PNNL-13591

Pacific Northwest National Laboratory
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Borehole Data Package for Calendar Year 2000-2001 RCRA Wells at Single-Shell Tank Waste Management Area TX-TY

D. G. Horton
F. N. Hodges

August 2001

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RL01830

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Richland, Washington 99352

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1.0 Introduction

Five boreholes were drilled at the single-shell tank farm Waste Management Area (WMA) TX-TY in August 2000 through March 2001. The wells are 299-W10-27, 299-W14-15, 299-W14-16, 299-W14-17, and 299-W15-763. Table 1 lists the well names and well numbers. The five wells were installed as Resource Conservation and Recovery Act (RCRA) groundwater monitoring wells in fulfillment of Tri-Party Agreement (Ecology et al. 1998) milestones M-24-00L and M-24-00M. Well 299-W10-27 is located at the northeast corner of TY tank farm and is a new downgradient well in the monitoring network. Well 299-W14-15 is a new downgradient well on the east side of TX tank farm. Wells 299-W14-16 and 299-W14-17 are located to the east of the TX tank farm and were constructed to help define the extent of contamination. Well 299-W15-763 is on the south side of TX tank farm and is a replacement for well 299-W15-4, which is dry. The locations of all wells in the WMA TX-TY monitoring network are shown on Figure 1.

The original assessment monitoring plan for WMA TX-TY was issued in 1993 (Caggiano and Chou 1993). That plan was updated for the continued assessment at WMA TX-TY in 2001 (Hodges and Chou 2001). The updated plan provides justification for the new wells. The new wells were constructed to the specifications and requirements described in Washington Administrative Code (WAC) 173-160 and WAC 173-303, the updated assessment plan for WMA TX-TY (Hodges and Chou 2001), and the description of work for well drilling and construction.[(a)]

This document compiles information on the drilling and construction, well development, pump installation, and sediment and groundwater sampling applicable to the installation of new wells in calendar year 2000-2001 at WMA TX-TY. Appendix A contains the Well Summary Sheets (as-built diagrams), the Well Construction Summary Reports, and the geologist's logs; Appendix B contains physical properties data; and Appendix C contains the borehole geophysical logs. Additional documentation concerning well construction is on file with Bechtel Hanford, Inc., Richland, Washington.

Table 1. Well Names and Well Numbers for New Wells at Waste Management Area TX-TY

Well Name	Well Number
299-W10-27	C3125
299-W14-15	C3114
299-W14-16	C3120
299-W14-17	C3121
299-W15-763	C3339

(a) Letter from J. S. Fruchter, Pacific Northwest National Laboratory, to G. C. Henckel, Bechtel Hanford, Inc., "Description of Work for Drilling CY 2000 RCRA Groundwater Monitoring Wells," dated May 12, 2000.

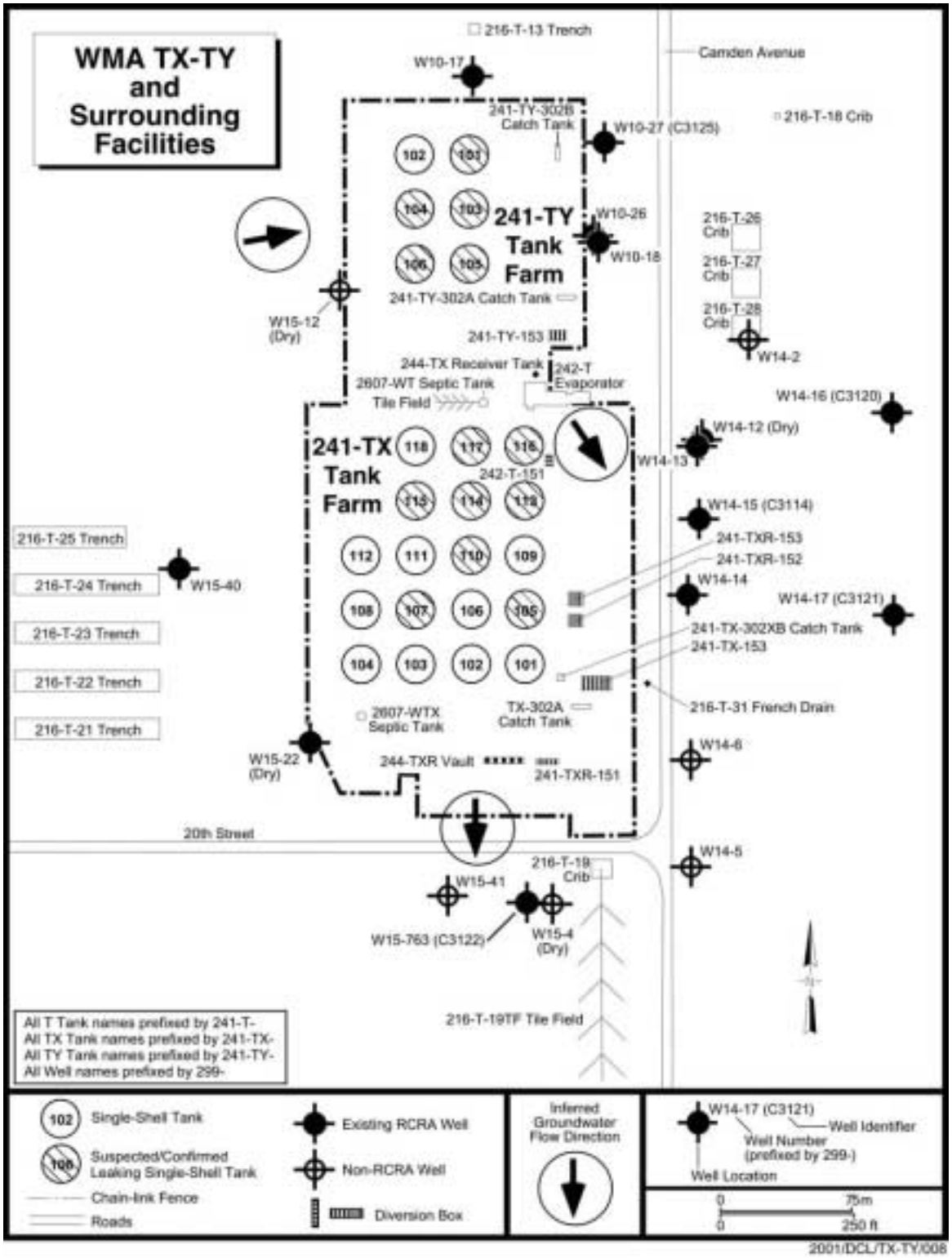


Figure 1. Map of Waste Management Area TX-TY and Locations of Wells in the Groundwater Monitoring Network

English units are used in this report because that is the system of units used by drillers to measure and report depths and well construction details. To convert feet to meters, multiply by 0.3048; to convert inches to centimeters multiply by 2.54.

2.0 Well 299-W10-27

Well 299-W10-27 was drilled from January through March 2001. The well is located on the northeast side of TY tank farm.

2.1 Drilling and Sampling

Well 299-W10-27 was drilled with a cable tool drill rig to a total depth of 268.7 ft below ground surface (bgs). Temporary 11 3/4-in.-outside-diameter, carbon steel casing was placed from the surface to 56 ft; 8 5/8-in.-outside-diameter, carbon steel casing was placed from the surface to total depth. The borehole was advanced with a drive barrel from 0 to 132.5 ft and with hard tool from 132.5 to 268.7 ft bgs. At least 246 gal of water were added to the borehole during hard tool drilling.

Sediments encountered during drilling were Hanford formation sand, sandy gravel, and silty sandy gravel from 0 to 41 ft and sand from 41 to 89 ft bgs. Plio-Pleistocene silt was encountered from 89 to 98 ft bgs and Plio-Pleistocene silty sand with caliche from 98 to 124.5 ft bgs. Ringold Formation silty sandy gravel was found from 124.5 ft to total depth. A possible clastic dike was noted by the geologist at 117 ft bgs. A geologist's log is included in Appendix A.

The borehole was continuously sampled by split spoon from 52.5 ft to 132.5 ft depth. Additional split spoon samples were taken at 226 to 227 ft, 241 to 242 ft, and 254 to 256 ft depth for analysis of particle size distribution. The particle size data is included in Appendix B. Also, grab samples of sediment for geologic description and archive were collected at approximate 5-ft intervals throughout the borehole.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. The drill cuttings at a depth of 17 ft were about 20 counts per minute (beta-gamma) above the background value of 350 counts per minute. Sediments were also slightly above background at 100 ft bgs.

The borehole was geophysically logged with spectral gamma-ray and neutron moisture tools on March 15, 2001. No manmade radionuclides were identified.

2.2 Well Construction

The permanent casing and screen were installed in well 299-W10-27 March 2001. A 4-in.-inner-diameter, stainless steel, continuous wire-wrap (20 slot) screen was set from 256.0 to 221.0 ft bgs. The

permanent casing is 4-in.-inner-diameter, stainless steel from 221.0 ft bgs to 2.0 ft above ground surface. A 2-ft-long sump was installed below the screen from 257.9 to 256 ft.

The filter pack is 10 to 20 mesh silica sand from 263.3 ft to 210.0 ft bgs. The annular seal is bentonite pellets from 210.0 ft to 204.6 ft bgs, granular bentonite from 204.6 to 10.9 ft bgs, and Portland cement from 10.9 ft to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A 6-in. stainless steel protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The inner casing extends 2.0 ft above the concrete pad and the protective casing extends 3.0 ft above the concrete pad. The Well Construction Summary Report and the Well Summary Sheet (as-built) are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in May 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington, and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing bench marks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2.

Table 2. Survey Data for New Wells at Waste Management Area TX-TY

Well Name	Easting (m)	Northing (m)	Elevation (m)	
299-W10-27	566,843.969	136,441.778		Center of Casing
			205.624	Top of Casing
	566,843.969	136,442.111	204.899	Brass Cap
299-W14-15	566,899.685	136,230.654		Center of Casing
			205.354	“X” on Rim of Casing
	566,899.661	136,231.044	204.584	Brass Cap
299-W14-16	567,001.334	136,318.482		Center of Casing
			206.123	“X” on Rim of Casing
	567,001.390	136,318.742	205.368	Brass Cap
299-W14-17	567,006.773	136,218.349		Center of Casing
			205.853	“X” on Rim of Casing
	567,006.644	136,218.746	205.079	Brass Cap
299-W15-763	566,809.207	136,028.763		Center of Casing
			202.947	Top of Casing
	566,809.177	136,029.053	202.175	Brass Cap

2.3 Well Development and Pump Installation

Well 299-W10-27 was developed in March 2001. A temporary, 3 hp, submersible pump was used for development with the intake at 251.66 ft bgs (29.6 ft below the water table). During initial development at 7 gal/min, there was 27 ft of drawdown. In order to keep sufficient water above the pump intake for development, about 200 gal of water were added to the well from a decontamination tank. The added water contained about 2/3 pt of CLR Calcium Lime and Rust Remover. This was discovered when the geologist found foam in the water being pumped from the well. Approximately 1,800 gal of potable water were injected into, and pumped out of, the well to flush the well of the added chemical. After pumping the 1,800 gal of added water, about 420 gal of formation water were pumped at a rate of 1 gal/min resulting in about 25.6 ft of drawdown. Final turbidity was 102 NTU and pH was 8.4.

A dedicated submersible sampling pump was installed in well 299-W10-27 on April 2, 2001. The sampling pump intake is at 251 ft bgs (or about 29.9 ft below the water table). Static water level was measured at 221.11 ft bgs on April 2, 2001.

3.0 Well 299-W14-15

Well 299-W14-15 was drilled in August 2001. The well is located on the northeast side of the TX tank farm.

3.1 Drilling and Sampling

The borehole was drilled by cable tool from the surface to 20.7 ft bgs and by air rotary from 20.7 ft to a total depth of 260 ft bgs. Temporary 11 3/4-in.-outside-diameter, carbon steel casing was placed from 0 to 20.7 ft, 8 5/8-in.-outside-diameter carbon steel casing was placed from 20.7 ft to 260 ft bgs. At 18.5 ft, 20 gal of water were added to the borehole to hydrate the bentonite used as a seal where downsizing casing.

Sediments encountered during drilling were Hanford formation silty sand, gravelly silty sand, and silty sandy gravel from the surface to about 37 ft bgs and sand from 37 ft to about 88 ft bgs. Silty sand and calcareous slightly silty sand of the Plio-Pleistocene occurred from 88 ft to 123 ft bgs. Ringold Formation silty sandy gravel and sandy gravel occurred from about 123 ft bgs to total depth. A geologist's log is included in Appendix A.

Grab samples of sediment for geologic description and archive were collected at approximate 5 ft intervals throughout the borehole. Also, three split spoon samples were collected from 222.2 to 224.5 ft, 237.5 to 239.5 ft and from 252.5 to 254.5 ft bgs for analysis of particle size distribution. The analysis results are in Appendix B.

Three groundwater samples were collected during drilling. The samples were air lifted slurries of cuttings and water obtained during air rotary drilling. The slurries were filtered using a peristaltic pump and a 0.4-µm filter cartridge prior to analysis in the field. The samples were tested for nitrate and specific conductance as a screen for contamination distribution with depth. All analyzed nitrate levels are above the 45 mg/L maximum contaminant level. The analytical results are shown in Table 3.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. At 10-ft depth, monitoring showed contamination at 160 decays per minute alpha and 10,000 decays per minute beta. Drilling was temporarily stopped, the borehole labeled as a contamination zone, and the work site labeled as a radiological buffer zone. Contamination decreased to background levels by 21-ft depth and no other contamination was noted.

Table 3. Results of Groundwater Analyses from Samples from New Wells at Waste Management Area TX-TY[(a)]

Well	Depth to Water (ft bgs)	Sample Depth (ft bgs)	Nitrate (mg/L)	Specific Conductance (µS/cm)
299-W14-15	220.7	232	64	544[(b)]
		237.5	94	555[(b)]
		252.3	111	570[(b)]
299-W14-16	222	232[(c)]	30	304
		242	46	403
		252	80	533
		265	149	680
299-W14-17	222	262	275	680

(a) Nitrate is mg/L as NO_3^-. Analyzed by HACH cadmium reduction method (Method 8039) using a DR/2010 portable spectrophotometer. Reagent blank corrected.
(b) Suspect results.
(c) Water added during drilling just above the water table may have diluted results.

3.2 Well Construction

The permanent casing and screen were installed in well 299-W14-15 in August 2000. A 4-in.-inner-diameter, stainless steel, continuous wire-wrap (20 slot) screen was set from 254.62 to 219.75 ft bgs. The permanent casing is 4-in.-inner-diameter, stainless steel from 219.75 ft bgs to 2.6 ft above ground surface. A 2-ft-long sump was installed below the screen from 256.7 to 254.6 ft.

The filter pack is 10 to 20 mesh silica sand from 260 ft to 290.9 ft bgs. The annular seal is bentonite pellets from 209.9 ft to 199.3 ft bgs, granular bentonite from 199.3 to 13.5 ft bgs, and Portland cement grout from 13.5 ft to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The permanent casing extends 1.39 ft above the concrete pad and the protective casing extends 2.48 ft above the concrete pad. The Well Construction Summary Report and the Well Summary Sheet (as-built) are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in March 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington, and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing bench marks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2.

3.3 Well Development and Pump Installation

Well 299-W14-15 was developed September 5, 2000. A temporary, 3 hp, submersible pump was used to remove approximately 2,725 gal of formation water. First, about 1,800 gal of water were removed from the well at 24 gal/min with a drawdown of about 8.8 ft. The pump intake was at 251 ft bgs (4.2 ft above the bottom of the well). Second, about 925 gal of water were removed at 25 gal/min with the pump intake at 233 ft bgs resulting in 8.6 ft of drawdown. The final turbidity was 3.15 NTU.

A dedicated Hydrostar sampling pump was installed in well 299-W14-15 on September 5, 2000. The sampling pump intake is at 220.7 ft bgs (or about 7.1 ft below the water table). Static water level was measured at 220.7 ft bgs on September 5, 2000.

4.0 Well 299-W14-16

Well 299-W14-16 was drilled in October and November 2000. The well is located northeast of the TX tank farm.

4.1 Drilling and Sampling

To drill this well, an air rotary drill rig was used from the surface to a total depth of 265 ft bgs. Temporary 10 3/4-in.-outside-diameter, carbon steel casing was used from the surface to total depth. An unknown amount of water was added to the borehole above the water table to control dust, help lift cuttings, and unplug the drill bit.

Sediments encountered during drilling were Hanford formation sand, silty sandy gravel and sandy gravel from the surface to about 34 ft bgs and sand from 34 ft to 89 ft bgs. Calcareous sandy silt, and silty sandy gravel the Plio-Pleistocene unit occurred from 89 ft to 122 ft bgs. Ringold Formation silty sandy gravel, sandy gravel, and gravelly sand occurred from about 122 ft bgs to total depth. A geologist's log is included in Appendix A.

Grab samples of sediment for geologic description and archive were collected at approximate 5-ft intervals throughout the borehole. Also, three split spoon samples were collected from 223.2 to 224.7 ft, 241.1 to 244 ft, and from 251.0 to 253.5 ft bgs for analysis of particle size distribution. The analysis results are in Appendix B.

Four groundwater samples were collected during drilling. The samples were air lifted slurries of cuttings and water obtained during air rotary drilling. The slurries were filtered using a peristaltic pump and a 0.4-µm filter cartridge prior to analysis in the field. The samples were tested for nitrate and specific conductance as a screen for contamination distribution with depth. Except for the shallowest sample at 232-ft depth, all analyzed nitrate levels are above the 45 mg/L maximum contaminant level. Water was added to the borehole at 232 ft bgs so that the sample may have been diluted. The analytical results are shown in Table 3.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contaminants were noted.

The well was geophysically logged through the temporary casing using high resolution, spectral gamma-ray and neutron moisture instrumentation on November 1 and 2, 2000. No manmade radionuclides were detected. The geophysical logs are in Appendix B.

4.2 Well Construction

The permanent casing and screen were installed in well 299-W14-16 in November 2000. A 4-in.-inner-diameter, stainless steel, continuous wire-wrap (0.02 in. slot) screen was set from 257.88 to 222.94 ft bgs. The permanent casing is 4-in.-inner-diameter, stainless steel from 222.94 ft bgs to 2.0 ft above ground surface. A 2-ft-long, stainless steel sump is below the screen from 260.06 to 257.88 ft bgs.

The filter pack is 10 to 20 mesh silica sand from 265.0 to 210.4 ft bgs. The annular seal is 1/4 in. bentonite pellets from 210.4 to 204.5 ft bgs; granular bentonite from 204.5 to 11.3 ft bgs; and Portland cement from 11.3 ft bgs to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The permanent casing extends 1.46 ft above the concrete pad and the protective casing extends 2.46 ft above the concrete pad. The Well Construction Summary Report and the Well Summary Sheet (as-built) are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in March 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington, and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing bench marks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2.

4.3 Well Development and Pump Installation

Well 299-W14-16 was developed on November 22 and November 27, 2000. A temporary, 3 hp, submersible pump was used to remove approximately 5,180 gal of formation water from the well. First, about 4,775 gal of water were removed from the well at 24 gal/min with a drawdown of about 14.7 ft. The pump intake was at 257 ft bgs (1.3 ft above the bottom of the screen). Second, about 405 gallons of water were removed at 24 gal/min with the pump intake at 237 ft bgs. The final turbidity was 3.16 NTU.

A dedicated, Redi Flo2 submersible sampling pump was installed in well 299-W11-16 on December 22, 2000. The sampling pump intake is at 232.9 ft bgs (or about 9.5 ft below the water table). Water level was measured at 223.4 ft bgs on December 22, 2000.

5.0 Well 299-W14-17

Well 299-W14-17 was drilled in October 2000. The well is located east of TX tank farm.

5.1 Drilling and Sampling

The well was drilled from the surface to 20.6 ft bgs with a cable tool rig and drive barrel and from 20.6 ft to a total depth of 265.3 ft bgs with an air rotary rig. Temporary 11 3/4-in.-outside-diameter, carbon steel casing was placed from 0 to 20.6 ft bgs and temporary 8 5/8-in.-outside-diameter carbon steel casing from 20.6 ft to 265.3 ft bgs. An unknown amount of water was added to the drilling air stream at 185-ft depth for dust control.

Sediments encountered during drilling were Hanford formation gravelly sand, silty sandy gravel, and sandy gravel from the surface to about 34 ft bgs and sand from 34 ft to 93 ft bgs. Calcareous silty sand, gravelly silty sand, and silty sandy gravel of the Plio-Pleistocene unit occurred from 93 ft to 113 ft bgs. Sand, probably belonging to the Ringold Formation member of Taylor Flat, occurred from 113 ft to 122 ft bgs and Ringold Formation member of Wooded Island sandy gravel, silty sandy gravel, and gravelly sand occurred from about 122 ft bgs to total depth. A geologist's log is included in Appendix A.

Grab samples of sediment for geologic description and archive were collected at approximate 5-ft intervals throughout the borehole. Also, three split spoon samples were collected from 228 to 228.75 ft, 244.9 to 246.4 ft, and from 255.4 to 257.9 ft bgs for analysis of particle size distribution. The analysis results are in Appendix B.

One groundwater sample was collected during drilling. The sample was an air lifted slurry of cuttings and water obtained during air rotary drilling. The slurry was filtered using a peristaltic pump and a 0.4-µm filter cartridge prior to analysis in the field. The sample was tested for nitrate and specific conductance as a screen for contamination distribution with depth. The nitrate level was above the 45 mg/L maximum contaminant level. The analytical results are shown in Table 3.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contaminants were noted.

The well was geophysically logged through the temporary casing using high resolution, spectral gamma-ray and neutron moisture instrumentation on October 17, 2001. No manmade radionuclides were detected. The geophysical logs are in Appendix C.

5.2 Well Construction

The permanent casing and screen were installed in well 299-W14-17 in October 2001. A 4-in.-inner-diameter, stainless steel, continuous wire-wrap (0.02 in. slot) screen was set from 256.96 to 221.94 ft bgs. The permanent casing is 4-in.-inner-diameter, stainless steel from 221.94 ft bgs to 2.58 ft above ground surface. The bottom of the screen has a 2-ft-long sump from 259.01 to 256.6 ft bgs.

The filter pack is 10 to 20 mesh silica sand from 265.5 to 211.9 ft bgs. The annular seal is 3/8-in. bentonite pellets from 211.9 to 204.7 ft bgs; granular bentonite from 204.7 to 10.6 ft bgs; and Portland cement from 10.6 ft to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The permanent casing extends 1.83 ft above the concrete pad and the protective casing extends 2.58 ft above the concrete pad.

A straightness test on October 18, 2001, using a 20 ft section of 6-5/8-outer-diameter stainless casing was unsuccessful at 170 ft bgs. This corresponds to the depth (173 ft) at which a probable boulder was encountered during drilling. A camera survey showed that the casing appeared solid and all joints were intact. A second straightness test using a 21 ft piece of 5 5/8-in.-outside-diameter pipe was successful.

The Well Construction Summary Report and the Well Summary Sheet (as-built) are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in March 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington, and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing bench marks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2.

5.3 Well Development and Pump Installation

Well 299-W14-17 was developed on November 27, 2000. A temporary, submersible pump was used to remove approximately 2,050 gal of formation water from the well. First, about 897 gal of water were removed from the well at 23 gal/min with a drawdown of about 8.8 ft. The depth of the pump intake is not documented. Second, about 1,160 gal of water were removed at 20 and 17 gal/min with a drawdown of 8.2 ft. The final turbidity was 1.81 NTU.

A dedicated, Redi Flo2 submersible sampling pump was installed in well 299-W14-17 on December 27, 2000. The sampling pump intake is about 10 ft below the water table. The water level was measured at 222.7 ft bgs on December 27, 2000.

6.0 Well 299-W15-763

Well 299-W15-763 was drilled from November 2000 through January 2001 using a cable tool drill rig. The well is located south of the TX tank farm.

6.1 Drilling and Sampling

Temporary 11 3/4-in.-outside-diameter, carbon steel casing was placed from 0 to 134.2 ft. below ground surface (bgs) and 8 5/8-in.-outside-diameter carbon steel casing was placed from 134.2 to 252.6 ft bgs. The borehole was advanced with drive barrel from the surface to 134.2 ft depth and by hard tool from 134.2 ft to a total depth of 257.6 ft. Approximately 430 gal of water were added to the borehole during hard tool drilling.

Sediments encountered during drilling were predominantly gravelly sand, sandy gravel, and silty sandy gravel of the Hanford formation from the surface to about 94 ft bgs. Plio-Pliestocene silt and silty sand was encountered from 94 ft to 101.5 ft and Plio-Pleistocene gravelly silty sand with caliche was found from 101.5 ft to 117 ft bgs. Ringold Formation silty sandy gravel with lesser amounts of sandy gravel and gravelly silty sand occurred from 117 ft to total depth (257.6 ft). A geologist's log is included in Appendix A.

Grab samples of sediment for geologic description and archive were collected at approximate 5-ft intervals from 20 ft to total depth. Three split spoon samples were collected from 217 to 219 ft, 232 to 234 ft and from 245 to 247 ft bgs for analysis of particle size distribution. Particle size distribution data is in Appendix C.

The borehole and drill cuttings were monitored regularly for organic vapors and radionuclide contaminants. No contamination was found.

6.2 Well Construction

The permanent casing and screen were installed in well 299-W15-763 in January 2001. A 4-in.-inner-diameter, stainless steel, continuous wire-wrap (0.02 in. slot) screen was set from 246.82 to 211.75 ft bgs. The permanent casing is 4-in.-inner-diameter, stainless steel from 211.75 ft bgs to 2.0 ft above ground surface. A 2-ft stainless steel sump was placed at the bottom of the screen from 248.82 to 246.82 ft bgs.

The sand pack is 10 to 20 mesh silica sand from 257.6 to 202.4 ft bgs. The annular seal is bentonite pellets from 202.4 to 191.1 ft bgs, granular bentonite from 191.1 to 9.2 ft bgs, and Portland cement with bentonite from 9.2 ft depth to the surface. A 4 ft by 4 ft by 6 in. concrete pad was placed around the well at the surface. A 6-in. stainless steel protective casing with locking cap, four protective steel posts, and a brass marker stamped with the well number were set into the concrete. The protective casing extends

2.56 ft above the concrete pad and the inner casing extends 1.54 ft above the concrete pad. The Well Construction Summary Report and the Well Summary Sheet (as-built) are included in Appendix A.

The vertical and horizontal coordinates of the well were surveyed in May 2001. The horizontal position of the well was determined by Global Positioning System observations referenced to horizontal control stations established by Rogers Surveying, Inc., Richland, Washington, and the U.S. Army Corps of Engineers. The coordinates are Washington Coordinate System, South Zone, NAD83(91) datum. Vertical datum is NAVD 1988 and is based on existing bench marks established by the U.S. Army Corps of Engineers. Survey data are included in Table 2.

6.3 Well Development and Pump Installation

Well 299-W15-763 was developed on March 26 through March 28, 2001. A temporary, 3 hp, submersible pump was used to remove approximately 3,613 gal of formation water from the well. First, 2,294 gal were pumped at 5 to 6 gal/min with the pump set at 239.8 ft bgs; drawdown was 22.5 ft. Second, about 1,319 gal were pumped at 4.8 gal/min with the pump at 227.8 ft bgs. Final drawdown was 3.2 ft. The final turbidity was 4.98 NTU.

A dedicated, Redi Flo2 submersible sampling pump was installed in well 299-W15-763 on March 29, 2001. The sampling pump intake is at 227.8 ft bgs (or about 13.3 ft below the water table). The static water level was 214.97 ft bgs on March 29, 2001.

7.0 References

Caggiano, J. A., and C. J. Chou. 1993. *Interim-Status Groundwater Quality Assessment Plan for the Single Shell Tank Waste Management Areas T and TX-TY.* WHC-SD-EN-AP-132, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Ecology - Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy. 1998. *Hanford Federal Facility Agreement and Consent Order.* Document No. 89-10, Rev. 5 (The Tri-Party Agreement), Olympia, Washington.

Hodges, F. N., and C. J. Chou. 2001. *RCRA Assessment Plan for Single-Shell Tank Waste Management Area TX-TY at the Hanford Site.* PNNL-12072, Pacific Northwest National Laboratory, Richland, Washington.

RCRA - Resource Conservation and Recovery Act. 1976. Public Law 94-580, as amended, 90 Stat. 2795, 42 USC 6901 et seq.

WAC 173-160, Washington Administrative Code. *Minimum Standards for Construction and Maintenance of Wells.* Olympia, Washington.

WAC 173-303, Washington Administrative Code. *Dangerous Waste Regulations.* Olympia, Washington.

Appendix A

Well Construction and Completion Documentation

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 1-22-01
Finish Date: 3/23/01
Page 1 of 1

Specification No.: 0200W-SP-C0007	Rev. No.: 0	Well Name: 299-W10-27	Temp. Well No.: C3125
ECNs: N/A		Approximate Location: 5m East of 241-TY Tank Farm	
Project: RCRA Drilling CY 2001		Other Companies: BHI, CHI	
Drilling Company: Resonant Sonic Int.		Geologist(s): L. Walker, J.M. Paurote, R.F. Raidl, J. Murray, C. Martinez	
Driller: M. Wraspir			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
FJ Carbon Steel (11 3/4"/10 1/4")	0' - 56'	12"
FJ Carbon Steel (8 5/8"/7 3/4")	0 - 263.5'	9"/8"
	-	
	-	
	-	

*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design

DRILLING METHOD/HOLE DIAMETER

Auger:	Diameter From	to	
Cable Tool: ✓ 10"	Diameter From 0'	to 60'	
Air Rotary:	Diameter From	to	
A.R. w/Sonic:	Diameter From	to	
Cable tool 7"	Diameter From 60'	to 268.7'	
	Diameter From	to	
	Diameter From	to	

Total Drilled Depth: 268.7'	Hole Dia @ TD: 7"	Drilling Fluid: N/A	
Well Straightness Test Results: not documented		Total Amt. Of Water Added During Drilling: at least 246 gallons	
		Static Water Level: 220.63'	Date: 3/23/01

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	-	3/15/01		-	
Neutron	-	3/15/01		-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annual Seal/Filter Pack	Volume	Mesh Size
4" ID SS Endcap (Sump)	256.56' - 258.86'	F480	N/A	Portland Cement	0' - 10.9'	10 bags	
4" ID 304 SS WW Screen	228' - 256.56'	F480	0.020"	Granular Bentonite	10.9' - 204.6'	123.5 bags	
4" ID 304 SS casing (sched 5)	+2.0' - 221'	F480	N/A	Bentonite Pellets (1/4")	204.6' - 210.0'	5 buck	
	-			Silica Sand	210.0' - 263.3'	40 bags	10-20
	-				-		

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Abandoned:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA

Date:	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Cap Elevation:

COMMENTS/REMARKS

Portland cement uses 94 lb. sacks, Granular bentonite in 50 lb. sacks, bentonite pellets in 50 lb. bucket, silica sand in 50 lb. sacks.

Reported By: Charlene Martinez		Reviewed Reported By: DC Weekes	
Title: Geologist	Date: 03/23/01	Title: Geologist	Date: 4/3/01
Signature: Charlene Martinez		Signature: DC Weekes	

BHI-EE-181 (12/97)

WELL SUMMARY SHEET

Page 1 of 2

Date: 03/06/01

Well ID: C 3125	Well Name: 299-W10-27
Location: 3m. East of 241-TY Tank Farm	Project: RCRA FY01 Drilling
Prepared By: J.M. Faurote — Date: 03/06/01	Reviewed By: D.C. Weekes — Date: 4/3/01
Signature: J.M. Faurote	Signature: D.C. Weekes

CONSTRUCTION DATA

Description

Stainless steel protective casing sticks up 3.0' above ground

12" nominal casing 0-56'

8 5/8" / 7 3/4" temp. casing to TD

4-in ID sched 5 SS 304L well casing:

+2.00 → 257.36'

Portland Cement Grout:

0 → 10.9'

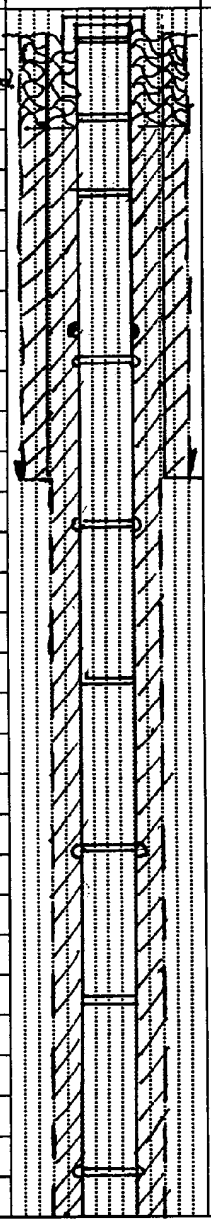
Bentonite (granular):

10.9' → 204.6'

All depths in Feet Below ground surface.

