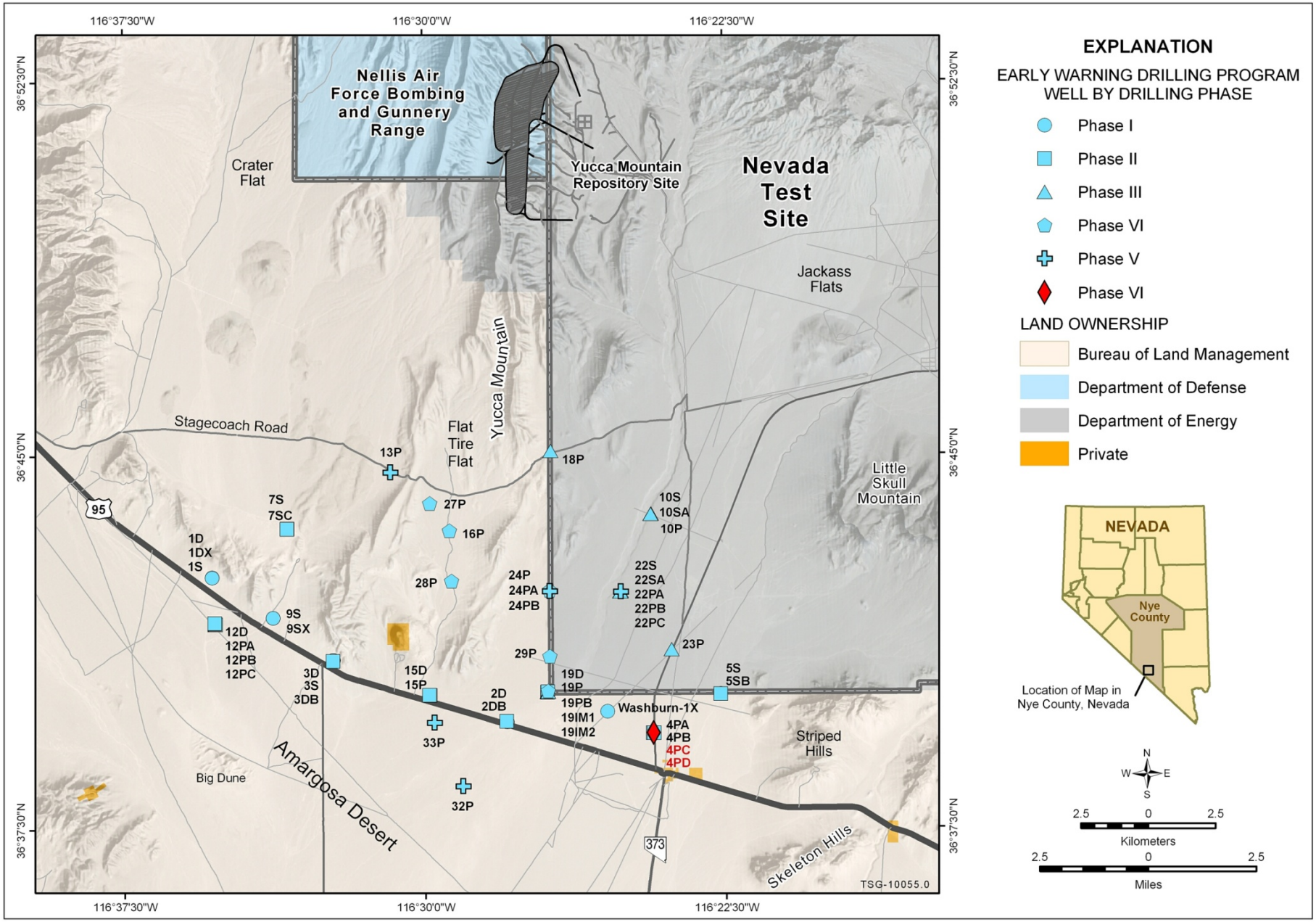

Figure 1.1-1
Early Warning Drilling Program Region

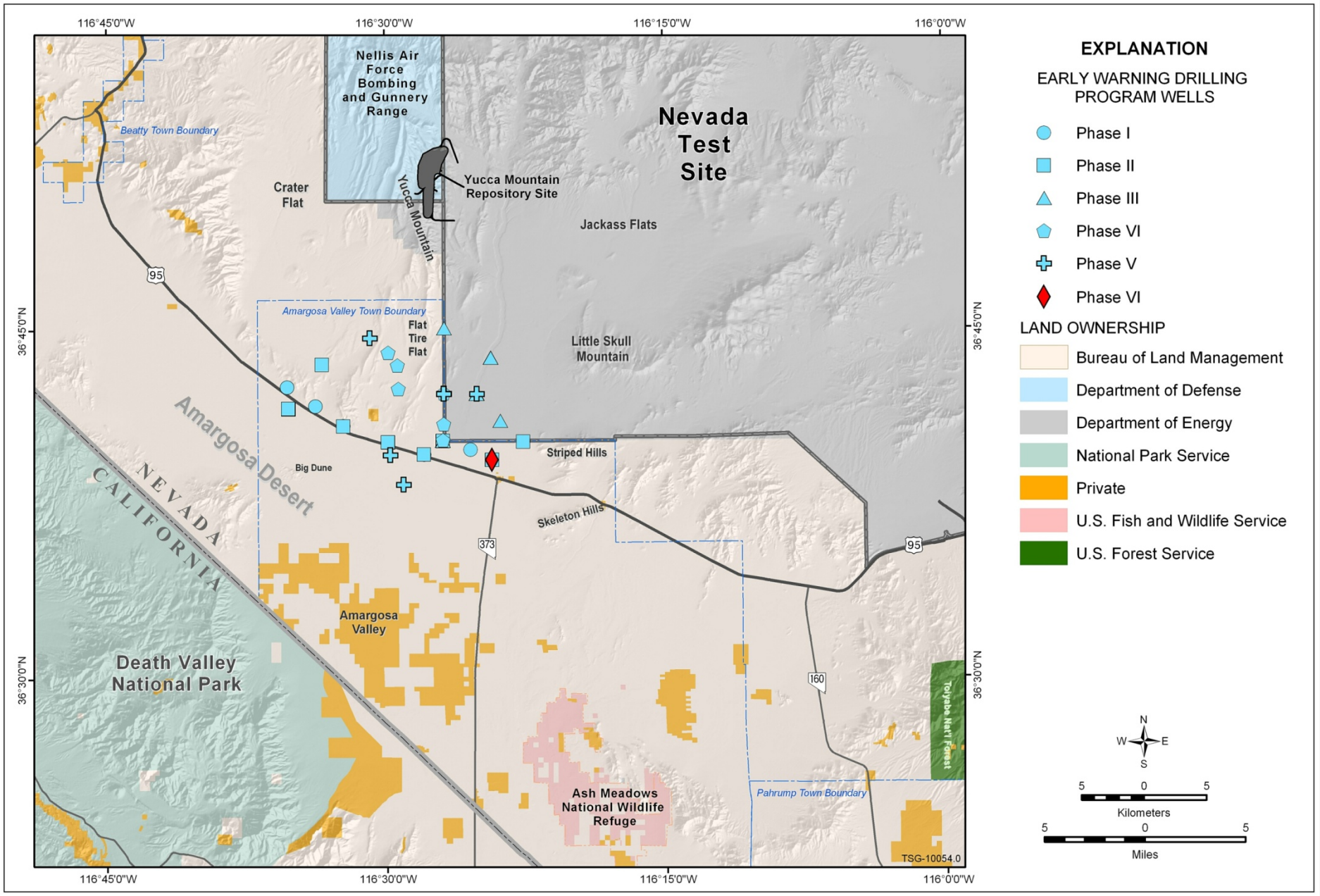

Figure 1.3-1
Early Warning Drilling Program Well Locations by Phase

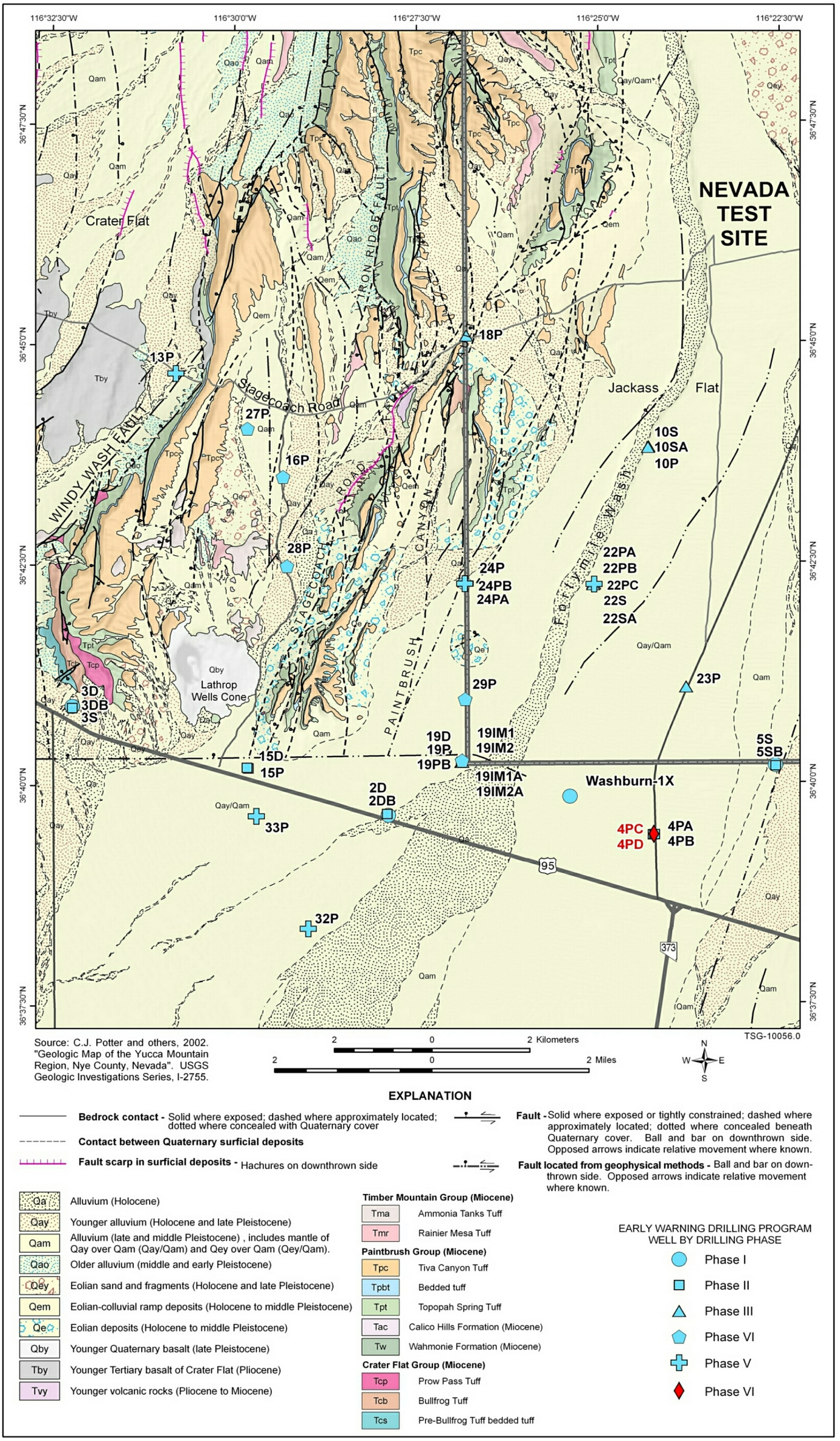

Figure 1.4-1
Geologic Map of the Yucca Mountain Area

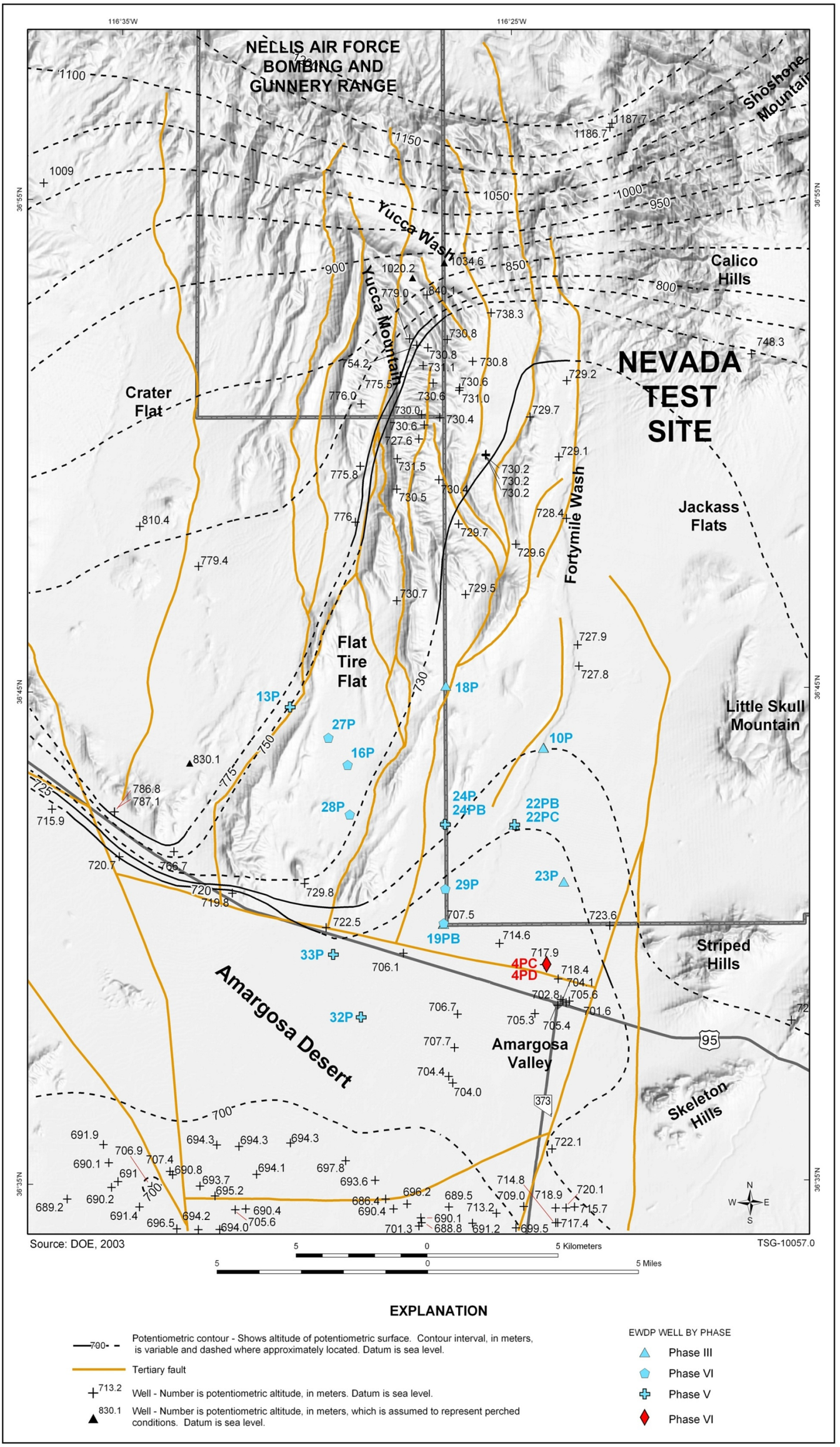

Figure 1.4-2
Potentiometric Surface Map of Yucca Mountain / Amargosa Desert Area

Alluvium Drill Cuttings Logging Form - Nye County Nuclear Waste Repository Project Office

Borehole ID: **NC-EWDP-4PC** (Phase 6) Driller/Drilling Company: Nick Owens/Drill Tech, Inc. Drilling Method: Air-rotary reverse-circulation Alluvium Depth (ft bgs): 0 to 460 Start Date: 6/9/2008 End Date: 7/1/2008 Page 1 of 4

Date Logged	Logged By (Initials)	Date Checked	Checked By (Initials)	Sample Number	Depth Interval (feet bgs) From	Depth Interval (feet bgs) To	Drilling Data: Liquid Drilling Fluid Injection Rate (gpm)	Drilling Data: Drilling Rate (feet/min)	Drilling Data: Water Production (gpm)	Drilling Data: Sample Recovery (gallons)	Drilling Data: Borehole Diameter (inches)	Sample Density Measurements: Tare Weight (kg)	Sample Density Measurements: Sample Plus Tare Weight (kg)	Sample Density Measurements: Sample Weight (kg)	Munsell Color Symbol	Moisture Content: Dry	Moisture Content: Moist	Moisture Content: Wet	Particle Size Distribution (%): Gravel	Sand	Silt	Clay	Fines (Silt plus Clay)	Grading: Well Graded	Grading: Poorly Graded	Estimated Plasticity: None	Low	Moderate	High	USCS Group Symbol	Gravel/Sand GrainShape: Angular	Subangular	Subrounded	Rounded	Cementation: None	Weak	Moderate	Strong	HCL Reaction: None	Weak	Strong	Major Rock Type (%): Volcanics	Carbonates	Other
6/9/2008	BW	8/5/2008	JSW	4PC-0-5	0.00	5.00	2.50	1.10			5.500					☐	☐	☐						☐	☐	☐	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			
6/9/2008	BW	8/5/2008	JSW	4PC-5-10	5.00	10.00	2.50	1.10		2.00	5.500				10YR 5/3	☐	☐	☐	54	45	1	0	1	☑	☐	☑	☐	☐	☐	GW	☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	☑	100		
6/9/2008	BW	8/5/2008	JSW	4PC-10-15	10.00	15.00	2.50	1.10		5.00	5.500				10YR 5/3	☐	☐	☐	22	76	2	0	2	☑	☐	☑	☐	☐	☐	SW	☐	☐	☑	☐	☑	☐	☐	☐	☐	☐	☑	100		
