> Metamorphics>Granitoids. ~~Sed is dry~~ w/ sparse 6" round boulders. no rxn w/ HCl sed is slightly moist	267-267.5: Soil Grab RCT ≤ Bkgrnd AL 4-10-08 269.5-270: Soil Grab
270	Grab	I-108 BITDV8 BITF72		270-272.5': Sandy Gravel (SG) sediment is similar to above interval. w/ mild rxn w/ HCl	RCT ≤ Bkgrnd
272.5	Grab	I-109 BITDV9 BITF73		272.5-274': Sandy Gravel (SG) 85%G, 15%S Matrix is m-vf. angular sand 60%-70% Felsic 4-cl/OT wish in subrnd.-subang. m.-v.c. pebs. Bslt>Metamorphics Dry.* silty (10%S) AL 4-14-08	272-272.5: Soil Grab RCT ≤ Bkgrnd 272.5-275.5: Soil Split spoon vOts. from top of #2 sleeve.
275	I-110 BITDV10, BITDV11, BITDV12, BITDV13, BITDV14, BITDV15, BITDV16			274-275.5': Gravelly Sand (gS) ang. m-vc. Mafic dominant Sand w/ m-f.-m. pebs of Bslt>Metamorph Gravel content decreases from 85%G → 10%G w/ depth. moist*, silt (10%) in nodules 2.5YR 7/3 pale yellow.	
				275.5-277.5': Sandy Gravel (sg): 275.5-276.5' sed. is similar to 267.5-270' interval. AL 4-15-08	
277.5				276.5'-278.5' Silty Sand (mS) 40%m, 60% S. sand is angular f.-vc. grained of Mafics. ~~w/ minor~~ felsics. Color is: 2.5Y 7/3 lt. olive brn. moist. AL 4-15-08	• Moisture fluctuating b/n slightly moist - moist every 6"
280				277.5-280.5': Sandy Gravel (SG) 50%S, 50%G (10%m) angular-subang. felsic dominant m-vc. sand w/ vf. pebs - m. pebs, rounded. of Bslt>Qtzite>Docite (purple) crystalline w/ 5-10% sandy silt nodules 4" max. sed is moist to slightly moist @ 280'	
				280-282.5': Sandy Gravel (SG) 60%G, 40%S, <10%m ang.-subang. fels. dominant f.-vc. sand matrix w/	
282.5	Grab	I-150 BIV9Y7 (x2)		vf.-vc. pebs. of Mafics, granitoids>metamorphic, Dry. white fine crystalline coating on some clasts. 282.5-285': Sandy Gravel (SG) 40%G, 60%S, 20%m Dk gray yellowish, weathered flag., Sed. similar to above w/ >% of silt. w/ sparse 10" boulder moist	Soil Grab: 282-282.5 BIV9Y7 (x2); RCT ≤ Bkgrnd

Reported By: A. Lantow		Reviewed By: L.D. Walker	
Title: Geologist		Title: Geologist	
Signature: Aaron Lantow	Date: 4/21/08	Signature: L.D. Walker	Date: 5/15/08

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BOREHOLE LOG

Page 16 of 16
Date: 4-21-08

Well ID: 1594 | Well Name: -Nt- | Location: 216-A-30crib, S.W. of W.T.P

Project: 216-A-30crib, Investigation | Reference Measuring Point: Ground Surface

Depth (Ft.)	Sample Type No.	Sample Blows Recovery	Graphic Log	Sample Description (Group Name, Grain Size Distribution, Soil Classification, Color, Moisture Content, Sorting, Angularity, Mineralogy, Max Particle Size, Reaction to HCl)	Comments (Depth of Casing, Drilling Method, Method of Driving Sampling Tool, Sampler Size, Water Level)
285	Grab	I-151 BIV9Y8 (x2)		285.0'-287.5: ~~Silty Sandy~~ Gravel (G~~S~~G) 10%m	Soil Grab: 284.5-285.0'
	Split Spoon I-SS-001	BIVB27 BIVB28 BIVB29 BIVB30 (x4) BIVB31		60% 40%S, 70%G. silty angular m-vC. sand (70% Felsic)	BIV9Y8 ≤ Bkgrnd.
				in rounded. f-m. Felsic dominant pebbles. (round-sub round)	285-287.9': Soil Split Spoon
				silt color is: 7.5YR 5/3 Brown	RCT: ≤ Bkgrnd. B,Y w/GM
				Sed is wet. (5%m, 15%S, 80%G) "Gravel"	Top of #2 Iexan sleeve @ 286.0' bgs.
287.5				First signs of free water @ 285'	α: ≤ Bkgrnd w/PAM. *
	Grab	I-152 BIV9Y9		287.5-290.0': Sandy Gravel (SG) Just Gravel (G)	287-287.5': Grab
				10%S, 90%G. m-vC. angular Felsic dominant sand in	I-152, HES # BIV9Y9 (x2)
				sub rnd-subang. Mafic rich vf.-m pebs. of Bslt > Qtz >	
				Metamorphics w/ sparse Dacite. Sed. is wet.	
290	Grab	I-0153 BIVB00 BIVB00		sparse small cobbles.	289.5'-290': Soil Grab
				290.0-292.5': Gravel (G) 10%m 10-15%S, 90%G.	BIVB00, BIVB00
				silty sand matrix of vf-vC. sand in vf-m. pebbles (sub rnd)	
				of Felsics > Mafics.	
292.5	Grab	I-154 BIVB01 BIVB01		292.5-295.0': Gravel (G) 10%m 10-15%m, 20%S, 80%	292-292.5': Soil Grab
				Gravel. ~~f-m.~~ angular felsic dominant Sand	HES # BIVB01, BIVB01
				w/ 10% gray silt as matrix in vf-vC. pebbles. (sub	
				rounded) of Metamorphics > Bslt. ~~Gravely Silt~~ (gM)	
				294.5-294.8': Dark gray ~~Silty Gravel~~	
295	Grab	I-155 BIVB02 BIVB02		295 50% Gravel; Color: 2.5YR 4/1 Gray.	294.5-295': Soil Grab.
				294.8-296.5: Gravel (G) 90%G, 10%S.	RCT: ≤ Bkgrnd w/GM
				m-C. angular Graphitic sand matrix in sub rnd-	IA: no detect.
296.5	Water Sample T.D.	I-111	T.D.	well rnd. f-m. pebbles of Metamorphics > Qtz > Bslt.	
					Total Depth 296.5
297.5					296.5: Water Sample
					HES # BIT
					BIV350, BIV351, BIV352
					BIV354 (MS)

Reported By: A. Lantow | Reviewed By: L.D. Walker

Title: Geologist | Title: Geologist

Signature: Aaron Lantow | Date: 4/21/08 | Signature: LD Walker | Date: 5/15/08

A-6003-642 (03/03)

APPENDIX D
GEOPHYSICAL LOG REPORT

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HGLP-LDR-204, Rev. 0

C5941
Log Data Report

Borehole Information:

Borehole:	C5941		Site:	216-A-30 Crib	
Coordinates (WA St Plane)		GWL[1] (ft):	283.75	GWL Date:	04/22/08
North (m)	East (m)	Drill Date	TOC[2] Elevation	Total Depth (ft)	Type
Unknown	Unknown	03/2008	Unknown	300	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Threaded Steel	1.7	10 13/16	9 5/8	19/32	0	178
Threaded Steel	3.8	8 5/8	7 9/16	17/32	0	299

Borehole Notes:

On the ground surface is a 6 to 8-in gravel pad. Borehole is located within a wooden shed. Logger measured casting using a steel tape and rounding to the nearest 1/16-in. The zero reference is the top of the ground surface.

This borehole was logged over several days. The first logging event occurred on 3/20/08, which a maximum logging depth achieved was 89.0 ft. The second logging event occurred on 4/03/08, which a maximum logging depth achieved was 180.0 ft. The third logging event occurred on 4/22/08, which a maximum logging depth of 300 ft. was achieved.

Logging Equipment Information:

Logging System:	Gamma 4 L		Type: Serial No.:	SGLS HPGe (60%) 47TP32211A
Effective Calibration Date:	12/31/07	Calibration Reference:	HGLP-CC-027	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 4 H		Type: Serial No.:	NMLS H310700352
Effective Calibration Date:	11/06/07	Calibration Reference:	HGLP-CC-021	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Logging System:	Gamma 4 H		Type: Serial No.:	PNLS H310700352
Effective Calibration Date:	None Required	Calibration Reference:	None Required	
		Logging Procedure:	HGLP-MAN-002, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 Repeat	7	8 Repeat	13
Date	03/20/08	03/20/08	04/03/08	04/03/08	04/22/08
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	0.0	15.0	87.0	105.0	177.0
Finish Depth (ft)	89.0	25.0	180.0	115.0	300.0
Count Time (sec)	100	100	100	100	100
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N

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Log Run	1	2 Repeat	7	8 Repeat	13
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	DL201CAB	DL201CAB	DL231CAB	DL231CAB	DL291CAB
Start File	DL201000	DL201090	DL231000	DL231094	DL291000
Finish File	DL201089	DL201100	DL231093	DL231104	DL291123
Post-Verification	DL201CAA	DL201CAA	DL231CAA	DL231CAA	DL291CAA
Depth Return Error (in.)	N/A	N/A	N/A	Low 1	N/A
Comments	No fine gain adjustment made.	Repeat section.	No Fine gain adjustment made.	Repeat section.	Fine gain adjustment made after files 72 and 83

Log Run	14 Repeat				
Date	04/22/08				
Logging Engineer	Spatz				
Start Depth (ft)	177.0				
Finish Depth (ft)	300.0				
Count Time (sec)	100				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
ft/min	N/A				
Pre-Verification	DL291CAB				
Start File	DL291124				
Finish File	DL291139				
Post-Verification	DL291CAA				
Depth Return Error (in.)	3 Low				
Comments	Repeat section.				