All temporary casing removed from the ground

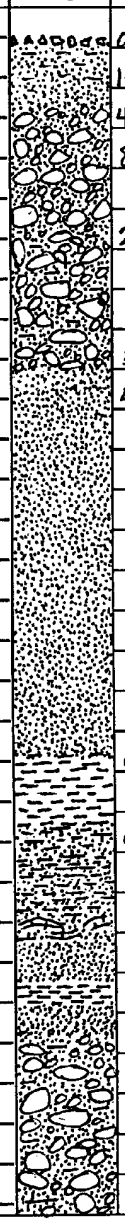
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 25, 50, 75, 100, 125

Graphic Log



Lithologic Description

0-1' Construction gravel

1'-4.5' Silty SAND (mS)

4.5'-8.5' SAND (S)

8.5'-24' Sandy Gravel (sG)

24'-38' Silty Sandy Gravel (msG)

38'-41.5' Sandy Gravel (sG)

41.5'-89.0' SAND (S)

89.0'-98.2' Silt (M)

Plio-Pleistocene top

98.2'-~~104~~ 102' Caliche in Silty SAND (mS)

102'-108' Silty SAND (mS)

108'-112' Caliche in SAND (S)

112'-117.5' SAND (S)

117.5'-120.5' SILT (M)

120.5'-124.5 SAND (S)

124.5'-220' Silty Sandy Gravel (msG)

TOP RINGOLD E

BHI-EE-189 (12/97)

WELL SUMMARY SHEET

Date: 03/15/01

Well ID: C3125	Well Name: 299-W10-27
Location: 3m East 241-TY Tank Farm	Project: RCRA FY01 Drilling
Prepared By: C. Martinez — Date: 03/15/01	Reviewed By: DC Weekes — Date: 4/3/01
Signature: Charlene Martinez	Signature: DC Weekes

CONSTRUCTION DATA

Description

Bentonite Pellets 1/4":
204.6' → 210'

Silica Sand, 10-20 mesh:
210' → 263.3'

Well screen:
4-in ID, 0.020-in slot
cont. wire wrap, SS type
304:
256' → 221'

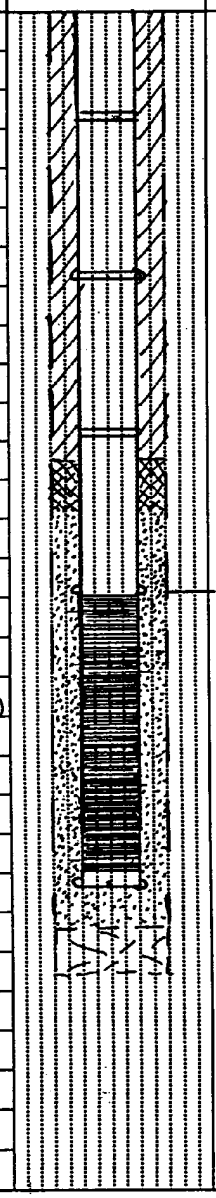
Sump:
4-in ID, SS304L
256' → 258.86'

Total 4-in ID SS material
is 262.49' (+2.00 → 258.86)
less 2.63' cutoff

Slough: 263.3' → 268.7'

All depths in feet below
Ground Surface.
All temporary casing removed
from the ground

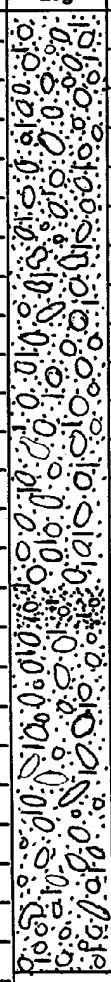
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 150, 175, 200, 225, 250, 275

Graphic Log



Lithologic Description

124.5'-220' Silty Sandy Gravel (msg)

220'-225' Slightly Silty Gravelly Sand

225'-268.7' Silty Sandy Gravel (msg)

TD = 268.7'

GW tagged 220.63' bgs
03/23/01

BHI-EE-189 (12/97)

BOREHOLE LOG

Page 1 of 9
Date: 1-22-01

Well ID: C 3125	Well Name: 299-W10-27	Location: 5m East of 241-TY Fenceline/200W	
Project: RCRA Drilling CY 2001		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	Drive Barrel	NA		0→1': Sandy GRAVEL, surface construction material	Drive barrel; 11¾"/ 10¾" threaded CS casing
				1'→4.5': Silty SAND; (mS), 75% Sand, 25% silt; Sand predom fn-v. fn; 10YR5/3 (brn) sl moist	5': Grab sample for archive
5	Grab-Archive			4.5'→8.5': SAND (S); 5% Gravel 95% Sand. Sand 10% v.cse, 70% cse, 20% med-fn. 2.5Y4/2 (dk gray-brn) mod sorted; SA-A; 70% basalt, 30% qtz/feld; no rxn HCl	α, β, γ at background levels End 1-22-01 Begin 1-23-01
10	Grab-Archive			8.5'→24': Sandy GRAVEL (sG) 40% Gravel, 60% Sand, tr silt. Gravel predom. med-cse peb, R-SR tr caliche coatings. Sand as above.	10': Grab-archive rad-background
15	Grab-Archive			11': 0.5 ft layer silty sand, then back to sG 15 ft: Gravel content/fraction up to ~60%	15': Grab-archive rad-background End 1-23-01 Begin 1-24-01
20	Grab-Archive			18-19 Ft: Cobbles up to ~15 cm.	20': Grab-archive rad-background
				24'→38': Silty Sandy GRAVEL (msG); 70% Gravel, 15% Sand, 15% Silt Gravel 20% cobble, 30% v.cse-cse, 40% med, 10% fn-v. fn peb; SR-R, 10YR4/2 (dk gr-brn), moist; poorly sorted; Gravel 60% basalt, 40% qtzite/granitic; Sand predom med-fn; weak rxn HCl	25': Grab-archive rad-background
25	Grab-Archive				

Reported By: L.D. Walker		Reviewed By: DCWeekes	
Title: Geologist		Title: Geologist	
Signature: LDWalker	Date: 1-24-01	Signature: DCWeekes	Date: 4/3/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 2 of 9
Date: 1-24-01

Well ID: C3125 | Well Name: 299-W10-27 | Location: 5m East of 241-TY Farm / 200W

Project: RCRA Drilling CY2001 | 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)
30	Grab-Archive	NA		Silty Sandy GRAVEL (msG) similar	Cable tool drive
	Drive Barrel			to above. 60% Gravel, 25-30% Sand	barrel, 11¾"/10¼"
				10-15% Silt. Sand predom. cse-med.	CS casing
					30': Grab Sample
35	Grab-Archive				for archive
				silt content decrease	d,β,γ: background
				38' → 41.5': Sandy GRAVEL (sG)	35': Grab-archive
				60% Gravel, 30-35% Sand, 5-10%	rad: background
40	Grab-Archive			Silt. Gravel tr cobble, 40% v.cse-cse	
				peb, 40% med, 20% fn-v. fn. Sand	40': Grab-archive
				predom cse, basalt rich. Poorly	rad: background
				Sorted, Gravel R-SR, Sand SA,	
				no rxn HCl.	
45	Grab-Archive				45': Grab-archive
				41.5' → 89.0' : SAND (S)	rad-background
				tr-5% Gravel, 95-100% Sand, tr silt.	
				20% v.cse sand, 50% cse, 20% med, 10%	
				fn-v. fn. 2.5Y4/2 (dk gr-brn) sl moist;	50': Grab-archive
50	Grab-Archive			mod-well sorted; SA-A; 40% basalt,	rad-background
	ST #1 PNNL Analysis	100% rec.		60% qtz/feld, tr iron oxide staining, no	New low risk
				rxn HCl. Max gravel ~1 cm.	radiological
	ST #2 PNNL Anal.	100% rec			split tube #1 –
				54': Silt content increase to ~5%	50.0'→52.5'
55		Archive		no gravel	-recover 2.0' in liners
	ST #3 PNNL	100% rec.			50.0'→52.0'
					ST #2: 52.5'→55'
	ST #4 PNNL	100% rec.		(11¾" OD casing set 56' bgs)	55': Archive
					ST#3: 55'→57.5'

Reported By: L.D. Walker		Reviewed By: DCWeekes	
Title: Geologist		Title: Geologist	
Signature: [signature]	Date: 1/24/01	Signature: [signature]	Date: 4/3/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 3 of 9
Date: 1-24-01

Well ID: C 3125 | Well Name: 299-W10-27 | Location: 5m east of 241-TY farm/200W

Project: RCRA Drilling CY2001 | 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
60	Archive			ST#4: 57.5-60'	5" OD split tube
	SPLIT SPOON #5 PNNL	100% rec.		v. sporadic sm. gravel, @ < 1cm size. m-cr grnd 60-61, @ 61 became f-m grnd	Sampler, for PNNL analysis / archive
	ST#6 PNNL Analysis	100%			ST#5: 60.-62.5' 65' Archive
65	Archive			interfingered coarse sand lenses inother-	ST#6: 62.5-65.0
	ST#7 PNNL Analysis	100%		wise f-med grnd gy-bn, mod. sorted, SA-SR grnd, dry sand w/ trace to minor amounts of silt. The unit is 60% basalt	ST#7: 65'-67.5'
	ST#8 PNNL Analyses	100% recovery			ST#8: 67.5-70'
70	Archive				Archive grab sample 70'
	ST#9 PNNL Analysis	100%			ST#9 (70'-72.5')
	ST#10 PNNL Analysis	100%		Whitish-gray cement? (carbonate) started @ 72' bgs. Sand is now lt-med gy vf-vcr grnd. exhibits v. sm. sporadic hematite spots (1-2 mm)	ST#10 (72.5'-75') Archive 75' Sample
75	Archive				
	ST#11 PNNL Analysis	100%			ST#11 (75-77.5')
	ST#12 PNNL Analysis	100%		increasing hematite, sporadic mica, continues SA-SR, dry f-vcr sand w/ minor silt. lt-med. $CaCO_3$ cement.	ST#12 (77.5'-80')
80	Archive				Archive 80' Sample.
	ST#13 PNNL Analyses	100%			ST#13 (80-82.5')
	ST#14 PNNL Analysis	100%			ST#14 (82.5-85.0)
85	Archive				Archive 85' sample
	ST#15 PNNL Analysis	100%			START 1 MAR 01 RFR ST 15 (85.0-87.5
	ST 16	100%		89.0 SILT LAYER	Archive 90' sample ST 16 87.5-90
		Archive			

Reported By: JMFaurote | Reviewed By: DCWeekes

Title: Geologist | Title: Geologist

Signature: JMFaurote | Date: | Signature: DCWeekes | Date: 4/3/01

BHI-ES-183 (12/97)

BOREHOLE LOG

Date: 1 MAR 2001

Well ID: C3125	Well Name: 299-W10-27	Location: 5m E. of 241-TY Tank Farm	
Project: RCRA Drilling CY 2001		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
90	ST 17	90%		Silt w/ thin medium sand lenses.	ST 17 90-92.5
				Silt w/ fine-med sand lenses	
	ST 18	100%		Silt w/ sandy lenses; may have some angular lithic fragments.	ST 18 92.5-95 Archive @ 95 ft.
95	Archive				
	ST 19	100%		97.0 Caliche start to appear?	ST 19: 95-97.5
	ST20	100%		98.25 Top of caliche; coarse lithic frags in silty sand matrix. Mottled Dry; mostly angular.	ST 20: 97.5-100 ft, Archive @ 100'
100	Archive				
	ST21	100%		Grading into ~~medium~~ fine RFR sand w/silt. 80% fine RFR ~~med~~ qtz grains, 20% basalt; other lithic frags. loosely cemented or indurated. Well sorted. lt. greenish gray.	ST21- 100-102.5
	ST22	100%			ST22 102.5-105.
105	Archive				ST23 105-107.5
	ST23	100%		Silty SAND, calcareous, violent rxn HCl, 10YR 6/3 (pale brown), dry, predom fn-v.fn sand	Begin 3/2/01 ST 24: 107.5'→110' Archive from shoe
	ST 24	100% rec.		Caliche fragments increase 109'→110'	at 110'
110	Archive				
	ST 25	100%		moisture increase - 111'→112', tr gravel at 112'. Drilling rate increase.	ST 25: 110'→112.5'
	ST 26	100%			ST 26: 112.5'→115'
115	Archive			112.5'→117.5': SAND (S)	115' Archive
	ST 27	100%		95-100% Sand, tr-5% Silt. Sand 10% cse, 30% med, 40% fn, 20% v. fn.	ST 27: 115'→117.5'
	ST 28	100%		10YR 7/2 (lt. gry) dry, mod sorted, SA-A 90% qtz/Feld, 10% basalt/mafic	ST 28: 117.5'→120' * Clastic Dike.

Reported By: R.F. Raidl / L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: RRaidl / LDWalker	Date: 4 Apr 01	Signature: DCWeekes	Date: 4/3/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 3-2-01

Well ID: C3125 | Well Name: 299-W10-27 | Location: East side 241-TY Tank Farm

Project: RCRA Drilling CY2001 | 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
120	ST 28	Archive		Probable clastic dike starting	Cable tool, 8"
	ST 29	100% rec.		117.5': SILT (M) 90-100% Silt	casing
				tr-10% Sand, 10YR5/4 (yel. brn) wet	120': Archive
	ST 30	100% rec.		→ free water. 100% silt-moist- by	ST #29: 120→122.5
				120'	
125	Archive			120.5'→124.5': SAND (S)	ST #30: 122.5'-125'
	ST 31	100% rec.		95% Sand, 5% Silt. Sand tr v.cse,	Archive 125'
				20% cse, 40% med, 30% Fn, 10% v.Fn.	ST 31: 125'→127.5'
	ST 32	100% rec.		10YR 6/1 (gray), moist at 121', dry by 122';	
				mod sorted, SA-A; 60-70% qtz/feld, 30-	ST 32: 127.5'→130.0'/129.5'
130	Archive			40% basalt/other lithic Frags; max ~2mm	Archive 130'
	ST 33	100% rec.		123.5' tr gravel	ST 33: 130.0'→132.0
	DB			124.5'→220: Silty Sandy GRAVEL	refusal at 132.0'
	HT	NA		(msG) 50-60% Gravel, 25-35% Sand,	
				15% Silt. Gravel med peb - sm cob, Sand	132.5': Switch
135	Archive			predom med-cse; silt layers moist.	to Hard Tool
				poorly sorted, Gravel R-SR, Sand SA,	End 3/2/01
	HT			40-50% basalt, 50-60% qtzite/other,	Grab Sample- Archive
				tr iron oxide staining ~130'	@ 135'
140	Archive			very basaltic (~65%) @ 140'	Grab 140' Archive
					and chip tray sample
	HT				
					Grab 145' Arch. & Chip
145	Archive				End Shift 03/05/01
	HT				

Reported By: L.D. Walker/J.M. Faurote | Reviewed By: DC Weekes

Title: Geologist / Geologist | Title: Geologist

Signature: [signature] | Date: 03/06/01 | Signature: [signature] | Date: 4/3/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 6 of 9
Date: 03/06/01

Well ID: C 3125 | Well Name: 299-W10-27 | Location: East of 241-TY Tank Farm
Project: RCRA FY01 Drilling | 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
150	Archive HT	NA		Continues as Silty Sandy Gravel, 50-60% Gravel, 25-30% sand, 15-20% silt. Color has become med. brown. Gravel is med. peb to sm. cob. and consists of 40% basalt, 60% metamorphics and quartz in a dry, poorly sorted, SA-SR unit.	Archive & Grab for Chip Tray @ 150'
155	Archive HT			Probable increase in silt 154-157 Sand increases 157-159.5	155' Archive & grab sample <d γ β α - RCT
160	Archive HT			* Driller reports "very hard" drilling @ 159.5' Apparent silt content down to 10-15%, numerous quartzite fragments	160' Archive & grab shift end 03/06/01 03/07/01 AM Survey <d γ, β, α
165	Archive HT			Remains and continues very hard drilling w/ large pebbles and small cobbles.	165' Archive & chip sample
170	Archive HT				170' Archive and chip tray sample. RCT PM: <d γ β α
175	Archive HT				175' Archive & grab

Reported By: J.M. Faurote | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: JM Faurote | Date 03/07/01 | Signature: DC Weekes | Date: 4/3/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 03/08/01

Well ID: C3125 | Well Name: 299-W10-27 | Location: East of 241TY Tank Farm

Project: RCRA FY01 Drilling | 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
180	Archive	NA		~180' unit maybe more cemented rather than	180' Archive & grab
	HT			large cobble, by the amount of mud being	
				generated per foot of drilling.	<d γ, β, α Am Survey
				Gravel continues as 60% Gravel, 35%	
				sand and 15% silt. The color has changed	
185	Archive			to lt-bn, tan. It consists of 35-40% basalt	185' Archive & Grab
	HT			and the remainder is dominantly quartz	
				and metamorphics in a poorly sorted, dry	
				med to coarse grained unit. Max particle	
				size is probably 3" or less.	190' Archive & Grab
190	Archive				
	HT				
195	Archive				195' Archive & Grab
					PM Survey: <d α, β, γ
	HT				
				became "hard" again @ 198'	
200	Archive				200' Archive & Grab
	HT				
				205' - CONTINUES AS SILTY SANDY GRAVEL	205' Archive +
205	ARCHIVE			Color same as above, No HCl rxn, 65% grvl,	Grab
	HT			15% silt, 20% sand: 40% basalt → grvls dominant → Drilling slow	
				by pebbles - mod sorted subang; sands subround	
				mod sorting 50% fine, 50% med, trace of other	

Reported By: JM Faurote / JK Murray | Reviewed By: DC Weekes

Title: Geologist / Geologist | Title: Geologist

Signature: JM Faurote / JK Murray | Date: 4/3/01 | Signature: DC Weekes | Date: 4/3/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 03/12/01

Well ID: C3125 | Well Name: 299-W10-27 | Location: East of 241 TY Tank Farm

Project: BCRA FY01 Drilling | 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)
	HT				
210	Archive HT	NA		210' No color/HCl changes - Sands appear a little coarser, basalt content 30-35% → still Silty Sandy Gravel	210' Archive + Grab
					214'- Penetration rate ↑
					215' Archive + Grab
215	Archive HT			215' - similar to above 15% silt, less grvl ~ 45%, 40% sands No HCl rxn, No color change ↑ in sands - fine grained dominates; Gvls appear to have ↑ in size but ↓ in content - 35% basalt	220' Grab + Archive Sample
220	Archive HT			220' - 225' Slightly Silt Gravelly Sand 25-30% grvls, 15% silt, 60% sand → V. WK HCl rxn, grvls med pebbles ~ 30% basalt; Sands v. coarse dominate ~60%, 30% coarse, 10% others Subang. poor-mod sorted, No color change (Gradational ↑ in sand from 214-220')	Penetration rate Still good
225	Grab HT			225' - 268.7' silty sandy gravel. Silt 15%, gravel 35-45%, sand ↑40%. v f-c, (wet) A-SR, 35% bas. Strong rxn to HCl).	225' Grab sample
	Split Spoon HT	25% NA		226'-227' silty sandy gravel. Same as above	225'-226'-227' Split Spoon 25% recovery. Hit large rock + ruined spoon
230	Grab HT			230' silty sandy gravel (msg). Silt 15%, gravel 35%, sand 40%-50%. Coarse sand 30%, m-f sand 70%. Basalt 35%. A-SR Poorly sorted	Grab Sample @ 230'
235	Grab			235' silty sandy gravel (msg) same as above	Grab sample @ 235'
					End of shift 03/12/01

Reported By: Jill Murray / Charlene Martinez | Reviewed By: DC Weekes

Title: Geologist | Title: Geologist

Signature: Jill Murray / C Martinez | Date: 03/12/01 | Signature: DC Weekes | Date: 4/3/01

BHI-FE-183 (12/97)

BOREHOLE LOG

Date: 03/13/01

Well ID: C3125	Well Name: 299-W10-27	Location: East of 241-TY Tank Farm	
Project: RCRA FY01 Drilling		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
240	HT ↓ Split Spoon + Grab Sample	NA ↓		241'-242' silty sandy gravel. 15% silt, 40% gravel, 45% sand. wide color variation dk brown to green to off-white nodules. No rxn to HCl. Basalt ↓ 25-30%. Felsics ↑ 70-75%. Poorly sorted. A-SR. Sm cobbles ≈2"	split spoon / grab @ 241' very hard drilling. Had to get both together 25% recovery
	HT ↓	NA ↓			
245	Grab HT ↓			245' silty sandy gravel (msg) 15% silt 40% gravel, 45% sand. dk br (wet). Basalt 30-35%, felsics 65-70%, Poorly sorted. A-SR grains/gravel	grab @ 245'
250	Grab HT ↓	↓		250' silty sandy gravel (msg) 15% silt, 30% gravel, 55% sand. dk br (wet) Basalts predominately in coarse grained sands 50% coarse sand 50% m-f sands. Bas 35%, felsics 60-70% Poorly sorted. A-SR. Rxn to HCl	grab @ 250' End of shift due to ↑ winds 03/13/01
255	Grab	split spoon		254'-256' split spoon. silty sandy gravel (msg) 15% silt 30-35% gravel. 50-55% sand. dk br (wet) Basalts 25-30%, felsics 70-75%. Poorly sorted. A-SR. small cobbles	254'-256' split spoon 75-80% recovery 255' - grab sample
	HT ↓	NA ↓			
260				265' silty sandy gravel (msg) same description as above	
265				Grab Sample @ 268.7'. very watery due to the H_2O added to the borehole.	
				TD = 268.7' (03/14/01)	

Reported By: Charlene Martinez		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: Charlene Martinez	Date: 03/13/01	Signature: DC Weekes	Date: 4/3/01

BHI-EE-183 (12/97)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 8-17-00
Finish Date: 9-1-00
Page 1 of 1

Specification No.:	Rev. No.:	Well Name: 299-W14-15	~~Temp.~~ Well No.: C3114
ECNs:		Approximate Location: E. side 241-TX Tank Farm	
Project: CY 2000 RCRA Drilling		Other Companies: BHI, CHI	
Drilling Company: Resonant Sonic International		Geologist(s): L. Walker	
Driller:			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
FJ ~~8 5/8"/7 5/8"~~ LW	0 - 20.7	12"/10 1/4"
FJ 11 3/4"/10 1/4"	-	
FJ 8 5/8"/7 5/8"	20.7 -	9"/7 5/8"
	-	
	-	

*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design

DRILLING METHOD/HOLE DIAMETER

Auger:	Diameter From ___ to ___	
Cable Tool: ✓ 11 3/4"	Diameter From 0 to 20.7	
Air Rotary: ✓ 8 5/8"	Diameter From 20.7 to 260.0	
A.R. w/Sonic:	Diameter From ___ to ___	
	Diameter From ___ to ___	
	Diameter From ___ to ___	
	Diameter From ___ to ___	

Drilling Fluid: Air

Total Drilled Depth: 260'	Hole Dia @ TD: 9"	Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results:		Static Water Level: 219.80'	Date: 9-5-00

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
	-			-	
	-			-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annual Seal/Filter Pack	Volume	Mesh Size
4" ID SS304 Casing	+2.6 - 219.75'		NA	Portland Cement Grout	0 - 13.5'	9 sacks	NA
4" ID SS304 Screen	219.75' - 254.62'		0.020"	Bentonite, granular	13.5' - 199.3'	90 bags	
4" ID SS304 Sump	254.62 - 256.7'		NA	Bentonite, pellets	199.3' - 209.9'	6 buckets	3/8"
	-			Colorado Silica Sand	209.9' - 260.0'	59 bags	10-20
	-				-		

OTHER ACTIVITIES

Aquifer Test: Well development	Date: 9-5-00	Well Abandoned:	Yes:	No:	Date:
Description: Monitor drawdown and recovery		Description:			

WELL SURVEY DATA

Date:	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Cap Elevation:

COMMENTS/REMARKS

50-lb. bag 10-20 sand = 0.54 ft^3 ; 50-lb bucket bentonite pellets = 0.62 ft^3
50-lb bag granular bentonite = 0.73 ft^3 ; 94-lb. bag Portland Cement = 1.285 ft^3

Reported By: L.D. Walker		Reviewed By: J Rovea	
Title: Geologist	Date:	Title: Sr. Proj Engr.	Date: 9/21/00
Signature: L.D. Walker		Signature: J Rovea	

BHI-EE-181 (12/97)

WELL SUMMARY SHEET

Date: 9-11-00

Well ID: C3114	Well Name: 299-W14-15
Location: 25m E. of 241-TX Tank Farm/200W	Project: CY 2000 RCRA Drilling
Prepared By: L.D. Walker — Date: 9-11-00	Reviewed By: DC Weekes — Date: 9/14/00
Signature: [signature]	Signature: DC Weekes

CONSTRUCTION DATA

Description

6"-dia Protective casing 1.0' above the 4" casing

4.5"OD/4"ID Well Casing SS type 304 +2.6' → 219.75'

Portland Cement Grout 0' → 13.5'

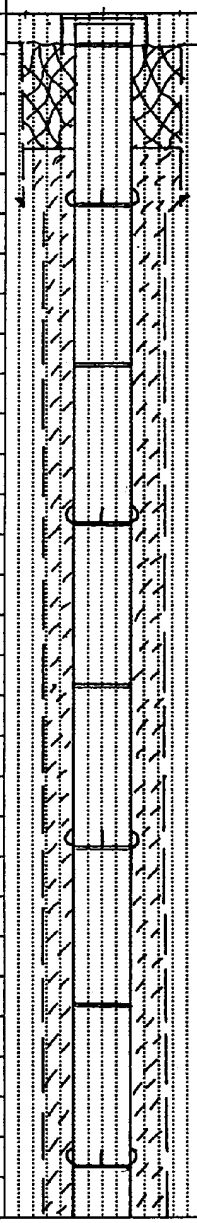
Granular Bentonite 13.5' → 199.3'

Temporary Casing 11 3/4" / 10 1/4" set at 20.7' 8 5/8" / 7 5/8" to TD

All depths in feet below ground surface

All temp. casing removed from ground.

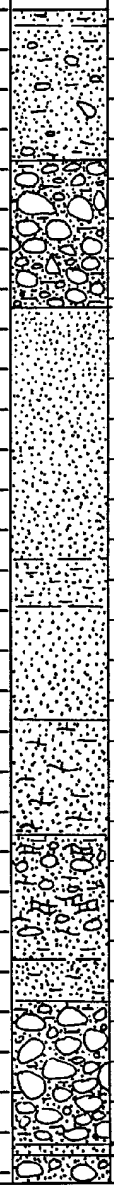
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 25, 50, 75, 100, 125

Graphic Log



Lithologic Description

0 → 2': Silty SAND

2' → 19': Gravelly Silty SAND

19' → 37': Silty Sandy GRAVEL

37' → 68': SAND

68' → 74': Silty SAND

74' → 88': SAND

88' → 103': Silty SAND

103' → 118': Slightly Silty Gravelly SAND

caliche frags at 103', 112'

118' → 123': Slightly Silty SAND

123' → 142': Silty Sandy GRAVEL

142' → 143': SAND

BHI-EE-189 (12/97)

WELL SUMMARY SHEET

Page 2 of 2

Date: 9-11-00

Well ID: C 3114		Well Name: 299-W14-15	
Location: 25 m. East of 241-TX Tank Farm		Project: CY 2000 RCRA Drilling	
Prepared By: L.D. Walker	Date: 9-11-00	Reviewed By: DC Weekes	Date: 9/14/00
Signature: [signature]		Signature: [signature]	

CONSTRUCTION DATA

Description

Bentonite Pellets
199.3' → 209.9'

Silica Sand, 10-20 mesh
209.9' → 260.0'

Well Screen, 4" ID, 0.020-in slot continuous wire-wrap, SS type 304
219.75' → 254.62'

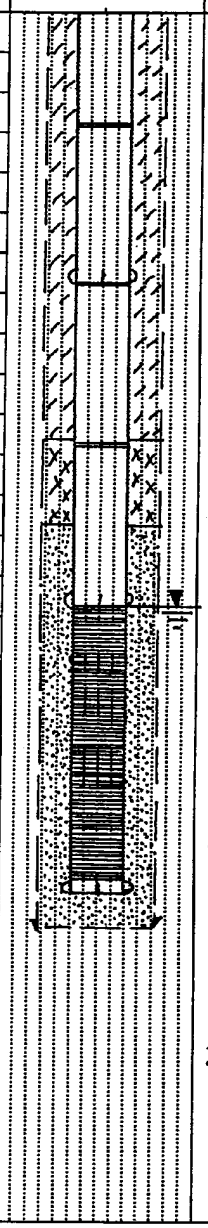
Sump, 4" ID SS type 304,
254.62' → 256.7'

Total SS 4" ID material is 259.30' (+2.6' → 256.7')

All depths in feet below ground surface

All temp. casing removed from ground.

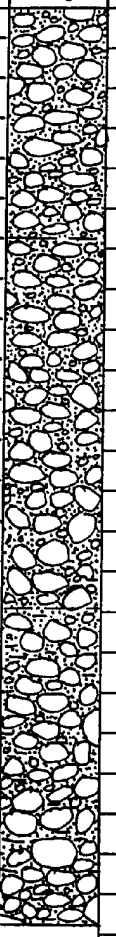
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 150, 175, 200, 225, 250, 275

Graphic Log



Lithologic Description

143' → 175': Sandy GRAVEL

175' → 221': Sandy GRAVEL

221' → 260': Silty Sandy GRAVEL

TD = 260.0'

W.L. = 219.80' bgs (9-5-00)

BHI-EE-189 (12/97)

BOREHOLE LOG

Date: 8-18-00

Well ID: C3/14 | Well Name: 299-W14-15 | Location: 25m E. of 241-TX Tank Farm/200W

Project: CY 2000 RCRA Drilling | 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	Cable Tool	NA		0'→2': Silty SAND (m S), 75% Sand, 25% Silt. Sand 20% cse-med, 30% Fn, 50% v.Fn. 10YR6/2 (lt. brn. gry) dry; mod sort; SA-A, predom qtz/feld, no rxn HCl.	Cable tool; 11 3/4 OD CS casing; drive barrel. β,γ < 2x background
5	Grab-Archive	Waste charact.		2'→19': Gravelly Silty SAND (gm S) 20% Gravel, 60% Sand, 20% Silt. Similar to above, with med-cse pebs. sl moist, weak rxn HCl.	5': Grab sample for archive. β,α < 2x background 8': β,α ≈ 2X back.
10	α: 160 dpm β,γ: 10,000 dpm	Waste Ch.		10 Feet: Gravel content decrease to 10-15%	10': ~~α,β ≈ 4000 dpm~~ LW α = 160 β,γ = 10,000 dpm
	α: 73 dpm β,γ ~ 800 dpm			Waste Characterization samples: 5' rad analysis - B0YVY5; 10' rad analysis - B0YVY6; 5'/10' Chemical composite - B0YVY7; 5'/10' rad screen - B0YVP0	End 8/18/00 Resume 8/22/00
15	α: 46 dpm β,γ: ~~background~~ LW (<500 dpm)				
	α: 69 dpm β,γ: ~~background~~ LW (<500 dpm)				No Archive samples collected in soil contamination
	α: 69 dpm β,γ: ~~background~~ LW (<500 dpm)			18': Silt content increase to ~30% Similar to above; sl moist.	
20	α: 42 dpm β,γ: <500 dpm			19'→37': Silty Sandy GRAVEL (ms G) 60% Gravel, 25-30% Sand, 10-15% Silt. Cuttings not circulating well - difficult to guess gravel sizes.	21': downgrade to non-rad work area 11 3/4" OD casing set at 20.7'
25	Air Rotary; Grab-Archive			Sand 20% v. cse, 40% cse, 40% med-v.fn 10YR4/1 (dk. gray) moist from injected water for dust control; poorly sort, predom. basalt gravel & sand.	*22.5': begin air rotary drilling; 8 5/8" OD CS casing. 25': Grab sample for archive

Reported By: L. D. Walker | Reviewed By: DCWeekes

Title: Geologist | Title: Geologist

Signature: [signature] | Date: 8/23/00 | Signature: [signature] | Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 8-23-00

Well ID: C3114	Well Name: 299-W14-15	Location: 25m E. of 241-TX Tank Farm / 200 W	
Project: CY 2000 RCRA Drilling		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
30	Grab-Archive				Air Rotary; 8 5/8" OD
	Air Rotary			19' → 37': Silty Sandy GRAVEL (msG)	CS casing, 7 1/4"-tri
				similar to description on	cone bit.
				previous page.	~~End 8-23-00~~
					30': Grab sample
35	Grab-Archive				for archive
					End 8-23-00
				37' → 68': SAND (S); tr gravel,	Begin 8-24-00
				100% sand 20% v. cse, 50% cse,	35': Grab-archive
				20% med, 10% fn-v. fn. tr silt.	37' → 40': casing
40	Grab-Archive			~~7.5 4~~ 7.5 YR 4/2 (brown) sl moist	drops, driller says
				from dust supp. water injection, (natural	"like a hole"
				dry) mod-well sorted; SA-A; 60%	40': Grab-archive
				qtz, Felds / 40% basalt and other lithic	
				frags; max gravel size ≈ 2 cm	
45	Grab-Archive			HCl rxn weak to none.	45': Grab-archive
					Drill rate ~ 5'/5 min.
					50': Grab sample
50	Grab-Archive			50': Sand predom. v. cse	for archive
					LEL, OVM < detect
					55': Grab sample
					for archive
55	Grab Archive				

Reported By: L.D. Walker		Reviewed By: DCWeekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 8/24/00	Signature: DC Weekes	Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 3 of 9
Date: 8/24/00

Well ID: C 3114 | Well Name: 299-W14-15 | Location: 25m E. of 241-TX Tank Farm/200W
Project: CY 2000 RCRA Drilling | 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
60	Grab-Archive			37' → 68' : ~~SADt~~ SW SAND (S)	Air Rotary, 8 5/8"
	Air Rotary			As described above	OD CS casing
					60': Grab sample for archive
65	Grab-Archive			66': silt content slow increase	65': Grab-archive
				68' → 74' : Silty SAND (mS)	70': Grab-archive
70	Grab-Archive			75-80% Sand, 20-25% Silt. Sand 20% v. cse-med, 40% Fn, 40% v.Fn; 10YR 6/3 (pale brown), dry-sl moist, mod-well sorted; SA-A; 75% qtz/Feld, 25% basalt/other; strong rxn HCl.	
75	Grab-Archive			74' → 88' : SAND (S)	75': Grab-archive
				90-95' Sand, 5-10% Silt. 30% v. cse-cse, 40% med, 30% Fn-v. Fn. Similar to above with lower silt content, weak rxn HCl.	80': Grab-archive
80	Grab-Archive				
					85': Grab-archive
85	Grab-Archive				

Reported By: L. D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: LD Walker | Date: 8/24/00 | Signature: DC Weekes | Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 8-24-00

Well ID: C 3114	Well Name: 299-W14-15	Location: 25 m E. of 241-TX Tank Farm/200W	
Project: CV 2000 RCRA Drilling		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
90	Grab-Archive			88'→103': Silty SAND (mS)	Air rotary; 8 5/8"
				60% Sand, 40% Silt; Sand is fr	OD CS casing
				med, 40% Fn, 60% v. Fn; 10YR 6/3	
				(pale brown); sl moist, ~~sw~~ mod-well	90': Grab sample
				sorted; SA; predom qtz/Felds; strong	For archive
95	Grab-Archive			- violent HCl rxn. Calcareous - low	93': drill rate slows
				plasticity in small silty/clayey Frags.	then increases
					to 5'/2 min.
				Sand content slowly increase	95': Grab-archive
				to 75-80% sand	
100	Grab-Archive				
					100': Grab-archive
				103'→118': Slightly Silty Gravelly SAND	
				((m)gS) 20% Gravel, ~~55-60%~~ 65-70% Sand,	105': Grab-archive
105	Grab-Archive			10-15% silt. Gravel predom. med peb,	
				caliche coatings, Sand 10% csc-med,	
				40% Fn, 50% v. Fn; color as above;	
				poorly sorted, Sand 80-90% qtz/Feld;	110': Grab-archive
				10-20% basalt/other; strong rxn HCl.	
110	Grab-Archive			103'- caliche Fragments	
				112': Caliche Fragments	
					115': Grab-archive
115	Grab-Archive				

Reported By: L. D. Walker		Reviewed By: DCWeekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 8-24-00	Signature: DCWeekes	Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 8-24-00

Well ID: C3114	Well Name: 299-W14-15	Location: 25m E. of 241-TX Tank Farm/200W	
Project: CY 2000 RCRA Drilling		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
120	Grab-Archive			118' → 123': Slightly Silty SAND	Air rotary; 8 5/8"
	Air Rotary ↓			((m)S) 85-90% Sand, 10-15% Silt.	OD CS casing
				Sand 40% med, 40% Fn, 20% v. Fn.	
				10YR6/3 (pale brown), dry; mod-well	120': Grab sample
				sorted; SR-SA; 90% qtz/felds, 10%	for archive
125	Grab-Archive			other; strong rxn HCl.	
					125': Grab-archive
				123' → 142': Silty Sandy GRAVEL	
				(mSG) 50% Gravel, 35% Sand,	
				15% silt. Gravel tr v. cse peb, 25%	130': Grab-archive
130	Grab-Archive			cse peb, 50% med, 25% Fn-v. Fn.	
				Sand 20% v.cse-cse, 40% med, 40% Fn-	
				v. Fn.; 10YR6/3 (pale brown), dry; poorly	
				sorted; Gravel R-SA, Sand SR-SA;	135': Grab-archive
				Gravel 40% basalt, 60% qtzite, granitics	
135	Grab-Archive			Max size-drilling indicates occ.	
				cobble; weak to strong rxn HCl.	
				silt content decreasing to	140': Grab-archive
140	Grab-Archive			below 10%	
				142' → 143': Sand lens	
				qtz rich, predom med size	
					145': Grab-archive.
145	Grab-Archive			143' → 175': Sandy GRAVEL (sG)	
				described on next page.	