6/9/2008	BW	8/5/2008	JSW	4PC-15-18.3	15.00	18.30	2.50	1.10		0.50	5.500				7.5YR 5/6	☐	☐	☐	42	57	1	0	1	☑	☐	☑	☐	☐	☐	SW	☐	☐	☑	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/10/2008	BW	8/5/2008	JSW	4PC-18.3-20	18.30	20.00	2.50	1.10		0.00	5.500					☐	☐	☐						☐	☐	☐	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			
6/10/2008	BW	8/5/2008	JSW	4PC-20-25	20.00	25.00	2.50	1.10		0.00	5.500					☐	☐	☐						☐	☐	☐	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			
6/10/2008	BW	8/5/2008	JSW	4PC-25-30	25.00	30.00	2.50	1.10		5.00	5.500				10YR 5/3	☐	☐	☐	27	72	1	0	1	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/10/2008	BW	8/5/2008	JSW	4PC-30-31	30.00	31.00	2.50	1.10		2.50	5.500					☐	☐	☐						☐	☐	☐	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			
6/10/2008	BW	8/5/2008	JSW	4PC-31-35	31.00	35.00	2.50	1.10		1.50	5.500				10YR 5/3	☐	☐	☐	31	68	1	0	1	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/10/2008	BW	8/5/2008	JSW	4PC-35-40	35.00	40.00	2.50	1.10		2.00	5.500				10YR 5/4	☐	☐	☐	44	55	1	0	1	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/10/2008	BW	8/5/2008	JSW	4PC-40-45	40.00	45.00	2.50	1.20		2.50	5.500				7.5YR 6/3	☐	☐	☐	32	67	1	0	1	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/10/2008	BW	8/5/2008	JSW	4PC-45-50	45.00	50.00	2.50	1.20		2.50	5.500				7.5YR 6/3	☐	☐	☐	31	66	3	0	3	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☐	☑	100		
6/10/2008	BW	8/5/2008	JSW	4PC-50-52.8	50.00	52.80	2.50	1.20		10.00	5.500					☐	☐	☐						☐	☐	☐	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			
6/10/2008	BW	8/5/2008	JSW	4PC-52.8-55	52.80	55.00	2.50	1.20		2.00	5.500				7.5YR 6/3	☐	☐	☐	18	80	0	2	2	☑	☐	☐	☐	☑	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/10/2008	BW	8/5/2008	JSW	4PC-55-60	55.00	60.00	2.50	1.60		2.00	5.500				7.5YR 6/3	☐	☐	☐	16	82	1	0	1	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/10/2008	BW	8/5/2008	JSW	4PC-60-65	60.00	65.00	2.50			0.00	6.500					☐	☐	☐						☐	☐	☐	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			
6/12/2008	BW	8/5/2008	JSW	4PC-65-70	65.00	70.00	2.50	0.70		2.50	6.500				5YR 4/3	☐	☐	☐	41	59	0	0	0	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☐	☐	☐	☑	☐	☑	☐	100		
