

Table 1.3-1
Survey Coordinates and Well Completion Information

Well Name	Construction Duration		Total Depth (feet bgs ^a)	Survey Coordinates ^b		Ground Elevation (feet amsl ^c)	Approximate Open Hole Water Level at End of Drilling (feet bgs)	Piezometer Screen and U-tube/ Injection Line Interval(s) (feet bgs)		Sand Pack Interval(s) (feet bgs)		Lithology at Sand Pack Interval(s)	Well Casing Type	Well Casing Total Depth (feet bgs)	Well Casing Outside Diameter (inches)
	Start	End		North Latitude	West Longitude			To	From	To	From				
4PC	06/02/08	07/10/08	460	36° 39' 24.87894"	116° 24' 18.00663"	2,700.90	368	N/A ^d	N/A	N/A	N/A	N/A	Steel	320	6.625
4PD	07/12/08	12/03/08	1,860.0	36° 39' 24.83931"	116° 24' 17.74368	2,700.47	287°	317.6	397.9	315.0	405.0	Alluvium	Steel	1,851.2	8.625
								498.0	638.8	495.0	645.0	Alluvium			
								738.9	999.9	735.0	1,005.0	Alluvium			
								1,059.9	1,260.5	1,055.0	1,265.0	Alluvium			
								1,480.5	1,550.6	1,475.0	1,555.0	Basalt			
								1,780.8	1,851.2	1,775.0	1,860.0	Ash-Flow Tuff			

^aBelow ground surface.

^bSurvey performed by Nelson Surveying

^cFeet above mean sea level.

^dNot applicable.

^eMud fluid level in hole at end of drilling not adjusted for mud cake or formation infiltration.

NOTES:

4PC was abandoned due to borehole problems and drilling equipment lost in the borehole at approximately 460 feet.

Table 1.6-1
Phase VI Quality Assurance Documents

Type	Number	Revision	Change	Title	Date
Work Plan	WP-5.0	7	N/A ^a	Phase VI Drilling and Well Construction	5/28/08
	WP-6	1	N/A	Early Warning Drilling Program Geophysical Logging Work Plan	5/31/01
	WP-8.0	5	1	Sample Management	5/28/08
Technical Procedure	TP-7.0	4	N/A	Drill Site Management	5/28/08
	TP-8.0	6	N/A	Field Collection, Logging, and Processing of Borehole Geologic Samples	5/29/08
	TP-11.0	0	N/A	Borehole Geophysical Logging Data Identification and Acceptance	8/28/02
Laboratory Procedure	N/A	Version 1	N/A	Procedures for the Nye County NWRPO Rock Hydrologic Testing Laboratory	3/26/04
	N/A	Version 2	N/A	Procedures for the Nye County NWRPO Rock Hydrologic Testing Laboratory	6/11/04

^aNot applicable.

Table 2.1-1
Summary of Drilling Equipment Used in Phase VI Boreholes

Well Name	Drilling Method			Pipe Specifications			Drill Bit Assembly			
	Type	Depth Interval (feet)		Diameter (inches)	Depth Interval (feet)		Type	Diameter (inches)	Depth Interval (feet)	
		From	To		From	To			From	To
4PC	AR-RC ^a	0	460	4.5 (Dual wall)	0	460	Tricone bit; center return circulation.	6.5	0	320
							Tricone bit; center return circulation.	5.5	320	460
4PD	MR-CC ^b	0	1,470	5.0 to 5.375 (API drill pipe)	0	123	Tricone bit; conventional return circulation.	12.875	0	123
								7.875	123	1,470
		1,470	1,860	4.5 (API drill pipe)	123	1,847	Milltooth bit; conventional return circulation.	7.875	1,470	1,847
					1,847	1,860	Reamer bit ^c	15	100	1,860

^a Air-rotary reverse circulation.

^b Mud-rotary conventional circulation.

^c Hole was reamed from 100 ft to T.D. at 1,860 feet after installation of 16 in. surface casing.

Table 2.2-1
Summary of Drill Cuttings Sampling, Splitting, and Testing

Well Name	Geologic Material	Drilling Method	Drill Cuttings Sample Interval (feet)	Total Number of Drill Cuttings Samples	Number of Drill Cuttings Samples									
					Split (5-lb bag)				Nuclear Waste Repository Project Office (NWRPO) Laboratory Analysis					
					NWRPO Sample	DOE Sample	NWRPO Field Logging Sample	NWRPO Laboratory Sample	Gravimetric Water Content ^b	Soil Water Extract Electrical Conductivity ^b	Wet Sieve	Hydrometer	Specific Gravity	Atterberg Limits
					Sent To YMP SMF ^a									
4PC	Alluvium ^c	AR-RC ^d	2 to 5	113	113	91	97	113			91	22	22	
4PD	Alluvium	MR-CC ^f	10	144	144	143	144	133			137	0	0	
	Non-alluvium ^e		10	11	11	11	11	0			0	0	0	
TOTAL				268	268	245	252	246			228	22	22	

^aU.S. Department of Energy Yucca Mountain Project Sample Management Facility.