Neutron Moisture Logging System (NMLS) Log Run Information:

Log Run	3	4 Repeat	9	10 Repeat	15
Date	03/20/08	03/20/08	04/04/08	04/04/08	04/22/08
Logging Engineer	Spatz	Spatz	Pearson	Pearson	Pearson
Start Depth (ft)	0.0	15.0	87.0	140.0	177.0
Finish Depth (ft)	88.50	25.0	180.0	150.0	277.0
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
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	DHC42CAB	DHC42CAB	DHC72CAB	DHC72CAB	DHD22CAB
Start File	DHC42000	DHC42355	DHC72000	DHC72373	DHD22000
Finish File	DHC42354	DHC42395	DHC72372	DHC72413	DHD22400
Post-Verification	DHC42CAA	DHC42CAA	DHC72CAA	DHC72CAA	DHD22CAA
Depth Return Error (in.)	N/A	0	N/A	1 Low	N/A
Comments	None	Repeat section.	None	Repeat section.	None

Log Run	16	17 Repeat			
Date	04/22/08	04/22/08			
Logging Engineer	Pearson	Pearson			

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Log Run	16	17 Repeat			
Start Depth (ft)	277.25	272.0			
Finish Depth (ft)	283.0	283.0			
Count Time (sec)	15	15			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	0.25	0.25			
ft/min	N/A	N/A			
Pre-Verification	DHD22CAB	DHD22CAB			
Start File	DHD22401	DHD22425			
Finish File	DHD22424	DHD22469			
Post-Verification	DHD22CAA	DHD22CAA			
Depth Return Error (in.)	N/A	2 Low			
Comments	Changed Directory	Repeat section			

Passive Neutron Logging System (PNLS) Log Run Information:

Log Run	5	6 Repeat	11	12 Repeat	18
Date	03/20/08	03/20/08	04/04/08	04/04/08	04/22/08
Logging Engineer	Spatz	Spatz	Pearson	Pearson	Pearson
Start Depth (ft)	0.0	15.0	87.0	140.0	177.0
Finish Depth (ft)	89.0	25.0	180.0	150.0	283.0
Count Time (sec)	60	60	60	60	60
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
ft/min	N/A	N/A	N/A	N/A	N/A
Pre-Verification	DHC52CAB	DHC52CAB	DHC82CAB	DHC82CAB	DHD32CAB
Start File	DHC52000	DHC52090	DHC82094	DHC82094	DHD32000
Finish File	DHC52089	DHC52100	DHC82104	DHC82104	DHD32106
Post-Verification	DHC52CAA	DHC52CAA	DHC82CAA	DHC82CAA	DHD32CAA
Depth Return Error (in.)	N/A	N/A	N/A	1 Low	N/A
Comments	None	Repeat section	None	Repeat section	None

Log Run	19 Repeat				
Date	04/22/08				
Logging Engineer	Pearson				
Start Depth (ft)	283.0				
Finish Depth (ft)	272.0				
Count Time (sec)	60				
Live/Real	R				
Shield (Y/N)	N				
MSA Interval (ft)	1.0				
ft/min	N/A				
Pre-Verification	DHD32CAB				
Start File	DHD32107				
Finish File	DHD32118				
Post-Verification	DHD32CAA				
Depth Return Error (in.)	2 Low				

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HGLP-LDR-204, Rev. 0

Log Run	19 Repeat				
Comments	Repeat section				

Logging Operation Notes:

Data were collected using Gamma 4, HO 68B-3573. A centralizer was installed on the sonde prior to logging. The SGLS pre- and post-survey verification measurements were acquired in the Amersham KUTh-115 field verifier. The NMLS pre- and post-survey verification measurements were acquired in the standard field verifier. The PNLS pre- and post- survey measurements were acquired next to the AmBe source.

Analysis Notes:

Analyst:	Legler/ McCain	Date:	5/7/2008	Reference:	GJO-HGLP 1.6.3, Rev. 0

The SGLS pre- and post-survey verification spectra met the acceptance criteria for the established system, but the verification spectra files DL201CAB, DL291CAB, DL291CAA, and DL231CAA had measurements below the lower control limit for the 1461 keV energy line.

The NMLS pre- and post-survey verification spectra met the acceptance criteria for the established system, but all verification spectra have measurements above the upper control limit for count rate (cps).

Casing corrections for 19/32-in and 17/32-in thick casings were applied during analysis. A water correction was also applied from 283.75 ft to total logged depth of borehole.

SGLS spectra were processed in batch mode in APTEC SUPERVISOR to identify individual peaks and count rates. Concentrations for the SGLS were calculated using an EXCEL template identified as G4LDec07.xls using an efficiency function and corrections for casing dead time and water as determined by annual calibrations.

NMLS spectra were process in batch mode in APTEC SUPERVISOR to identify count rates. NMLS count rates were calculated using an EXCEL template identified as G4HNov07.xls. NMLS data are presented in counts per second (cps), because no calibration data exists for a 95/8-in and 7 9/16-in. borehole casing.

Results and Interpretations:

The only manmade radionuclide detected was Cs-137. Cs-137 was detected intermittently in this borehole at depth of 0 ft, 14 – 19 ft, 25 ft, 36 ft, 41 ft, 43 ft, 187 ft, 282 ft, and 288 ft with the maximum concentration being approximately 2.14 pCi/g at 18 ft. Inspection of the individual spectra at these depths indicate depths 0, 14 –19 ft, and 25 ft had measurable activity above background, and the remaining depths appear to be statistical fluctuations associated with the processing software.

The KUT and Manmade plots indicate good repeat ability. Radon is exhibited in log run 2 (87 – 180 ft) as shown by an elevated 609 keV peak relative to the 1764 keV peak.

Several zones of elevated total gamma with no corresponding manmade radionuclide or variations of natural radionuclides that would be attributed to the higher gamma counts seem to indicate the presence of Sr-90 (McCain, 2002). Three zones of possible Sr-90 contamination were identified using shape factor 2 analysis (SF2), which are 15 – 37 ft, 64 – 73 ft, and 106 – 122 ft.

References:

McCain, R.G. and C.J. Koizumi. 2002. *Correlation of Spectral Gamma Log Response and Sr-90 Concentrations for a Steel-Cased Borehole.* GJO-2002-322-TAR. Prepared by MACTEC-ERS for the Grand Junction Office. Grand Junction, Colorado.

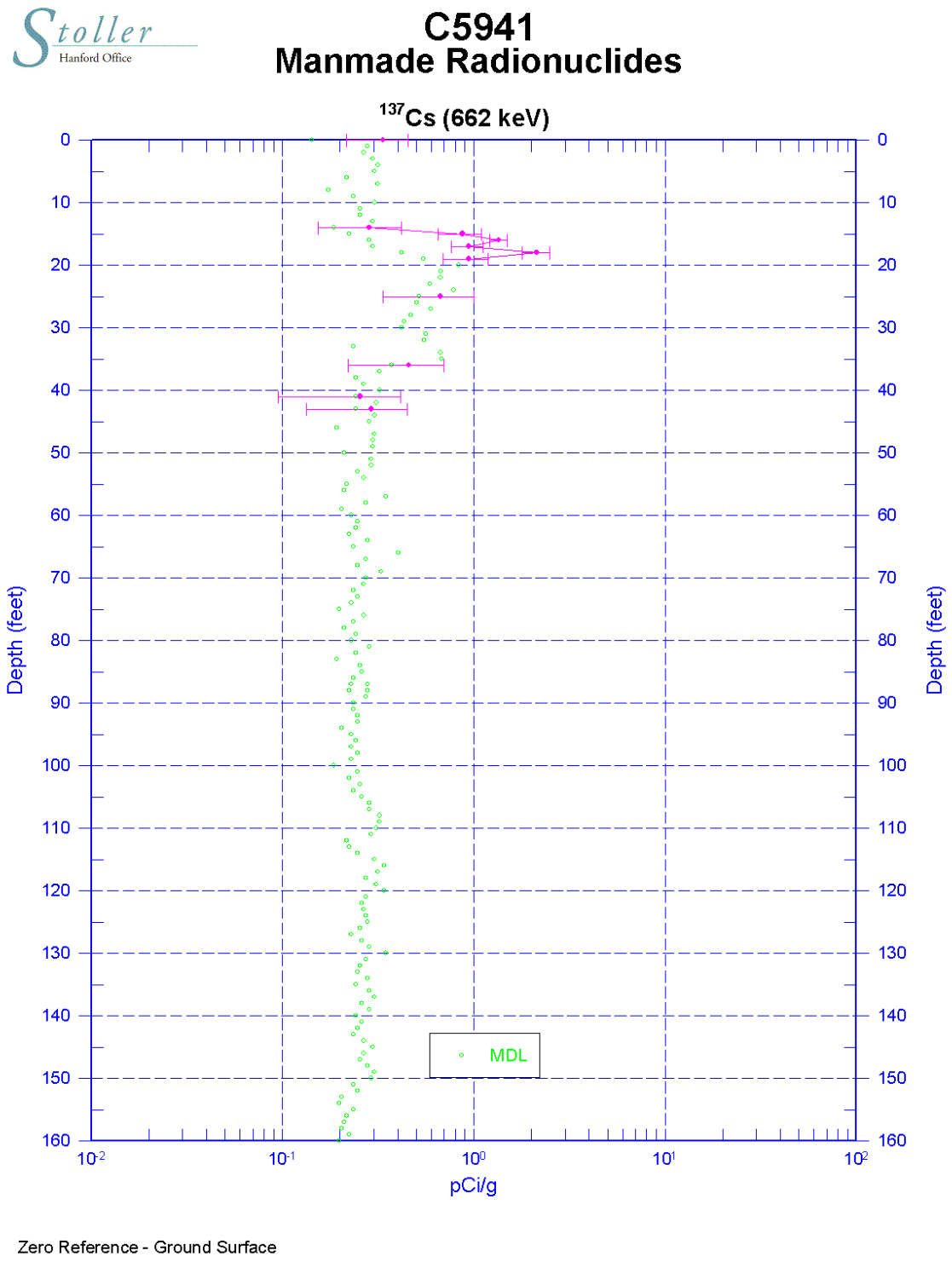
List of Log Plots:

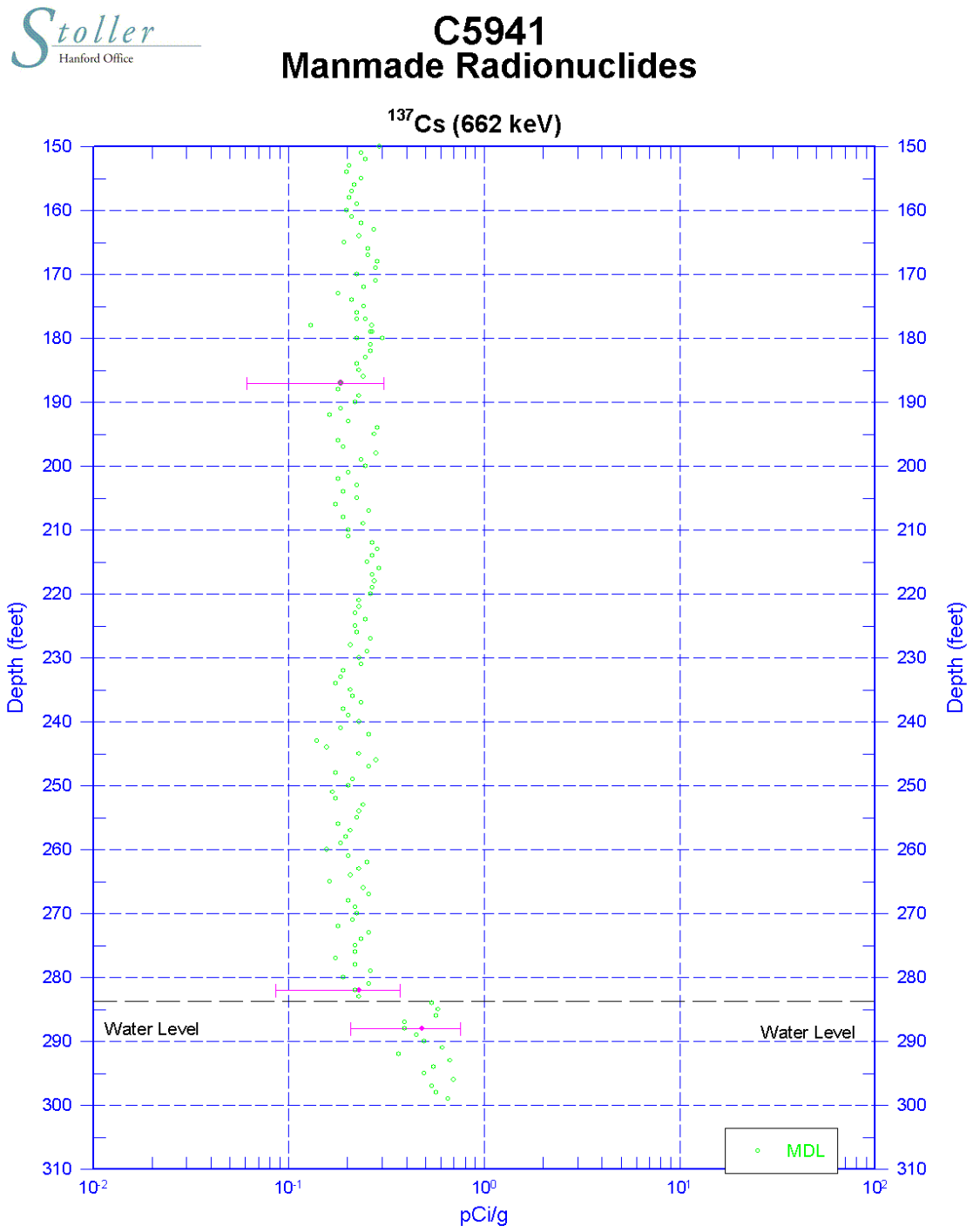
Depth Reference is top of ground surface

Manmade Radionuclides
Natural Gamma Logs
Combination Plots
Combination Plot (0-340 ft)
Total Gamma & Dead Time
Passive Neutron & Moisture
Repeat Section of Manmade Radionuclides
Repeat Section of Natural Gamma Logs
Repeat Section of Moisture

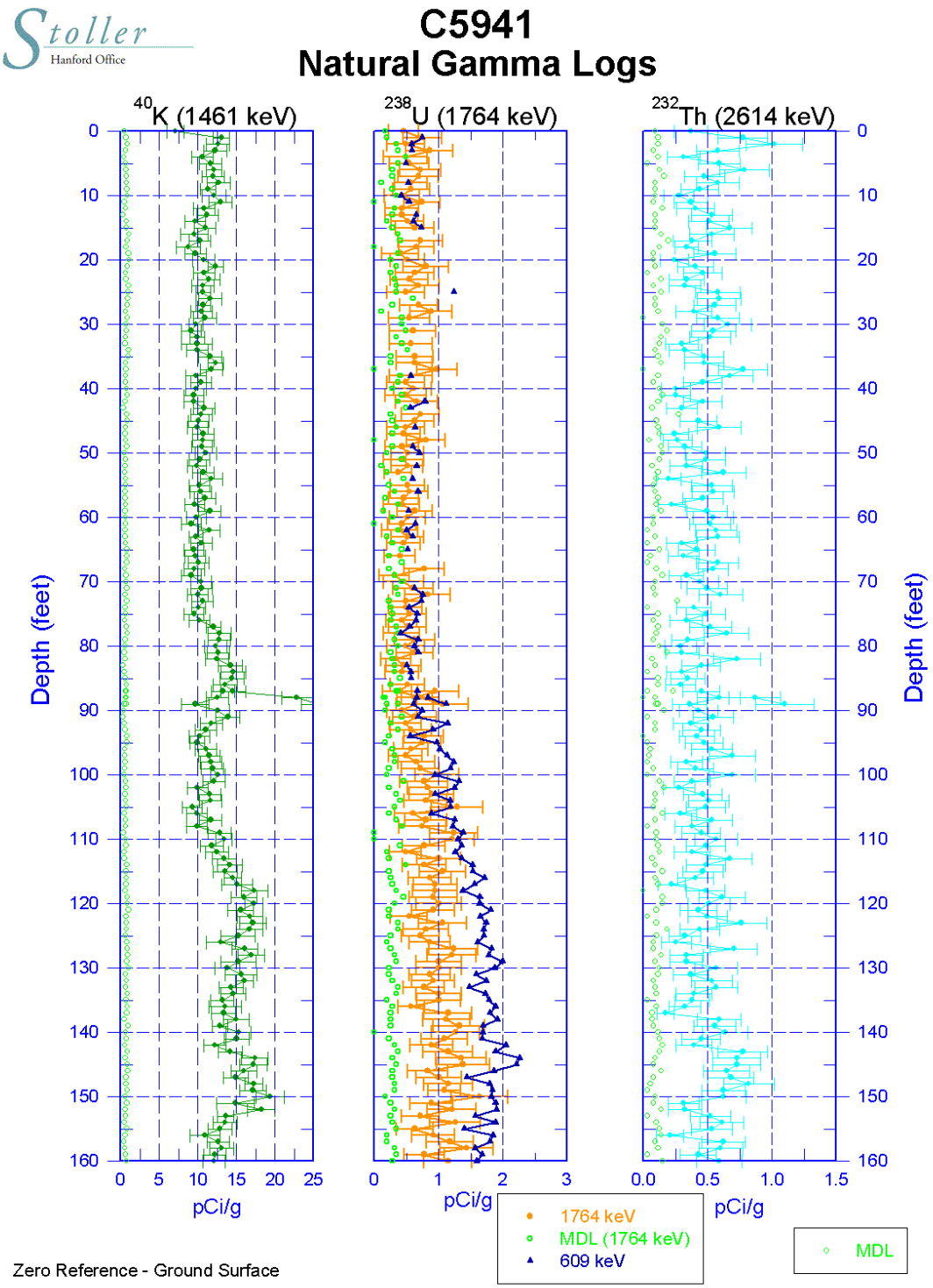
---

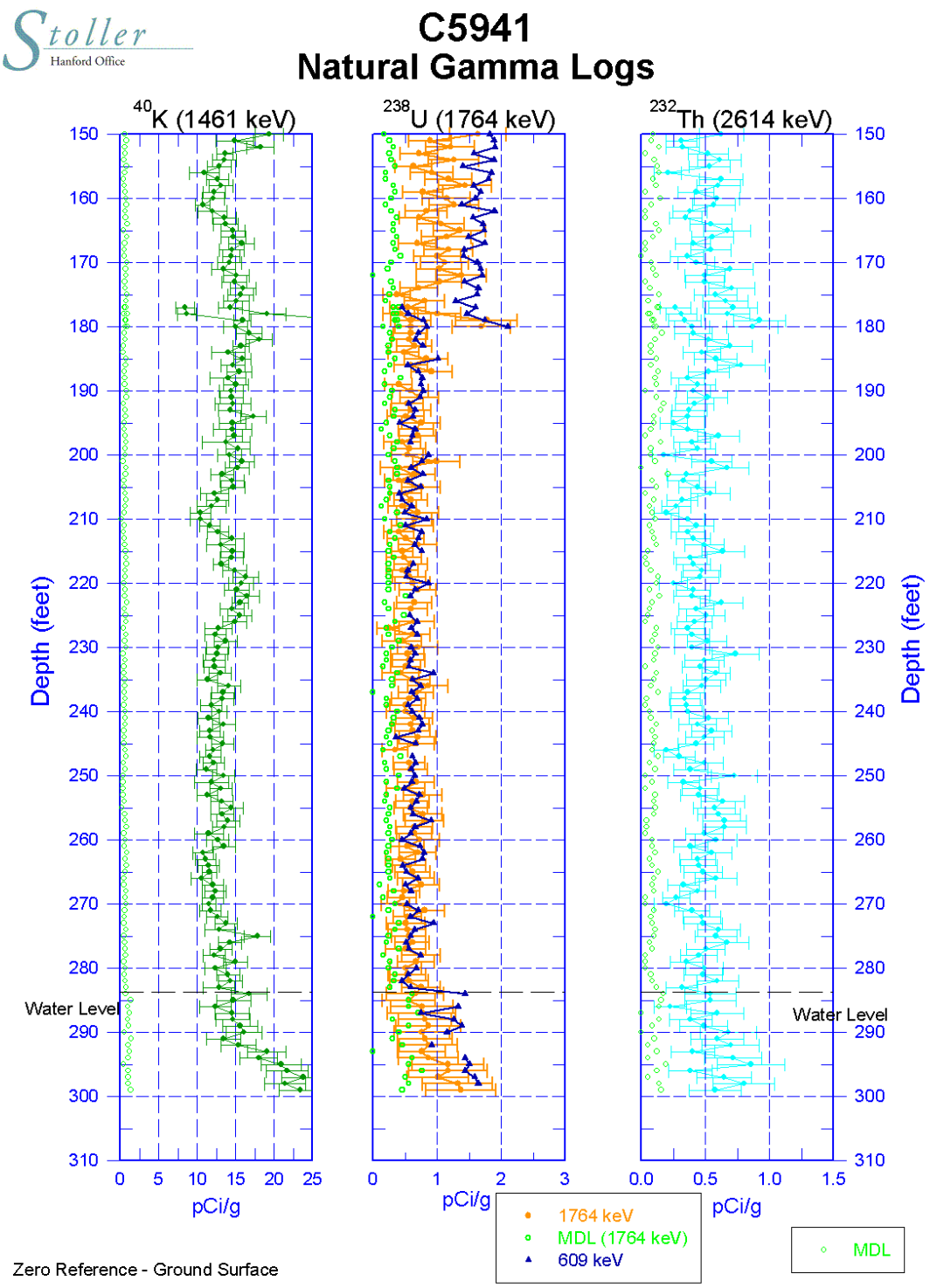
[1] GWL – groundwater level
[2] TOC – top of casing