6/12/2008	BW	8/5/2008	JSW	4PC-70-75	70.00	75.00	2.50	0.70		2.00	6.500				5YR 4/3	☐	☐	☐	41	59	0	0	0	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/12/2008	BW	8/5/2008	JSW	4PC-75-78.6	75.00	78.60	2.50	0.70		10.00	6.500					☐	☐	☐						☐	☐	☐	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			
6/12/2008	BW	8/5/2008	JSW	4PC-78.6-80	78.60	80.00	2.50	0.70		2.00	6.500				5YR 4/3	☐	☐	☐	18	81	1	0	1	☐	☑	☑	☐	☐	☐	SP	☐	☐	☑	☐	☑	☐	☐	☐	☑	☐	☐	100		
6/12/2008	BW	8/5/2008	JSW	4PC-80-85	80.00	85.00	2.50	0.80		2.00	6.500				5YR 4/3	☐	☐	☐	24	75	1	0	1	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/12/2008	BW	8/5/2008	JSW	4PC-85-90	85.00	90.00	2.50	0.80		2.00	6.500				5YR 4/3	☐	☐	☐	19	79	1	1	2	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/12/2008	BW	8/5/2008	JSW	4PC-90-93.6	90.00	93.60	2.50	0.80		10.00	6.500					☐	☐	☐						☐	☐	☐	☐	☐	☐		☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐			
6/12/2008	BW	8/5/2008	JSW	4PC-93.6-95	93.60	95.00	2.50	0.80		2.00	6.500				5YR 4/3	☐	☐	☐	25	73	1	1	2	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/12/2008	BW	8/5/2008	JSW	4PC-95-100	95.00	100.00	2.50	0.80		2.00	6.500				5YR 4/3	☐	☐	☐	18	79	2	1	3	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/13/2008	BW	8/5/2008	JSW	4PC-100-105	100.00	105.00	10.00	0.80		2.50	6.500				5YR 4/3	☐	☐	☐	12	86	1	1	2	☑	☐	☑	☐	☐	☐	SW	☐	☑	☐	☐	☐	☐	☐	☑	☐	☑	☐	100		
6/13/2008	BW	8/5/2008	JSW	4PC-105-110	105.00	110.00	10.00	0.80		2.00	6.500				5YR 6/4	☐	☐	☐	8	87	4	1	5	☑	☐	☑	☐	☐	☐	SW	☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/13/2008	BW	8/5/2008	JSW	4PC-112.1-115	112.10	115.00	10.00	0.80		4.50	6.500				5YR 6/3	☐	☐	☐	8	87	4	1	5	☑	☐	☑	☐	☐	☐	SW	☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/13/2008	BW	8/5/2008	JSW	4PC-115-120	115.00	120.00	10.00	1.00		2.00	6.500				5YR 5/4	☐	☐	☐	6	89	4	1	5	☑	☐	☑	☐	☐	☐	SW	☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/13/2008	BW	8/5/2008	JSW	4PC-120-125	120.00	125.00	10.00	1.00		0.50	6.500				5YR 4/3	☐	☐	☐	7	88	4	1	5	☑	☐	☑	☐	☐	☐	SW	☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/13/2008	BW	8/5/2008	JSW	4PC-125-130	125.00	130.00	10.00	1.00		1.00	6.500				5YR 4/3	☐	☐	☐	11	87	2	0	2	☑	☐	☑	☐	☐	☐	SW	☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		
6/13/2008	BW	8/5/2008	JSW	4PC-133.4-135	133.40	135.00	10.00	1.00		2.50	6.500				5YR 5/4	☐	☐	☐	13	79	4	4	8	☑	☐	☐	☐	☑	☐	SW-SM	☑	☐	☐	☐	☑	☐	☐	☐	☐	☑	☐	100		