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: [signature]	Date: 8-24-00	Signature: [signature]	Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 8-24-00

Well ID: C3114	Well Name: 299-W14-15	Location: 25m E of 241-TX Tank Farm/200W	
Project: CY 2000 RCRA Drilling		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
150	Grab-Archive				Air Rotary; 8 5/8" OD CS casing
					150': grab sample for archive
				Silt ~ 10%	152': drill rate slows
155	Grab-Archive				
				silt content decreasing	155': grab-archive
				143' → 175'	
160	Grab-Archive			Sandy GRAVEL (sG); 75% gravel, 20% Sand, 5% silt. Drilling indicates tr. cobbles; 30% v.cse peb, 30% cse peb, 40% med-v. Fn peb; Sand 10% v.cse, 20% cse, 50% med, 20% Fn-v. Fn. 10YR5/2 (grayish brown); dry; poorly sorted; Gravel R-SA; Gravel 60% basalt, 40% granitic, qtzite, other; Sand 40% basalt, 60% qtz/other tr mica; no rxn HCl.	160': Grab-archive
					injecting water for dust control
165	Grab-Archive				165': Grab-Archive
					170': Grab-archive
170	Grab-Archive				
				Slight color change, increase sand content.	175': Grab-archive
175	Grab-Archive			175' → 221': Sandy GRAVEL (sG) 50%-60% Gravel; 40-50% Sand Gravel 20% v.cse peb, 30% cse, 30% med, 20% Fn-v. Fn peb. Sand 20% v.cse-cse, 50% med, 30% fn-v. Fn (see next page)	

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 8-24-00	Signature: DC Weekes	Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 8-24-00

Well ID: C3114	Well Name: 299-W14-15	Location: 25m E. of 241-TX Tank Farm / 200W	
Project: CY 2000 RCRA Drilling		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
180	Grab-Archive			Sandy GRAVEL (sG) - continued	Air Rotary; 8 5/8"
				10YR 5/3 (brown), dry; poorly sorted;	OD CS casing
				Gravel SR-SA, sand SA; Gravel 60-70%	180': Grab sample
				qtzite, granitic, other; 30-40% basalt;	for archive
				Sand 80% qtz, 20% basalt/other;	
185	Grab-Archive			no rxn HCl.	185': Grab-archive
				188': sl increase in sand content	190': Grab-archive
190	Grab-Archive			188' → 192' sand content 50-60%,	
				otherwise as above.	
					195': Grab-archive
195	Grab-Archive				
					drill rate:
					5'/10 min
					200': Grab-archive
200	Grab-Archive			Sandy GRAVEL (sG) - similar	
				to above. 60% Gravel, 40%	
				Sand, tr silt. Gravel predom	
				cse-med peb, Sand predom med.	
				10YR 6/3 (pale brown) dry; poorly	205': Grab-archive
205	Grab-Archive			sorted, gravel SR-SA, sand SR-SA;	
				Sand predom qtz/Feld; no rxn HCl.	

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 8-24-00	Signature: DC Weekes	Date: 9/14/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 8-24-00

Well ID: C3114	Well Name: 299-W14-15	Location: 25m E. of 241-TX Tank Farm/200W	
Project: CY 2000 RCRA Drilling		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
210	Grab-Archive				Air Rotary; 8 5/8" OD
				Sandy GRAVEL (sG)	CS casing
				similar to above.	
				50% Gravel, 50% sand, tr silt	210': Grab sample
				Gravel R-SR, cse-med peb.	For archive.
215	Grab-Archive			mineralogy as above	End 8/24/00
					Begin 8/25/00
					215': Grab-archive
					220': Grab-archive
220	Grab-Archive				
					222.2' → 224.5':
				221' → 260': Silty Sandy GRAVEL	Split tube #1 for
	ST #1	80% rec.		(msG) 55% Gravel, 30% Sand, 15%	sieve analysis
	Sieve analysis	/waste		Silt. Gravel 10% cobble, 30% v.cse	
225	Grab-archive	charact.		peb, 20% cse, 40% med-v. fn. Sand	225': Grab-archive
				20% v.cse-cse, 30% med, 30% fn, 20%	
				v. fn; 10YR4/3 (brown), wet; poorly	
				sorted; Gravel R-SA, sand SA; gravel 30-	
				40% basalt, 60-70% granitic, qtzite, other	230': Grab-archive
230	Grab-Archive			max size > 10 cm; no rxn HCl	
				tr yellow/olive color clay	
				230': sand content sl decrease, silt sl	
				increase.	235': Grab-archive
					end 8-25-00
235	Grab-Archive				
					Begin 8-28-00
	waste charact.				236' → 238': waste charac
	ST #2	100% rec.			Split tube.
	Sieve				237.5' → 240': Split tube sieve #2

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 8-28-00	Signature: DC Weekes	Date: 9/4/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 9 of 9
Date: 8-28-00

Well ID: C3114
Well Name: 299-W14-15
Location: 25 m E. of 241-TX Tank Farm/200W
Project: CY 2000 RCRA Drilling
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
	ST #2				Air Rotary; 8 5/8" OD
240	Grab-Archive			Silty Sandy GRAVEL (msG)	CS casing
	Air Rotary ↓			as described above	240': Grab sample for archive
245	Grab-Archive				245': Grab-archive
					W.L.= 220.25' bgs
				249-250': Silt ~20%	250': Grab-archive
250	Grab-Archive				↳ water production decrease during drilling
				221'→260' Silty Sandy GRAVEL (msG)	
	ST #3 Sieve Analysis	90% rec.		50% Gravel, 35% Sand, 15% Silt.	252.5'→254.5':
255	Grab-Archive			The gravel is tr sm. cob, 20% v. cse peb, 30% cse-med peb, 30% fn peb, 20% v. Fn. Sand 20% v. cse-cse, 40% med, 30% Fn, 10% v. Fn. 10YR 5/3 (brown) wet, poorly sorted; Gravel R-SR, sand SA, Gravel 30% basalt, 70% qtzite/granitic/other; Sand 10-15% basalt, 85-90% qtz/Feld; tr mica; tr iron staining; Max size 8-10 cm; no rxn HCl.	Split tube sample for sieve analysis α, β, γ at background
					255'= Grab-archive
260	Grab-Archive				260': Grab-archive
					TD = 260.0' bgs
				256': Sand increase to ~40%	
				258'→260': Water production increase	
265					

Reported By: L. D. Walker
Title: Geologist
Signature: LD Walker
Date: 8-28-00

Reviewed By: DC Weekes
Title: Geologist
Signature: DC Weekes
Date: 9/14/00

BHI-EE-183 (12/97)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 10-25-00
Finish Date: 11-8-00
Page 1 of 1

Specification No.: 0200W-SP-C0007	Rev. No.: 0	Well Name: 299-W14-16	Temp. Well No.: C3120
ECNs: NA		Approximate Location: 300m east of 241-TY tank farm	
Project: CY 2000 RCRA Drilling		Other Companies: BHI, CHI	
Drilling Company: Resonant Sonic Int.		Geologist(s): L.D. Walker, C.S. Wright, D.C. Weekes	
Driller: K. Cowen			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
FJ 10 3/4"/9 3/8"	0' - 265'	11"/9 3/8"
(Carbon Steel)	-	
	-	
	-	
	-	

*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design

DRILLING METHOD/HOLE DIAMETER

Auger:	Diameter From ___ to ___
Cable Tool:	Diameter From ___ to ___
Air Rotary: ✓ 8 3/4" bit	Diameter From 0' to 265'
A.R. w/Sonic:	Diameter From ___ to ___
	Diameter From ___ to ___
	Diameter From ___ to ___
	Diameter From ___ to ___

Drilling Fluid: Air

Total Drilled Depth: 265'	Hole Dia @ TD: 11" shoe	Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results: satisfactory 11/2/00		Static Water Level: 222.55'	Date: 11-8-00

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
Spectral Gamma	0' - 265'	11-1-00		-	
Neutron moisture	0' - 222'	11-1-00		-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annual Seal/Filter Pack	Volume	Mesh Size
Sump - 4" sch.5 SS304L	257.88' - 260.06'	F480	NA	Silica Sand	210.4' - 265.0'	153 bags	10-20
Screen - 4" SS304L	222.94' - 257.88'	F480	0.020"	Bentonite Pellets	204.5' - 210.4'	8 buck.	1/4"
Casing - 4" Sch.5 SS304L	+2.0 - 222.94'	F480	NA	Granular Bentonite	11.3' - 204.5'	159 bags	
	-			Portland Cement	0' - 11.3'	8 bags	NA
	-				-		

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Abandoned:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA

Date:	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Cap Elevation:

COMMENTS/REMARKS

50-lbs bag 10-20 sand = 0.54 ft³; 50-lbs bucket bentonite pellets = 0.62 ft³; 50-lbs bag granular bentonite = 0.73 ft³; 94-lbs bag portland cement = 1.285 ft³

Reported By: L.D. Walker		Reported By: DCWeekes	
Title: Geologist	Date: 11-8-00	Title: Geologist	Date: 2/14/01
Signature: LD Walker		Signature: DCWeekes	

BHI-EE-181 (12/97)

WELL SUMMARY SHEET

Date: 11-8-00

Well ID: C3120		Well Name: 299-W14-16	
Location: 300m east of 241-TY Tank Farm / 200W		Project: CY 2000 RCRA Drilling	
Prepared By: L.D. Walker	Date: 11-8-00	Reviewed By: DC Weekes	Date: 12/27/00
Signature: LD Walker		Signature: DC Weekes	

CONSTRUCTION DATA

Description

6-in. dia protective SS casing set 1.0' above the 4-in. casing

4-in. ID sched. 5, SS304L well casing: +2.0' → 222.94'

Portland cement grout: 0' → 11.3'

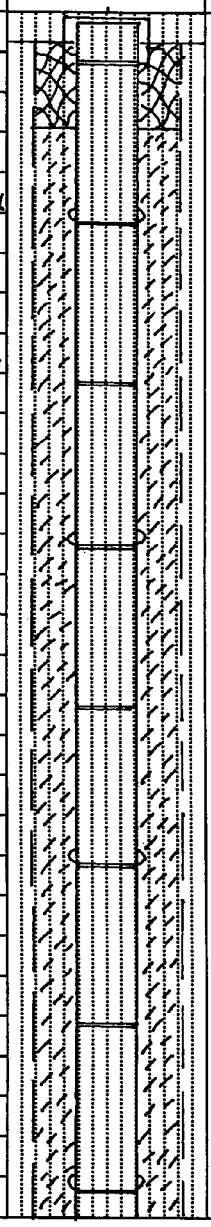
Granular bentonite: 11.3' → 204.5'

Temporary casing: 10¾" / 9⅝" set at 265'

All depths in feet below ground surface

All temp. casing removed from the ground.

Diagram

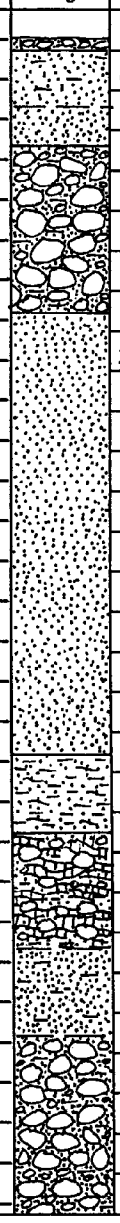


GEOLOGIC/HYDROLOGIC DATA

Depth in Feet

0, 25, 50, 75, 100, 125

Graphic Log



Lithologic Description

0' → 1.5': Sandy GRAVEL

1.5' → 8': Slightly Silty SAND

8' → 13.5': SAND

13.5' → 34': Silty Sandy GRAVEL

34' → 89': SAND

89' → 99': Sandy SILT

99' → 113': Silty Sandy GRAVEL w/ caliche

113' → 124': Silty SAND

124' → 179': Silty Sandy GRAVEL

BHI-EE-189 (12/97)

WELL SUMMARY SHEET

Date: 11-8-00

Well ID: C 3120	Well Name: 299-W14-16
Location: 300m east of 241-TY tank farm / 200 W	Project: CY 2000 RCRA Drilling
Prepared By: L.D. Walker Date: 11-8-00	Reviewed By: DC Weekes Date: 12/27/00
Signature:	Signature:

CONSTRUCTION DATA

Description

Bentonite pellets, 1/4"
204.5' → 210.4'

Silica Sand, 10-20 mesh
210.4' → 265.0'

Well screen
4-in. ID, 0.020-in slot
cont. wire-wrap SS304L
222.94' → 257.88'

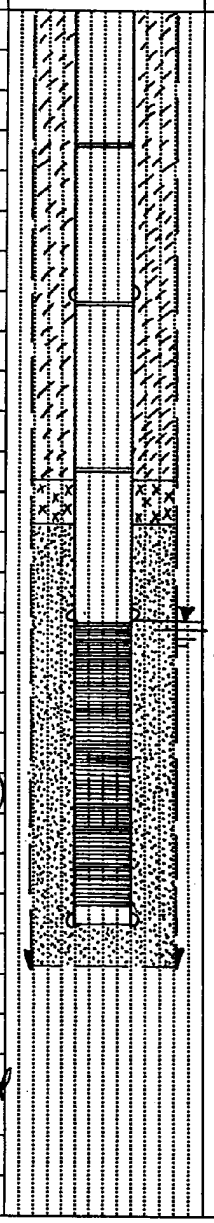
Sump
4-in ID SS304L
257.88' → 260.06'

Total 4-in. ID SS material
is 262.06' (+2.0' → 260.06')

All depths in feet below ground surface

All temp. casing removed from the ground

Diagram

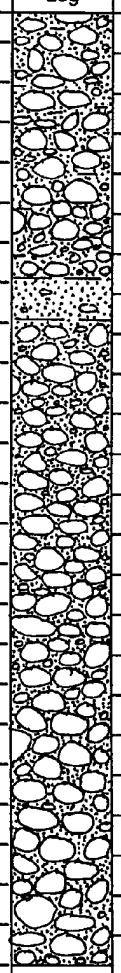


GEOLOGIC/HYDROLOGIC DATA

Depth in Feet

150
175
200
225
250
275

Graphic Log



Lithologic Description

179' → 184': Gravelly SAND

184' → 265': Sandy GRAVEL

W.L. = 222.55' bgs
(11-8-00)

TD = 265.0'

BHI-EE-189 (12/97)

BOREHOLE LOG

Page 1 of 9
Date: 10-26-00

Well ID: C 3120
Well Name: 299-W14-16
Location: 300m east of 241-TY tank farm/200W
Project: CY 2000 RCRA Drilling
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'→1.5': Sandy GRAVEL (sG) 60% Gravel, 40% Sand, tr silt. Drill pad gravel / crushed rock, predom basalt.	Air rotary, 8¾" tricone bit, 10¾" OD CS casing
				1.5'→8': Slightly Silty SAND ((m)S) 85%-90% Sand, 10-15% Silt. Sand 10% med, 40% Fn, 50% v. Fn. 10YR5/3 (brn) sl moist, mod-well sorted, SA-SR, predom qtz/feld, strong rxn to HCl.	5': Grab sample for archive
5	Grab-Archive				
					10': Grab-archive
10	Grab-Archive			8'→13.5': SAND (S); 95% Sand, 5% silt. Sand 10% v.cse-cse, 30% med, 40% Fn, 20% v. Fn. Otherwise similar to above. Strong rxn HCl.	γ at background levels (386 cpm)
					15': Grab-archive
15	Grab-Archive			13.5'→34': Silty Sandy GRAVEL 60-70% Gravel, 15-25% Sand, 15% silt. Gravel tr boulder/cobble, 30% v.cse peb, 40% cse peb, 30% med-Fn; Sand 30% v.cse-cse, 30% med, 40% Fn-v. Fn; moist from water injected for dust control, poorly sorted; gravel R-SR, sand SA; Gravel 60% basalt, 40% granitic, qtzite, other; max size over 20 cm, weak-no rxn HCl.	17': Drilling indicates boulder
20	Grab-Archive				20': Grab-archive
					25': Grab-archive
25	Grab-Archive				

Reported By: L.D. Walker
Title: Geologist
Signature: LD Walker
Date: 10-26-00

Reviewed By: JM Faurote
Title: Geologist
Signature: JM Faurote
Date: 12/28/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-26-00

Well ID: C3120	Well Name: 299-W14-16	Location: 300 m east of 241-TY tank farm	
Project: CY 2000 RCRA Drilling		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
30	Grab-Archive			13.5' → 34': Silty Sandy GRAVEL described on previous page.	Air rotary, 10¾" OD CS casing
					30': Grab sample for archive
35	Grab-Archive			34' → 89': SAND (S); tr-5% Gravel, 95-100% Sand, tr silt. Gravel predom cse-med peb; Sand 30% v.cse, 40% cse, 20% med, 10% Fn-v.Fn; 10YR 5/2 (gr bru), sl moist, salt-n-pepper color, mod sorted, SA, 40-50% basalt, 50-60% qtz/feld Max size ~ 3 cm; ~~to~~ sl rxn HCl.	35': Grab-archive
					poor returns
40	Grab-Archive				40': Grab-archive
				43'-44': 5-10% gravel, then back to occasional gravel.	
45	Grab-Archive				45': Grab-archive
50	Grab-Archive				50': Grab-archive
55	Grab-Archive				55': Grab-archive

Reported By: L. D. Walker		Reviewed By: JM Faurote	
Title: Geologist		Title: Geologist	
Signature: [signature]	Date: 10-26-00	Signature: [signature]	Date: 12/20/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 3 of 9
Date: 10-26-00

Well ID: C 3120 | Well Name: 299-W14-16 | Location: 300m east of 241-TY tank Farm

Project: CY 2000 RCRA Drilling | 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
60	Grab-Archive			34' → 89'	Air rotary; 10 3/4"
				SAND (S); tr gravel, 100%	OD CS casing
				sand, tr silt. 20% v.cse-cse, 50%	
				med, 30% fn-v. fn; 10YR 5/3 (brown)	60': Grab sample
				sl moist; mod. sorted; SA; 30-40%	for archive
65	Grab-Archive			basalt, 60-70% qtz, feld, other; max	
				gravel ~ 2 cm; weak rxn HCl.	65': Grab-archive
70	Grab-Archive			slight increase in gravel at 70'	70': Grab-archive
				to about 2-3%	
					75': Grab-archive
75	Grab-Archive				
					Drill rate: 5 ft/2 min.
					80': Grab-archive
80	Grab-Archive				
				Sand predom. med., tr mica	85': Grab-archive
85	Grab-Archive				
	NA-LW			89': sharp contact	

Reported By: L.D. Walker | Reviewed By: JM Faurote

Title: Geologist | Title: Geologist

Signature: [signature] | Date: 10-26-00 | Signature: [signature] | Date: 10/26/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-26-00

Well ID: C3120	Well Name: 299-W14-16	Location: 300m east of TY tank Farm/200W
Project: CY 2000 RCRA Drilling		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
90	Grab-Archive			89' → 99' : Sandy SILT (sM)	Air rotary; 10 3/4"
				30% Sand, 70% Silt. Sand is 20% fn,	OD CS casing
				80% v. fn. 10YR6/4 (lt yel. brown); sl	
				moist, well sorted, SA - predom qtz/feld,	90': Grab sample
				Max size < 1mm; calcareous - strong rxn	for archive
95	Grab-Archive			HCl.	
					95': Grab-archive
				99' → 113' : Silty Sandy GRAVEL	100': Grab-archive
100	Grab-Archive			(msG). Caliche coating on gravel,	
				and caliche fragments 1-2 cm broken	101': water injected
				by drill bit. Below 110', caliche frags	to lift cuttings/
				rare. 30-40% Gravel, 40-50% Sand,	dust control.
				20% silt. Gravel predom med-fn peb,	
105	Grab-Archive			Sand med-fn grain; 10YR6/3 (pale brown),	drill rate: 5'/11 min.
				dry, poorly sorted, gravel SA-SR, sand	
				SA; 30% basalt, 70% qtzite/granitic/other,	105': Grab-archive
				max gravel size ~2 cm; violent rxn	
				to HCl.	
110	Grab-Archive				110': Grab-archive
				113' → 124' : Silty SAND (mS)	
				70% sand, 30% silt; Sand 10% med,	
115	Grab-Archive			40% fn, 50% v. fn; 10YR5/4 (yel. brown)	115': Grab-archive
				sl moist; well sorted; SA; 80% qtz/feld,	
				20% basalt/other; Strong rxn HCl.	

Reported By: L.D. Walker		Reviewed By: JM Faurote	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 10-26-00	Signature: JM Faurote	Date: 12/28/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-26-00

Well ID: C3120	Well Name: 299-W14-16	Location: 300m east of TY tank farm / 200W	
Project: CY 2000 RCRA Drilling		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
120	Grab-Archive			120': silt content increase to ~40%, HCl rxn decrease to weak.	Air rotary, 10¾" OD CS casing
				122': gravel start	120': Grab sample for archive
					124': drilling indicates cobbles
125	Grab-Archive			124'→179': Silty Sandy GRAVEL (ms G) 50-60% Gravel, 25-35% Sand, 15% Silt. Poor returns lift only small cuttings, but drilling indicates occ. cobbles. Sand 10% v. cse, 30% cse-med, 50% fn, 10% v. fn. 10YR5/2 (gr. brn), dry; very poorly sorted, Gravel 40% basalt, 60% qtzite/granitic, Sand 10-15% basalt, 85-90% qtz/feld. weak rxn HCl.	125': Grab-archive
130	Grab-Archive				130': Grab-archive end 10-26-00 (132')
135	Grab-Archive			weak rxn to HCl	135': Grab-Archive
140	Grab-Archive			no rxn to HCl	140': Grab-Archive Poor returns - highly ground sample
145	Grab-Archive			Samples are wet from about 144 ft due to driller adding water. This "washes" out many of the fines and sand. weak rxn to HCl	145': Grab-Archive

Reported By: L. D. Walker / DC Weekes		Reviewed By: JM Faurote	
Title: Geologist		Title: Geologist	
Signature: LD Walker / DC Weekes	Date: 10/27/00	Signature: JM Faurote	Date: 12/28/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 6 of 9
Date: 10/27/00

Well ID: C3120 | Well Name: 299-W14-16 | Location: 300m east of TY tank farm/200W

Project: CY2000 RCRA Drilling | 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
150	Grab-Archive			mostly gravel	150': Grab-archive
					Air Rotary, 10 3/4"
					OD CS casing
					Added 20' casing
155	Grab-Archive			strong rxn to HCl	155': Grab-Archive
160	Grab-Archive			weak to moderate rxn to HCl	160': Grab-Archive
165	Grab-Archive			~~weak~~ strong rxn to HCl	165': Grab-Archive
170	Grab-Archive			strong rxn to HCl	170': Grab-Archive
175	Grab-Archive			moderate rxn to HCl	175': Grab-Archive

Reported By: DCWeekes | Reviewed By: JMFaurote

Title: Geologist | Title: Geologist

Signature: DCWeekes | Date: 10/27/00 | Signature: JMFaurote | Date: 10/28/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10/27/00

Well ID: C3120 | Well Name: 299-W14-16 | Location: 300m east of TY Tank Farm/200W

Project: CY2000 RCRA Drilling | 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
180	Grab-Archive			179'→184': Gravelly SAND (gS), 10YR6/3 pale brown (dry), mostly medium sand ranging from C to f, less than 10% silt, 10 to 20% gravel (probably from above); sand is SA to SR, 90% qtz, common mica, <10% bas, well sorted, no rxn to HCl	Air rotary, 10¾" OD CS casing 180': Grab-archive indistinct contact (upper + lower)
185	Grab-Archive			184'-265': Sandy GRAVEL (sG), 70%-80% gravel, <10% silt, 10YR5/2 grayish brown (dry), sample was wet due to water added to borehole; gravel is A to SR, 40% bas, 60% other, moderately sorted,	185': Grab-archive
190	Grab-Archive				190': Grab-archive
195	Grab-Archive				195': Grab-archive
200	Grab-Archive				200': Grab-archive
205	Grab-Archive				205': Grab-archive

Reported By: DCUkekes | Reviewed By: JMFaurote

Title: Geologist | Title: Geologist

Signature: DCUkekes | Date: 10/27/00 | Signature: JMFaurote | Date: 12/28/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10/27/00

Well ID: C3120 | Well Name: 299-W14-16 | Location: 300m east of TY Tank Farm/200W

Project: CY2000 RCRA Drilling | 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
210	Grab-Archive				Air rotary, 10¾" OD CS casing
					210': Grab Archive
					End of shift 10/27/00 212'
					Begin 10/30/00
215	Grab-Archive				
					215': Grab-archive
				Note: Driller injecting ~5 gpm water into drilling air while above ground water for dust control and to aid lifting cuttings.	Very poor returns
220	Grab-Archive				220': Grab-archive LEL, ovm <detect.
					*water level = 222.1' (10-30-00)
	ST#1 Sieve analysis	100% rec.		184' → 265 :	223.2' → 224.7' : Split tube #1 for sieve analysis
225	Grab-Archive			Sandy GRAVEL (sG) 60% Gravel, 30% Sand, 10% Silt. Gravel tr small cobble, 20% v.cse peb, 40% cse peb, 30% med peb, 10% Fn-v.Fn. Sand ~~20%~~ 10% v.cse-cse, 30% med, 40% Fn, 20% v.Fn; 10YR5/4 (yel. brown), wet; poorly sorted, gravel SR-R, sand SA; Gravel 30-40% basalt, 60-70% granitic, qtzite, other; Sand 80% qtz/Feld, 20% basalt/other; tr mica; Max size > 10 cm; weak-mod rxn to HCl.	225': Grab-archive end 10-30-00 begin 10-31-00
230	Grab-Archive				230': Grab-archive * collect water grab sample for PNNL w/ casing shoe at 232'
235	Grab-Archive			Sandy GRAVEL - as above	235': Grab-archive

Reported By: DCWeekes / L.D. Walker		Reviewed By: JMFaurote	
Title: Geologist		Title: Geologist	
Signature: DCWeekes / LD Walker	Date: 10/27/00 10-31-00	Signature: JMFaurote	Date: 11/08/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 9 of 9
Date: 10-31-00

Well ID: C 3120 | Well Name: 299-W14-16 | Location: 300m east of 241-TY tank farm/200W

Project: CY 2000 RCRA Drilling | 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
240	Grab-Archive				Air rotary, 10¾" OD CS casing
	Split tube #2 sieve	100% rec.		184' → 265'	240': Grab sample for archive
				Sandy GRAVEL (sG)	
				65% Gravel, 25% Sand, 10% Silt.	241.1' → 244': Split tube #2 for sieve analysis.
245	Grab-Archive			(from split tube #2) 10% sm cobble, 30% v.cse-cse peb, 40% med peb, 20% fn-v.fn; Sand 5% v.cse-cse, 30% med, 40% fn, 25% fn^w v. fn; 10YR5/4 (yel. brown), wet; poorly sorted; gravel R-SR, sand SR-SA; Gravel 25% basalt, 50% qtzite, 25% granitic/other; Sand 85% qtz/Feld, 15% basalt/other; Max size ≈10cm, no rxn HCl.	· water sample from cyclone for PNNL w/ shoe at 242'
250	Grab-Archive				245': Grab-archive
	ST #3 sieve analysis	100% rec.			250': Grab-archive end 10-31-00 begin 11-1-00
				~248': increase in sand content, increase in water production	
255	Grab-Archive			250': 60% Gravel, 40% Sand, tr silt Sand predom med-fn. /otherwise similar to above.	251.0' → 253.5': Split tube #3 for sieve. · water sample for PNNL w/ shoe at 252'.
				255': water production decrease while drilling.	
260	Grab-Archive				255': Grab-archive
					260': Grab-archive
					265': Grab-archive · water sample for PNNL, shoe at 265'
265	Grab-Archive			TD= 265.0'	

Reported By: L.D. Walker | Reviewed By: JM Faurote

Title: Geologist | Title: Geologist

Signature: LD Walker | Date: 11-1-00 | Signature: JM Faurote | Date: 7/28/08

BHI-EE-183 (12/97)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 10-10-00
Finish Date: 10-24-00
Page 1 of 1

Specification No.: 02200W-SP-C0007	Rev. No.: 0	Well Name: 299-W14-17	~~Temp.~~ Well No.: C3121
ECNs: NA		Approximate Location: 300 m east of 241-TX tank Farm	
Project: CY 2000 RCRA Drilling		Other Companies: BHI, CHI	
Drilling Company: Resonant Sonic International		Geologist(s): L. Walker J. Murray G. Thomas	
Driller: K. Cowden			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
FJ/carbon steel	0 - 20.6	12"/10 1/4"
FJ/carbon steel	20.6 - 265.3	9"/7 5/8"
	-	
	-	
	-	

*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design

DRILLING METHOD/HOLE DIAMETER

Auger:		Diameter From ____ to ____
Cable Tool: ✓	12"	Diameter From 0' to 20.6'
Air Rotary:	8"	Diameter From 20.6 to 265.5
A.R. w/Sonic:		Diameter From ____ to ____
		Diameter From ____ to ____
		Diameter From ____ to ____
		Diameter From ____ to ____

Drilling Fluid:

Total Drilled Depth: 265.5'	Hole Dia @ TD: 8 5/8"	Total Amt. Of Water Added During Drilling:	
Well Straightness Test Results:		Static Water Level: 221.69'	Date: 10-24-00

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
neutron	-	10-17-00		-	
spectral gamma	-	10-17-00		-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annual Seal/Filter Pack	Volume	Mesh Size
4" ID sched 5 SS304L	+2.58 - 221.94		NA	Portland Cement Grout	0' - 10.6'	11 bag	NA
4" ID SS304L screen	221.94 - 256.96		0.020"	Granular Bentonite	10.6' - 204.7'	120 bag	
4" ID SS304L sump	256.96 - 259.01		NA	Bentonite Pellets	204.7' - 211.9'	7 buck	3/8"
	-			Colorado Silica Sand	211.9' - 265.5'	109 bag	10-20
	-				-		

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Abandoned:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA

Date:	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Cap Elevation:

COMMENTS/REMARKS

50-lb. bag 10-20 Sand = 0.54 ft^3; 50-lb. bucket bentonite pellets = 0.62 ft^3; 50-lb. bag granular bentonite = 0.73 ft^3; 94-lb. bag portland cement = 1.285 ft^3

Reported By: L.D. Walker		Reviewed By: ML Johnson	
Title: Geologist	Date: 10-24-00	Title: BHI STR	Date: 10/31/00
Signature:		Signature:	

BHI-EE-181 (12/97)

WELL SUMMARY SHEET

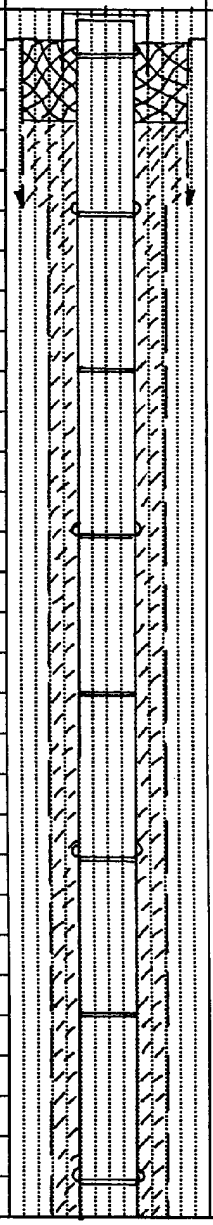
Date: 10-24-00

Well ID: C3121	Well Name: 299-W14-17
Location: 300m East of 241-TX tank Farm / 200W	Project: CY 2000 RCRA Drilling
Prepared By: L.D. Walker Date: 10-24-00	Reviewed By: DCWeekes Date: 12/27/00
Signature: [signature]	Signature: [signature]

CONSTRUCTION DATA

Description
6-in dia protective SS casing set 0.73' above the 4-in. casing
4-in ID sched. 5, SS304L Well casing: +2.58' → 221.94'
Portland cement grout: 0' → 10.6'
Granular bentonite: 10.6' → 204.7'
Temporary Casing: 11 3/4"/10 3/4" set at 20.6' 8 5/8"/7 5/8" to TD
All depths in feet below ground surface
All temp. casing removed from the ground

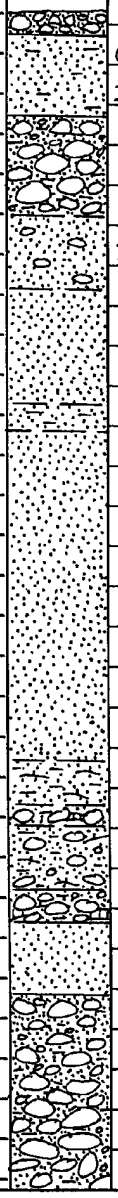
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 25, 50, 75, 100, 125

Graphic Log



Lithologic Description

- 0' → 2.5': Sandy GRAVEL
- 2.5' → 12.5': Slightly Silty SAND
- 12.5' → 25': Silty Sandy GRAVEL
- 25' → 34': Gravelly SAND
- 34' → 48': SAND
- 48' → 52': Slightly Silty SAND
- 52' → 93': SAND
- 93' → 98': Silty SAND
- 98' → 101': Gravelly Silty SAND
- 101' → 109': Gravelly Silty SAND
- 109' → 113': Silty Sandy GRAVEL
- 113' → 122': SAND
- 122' → 153': Silty Sandy GRAVEL

BHI-EE-189 (12/97)

WELL SUMMARY SHEET

Date: 10-24-00

Well ID: C3121		Well Name: 299-W14-17	
Location: 300 m East of 241-TX tank farm/200W		Project: CY 2000 RCRA Drilling	
Prepared By: L.D. Walker	Date: 10-24-00	Reviewed By: D.C. Weekes	Date: 12/27/00
Signature: [signature]		Signature: [signature]	

CONSTRUCTION DATA

Description

Bentonite pellets, 3/8":
204.7' → 211.9'

Silica Sand, 10-20 mesh
211.9' → 265.5'

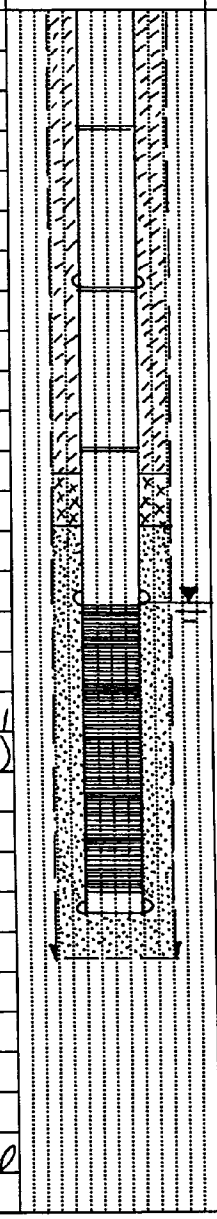
Well Screen
4-in. ID, 0.020-in. slot
cont. wire-wrap, SS
type 304:
221.94' → 256.96'

Sump:
4-in ID SS304L
256.96' → 259.01'

Total 4-in. ID SS material
is 261.59' (+2.58' → 259.01')

All depths in feet below
ground surface
All temp. casing removed
from the ground

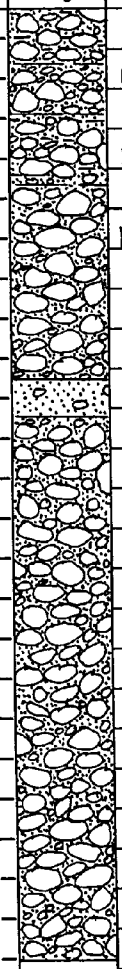
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 150, 175, 200, 225, 250, 275