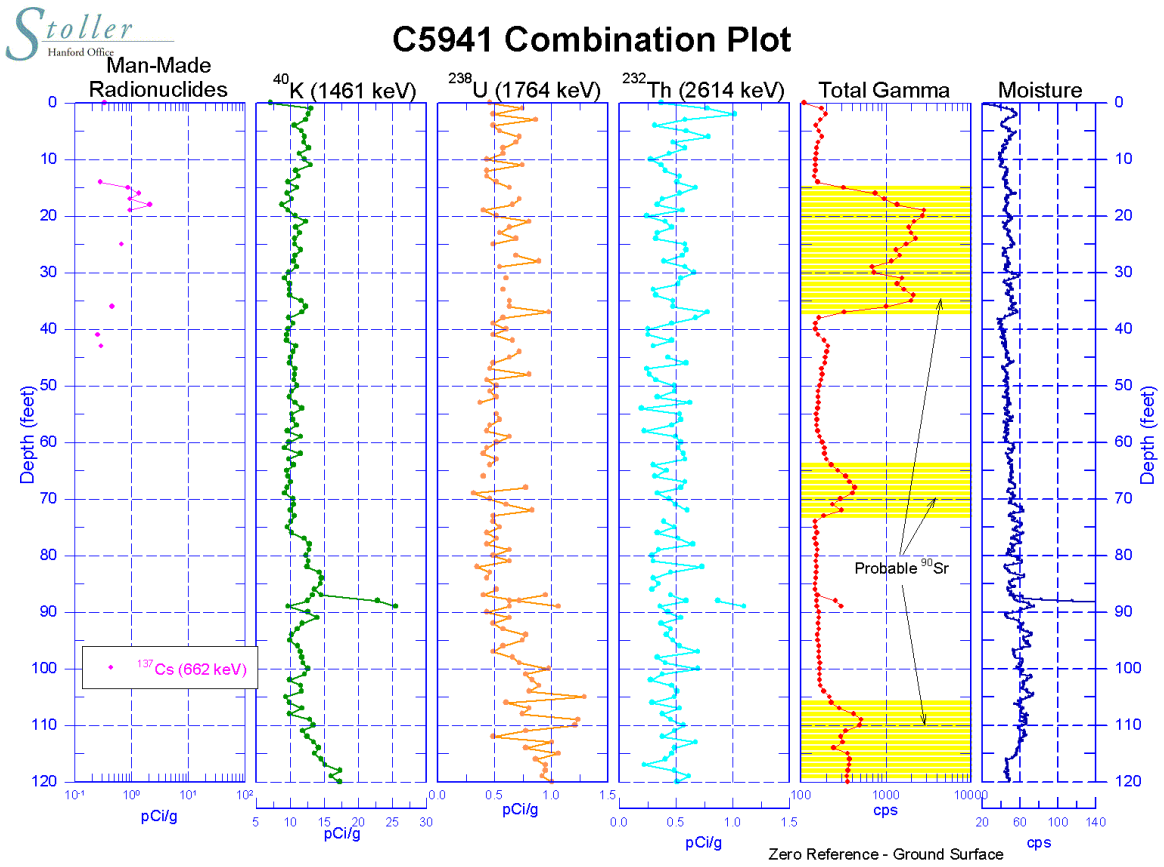

Stoller
Hanford Office
C5941
Manmade Radionuclides
137Cs (662 keV)
Depth (feet)
pCi/g
MDL
Zero Reference - Ground Surface

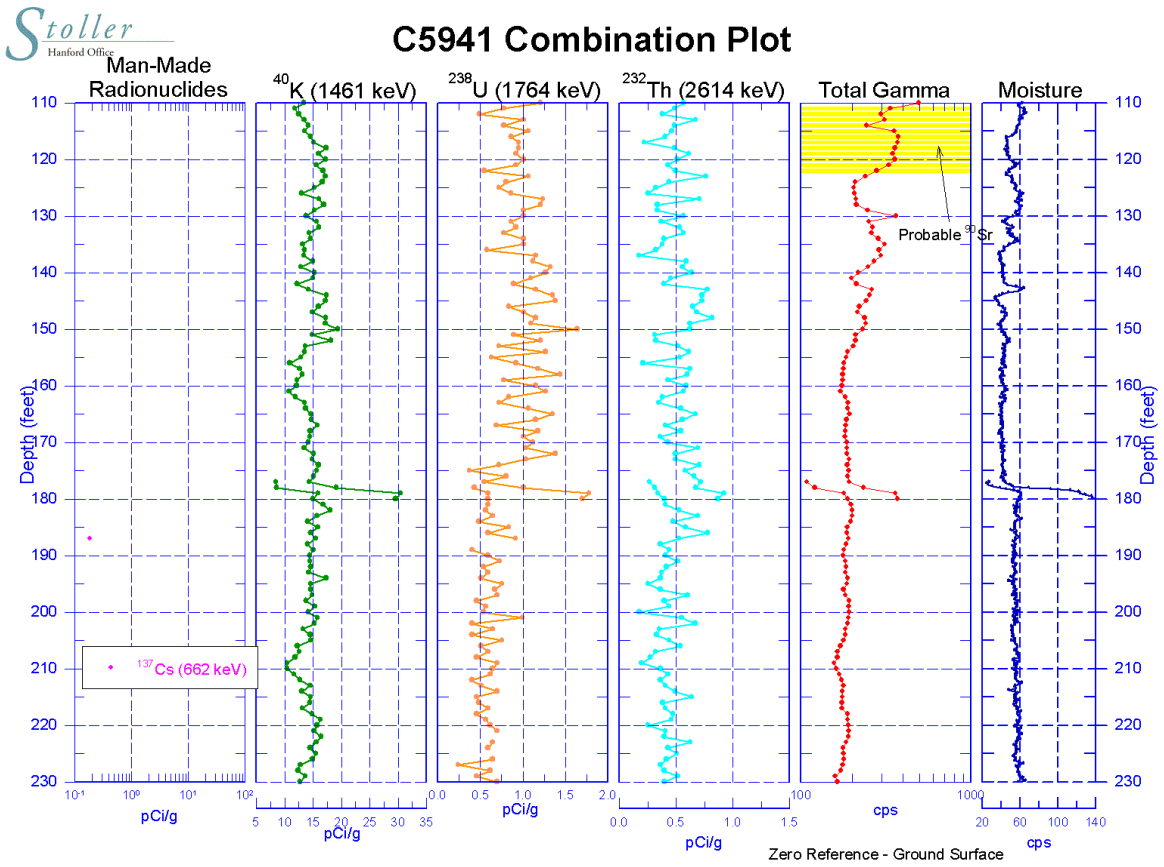


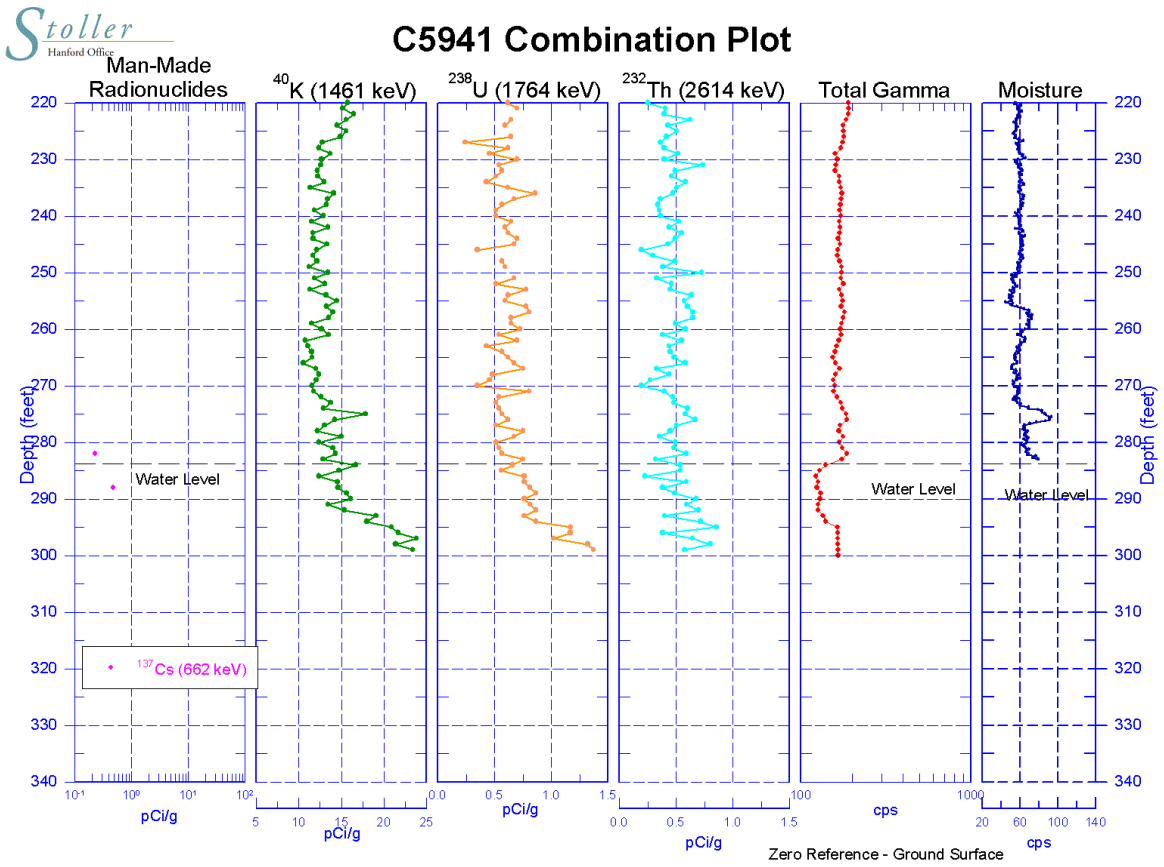
Zero Reference - Ground Surface

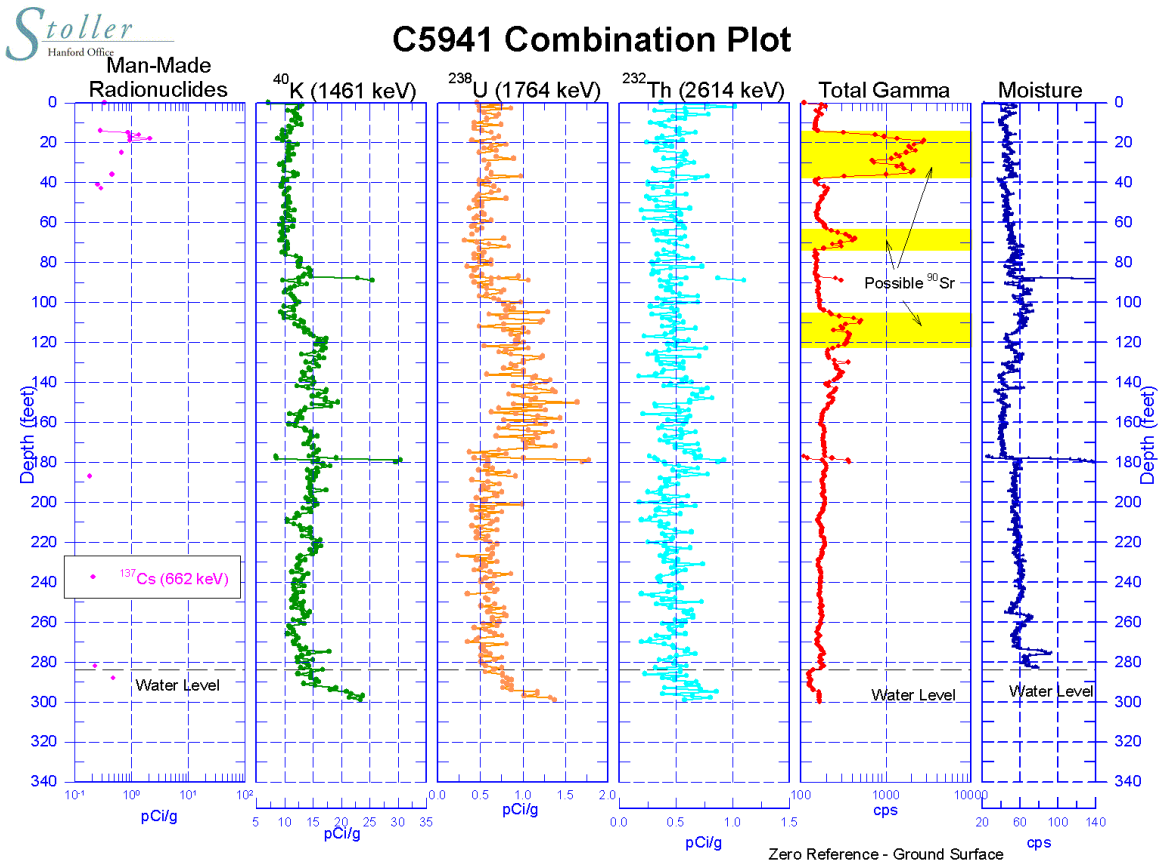

Stoller
Hanford Office
C5941
Natural Gamma Logs
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Depth (feet)
pCi/g
1764 keV
MDL (1764 keV)
609 keV
MDL
Zero Reference - Ground Surface

