Appendix A. Hydraulic Properties Statistics Tables

Table A1. Hydraulic properties statistics for the alluvium (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.20	34.6	14.4	6.5×10^{-5}	-4.19	0.0	.0058	1.277
Maximum	1.75	49.0	100	8.2×10^{-4}	-3.09	7.6	.0711	1.838
Median	1.40	43.7	50.4	4.4×10^{-4}	-3.64	3.8	.0385	1.558
Mean	1.42	43.3	46.8	4.4×10^{-4}	-3.64	3.8	.0385	1.558
Standard Deviation	.1708	4.274	28.95					
Harmonic Mean								
Number of Observations	9	8	8	2	2	2	2	2

Table A2. Hydraulic properties statistics for Tshirege Unit 3 (all sources).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.25	34.6	33.4	5.6×10^{-6}	-5.25	0.0	.0011	1.381
Maximum	1.80	56.2	86.9	5.1×10^{-4}	-3.29	7.9	.0052	2.877
Median	1.47	47.3	54.3	4.7×10^{-5}	-4.33	5.0	.0026	1.639
Mean	1.47	46.9	52.4	8.8×10^{-5}	-4.27	4.5	.0029	1.884
Standard Deviation	.2116	8.251	16.73	1.0×10^{-4}	.4397	3.379	.0017	.6800
Harmonic Mean				3.3×10^{-5}				
Number of Observations	10	10	10	34	34	4	4	4

Table A3. Hydraulic properties statistics for Tshirege Unit 3 (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.25	34.6	33.4	2.2×10^{-5}	-4.65	0.0	.0011	1.381
Maximum	1.80	56.2	86.9	5.1×10^{-4}	-3.29	7.9	.0052	2.877
Median	1.47	47.3	54.3	1.8×10^{-4}	-3.75	5.0	.0026	1.639
Mean	1.47	46.9	52.4	1.9×10^{-4}	-3.86	4.5	.0029	1.884
Standard Deviation	.2116	8.251	16.73	1.5×10^{-4}	.4129	3.379	.0017	.6800
Harmonic Mean				6.9×10^{-5}				
Number of Observations	10	10	10	10	10	4	4	4

Table A4. Hydraulic properties statistics for Tshirege Unit 3 (Nyhan 1979).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum				5.6×10^{-6}	-15.25			
Maximum				1.0×10^{-4}	-3.99			
Median				4.0×10^{-5}	-4.39			
Mean				4.5×10^{-5}	-4.44			
Standard Deviation				2.7×10^{-5}	.3302			
Harmonic Mean				2.6×10^{-5}				
Number of Observations				24	24			

Table A5. Hydraulic properties statistics for Tshirege Unit 2b (all sources).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.28	39.6	2.9	8.4×10^{-5}	-4.07	0.0	.0060	1.760
Maximum	1.46	73.6	91.5	3.5×10^{-3}	-2.45	6.7	.0082	2.648
Median	1.37	45.9	10.5	4.1×10^{-4}	-3.38	3.8	.0064	2.044
Mean	1.37	47.9	33.0	6.5×10^{-4}	-3.41	3.2	.0066	2.090
Standard Deviation	.0643	8.613	37.96	9.0×10^{-4}	.4337	3.095	.0009	.3403
Harmonic Mean				2.6×10^{-4}				
Number of Observations	5	14	5	14	14	5	5	5

Table A6. Hydraulic properties statistics for Tshirege Unit 2b (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.28	44.1	2.9	3.7×10^{-4}	-3.43	0.0	.0060	1.760
Maximum	1.46	48.1	91.5	3.5×10^{-3}	-2.45	6.7	.0082	2.648
Median	1.37	45.5	10.5	4.2×10^{-4}	-3.38	3.8	.0064	2.044
Mean	1.37	45.8	33.0	1.3×10^{-3}	-3.09	3.2	.0066	2.090
Standard Deviation	.0643	1.536	37.96	1.3×10^{-3}	.4404	3.095	.0009	.3403
Harmonic Mean				5.9×10^{-4}				
Number of Observations	5	5	5	5	5	5	5	5

Table A7. Hydraulic properties statistics for Tshirege Unit 2a (all sources).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.19	41.4	1.4	7.4×10^{-5}	-4.13	0.0	.0012	1.733
Maximum	1.47	64.4	50.8	8.8×10^{-4}	-3.05	5.6	.0045	2.347
Median	1.26	48.3	3.8	1.3×10^{-4}	-3.89	0.0	.0029	2.070
Mean	1.27	48.2	10.3	1.9×10^{-4}	-3.84	0.7	.0030	2.045
Standard Deviation	.0738	5.863	14.72	2.1×10^{-4}	.2924	1.811	.0009	0.2223
Harmonic Mean				1.2×10^{-4}				
Number of Observations	11	13	11	13	13	10	10	10

Table A8. Hydraulic properties statistics for Tshirege Unit 2a (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.19	41.4	1.4	7.4×10^{-5}	-4.13	0.0	.0012	1.733
Maximum	1.47	51.4	50.8	8.8×10^{-4}	-3.05	5.6	.0045	2.347
Median	1.26	48.3	3.8	1.3×10^{-4}	-3.89	0.0	.0029	2.070
Mean	1.27	47.2	10.3	1.9×10^{-4}	-3.85	0.7	.0030	2.045
Standard Deviation	.0738	3.402	14.72	2.3×10^{-4}	.3046	1.811	.0009	0.2223
Harmonic Mean				1.2×10^{-4}				
Number of Observations	11	11	11	11	11	10	10	10

Table A9. Hydraulic properties statistics for Tshirege Unit 1b (all sources).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.05	43.5	5.7	1.9×10^{-5}	-4.72	0.0	.0014	1.392
Maximum	1.28	74.2	39.4	1.3×10^{-3}	-2.90	4.4	.0154	2.087
Median	1.20	49.5	21.4	6.9×10^{-5}	-4.16	0.0	.0033	1.647
Mean	1.18	52.8	22.4	1.7×10^{-4}	-4.12	0.9	.0044	1.660
Standard Deviation	.0790	8.699	13.63	3.2×10^{-4}	.4943	1.547	.0045	0.2196
Harmonic Mean				4.9×10^{-5}				
Number of Observations	9	13	8	14	14	8	8	8

Table A10. Hydraulic properties statistics for Tshirege Unit 1b (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.05	43.5	5.7	1.9×10^{-5}	-4.72	0.0	.0014	1.392
Maximum	1.28	50.8	39.4	9.9×10^{-5}	-4.00	4.4	.0154	2.087
Median	1.20	48.6	21.4	4.5×10^{-5}	-4.35	0.0	.0033	1.647
Mean	1.18	48.2	22.4	4.7×10^{-5}	-4.40	0.9	.0044	1.660
Standard Deviation	.0790	2.445	13.63	2.8×10^{-5}	.2561	1.547	.0045	0.2196
Harmonic Mean				3.5×10^{-5}				
Number of Observations	9	8	8	9	9	8	8	8

Table A11. Hydraulic data for weathered Tshirege Unit 1a (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	1.16	38.2	24.1	2.2×10^{-5}	-4.66	0.0	.0043	1.249
Maximum	1.49	52.1	89.8	1.1×10^{-3}	-3.07	8.6	.0281	1.862
Median	1.19	47.9	57.0	4.3×10^{-5}	-4.37	5.3	.0072	1.661
Mean	1.26	46.0	56.1	2.3×10^{-4}	-4.08	5.1	.0138	1.583
Standard Deviation	.1356	5.467	24.06	3.5×10^{-4}	.6805	3.174	.0110	.2419
Harmonic Mean				4.3×10^{-5}				
Number of Observations	5	5	5	5	5	5	5	5

Table A12. Hydraulic properties statistics for Tshirege Unit 1a (all sources).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	0.91	38.1	3.4	3.0×10^{-5}	-4.52	0.0	.0023	1.152
Maximum	1.52	68.6	89.7	3.9×10^{-3}	-2.41	6.9	.2312	1.939
Median	1.17	51.2	37.6	1.5×10^{-4}	-3.82	0.2	.0071	1.632
Mean	1.16	50.9	38.4	3.2×10^{-4}	-3.77	1.8	.0222	1.592
Standard Deviation	.1129	6.653	21.05	6.9×10^{-4}	.3962	2.440	.0524	0.2106
Harmonic Mean				1.2×10^{-4}				
Number of Observations	49	53	47	31	31	20	20	20

Table A13. Hydraulic properties statistics for Tshirege Unit 1a (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	0.91	38.1	3.4	3.0×10^{-5}	-4.52	0.0	.0023	1.152
Maximum	1.52	68.6	89.7	3.9×10^{-3}	-2.41	6.9	.2312	1.939
Median	1.17	51.0	37.6	1.4×10^{-4}	-3.85	0.2	.0071	1.632
Mean	1.16	50.4	38.4	3.4×10^{-4}	-3.76	1.8	.0222	1.592
Standard Deviation	.1129	6.382	21.05	7.4×10^{-4}	.4215	2.440	.0524	0.2106
Harmonic Mean				1.2×10^{-4}				
Number of Observations	49	49	47	27	27	20	20	20

Table A14. Hydraulic properties statistics for the Tshirege Member (all sources).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	0.91	34.6	1.4	5.6×10^{-6}	-5.25	0.0	.0011	1.152
Maximum	1.80	74.2	91.5	3.9×10^{-3}	-2.41	8.6	.2312	2.877
Median	1.2	49.2	35.6	1.1×10^{-4}	-3.96	0.0	.0044	1.728
Mean	1.23	49.8	35.6	2.5×10^{-4}	-3.94	2.1	.0120	1.759
Standard Deviation	.156	7.329	23.81	5.3×10^{-4}	.5109	2.719	.0333	0.3410
Harmonic Mean				6.0×10^{-5}				
Number of Observations	89	108	86	111	111	52	52	52

Table A15. Hydraulic properties statistics for the Tshirege Member (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	0.91	34.6	1.4	1.8×10^{-5}	-4.72	0.0	.0011	1.152
Maximum	1.80	68.6	91.5	3.9×10^{-3}	-2.41	8.6	.2312	2.877
Median	1.2	48.9	35.6	1.3×10^{-4}	-3.89	0.0	.0044	1.728
Mean	1.23	48.9	35.6	3.2×10^{-4}	-3.85	2.1	.0120	1.759
Standard Deviation	.156	5.997	23.81	6.5×10^{-4}	.4966	2.719	.0333	0.3410
Harmonic Mean				8.3×10^{-5}				
Number of Observations	89	88	86	67	67	52	52	52

Table A16. Hydraulic properties statistics for Tshirege Member (Kearl et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum		39.6		8.4×10^{-5}	-4.07			
Maximum		74.2		1.3×10^{-3}	-2.90			
Median		52.6		2.0×10^{-4}	-3.70			
Mean		54.1		2.9×10^{-4}	-3.67			
Standard Deviation		10.69		2.7×10^{-4}	.3191			
Harmonic Mean				1.7×10^{-4}				
Number of Observations		20		20	20			

Table A17. Hydraulic properties statistics for the Tsankawi Member (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	0.90	34.7	9.6	4.7×10^{-5}	-4.33	0.0	.0005	1.106
Maximum	1.60	65.6	99.4	4.3×10^{-3}	-2.37	7.3	.0513	1.890
Median	1.29	47.3	53.3	9.9×10^{-4}	-3.03	0.2	.0131	1.428
Mean	1.25	49.0	46.8	1.3×10^{-3}	-3.25	1.7	.0187	1.481
Standard Deviation	.1982	9.833	28.35	1.4×10^{-3}	.6999	2.7	.0194	.2455
Harmonic Mean				1.9×10^{-4}				
Number of Observations	20	19	19	10	10	9	9	9

Table A18. Hydraulic properties statistics for the Otowi Member (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	0.98	40.3	7.1	1.1×10^{-5}	-4.96	0.0	.0039	1.388
Maximum	1.49	59.0	53.3	7.8×10^{-3}	-2.11	12.0	.0185	2.307
Median	1.18	44.6	33.3	2.7×10^{-4}	-3.57	2.5	.0059	1.682
Mean	1.18	46.9	33.0	6.3×10^{-4}	-3.57	2.6	.0066	1.711
Standard Deviation	.0964	5.260	9.855	1.5×10^{-3}	.4941	2.695	.0030	.2176
Harmonic Mean				1.3×10^{-4}				
Number of Observations	32	32	31	25	25	21	21	21

Table A19. Hydraulic properties statistics for the Bandelier Tuff (all sources).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	0.90	34.6	1.4	5.6×10^{-6}	-5.25	0.0	.0005	1.106
Maximum	1.80	74.2	99.4	7.8×10^{-3}	-2.11	12.0	.2312	2.877
Median	1.20	48.5	36.1	1.4×10^{-4}	-3.85	1.1	.0056	1.709
Mean	1.22	49.2	37.5	3.9×10^{-4}	-3.83	2.2	.0113	1.716
Standard Deviation	.1520	7.358	23.97	8.9×10^{-4}	.5599	2.687	.0274	.3134
Harmonic Mean				7.0×10^{-5}				
Number of Observations	141	159	136	146	146	82	82	82

Table A20. Hydraulic properties statistics for the Bandelier Tuff (Stephens et al.).

	ρ_b (g/cm^3)	θ_{sat} (%)	S (%)	K_{sat} (cm/sec)	log K_{sat}	θ_r (%)	α (cm^{-1})	N
Minimum	0.90	34.6	1.4	1.1×10^{-5}	-4.96	0.0	.0005	1.106
Maximum	1.80	68.6	99.4	7.8×10^{-3}	-2.11	12.0	.2312	2.877
Median	1.20	48.2	36.1	1.7×10^{-4}	-3.77	1.1	.0056	1.709
Mean	1.22	48.4	37.5	4.9×10^{-4}	-3.72	2.2	.0113	1.716
Standard Deviation	.1520	6.495	23.97	1.0×10^{-3}	.5489	2.687	.0274	.3134
Harmonic Mean				9.7×10^{-5}				
Number of Observations	141	139	136	102	102	82	82	82

Appendix B. Hydraulic Properties Data Tables by Lithologic Unit

Table B1. Hydraulic properties data for crushed tuff.

Data Source	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
Stephens et al. (1994a)	1.40	7.5	38.3	19.6	8.2×10^{-4}	0.0	1.779	.0083
Abeele (1979, 1984)*			40.0			0.0	1.326	.0449
Abeele (1979)			40.0		9.2×10^{-5}			
Abeele (1984)			40.0		1.4×10^{-4}			

*Combination of pressure plate (Abeele, 1979) and caisson (Abeele, 1984) data.

Table B2. Hydraulic properties data for the Alluvium.

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
MCM-5.1	4	1.34	6.5	45.3	14.4				
MCM-5.1	8	1.40	8.3	42.9	19.3				
MCM-5.1	13.5	1.40	8.1	42.9	19.0				
MCM-5.1	18	1.36	21.6	44.5	48.5				
MCM-5.1	22.5	1.25	25.7	49.0	52.4				
MCM-5.1	28	1.44	41.8	41.2	100				
PC-4	4	1.61	22.6	34.6	65.3	8.2×10^{-4}	0.0	1.277	.0711
PC-4	9	1.20	26.0	46.5	55.9	6.5×10^{-5}	7.6	1.838	.0058

Table B3. Hydraulic properties data for Tshirege Unit 3 (Nyhan, 1979).