^bThis test was not conducted on samples below the water table.

^cAlluvium is defined herein as unconsolidated rock.

^dAir-rotary reverse circulation.

^eNon-alluvium is defined herein as consolidated rock.

^fMud-rotary conventional circulation

Table 2.4-1
Laboratory Test Methods

Test	Method ^a
Specific Gravity (grain density)	ASTM D-854-02. Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer. In: 2003 <i>Annual Book of ASTM Standards</i> , Vol. 04.08, American Society for Testing and Materials.
Atterberg Limits	ASTM D-4318-00. Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils. In: 2003 <i>Annual Book of ASTM Standards</i> , Vol. 04.08, American Society for Testing and Materials.
Soil-Water Extract Electrical Conductivity	Rhoades, J.D. 1982. Soluble Salts—Extracts at Soil/Water Ratios of 1:1 and 1:5, Electrical conductivity of saturation extract. In: Page, A.L. (ed), <i>Methods of Soil Analysis</i> , Part 2, Chemical and Microbiological Properties (2nd ed.), American Society of Agronomy, Chapter 10, pp. 169-170 and 172-173.
Gravimetric Water Content	ASTM D-2216-98. Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. In: 2003 <i>Annual Book of ASTM Standards</i> , Vol. 04.08, American Society for Testing and Materials.
Wet Sieve Analysis	ASTM D-1140-00. Standard Test Methods for Amount of Material in Soil Finer Than the No. 200 (75 μ) Sieve (Method B for wet sieve analysis). In: 2003 <i>Annual Book of ASTM Standards</i> , Vol. 04.08, American Society for Testing and Materials.
Hydrometer Analysis (silt/clay break)	ASTM D-422-63 (Re-approved 1998). Standard Test Method for Particle Size Analysis of Soils. In: 2003 <i>Annual Book of ASTM Standards</i> , Vol. 04.08, American Society for Testing and Materials.

^aMethod used by Nuclear Waste Repository Project Office Rock Hydrologic Testing Laboratory.

Table 2.5-1
Description of Types and Applications of Geophysical Logs

Log Name	Suite	Description	Application
Casing Collar Locator	Completion	Casing Collar Locations	Identifies locations of casing collars or casing damage; used to avoid casing collars in perforating operations.
Caliper	Open-hole	Borehole diameter	Provides borehole correction (e.g., wash-out zones) for other logs, borehole volume for well completions, and possible identification of fractures and contacts.
Density	Drill-string, open-hole, and well completion	Tool output altered by formation materials ^a	Yields density information on adjacent borehole wall formation material; identifies washout zones.
Deviation	Drill-string, open-hole, and well completion	Deviation of borehole from vertical	Permits calculation of true elevations for lithologic contacts, well screens, water levels, and other borehole depth measurements.
Fluid Electrical Conductivity	Open-hole	Borehole and injection fluid conductivities	Estimates relative amount of dissolved salts in borehole fluid and may provide an indication of inflow in open boreholes.
Fluid Resistivity	Open-hole	Borehole fluid resistivity and conductivity	Estimates relative amount of dissolved salts in borehole fluid and may provide an indication of inflow in open boreholes.
Fluid Temperature (Temperature)	Drill-string, open-hole, and well completion	Borehole fluid temperature	Helps identify locations of inflow/outflow in open boreholes, and geothermal gradient in cased boreholes.
Gamma (Natural Gamma)	Drill-string, open-hole, and well completion	Gamma radiation from natural sources in formation and in borehole drilling fluids	Helps identify lithology and stratigraphic unit correlation; may respond to differences in clay content.
Neutron (Moisture)	Drill-string, open-hole, and well completion	Tool output altered by water in formation and borehole ^b	Identifies moisture content changes in the unsaturated zone and/or indicates porosity changes in the saturated zone.
Optical Televiwer	Open-hole	360° image of reflection of borehole wall via prism mirror and camera	May help detect fractures, thin beds, and bedding dip; provides caliper and deviation data.
Resistivity (Formation) (R8, R16, R32, or R64)	Open-hole	Apparent formation resistivities at different distances from the borehole	Helps identify lithology and stratigraphic unit correlation; indicates relative changes in water quality.
Single-Point Resistivity (SPR)	Open-hole	Resistivity of borehole fluids and adjacent formation	Helps identify lithology and changes in borehole fluid composition.
Sonic	Open-hole	Compressional wave velocity through fluids and formations	Helps define changes in porosity and lithology; indicates of fractures.
Spectral Gamma	Drill-string, open-hole, and well completion	Radiation emitted by uranium, thorium and potassium	Can help identify minerals containing uranium, thorium and potassium.
Spontaneous Potential	Open-hole	Electrical potential between fluids in borehole and adjacent formation	Helps identify lithology, clay, and shale content and relative changes in formation water quality.