Graphic Log



Lithologic Description

153' → 159': Sandy GRAVEL

159' → 168': Silty Sandy GRAVEL

168' → 193': Sandy GRAVEL

193' → 197': Gravelly SAND

197' → 265.5': Sandy GRAVEL

W.L. = 221.69' bgs (10-24-00)

TD = 265.5'

BHI-EE-189 (12/97)

BOREHOLE LOG

Page 1 of 9
Date: 10-10-00

Well ID: C3121	Well Name: 299-W14-17	Location: 300 m East of 241-TX Tank Farm	
Project: CY 2000 RCRA Drilling		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	Drive barrel			0' → 2.5' : Sandy GRAVEL (sG) 60% Gravel, 40% Sand, tr silt. First 1 foot drill pad gravels; 1→2.5' also look like construction material	Cable tool, 11 3/4" OD CS casing; 4': 400 dpm β,γ
5	Grab-Archive; Waste-B105V9			2.5' → 12.5': Slightly Silty SAND (m S); 85-90% Sand, 10-15% Silt, tr gravel. 10% v.cse-med, 40% fn, 50% v.fn sand; 10YR6/3 (pale brn) dry; mod-well sorted, predom qtz/feld, tr mica; max size gravel ~1 cm; strong rxn HCl.	5': Grab sample Collected for archive; 5-6': Waste Charact. Rad. analysis HEIS # B105V9 α,β,γ at background
10	Grab-Archive; Waste-B105W6				10': Archive; Waste Charact. Chem analysis B105W6 α,β,γ background
15	Archive; Waste-B10F66			12.5' → 25' : Silty Sandy GRAVEL (ms G); 30-40% Gravel, 40-50% Sand, 20% Silt. Gravel tr. sm cob, 20% v.cse-cse, 50% med, 30% fn-v.fn peb. Sand 20% v.cse, 20% cse, 30% med, 30% fn-v.fn; 10YR5/2 (gr. brown), sl moist; v. poorly sorted,	15': Archive; waste charact. rad analysis B10F66 α,β,γ at background
20	Grab-Archive; Air Rotary			Gravel SR-R; Sand SA; Gravel 40% basalt, 60% qtzite/granitic; Sand 30-40% basalt, 60-70% qtz/feld/other Max gravel ~10 cm; weak rxn HCl. 17-18': Gravel content increase to ~50%	20': Grab-archive 11 3/4" casing set at 20.6';
25	Grab-Archive			25': Gravel content decrease to 25% 25' → 34' : Gravelly SAND (gS) 20-25% Gravel, 70-75% Sand, tr-5% Silt. Description on next page	Begin air rotary drilling w/ 8 5/8" OD CS casing. 25': Grab-archive

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 10-11-00	Signature: DC Weekes	Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-11-00

Well ID: C3121	Well Name: 299-W14-17	Location: 300m E. of 241-TX tank farm	
Project: CY 2000 RCRA Drilling		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
30	Grab-Archive			Gravelly SAND (gS); Gravel predom. med-Fn peb; Sand 30% v. cse, 50% cse, 20% med-v. Fn.	Air rotary; 8 5/8" OD CS casing, 7 1/4" tricone bit
				30': Silt content decrease to trace.	
				10YR5/3 (brown), sl moist; mod sorted,	30': Grab sample
35	Grab-Archive			Sand SA; 30% basalt, 70% qtz/Feld/other	for archive
				tr mica; max gravel ~2 cm; ~~sl rxn~~	
				weak rxn HCl	35': Grab-archive
				34' → 48': SAND (S); tr Gravel,	
40	Grab-Archive			100% Sand, tr silt. Similar to	40': Grab-archive
				Sand fraction above. Predom.	
				v. cse-cse; SA; 25-35% basalt,	
				65-75% qtz/Feld; weak rxn HCl.	45': Grab-archive
45	Grab-Archive			48' → 52': Slightly Silty SAND (m S)	
				85-90% Sand, 10-15% Silt. Similar	
				to sand above, Finer.	50': Grab-archive
				10-20% basalt, 80-90% qtz/feld.	
				Strong rxn HCl; 10YR6/3 (pale brn)	
50	Grab-Archive				
				52' → 93': SAND (S)	55': Grab-archive
				100% Sand. Predom. cse, similar	
				to sand 34' → 48'	
55	Grab-Archive				Drill rate: 5 Ft/2 min

Reported By: L.D. Walker		Reviewed By: DCWeekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 10-11-00	Signature: DC Weekes	Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-11-00

Well ID: C 3121	Well Name: 299-W14-17	Location: 300 m. East of 241-TX tank farm	
Project: CY 2000 RCRA Drilling		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
60	Grab-Archive			52' → 93' : SAND (S)	Air rotary; 8 5/8"
				tr Gravel, 100% Sand, tr silt.	OD CS casing
				Sand is 10% v. cse, 40% cse, 30% med	
				20% Fn-v. Fn; 10YR 5/3 (brown), dry;	60': Grab sample
				mod sorted; SA; 20-30% basalt	For archive
65	Grab-Archive			70-80% qtz/feld; mod rxn HCl.	
					65': Grab-archive
					70': Grab-archive
70	Grab-Archive				
					75': Grab Sample -
75	Grab-Archive			SAND : as above	archive
					Drill rate: 5 ft./1 min.
					80': Grab-archive
80	Grab-Archive				
					85': Grab-archive
85	Grab-Archive				
				87': Sand slowly becomes Finer.	
				Now predom med-Fn.	

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 10-11-00	Signature: DC Weekes	Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-11-00

Well ID: C3121	Well Name: 299-W14-17	Location: 300m. East of 241-TX tank farm
Project: CY2000 RCRA Drilling		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
90	Grab-Archive				Air rotary; 8 5/8" OD CS casing
				93' → 98' : Silty SAND (mS); 60% Sand 40% silt; Sand predom. v. Fn; 10YR6/3 (pale brown), dry; well sorted, SA, 90% qtz/Feld, 10% basalt/other; strong rxn HCl.	90': Grab sample for archive
95	Grab-Archive				95': Grab-archive
				98' → 101' : Gravelly Silty SAND (gmS) similar to above w/ ~10% gravel tr caliche frags at 100'; violent rxn HCl.	
100	Grab-Archive				100': Grab-archive
				101' → 109 : Gravelly Silty SAND (gmS) 25% Gravel, 50% Sand, 25% silt. Gravel cse-med peb, predom. basalt 10YR 6/3 (pale brn) sand Fn-v. Fn, SA, very strong rxn HCl	105': Grab-archive
105	Grab-Archive				
				109' → 113' : Silty Sandy GRAVEL (msG) 40% gravel, 45% Sand, 15% silt Gravel med-fn peb, predom. basalt, sl moist, 10YR 5/3 (brown), poorly sorted, common caliche coatings on gravel, tr caliche frags, violent rxn HCl	110': Grab-archive
110	Grab-Archive				
					115': Grab-archive
115	Grab-Archive			113' → 122' : SAND (S) tr gravel, 100% Sand, tr silt. Sand 20% v.cse, 50% cse, 30% med-Fn. dry, mod sorted, SA-A, 30-40% basalt, 60-70% qtz/Felds. mod rxn HCl.	

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 10-11-00	Signature: DC Weekes	Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-11-00

Well ID: C3121	Well Name: 299-W14-17	Location: 300m East of 241-TX tank Farm	
Project: CY 2000 RCRA Drilling		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
120	Grab-Archive				Air rotary; 8 5/8"
				120-121': Sand cse - v. cse	OD CS Casing
					120': Grab sample
				122' → 153': Silty Sandy GRAVEL	for archive
125	Grab-Archive			(msG) ~~50~~ 55-60% Gravel, 30% Sand	
				10-15% Silt. Gravel tr cob, 20%	125': Grab-archive
				v. cse peb, 30% cse peb, 30% med,	
				20% Fn-v.Fn. Sand Fn 122'→125',	
				then predom cse below.	130': Grab-archive
130	Grab-Archive			Dry; poorly sorted; gravel SA-	
				SR, sand SA; Gravel 60-70%	Poor air circulation
				basalt, 30-40% granitic/qtzite,	Poor cutting returns
				weak rxn HCl.	
					135': Grab-archive
135	Grab-Archive				
					140': Grab-archive
140	Grab-Archive			Silt content appears to decrease-	
				could be result of water injected	
				for dust control washing out fines.	
					145': Grab-archive
145	Grab-Archive				

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 10-11-00	Signature: DC Weekes	Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-11-00

Well ID: C3121	Well Name: 299-W14-17	Location: 300 m E. of 241-TX tank farm/200W	
Project: CY 2000 RCRA Drilling		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
150	Grab-Archive				Air rotary; 8⅝" OD
					CS casing.
					150': Grab sample
				153'→159': Sandy GRAVEL (sG)	for archive
				60% Gravel, 35% Sand, 5% Silt.	end 10/11/00
155	Grab-Archive			Drilling indicates sm boulders/lg	begin 10/12/00
				cobbles. 30% v. cse peb, 40% cse peb,	
				30% med-v. fn. Sand 30% v. cse-cse	155': Grab-archive
				40% med, 30% fn. Poorly sorted,	
				gravel SR, Sand SA. 40% basalt,	Drill rate: ~5 ft/10 min.
160	Grab-Archive			60% granitic/qtzite/other.	
				no rxn HCl.	160': Grab-archive
				- silt content increasing -	
				159'→168': Silty Sandy GRAVEL	
				(msG) 50% Gravel, 35% Sand,	
165	Grab-Archive			15% Silt. Similar to above, with	165': Grab-archive
				higher silt content	
				168'→193': Sandy GRAVEL (sG)	
				60% Gravel, ~~35%~~ 35-40% Sand,	170': Grab-archive
170	Grab-Archive			tr-5% Silt. Gravel tr cob; 20%	α, β, γ ≤ background
				v. cse peb, 40% cse peb, 30% med, 10%	173': Drilling
				fn-v. fn. Sand 10% v. cse-cse, 20%	indicates boulder/
				med, 50% fn, 20% v. fn; Sand	or cobbles - need to
				color 10YR5/4 (yel. brn), gravel 40%	backpull 5' & re-drill
175	Grab-Archive			basalt, 60% granitic/other; Sand 90%	175': Grab-archive
				qtz/Feld, 10% basalt/other lithics	
				Gravel R-SR, Sand SR; no rxn HCl.	Drill rate 5 ft/45 min

Reported By: L.D. Walker		Reviewed By: DC Weekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 10-12-00	Signature: DC Weekes	Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-12-00

Well ID: C3121	Well Name: 299-W14-17	Location: 300m E. of 241-TX tank Farm/200W
Project: CY 2000 RCRA Drilling		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
180	Grab-Archive			Sandy GRAVEL – as described previous page	Air rotary; 8⅝" OD CS casing.
				183': percent content of sand increase to ~ 50%	180': Grab sample for archive
185	Grab-Archive				185': Grab-archive
					Drill rate: 5 ft/20 min
					190': Grab-archive
190	Grab-Archive				
				193'→197': Gravelly SAND (gS) 10% Gravel, 90% Sand, tr silt. Gravel predom cse-med. Sand 10% v.cse-cse, 50% med, 30% fn, 10% v. fn. Sand 10YR5/4 (yel. brown), sl moist; med-well sorted, SA-SR; Sand 90% qtz/felds, 10% basalt/other; no rxn HCl.	195': Grab-archive
195	Grab-Archive				
					200': Grab-archive
200	Grab-Archive			197'→265.5': Sandy GRAVEL (sG) 50-60% Gravel, 40-50% Sand, tr silt. Gravel tr cob, 30% v.cse peb, 40% cse, 30% med-fn. Sand as above.	Drill rate 5 ft/10 min.
				Color of above. Gravel 20-30% basalt, 70-80% granitic/qtzite/other. Gravel R-SR, max size 6-8 cm.	205': Grab-archive
205					

Reported By: L.D. Walker		Reviewed By: DC Ukekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 10-12-00	Signature: DC Ukekes	Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 10-12-00

Well ID: C3121 | Well Name: 299-W14-17 | Location: 300m E. 241-TX tank farm / 200W

Project: CY 2000 RCRA Drilling | 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
210	Grab-Archive				Air rotary; 8⅝" OD CS casing
					210': Grab sample for archive
215	Grab-Archive				End 10-12-00
					Begin 10-13-00
				217' Gravel size increasing	215' - Grab-archive
220	Grab-Archive			220' Sandy GRAVEL (SG)	220' - Grab-Archive
				60-70% Gravel, 30-40% Sand, tr silt	
				50% cse peb, 50% med-fine. Sand	
				35% v.cse, 30% cse, 35% fine-Med.	
				Sand 10YR 6/3 (pale brown), SL moist, Gravel	
225	Grab-Archive			20-25% Basalt, 75-80% granite/qtzite/other.	225' - Grab-Archive
				Gravel max size 8-10 cm	
	Waste Designation	B10F68		225': percent content of sand decreases to	227' - Waste Designation
	Split #1 Spoon			~ 20%	228' → 228.75': split
				228' ~~50-60~~ Sandy GRAVEL (SG)	spoon sample #1 for
230	Grab-Archive			50-60% Gravel, 40-45% Sand, tr silt	sieve analysis
				10% cse peb, 20% medium, 70% fine-v. fine peb	230' - Grab-Archive
	Waste Designation	B10F86		Sand: 35% cse-v.cse, 30% med, 35% fine-v.fine	
				Moist, Sand 10YR 7/1 (light Gray), 10% basalt,	232' - Waste Designation
				90% granite/qtzite/other. Gravel max size	
235	Grab-Archive			12-14 cm.	235' Grab-Archive
				230' → 245' fines getting washed out &	
				Gravels decreasing in size	
	Waste Designation	B10F69			237' - Waste Designation

Reported By: L.D. Walker / G.S. Thomas | Reviewed By: D C Weekes

Title: Geologist | Title: Geologist

Signature: L.D. Walker / Greg Thomas | Date: 10-13-00 | Signature: D C Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 9 of 9
Date: 10-17-00

Well ID: C3121 | Well Name: 299-W14-17 | Location: 300m E. 241-Tx tank Farm / 200W

Project: CY 2000 RCRA Drilling | 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
240	Grab sample				240' - Grab - Archive
				197' → 265.5':	
				Sandy GRAVEL (sG - from split tube	
245	Grab Archive	ST #2 - sieve - 100% rec.		at 245') 60% Gravel, 35% Sand,	245' - Grab - Archive
				5% silt. Gravel tr cob, 20% v.cse	244.9' → 246.4':
				peb, 30% cse, 30% med, 20% fn-v.fn	Split tube sample #2
				Sand predom med-fn; 10YR5/4 (yellow)	- sieve analysis
				wet; poorly sorted; Gravel R-SR,	*10-16-00 WL = 222.05'
250	Grab archive			sand is SA-SR; Gravel 25% basalt,	w/ casing shoe at 245'
				75% qtzite, granitics, Sand 80% qtz/feldsp,	
				20% basalt/other lithic frags; common	250': Grab - archive
				iron oxide staining ~ 245'; no rxn HCl.	
255				255': Silt content increase to ~	255.4' → 257.9':
	ST #3 Sieve analysis and archive	80% rec.		5-10% Common dark brick	Split tube sample
				red of iron oxide.	#3 - sieve analysis
					→ also archive
					End 10/16/00
260	Grab - archive				Begin 10/17/00
					260': Grab - archive
265	Grab - archive				265': Grab - archive
				T.D. = 265.5'	10-17-00 Geophysical logging - neutron and spectral gamma

Reported By: G.S. Thomas / L.D. Walker | Reviewed By: D C Weekes

Title: Geologist | Title: Geologist

Signature: G.S. Thomas / L.D. Walker | Date: 10-17-00 | Signature: D C Weekes | Date: 12/27/00

BHI-EE-183 (12/97)

WELL CONSTRUCTION SUMMARY REPORT

Start Date: 11/30/00
Finish Date: 1/17/01
Page 1 of 1

Specification No.: 0200W-SP-C0007	Rev. No.: 0	Well Name: 299-W15-763	~~Temp.~~ Well No.: C3339
ECNs: N/A		Approximate Location: S. of 241-TX TANK FARM	
Project: RCRA Drilling CY00		Other Companies: RSI, BHI, THI, CHI	
Drilling Company: RESONANT SONIC International		Geologist(s): JILL MURRAY, P. Vellines, DC Weekes, LD Walker, JM Favrote, GS Thomas	
Driller: MO WRASPIR			

TEMPORARY CASING AND DRILL DEPTH

*Size/Grade/Lbs. Per Ft.	Interval	Shoe O.D./I.D.
CARBON STEEL threaded	0' - 134.2'	11 3/4" / .80'
FJ carbon steel threaded	134.2' - 252.6'	8 5/8" / 7 5/8"
	-	
	-	
	-	

*Indicate Welded (W) - Flush Joint (FJ) Coupled (C) & Thread Design

DRILLING METHOD/HOLE DIAMETER

Auger:		Diameter From ____	to ____
Cable Tool: Drive Barrel 11 3/4		Diameter From 0'	to 134.2'
Air Rotary: 10 5/8"		Diameter From ____	to ____
A.R. w/Sonic: •		Diameter From ____	to ____
Cable Tool: Hard Tool 8 5/8		Diameter From 134.2'	to ~~252.6'~~ 257.6'
(A to Hard Tool @ 153')		Diameter From ____	to ____
		Diameter From ____	to ____

Total Drilled Depth: 257.6'	Hole Dia @ TD: 8 5/8"	Drilling Fluid: water	
Well Straightness Test Results: PASSED 1/9/01		Total Amt. Of Water Added During Drilling: 417 gallons	
		Static Water Level: 246.97'	Date: 4/10/01

GEOPHYSICAL LOGGING

Sondes (type)	Interval	Date	Sondes (type)	Interval	Date
NA	-			-	
	-			-	
	-			-	

COMPLETED WELL

Size/Wt./Material	Depth	Thread	Slot Size	Type	Interval Annual Seal/Filter Pack	Volume	Mesh Size
SUMP SS304L 4" ID	246.82' - 248.82'	F480	NA	Colorado Silica Sand	202.4 - 257.6	41 bags	10-20
SCREEN SS304L	211.75' - 246.82'	F480	.020	Bentonite Pellets	191.1 - 202.4	10 buckets	3/8"
Casing SS304L	+2 - 211.75'	F480	NA	Granular bentonite	9.2' - 191.1	219 bags	NA
Protective	+4.5' - 2'		NA	Portland I-II cement	0 - 9.2'	7 bags	NA
	-			& Quik gel bentonite	0 - 9.2'	1/4 bag	NA

OTHER ACTIVITIES

Aquifer Test:	Date:	Well Abandoned:	Yes:	No:	Date:
Description:		Description:			

WELL SURVEY DATA

Date:	Protective Casing Elevation:
Washington State Plane Coordinates:	Brass Cap Elevation:

COMMENTS/REMARKS

Vol. calcs: 10-20 sand: - 0.54 ft³/50# bag x 41 bags = 22.14 ft³; bentonite pellets: 0.62 ft³/bucket x 10 buckets = 6.2 ft³; Granular bentonite - 0.73 ft³/50# bag x 219 bags = 160 ft³

Reported By: JILL MURRAY / Pat Vellines		Reviewed ~~Reported~~ By: DC Weekes	
Title: Geologist	Date:	Title: Geologist	Date: 4/10/01
Signature: Jill Murray / Pat Vellines		Signature: DC Weekes	

BHI-EE-181 (12/97)

WELL SUMMARY SHEET

Page 1 of 2

Date: 1/17/01

Well ID: 299-W15-763		Well Name: C 3339	
Location: S of 241 Tx Tank Farm		Project: RCRA FY 2000	
Prepared By: Pat Vellinis	Date: 1/17/01	Reviewed By: DC Weekes	Date: 4/10/01
Signature: Pat Vellinis		Signature: DC Weekes	

CONSTRUCTION DATA

Description

Surface to 9.2'
Portland Cement Grout

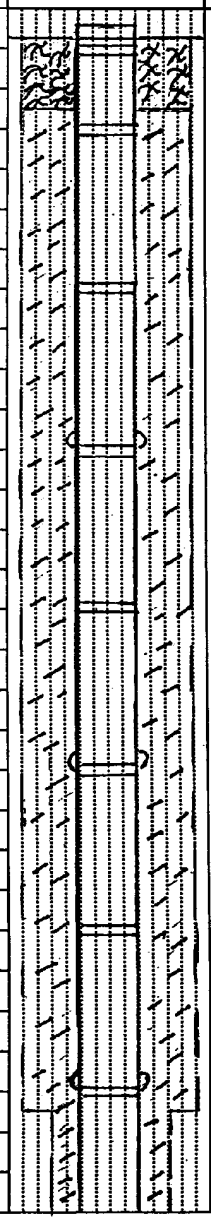
9.2' – 191.1' Granular
Bentonite

Permanent casing
SS 304, 4" ID, 4.5" OD
from
+2' – 211.75'

+1.5' – 2' Protective
Casing.

Ground surface is
reference for all measurements

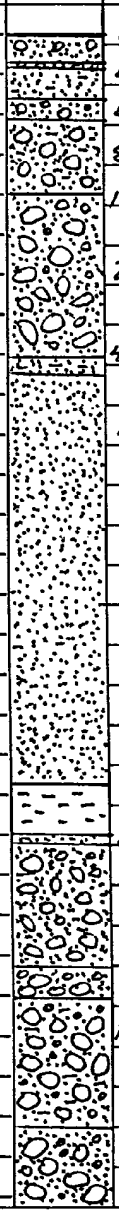
Diagram



GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 0, 25, 50, 75, 100, 125

Graphic Log



Lithologic Description

0-4' Gravelly SAND
4'-4.5' GRAVEL
4.5'-8' Slightly Silty SAND
8'-10.5' Sandy GRAVEL
10.5'-20' Silty Sandy GRAVEL
20'-40.5' Sandy GRAVEL
40.5'-42.5' Silty SAND
42.5'-94' SAND
94'-100' SILT
100'-101.5' Silty SAND
101.5'-117' ~~Sandy~~ GRAVELLY Silty SAND
117'-120 SANDY GRAVEL
120'-142' Silty Sandy GRAVEL
142'-170' Sandy GRAVEL

HI-EE-189 (12/97)

WELL SUMMARY SHEET

Page 2 of 2

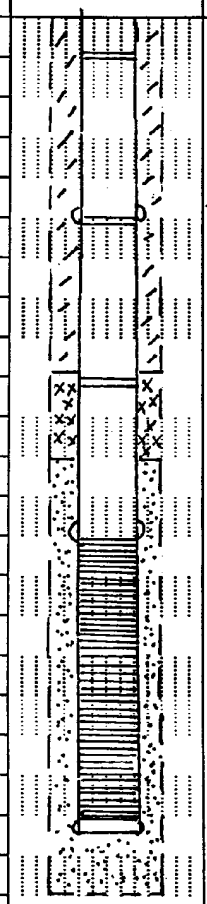
Date: 1/17/01

Well ID: 299-W15-763	Well Name: C3339
Location: S. of 241 Tx Tank Farm	Project: RCRA FY2000
Prepared By: Dan Vellines — Date: 1/17/01	Reviewed By: DCWeekes — Date: 4/10/01
Signature: Dan Vellines	Signature: DCWeekes

CONSTRUCTION DATA

Description
191.1' - 202.4' Bentonite Pellets
202.4' - 257.6' 10-20 mesh sand pack
211.75' - 246.82' .020 slot, SS304 screen; 4" ID, 4.5" OD
246.82 - 248.82' SS304 sump, 4" ID, 4.5" OD.
All temporary casing removed; all measurements relative to ground surface.

Diagram

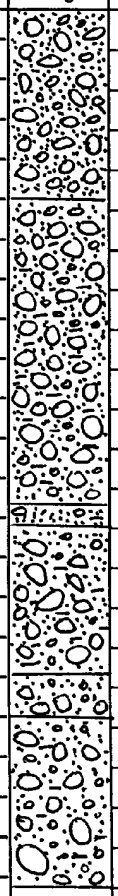


GEOLOGIC/HYDROLOGIC DATA

Depth in Feet: 150, 175, 200, 225, 250, 275

WL = 213.3'

Graphic Log



Lithologic Description

142' - 170' SANDY GRAVEL

170' - 209' silty sandy GRAVEL

209' - 211' Gravelly Silty SAND

211' - 230' silty SANDY GRAVEL

230 - 235' SANDY GRAVEL

235 - 240' silty SANDY GRAVEL

240 - 257' silty sandy GRAVEL

TD = 257.6'

BHI-EE-189 (12/97)

BOREHOLE LOG

Page 1 of 9
Date: 11/30/00

Well ID: C3339 | Well Name: 299-W15-763 | Location: S. of 241-TX TANK FARM
Project: RCRA CY2000 | 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	CABLE TOOL DRIVE BARREL	NA		0'-4' Gravelly Sand (BACKFILL)	
				SAND ~80%, 20% gravel; trace silts, poorly sorted	
				rnd. gravels; mod. sort sand with med. grains dominating	
				HCl rxn; 5YR 4/1 DK Gray; cobbles max size	
				4'- Cobble layers (max size lg cobb; sm. dominate)	
5	GRAB			4.5'-8' SLIGHTLY SILTY SAND (m) S	5'- Grab Sample taken
				SAND 80%, Gravel 5%, 15% silts; Basalt 70%:	
				Sands med-fine grain, mod sort. rounded; Gravels - sm med - cobb	
				42m max, rounded; silts look like high basalt as well,	
				WK HCl rxn; Color (moist) 5YR 4/1 DK. Gray	10'- Grab Sample taken
10	GRAB DB			8'-10.5' SANDY Gravel SG	
				Gvl: 40% SAND 55%, SILTS 5%; Basalt 70%	
				MAX size: sm. cobb, HCl rxn, Gvl poorly sorted, Sands mod	12'- silty lens
				sorting, sr, med-coarse dominate, Color dry 5YR 5/1 Gray	
				10.5'- SILTY SANDY Gravel mSG	
15	GRAB DB			30% Gravel, 15% silts, 55% sand; Basalt 70%, ↑ silts,	
				↓ grvl; descriptions otherwise same as above	
					Seal drum-00-0215 11-20'
				subtle change to f-m. grnd gravel,	
20	Archive, chip.			w/ max size at 1½" x 2" (sporadic). 65% basalt, generally	
				Gray to med. gray. Grains are round to well rounded, but	
				med. sorted. wk rxn to HCl. Silt <10%	
				sporadic v.sg. rxn to HCl - in gy-or to flesh colored	
				caliche type cements on gravel... not consistent @	
25	Archive*	Grab detect		< 2%. the gravel is highly variable in size.	
				* Cobbles 25-27, max size is 7" x 4" x 3" in sdy gravel matrix.	

Reported By: JL MURRAY / JM Faurote | Reviewed By: DC Weekes
Title: GEOLOGIST / Geologist | Title: Geologist
Signature: JL Murray / JM Faurote Date: 11/30/00 | Signature: DC Weekes Date: 3/12/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 2 of 9
Date: 11/30/00

Well ID: C3339 | Well Name: 299-W15-763 | Location: South of 241-TX Tank Farm
Project: RCRA CY 2000 | 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
30	Archive	grab NA		20' → 40.5': Sandy GRAVEL (sG)	no detect. RAD
	Drive barrel			60% Gravel, 35% Sand, 5% silt.	end shift 11/30/00
				Gravel tr lg cob, 10% sm. cob,	12-1-00
				40% v.cse-cse peb, 30% med, 20% fn-v. fn peb; Sand predom. med-cse;	Cable tool; 11 3/4"/10 3/4" CS casing
35	Archive	grab		overall color 10YR 4/2 (dk gry brown)	
				dry-sl moist; poorly sorted; gravel	35': Grab sample
				R-SR, sand SA; Predom basalt	for archive.
				(60-70%), occ. qtzite cobble, tr	α, β, γ at background
				caliche coating on gravel; HCl rxn	levels
40	Archive	grab		weak to strong.	
				37': Cobbles decrease to tr; Sand	40': Grab-Archive
				content sl increase	rad at background
					LEL, OVM < detect.
				40.5' → 42.5: Silty SAND (mS)	
45	Archive	grab		70% Sand, 30% Silt. Sand med-	45': Grab-Archive
				cse; Coarsening down; 10YR 4/3 (brn)	rad = background
				sl moist; no rad contam. detected	
				no rxn HCl.	
				42.5' → 94': SAND (S), 100% Sand	
50	Archive	grab		tr silt. 30% v. cse, 60% cse, 10%	50': Grab-Archive
				med-fn; 10YR 5/2 (gry brn), dry;	rad = background
				mod sorted-well; SA-A; 60% qtz/feld,	
				40% basalt/other lith. frags; max	
				size 2-3 mm; no rxn HCl.	55': Grab-Archive
55	Archive	grab		47': Size predom cse-med	rad = background
				Silty stringers at 49' and near 50'	
				Sand mineralogy changes to	
				predom qtz/Feld (<25% basalt)	

Reported By: JMFaurote / L.D. Walker | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: JMFaurote / LD Walker | Date: 12-1-00 | Signature: DC Weekes | Date: 3/12/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 12-1-00

Well ID: C 3339 | Well Name: 299-W15-763 | Location: South of 241-TX tank farm /200w

Project: RCRA CY 2000 | 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
60	Archive	Grab NA		42.5'→ 94' : SAND (S)	Cable tool, drive barrel
	Drive			95-100% Sand, tr-5% silt.	w/ 11 3/4"/10 1/4" CS casing
	barrel				
					60': Grab sample
					for archive
65	Archive	Grab		65.5-66': Silty layer, then	α,β,γ at background
				back to med-cse sand	
					65': Grab-Archive
					rad = background
				69': Silt layer < 0.5' thick	
70	Archive	Grab		possible clastic dike	70': Grab-Archive
				70': tr-5% gravel (v. fn peb)	rad at background
				Sand 30% v. cse, 40% cse, 20% med	
				10% fn-v. fn. Overall color 10YR5/2	
				(grayish brown), dry; mod-poor	75': Grab-Archive
75	Archive	Grab		sorted, A-SA; 60% qtz/feld, 40%	rad - background
				basalt/other lithic frags, max size	
				~5 mm; no rxn HCl.	
				75-76': tr-5% v. fn peb.	
					80': Grab-archive
80	Archive	Grab			
				Sand - as above	drill rate: 5'/12 min.
				tr mica	
				occ. iron staining on sand grains.	85': Grab-archive
85	Archive	Grab			
				86': tr-5% Gravel (v. fn peb)	
				89': Silt layer ~0.3' thick	

Reported By: L.D. Walker | Reviewed By: D C Weekes

Title: Geologist | Title: Geologist

Signature: LD Walker | Date: 12-4-00 | Signature: DC Weekes | Date: 3/12/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 4 of 9
Date: 12-4-00

Well ID: C 3339	Well Name: 299-W15-763	Location: South of 241-TX tank farm/200W	
Project: RCRA CY 2000		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
90	Archive	Grab NA		42.5' → 94' : SAND (S)	Cable tool, drive
	Drive			95-100% Sand, tr-5% silt	barrel; 11¾" OD
	Barrel			92' : Silt layer ~0.2' thick - 10YR5/3	CS casing.
				(brown) sl moist, weak rxn HCl	
					90': Grab sample
95	Archive	Grab		94' → 100' : Silt (M); 10-15% Sand	for achive
				85-90% Silt. Sand is v. fn grain.	
				10YR 5/3 (brn) sl moist; well sorted,	95': Grab - Archive
				low - nonplastic; mod - strong HCl rxn.	
				- slowly grades coarser.	
100	Archive	Grab		100' → 101.5 : Silty SAND (m S)	100': Grab - Archive
				50-60% Sand, 40-50% Silt.	
				Sand is v. fn gr; strong rxn HCl.	
				101.5' → 117' : Gravelly Silty SAND	105': Grab - Archive
105	Archive	Grab		(gm S), Calcareous, massive caliche	
				in upper 1-2 Ft (102-103' bgs); 10-15%	
				Gravel, 50% Sand, 35-40% Silt. Gravel	
				R, med - v. cse peb; Sand predom med -	
				Fn; 10YR 6/3 - 10YR 5/4 (pale brn - yel. brn)	110': Grab - Archive
110	Archive	Grab		sl moist; poorly sorted; sand 75% qtz/	
				Feld, 25% basalt/other; max gravel	LEL, OVM < detect.
				~6 cm; violent rxn to HCl	
				111': dry	
					115': Grab - Archive
115	Archive	Grab		115': layers of brown silt (weak HCl	
				rxn) < 0.1' thickness with cream colored	
				caliche layers (violent rxn HCl)	end 12/4/00
				117' → 120' : Sandy GRAVEL (sG)	

Reported By: L.D. Walker		Reviewed By: DCWeekes	
Title: Geologist		Title: Geologist	
Signature: LD Walker	Date: 12/5/00	Signature: DC Weekes	Date: 3/12/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 5 of 9
Date: 12/5/00

Well ID: 299-W15-763 | Well Name: C3339 | Location: S. of 241-Tx Tank Farm

Project: RCRA CY 2000 | 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
120	Archive	GRAB NA		117 → 120': Sandy GRAVEL (SG), 10YR6/2	Cable tool; drive
	Drive Barrel			light brownish gray, sl. moist, 40-45% gravel	barrel w/ 11 3/4" casing
				50% sand, 5-10% silt, GRAVEL: SA → R, med. pebbles	120': Grab sample
				to sm. cobbles (to 85mm), SAND: pred. med - fine,	for archive
				poorly sorted, SA, 70-75% qtz/feldspar, 25-30%	
125	Archive	GRAB		basalt/other, no Rxn to HCl.	125' grab sample
	Drive Barrel				for archive
				120-135': Decreasing sand content: increasing	
				silt content (15 to 20%) silty sandy GRAVEL (mSG)	
130	Archive	GRAB			130' grab sample
	Drive Barrel				for archive
					Cable tool w/ 8 5/8"
					CS casing @ 135' bgs.
135	Archive	GRAB		135-140': silty sandy GRAVEL (mSG), 10YR6/2	135' grab sample
	Drive Barrel			lt. br. gray, sl. moist, 45-50% gravel, 40% sand,	for archive
				10-15% silt, GRAVEL: SA-R med pebbles - sm. cobbles,	
				SAND: med-fine, poorly sorted, SA-SR, sand + gravel:	
				30% basalt 70% other, no HCl Rxn.	
140	Archive	GRAB		140-141.5' silty sandy GRAVEL (mSG), increasing	140' grab sample
	Drive Barrel			gravel (50-55%), 35% sand, 10-15% silt	for archive
				141.5'-142' ~6" well sorted, med gr. sand lense	
				142'-145 1/2': Sandy GRAVEL (SG) 10YR 5/2	140' → 160' all samples
				grayish brown, moist, 40% gravel, 55% sand, 5% silt,	< rad background
145	Archive	GRAB		GRAVEL: A-SR, v. fine gravel (pebbles to sm. cobbles)	145' grab sample
	Drive Barrel			v. poorly sorted, 25% basalt, 75% other, sand: poorly	for archive
				sorted, SA, pred. fine + med., little CSS, 25-30% basalt, 65-70% other	
				145: Sandy Gravel (SG), 60% gravel, 35% sand, 5% silt.	
				145 1/2 → 147, matrix saturated, mod. cemented, no Rxn HCl	