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
TA-21:10						8.1×10^{-5}			
TA-21:11						9.4×10^{-5}			
TA-21:12						8.3×10^{-6}			
TA-21:13						5.0×10^{-5}			
TA-21:14						3.9×10^{-5}			
TA-21:15						3.1×10^{-5}			
TA-21:16						4.2×10^{-5}			
TA-21:17						2.2×10^{-5}			
TA-21:18						3.6×10^{-5}			
TA-21:19						2.8×10^{-5}			
TA-21:20						5.0×10^{-5}			
TA-21:21						8.6×10^{-5}			
TA-21:22						3.3×10^{-5}			
TA-21:23						8.1×10^{-5}			
TA-21:24						2.5×10^{-5}			
TA-21:25						8.3×10^{-6}			
TA-21:26						2.5×10^{-5}			
TA-21:27						3.6×10^{-5}			
TA-21:28						5.3×10^{-5}			
TA-21:29						4.2×10^{-5}			
TA-21:30						5.6×10^{-6}			
TA-21:7						6.7×10^{-5}			
TA-21:8						1.0×10^{-4}			
TA-21:9						4.4×10^{-5}			

Table B4. Hydraulic properties data for Tshirege Unit 3 (Stephens et al.).

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
TA-16 P-16	8	1.25	35.4	51.8	68.3	1.6×10^{-4}	7.9	2.877	.0025
TA-16 P-16	12	1.26	18.7	56.1	33.4	2.8×10^{-4}			
TA-16 P-16	17	1.27	22.2	54.9	40.5	2.8×10^{-4}			
TA-16 P-16	22	1.25	20.0	56.2	35.5	2.0×10^{-4}			
TA-16 P-16	26	1.38	19.2	52.0	36.9	9.2×10^{-5}			
TA-16 P-16	36	1.61	23.4	42.8	54.7	2.3×10^{-5}			
TA-16 P-16	43	1.62	36.7	42.3	86.9	8.6×10^{-5}			
TA-16 P-16	62	1.70	19.6	36.4	54.0	5.2×10^{-4}	6.0	1.759	.0028
TA-16 P-16	76	1.57	23.1	41.6	55.6	2.3×10^{-4}	0.0	1.381	.0052
TA-16 P-16	81	1.80	20.1	34.6	58.1	4.4×10^{-5}	4.0	1.519	.0011

Table B5. Hydraulic properties data for Tshirege Unit 2b.

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
5 LLC-85-15	10.5	1.46	4.0	46.4	8.6	1.6×10^{-3}	3.8	2.044	.0060
54-1006	42	1.28	4.7	44.9	10.5	4.1×10^{-4}	0.0	1.760	.0064
8 LLC-85-14	30	1.37	1.3	44.1	2.9	4.2×10^{-4}	0.0	1.890	.0060
AB-6	40	1.35	23.4	45.5	51.4	3.7×10^{-4}	5.5	2.648	.0082
AB-6	60	1.37	44.0	48.1	91.5	3.5×10^{-3}	6.7	2.107	.0065
LGM-85-06	29			42.5		4.8×10^{-4}			
LGM-85-06	51			40.2		8.4×10^{-5}			
LGM-85-11	3			54.0		5.4×10^{-4}			
LGM-85-11	30			51.5		2.8×10^{-4}			
LLM-85-01	30			39.6		1.1×10^{-4}			
LLM-85-02	7			41.5		4.4×10^{-4}			
LLM-85-02	36			46.5		1.2×10^{-4}			
LLM-85-05	15			52.6		5.6×10^{-4}			
LLM-85-05	36			73.6		2.2×10^{-4}			

Table B6. Hydraulic properties data for Tshirege Unit 2a.

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
2A LLC-86-22	54.5	1.26	2.5	51.0	4.9	8.2×10^{-5}	2.0	2.238	.0037
2B LLC-86-22	54.5	1.26	1.3	48.3	2.7	2.5×10^{-4}	0.0	1.932	.0045
54-1001	68	1.20	1.6	41.4	3.9	1.3×10^{-4}	0.0	1.894	.0034
54-1001	83	1.25	2.6	46.0	5.6	1.1×10^{-4}	0.0	2.225	.0022
54-1001	102	1.19	6.9	51.4	13.4	1.6×10^{-4}	0.0	1.782	.0034
54-1002	92.5	1.26	1.5	46.0	3.3	8.1×10^{-5}	0.0	2.213	.0012
54-1003	102	1.22	1.5	51.0	2.9	1.3×10^{-4}	0.0	1.733	.0030
54-1006	76.9	1.28	0.6	44.5	1.4	9.8×10^{-5}	0.0	1.880	.0030
7 LLC-86-22	65	1.27	1.3	48.7	2.7	1.4×10^{-4}	0.0	2.347	.0026
AB-6	100	1.27	10.4	48.5	21.4	8.8×10^{-4}			
AB-6	110	1.47	21.7	42.7	50.8	7.4×10^{-5}	5.6	2.208	.0029
LLM-85-01	52			64.4		2.6×10^{-4}			
LLM-85-02	67			43.3		9.8×10^{-5}			

Table B7. Hydraulic properties data for Tshirege Unit 1b.

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
1 LLC-86-22	131.5	1.05	20.0	50.7	39.4	1.9×10^{-5}	1.2	1.586	.0021
1B LLC-86-22	131.5	1.05	20.0	50.8	39.4	2.7×10^{-5}	4.4	1.709	.0021
54-1001	122	1.18	9.0	46.4	19.4	2.2×10^{-5}	0.0	1.583	.0041
54-1001	142	1.20	15.6	48.2	32.4	8.2×10^{-5}	0.0	1.429	.0037
54-1002	122	1.23	3.2	49.5	6.5	4.6×10^{-5}	0.0	1.773	.0031
54-1002	142.5	1.19	11.5	49.1	23.4	2.5×10^{-5}	1.7	1.393	.0154
54-1003	119.5	1.22	6.4			9.9×10^{-5}			
54-1006	124.5	1.22	2.5	43.5	5.7	4.5×10^{-5}	0.0	1.721	.0035
54-1006	136.7	1.28	6.3	47.2	13.3	5.7×10^{-5}	0.0	2.087	.0014
LGM-85-06	99			52.6		1.3×10^{-3}			
LGM-85-11	94			64.3		1.1×10^{-4}			
LLM-85-01	101			62.1		2.5×10^{-4}			
LLM-85-02	117			48.5		1.7×10^{-4}			
LLM-85-05	76			74.2		1.3×10^{-4}			

Table B8. Hydraulic properties data for weathered Tshirege Unit 1a.

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
CDBM-2	28	1.19	11.5	47.9	24.1	8.5×10^{-4}	5.1	1.433	.0281
PC-4	14	1.19	24.5	43.0	57.0	4.3×10^{-5}	6.6	1.862	.0065
PC-4	29	1.49	24.2	38.2	63.3	2.5×10^{-5}	0.0	1.249	.0233
PC-4	59	1.29	44.0	49.0	89.9	2.2×10^{-5}	8.6	1.711	.0043
MCM-5.1	43.5	1.16	24.1	52.1	46.2	2.0×10^{-4}	5.3	1.661	.0072

Table B9. Hydraulic properties data for Tshirege Unit 1a.

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
54-1002	179.3	1.16	6.6	39.3	16.8	6.5×10^{-5}	0.0	1.815	.0043
54-1002	244	1.14	7.5	39.3	19.1	1.7×10^{-4}	0.0	1.745	.0062
54-1003	157	1.14	4.9	43.2	11.3	1.3×10^{-4}	2.5	1.765	.0040
54-1003	207	1.18	8.0	42.8	18.7	1.5×10^{-4}			
54-1003	261	1.11	9.6	48.8	19.7	2.7×10^{-4}			
54-1003	271.5	1.31	12.1	41.0	29.5	2.6×10^{-4}			
54-1006	161	1.13	1.8	52.6	3.4	1.2×10^{-4}			
AB-6	150	1.32	22.8	46.7	48.8	6.1×10^{-5}	5.7	1.816	.0023
CDBM-1	24	1.17	2.7	48.8	5.5	6.2×10^{-5}	0.0	1.939	.0029
CDBM-1	34	1.07	5.8	46.2	12.7	2.2×10^{-4}	0.0	1.634	.0055
CDBM-1	44	1.26	9.3	44.5	20.8	7.0×10^{-5}	0.0	1.682	.0041
CDBM-1	54	1.09	8.9	44.6	20.1	4.6×10^{-4}	0.0	1.519	.0070
CDBM-1	64	1.23	11.2	45.1	24.9	1.2×10^{-4}	0.5	1.724	.0053
CDBM-2	38	0.94	8.3	48.4	17.2	4.5×10^{-4}	2.6	1.791	.0071
LGM-85-06	115			56.3		9.1×10^{-5}			
LGM-85-11	115			60.1		1.8×10^{-4}			
LLM-85-01	124			48.9		2.2×10^{-4}			
LLM-85-05	123			65.6		1.6×10^{-4}			
MCM-5.9A	85	1.00	38.9	59.3	65.6				
MCM-5.9A	86	1.08	38.8	68.6	56.5	3.9×10^{-3}	0.0	1.152	.2312
MCM-5.9A	86	1.09	38.8	55.5	69.9				
MCM-5.9A	90	0.95	42.2	61.0	69.2				
MCM-5.9A	95	1.35	17.2	49.8	34.6	1.1×10^{-3}	5.2	1.258	.0865
MCM-5.9A	95	1.52	17.2	38.1	45.1				
SIMO-1	22	1.19	9.8	55.1	17.8				
SIMO-1	33	1.47		46.0		2.7×10^{-4}			
SIMO-1	41	1.17	12.7	56.0	22.7				

Table B9 (continued). Hydraulic properties data for Tshirege Unit 1a.

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
MCM-5.1	43	1.19	24.1	51.4	46.8				
MCM-5.1	46.5	0.99	15.1	59.6	25.3				
MCM-5.1	50.5								
MCM-5.1	53	1.09	17.1	55.5	30.7				
MCM-5.1	54	1.16	17.1	45.4	37.6	1.5×10^{-4}			
MCM-5.1	55.5								
MCM-5.1	57.5	1.09	16.1	55.5	29.1				
MCM-5.1	58	1.18	16.1	52.0	31.1	1.8×10^{-4}	4.0	1.630	.0095
MCM-5.1	63	0.91	14.4	62.9	22.9				
MCM-5.1	64	1.17	14.4	53.2	27.1	1.3×10^{-4}	5.9	1.647	.0126
MCM-5.1	65.5	1.20	19.2	51.0	37.6				
MCM-5.1	67.5	1.15	20.1	52.0	38.7	1.1×10^{-4}	3.3	1.614	.0089
MCM-5.1	68	1.23	20.1	49.8	40.5				
MCM-5.1	70.5								
MCM-5.1	72.5	1.19	20.3	51.5	39.5	1.4×10^{-4}	0.3	1.468	.0109
MCM-5.1	73	1.09	20.3	55.5	36.6				
MCM-5.1	75.5	1.18	21.7	51.8	41.8				
MCM-5.1	78	1.20	22.8	51.0	44.7				
MCM-5.1	80.5	1.22	23.2	50.2	46.3				
MCM-5.1	82.5	1.20	25.0	58.9	42.5	1.2×10^{-4}	6.9	1.278	.0135
MCM-5.1	83	1.18	25.0	51.8	48.3				
MCM-5.1	85.5	1.19	28.8	51.4	55.9				
MCM-5.1	87.5	1.09	33.8	51.2	66.1	1.1×10^{-4}	0.0	1.410	.0098
MCM-5.1	88	1.13	33.8	53.9	62.8				
MCM-5.1	90.5	1.18	43.3	51.8	83.5				
MCM-5.1	92.5	1.24	43.7	49.4	88.6				
PC-4	64	1.18	40.6	45.3	89.7	9.7×10^{-5}	0.0	1.549	.0039
PC-4	79	1.22		41.1		3.0×10^{-5}			
PC-4	84	1.17	18.4	45.0	40.9	3.5×10^{-4}	0.0	1.397	.0079

Table B10. Hydraulic properties data for the Tsankawi/Cerro Toledo Member.

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
CDBM-1	89	1.20	17.6	44.2	39.9	2.3×10^{-4}	0.0	1.428	.0131
CDBM-1	94	1.05	10.4	50.3	20.8	1.5×10^{-3}	1.6	1.585	.0173
MCM-5.9A	105	1.27				2.0×10^{-3}			
MCM-5.9A	105	0.92	55.8	62.4	89.3				
MCM-5.9A	109.5	0.90	44.5	63.2	70.3				
MCM-5.9A	109.5	1.01	44.5	64.6	68.8	4.3×10^{-3}	0.0	1.301	.0065
MCM-5.1	93	1.32	43.7	44.0	99.4	4.7×10^{-5}	0.0	1.335	.0024
MCM-5.1	95	1.08	48.5	65.6	74.0	6.8×10^{-4}	0.2	1.106	.0243
MCM-5.1	97.5	1.37	36.8	42.3	87.0	5.8×10^{-5}	0.0	1.601	.0005
MCM-5.1	98	1.42	36.8	42.0	87.7				
MCM-5.1	98.5	1.32	33.1	46.1	71.7				
MCM-5.1	103	1.27	22.4	48.2	46.6				
MCM-5.1	107.5	1.46	24.3	47.8	50.8	1.3×10^{-3}	7.3	1.335	.0513
MCM-5.1	108	1.29	24.3	47.3	51.3				
MCM-5.1	110.5	1.60	17.0	34.7	49.0				
PC-4	89	1.29	18.4	38.8	47.4	1.6×10^{-4}	5.1	1.890	.0049
PC-4	104	1.34	7.6	36.7	20.7	2.5×10^{-3}	1.0	1.748	.0496
SIMO-1	51	1.55	5.1	41.3	12.3				
SIMO-1	54	1.01	9.5	61.9	15.4				
SIMO-1	64	1.33	4.8	49.9	9.6				

Table B11. Hydraulic properties data for the Otowi Member.

Well / Sample	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
AB-7	70	1.24	17.5	46.0	38.0	1.7×10^{-4}			
AB-7	80	1.10	19.9	46.2	43.1	2.2×10^{-4}			
CDBM-1	104	1.20	15.1	44.6	33.8	2.3×10^{-4}	0.0	1.489	.0064
CDBM-1	114	1.29	15.6	45.1	34.6	1.6×10^{-4}	2.5	1.778	.0045
CDBM-1	124	1.10	11.0	43.7	25.1	2.9×10^{-4}	0.0	1.447	.0082
CDBM-1	134	1.24	11.7	44.7	26.2	1.6×10^{-4}	1.2	1.646	.0057
CDBM-1	144	1.14	10.2	42.8	23.9	4.2×10^{-4}	4.2	2.307	.0055
CDBM-1	154	1.29	11.1	41.0	27.1	1.0×10^{-4}	2.7	1.890	.0039
CDBM-1	164	1.21	10.6	43.6	24.2	1.7×10^{-4}	0.0	1.485	.0061
CDBM-1	174	1.18	10.1	41.2	24.4	2.1×10^{-4}	3.0	1.897	.0053
CDBM-1	184	1.18	9.3	43.2	21.4	3.0×10^{-4}	2.6	1.894	.0062
CDBM-1	189	1.19	9.4	43.0	21.9	1.8×10^{-4}	0.8	1.648	.0057
CDBM-2	67	1.16	11.6	44.6	26.1	5.0×10^{-4}	1.7	1.598	.0084
CDBM-2	68	1.22	12.3	44.0	27.9	2.7×10^{-4}	3.9	1.987	.0060
MCM-5.9A	120	1.08	23.2	55.7	41.6				
MCM-5.9A	120	1.11	23.2	43.5	53.3	7.9×10^{-4}	0.0	1.388	.0185
MCM-5.9A	125	1.11	17.9	54.6	32.8				
MCM-5.9A	125	1.04	17.9	53.8	33.3	2.8×10^{-4}	2.5	1.512	.0069
MCM-5.9A	130	1.15	19.5	51.9	37.6	7.8×10^{-3}	6.5	1.829	.0056
MCM-5.9A	130	1.05	19.5	57.0	34.2				
MCM-5.9A	150	1.16	22.1	52.5	42.1				
MCM-5.9A	150	1.30	22.1	53.8	41.1	1.7×10^{-3}	2.8	1.512	.0069
MCM-5.9A	155	1.24	21.7	49.2	44.0				
MCM-5.9A	165	1.20	21.2	48.6	43.7	2.9×10^{-4}	12.0	1.682	.0050
MCM-5.9A	165	1.26	21.2	48.5	43.8				
PC-4	109	1.16		42.0		3.9×10^{-4}	1.5	1.733	.0074
PC-4	118.5	1.12	13.2	40.8	32.4	3.3×10^{-4}	2.2	1.848	.0050
PC-4	149	1.22	15.1	40.3	37.5	7.5×10^{-5}	2.8	1.710	.0045
PC-4	168.5	1.15	12.4	43.7	28.3	4.3×10^{-4}	0.9	1.653	.0062
SIMO-1	71	1.49	3.1	43.6	7.1				
SIMO-1	86	0.98	13.3	59.0	22.5	2.0×10^{-4}			
SIMO-1	90	1.30	24.4	50.1	48.7	1.1×10^{-5}			

Appendix C. Hydraulic Properties Data Tables by Well

Table C1. Hydraulic properties data for wells CDBM-1 and CDBM-2.