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Figure 2.3-1
Example of Alluvium Drill Cuttings Geologic Logging Form

Non-Alluvium Logging Form - Nye County Nuclear Waste Repository Project Office

Borehole ID: **NC-EWDP-4PD** (Phase 6) Driller/Drilling Company: Nick Owens/Chris VanKeuren/Drill Tech, Inc. Drilling Method: Conventional Mud-Rotary Non-Alluvium Depth (ft bgs): 1770 to 1860 Start Date: 8/7/2008 End Date: 10/7/2008 Page 1 of 1

Logged		Checked		Sample	Depth Interval (feet/bgs)		Drilling/Coring Data: Liquid Drilling Fluid Injection Rate (gpm)	Drilling/Coring Rate (feet/min)	Water Production (gpm)	Sample Recovery (gallons)	Sample Density Data: Borehole Diameter (inches)	Tare Weight (kg)	Sample Plus Tare Weight (kg)	Sample Weight (kg)	Munsell Color Symbol
08/07/08	BW	09/05/08	JSW	4PD-1770-1780	1770.00	1780.00	150.00	0.50		15.00	7.88				2.5Y 8/4
08/07/08	BW	09/05/08	JSW	4PD-1780-1783.8	1780.00	1783.80	150.00	0.50		15.00	7.88				2.5Y 8/4
08/07/08	BW	09/05/08	JSW	4PD-1783.8-1790	1783.80	1790.00	150.00	0.60		5.00	7.88				2.5Y 8/4
08/07/08	BW	09/05/08	JSW	4PD-1790-1800	1790.00	1800.00	150.00	0.60		10.00	7.88				2.5Y 8/4
08/07/08	BW	09/05/08	JSW	4PD-1800-1810	1800.00	1810.00	150.00	1.10		10.00	7.88				2.5Y 8/4
08/07/08	BW	09/05/08	JSW	4PD-1810-1820	1810.00	1820.00	150.00	1.10		10.00	7.88				2.5Y 8/4
08/07/08	BW	09/05/08	JSW	4PD-1820-1830	1820.00	1830.00	150.00	1.00		10.00	7.88				10YR 5/3
08/07/08	BW	09/05/08	JSW	4PD-1830-1840	1830.00	1840.00	150.00	1.00		10.00	7.88				10YR 7/3
08/07/08	BW	09/05/08	JSW	4PD-1840-1846.6	1840.00	1846.60	150.00	1.00		10.00	7.88				10YR 7/3
10/07/08	BW	11/25/08	JSW	4PD-1846.6-1850	1846.60	1850.00	200.00	0.32			7.88				10YR 7/3
10/07/08	BW	11/25/08	JSW	4PD-1850-1860	1850.00	1860.00	200.00	0.20			7.88				10YR 7/3

Sample	Moisture Content				HCL Re-action			Rock Unit – Tuff: Deposition			Welding				Alteration					Sedimentary						Carbonate			Weathering					Structure					Matrix		
	Not Applicable	Dry	Moist	Wet	None	Weak	Strong	Ash Fall	Ash Flow	Reworked	Dense	Moderate	Weak	None	Vitric	Devitrified	Matrix	Vapor Phase	Spherulitic	Claystone	Mudstone	Siltstone	Sandstone	Conglomerate	Chert	Limestone	Dolomite	Other	Fresh	Slight	Moderate	High	Decomposed	None Observed	Stratified	Laminated	Fractured	Other	Dense/Non-porous	Open/Porous	Other
4PD-1770-1780				✓	✓				✓					✓	✓														✓					✓					✓		
4PD-1780-1783.8				✓	✓				✓					✓	✓														✓					✓					✓		
4PD-1783.8-1790				✓	✓				✓					✓	✓														✓					✓					✓		
4PD-1790-1800				✓	✓				✓					✓	✓														✓					✓					✓		
4PD-1800-1810				✓	✓				✓					✓	✓														✓					✓					✓		
4PD-1810-1820				✓	✓				✓					✓	✓														✓					✓					✓		
4PD-1820-1830				✓	✓				✓					✓	✓															✓				✓					✓		
4PD-1830-1840				✓	✓				✓					✓	✓															✓				✓					✓		
4PD-1840-1846.6				✓	✓				✓					✓	✓															✓				✓					✓		
4PD-1846.6-1850				✓	✓				✓					✓	✓														✓					✓					✓		
4PD-1850-1860				✓	✓				✓					✓	✓														✓					✓					✓		