Reported By: P M Vellinis | Reviewed By: DC Weekes

Title: Geologist | Title: Geologist

Signature: P M Vellinis | Date: 12/5/00 | Signature: DC Weekes | Date: 3/12/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 6 of 9
Date: 12/7/00

Well ID: 299-W15-763 | Well Name: C3339 | Location: S. of 241 Tx Tank Farm

Project: RCRA CY2000 | 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
150	Archive	GRAB NA		145-160 : sandy GRAVEL (SG) 10YR 5/2 gr. brown,	cable tool, Drive barrel
	Drive Barrel			sl. moist, med dense, 55% gravel, 45% sand	with 8 5/8" casing
				5% silt, GRAVEL: poorly sorted, 20% small washed	150' GRAB/ARCHIVE
				cobbles, 80% fine to V. coarse pebbles, matrix cemented,	153' change to
	Hard Tool			no RXN HCl, trace FeO2 stain, 15% basalt, 85% other,	Hard Tool w/ 8 5/8"
155	Archive	GRAB		broken cobbles + pebbles, SA-R., SAND: 30% CSS,	casing.
				70% med + fine, SA-SR, 15-20% basalt, 80-85% other	155' GRAB/ARCHIVE
	Hard Tool			poorly sorted.	
				153: SG (as above) loose, dry-sl. moist, inc. silt	
160	Archive	GRAB		160-170 : sandy GRAVEL (SG), 10YR 5/2 gr.	
				brown, saturated, med dense, 45-50% crushed	160' GRAB/ARCHIVE
	Hard Tool			gravel, 40% sand, 5-10% silt, angular gravel;	
				30-40% basalt, 60-70% qtz, feldspar, andesite etc.	
				poorly sorted. SAND: V. poorly sorted, SA, 40%	
165	Archive	GRAB		CSS, 40% med, 20% fine; 30% basalt, 70% qtz,	
				feldspar, mica, other. no RXN HCl.	165' GRAB/ARCHIVE
	Hard Tool			165-166 Sandy GRAVEL (SG) as above, Slight	
				increase in silt from 165-166', smoother drilling noted.	
170	Archive	GRAB		170-180 - silty, sandy GRAVEL (mSG), 35-40%	
				gravel, 50% sand, 10-15% silt, 10YR 4/2	170' GRAB/ARCHIVE
	Hard Tool			dk. grayish brown, saturated, med. dense,	
				SR-angular gravels crushed to 22mm, 25%	
				basalt, 75% other, SAND: Sub angular 20%	
175	Archive	GRAB		fine, 30% med, 50% CSS, no RXN HCl.,	
				15-20% basalt, 80-85% other.	175' GRAB/ARCHIVE
	Hard Tool				
					More noted faster drilling/
					more silt from 175' on

Reported By: Pat Moore Vellines | Reviewed By: DC Weekes

Title: Geologist | Title: Geologist

Signature: P Vellines | Date: 12/7/00 | Signature: DC Weekes | Date: 3/12/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 12/12/00

Well ID: 299-W15-763 | Well Name: C3339 | Location: S. of 241 Tx Tank Farm

Project: RCRA CY 2000 | 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
180	archive	GRAB NA		180-185' silty sandy GRAVEL (mSG) 10YR5/1	Hard Tool, 8 5/8" casing
	Hard tool			gray, saturated, 30% gravel, 45% sand, 15% silt	180' GRAB/ARCHIVE
				A-SA crushed gravels (pebbles): 20% basalt, 80%	
				qtz, feldspar etc., SAND: 30% CSS, 45% med, 25% fine,	
				25% basalt, 75% other, no RXN HCL	
185	archive	GRAB		185- as above (SG), 30-40% gravel,	185' GRAB/ARCHIVE
	Hard tool			50% sand, 10-20% silt, gravels: 20% basalt,	
				80% qtz, plag. K feld, andesite?, Sand:	Casing separated
				15-20% basalt, rest qtz, mica, feldspar	(actually @187' bgs @177'
				etc.	top of 1st 10' section)
190	archive	Grab		190' Silty Sandy Gravel (mSG) 10YR 4/2 (dark	190' Grab/archive
	Hard tool			grayish brown). 35%G, 46%S, 19% silt. Gravel broken	
				into angular pebbles of 5%c, 25%m, 70% f-v.f. unbroken	
				gravel rounded subdiscoidal. Basalt 90% other Quartz/Chert	
				with orange, light brown, brownish red & white color. Sand	
195	Archive	Grab		48% c-vc, 28% M, 24% f-v.f.	195' GRAB/archive
	Hard tool			195' Same as above	
	Drive Barrel				Hard tool stuck in or
	Archive	Grab		199' Silty Sandy Gravel with SMALL cobbles up to	at bottom of casing.
200	Hard tool			9.5cm in diameter. The material is dry & overall color	Drive Barrel 197'-199'
				is 10YR 7/1 (Light Gray). The formation is moderately	199' Grab/Archive from
				cemented by Silica & Iron oxide with a high dry strength.	Drive Barrel
				Gravel 58%, Sand 32%, Silt 10%. The Gravel is ≈35%	
				basalt w/ trace, diorites, granites & syenites. The	
205	Archive	Grab		cobbles to med size pebbles are rounded spherical to subprismoidal	205' Grab/Archive
	Hard tool			and some of the medium pebbles to all the fine grained pebbles	
				are angular. Gravel is 45% vc, 10% c, 20% m, 25% f-v.f. The Sand is	
				subangular with 40% v.c-c, 22% M, 38% f-v.f. The medium sand fine	
				sand is 65% Qtz & 35% basalt. Silt is light yellowish brown when wet.	

Reported By: P. Moore Vellenis / GS Thomas | Reviewed By: DC Weekes

Title: Geologist / scientist | Title: Geologist

Signature: P Vellenis / S Thomas | Date: 12/12/00 | Signature: DC Weekes | Date: 3/12/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Date: 1/4/01

Well ID: C3339	Well Name: 299-W15-763	Location: S of 241-TY Tank Farm	
Project: RCRA CY 2000		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
210	Archive	Grab NA		209-211 Gravelly Silty SAND. 10YR 5/2 (grayish brown)	210' Grab/Archive
	Hard tool			Saturated. SAND 52%, Silt 25%, Gravel 23%.	
				Sand 25% f-vf, 30% M, 45% V.C-C. Silt Color	
				10YR 6/2 - 5/2 (light brownish gray to grayish brown). Gravel	
				broken into Angular pebbles of fine to v.fine. Basalt	215' Grab/Archive
215	Archive	Grab		Silty Sandy Gravel. 10YR 5/2 (grayish brown)	1H < detectable
	Hard tool			Saturated. Gravel 33%, Sand 44%, Silt 23%.	217' Gamma Spect Sample B10FB2
				Gravel broken into Angular Pebbles of 7% M, 93% vf-f	217'-219' Split Spoon
	SS#1 1/4/01	Split Spoon		Sand 45% V.C-C, 25% M, 30% f-v.f. Silt pale brown to brown	
				217-219 Silty Sandy Gravel. Gravel 55%, Sand 33%	
220	Hard tool			Silt 12%. Gravel 20% vc, 15% C, 19% M, 56% f-v.f.	222' Chemical Sample B10F92
				Gravel is subrounded to rounded. 50% Basalt, 35% Granite,	
				15% Granitic. Silt color is 10YR 6/3 (pale brown). Sand	
				10% vC, 30% C, 20% M, 40% f-v.f. Basalt 30%. Sand	
				is subangular to subrounded. Both iron oxide	
225	Archive	Grab		& Silica cementation (moderate). Also greenish gray	225' Grab/Archive
				Coloration present in some of the interstitial	
	Hard Tool			spaces.	227' Gamma Spect Sample B10FB3
				225' Silty Sandy Gravel. Gravel 39%	
				Sand 37%, Silt 24%	Start SJAN01
230	Archive	Grab		230 SANDY GRAVEL. Gravel to	Collect 230 Grab/ Archive 0730
	HARD TOOL			1½ inch max, granitic & basaltic clasts	
				with some basaltic sand matrix,	232-234 split
	Split spoon #2			w/ trace fines. minor qtz sand. Gray brn. Very	Spoon Sample
				dense. Gravel ~ 50%, Sandy 40%	
235	NT ARCHIVE	GRAB		fines 10%. Gravel clasts sometimes	
	Hard Tool			wrtd. Sand subangular. fines w/	235 Grab / Archive
				sl plasticity.	

Reported By: G.S Thomas		Reviewed By: DCWeekes	
Title: Scientist		Title: Geologist	
Signature: Greg Thomas	Date: 1/4/01	Signature: DC Weekes	Date: 3/12/01

BHI-EE-183 (12/97)

BOREHOLE LOG

Page 9 of 9
Date: 1/5/01

Well ID: C3339 | Well Name: 299-W15-763 | Location: S of 241-TX Tank Farm
Project: RCRA CY 2000 | 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
240	archive	Grab		240' Silty Sandy GRAVEL (msG): 35% gray, 45% sand, 20% silt, 10YR 5/2 (wet) grayish brown, saturated, poorly sorted, FeOx grains ~~collect~~ common (mgtz), no rxn to HCl, material highly ground by drilling	240' grab 1/5/01
	Hard rod				
245	SS#3 1/8/01	Split Spoon		245' Silty Sandy Gravel (msG): 50% Gravel, 35% Sand, 15% Silt. Formation Consists of 35% Basalt & 65% Quartzite & Granite. Both silica and iron oxide cementation present (moderate). Also greenish gray coloration present in some of the interstitial spaces. Gravel c-vc 28%, m 17%, f-v.f- 40%, Cobbles 13%. Sand 40% c-vc, 32% m, 28% f-v.f. Max size Cobble 10cm	245' Split Spoon 1/8/01
	HT				
250					
255				TD'ed hole @ 257.6 bgs. 8 5/8" OD casing set @ 252.6' bgs. (temporary)	

Reported By: DC Weekes / GS Thomas | Reviewed By: DC Weekes
Title: Geologist | Title: Geologist
Signature: DC Weekes / Greg Thomas | Date: 1/8/01 | Signature: DC Weekes | Date: 3/12/01

BHI-EE-183 (12/97)

Appendix B

Physical Property Data

This Appendix includes the results of testing for particle size distribution on split spoon samples from the wells 299-W10-27, 299-W14-15, 299-W14-16, 299-W14-17, and 299-W15-763. The analyses were done by CH2M HILL Hanford Inc. using standard sieve techniques.

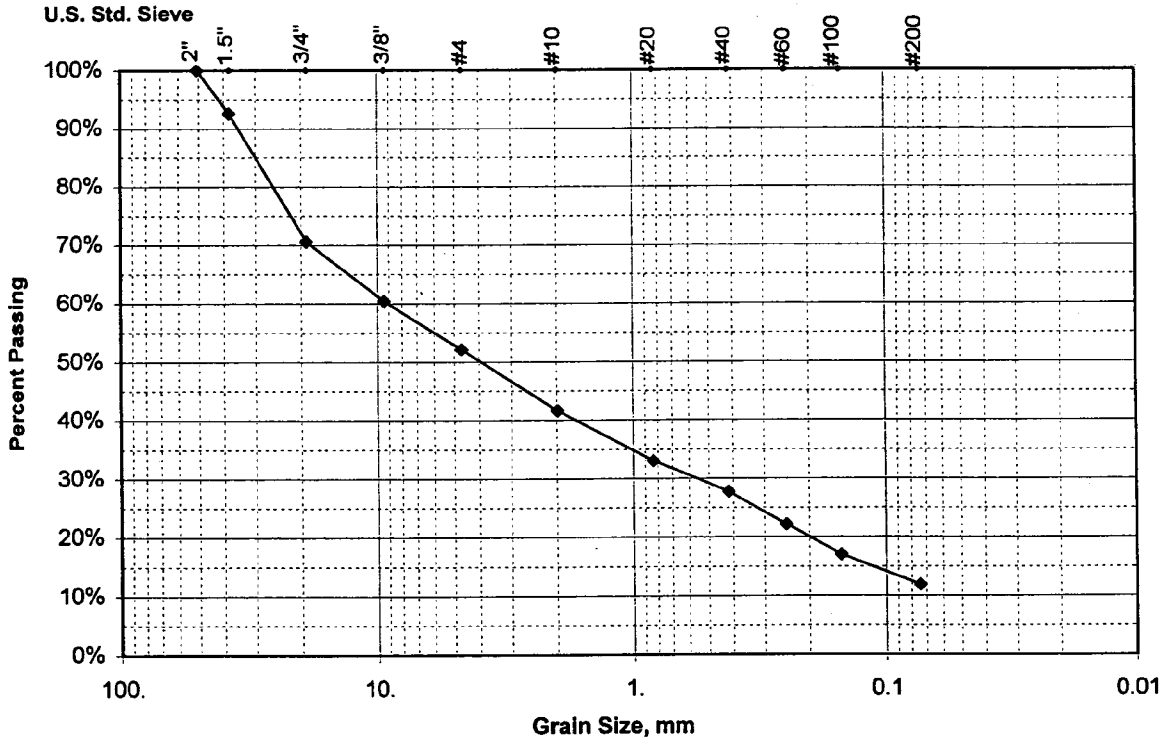
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W10-27	DEPTH	226.0'-228.0'	SAMPLE#	W10-27-226.0	WELL ID#	C3125
TESTED BY	John Wimett	CONTACT	Dave Weekes	PHONE	372-9130	DATE	03/23/2001

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
847.10	2"	0.0	0.0	100.0	50.80	
	1.5"	62.8	7.4	92.6	38.10	
	3/4"	249.0	29.4	70.6	19.05	
	3/8"	335.2	39.6	60.4	9.42	
	#4	405.6	47.9	52.1	4.70	
	#10	494.5	58.4	41.6	1.98	
	#20	567.6	67.0	33.0	0.83	
	#40	612.4	72.3	27.7	0.42	
	#60	659.4	77.8	22.2	0.25	
	#100	702.9	83.0	17.0	0.150	
	#200	746.6	88.1	11.9	0.074	

Sieve Analysis Data for Sample W10-27-226.0



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: [signature] Date: 4/3/01

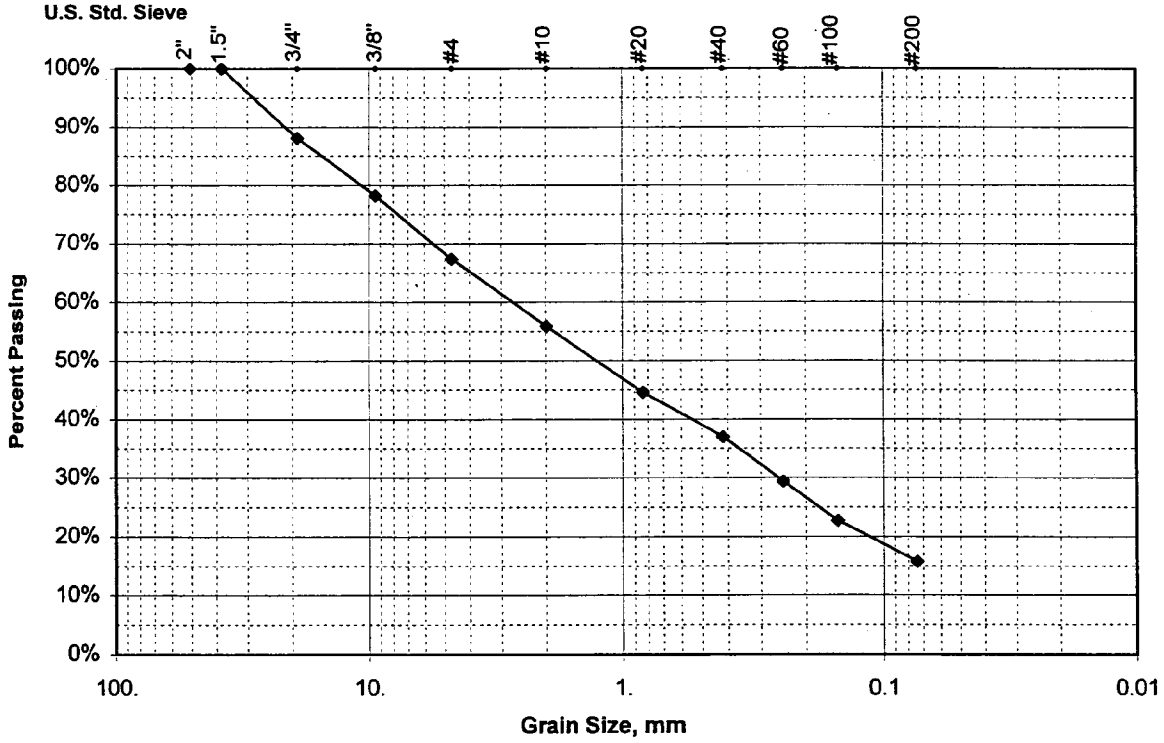
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W10-27	DEPTH	241.0'-242.0'	SAMPLE#	W10-27-241.0	WELL ID#	C3125
TESTED BY	John Wimett	CONTACT	Dave Weekes	PHONE	372-9130	DATE	03/23/2001

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
810.30	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	96.3	11.9	88.1	19.05	
	3/8"	176.2	21.7	78.3	9.42	
	#4	264.5	32.6	67.4	4.70	
	#10	357.2	44.1	55.9	1.98	
	#20	449.1	55.4	44.6	0.83	
	#40	510.5	63.0	37.0	0.42	
	#60	572.4	70.6	29.4	0.25	
	#100	626.5	77.3	22.7	0.150	
	#200	682.7	84.3	15.7	0.074	

Sieve Analysis Data for Sample W10-27-241.0



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: [signature] Date: 4/3/01

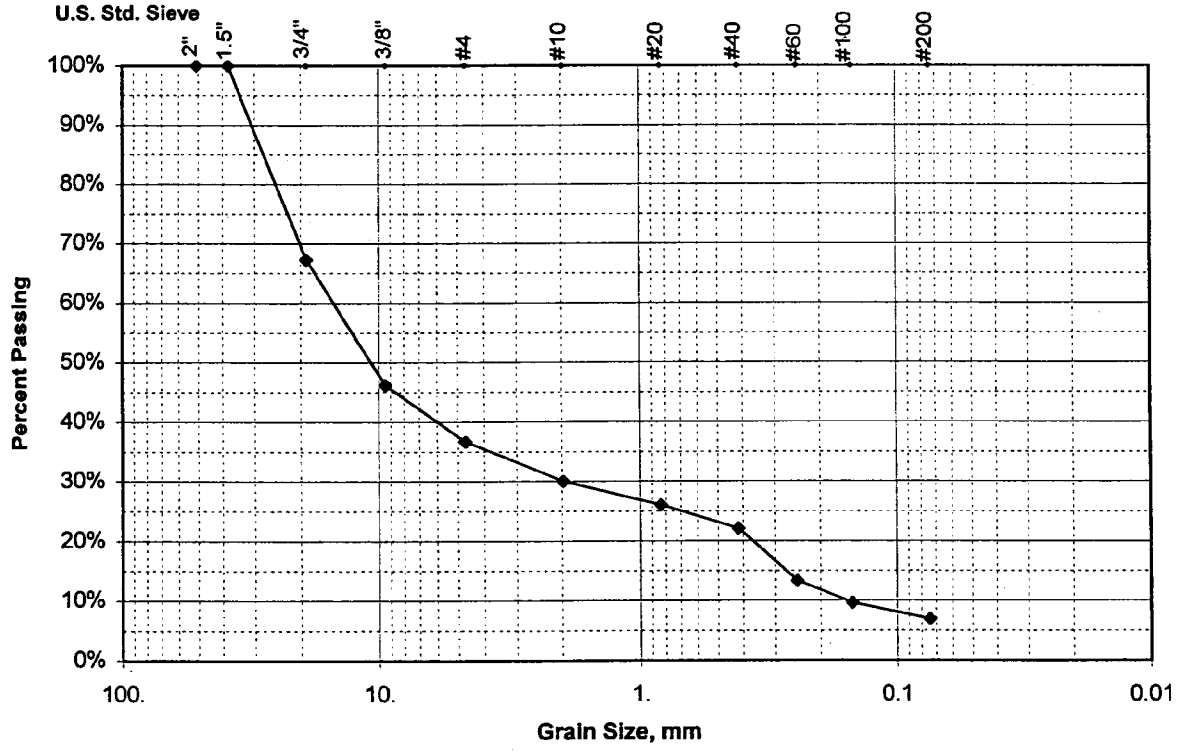
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W10-27	DEPTH	254.0'-256.0'	SAMPLE#	W10-27-254.0	WELL ID#	C3125
TESTED BY	John Wimett	CONTACT	Dave Weekes	PHONE	372-9130	DATE	03/23/2001

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
976.10	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	319.3	32.7	67.3	19.05	
	3/8"	525.3	53.8	46.2	9.42	
	#4	618.2	63.3	36.7	4.70	
	#10	683.3	70.0	30.0	1.98	
	#20	722.0	74.0	26.0	0.83	
	#40	760.4	77.9	22.1	0.42	
	#60	846.2	86.7	13.3	0.25	
	#100	882.3	90.4	9.6	0.150	
	#200	908.8	93.1	6.9	0.074	

Sieve Analysis Data for Sample W10-27-254.0



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: [signature] Date: 4/3/01

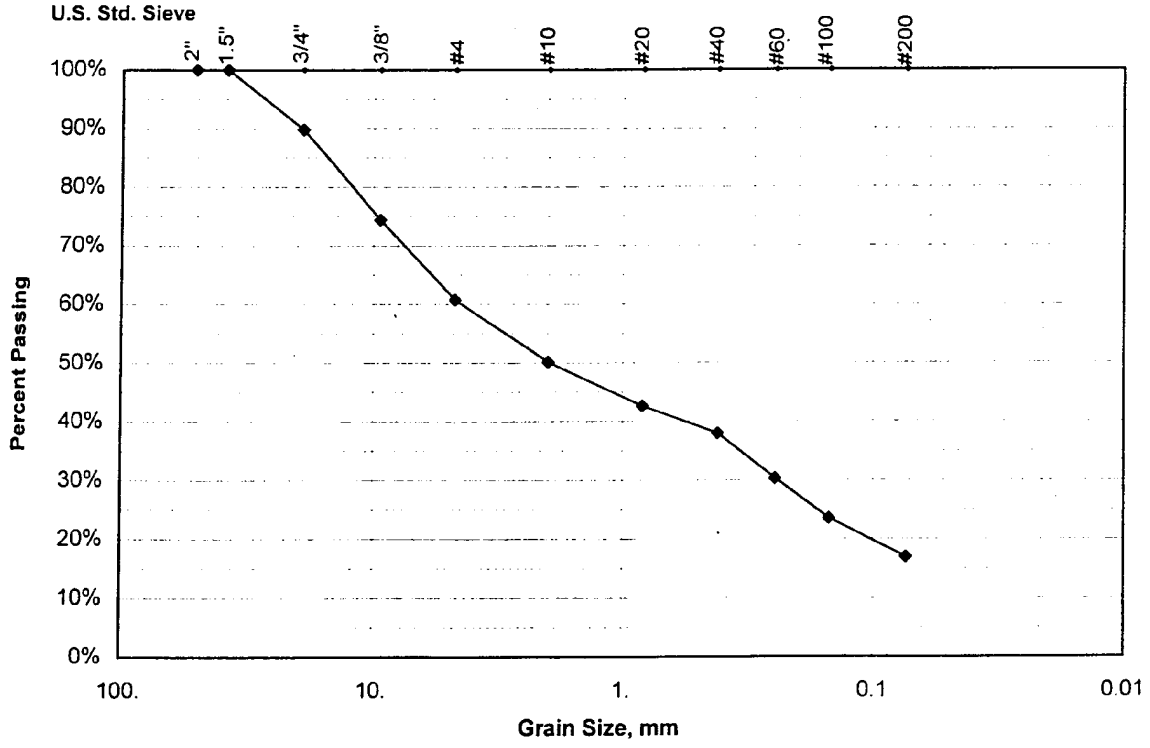
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W14-15	DEPTH	222.2'-224.5'	SAMPLE#	W14-15-222.2	WELL ID#	C3114
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	08/31/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
829.90	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	84.7	10.2	89.8	19.05	
	3/8"	212.7	25.6	74.4	9.42	
	#4	325.8	39.3	60.7	4.70	
	#10	414.0	49.9	50.1	1.98	
	#20	476.4	57.4	42.6	0.83	
	#40	515.0	62.1	37.9	0.42	
	#60	578.6	69.7	30.3	0.25	
	#100	634.9	76.5	23.5	0.150	
	#200	689.0	83.0	17.0	0.074	

Sieve Analysis Data for Sample W14-15-222.2



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: DC Weekes Date: 9/7/00

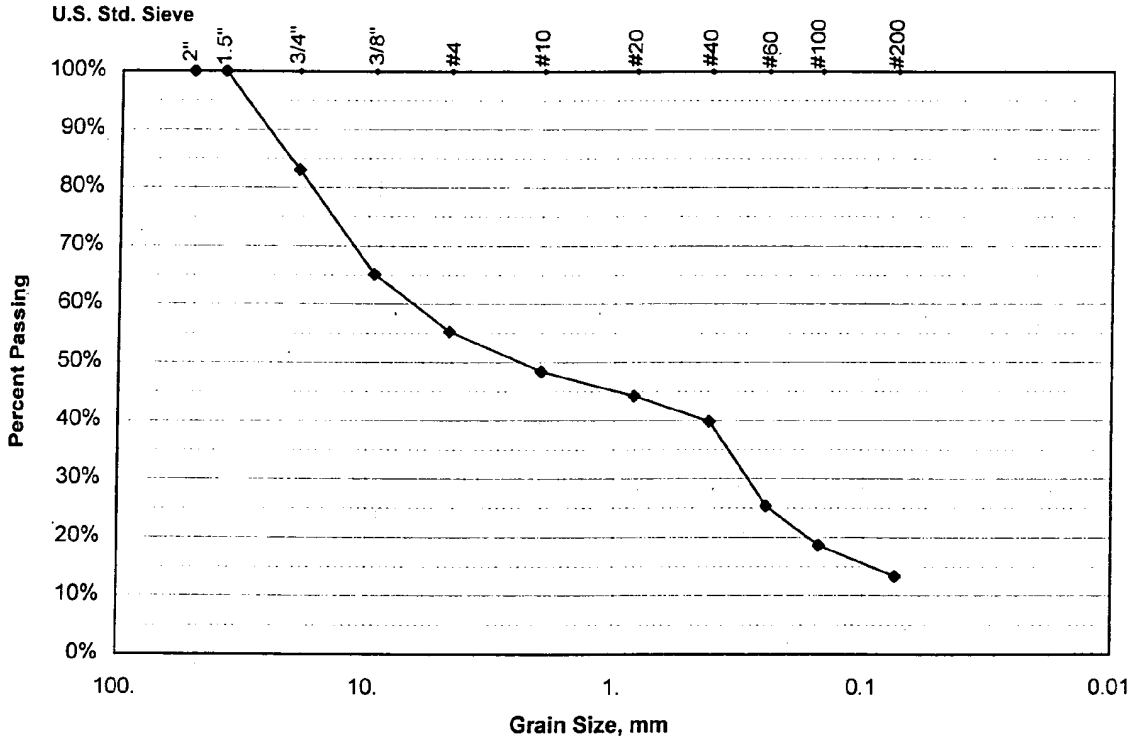
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W14-15	DEPTH	237.5'-240.0'	SAMPLE#	W14-15-237.5	WELL ID#	C3114
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	08/31/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
753.80	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	127.8	17.0	83.0	19.05	
	3/8"	262.9	34.9	65.1	9.42	
	#4	337.3	44.7	55.3	4.70	
	#10	388.7	51.6	48.4	1.98	
	#20	420.4	55.8	44.2	0.83	
	#40	453.4	60.1	39.9	0.42	
	#60	562.4	74.6	25.4	0.25	
	#100	613.4	81.4	18.6	0.150	
	#200	653.2	86.7	13.3	0.074	

Sieve Analysis Data for Sample W14-15-237.5



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: D.C. Weekes Date: 9/7/00

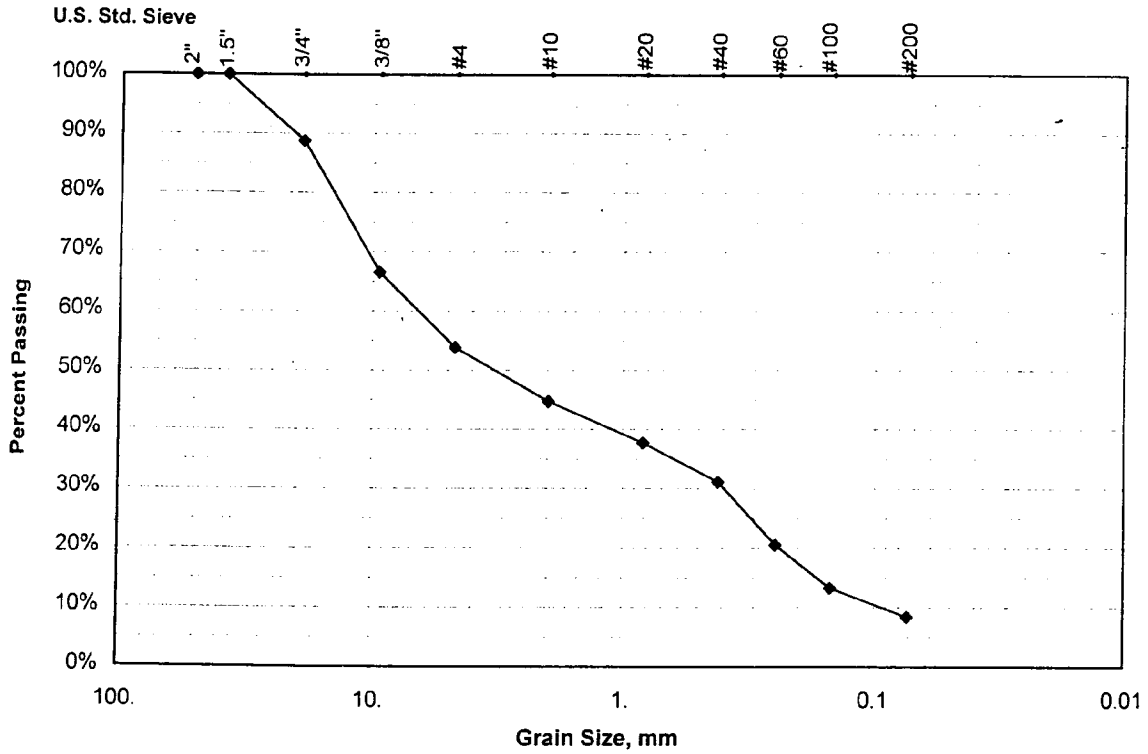
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W14-15	DEPTH	252.5'-254.5'	SAMPLE#	W14-15-252.5	WELL ID#	C3114
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	08/31/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
958.40	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	107.7	11.2	88.8	19.05	
	3/8"	320.5	33.4	66.6	9.42	
	#4	442.4	46.2	53.8	4.70	
	#10	529.9	55.3	44.7	1.98	
	#20	596.6	62.2	37.8	0.83	
	#40	659.8	68.8	31.2	0.42	
	#60	761.8	79.5	20.5	0.25	
	#100	831.1	86.7	13.3	0.150	
	#200	878.2	91.6	8.4	0.074	

Sieve Analysis Data for Sample W14-15-252.5



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: D Weekes Date: 9/7/00

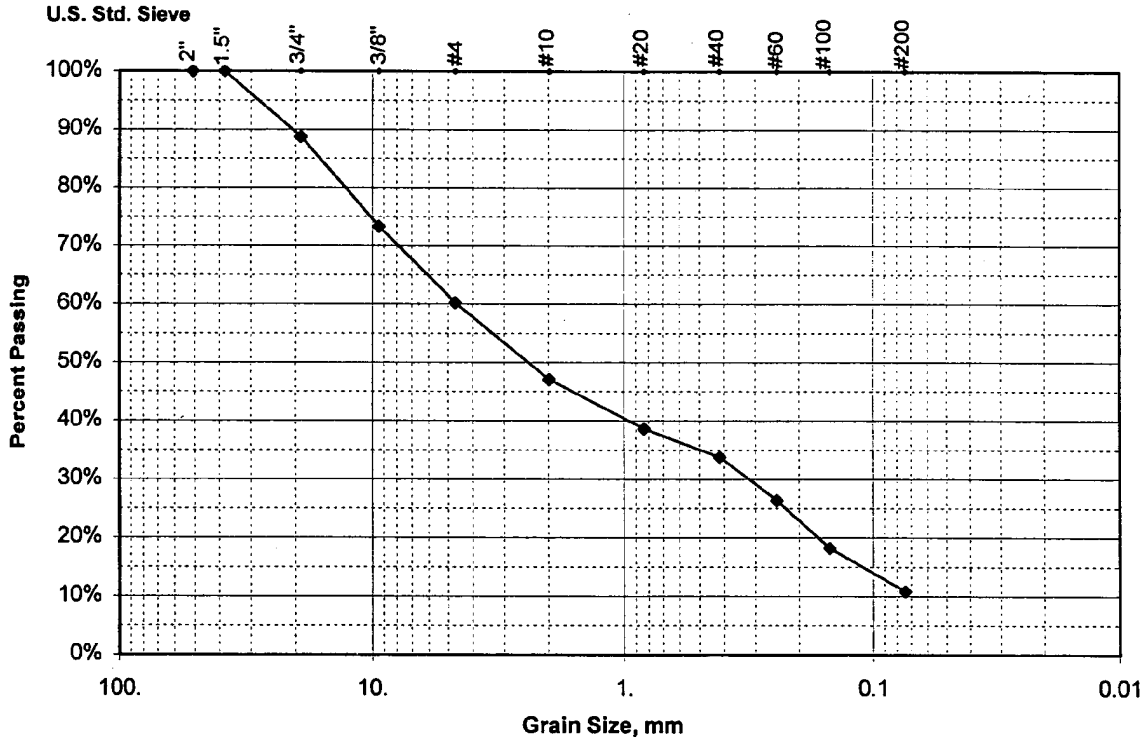
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W14-16	DEPTH	223.2'-224.7'	SAMPLE#	W14-16-223.2	WELL ID#	C3120
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	11/21/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
972.30	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	109.7	11.3	88.7	19.05	
	3/8"	260.0	26.7	73.3	9.42	
	#4	386.9	39.8	60.2	4.70	
	#10	514.7	52.9	47.1	1.98	
	#20	596.6	61.4	38.6	0.83	
	#40	643.8	66.2	33.8	0.42	
	#60	715.8	73.6	26.4	0.25	
	#100	795.3	81.8	18.2	0.150	
	#200	867.3	89.2	10.8	0.074	