Unit	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
				Well CDBM-1					
Tshirege 1a	24	1.17	2.7	48.8	5.5	6.2×10^{-5}	0.0	1.939	.0029
Tshirege 1a	34	1.07	5.8	46.2	12.7	2.2×10^{-4}	0.0	1.634	.0055
Tshirege 1a	44	1.26	9.3	44.5	20.8	7.0×10^{-5}	0.0	1.682	.0041
Tshirege 1a	54	1.09	8.9	44.6	20.1	4.6×10^{-4}	0.0	1.519	.0070
Tshirege 1a	64	1.23	11.2	45.1	24.9	1.2×10^{-4}	0.5	1.724	.0053
Tsankawi	89	1.20	17.6	44.2	39.9	2.3×10^{-4}	0.0	1.428	.0131
Tsankawi	94	1.05	10.4	50.3	20.8	1.5×10^{-3}	1.6	1.585	.0173
Otowi	104	1.20	15.1	44.6	33.8	2.3×10^{-4}	0.0	1.489	.0064
Otowi	114	1.29	15.6	45.1	34.6	1.6×10^{-4}	2.5	1.778	.0045
Otowi	124	1.10	11.0	43.7	25.1	2.9×10^{-4}	0.0	1.447	.0082
Otowi	134	1.24	11.7	44.7	26.2	1.6×10^{-4}	1.2	1.646	.0057
Otowi	144	1.14	10.2	42.8	23.9	4.2×10^{-4}	4.2	2.307	.0055
Otowi	154	1.29	11.1	41.0	27.1	1.0×10^{-4}	2.7	1.890	.0039
Otowi	164	1.21	10.6	43.6	24.2	1.7×10^{-4}	0.0	1.485	.0061
Otowi	174	1.18	10.1	41.2	24.4	2.1×10^{-4}	3.0	1.897	.0053
Otowi	184	1.18	9.3	43.2	21.4	3.0×10^{-4}	2.6	1.894	.0062
Otowi	189	1.19	9.4	43.0	21.9	1.8×10^{-4}	0.8	1.648	.0057
				Well CDBM-2					
Weathered 1a	28	1.19	11.5	47.9	24.1	8.5×10^{-4}	5.1	1.433	.0281
Tshirege 1a	38	0.94	8.3	48.4	17.2	4.5×10^{-4}	2.6	1.791	.0071
Otowi	67	1.16	11.6	44.6	26.1	5.0×10^{-4}	1.7	1.598	.0084
Otowi	68	1.22	12.3	44.0	27.9	2.7×10^{-4}	3.9	1.987	.0060

Table C2. Hydraulic properties data for wells AB-6, AB-7, and SIMO-1.

Unit	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
				Well AB-6					
Tshirege 2b	40	1.35	23.4	45.5	51.4	3.7×10^{-4}	5.5	2.648	.0082
Tshirege 2b	60	1.37	44.0	48.1	91.5	3.5×10^{-3}	6.7	2.107	.0065
Tshirege 2a	100	1.27	10.4	48.5	21.4	8.8×10^{-4}			
Tshirege 2a	110	1.47	21.7	42.7	50.8	7.4×10^{-5}	5.6	2.208	.0029
Tshirege 1a	150	1.32	22.8	46.7	48.8	6.1×10^{-5}	5.7	1.816	.0023
				Well AB-7					
Otowi	70	1.24	17.5	46.0	38.0	1.7×10^{-4}			
Otowi	80	1.10	19.9	46.2	43.1	2.2×10^{-4}			
				Well SIMO-1					
Tshirege 1a	22	1.19	9.8	55.1	17.8				
Tshirege 1a	33	1.47		46.0		2.7×10^{-4}			
Tshirege 1a	41	1.17	12.7	56.0	22.7				
Tsankawi	51	1.55	5.1	41.3	12.3				
Tsankawi	54	1.01	9.5	61.9	15.4				
Tsankawi	64	1.33	4.8	49.9	9.6				
Otowi	71	1.49	3.1	43.6	7.1				
Otowi	86	0.98	13.3	59.0	22.5	2.0×10^{-4}			
Otowi	90	1.30	24.4	50.1	48.7	1.1×10^{-5}			

Table C3. Hydraulic properties data for Well PC-4.

Unit	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
Alluvium	4	1.61	22.6	34.6	65.3	8.2×10^{-4}	0.0	1.277	.0711
Alluvium	9	1.20	26.0	46.5	55.9	6.5×10^{-5}	7.6	1.838	.0058
Weathered 1a	14	1.19	24.5	43.0	57.0	4.3×10^{-5}	6.6	1.862	.0065
Weathered 1a	29	1.49	24.2	38.2	63.3	2.5×10^{-5}	0.0	1.249	.0233
Weathered 1a	59	1.29	44.0	49.0	89.9	2.2×10^{-5}	8.6	1.711	.0043
Tshirege 1a*	64	1.09		44.7		3.6×10^{-4}	2.7	1.735	.0068
Tshirege 1a	64	1.18	40.6	45.3	89.7	9.7×10^{-5}	0.0	1.549	.0039
Tshirege 1a*	78.5	1.26		56.2		3.3×10^{-5}			
Tshirege 1a*	78.5	1.05		42.7		7.1×10^{-5}	4.6	1.960	.0029
Tshirege 1a*	79	1.22		41.1		3.0×10^{-5}	1.9	1.664	.0061
Tshirege 1a*	84	1.14		42.7		5.6×10^{-4}	3.8	1.775	.0050
Tshirege 1a	84	1.17	18.4	45.0	40.9	3.5×10^{-4}	0.0	1.397	.0079
Tsankawi*	88.5	1.27		43.5		5.3×10^{-4}	3.7	1.538	.0075
Tsankawi	89	1.29	18.4	38.8	47.4	1.6×10^{-4}	5.1	1.890	.0049
Tsankawi	104	1.34	7.6	36.7	20.7	2.5×10^{-3}	1.0	1.748	.0496
Otowi	109	1.16		42.0		3.9×10^{-4}	1.5	1.733	.0074
Otowi*	118.5	1.17		44.5		1.4×10^{-3}	2.8	1.792	.0045
Otowi	118.5	1.12	13.2	40.8	32.4	3.3×10^{-4}	2.2	1.848	.0050
Otowi*	119	1.17		49.3		1.8×10^{-4}			
Otowi*	148.5	1.20		40.7		9.4×10^{-5}	4.3	1.833	.0045
Otowi	149	1.22	15.1	40.3	37.5	7.5×10^{-5}	2.8	1.710	.0045
Otowi*	149	1.15		47.7		9.4×10^{-5}			
Otowi	168.5	1.15	12.4	43.7	28.3	4.3×10^{-4}	0.9	1.653	.0062

*SPOC (submersible pressure outflow cell, Constantz and Herkelrath, 1984) measurements in the wet portion of the retention curve, not included in the present analysis.

Table C4. Hydraulic properties data for well MCM-5.1.

Unit	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
Alluvium	4	1.34	6.5	45.3	14.4				
Alluvium	8	1.40	8.3	42.9	19.3				
Alluvium	13.5	1.40	8.1	42.9	19.0				
Alluvium	18	1.36	21.6	44.5	48.5				
Alluvium	22.5	1.25	25.7	49.0	52.4				
Alluvium	28	1.44	41.8	41.2	100.				
Tshirege 1a	43	1.19	24.1	51.4	46.8				
Tshirege 1a	43.5	1.16	24.1	52.1	46.2	2.0×10^{-4}	5.3	1.661	.0072
Tshirege 1a	46.5	0.99	15.1	59.6	25.3				
Tshirege 1a	50.5								
Tshirege 1a	53	1.09	17.1	55.5	30.7				
Tshirege 1a	54	1.16	17.1	45.4	37.6	1.5×10^{-4}			
Tshirege 1a	55.5								
Tshirege 1a	57.5	1.09	16.1	55.5	29.1				
Tshirege 1a	58	1.18	16.1	52.0	31.1	1.8×10^{-4}	4.0	1.630	.0095
Tshirege 1a	63	0.91	14.4	62.9	22.9				
Tshirege 1a	64	1.17	14.4	53.2	27.1	1.3×10^{-4}	5.9	1.647	.0126
Tshirege 1a	65.5	1.20	19.2	51.0	37.6				
Tshirege 1a	67.5	1.15	20.1	52.0	38.7	1.1×10^{-4}	3.3	1.614	.0089
Tshirege 1a	68	1.23	20.1	49.8	40.5				
Tshirege 1a	70.5								
Tshirege 1a	72.5	1.19	20.3	51.5	39.5	1.4×10^{-4}	0.3	1.468	.0109
Tshirege 1a	73	1.09	20.3	55.5	36.6				
Tshirege 1a	75.5	1.18	21.7	51.8	41.8				
Tshirege 1a	78	1.20	22.8	51.0	44.7				
Tshirege 1a	80.5	1.22	23.2	50.2	46.3				
Tshirege 1a	82.5	1.20	25.0	58.9	42.5	1.2×10^{-4}	6.9	1.278	.0135
Tshirege 1a	83	1.18	25.0	51.8	48.3				
Tshirege 1a	85.5	1.19	28.8	51.4	55.9				
Tshirege 1a	87.5	1.09	33.8	51.2	66.1	1.1×10^{-4}	0.0	1.410	.0098
Tshirege 1a	88	1.13	33.8	53.9	62.8				

Table C4 (continued). Hydraulic properties data for well MCM-5.1.

Unit	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
Tshirege 1a	90.5	1.18	43.3	51.8	83.5				
Tshirege 1a	92.5	1.24	43.7	49.4	88.6				
Tsankawi	93	1.32	43.7	44.0	99.4	4.7×10^{-5}	0.0	1.335	.0024
Tsankawi	95	1.08	48.5	65.6	74.0	6.8×10^{-4}	0.2	1.106	.0243
Tsankawi	97.5	1.37	36.8	42.3	87.0	5.8×10^{-5}	0.0	1.601	.0005
Tsankawi	98	1.42	36.8	42.0	87.7				
Tsankawi	98.5	1.32	33.1	46.1	71.7				
Tsankawi	103	1.27	22.4	48.2	46.6				
Tsankawi	107.5	1.46	24.3	47.8	50.8	1.3×10^{-3}	7.3	1.335	.0513
Tsankawi	108	1.29	24.3	47.3	51.3				
Tsankawi	110.5	1.60	17.0	34.7	49.0				

Table C5. Hydraulic properties data for well MCM-5.9A.

Unit	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
Tshirege 1a	85	1.00	38.9	59.3	65.6				
Tshirege 1a	86	1.09	38.8	55.5	69.9				
Tshirege 1a	86	1.08	38.8	68.6	56.5	3.9×10^{-3}	0.0	1.152	.2312
Tshirege 1a	90	0.95	42.2	61.0	69.2				
Tshirege 1a	95	1.35	17.2	49.8	34.6	1.1×10^{-3}	5.2	1.258	.0865
Tshirege 1a	95	1.52	17.2	38.1	45.1				
Tsankawi	105	1.27				2.0×10^{-3}			
Tsankawi	105	0.92	55.8	62.4	89.3				
Tsankawi	109.5	1.01	44.5	64.6	68.8	4.3×10^{-3}	0.0	1.301	.0065
Tsankawi	109.5	0.90	44.5	63.2	70.3				
Otowi	120	1.11	23.2	43.5	53.3	7.9×10^{-4}	0.0	1.388	.0185
Otowi	120	1.08	23.2	55.7	41.6				
Otowi	125	1.11	17.9	54.6	32.8				
Otowi	125	1.04	17.9	53.8	33.3	2.8×10^{-4}	2.5	1.512	.0069
Otowi	130	1.05	19.5	57.0	34.2				
Otowi	130	1.15	19.5	51.9	37.6	7.8×10^{-3}	6.5	1.829	.0056
Otowi	150	1.30	22.1	53.8	41.1	1.7×10^{-3}	2.8	1.512	.0069
Otowi	150	1.16	22.1	52.5	42.1				
Otowi	155	1.24	21.7	49.2	44.0				
Otowi	165	1.26	21.2	48.5	43.8				
Otowi	165	1.20	21.2	48.6	43.7	2.9×10^{-4}	12.0	1.682	.0050

Table C6. Hydraulic properties data for well P-16.

Unit	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
Tshirege 3d	8	1.25	35.4	51.8	68.3	1.6×10^{-4}	7.9	2.877	.0025
Tshirege 3d	12	1.26	18.7	56.1	33.4	2.8×10^{-4}			
Tshirege 3d	17	1.27	22.2	54.9	40.5	2.8×10^{-4}			
Tshirege 3d	22	1.25	20.0	56.2	35.5	2.0×10^{-4}			
Tshirege 3d	26	1.38	19.2	52.0	36.9	9.2×10^{-5}			
Tshirege 3d	36	1.61	23.4	42.8	54.7	2.3×10^{-5}			
Tshirege 3c	43	1.62	36.7	42.3	86.9	8.6×10^{-5}			
Tshirege 3c	62	1.70	19.6	36.4	54.0	5.2×10^{-4}	6.0	1.759	.0028
Tshirege 3c	76	1.57	23.1	41.6	55.6	2.3×10^{-4}	0.0	1.381	.0052
Tshirege 3c	81	1.80	20.1	34.6	58.1	4.4×10^{-5}	4.0	1.519	.0011

Table C7. Hydraulic properties data for wells LLC-85-14, LLC-85-15, and LLC-86-22.