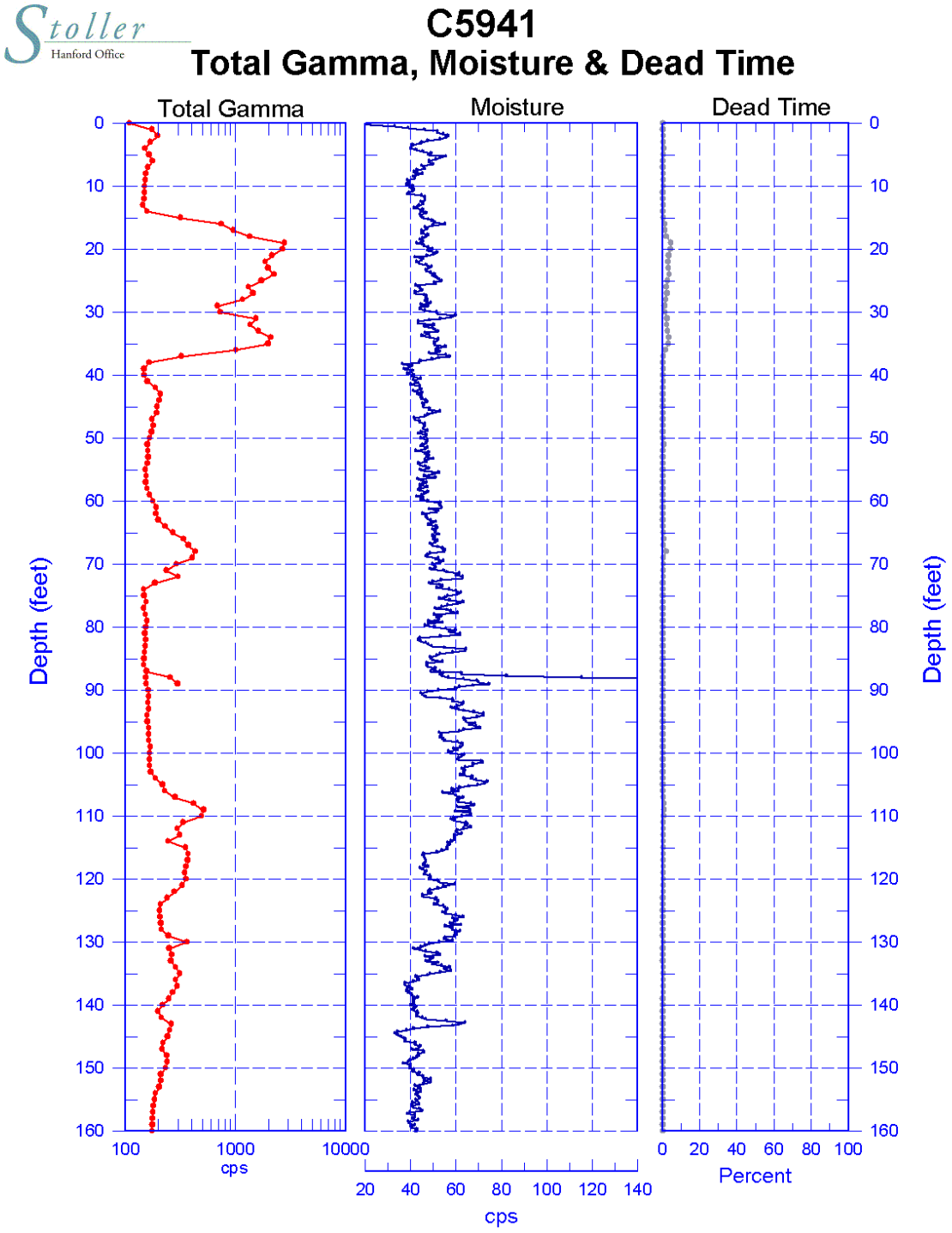

Stoller
Hanford Office
C5941
Natural Gamma Logs
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Depth (feet)
Water Level
pCi/g
1764 keV
MDL (1764 keV)
609 keV
MDL
Zero Reference - Ground Surface

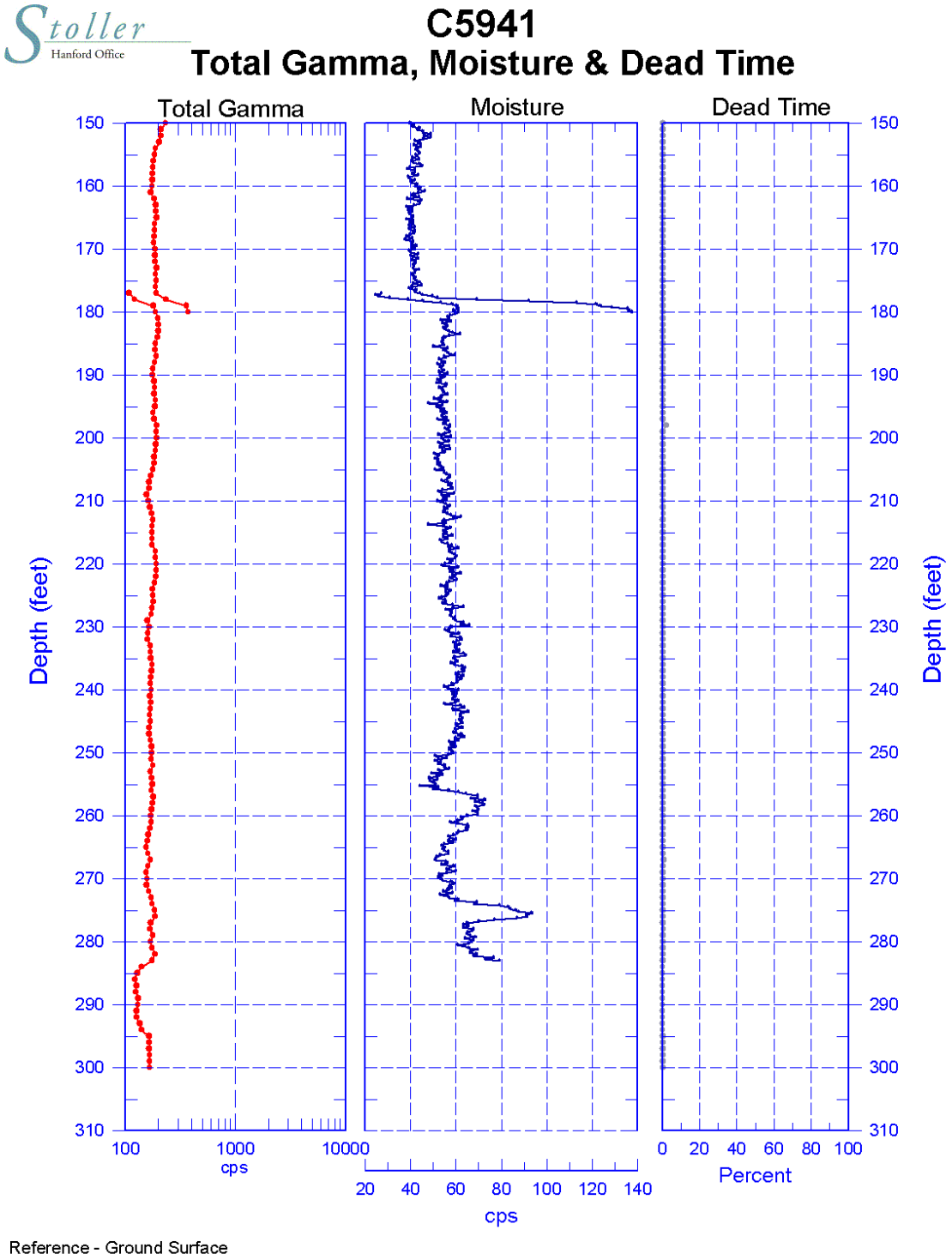

Stoller
Hanford Office
C5941 Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
137Cs (662 keV)
Probable 90Sr
pCi/g
cps
Zero Reference - Ground Surface


Stoller
Hanford Office
C5941 Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
137Cs (662 keV)
Probable 90Sr
pCi/g
cps
Zero Reference - Ground Surface