Sieve Analysis Data for Sample W14-16-223.2



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: D M Weekes Date: 12/27/00

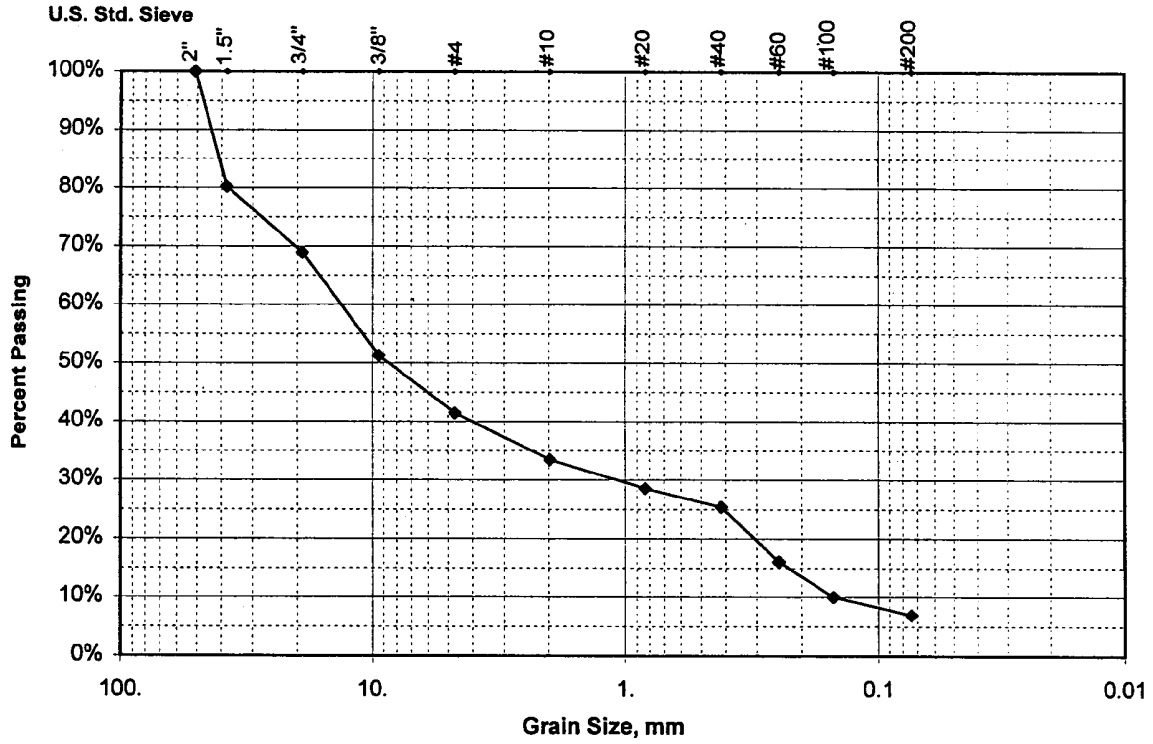
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W14-16	DEPTH	241.1'-244.0'	SAMPLE#	W14-16-241.1	WELL ID#	C3120
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	11/21/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
978.50	2"	0.0	0.0	100.0	50.80	
	1.5"	193.3	19.8	80.2	38.10	
	3/4"	304.6	31.1	68.9	19.05	
	3/8"	476.8	48.7	51.3	9.42	
	#4	572.9	58.5	41.5	4.70	
	#10	651.1	66.5	33.5	1.98	
	#20	699.3	71.5	28.5	0.83	
	#40	729.9	74.6	25.4	0.42	
	#60	821.4	83.9	16.1	0.25	
	#100	880.2	90.0	10.0	0.150	
	#200	910.7	93.1	6.9	0.074	

Sieve Analysis Data for Sample W14-16-241.1



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: [signature] Date: 12/27/00

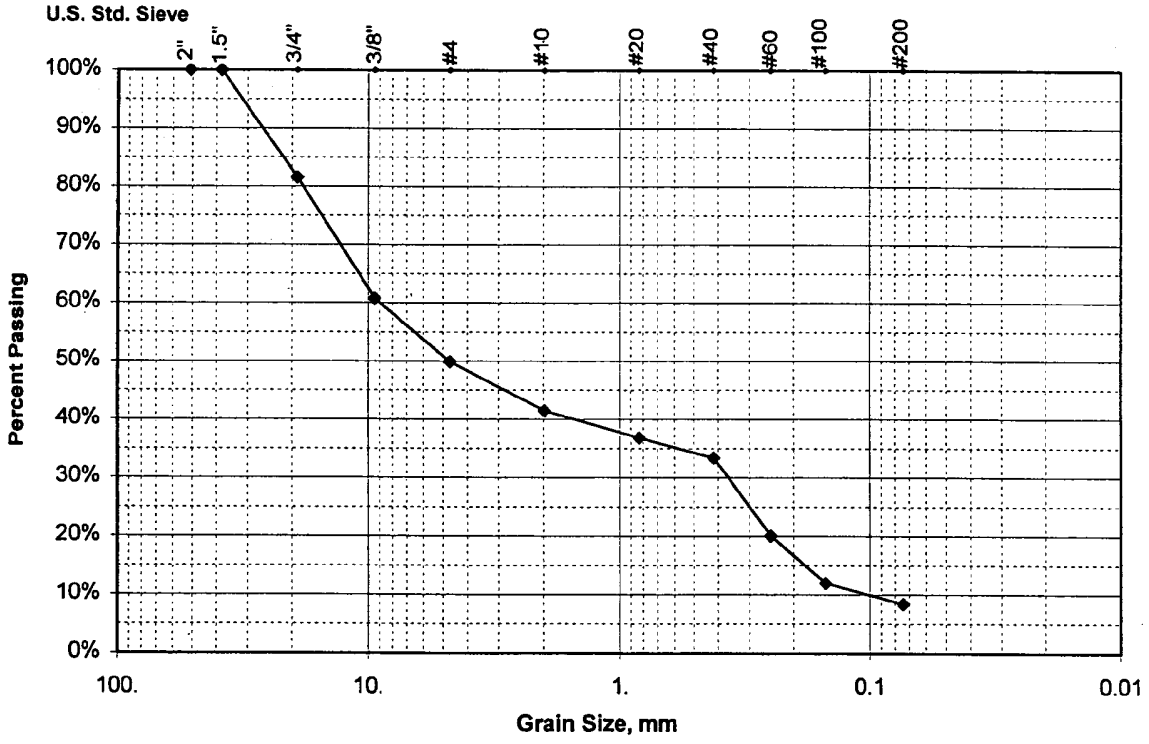
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W14-16	DEPTH	252.0'-253.5'	SAMPLE#	W14-16-252.0	WELL ID#	C3120
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	11/21/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
986.60	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	182.4	18.5	81.5	19.05	
	3/8"	387.7	39.3	60.7	9.42	
	#4	494.5	50.1	49.9	4.70	
	#10	577.2	58.5	41.5	1.98	
	#20	623.2	63.2	36.8	0.83	
	#40	657.1	66.6	33.4	0.42	
	#60	788.6	79.9	20.1	0.25	
	#100	868.1	88.0	12.0	0.150	
	#200	904.0	91.6	8.4	0.074	

Sieve Analysis Data for Sample W14-16-252.0



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: D C Weekes Date: 12/27/00

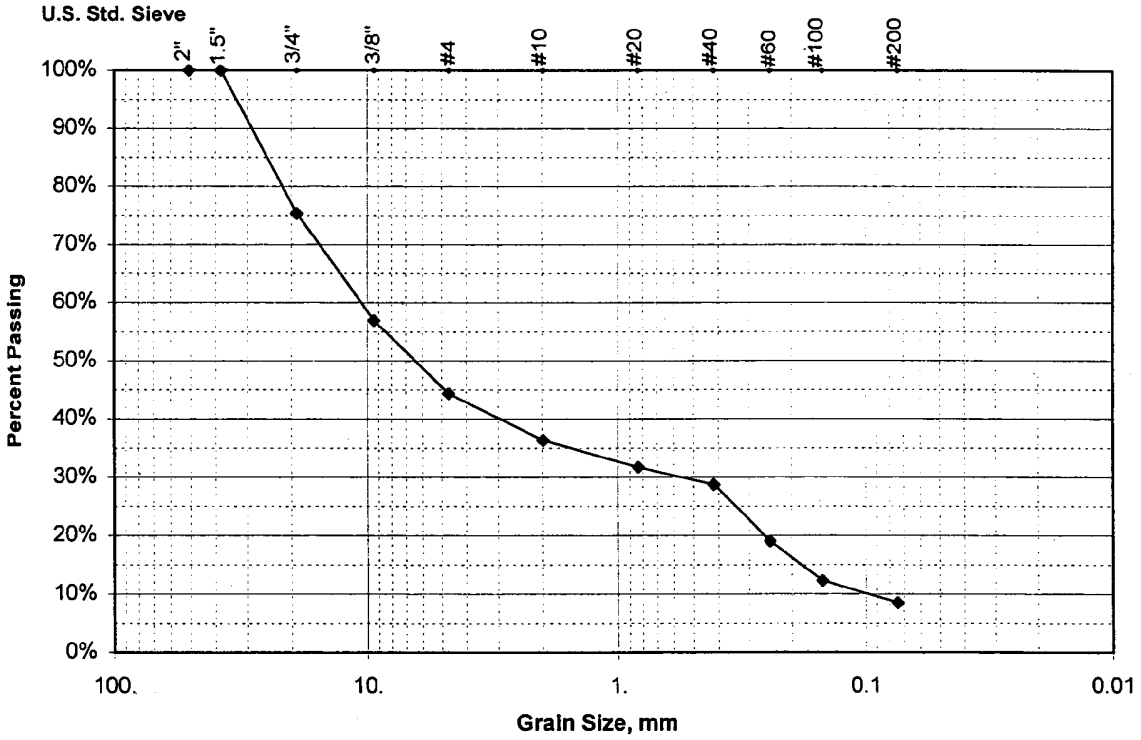
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W14-17	DEPTH	228.0'-228.75'	SAMPLE#	W14-17-228.0	WELL ID#	C3121
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	10/18/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
966.40	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	238.4	24.7	75.3	19.05	
	3/8"	416.4	43.1	56.9	9.42	
	#4	537.9	55.7	44.3	4.70	
	#10	615.0	63.6	36.4	1.98	
	#20	660.0	68.3	31.7	0.83	
	#40	689.4	71.3	28.7	0.42	
	#60	782.5	81.0	19.0	0.25	
	#100	847.7	87.7	12.3	0.150	
	#200	884.7	91.5	8.5	0.074	

Sieve Analysis Data for Sample W14-17-228.0



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: D C Weekes Date: 11/14/00

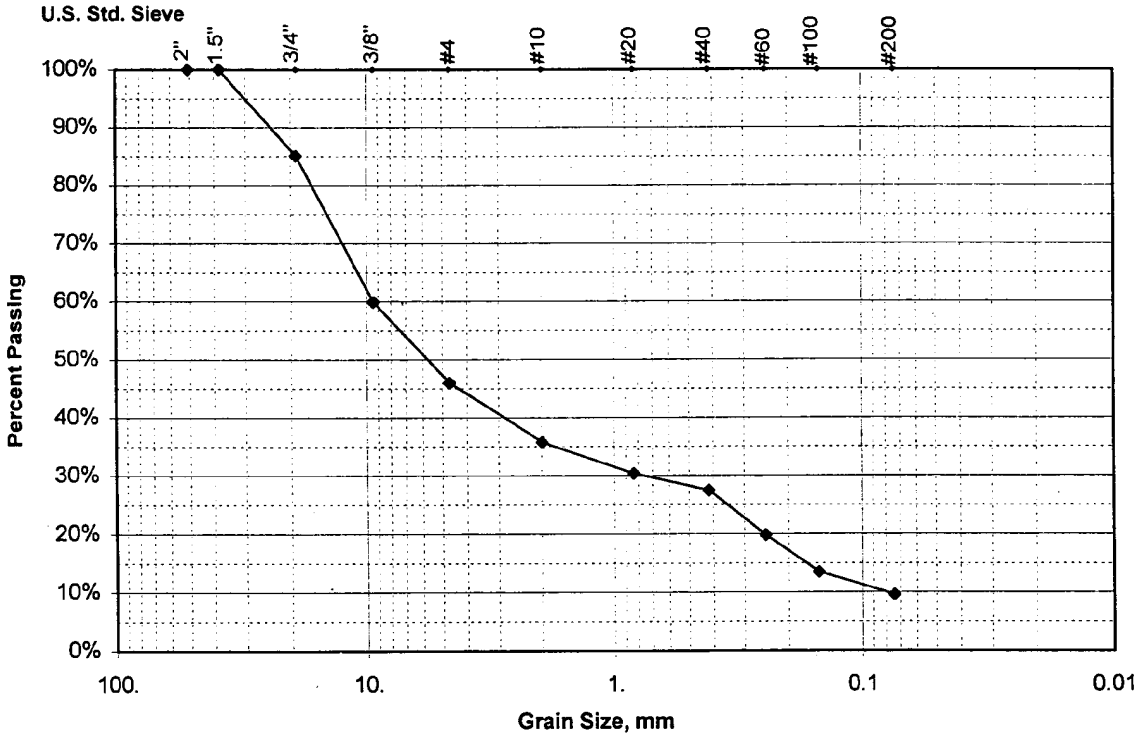
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W14-17	DEPTH	244.9'-246.4'	SAMPLE#	W14-17-244.9	WELL ID#	C3121
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	10/18/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
931.20	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	138.5	14.9	85.1	19.05	
	3/8"	373.5	40.1	59.9	9.42	
	#4	503.2	54.0	46.0	4.70	
	#10	598.3	64.3	35.7	1.98	
	#20	648.4	69.6	30.4	0.83	
	#40	675.6	72.6	27.4	0.42	
	#60	747.2	80.2	19.8	0.25	
	#100	806.0	86.6	13.4	0.150	
	#200	841.7	90.4	9.6	0.074	

Sieve Analysis Data for Sample W14-17-244.9



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: D.C. Weekes Date: 11/14/00

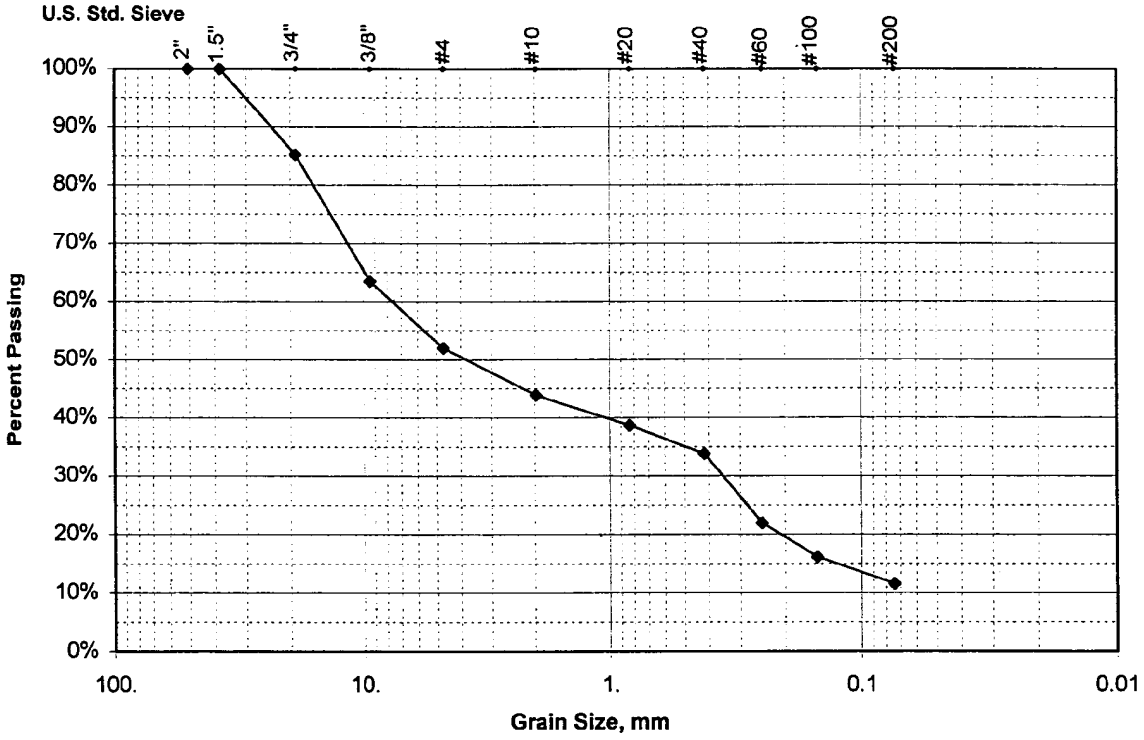
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W14-17	DEPTH	255.4'-257.9'	SAMPLE#	W14-17-255.4	WELL ID#	C3121
TESTED BY	JMW	CONTACT	Dave Weekes	PHONE	372-9524	DATE	10/18/2000

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
970.40	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	143.6	14.8	85.2	19.05	
	3/8"	355.0	36.6	63.4	9.42	
	#4	466.1	48.0	52.0	4.70	
	#10	544.6	56.1	43.9	1.98	
	#20	595.0	61.3	38.7	0.83	
	#40	642.1	66.2	33.8	0.42	
	#60	757.6	78.1	21.9	0.25	
	#100	813.5	83.8	16.2	0.150	
	#200	858.2	88.4	11.6	0.074	

Sieve Analysis Data for Sample W14-17-255.4



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: D C Weekes Date: 11/14/00

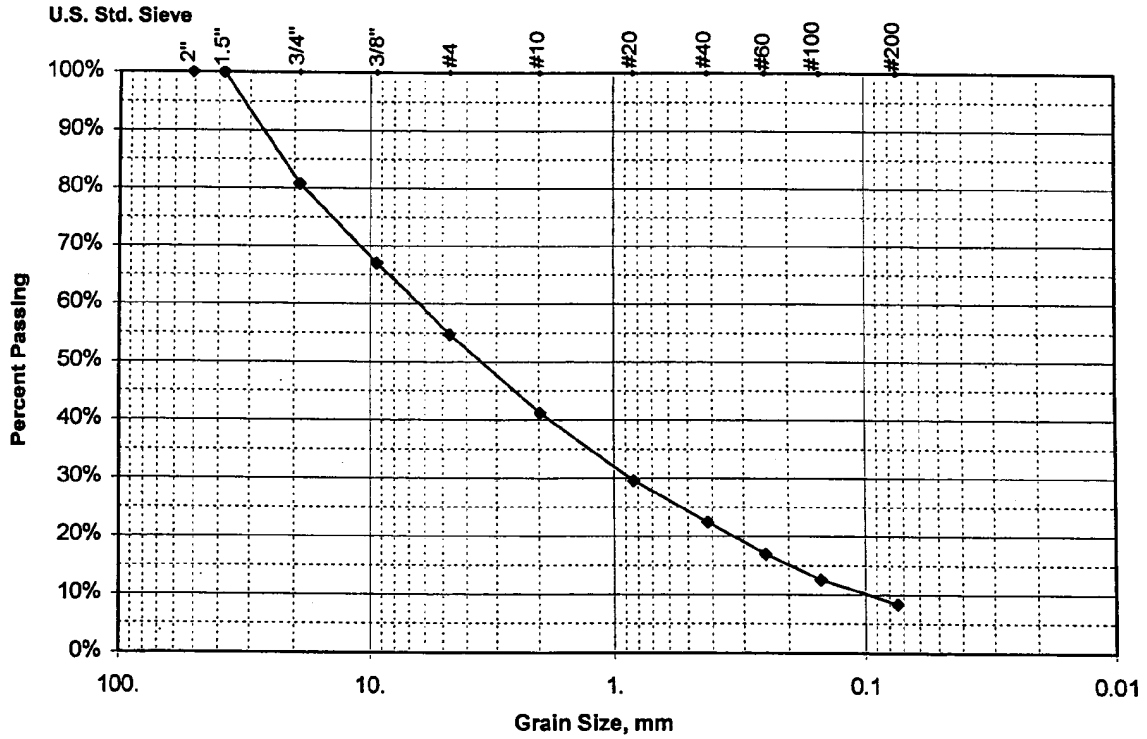
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W15-763	DEPTH	217.0'-219.0'	SAMPLE#	W15-763-217	WELL ID#	C3339
TESTED BY	J.M.Wimett	CONTACT	Dave Weekes	PHONE	372-9130	DATE	01/11/2001

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
982.20	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	189.1	19.3	80.7	19.05	
	3/8"	324.2	33.0	67.0	9.42	
	#4	444.8	45.3	54.7	4.70	
	#10	577.6	58.8	41.2	1.98	
	#20	692.4	70.5	29.5	0.83	
	#40	761.8	77.6	22.4	0.42	
	#60	815.7	83.0	17.0	0.25	
	#100	858.7	87.4	12.6	0.150	
	#200	899.9	91.6	8.4	0.074	

Sieve Analysis Data for Sample W15-763-217



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: [signature] Date: 3/14/01

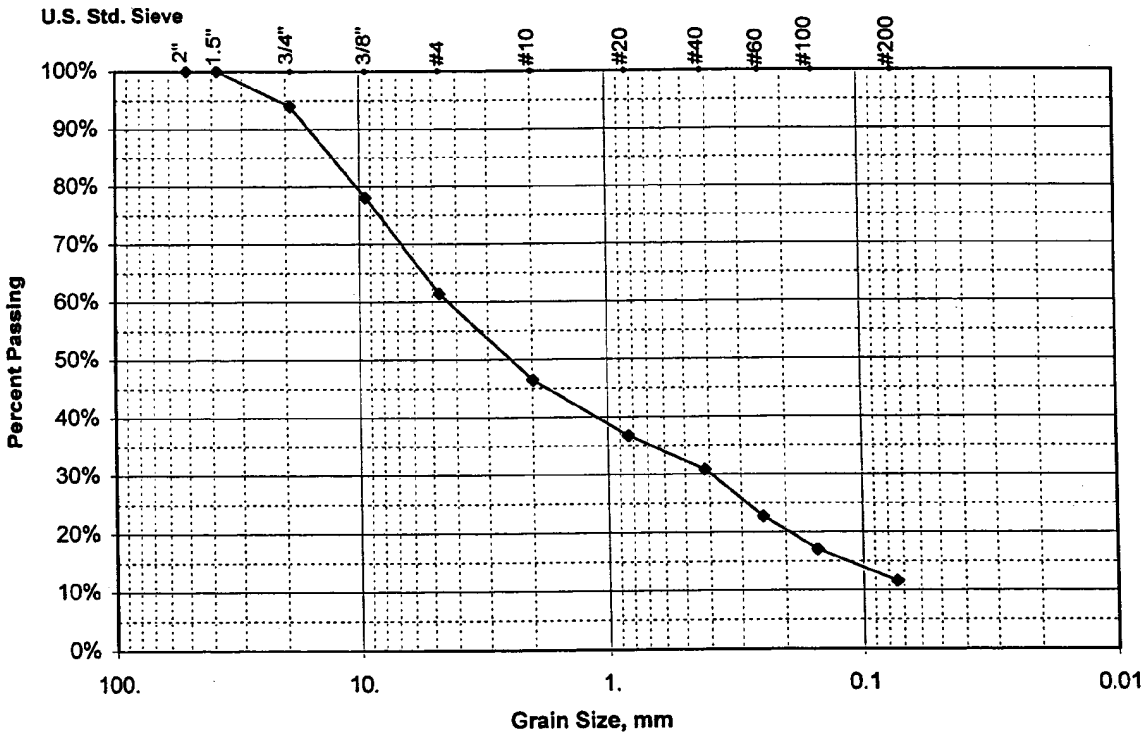
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W15-763	DEPTH	232.0'-234.0'	SAMPLE#	W15-763-232	WELL ID#	C3339
TESTED BY	J.M.Wimett	CONTACT	Dave Weekes	PHONE	372-9130	DATE	01/11/2001

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
952.30	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	57.8	6.1	93.9	19.05	
	3/8"	208.8	21.9	78.1	9.42	
	#4	368.0	38.6	61.4	4.70	
	#10	510.2	53.6	46.4	1.98	
	#20	602.3	63.2	36.8	0.83	
	#40	659.1	69.2	30.8	0.42	
	#60	735.6	77.2	22.8	0.25	
	#100	789.7	82.9	17.1	0.150	
	#200	842.1	88.4	11.6	0.074	

Sieve Analysis Data for Sample W15-763-232



Comments: Silty Sandy Gravel

All data are accurately and completely recorded.

Checked By: D.C. Weekes Date: 3/14/01

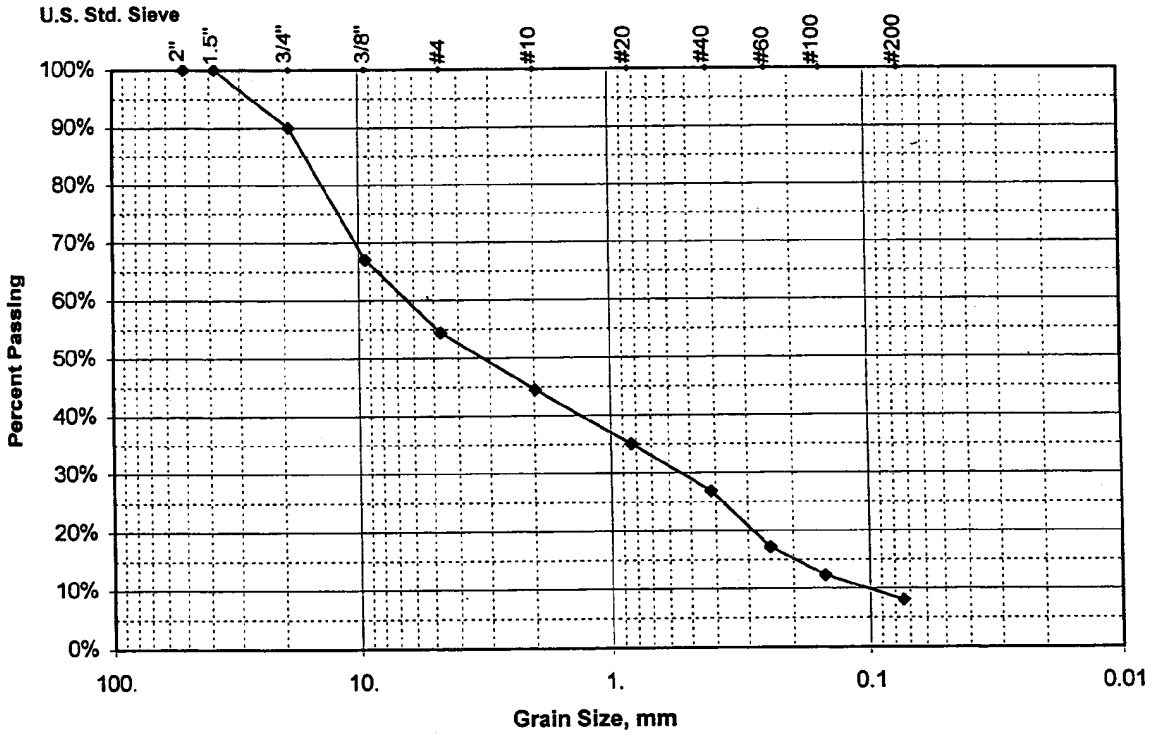
CH2M Hill Hanford, Inc.

SIEVE ANALYSIS

WELL NAME	299-W15-763	DEPTH	245.0'-247.0'	SAMPLE#	W15-763-245	WELL ID#	C3339
TESTED BY	J.M.Wimett	CONTACT	Dave Weekes	PHONE	372-9130	DATE	01/11/2001

SAMPLE WT (g)	SIEVE SIZE IN.	CUMULATIVE WEIGHT(g)	% WEIGHT RETAINED	% PASSING	Grain Size (mm)	COMMENTS
969.90	2"	0.0	0.0	100.0	50.80	
	1.5"	0.0	0.0	100.0	38.10	
	3/4"	97.4	10.0	90.0	19.05	
	3/8"	319.4	32.9	67.1	9.42	
	#4	442.2	45.6	54.4	4.70	
	#10	538.4	55.5	44.5	1.98	
	#20	630.3	65.0	35.0	0.83	
	#40	709.9	73.2	26.8	0.42	
	#60	803.3	82.8	17.2	0.25	
	#100	850.3	87.7	12.3	0.150	
	#200	891.7	91.9	8.1	0.074	

Sieve Analysis Data for Sample W15-763-245



Comments: Sandy Gravel

All data are accurately and completely recorded.

Checked By: [signature] Date: 3/14/01

Appendix C

Geophysical Logs

This appendix contains the borehole geophysical logs obtained from boreholes 299-W10-27, 299-W14-16, and 299-W14-17. The logs were run and analyzed by Duratek, Waste Management Federal Services Northwest, Inc. Included with the logs are Log Header Sheets and Log Analysis Summary Reports.

RLS Spectral Gamma Ray Borehole Survey

Duratek Federal Services

Log Header

Project: RCRA Drilling

Well: **299-W10-27**

Log Type: HPGe Spectral Gamma Ray

Borehole Information

Well # C3125	Water Depth	187.5*	ft	Total Depth	268.5 ft
Elevation Reference n/a	Elevation	n/a	ft		
Depth Reference Ground Surface	Casing Stickup	3.58	ft		
Casing Diameter 7.625 ID in	Depth Interval	0 to 264	ft	Thickness	0.5 in
Casing Diameter 11.75 ID in	Depth Interval	0 to 56	ft	Thickness	0.5 in

*Water depth determined from Moisture Log

Logging Information

Log Type:	HPGe Spectral Gamma Ray		
Company	Duratek Federal Services		
Date/Archive File Name	March 15, 2001 2HW10027		
Logging Engineers	D. Hollingsworth		
Instrument Series	RLSG07000S01.0		
Logging Unit	RLS-1		
Depth Interval	0 to 160 ft	Prefix	A713
	135 to 260 ft		A714
Instrument Calibration Date	Oct 6, 2000		
Calibration Report	WHC-SD-EN-TI-292, Rev 0.		

Analysis Information

Company	Three Rivers Scientific
Analyst	Russ Randall
Date	March 26, 2001

Notes No man-made contamination was detected. Many depth intervals have the natural uranium levels below detection threshold. The water level from 187.5 to 260 also reduces the gross gamma and raises detection thresholds.

Spectral Gamma Ray Log Analysis & Summary

Waste Management Federal Services

Project:	RCRA Drilling	Well:	**299-W10-27**
Log Type:	HPGe Spectral Gamma Ray	Log Date:	March 15, 2001

General Notes:

Total gamma is a response to geologic concentrations of natural radionuclides. A change in sensitivity of gross gamma to geologic concentrations of natural radionuclides occurs at both the dual casing change at 56 feet and the water level at 187.5 feet.

Log data collected with a depth reference of ground surface.

System Performance Verify: The pre- and post-log verification passed performance standards; a –0.02% change was observed in the gross, (based upon borehole survey data sheet). The FWHM of the 583 keV photo peak was also within specifications for pre- and post-log verification.

Repeat Interval: Based on the repeat interval, the logging system performed as per specifications.

Environmental Corrections: All radionuclide concentrations have been corrected for casing attenuation (entire well). Water correction was applied to depths deeper than 187.5 feet. The information on the borehole survey data sheet indicates the water depth of 221 feet, but the moisture log response and the HPGe log response puts the water depth at 187.5 feet. No casing correction was applied to the total gamma due to Compton downscatter interference.

Radionuclides:

No man-made radionuclide contamination was detected. This observation was confirmed using a summing technique for the spectral data.

The natural uranium concentration is below detection threshold over many intervals. The change in gross gamma at 41 feet is reflected by changes in potassium and thorium (from stacked response); which are indicative of geologic effects. The change in gross gamma at 56 feet is due to both a geologic change, reflected in potassium and uranium (stacked response) as well as the dual casing change. Note that the use of the normal uranium signal is difficult due to the high statistical deviations and the high detection threshold. The drop in gross gamma at 187.5 feet is due to the water attenuation within the well.