Sample No./ Unit	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
				Well LLC-85-14					
8/ Tshir 2b	30	1.37		44.1		4.2×10^{-4}	0.0	1.890	.0060
				Well LLC-85-15					
5/ Tshir 2b	10.5	1.46		46.4		1.6×10^{-3}	3.8	2.044	.0060
				Well LLC-86-22*					
2A/ Tshir 2a	54.5	1.26	2.5*	51.0	4.9	8.2×10^{-5}	2.0	2.238	.0037
2B/ Tshir 2a	54.5	1.26	1.3*	48.3	2.7	2.5×10^{-4}	0.0	1.932	.0045
7/ Tshir 2a	65	1.27	1.3*	48.7	2.7	1.4×10^{-4}	0.0	2.347	.0026
1/ Tshir 1b	131.5	1.05	20.0*	50.7	39.4	1.9×10^{-5}	1.2	1.586	.0021
1B/ Tshir 1b	131.5	1.05	20.0*	50.8	39.4	2.7×10^{-5}	4.4	1.709	.0021

*Moisture content and saturation values are from core measurements for this well (Kearl et al., 1986a and b).

Table C8. Hydraulic properties data for the Bendix wells (Kearl et al., 1986a).*

Unit	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat}† (%)	Sat (%)	K_{sat} (cm/sec)	θ_r* (%)	N*	α* (cm^{-1})
				Well LLM-85-01					
Tshirege 2b	30			39.6		1.1×10^{-4}	35.3	1.305	.0154
Tshirege 2a	52			64.4†		2.6×10^{-4}	8.9	1.191	.0355
Tshirege 1b	101			62.1†		2.5×10^{-4}	35.8	1.492	.0395
Tshirege 1a	124			48.9		2.2×10^{-4}	4.3	1.298	.0472
				Well LLM-85-02					
Tshirege 2b	7			41.5		4.4×10^{-4}	0.0	1.255	.0275
Tshirege 2b	36			46.5		1.2×10^{-4}	31.6	1.649	.1463
Tshirege 2a	67			43.3		9.8×10^{-5}	16.0	1.271	.0366
Tshirege 1b	117			48.5		1.7×10^{-4}	0.0	1.223	.0193
				Well LLM-85-05					
Tshirege 2b	15			52.6		5.6×10^{-4}	0.0	1.167	.0867
Tshirege 2b	36			73.6†		2.2×10^{-4}	0.0	1.586	.0054
Tshirege 1b	76			74.2†		1.3×10^{-4}	0.0	1.080	.0493
Tshirege 1a	123			65.6†		1.6×10^{-4}	43.1	1.357	.4158
				Well LGM-85-06					
Tshirege 2b	29			42.5		4.8×10^{-4}	10.2	1.370	.0440
Tshirege 2b	51			40.2		8.4×10^{-5}	14.3	1.270	.0360
Tshirege 1b	99			52.6		1.3×10^{-3}	41.0	1.220	5.920
Tshirege 1a	115			56.3		9.1×10^{-5}	26.3	1.150	.0920
				Well LGM-85-11					
Tshirege 2b	3			54.0		5.4×10^{-4}	6.1	1.250	.0410
Tshirege 2b	30			51.5		2.8×10^{-4}	0.0	1.640	.0090
Tshirege 1b	94			64.3†		1.1×10^{-4}	19.1	1.170	.0800
Tshirege 1a	115			60.1†		1.8×10^{-4}	40.7	1.370	.0800

*θ_r, N, and α values determined by Loeven and Springer (1993). The incomplete range of the retention data does not adequately represent the dry range of the retention curve.

† Some of the porosity values seem unreasonably large.

Table C9. Hydraulic properties data for wells 54-1001, -1002, -1003, and -1006.

Unit*	Depth (ft)	ρ_b (g/cm^3)	θ (%)	θ_{sat} (%)	Sat (%)	K_{sat} (cm/sec)	θ_r (%)	N	α (cm^{-1})
				Well 54-1001					
Tshirege 2a/1v	68	1.20	1.6	41.4	3.9	1.3×10^{-4}	0.0	1.894	.0034
Tshirege 2a/1v	83	1.25	2.6	46.0	5.6	1.1×10^{-4}	0.0	2.225	.0022
Tshirege 2a/1v	102	1.19	6.9	51.4	13.4	1.6×10^{-4}	0.0	1.782	.0034
Tshirege 1B/1v	122	1.18	9.0	46.4	19.4	2.2×10^{-5}	0.0	1.583	.0041
Tshirege 1B/1v	142	1.20	15.6	48.2	32.4	8.2×10^{-5}	0.0	1.429	.0037
				Well 54-1002					
Tshirege 2a/1v	92.5	1.26	1.5	46.0	3.3	8.1×10^{-5}	0.0	2.213	.0012
Tshirege 1b/1v	122	1.23	3.2	49.5	6.5	4.6×10^{-5}	0.0	1.773	.0031
Tshirege 1b/1v	142.5	1.19	11.5	49.1	23.4	2.5×10^{-5}	1.7	1.393	.0154
Tshirege 1a/1g	179.3	1.16	6.6	39.3	16.8	6.5×10^{-5}	0.0	1.815	.0043
Tshirege 1a/1g	244	1.14	7.5†	39.3	19.1	1.7×10^{-4}	0.0	1.745	.0062
				Well 54-1003					
Tshirege 2a/1v	102	1.22	1.5	51.0	2.9	1.3×10^{-4}	0.0	1.733	.0030
Tshirege 1b/1v	119.5	1.22	6.4			9.9×10^{-5}			
Tshirege 1a/1g	157	1.14	4.9	43.2	11.3	1.3×10^{-4}	2.5	1.765	.0040
Tshirege 1a/1g	207	1.18	8.0	42.8	18.7	1.5×10^{-4}			
Tshirege 1a/1g	261	1.11	9.6	48.8	19.7	2.7×10^{-4}			
Tshirege 1a/1g	271.5	1.31	12.1	41.0	29.5	2.6×10^{-4}			
				Well 54-1006					
Tshirege 2b/2	42	1.28	4.7	44.9	10.5	4.1×10^{-4}	0.0	1.760	.0064
Tshirege 2a/1v	76.9	1.28	0.6	44.5	1.4	9.8×10^{-5}	0.0	1.880	.0030
Tshirege 1b/1v	124.5	1.22	2.5	43.5	5.7	4.5×10^{-5}	0.0	1.721	.0035
Tshirege 1b/1v	136.7	1.28	6.3	47.2	13.3	5.7×10^{-5}	0.0	2.087	.0014
Tshirege 1a/1g	161	1.13	1.8	52.6	3.4	1.2×10^{-4}			

*The second Tshirege Unit designation follows the correlation of Vaniman and Wohletz (1990) and Vaniman (1991) (R. H. Gilkeson, personal communication, 1994).

† From field core moisture content; Stephens et al. value of 27.0 seems unrealistic.

Appendix D. Retention Curves

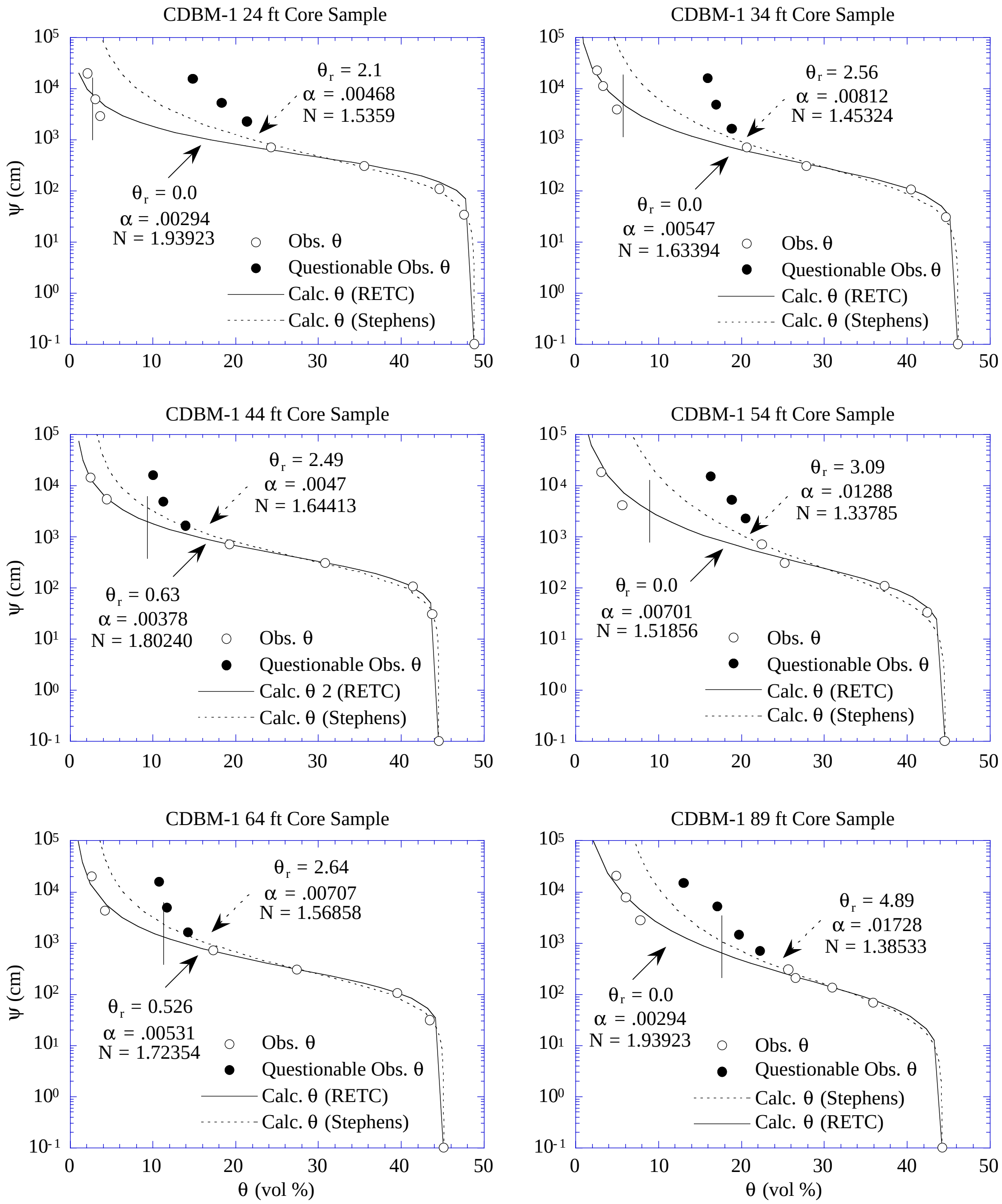


Figure D1. Cañada del Buey well CDBM-1 moisture retention curves. Non-equilibrated pressure plate retention points are shown by solid black circles, psychrometer and equilibrated pressure plate points by open circles. The saturated moisture content is plotted at an artificial suction of 0.1 cm. The in situ moisture content (solid vertical line) and the van Genuchten curve fits determined by the author and by Daniel B. Stephens & Associates, Inc. are shown.

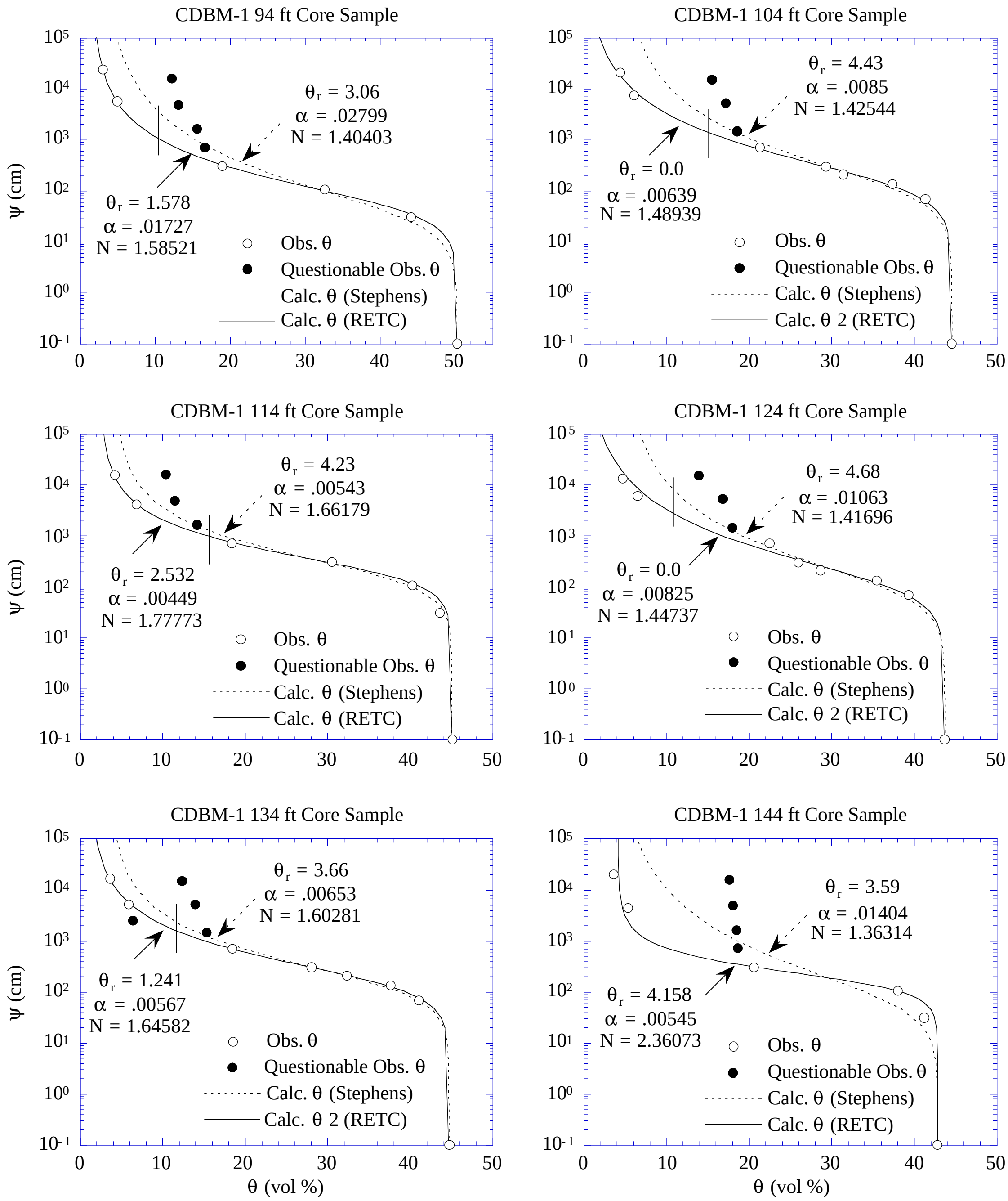


Figure D2. Cañada del Buey well CDBM-1 moisture retention curves. See Figure D1 for explanation.