Sample	Phenocrysts – Mafics: % by Vol.	Munsell Color Symbol	Max. Size (mm)	Quartz: % by Vol.	Munsell Color Symbol	Max. Size (mm)	Feldspar: % by Vol.	Munsell Color Symbol	Max. Size (mm)	Clasts – Pumice: % by Vol.	Munsell Color Symbol	Max. Size (mm)	Lithics: % by Vol.	Munsell Color Symbol	Max. Size (mm)
4PD-1770-1780	3	N 2.5	4	1	CL	1	0			10	N8	3	1	5 YR 5/2	2
4PD-1780-1783.8	2	N 2.5	2	1	CL	1	0			10	N 8	3	0		
4PD-1783.8-1790	1	N 2.5	1	1	CL	1	0			10	N 8	3	0		
4PD-1790-1800	1	N 2.5	1	1	CL	1	0			10	N 8	3	1	5 YR 5/2	1
4PD-1800-1810	2	N 2.5	3	1	CL	1	0			10	N 8	3	0		
4PD-1810-1820	2	N 2.5	2	3	CL	1	0			10	N 8	3	0		
4PD-1820-1830	1	N 2.5	1	3	CL	1	0			10	N 8	3	0		
4PD-1830-1840	1	N 2.5	1	1	CL	1	0			10	N 8	3	0		
4PD-1840-1846.6	1	N 2.5	1	1	CL	1	0			10	N 8	3	0		
4PD-1846.6-1850	1	N 2.5	1	1	CL	1	0			10	N 8	3	0		
4PD-1850-1860	1	N 2.5	1	1	CL	1	0			10	N 8	3	0		

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Figure 2.3-2
Example of Non-Alluvium Drill Cuttings Geologic Logging Form