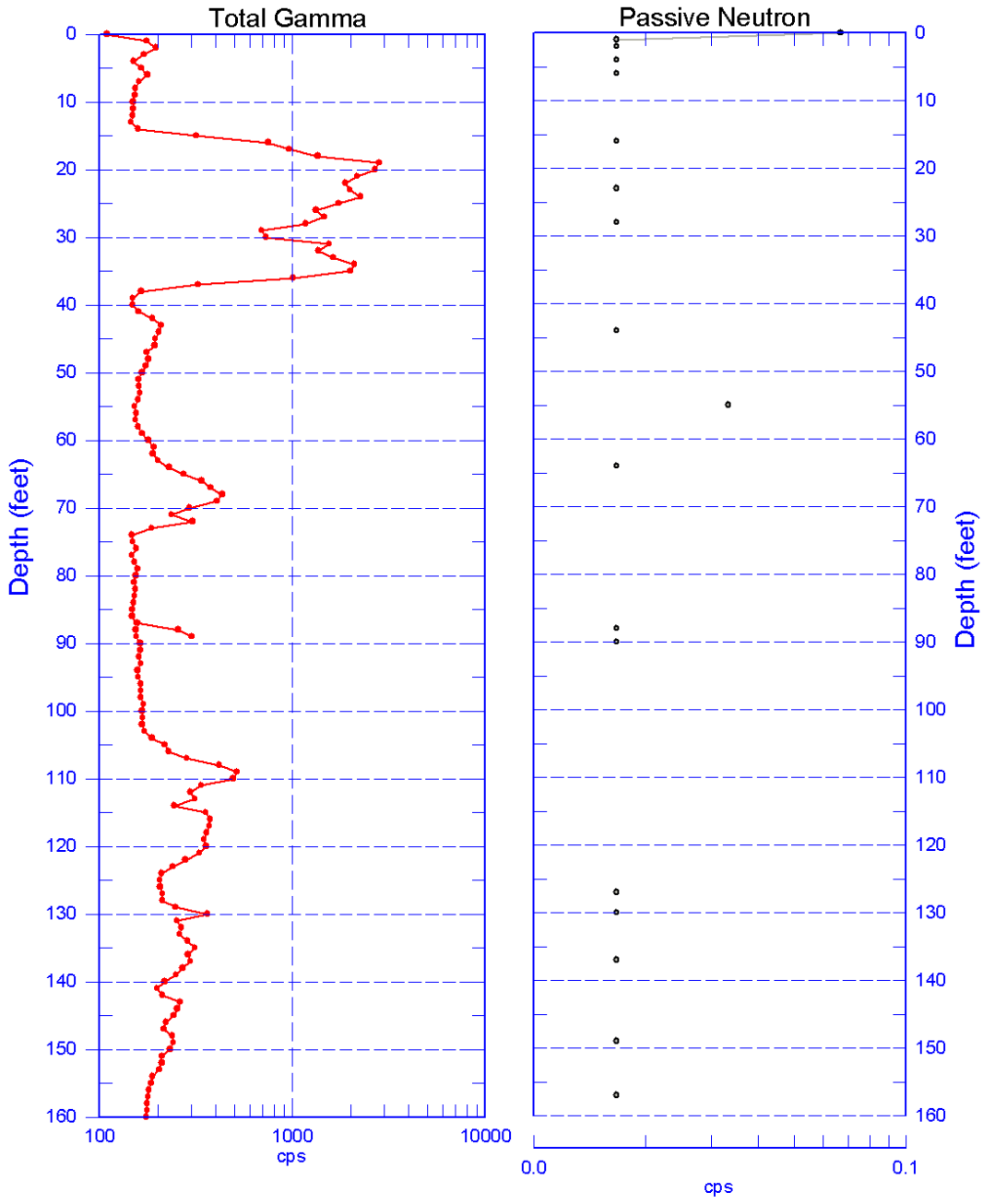

Stoller
Hanford Office
C5941 Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
Water Level
137Cs (662 keV)
pCi/g
cps
Zero Reference - Ground Surface


Stoller
Hanford Office
C5941 Combination Plot
Man-Made Radionuclides
40K (1461 keV)
238U (1764 keV)
232Th (2614 keV)
Total Gamma
Moisture
Depth (feet)
137Cs (662 keV)
Water Level
Possible 90Sr
pCi/g
cps
Zero Reference - Ground Surface


Stoller
Hanford Office
C5941
Total Gamma, Moisture & Dead Time
Total Gamma
Moisture
Dead Time
Depth (feet)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
100
1000
10000
cps
20
40
60
80
100
120
140
cps
0
20
40
60
80
100
Percent
Reference - Ground Surface

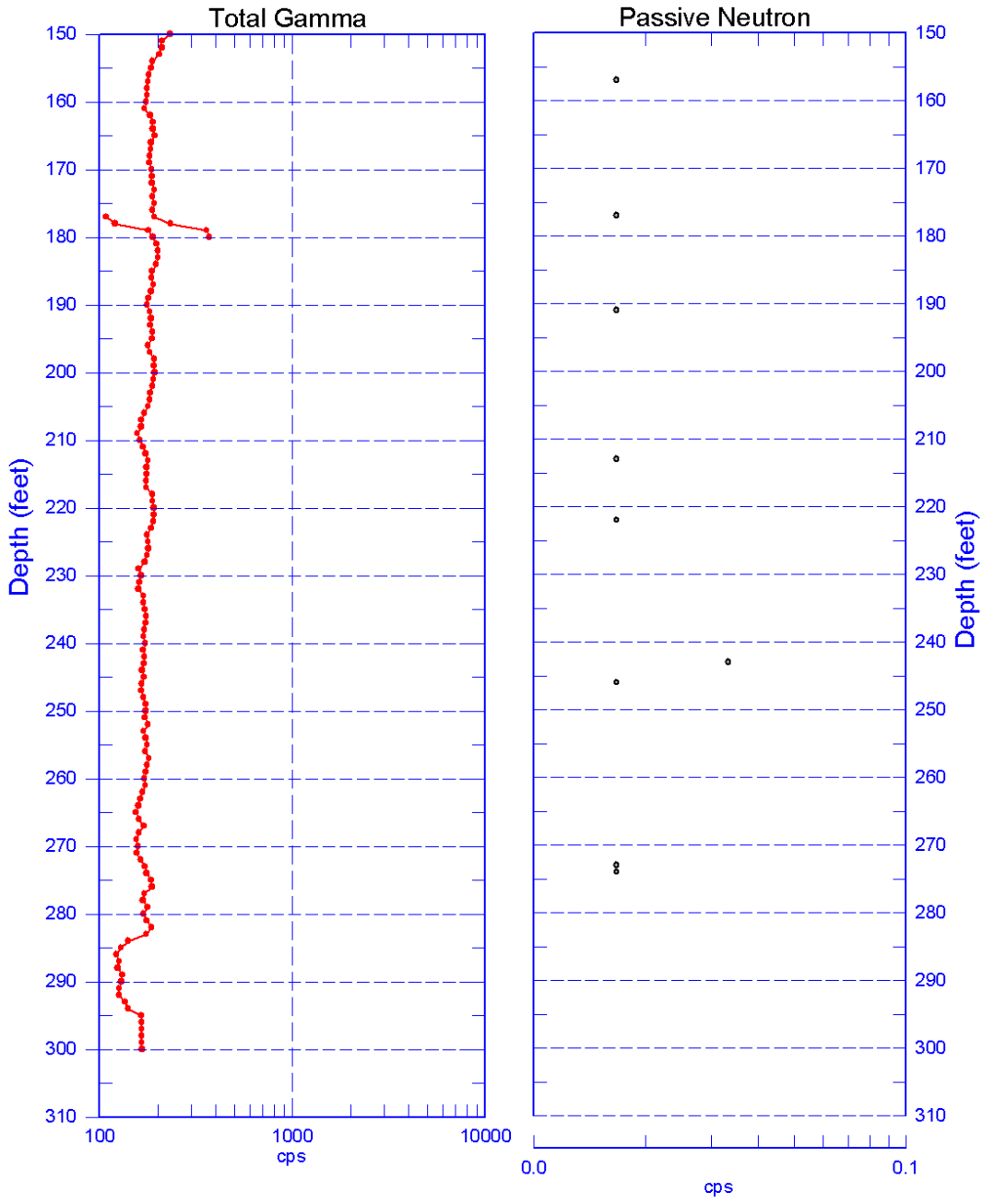

Stoller
Hanford Office
C5941
Total Gamma, Moisture & Dead Time
Total Gamma
Moisture
Dead Time
Depth (feet)
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310
100
1000
10000
cps
20
40
60
80
100
120
140
cps
0
20
40
60
80
100
Percent
Reference - Ground Surface