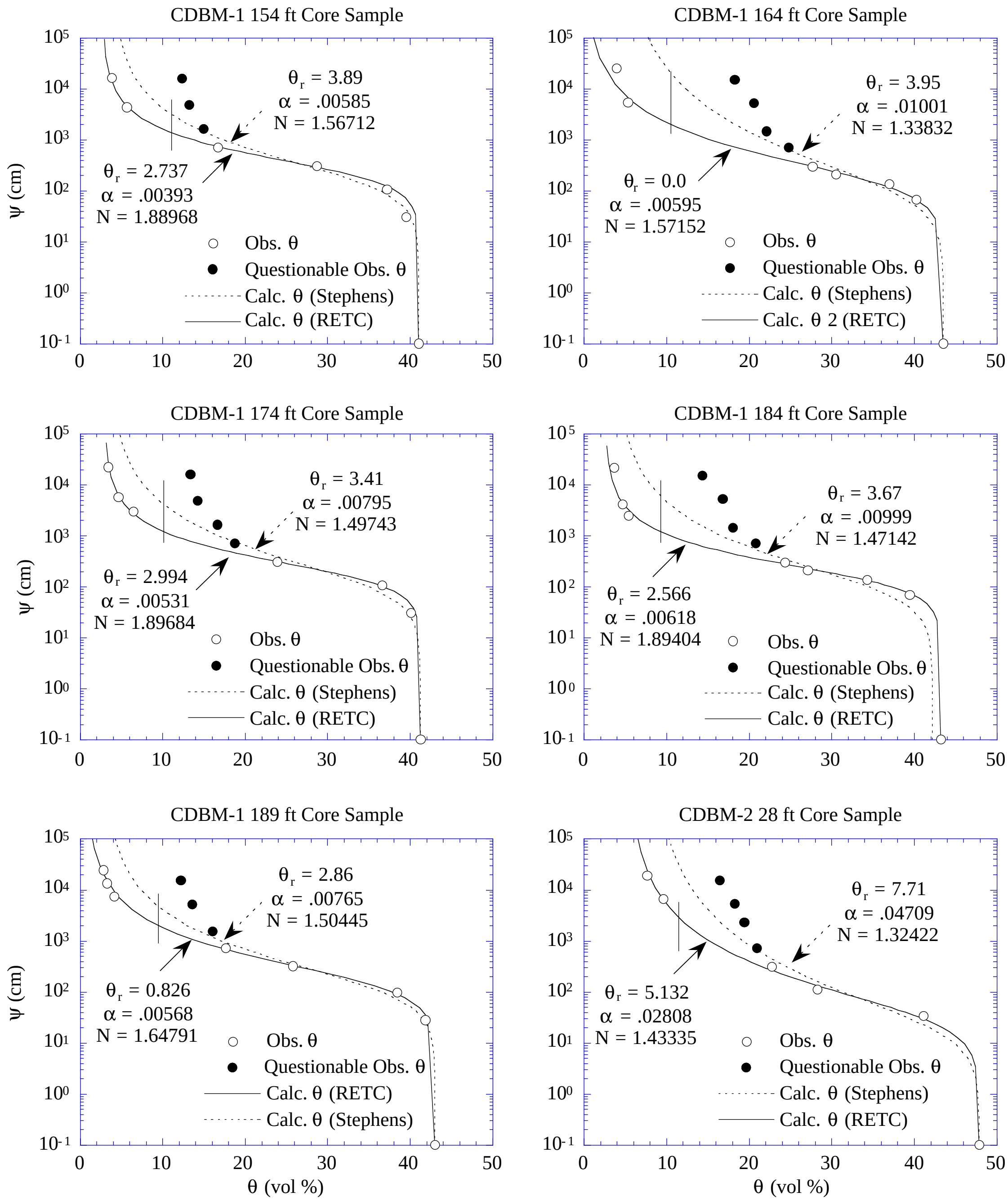


Figure D3. Cañada del Buey wells CDBM-1 and CDBM-2 moisture retention curves. See Figure D1 for explanation.

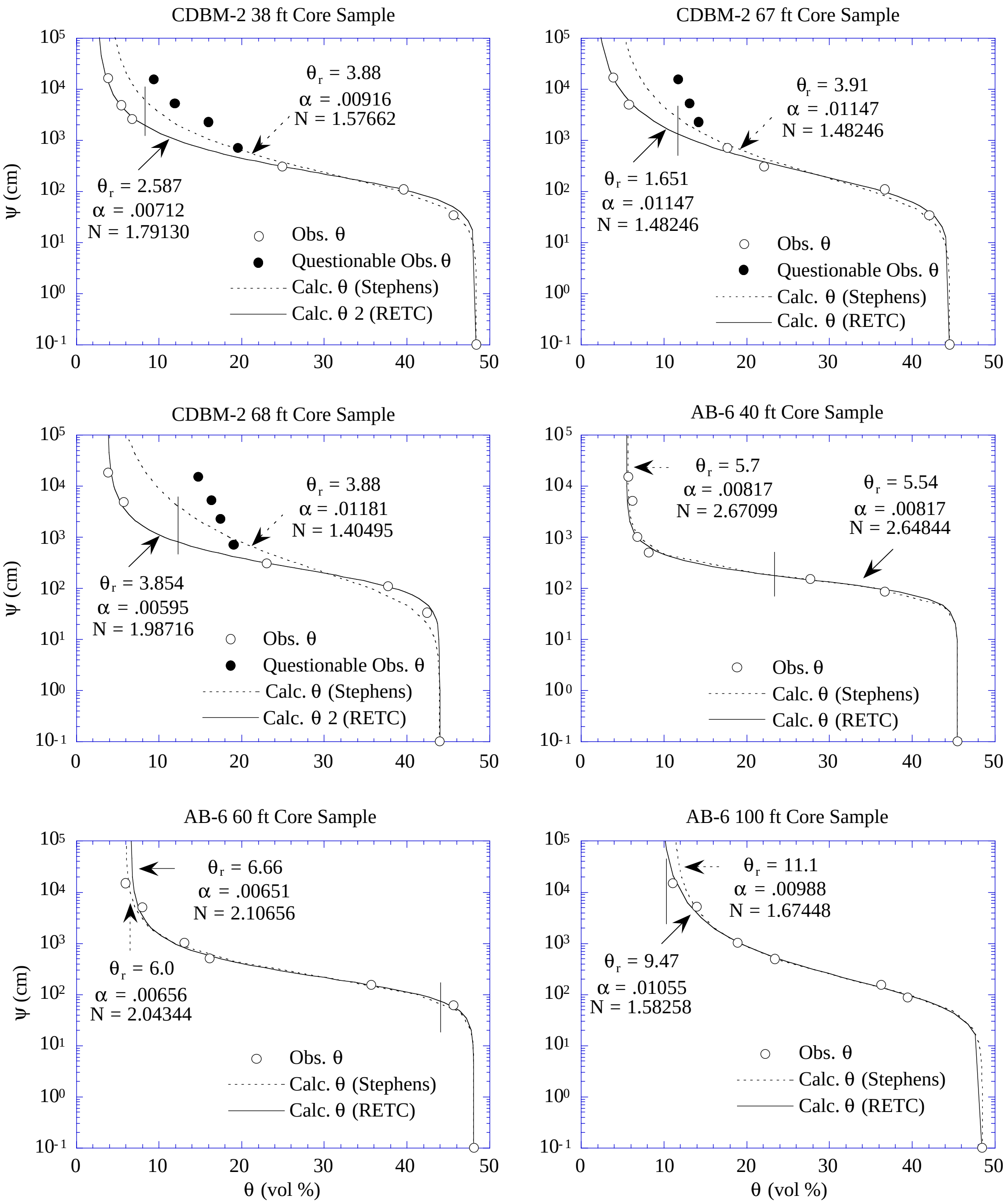


Figure D4. Cañada del Buey well CDBM-2 and TA-53 well AB-6 moisture retention curves. See Figure D1 for explanation.

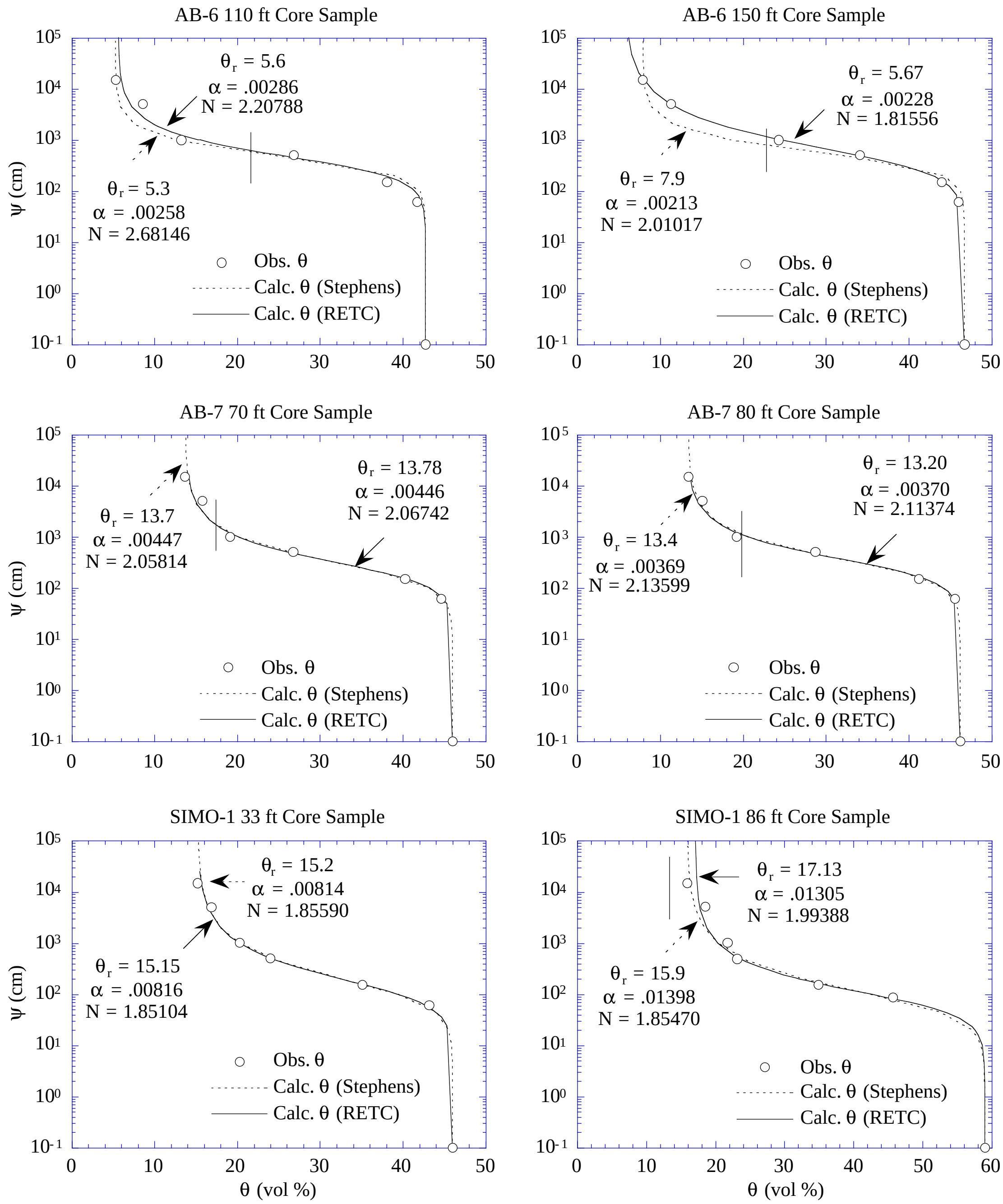


Figure D5. TA-53 wells AB-6, AB-7 and Mortandad Canyon well SIMO-1 moisture retention curves. See Figure D1 for explanation.

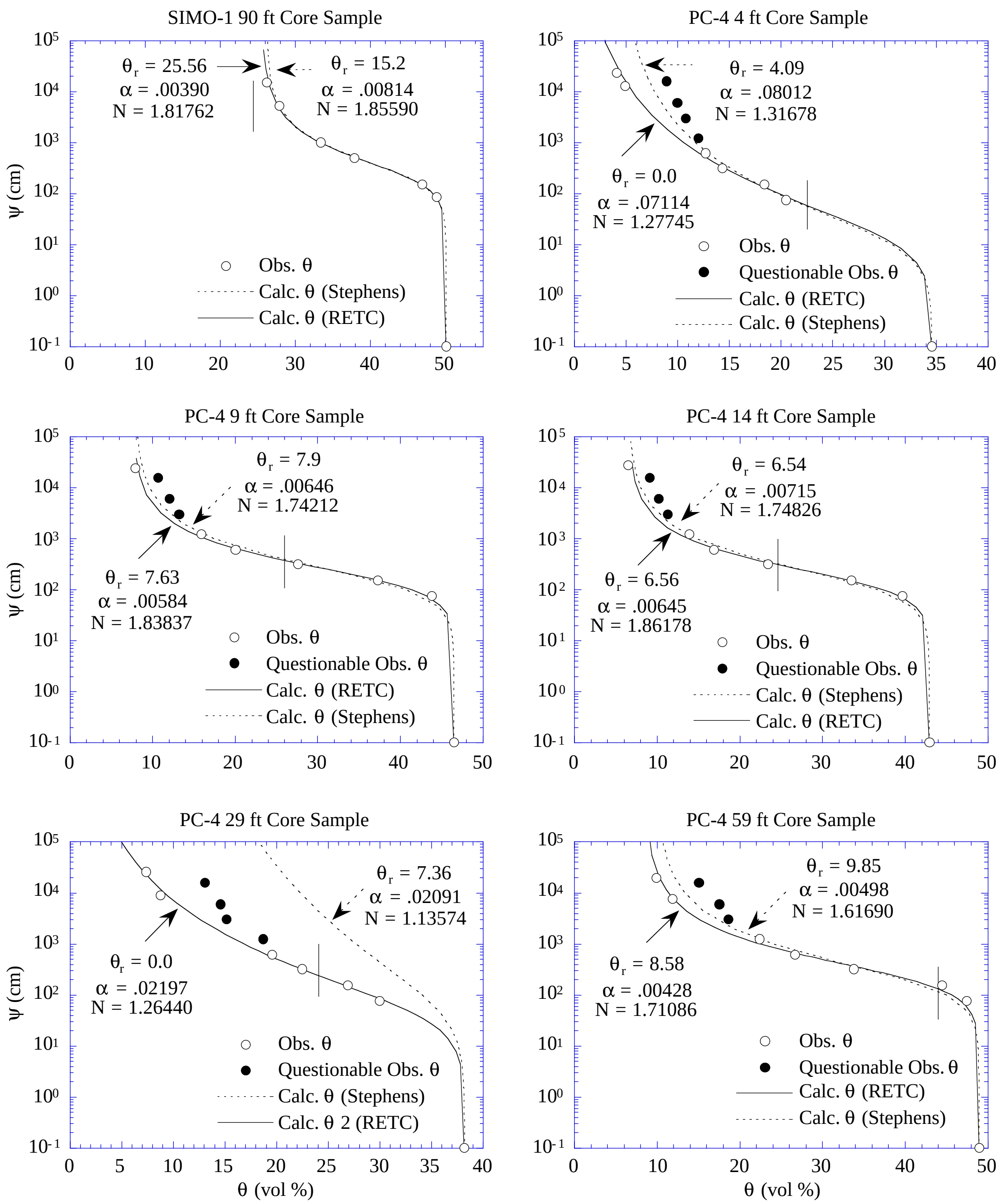


Figure D6. Mortandad Canyon well SIMO-1 and Potrillo Canyon well PC-4 moisture retention curves. See Figure D1 for explanation.