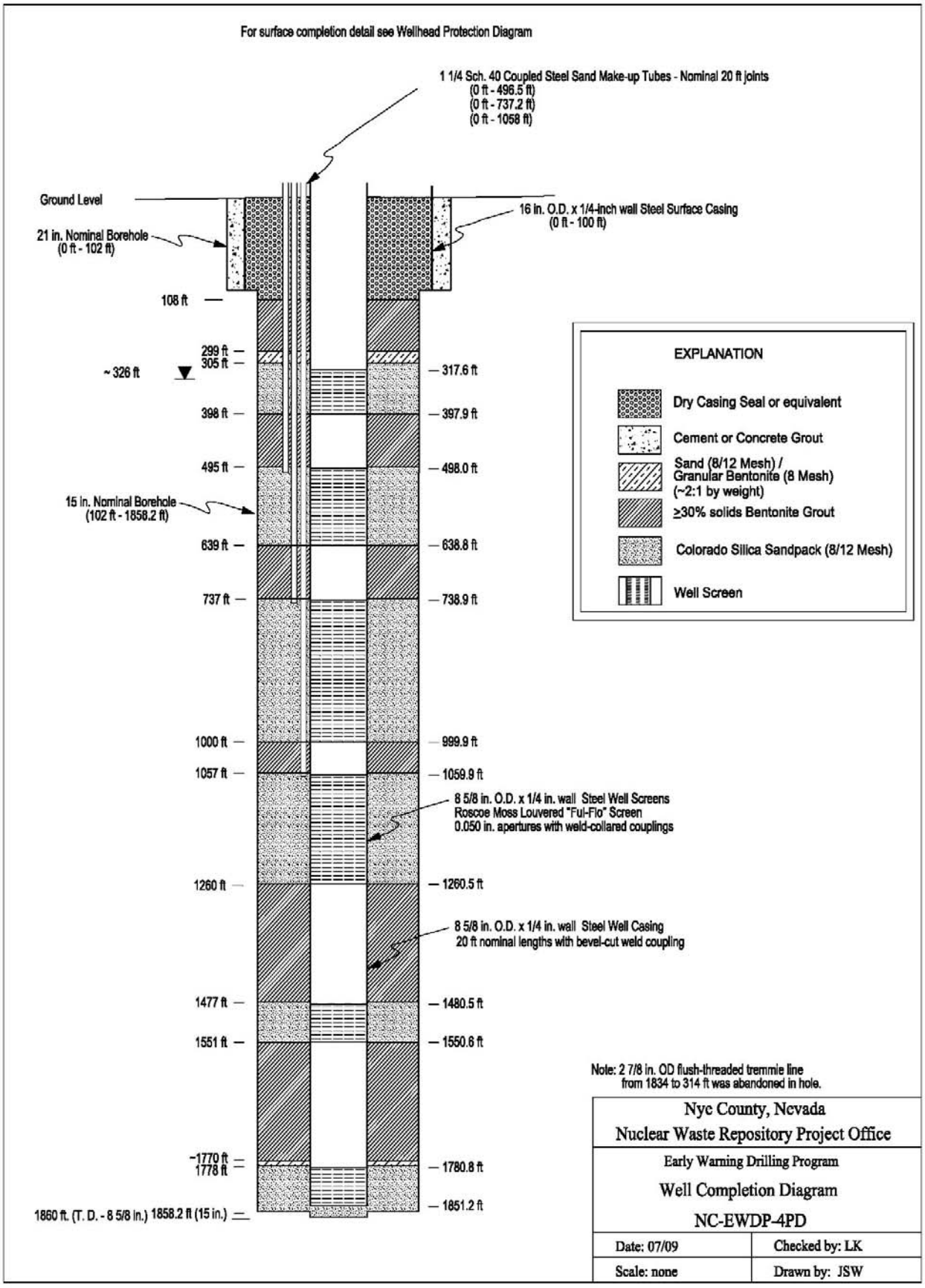

Figure 3.1-1
Multiple-Screen Well Completion Diagram for 4PD

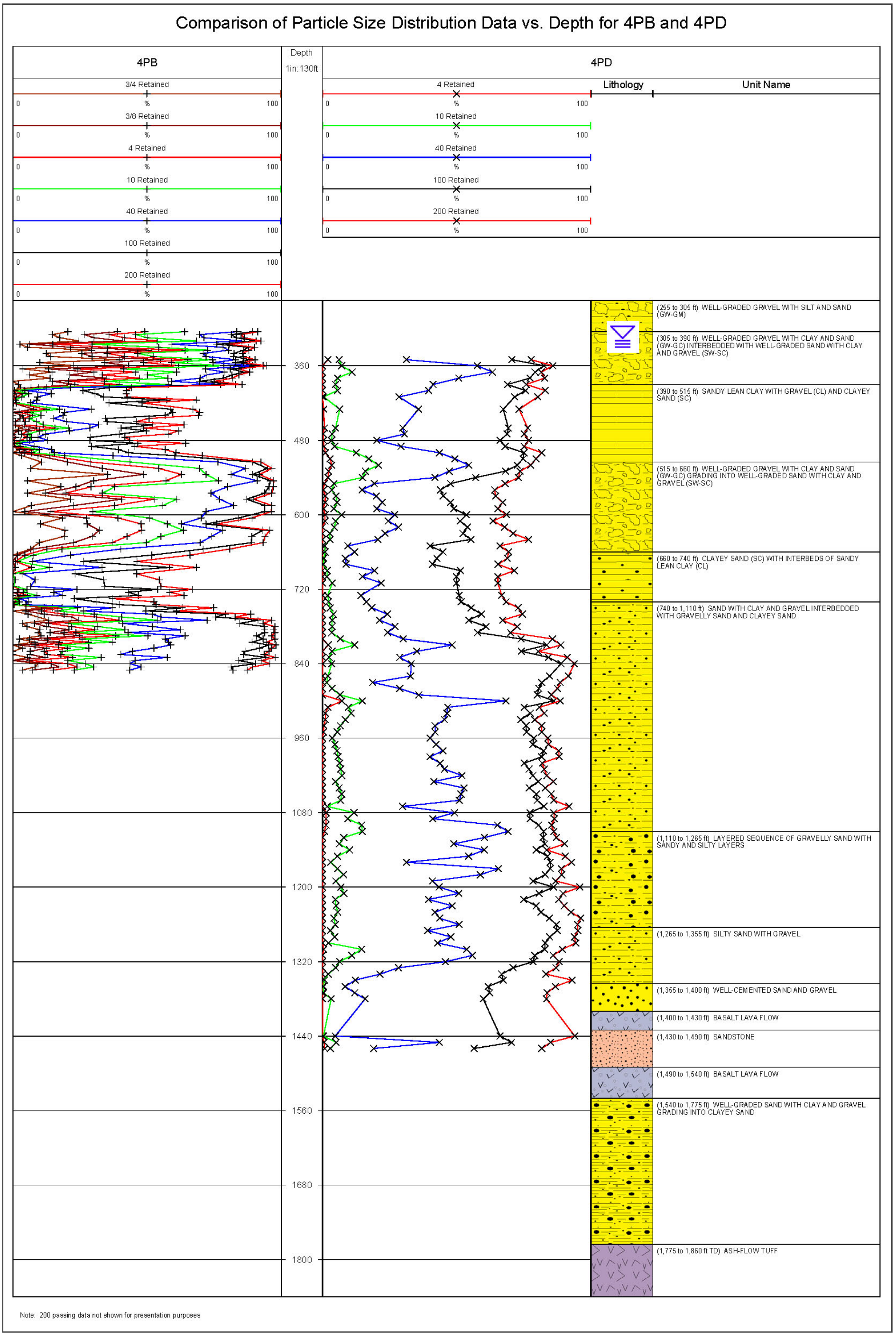

Figure 5.1-1
Comparison of Particle Size Distribution Data for 4PB and 4PD

Summary Lithologic Log for NC-EWDP-4PD

Depth 1in:65ft	Lithology	Description
100		For ease of discussion, wells and boreholes discussed in this section are referred to using the last three characters of their official designation (i.e., NC-EWDP-4PD is referred to as 4PD). Boreholes 4PB, 4PC, and 4PD were all drilled at the same site. Cuttings samples of unconsolidated geologic media (alluvium and valley-fill sediments) from 4PD were collected during mud rotary drilling operations. These samples are not representative of in-situ conditions and do not provide representative particle size distribution (PSD) classification. Therefore, this summary lithologic log was developed from several data sources. The interval from surface to 460 feet (ft) used a combination of PSD data from boreholes 4PB, 4PC and geophysical log data from 4PD. The interval from 460 to 850 ft used PSD data from 4PB and geophysical log data from 4PD. The interval from 850 to 1,860 ft primarily used geophysical logging data and cuttings sample data from 4PD. Below 740 ft, no Unified Soils Classification System descriptors were applied to the unconsolidated sediments; however, they are described in a manner similar to the sediments above. (0 to 165 ft) WELL-GRADED SAND WITH GRAVEL (SW) INTERBEDDED WITH WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM): Unit consists of predominantly thick layers of well-graded sand with gravel (SW) up to 30 ft thick interbedded with thinner layers of well-graded sand with silt and gravel (SW-SM) up to 15 ft thick. The two thickest layers of well graded sand with gravel occur from 35 to 65 ft and at the base of the unit from 140 to 165 ft. Three thin gravelly layers occur at the top of the unit from 10 to 15 ft, in the middle at 95 to 100 ft, and within the basal interval from 145 to 150 ft. Fines in the unit have no plasticity. Gravel clasts are volcanic in origin, subrounded to subangular from surface to 105 ft, and angular from 105 to 165 ft. Sediment color is variable and ranges from brown (10YR 5/3) to light brown (7.5YR 6/3) to reddish-brown (5YR 4/3 and 5/3) to light reddish-brown (5YR 6/4). Unit is not generally cemented, but cementation was observed from 65 to 70 ft, 100 to 120 ft and at the base of the unit from 160 to 165 ft. Sample reaction to 10 percent (%) hydrochloric acid (HCl) is predominantly weak, but strong reactions occur from 5 to 15 ft, 45 to 50 ft, 105 to 120 ft, and at the base of the unit from 160 to 165 ft. All samples were wet due to drilling methods.
200		(165 to 255 ft) WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM) GRADING INTO WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM): Upper part of the unit from 165 to 215 ft consists of well-graded gravel with silt and sand (GW-GM) and contains thin layers of well-graded sand with silt and gravel (SW-SM) and well-graded gravel with sand (GW). The lower part of the unit, from 215 to 255 ft, consists of well-graded sand with silt and gravels (SW-SM) and contains thin layers of well-graded gravels with silt and sand (GW-GM). Layering in both upper and lower parts is 5 to 10 ft thick. Fines are nonplastic from 165 to 215 ft and have low plasticity from 215 to 255 ft. Gravel clasts are volcanic in origin and range in shape from angular to subrounded. Sediment color ranges from reddish-brown (5YR 5/3 and 5/4) to brown (7.5YR 5/3). Cementation is variable from none to moderate from 165 to 235 ft and moderate from 235 to 255 ft. Sample reaction to 10% HCl is variable, ranging from none to strong from 165 to 235 ft and strong from 235 to 255 ft. All samples were wet due to wet drilling methods.
300		(255 to 305 ft) WELL-GRADED GRAVEL WITH SILT AND SAND (GW-GM): Unit consists of a thick, uniform, well-graded gravel with silt and sand (GW-GM). Unit contains one thin (5 ft) layer of sand with silt. Fines have low plasticity. Gravel clasts are volcanic in origin, predominantly subrounded from 255 to 275 ft and range from rounded to angular from 275 to 305 ft. Sediment color is predominantly reddish-brown (5YR 5/4). Cementation ranges from moderate to weak. Sample reaction to 10% HCl is weak to strong. All samples were wet due to wet drilling methods.
		(305 to 390 ft) WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC) INTERBEDDED WITH WELL-GRADED SAND WITH CLAY AND GRAVEL (SW-SC): Unit consists predominantly of thin layers of well-graded gravel with clay and sand (GW-GC) approximately 5 ft thick interbedded with thin layers of well-graded sand with clay and gravel (SW-SC) ranging from 5 to 10 ft thick. Two 5-ft-thick layers of silty sand occur at 305 to 310 ft and 320 to 325 ft. A 5-ft-thick layer of well-graded gravel occurs 355 to 360 ft. Fines increase in the basal section of the unit from 360 to 390 ft with clayey sand predominating. The basal section also contains a 5-ft-thick layer of well-graded gravel with clay from 365 to 370 ft and a 5-ft-thick layer of clayey gravel from 375 to 380 ft. Fines have low plasticity. Gravel clasts are volcanic and subrounded to subangular. Color of sediment is brown (5YR 4/3 and 5/4) from 305 to 385 ft and light brown (7.5YR 6/4) at the base of the unit from 385 to 390 ft. Cementation is weak to moderate from 305 to 365 ft and no cementation was observed from 365 to 390 ft. Samples react weakly to strongly with 10% HCl from 305 to 365 ft, and display no reaction from 365 to 390 ft. From 305 to 340 ft samples were wet due to wet drilling methods; however, the borehole began producing water at a depth of about 340 ft, so samples below 340 ft contain natural moisture.