Source: Modified from Keys (1990) and Telford and others (1990).

^aGeophysical Logging Services density tool contains no radioactive source; Century Geophysical tool uses a cesium-137 source.

^bGeophysical Logging Services moisture tool contains no radioactive source; Century Geophysical tool uses a directed americium-beryllium source.

Table 2.5-2
Summary of Phase VI Geophysical Logs

Well Name	Date	Suite	Interval Logged (feet)		Log Name														Record Index Designator (RID) Number	Company Name	Comments
					Gamma	Density	Spectral Gamma	Neutron (Moisture)	Fluid Temperature	Resistivity (SPR, R8-R64)	Fluid Resistivity	Fluid Electrical Conductivity	Spontaneous Potential	Caliper	Spinner	Acoustic Velocity (Sonic)	Optical Televue	Casing Collar Locator			
4PD	10/22/2008	Drill-string	0	1,800	X				X								X		7598	Jet West	Run in tremmie line inside steel cased borehole from 0 to 1,800 ft with 1,851.2 feet of 8.625-inch casing.
	10/07/2008	Open-hole	0	1,860										X					7591	GLS	Run in open borehole.
	08/01/2008	Open-hole	0	418	X				X	X	X		X						7612	GLS	Fluid level at ~325 feet. No resistivity logs run above fluid level.
	12/03/2008	Completion	0	1,850	X	X		X	X	X	X			X		X		X	7624	GLS	No useable data on video camera log due to lack of water clarity. Run in steel cased borehole from 0 to 1,850 feet with 1,851.2 feet of 8.625-inch surface casing.
	10/13/2008	Drill-string	0	1,830		X											X		7631	GLS	Run in tremmie line inside open borehole from 0 to 1,830 feet.
	02/12/2009	Completion	0	1,850	X				X		X				X	X	X		7632	GLS	Run in steel cased borehole from 0 to 1,850 feet with 1,851.2 feet of 8.625-inch casing.
	02/24/2009	Completion	0	1,630											X				7634	GLS	Run in steel cased borehole from 0 to 1,630 feet with 1,851.2 feet of 8.625-inch casing.
	02/27/2009	Completion	0.2	1,798.0											X				7635	GLS	Run in steel cased borehole from 0 to 1,830 feet with 1,851.2 feet of 8.625-inch casing.
	08/12/2008	Drill-string	0.2	1,798.0	X	X		X											7636	Century	Run in drill pipe inside open borehole from 0 to 1,830 feet.
	08/12/2008	Open-hole	0	1,841	X		X		X	X	X		X			X		X	7637	GLS	Logs merged with open-hole logs run on 8/8/2008 at ~1,620 feet except Spectral Gamma merged at 1,070 feet.

Table 3.1-1
Summary of Well Elevations and Water Levels

Well Name	Top of Casing Elevation ^a (feet amsl ^b)	Original Ground Surface Elevation ^d (feet amsl)	Water Level Measurement Date	Groundwater Elevation ^e (feet amsl)	Depth to Water ^e (feet)
4PC	n/a ^c	2,700.9	n/a ^f	n/a ^f	n/a ^f
4PD	2,703.2	2700.5	7/22/09	2,375.5	327.7 ^g

^aElevations provided by Nelson Surveying, LLC and based on a Global Positioning System together with a conventional survey .

^bAbove mean sea level (NGVD-29).

^c4PC is an abandoned well, surface collar location is represented by a spike in a concrete slab.

^dBased on GPS /conventional survey elevation at top of casing, minus casing stickup (NGVD-29).

^eGroundwater elevation and depth-to-water data have not been corrected for borehole deviation.

^f4PC was abandoned just below the water table; no water level measurement was obtained.

^gGroundwater elevation is a composite elevation of all 6 open screened intervals in the well.

Table 4.1-1
Summary of Censored Geologic, Drilling, and Laboratory Data

Well Name	Sample Type	Field Logging Data Depth Interval (feet below ground surface [bgs])	Laboratory Test Data Depth Interval in Alluvium (feet bgs)				
		Particle Size Distribution Data ^a	Wet Sieve PSD	Hydrometer PSD	Atterberg Limits	Gravimetric Water Content	Electrical Conductivity
		Alluvium					
4PC	Drill Cuttings						
4PD	Drill Cuttings	350-1,770	350-1,770				

^a Censored due to coarse bias from mud-rotary conventional circulation drilling.

Table 6.2-1
Summary of Censored Geophysical Logs

Well Name	Record Index Designator (RID) Number	Log Type	Interval (feet)		Reason for Censoring
			From	To	
4PD	7624	Video Camera Log	0	700	No useable data due to lack of water clarity.