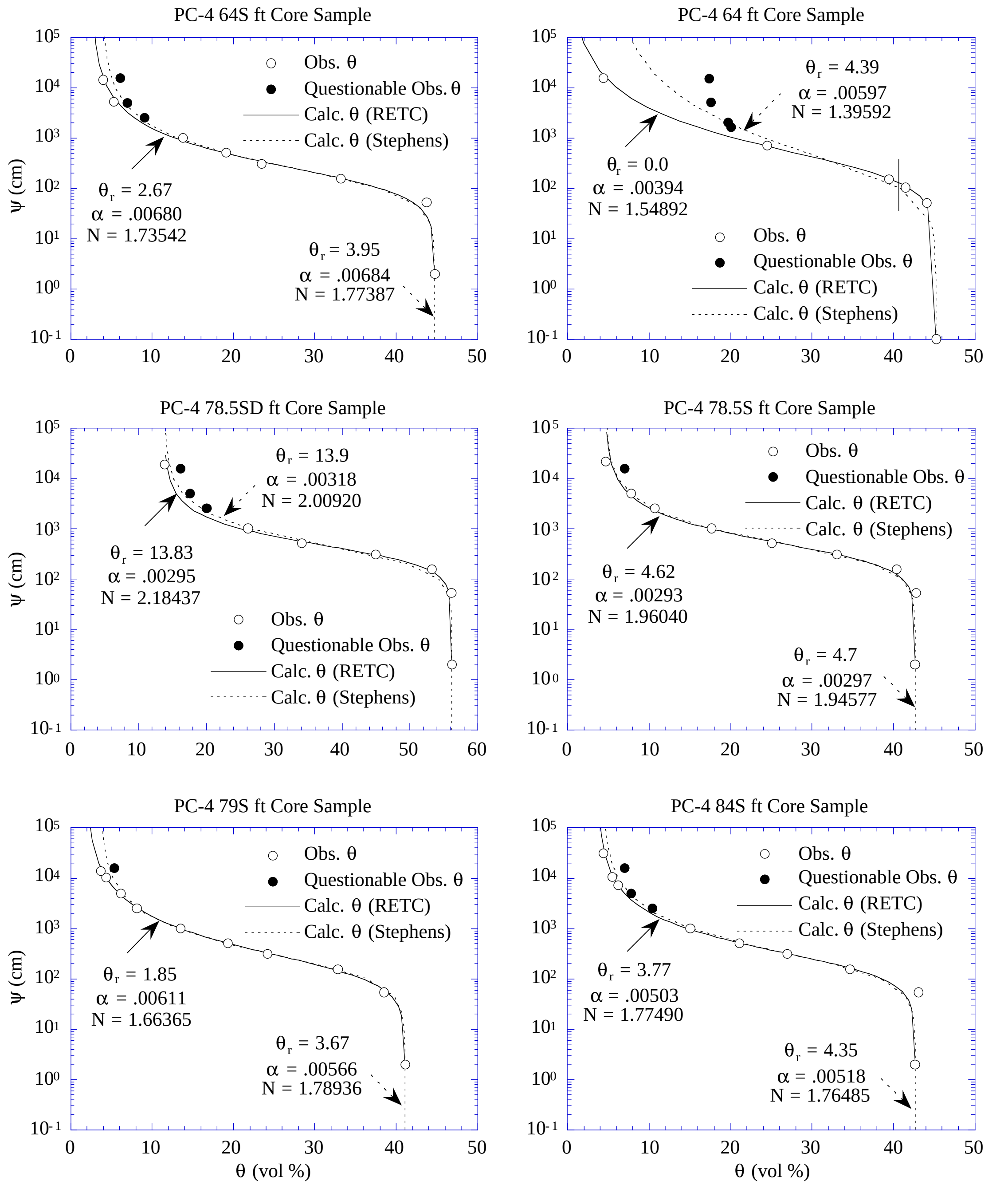


Figure D7. Potrillo Canyon well PC-4 moisture retention curves. S and SD denote SPOC (submersible pressure outflow cell, Constantz and Herkelrath, 1984) measurements in the wet portion of the retention curve. See Figure D1 for explanation.

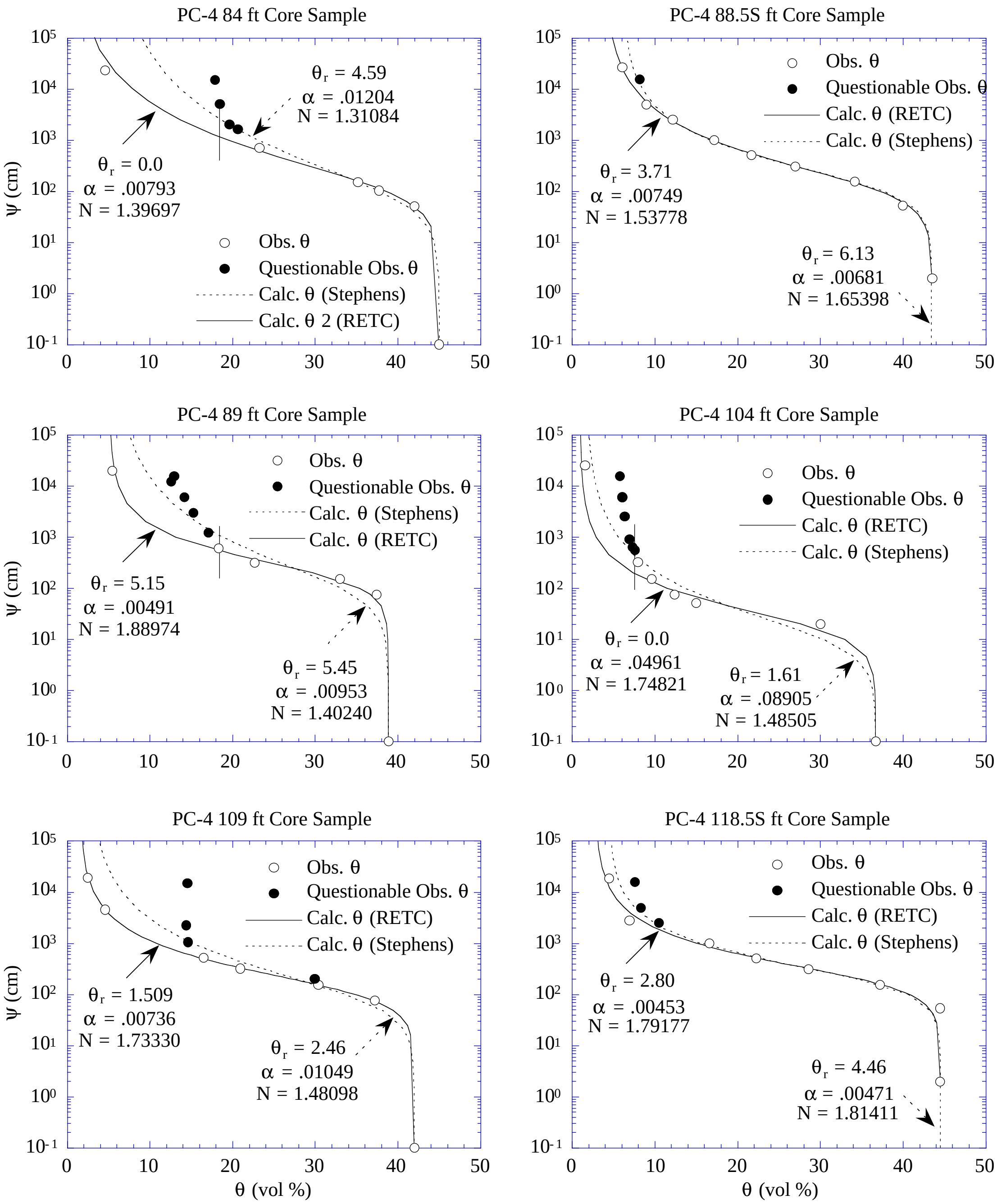


Figure D8. Potrillo Canyon well PC-4 moisture retention curves. S denotes SPOC (submersible pressure outflow cell, Constantz and Herkelrath, 1984) measurements in the wet portion of the retention curve. See Figure D1 for explanation.

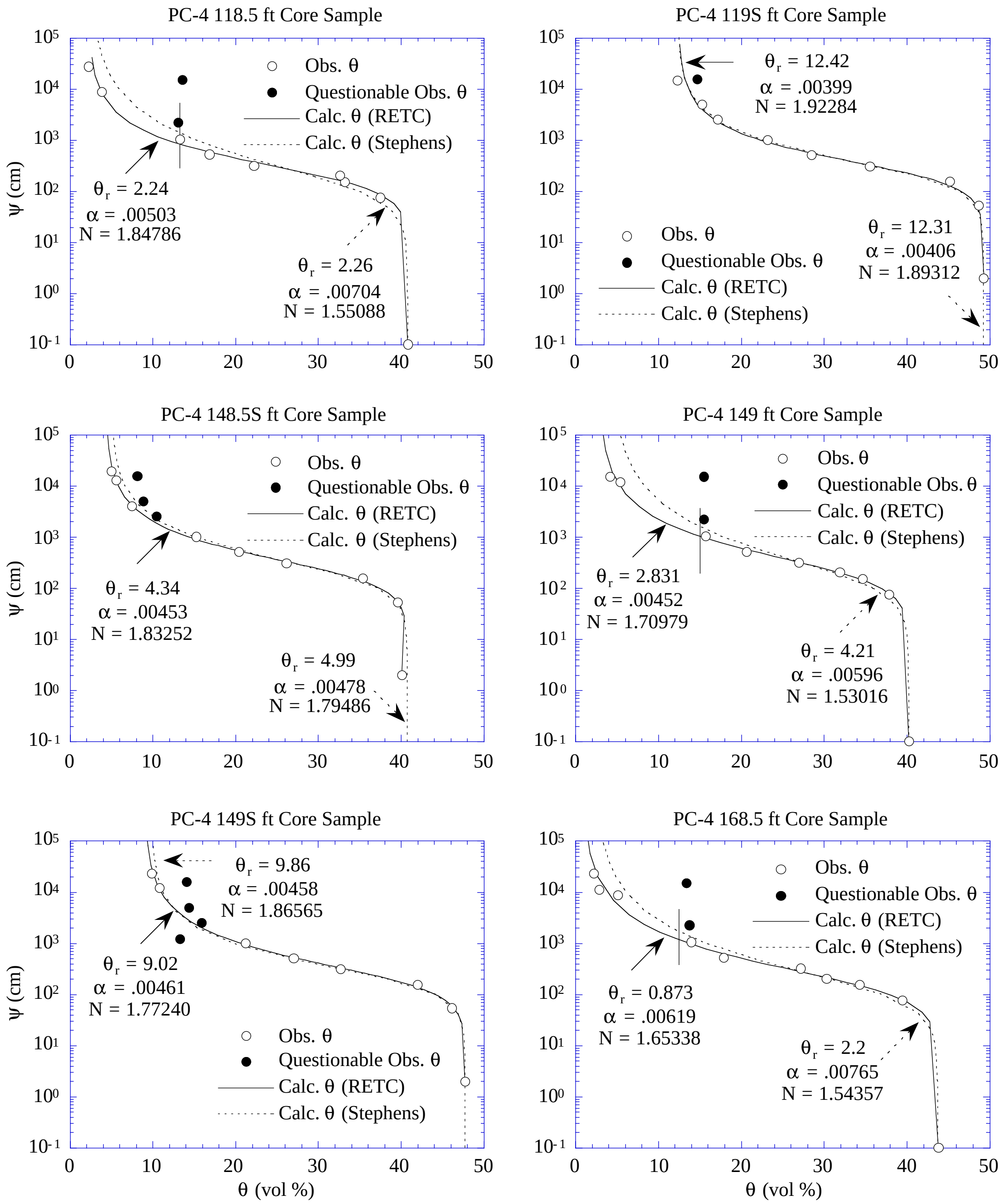


Figure D9. Potrillo Canyon well PC-4 moisture retention curves. S denotes SPOC (submersible pressure outflow cell, Constantz and Herkelrath, 1984) measurements in the wet portion of the retention curve. See Figure D1 for explanation.

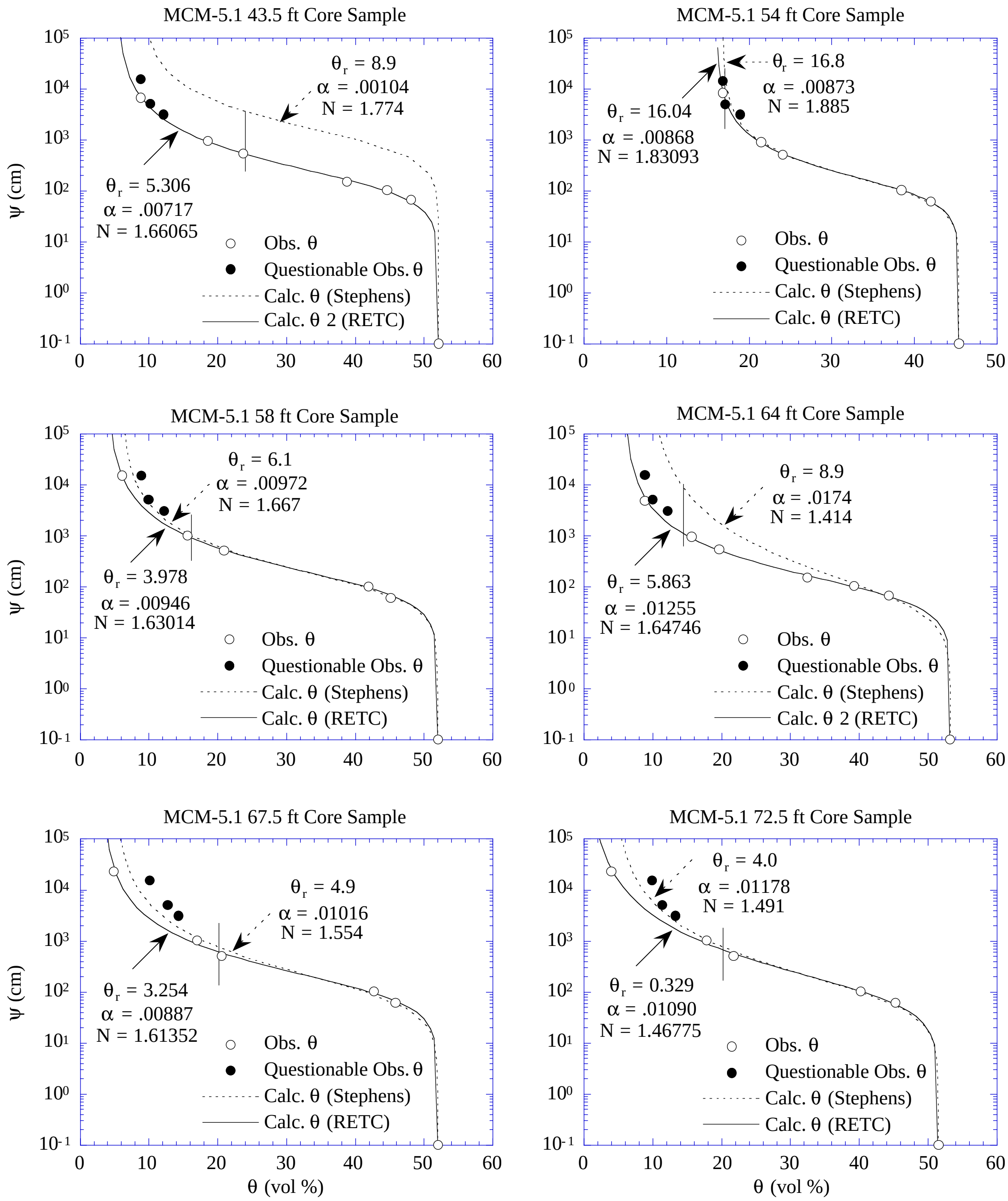


Figure D10. Mortandad Canyon well MCM-5.1 moisture retention curves. See Figure D1 for explanation.