400		(390 to 515 ft) SANDY LEAN CLAY WITH GRAVEL (CL) AND CLAYEY SAND (SC): Unit consists of four intervals: a thick layer of sandy lean clay (CL) from 390 to 420 ft; clayey sand (SC) from 420 to 445 ft; several thinly bedded and alternating layers of sandy lean clay (CL) and clayey sand (SC) with thicknesses ranging from 5 to 10 ft from 445 to 490 ft; and a thick layer of clayey sand (SC) from 490 to 515 ft. The base of the unit from 505 to 515 ft is gravelly. Fines have moderate plasticity throughout. Gravel clasts are volcanic in origin and subangular in shape. Sediment color ranges from moderate brown (5YR 4/4) to light brown (5YR 6/4 to 5YR 5/6) to pale yellowish-brown (10YR 6/2) to pale reddish-brown (10R 5/4). Weak cementation is present throughout the interval. Samples react strongly to 10% HCl. All samples were wet. The interval from 390 to 410 ft may represent a deeply weathered (clayey) primary tuffaceous volcanic unit. The tuff color is light brown (7.5YR 6/4). The tuff contains a trace amount (less than 1%) of small (less than 0.5 mm) quartz crystals and manganese coatings on the matrix. Tuff is nonwelded with an open and porous matrix. From 410 to 515 ft, the material appears to be a reworked tuff with an alluvial gravel component and an argillic ashy matrix. The color of the reworked interval is reddish-brown (5YR 4/3).
500		
600		(515 to 660 ft) WELL-GRADED GRAVEL WITH CLAY AND SAND (GW-GC) GRADING INTO WELL-GRADED SAND WITH CLAY AND GRAVEL (SW-SC): The upper part of the unit from 515 to 545 ft consists of well-graded gravel with clay and sand (GW-GC) and fines downward into a sequence of well-graded sand with clay and gravel (SW-SC) from 545 to 660 ft. Gravel clasts are volcanic in origin, subangular from 515 to 540 ft, and angular from 540 to 660 ft. Fines have moderate to high plasticity. Sediment color ranges from grayish-red (10R 4/2) to light brown (5YR 6/4 to 5YR 5/6) to grayish-orange (10YR 7/4). Cementation is weak to moderate throughout most the interval, but is strongly cemented and hard from 620 to 640 ft. Heavy grain coatings of fine to medium sand are prevalent on clasts within the strongly cemented interval. Sample reaction to 10% HCl ranges from none to weak from 515 to 620 ft, is strong in the well-cemented interval from 620 to 640 ft, and is weak from 640 to 660 ft. All samples were wet.
700		(660 to 740 ft) CLAYEY SAND (SC) WITH INTERBEDS OF SANDY LEAN CLAY (CL): The upper part of the unit, from 660 to 700 ft, consists of thin layers of clayey sand (SC), ranging in thickness from 5 to 15 ft, interbedded with 10-ft-thick layers of sandy lean clay (CL). The lower part of the unit, from 700 to 740 ft, consists of a fining-downward sequence of clayey sand with very few gravels (less than 5%). Fines have high plasticity. Gravel clasts are volcanic and rounded in shape. Color of sediment is a uniform light brown (5YR 6/4). The interval is weakly to moderately cemented and weakly indurated. Samples react strongly to 10% HCl. All samples were wet. This clay-rich sequence may represent a reworked and weathered tuffaceous volcanic deposit. Matrix clay is likely altered ash mixed with fine- to medium-grained, very well rounded sand. Gravel clasts are predominantly small (0.5 mm) with a few larger clasts present (5 mm) and have subrounded surfaces. The gravels may include lithic clasts derived from the tuff.
800		(740 to 1,110 ft) SAND WITH CLAY AND GRAVEL INTERBEDDED WITH GRAVELLY SAND AND CLAYEY SAND: Interval from 740 to 880 ft consists of poorly graded sand with gravel and clay with a thinly laminated sequence of siltstone and claystone from 850 to 880 ft. The remaining interval, from 880 to 1,110 ft, is a fining-downward sequence of sandy sediments. The interval from 880 to 970 ft has coarse volcanic gravel clasts and the interval from 970 to 1,030 ft has finer and more rounded gravel clasts. These gravels include non-volcanic clasts such as siltstone, sandstone, and quartzite. From 1,030 to 1,070 ft the sequence becomes finer and softer and may be a clayey sand with gravel. The lowermost interval in the sequence from 1,070 to 1,110 ft is layers of cemented and thinly bedded (laminated) sandstone, siltstone, and claystone. Fines have high plasticity, except for the uppermost part of the interval from 740 to 770 ft, where they are nonplastic. Color of sediment is light brown (5YR 6/4) to light reddish-brown (5YR 6/3). Samples react strongly to 10% HCl. All samples were wet.
900		