C5941
Total Gamma & Passive Neutron

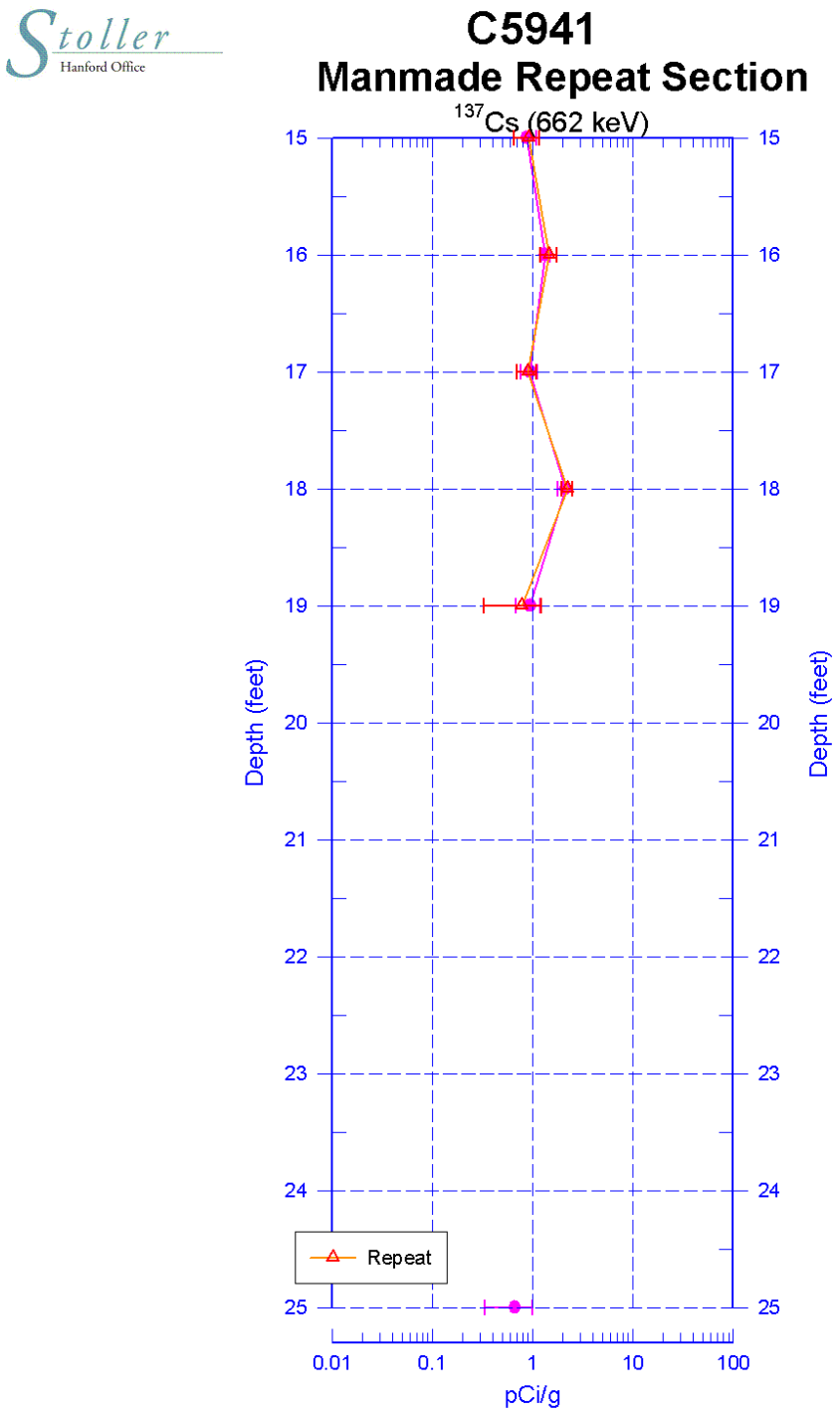


Reference - Ground Surface

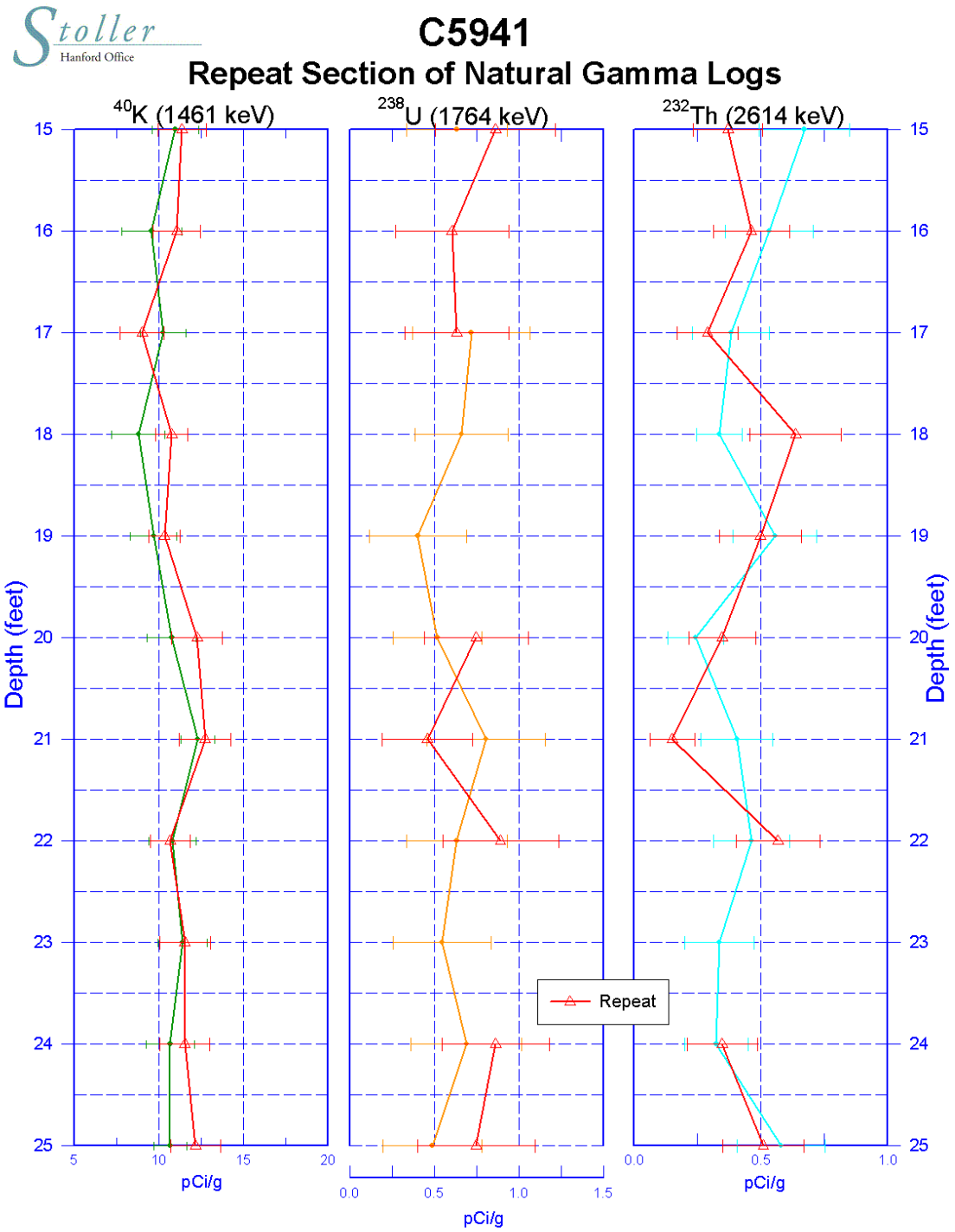
C5941
Total Gamma & Passive Neutron



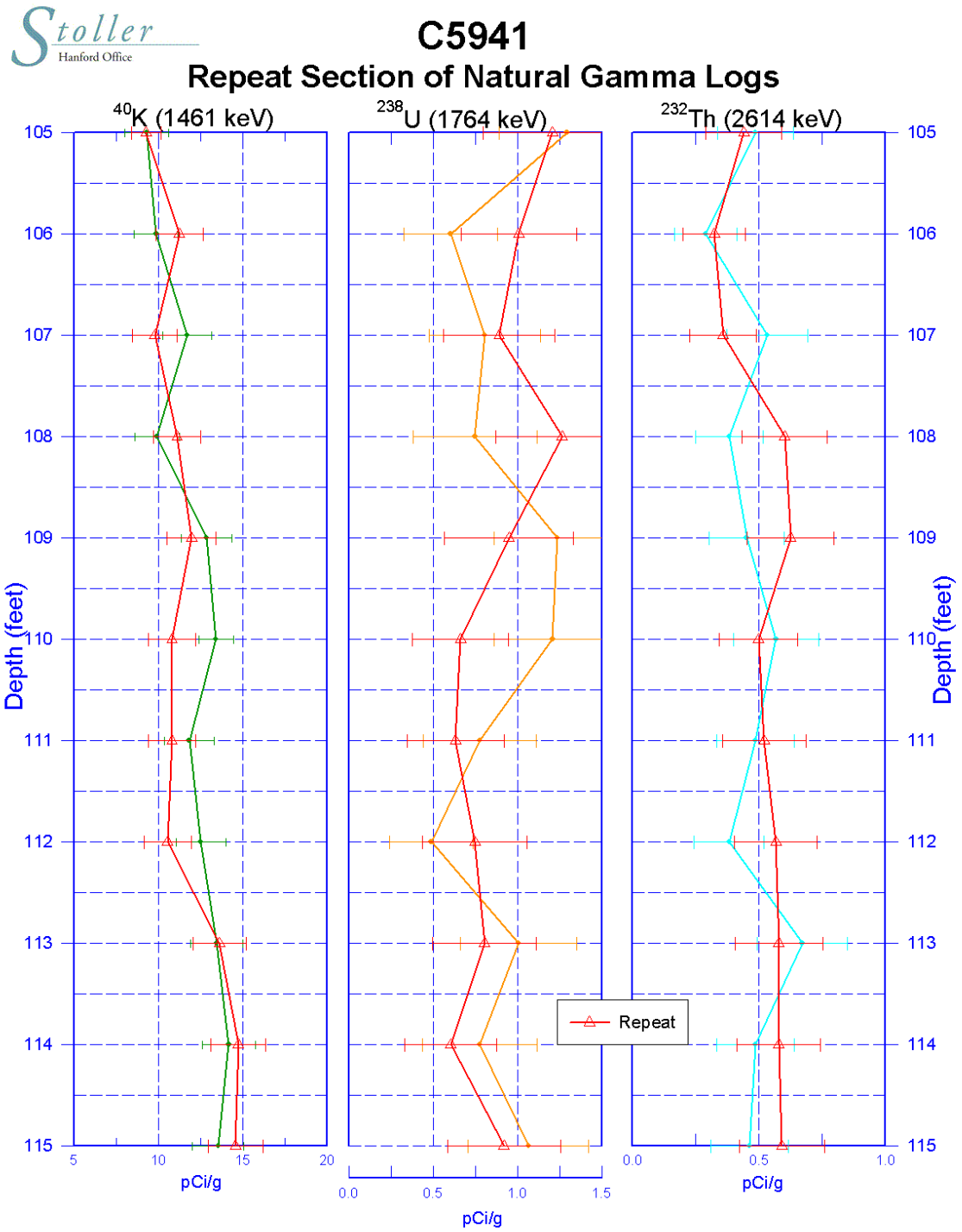
Reference - Ground Surface



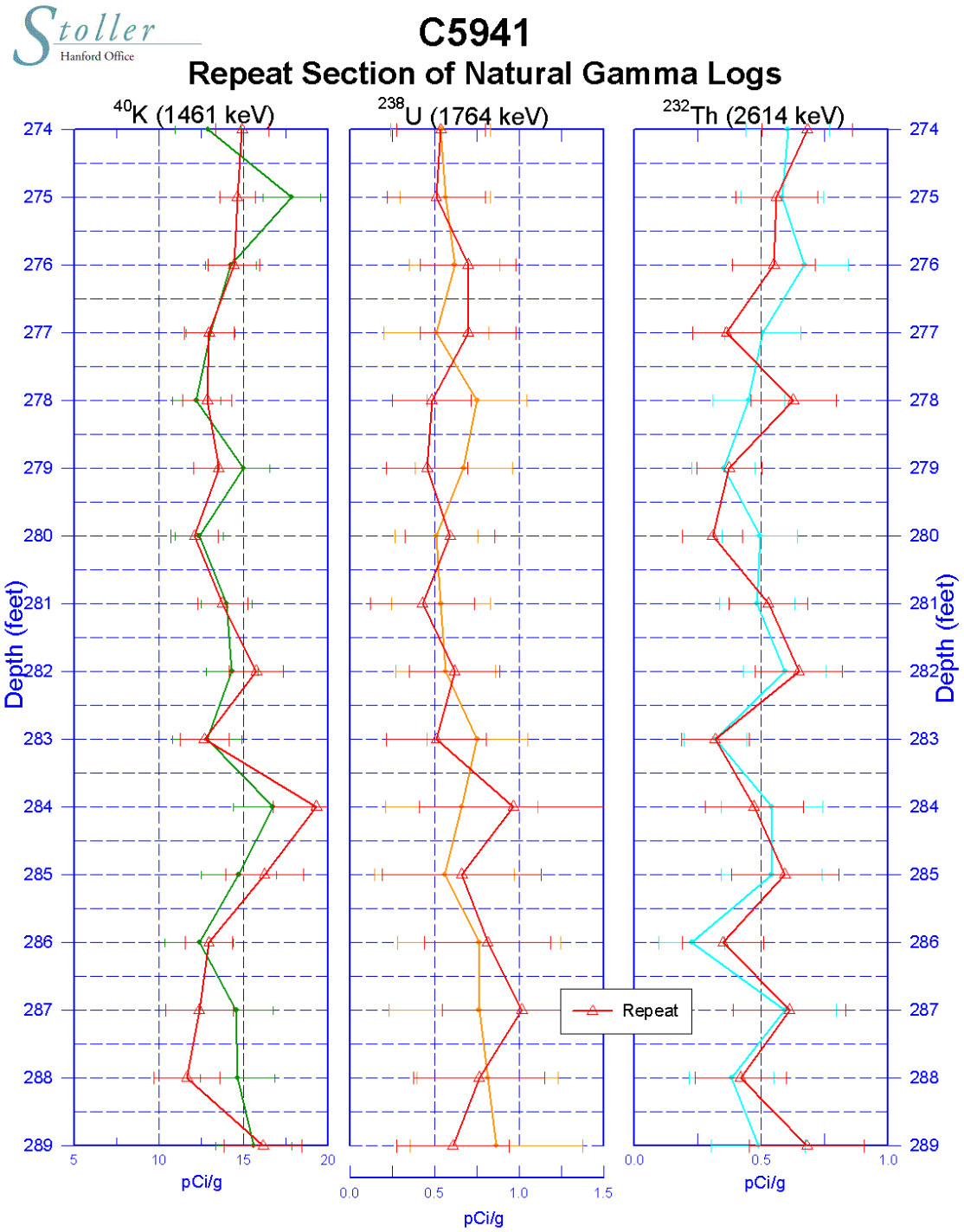
Reference - Ground Surface



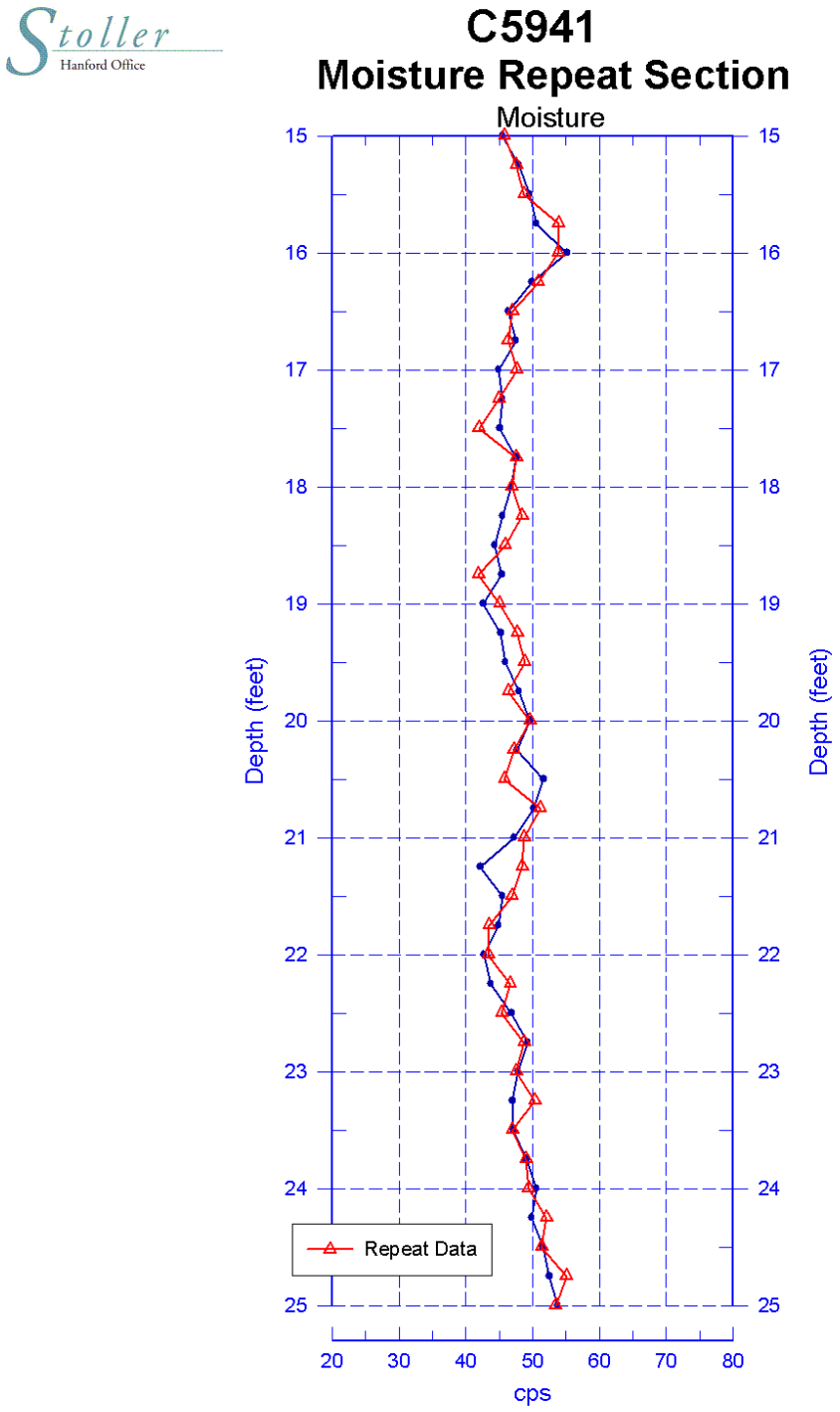
Zero Reference - Ground Surface



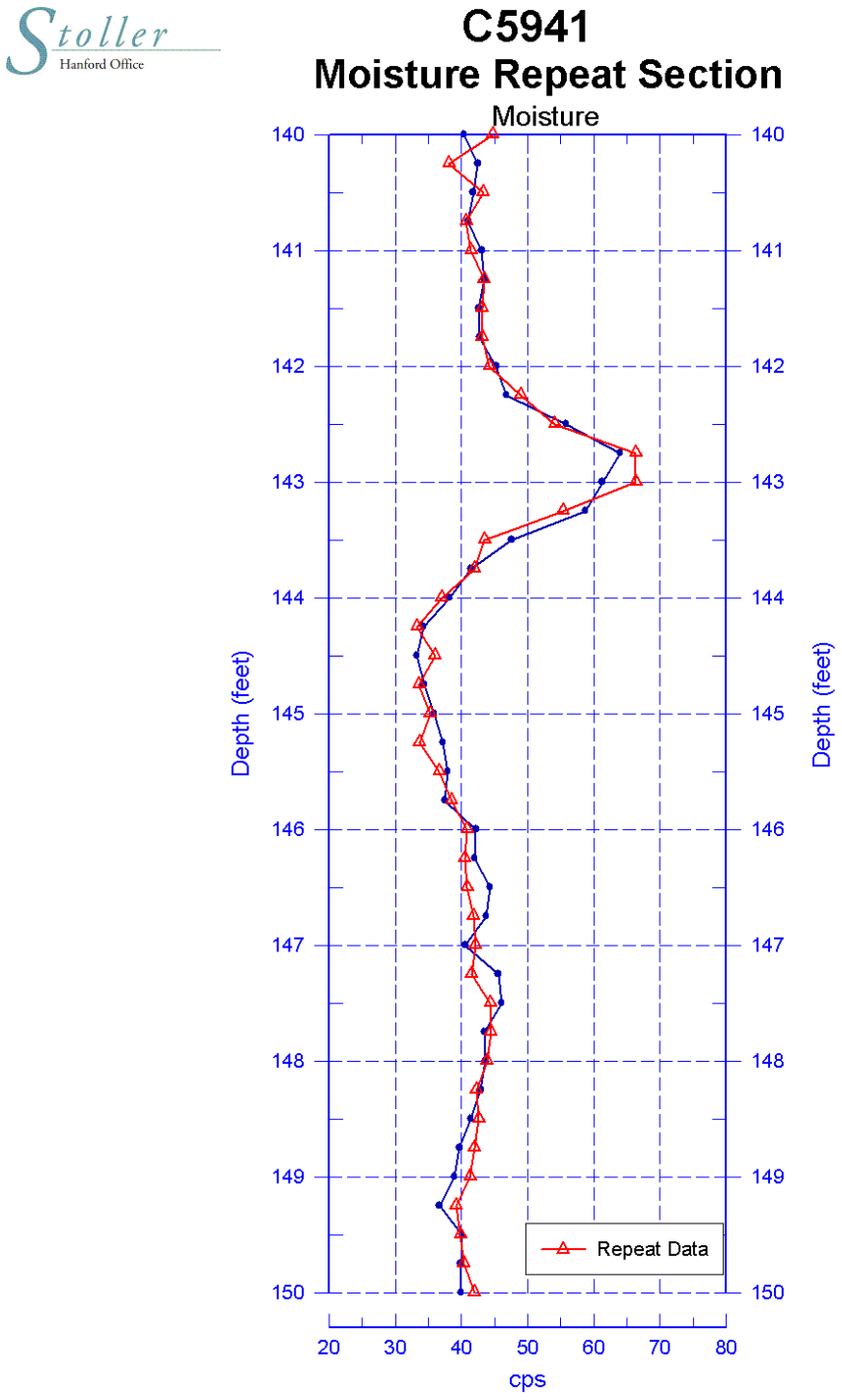
Zero Reference - Ground Surface



Zero Reference - Ground Surface



Reference - Ground Surface



Reference - Ground Surface

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APPENDIX E
WELL SURVEY DATA REPORT

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SURVEY DATA REPORT				Request No. 083-365
Project No.	Title: 216-A-30 Borehole C5941 Asbuilt Location			File No. 6AT12R26
Job No. MEH1NF123215-0010-CA10	Prepared By Larry A Henke	Date 7/1/08	Reviewer SAW -	Page 1 of 2

DESCRIPTION OF WORK	DISTRIBUTION	SDR	PLOT	DWG
Obtain Coordinates and elevation on Brass Cap Markers for Borehole C5941	Survey File	OR		
	D. P. Hughes	1		
Horizontal Datum: WCS83S/91 (Meters)	K.D. Christensen	1		
Vertical Datum: NAVD88 (Meters)	L.D. Bultena	1		
Equipment Used: Trimble GPS 5800 RTK	L.C. Sumner	1		