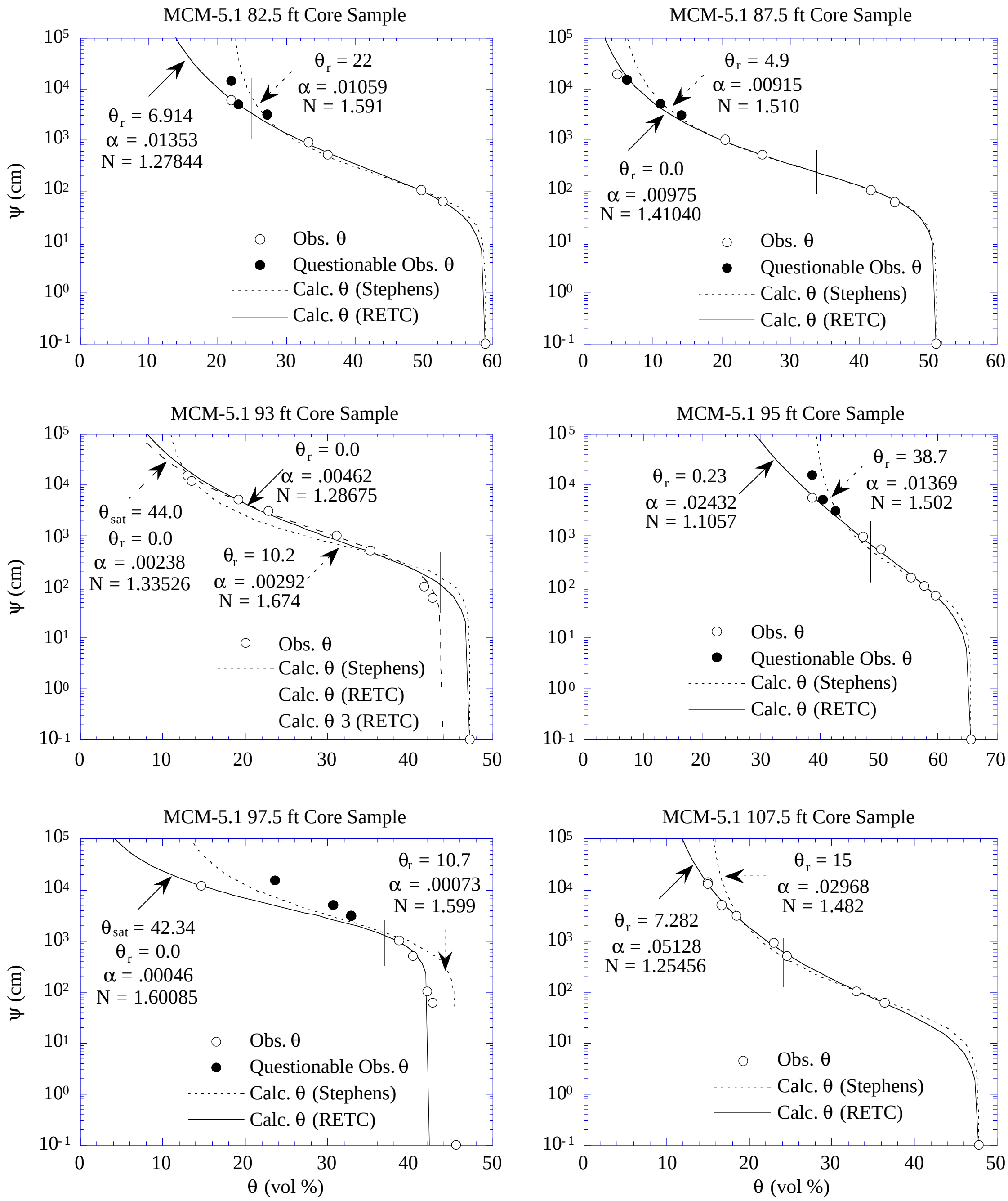


Figure D11. Mortandad Canyon well MCM-5.1 moisture retention curves. See Figure D1 for explanation.

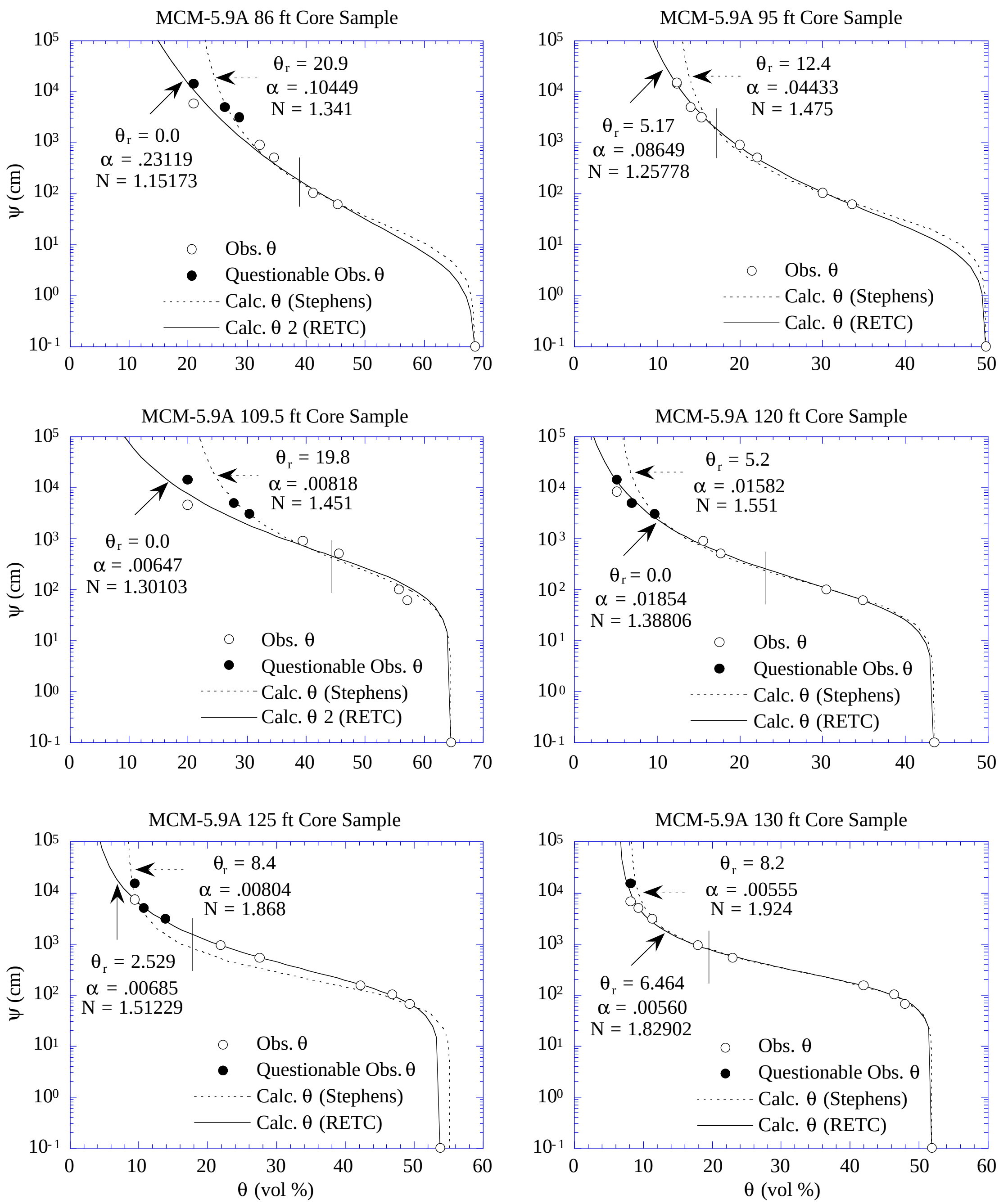


Figure D12. Mortandad Canyon well MCM-5.9 moisture retention curves. See Figure D1 for explanation.

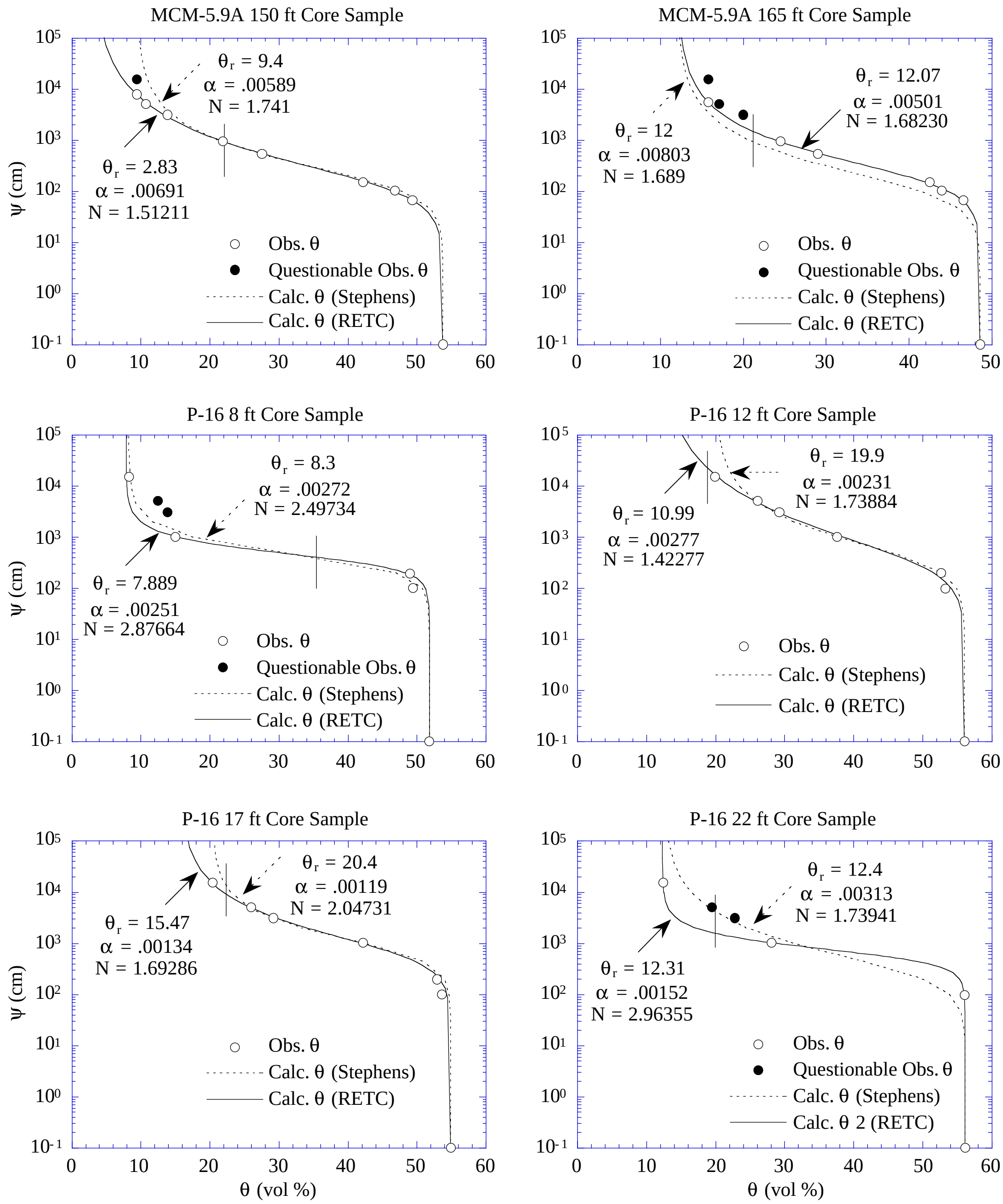


Figure D13. Mortandad Canyon well MCM-5.9 and TA-16 MDA P well P-16 moisture retention curves. See Figure D1 for explanation.

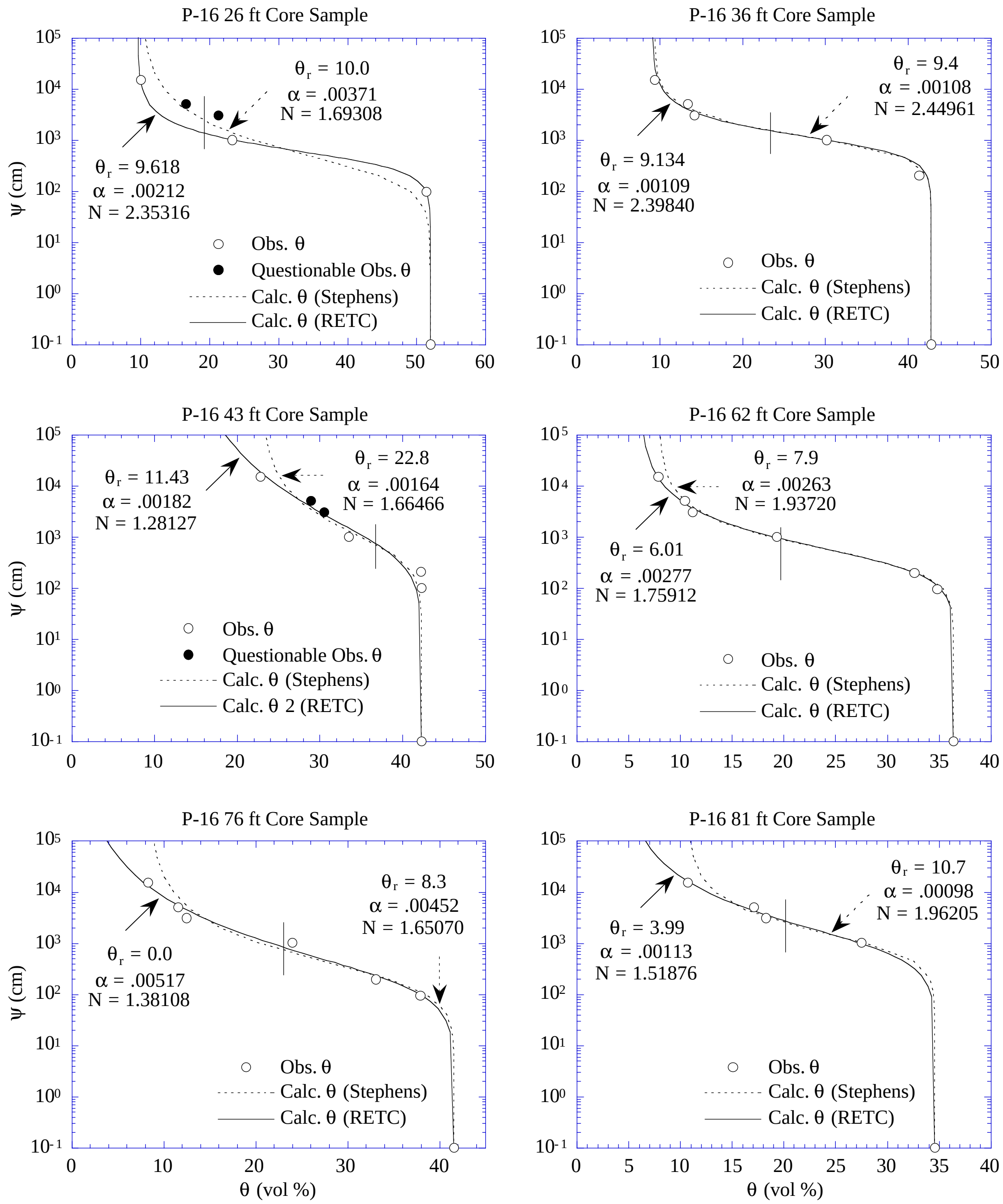


Figure D14. TA-16 MDA P well P-16 moisture retention curves. See Figure D1 for explanation.