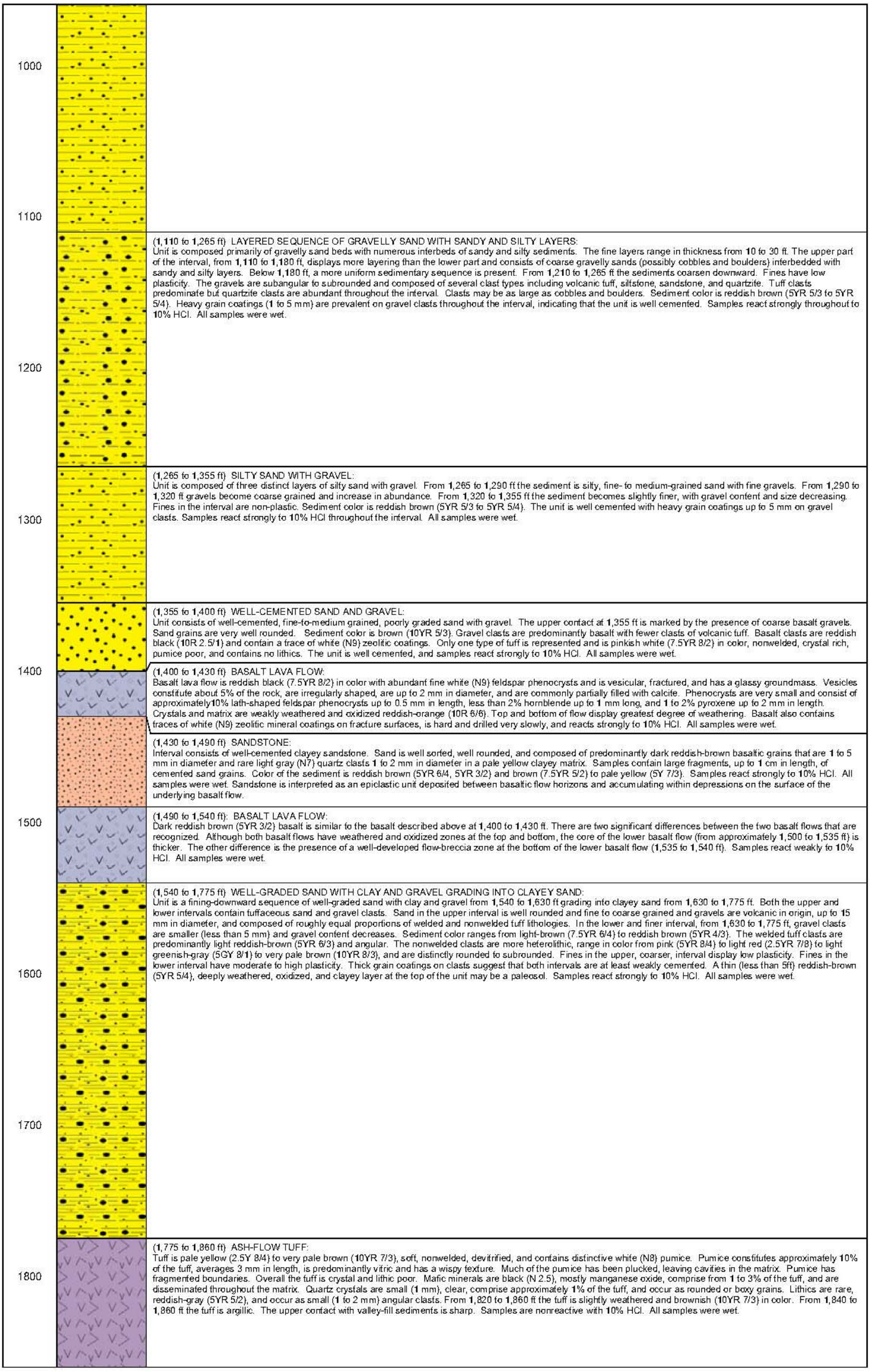

Figure 6.1-1
Summary Lithologic Log for 4PD

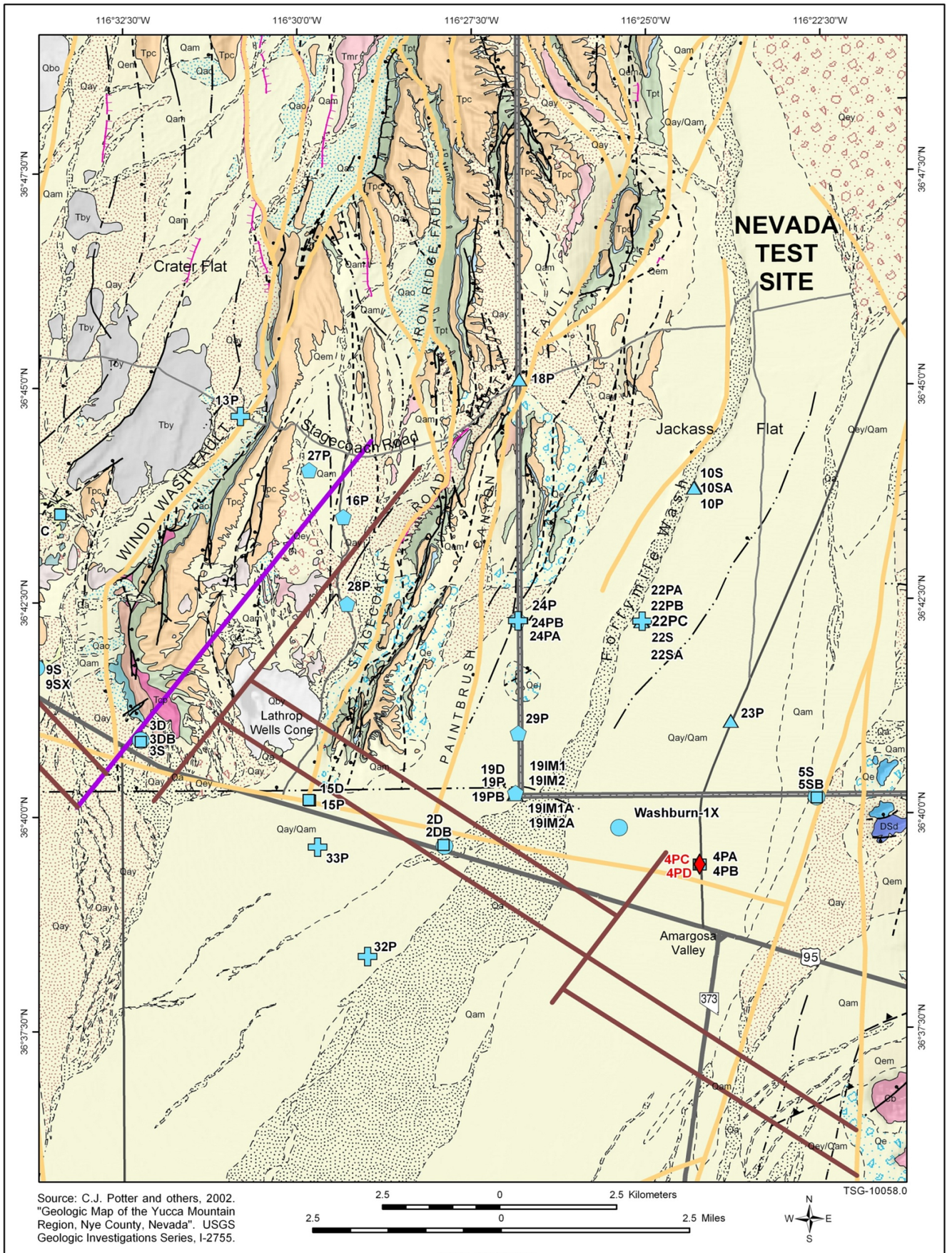

Figure 6.1-2
Geologic Map of the Yucca Mountain Area with Highway 95 Fault System Proposed in NWRPO 2009