Analysis by: Three Rivers Scientific

RLS Spectral Gamma Ray Borehole Survey

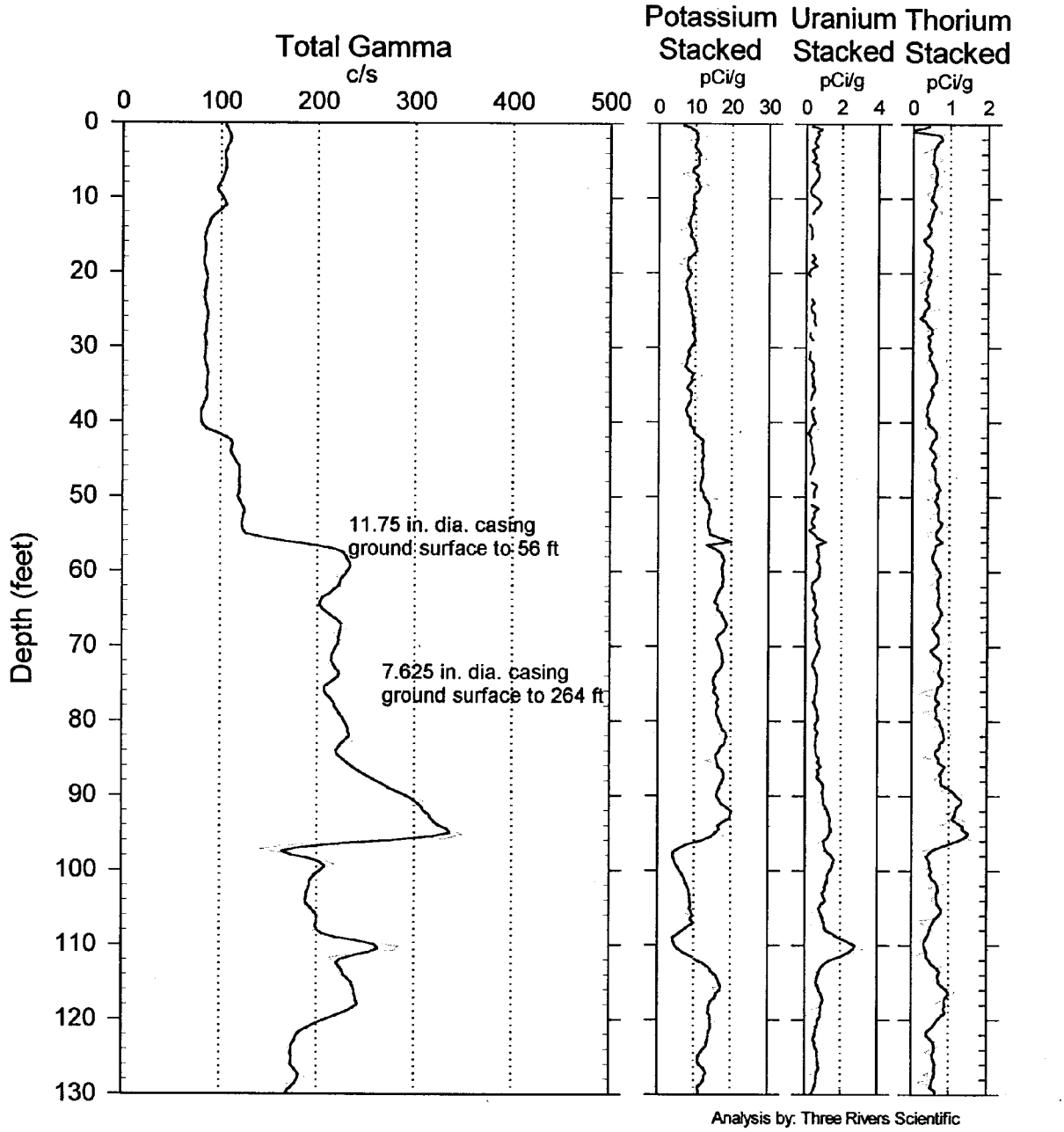
Duratek Federal Services

Project: RCRA Drilling

Log Date: March 15, 2001

Borehole: 299-W10-27

Naturally Occurring Radionuclides



Analysis by: Three Rivers Scientific

RLS Spectral Gamma Ray Borehole Survey

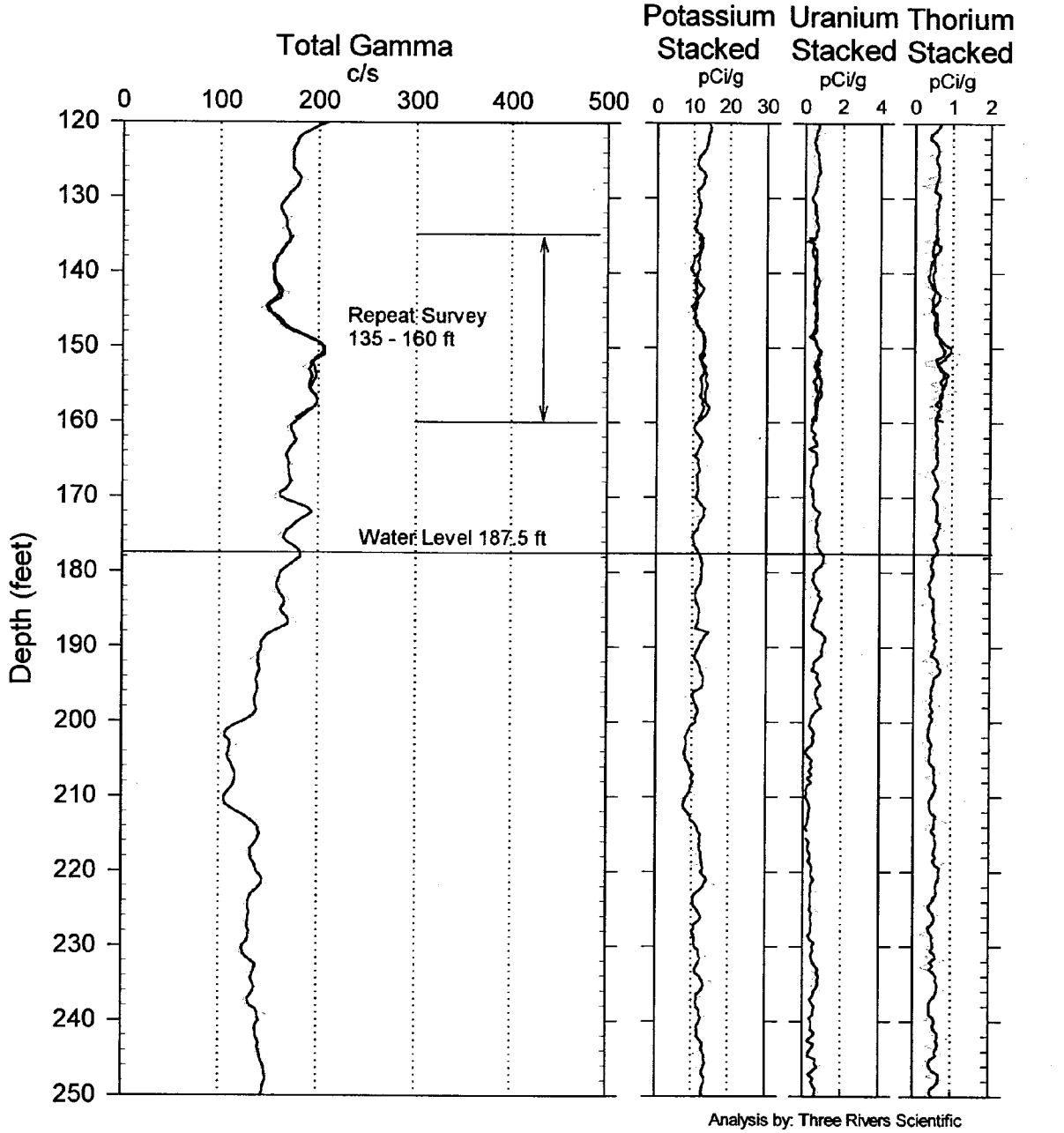
Duratek Federal Services

Project: RCRA Drilling

Log Date: March 15, 2001

Borehole: 299-W10-27

Naturally Occurring Radionuclides



RLS Spectral Gamma Ray Borehole Survey

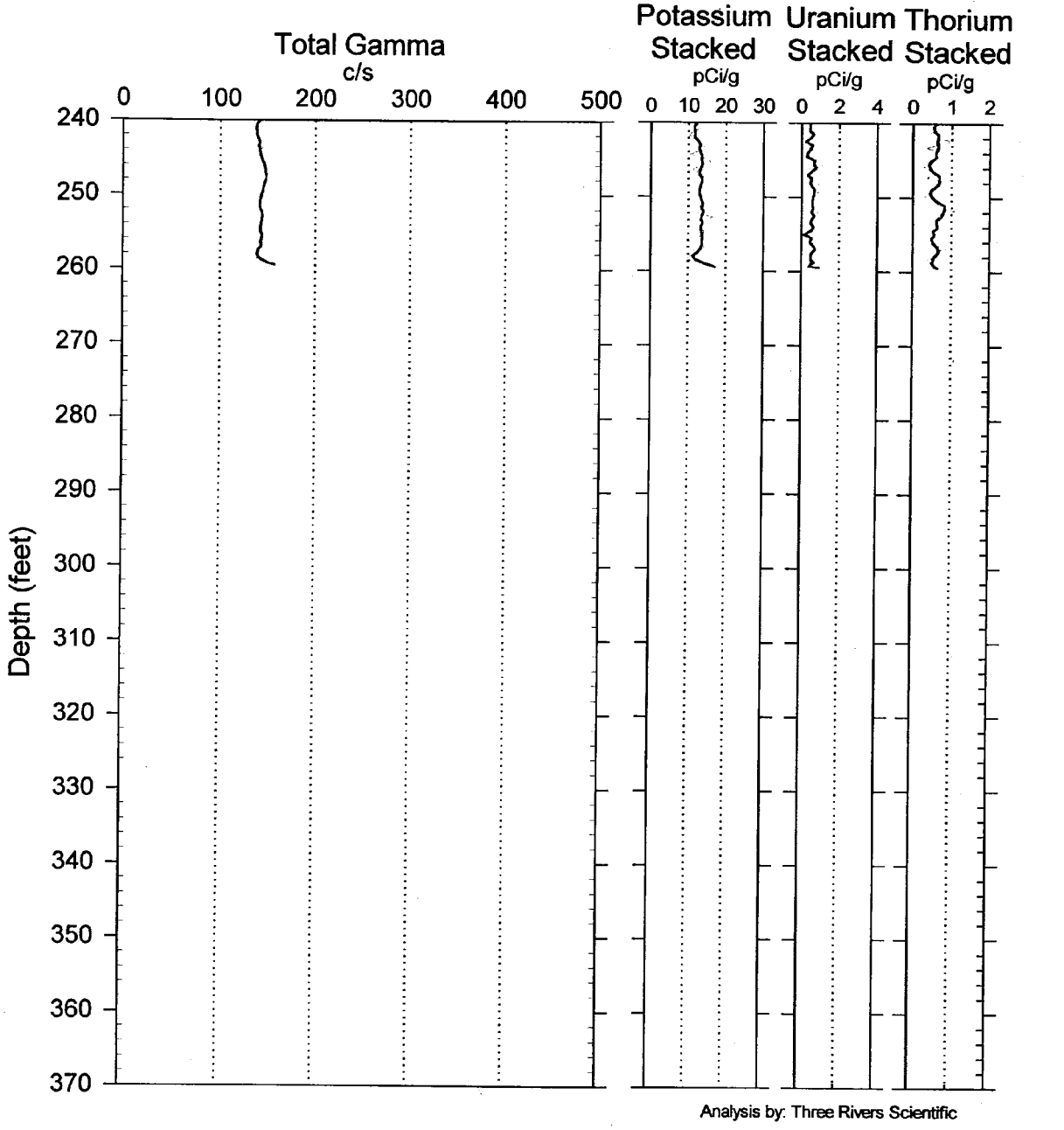
Duratek Federal Services

Project: RCRA Drilling

Log Date: March 15, 2001

Borehole: 299-W10-27

Naturally Occurring Radionuclides



Analysis by: Three Rivers Scientific

Neutron-Neutron Moisture Borehole Survey

Duratek Federal Services, Inc.

Log Header

Project: RCRA Drilling

Well: **299-W10-27**

Log Type: Moisture Gauge

Borehole Information

Well # C3125	Water Depth	187.5*	ft	Total Depth	268.5 ft
Elevation Reference n/a	Elevation	n/a	ft		
Depth Reference Ground Surface	Casing Stickup	3.58	ft		
Casing Diameter 7.625 ID in	Depth Interval	0 to 264	ft	Thickness	0.5 in
Casing Diameter 11.75 ID in	Depth Interval	0 to 56	ft	Thickness	0.5 in

*Water level determined from Moisture Log

Logging Information

Log Type:	Moisture Gauge		
Company	Duratek Federal Services, Inc.		
Date/Archive File Name	March 15, 2001 2M10027		
Logging Engineers	D. Hollingsworth		
Instrument Series	RLSM00.0		
Logging Unit	RLS-1		
Depth Interval	0 to 110 ft	Prefix	MA94
	85 to 185 ft		MA95
	180 to 189.75 ft		MA96
Instrument Calibration Date	July 14, 2000		
Calibration Report	WHC-SD-EN-TI-306, Rev. 0		

Analysis Information

Company	Three Rivers Scientific
Analyst	Russ Randall
Date	March 26, 2001

Notes Moisture values range from 2% to 25% for depths from 56 to 187 feet. The onset of high moisture readings at 187.5 feet is due to the proximity of the water level in the borehole. Standard calibration function was applied to all logged data. Depths shallower than 56 have dual casing with a borehole diameter of 12.75 inch. Thus the depths from 0 to 56 feet do not have a possible calibration, and the plot is shown in dark green; where the standard 8 inch calibration is incorrectly applied.

Moisture Log Analysis & Summary

Duratek Federal Services, Inc.

Project:	RCRA Drilling	Well ID:	**299-W10-27**
Log Type:	Moisture Gauge	Log Date:	March 15, 2001

General Notes:

The largest borehole diameter for the calibration models is an 8.64 inches borehole diameter, with .32 inch casing thickness, and the borehole diameter in these log data is 8.625 inches. Thus the standard calibration was applied to all log data. The depths shallower than 56 feet have dual casing with a borehole diameter of 12.75 inches. This diameter is beyond rigorous extrapolation and thus the standard calibration is applied, but invalid. The plot trace from 0 to 56 feet is shown in dark green.

Log data collected with a depth reference of ground surface.

System Performance Verify: The pre- and post-log verification passed performance standards, +3.2% change from start of log to end of log, in the shield verify.

Repeat Interval: Based on the repeat interval from 85 to 110 feet, the logging system performed according to specifications.

Environmental Corrections: The moisture levels have been corrected for casing thickness (0.5 inch) for well depths greater than 56 feet. Depths shallower than 56 feet were not casing thickness corrected since no applicable calibration exist for this borehole diameter. No formation density correction has been applied because density values are not available.

Observations:

The moisture levels show values ranging from 2% to 25% for depth intervals from 56 to 187 feet. The abnormally high readings that begin at 187.5 feet are a response to the water level at 187.5 feet. Note that geologist's information puts the water depth at 221 feet.

Analysis by: Three Rivers Scientific

RLS Neutron-Neutron Moisture

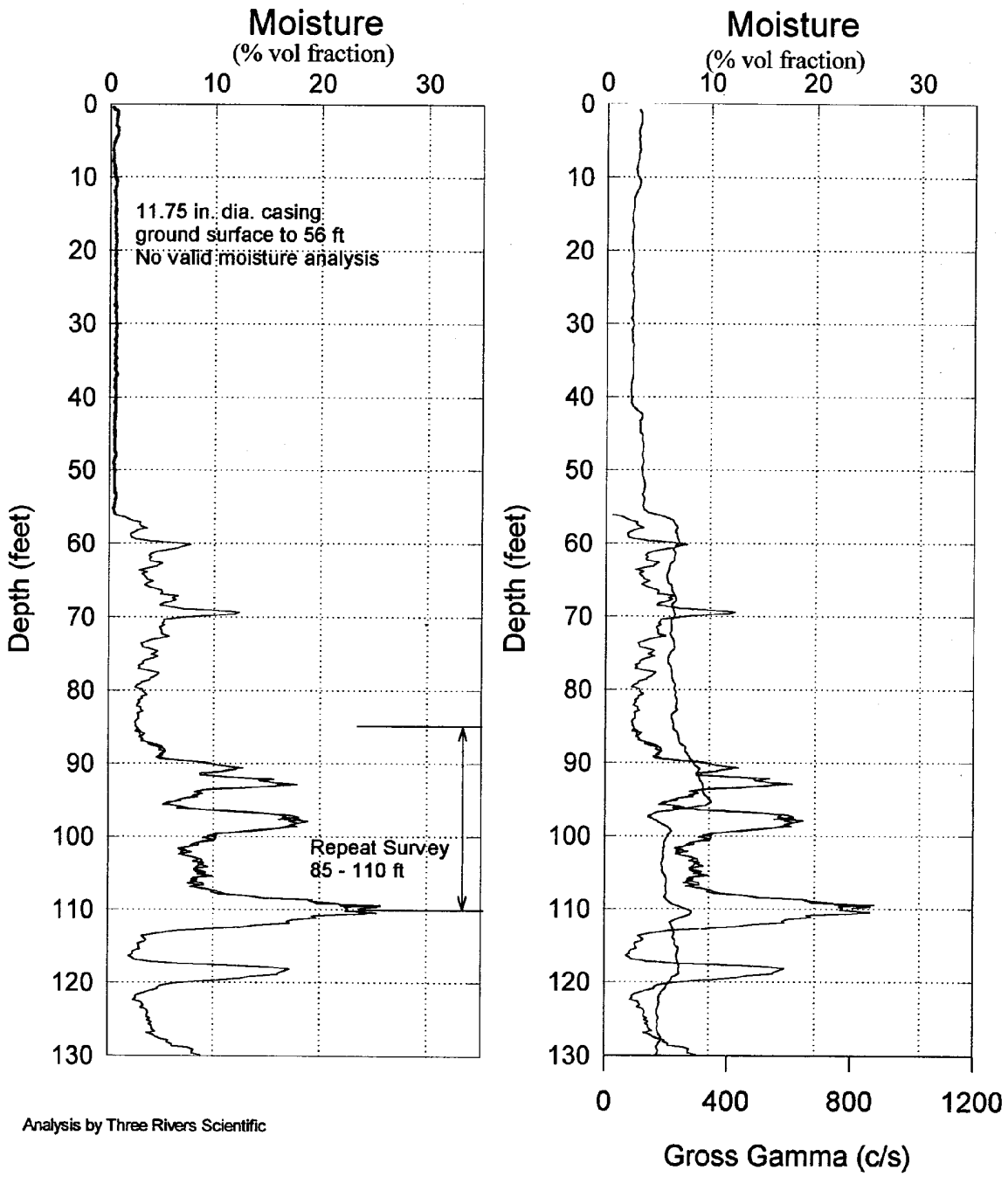
Duratek Federal Services, Inc.

Project: RCRA Drilling

Borehole: 299-W10-27

Log Date : March 15, 2001

Depth Datum : Ground Surface



Analysis by Three Rivers Scientific

RLS Neutron-Neutron Moisture

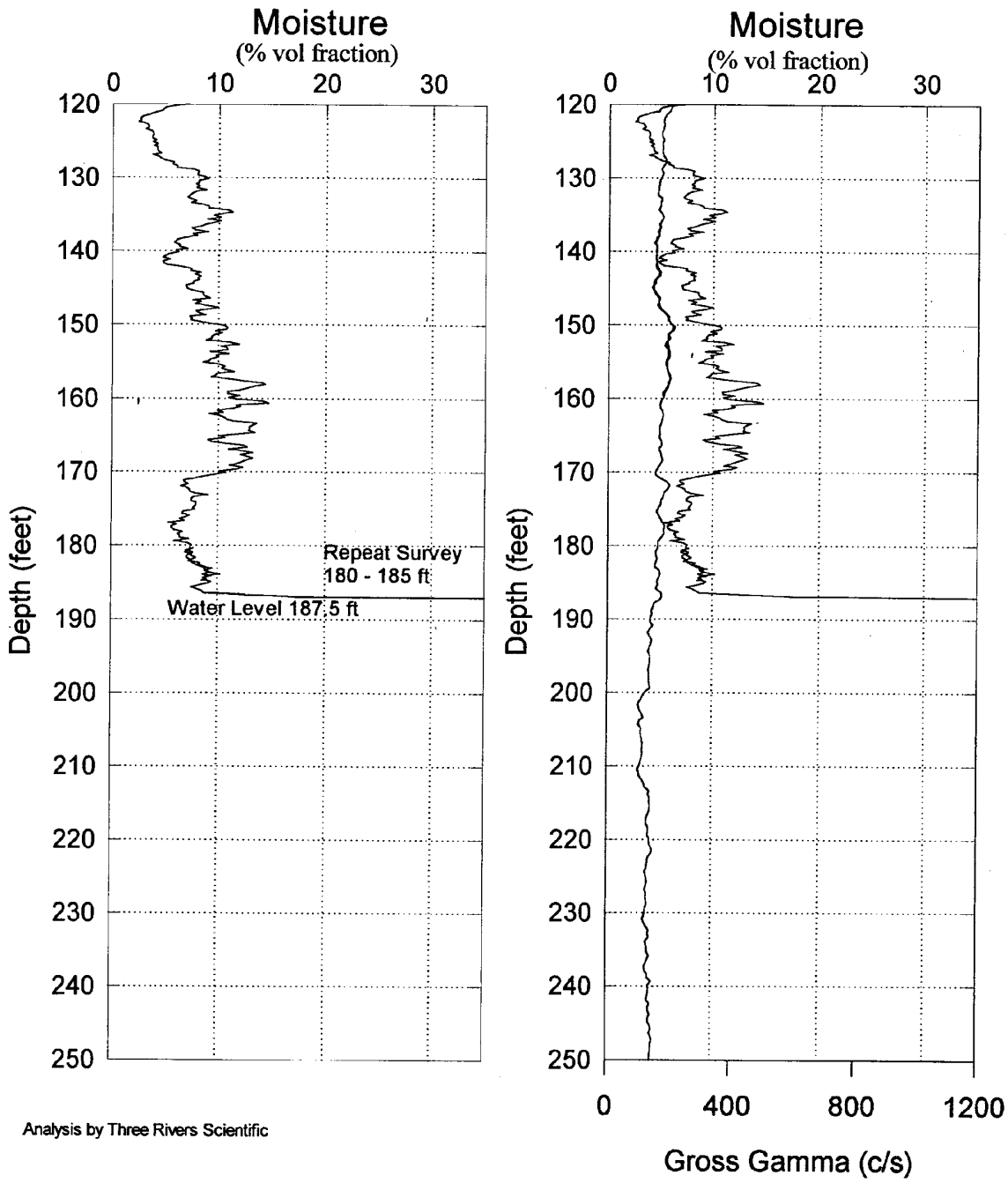
Duratek Federal Services, Inc.

Project: RCRA Drilling

Borehole: 299-W10-27

Log Date : March 15, 2001

Depth Datum : Ground Surface



Analysis by Three Rivers Scientific

RLS Spectral Gamma Ray Borehole Survey

Waste Management Federal Services

Log Header

Project: 2000 RCRA Drilling

Well: **299-W14-16**

Log Type: HPGe Spectral Gamma Ray

Borehole Information

Well # C3121	Water Depth	223	ft	Total Depth 265	ft
Elevation Reference n/a	Elevation	n/a	ft		
Depth Reference Ground Surface	Casing Stickup	0.5	ft		
Casing Diameter 9.25 ID	in	Depth Interval	0 to 265.4 ft	Thickness 0.75	in

Logging Information

Log Type:	HPGe Spectral Gamma Ray	
Company	Waste Management Federal Services	
Date/Archive File Name	November 1, 2000	H2W14016
Logging Engineers	J. Meisner, A. Pearson	
Instrument Series	RLSG07000S01.0	
Logging Unit	RLS-1	
Depth Interval	0 to 125 ft	Prefix A704
	100 to 265.4 ft	Prefix A705
Instrument Calibration Date	Oct 6, 2000	
Calibration Report	WHC-SD-EN-TI-292, Rev 0.	

Analysis Information

Company	Three Rivers Scientific
Analyst	Russ Randall
Date	November 24, 2000

Notes No man-made contamination was detected. Two depth intervals (0 to 100 and 120 to 265 feet) the natural uranium levels are below detection threshold. The water level from 223 to 265 also reduces the gross gamma and raises detection thresholds.

RLS Spectral Gamma Ray Borehole Survey

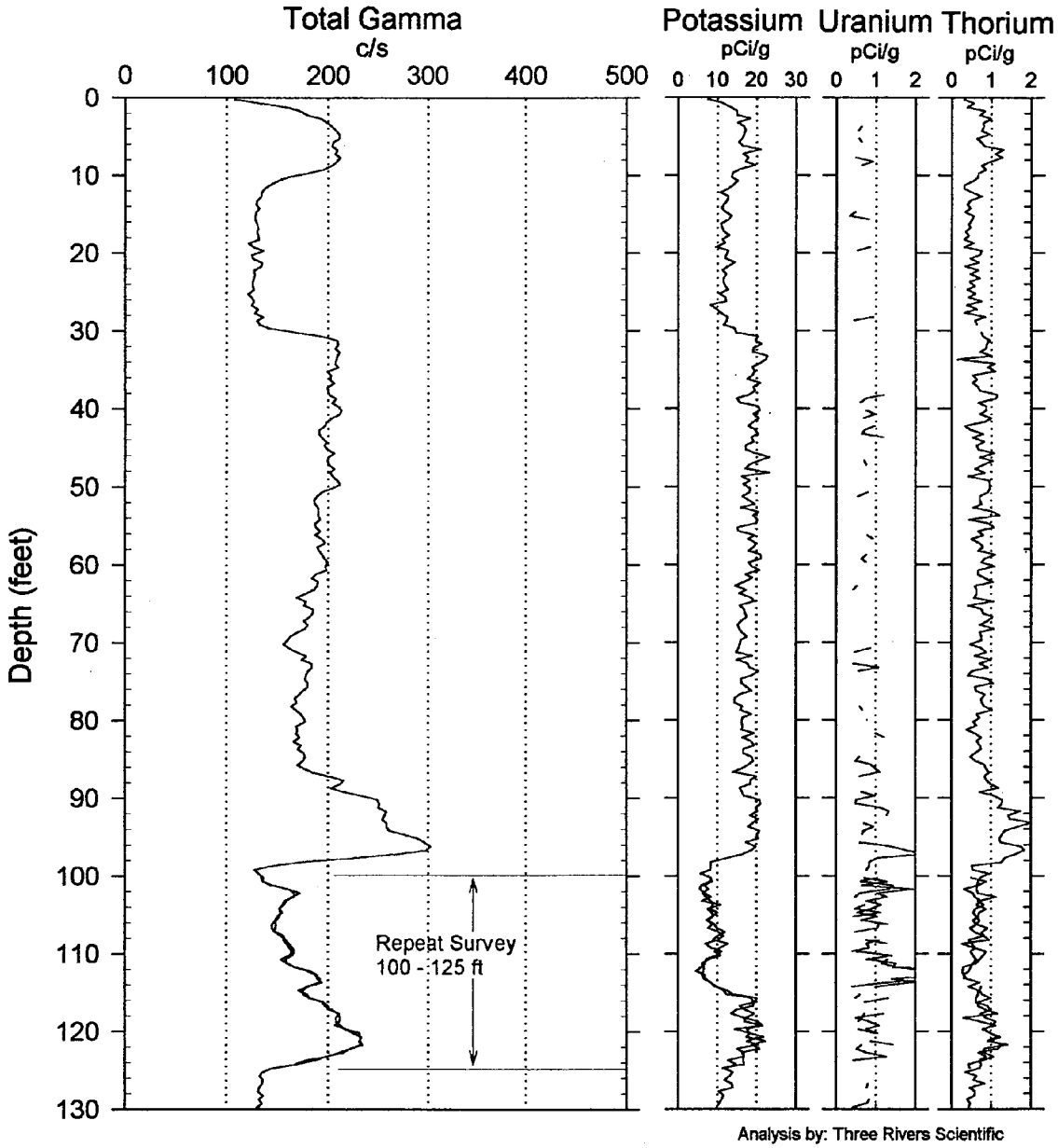
Waste Management Federal Services

Project: 2000 RCRA Drilling

Log Date: November 1, 2000

Borehole: 299-W14-16

Naturally Occurring Radionuclides



RLS Spectral Gamma Ray Borehole Survey

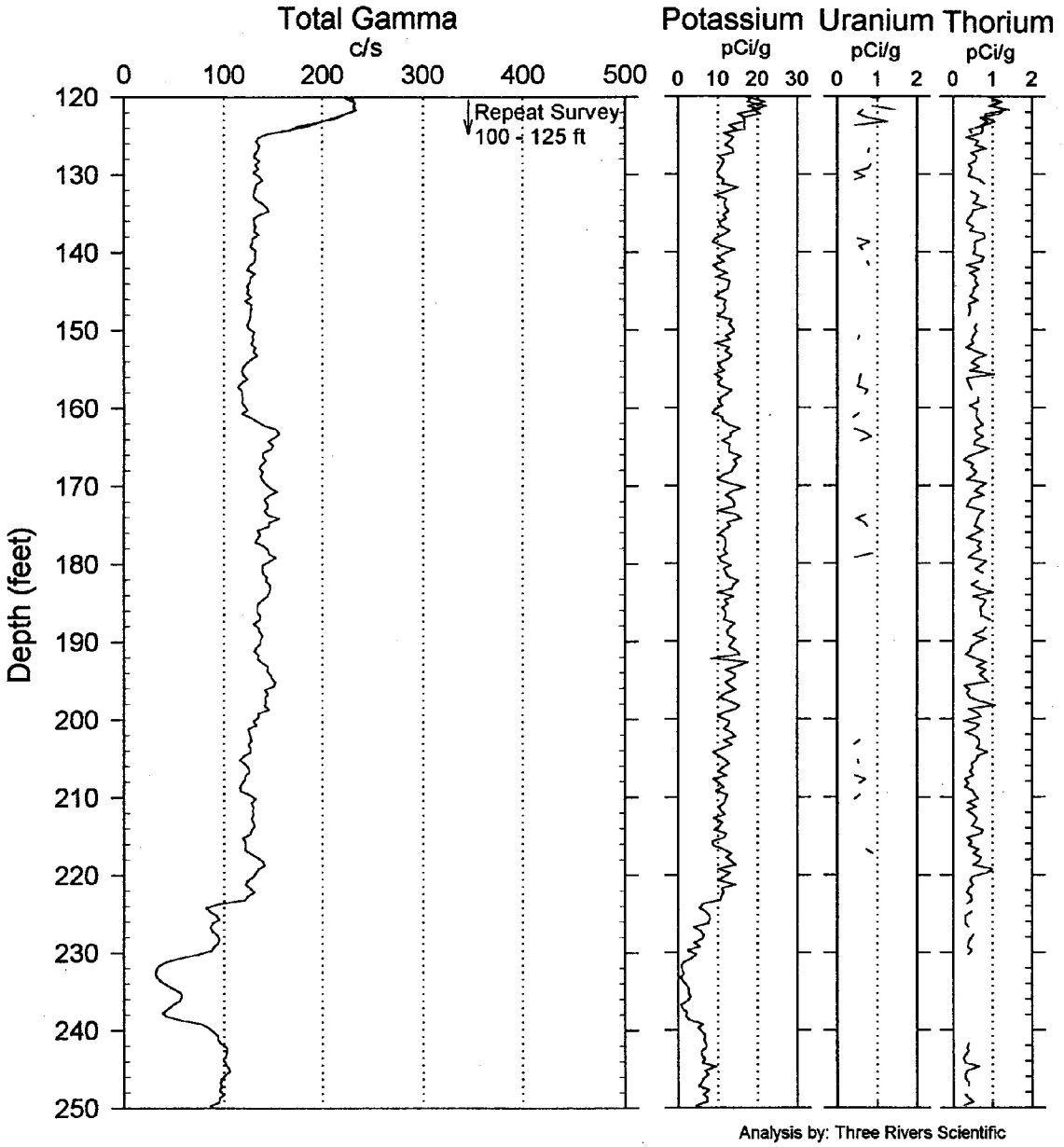
Waste Management Federal Services

Project: 2000 RCRA Drilling

Log Date: November 1, 2000

Borehole: 299-W14-16

Naturally Occurring Radionuclides



RLS Spectral Gamma Ray Borehole Survey

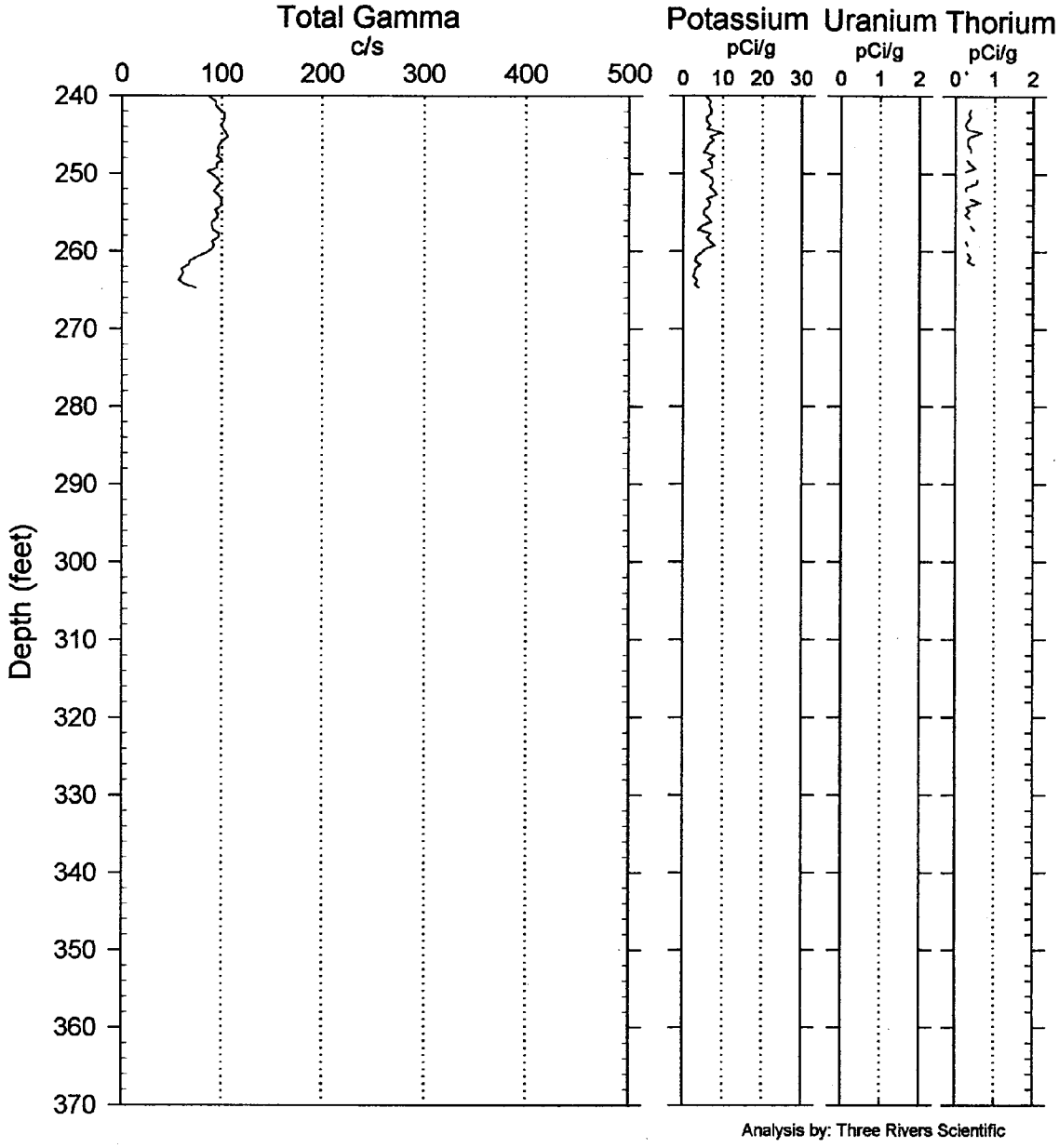
Waste Management Federal Services

Project: 2000 RCRA Drilling

Log Date: November 1, 2000

Borehole: 299-W14-16

Naturally Occurring Radionuclides



Spectral Gamma Ray Log Analysis & Summary

Waste Management Federal Services

Project:	2000 RCRA Drilling	Well:	**299-W14-16**
Log Type:	HPGe Spectral Gamma Ray	Log Date:	November 1, 2000

General Notes:

Total gamma is a response to geologic concentrations of natural radionuclides. A change in sensitivity of gross gamma to geologic concentrations of natural radionuclides occurd at the water level (223 feet).

Log data were collected with a depth reference of ground surface.

System Performance Verify: The pre- and post-log verification passed performance standards; a –0.01% change was observed in the gross. The FWHM of the 583 keV photo peak was also within specifications for pre- and post-log verification.

Repeat Interval: Based on the repeat interval, the logging system performed as per specifications.

Environmental Corrections: All radionuclide concentrations have been corrected for casing attenuation (entire well). Water correction was applied to depths deeper than 223 feet. No casing correction was applied to the total gamma due to Compton downscatter interference.

Radionuclides:

No man-made radionuclide contamination was detected.

The natural uranium concentration is below detection threshold from 0 to 100 feet, and from 120 to 265 feet. The changes in gross gamma from 85 to 125 feet are reflected by changes in potassium, uranium, and thorium; which is indicative of geologic effects.