	S.S. Lowe	1		

SURVEY RESULTS AND COMMENTS

SEE ATTACHED WELL SURVEY DATA REPORTS

NOTE: This Survey was performed under the supervision of a Licensed Professional Land Surveyor registered in the State of Washington.

E-NW-246 (09/04)

WELL SURVEY DATA REPORT

Project: NA	**Prepared By:** **Company:** Larry A Henke (FGG)
Date Requested: 6/18/08	**Requestor:** S.S. Lowe
Date of Survey: 7/1/08	**Surveyor:** Larry A Henke (FGG)
ERC Point of Contact:	**Survey Co. Point of Contact:** N. Fastabend (FGG)
Description of Work: LOCATE BOREHOLE C5941 FOR HORIZONTAL AND VERTICAL POSITION	**Horizontal Datum:** NAD83(91) **Vertical Datum:** NAVD88 **Units:** METERS **Hanford Area Designation:** 200E

Coordinate System: Washington State Plane Coordinates (South Zone)

Horizontal Control Monuments: Gable Mtn (FH), 2E-27 (FGG)

Vertical Control Monuments: Gable Mtn (FH), 2E-27 (FGG)

Well ID	Well Name	Easting	Northing	Elevation	
					Center of Casing
					Top Casing, N. Edge stamped "X"
C5941		575883.40	135558.22	208.30	Brass Survey Marker

Notes: Found in 216-A-30 Crib

EQUIPMENT USED: TRIMBLE GPS 5800 RTK

Original to:
Distribution by DIS:

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