Analysis by: Three Rivers Scientific

Neutron-Neutron Moisture Borehole Survey

Waste Management Federal Services

Log Header

Project: 2000 RCRA Drilling Well: **299-W14-16**

Log Type: Moisture Gauge

Borehole Information

Well # C3121	Water Depth	223 ft	Total Depth	265 ft	
Elevation Reference n/a	Elevation	n/a ft			
Depth Reference Ground Surface	Casing Stickup	0.5 ft			
Casing Diameter 9.25 ID in	Depth Interval	0 to 265.4 ft	Thickness	0.75 in	

Logging Information

Log Type:	Moisture Gauge		
Company	Waste Management Federal Services		
Date/Archive File Name	November 2, 2000	M2W14016	
Logging Engineers	D. Hollingsworth		
Instrument Series	RLSM00.0		
Logging Unit	RLS-1		
Depth Interval	0 to 100 ft	Prefix	MA70
	80 to 180 ft		MA71
	175 to 223.5 ft		MA72
Instrument Calibration Date	July 14, 2000		
Calibration Report	WHC-SD-EN-TI-306, Rev. 0		

Analysis Information

Company	Three Rivers Scientific
Analyst	Russ Randall
Date	November 24, 2000

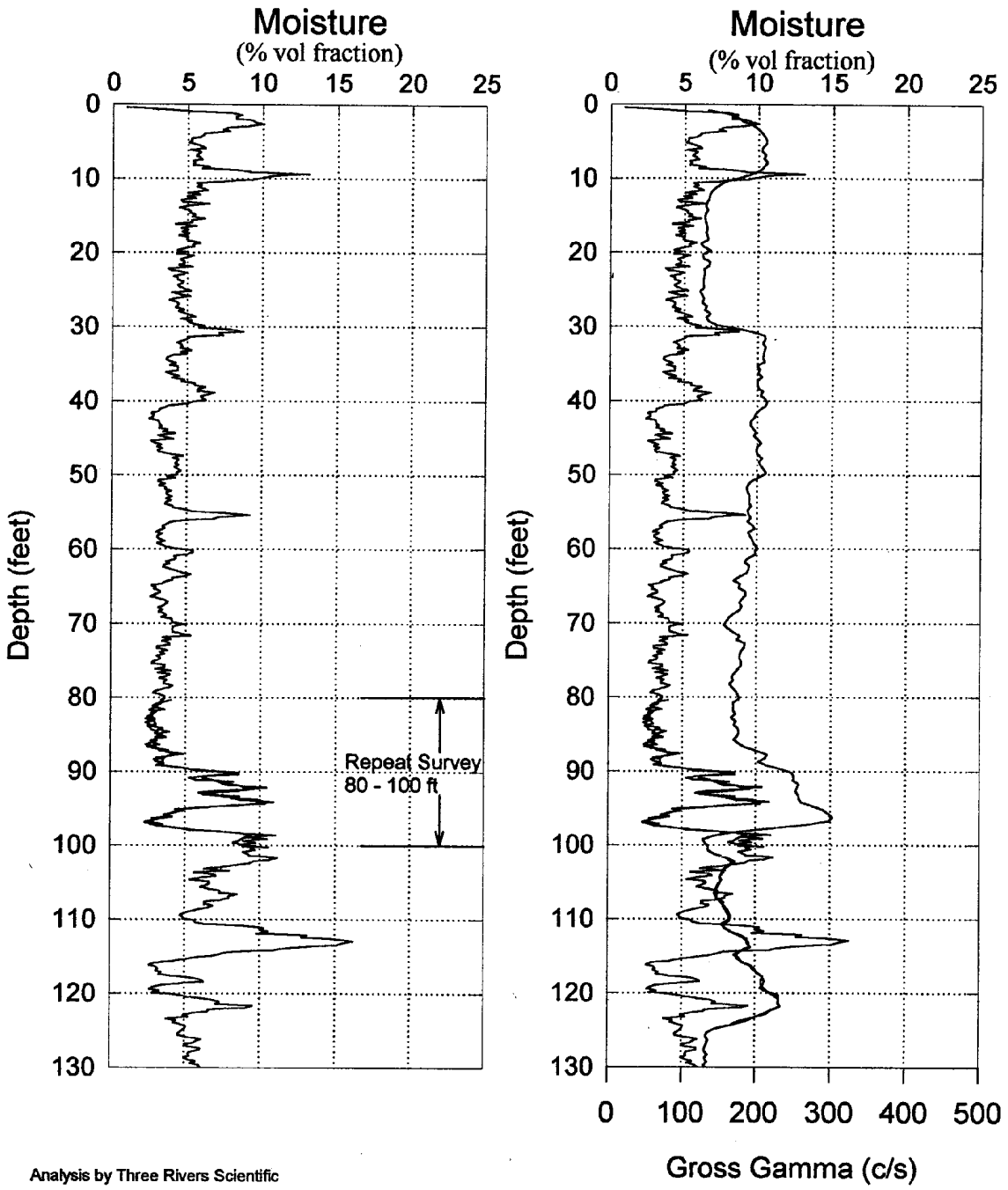
Notes Moisture values range from 2% to 16% for the depths logged. The onset of high readings at 223 feet is due to the proximity of the water level in the borehole. No valid calibration is available for the 10.75 inch OD casing, thus the calibration function was extrapolated from the model cases to this diameter. A casing thickness correction was applied prior to computation of the volume moisture.

RLS Neutron-Neutron Moisture

Waste Management Federal Services

Project: 2000 RCRA Drilling — Log Date : November 2, 2000

Borehole: 299-W14-16 — Depth Datum : Ground Surface



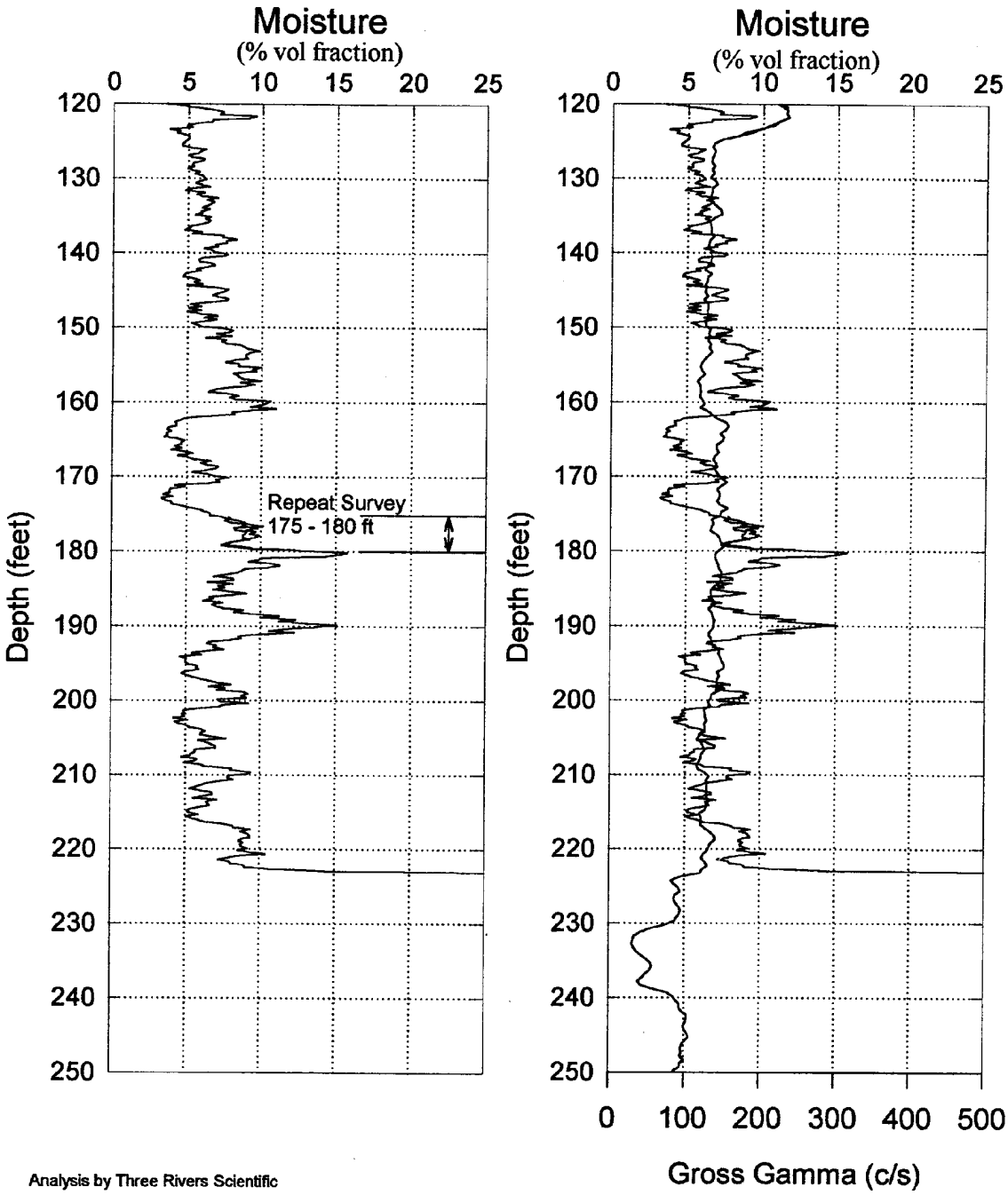
Analysis by Three Rivers Scientific

RLS Neutron-Neutron Moisture

Waste Management Federal Services

Project: 2000 RCRA Drilling — Log Date : November 2, 2000

Borehole: 299-W14-16 — Depth Datum : Ground Surface



Analysis by Three Rivers Scientific

Moisture Log Analysis & Summary

Waste Management Federal Services

Project:	2000 RCRA Drilling	Well ID:	**299-W14-16**
Log Type:	Moisture Gauge	Log Date:	November 2, 2000

General Notes:

The calibration coefficients were generated by extrapolation from the actual model standard diameters of 6.56 and 8.64 inch diameters. Thus the accuracy of the calibration is to be determined.

Log data were collected with a depth reference of ground surface.

System Performance Verify: The pre- and post-log verification passed performance standards; +0.10 change from start of log to end of log, in the shield verify.

Repeat Interval: Based on the repeat interval from 80 to 100 feet and 175 to 180 feet, the logging system performed according to specifications.

Environmental Corrections: The moisture levels have been corrected for casing thickness (0.75 inch) for all well depths logged. No formation density correction has been applied because density values are not available.

Observations:

The moisture levels show values ranging from 2% to 16% for the depth interval from 2 feet to 223 feet. The abnormally high readings that begin at 223 feet are a response to the water level at 223 feet.

Thin wetter zones exist at 10, 30, and 55 feet. A highly laminated structure of wetter zones bounded by drier zones exists from 90 feet to 124 feet. Over this interval (90 to 124 feet) there is a good correlation between the gross gamma and the moisture structure, which is indicative of geologic variations.

Variable moisture structure shows from 162 to 220 feet. Over this depth interval, there is no good correlation with the gross gamma signature. Therefore, moisture content is sensitive to the geologic structure over this interval, while the changes in natural radionuclides are not sensitive to the geologic structure.

Analysis by: Three Rivers Scientific

RLS Spectral Gamma Ray Borehole Survey

Waste Management Federal Services

Log Header

Project: 2000 RCRA Drilling

Well: **299-W14-17**

Log Type: HPGe Spectral Gamma Ray

Borehole Information

Well # C3121	Water Depth	222	ft	Total Depth 264.3	ft
Elevation Reference n/a	Elevation	n/a	ft		
Depth Reference Ground Surface	Casing Stickup	0.5	ft		
Casing Diameter 10.125 ID	in	Depth Interval	0 to 20.6 ft	Thickness 0.75	in
Casing Diameter 7.625 ID	in	Depth Interval	0 to 264.3 ft	Thickness 0.5	in

Logging Information

Log Type:	HPGe Spectral Gamma Ray	
Company	Waste Management Federal Services	
Date/Archive File Name	October 17, 2000	H2W14017
Logging Engineers	D.Hollingsworth	
Instrument Series	RLSG07000S01.0	
Logging Unit	RLS-1	
Depth Interval	0 to 200 ft	Prefix A700
	180 to 260 ft	Prefix A701
Instrument Calibration Date	Oct 6, 2000	
Calibration Report	WHC-SD-EN-TI-292, Rev 0.	

Analysis Information

Company	Three Rivers Scientific
Analyst	Russ Randall
Date	November 1, 2000

Notes No man-made contamination was detected. Two depth intervals (0 to 20 and 222 to 265 feet) the natural uranium levels are below detection threshold. The dual casing from 0 to 20 feet reduces the gross gamma and raises detection thresholds. The water level from 222 to 265 also reduces the gross gamma and raises detection thresholds.

RLS Spectral Gamma Ray Borehole Survey

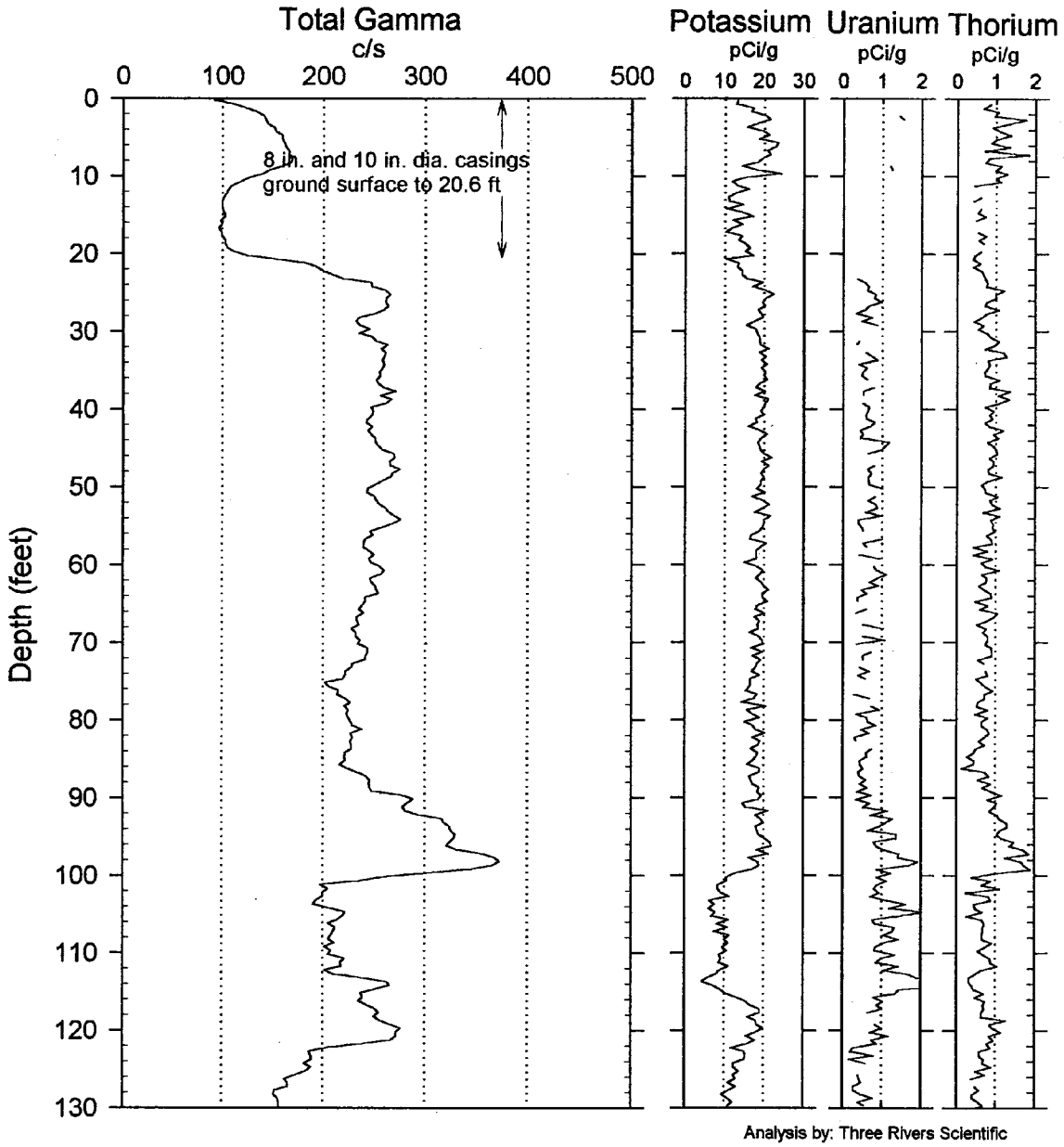
Waste Management Federal Services

Project: 2000 RCRA Drilling

Log Date: October 17, 2000

Borehole: 299-W14-17

Naturally Occurring Radionuclides



RLS Spectral Gamma Ray Borehole Survey

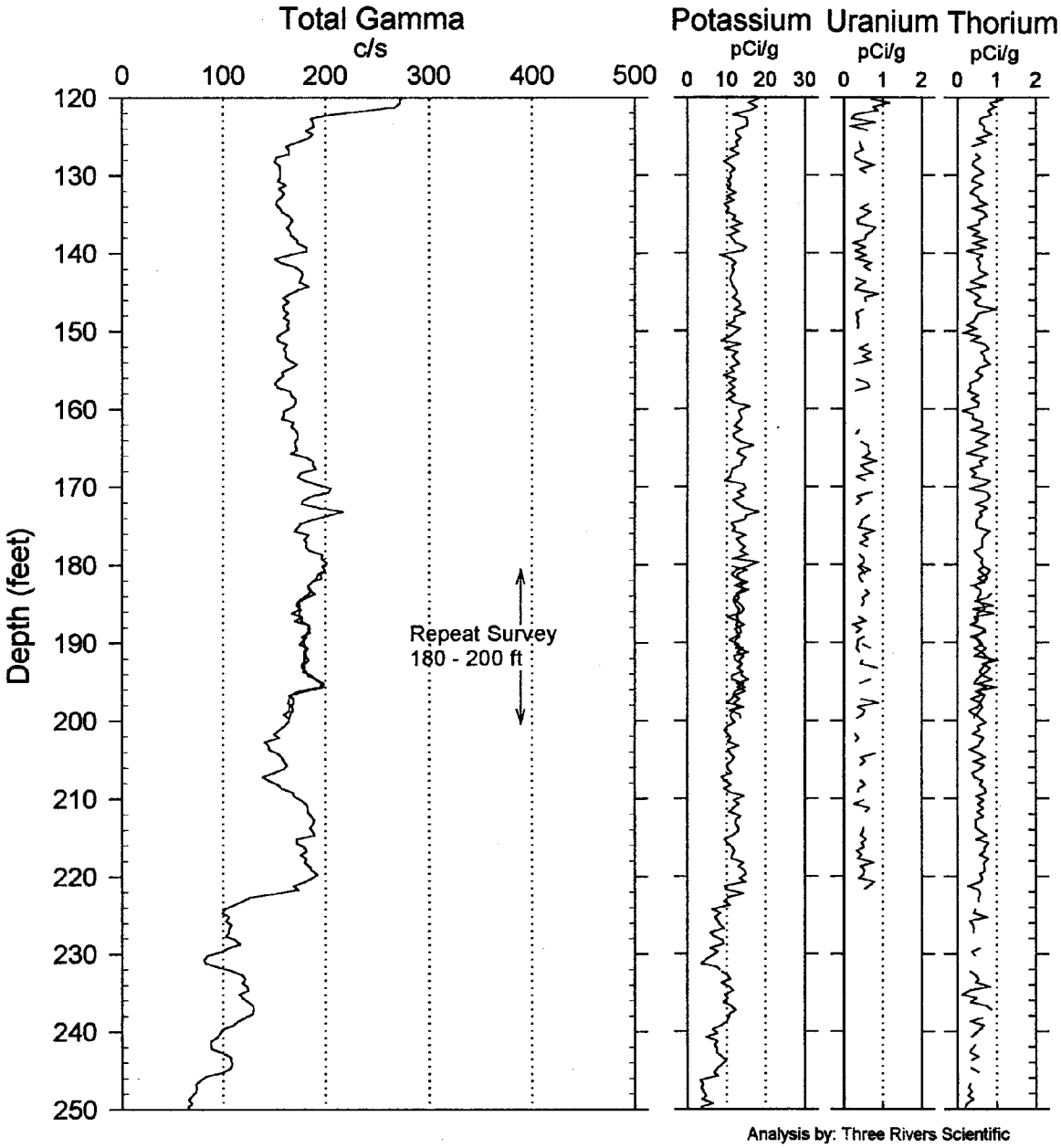
Waste Management Federal Services

Project: 2000 RCRA Drilling

Log Date: October 17, 2000

Borehole: 299-W14-17

Naturally Occurring Radionuclides



RLS Spectral Gamma Ray Borehole Survey

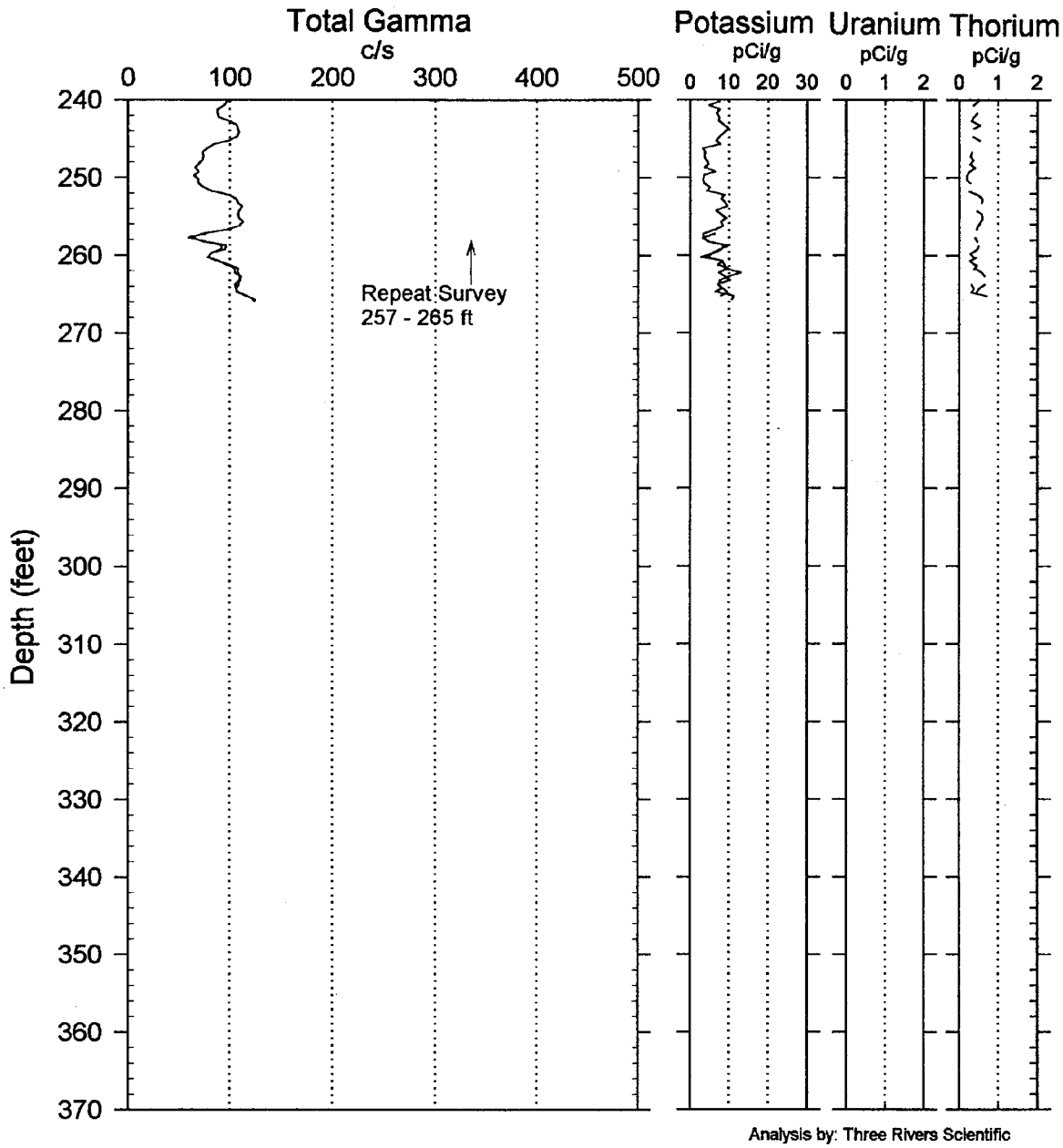
Waste Management Federal Services

Project: 2000 RCRA Drilling

Log Date: October 17, 2000

Borehole: 299-W14-17

Naturally Occurring Radionuclides



Spectral Gamma Ray Log Analysis & Summary

Waste Management Federal Services

Project:	2000 RCRA Drilling	Well:	**299-W14-17**
Log Type:	HPGe Spectral Gamma Ray	Log Date:	October 17, 2000

General Notes:

Total gamma is a response to geologic concentrations of natural radionuclides. Two changes in sensitivity of gross gamma to geologic concentrations of natural radionuclides occur at the dual casing change (20.6 feet) and the water level (222 feet).

Log data collected with a depth reference of ground surface.

System Performance Verify: The pre- and post-log verification passed performance standards; a -1.1% change was observed in the gross. The FWHM of the 583 keV photo peak was also within specifications for pre- and post-log verification.

Repeat Interval: Based on the repeat interval, the logging system performed as per specifications.

Environmental Corrections: All radionuclide concentrations have been corrected for casing attenuation (entire well). Water correction was applied to depths deeper than 222 feet. No casing correction was applied to the total gamma due to Compton downscatter interference.

Radionuclides:

No man-made radionuclide contamination was detected.

The natural uranium concentration is below detection threshold from 0 to 20.6 feet, and from 222 to 265 feet. Both of these intervals have additional gamma attenuation due to dual casing from 0 to 20.6 feet and the water annulus from 222 to 265 feet. The changes in gross gamma from 85 to 123 feet are reflected by changes in potassium, uranium, and thorium; which is indicative of geologic effects.

Analysis by: Three Rivers Scientific

Neutron-Neutron Moisture Borehole Survey

Waste Management Federal Services

Log Header

Project: 2000 RCRA Drilling Well: **299-W14-17**

Log Type: Moisture Gauge

Borehole Information

Well # C3121	Water Depth	222 ft	Total Depth	264.3 ft	
Elevation Reference n/a	Elevation	n/a ft			
Depth Reference Ground Surface	Casing Stickup	0.5 ft			
Casing Diameter 10.125 ID in	Depth Interval	0 to 20.6 ft	Thickness	0.75 in	
Casing Diameter 7.625 ID in	Depth Interval	0 to 264.3 ft	Thickness	0.5 in	

Logging Information

Log Type:	Moisture Gauge		
Company	Waste Management Federal Services		
Date/Archive File Name	October 17, 2000	M2W14017	
Logging Engineers	A. Pearson		
Instrument Series	RLSM00.0		
Logging Unit	RLS-1		
Depth Interval	16 to 115 ft	Prefix	MA57
	96 to 195 ft		MA58
	191 to 223 ft		MA59
Instrument Calibration Date	July 14, 2000		
Calibration Report	WHC-SD-EN-TI-306, Rev. 0		

Analysis Information

Company	Three Rivers Scientific
Analyst	Russ Randall
Date	November 2, 2000

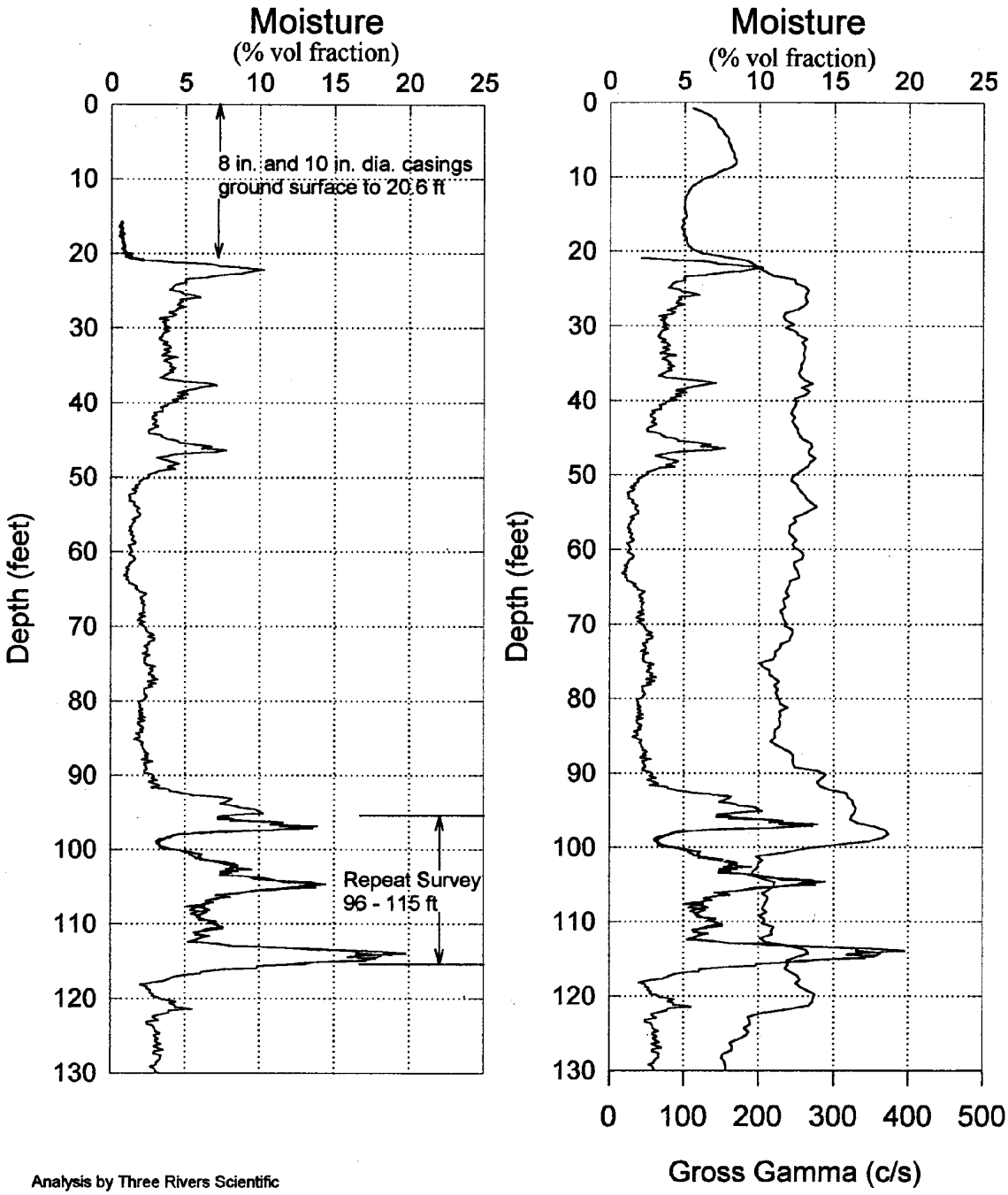
Notes Moisture values range from 2% to 20% for the depths logged. The onset of high readings at 222 feet is due to the proximity of the water level in the borehole. No valid calibration is available for the 10 inch casing diameter from surface to 20.6 feet, thus the application of the 8 inch calibration is plotted as a blue line (with circle symbols) over 16 to 20.6 feet.

RLS Neutron-Neutron Moisture

Waste Management Federal Services

Project: 2000 RCRA Drilling — Log Date : October 17, 2000

Borehole: 299-W14-17 — Depth Datum : Ground Surface



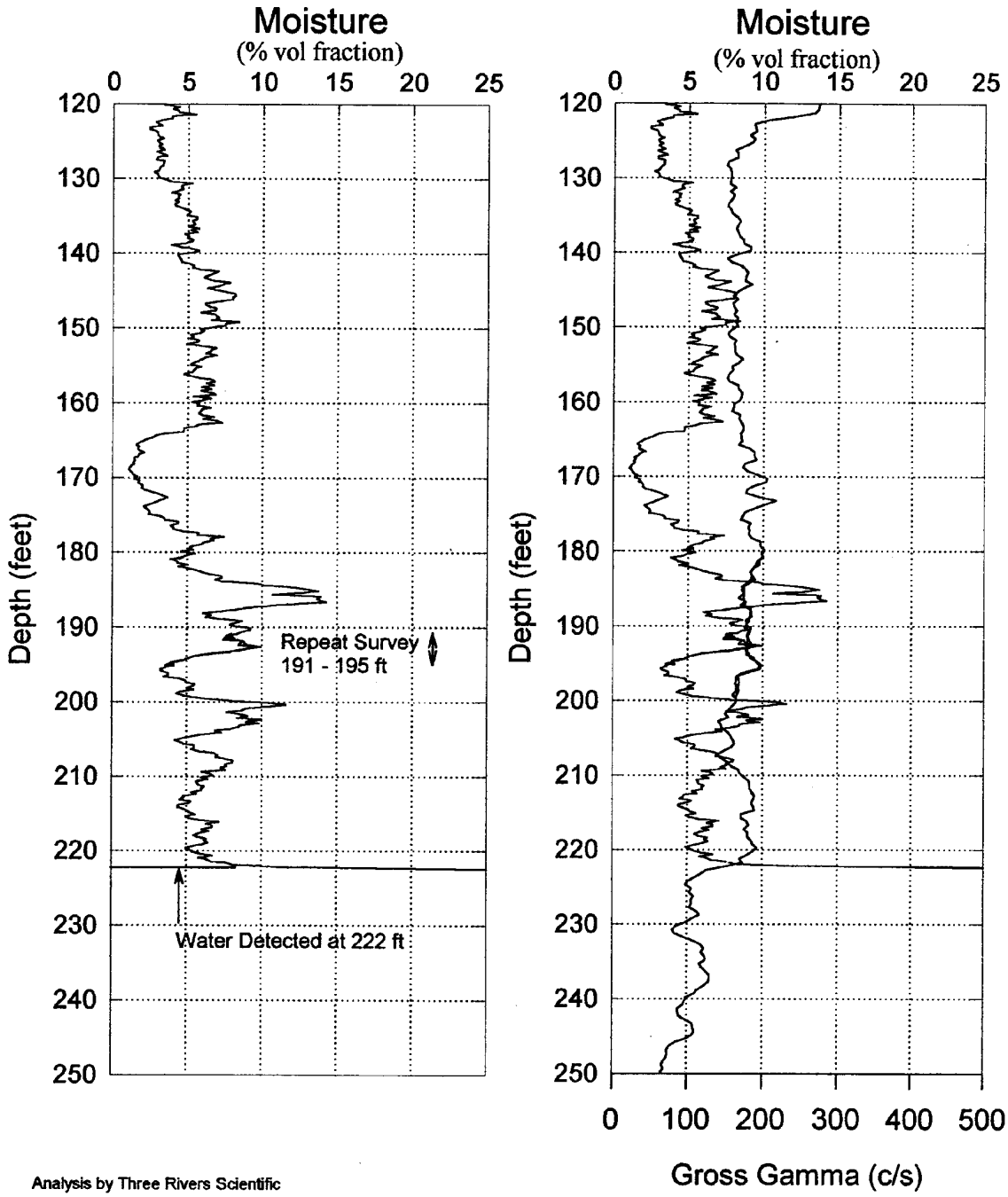
Analysis by Three Rivers Scientific

RLS Neutron-Neutron Moisture

Waste Management Federal Services

Project: 2000 RCRA Drilling — Log Date : October 17, 2000

Borehole: 299-W14-17 — Depth Datum : Ground Surface



Analysis by Three Rivers Scientific

Moisture Log Analysis & Summary

Waste Management Federal Services

Project:	2000 RCRA Drilling	Well ID:	**299-W14-17**
Log Type:	Moisture Gauge	Log Date:	October 17, 2000

General Notes:

The 8 inch calibration coefficients were used for all logged depths. The 8 inch calibration standard has an 8.64 inch borehole diameter, with .32 inch casing thickness, and the borehole diameter in these log data is 8.625 inches. The depth interval from 16 to 20.5 feet has both the 8 inch and 10 inch casing. Thus the inappropriate use of the 8 inch calibration from 16 to 20.5 feet is plotted with a blue line and circle symbols. Note: no calibration exists for the 10 inch casing.

Log data collected with a depth reference of ground surface.

System Performance Verify: The pre- and post-log verification passed performance standards, +0.4% change from start of log to end of log, in the shield verify.

Repeat Interval: Based on the repeat interval from 96 to 115 feet and 191 to 196 feet, the logging system performed according to specifications.

Environmental Corrections: The moisture levels have been corrected for casing thickness (0.5 inch) for all well depths logged. No formation density correction has been applied because density values are not available.

Observations:

The moisture levels show values ranging from 2% to 20% for the depth interval from 20.6 feet to 222 feet. The abnormally high readings that begin at 222 feet are a response to the water level at 222 feet.

Thin wetter zones exist at 22, 38, and 47 feet. A highly laminated structure of wetter zones bounded by drier zones exists from 92 feet to 123 feet. Over this interval (92 to 123 feet) there is a good correlation between the gross gamma and the moisture structure, which is indicative of geologic variations.

Variable moisture structure shows from 172 to 210 feet. Over this depth interval, there is no good correlation with the gross gamma signature. Therefore, moisture content is sensitive to the geologic structure over this interval, while the changes in natural radionuclides is not sensitive to the geologic structure.

Analysis by: Three Rivers Scientific

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