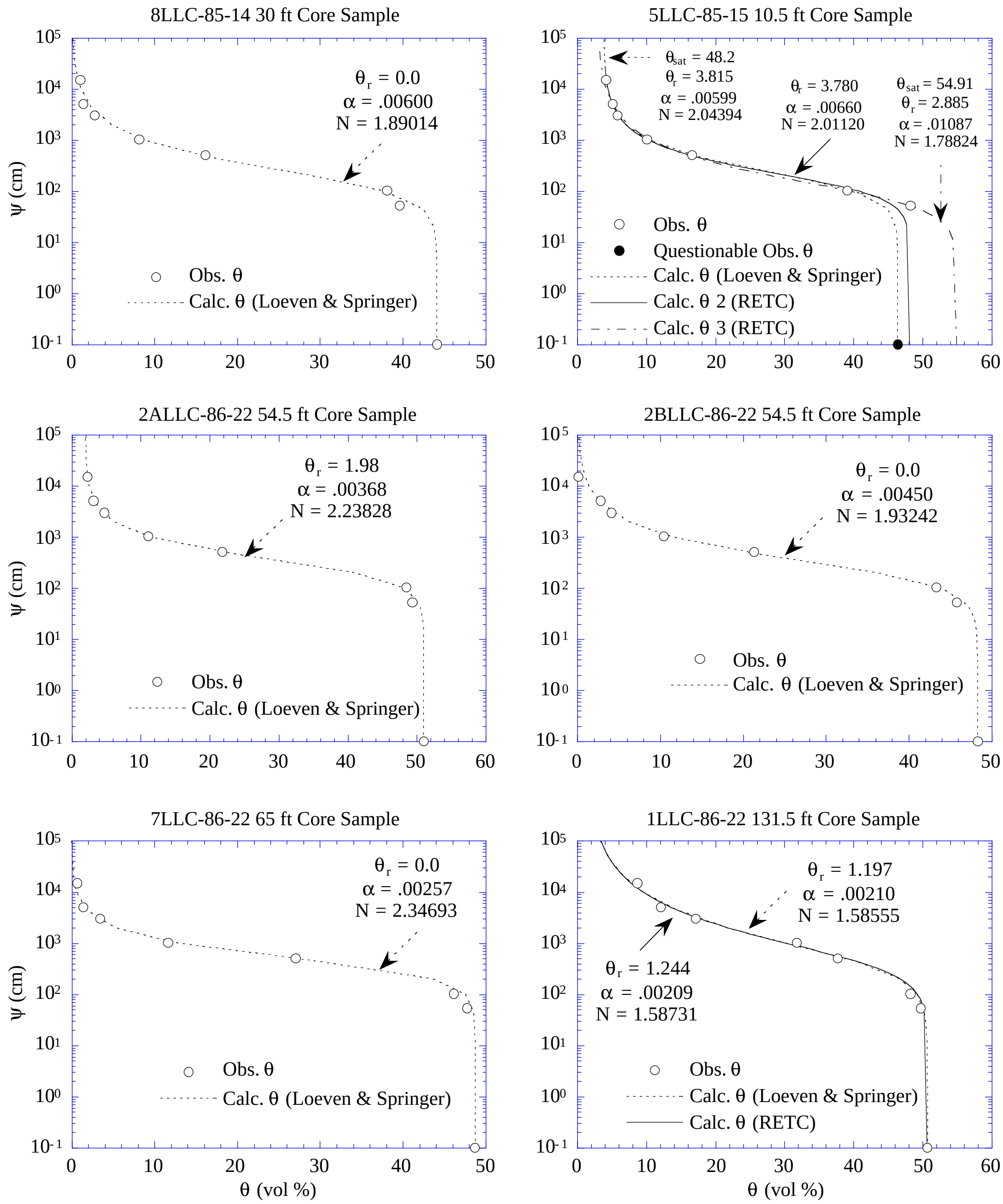


Figure D15. TA-54 wells LLC-85-14, LLC-85-15, and LLC-86-22 moisture retention curves. See Figure D1 for explanation. Most of the moisture retention functions were determined by Loeven and Springer (1993).

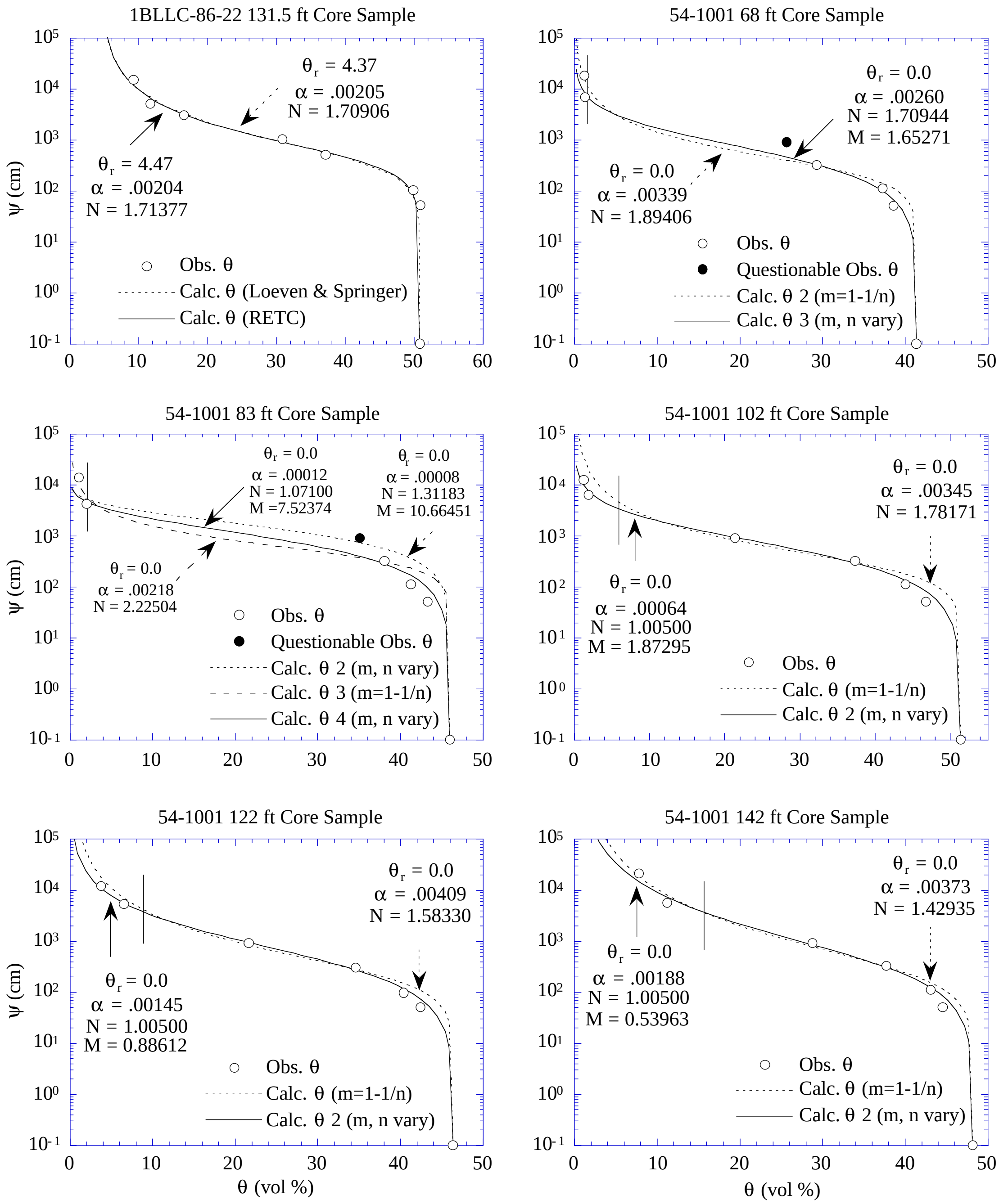


Figure D16. TA-54 wells LLC-86-22 [with moisture retention function determined by Loeven and Springer (1993)] and 54-1001 moisture retention curves. See Figure D1 for explanation.

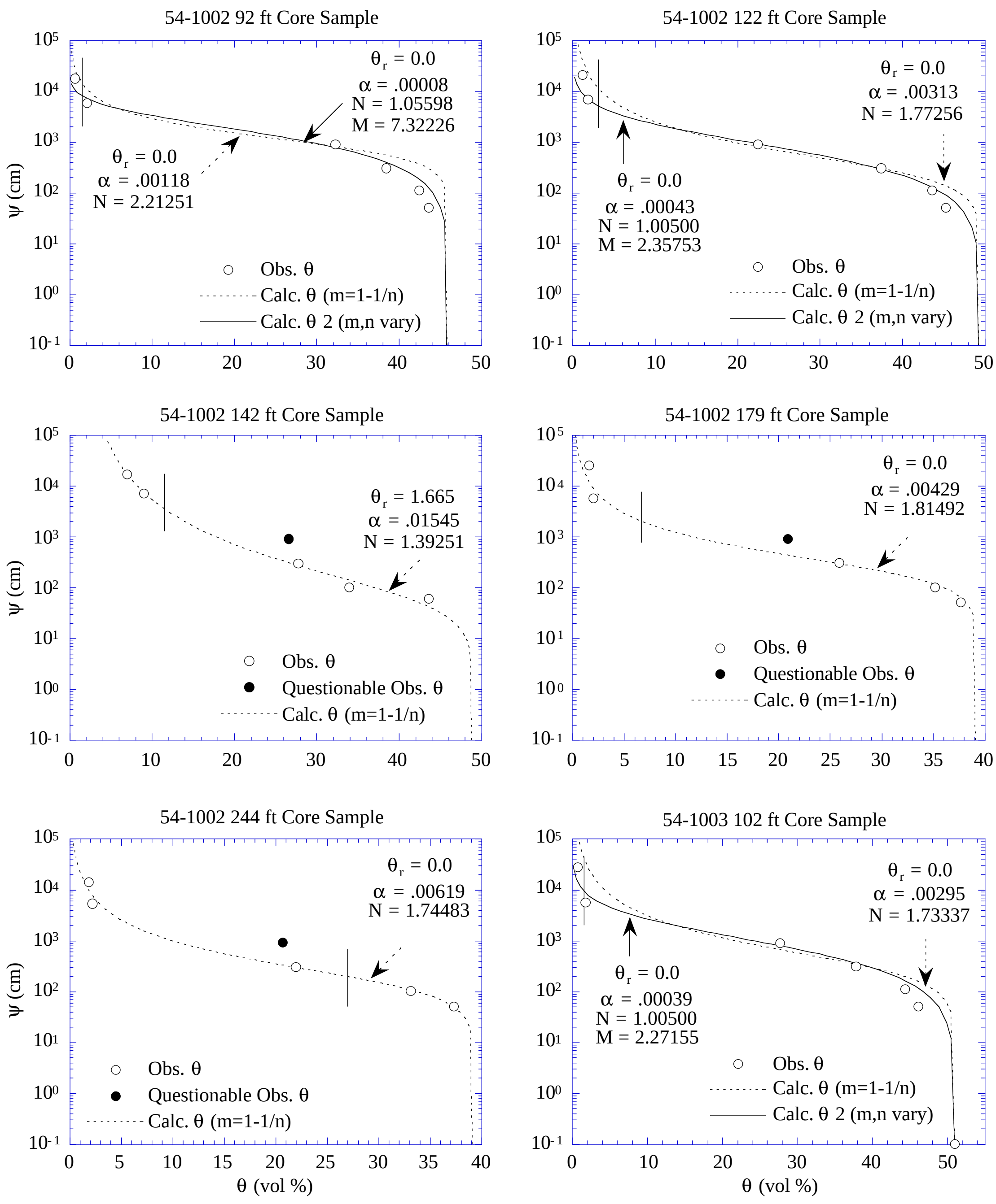


Figure D17. TA-54 wells 54-1002 and 54-1003 moisture retention curves. See Figure D1 for explanation.

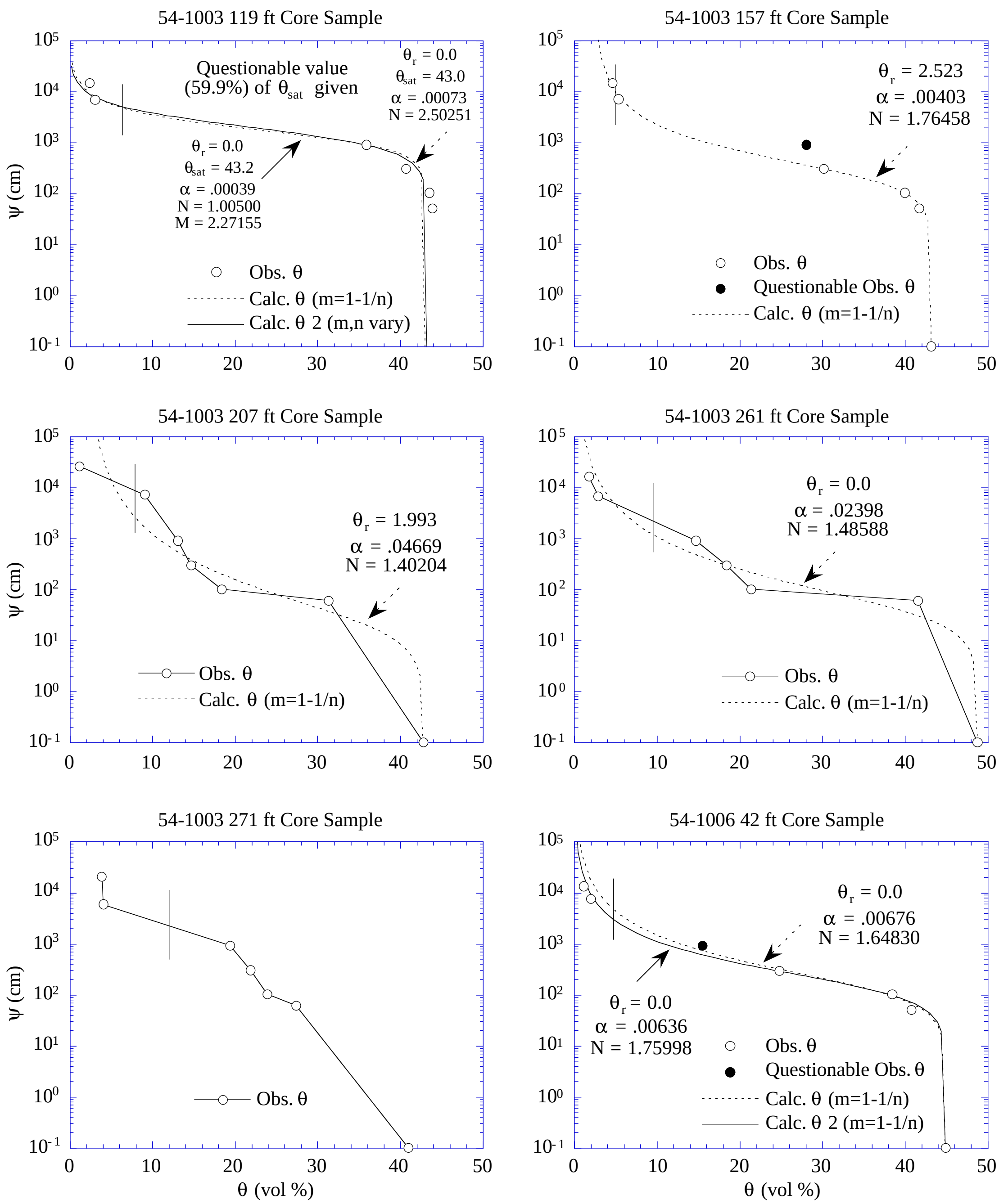


Figure D18. TA-54 wells 54-1003 and 54-1006 moisture retention curves. Cores for well 54-1003 at 207, 261, and 271 ft. were drive sampled; retention curves are unreliable. A questionable value of θ_{sat} (59.9%) was reported for well 54-1003 at 119 ft. See Figure D1 for explanation.

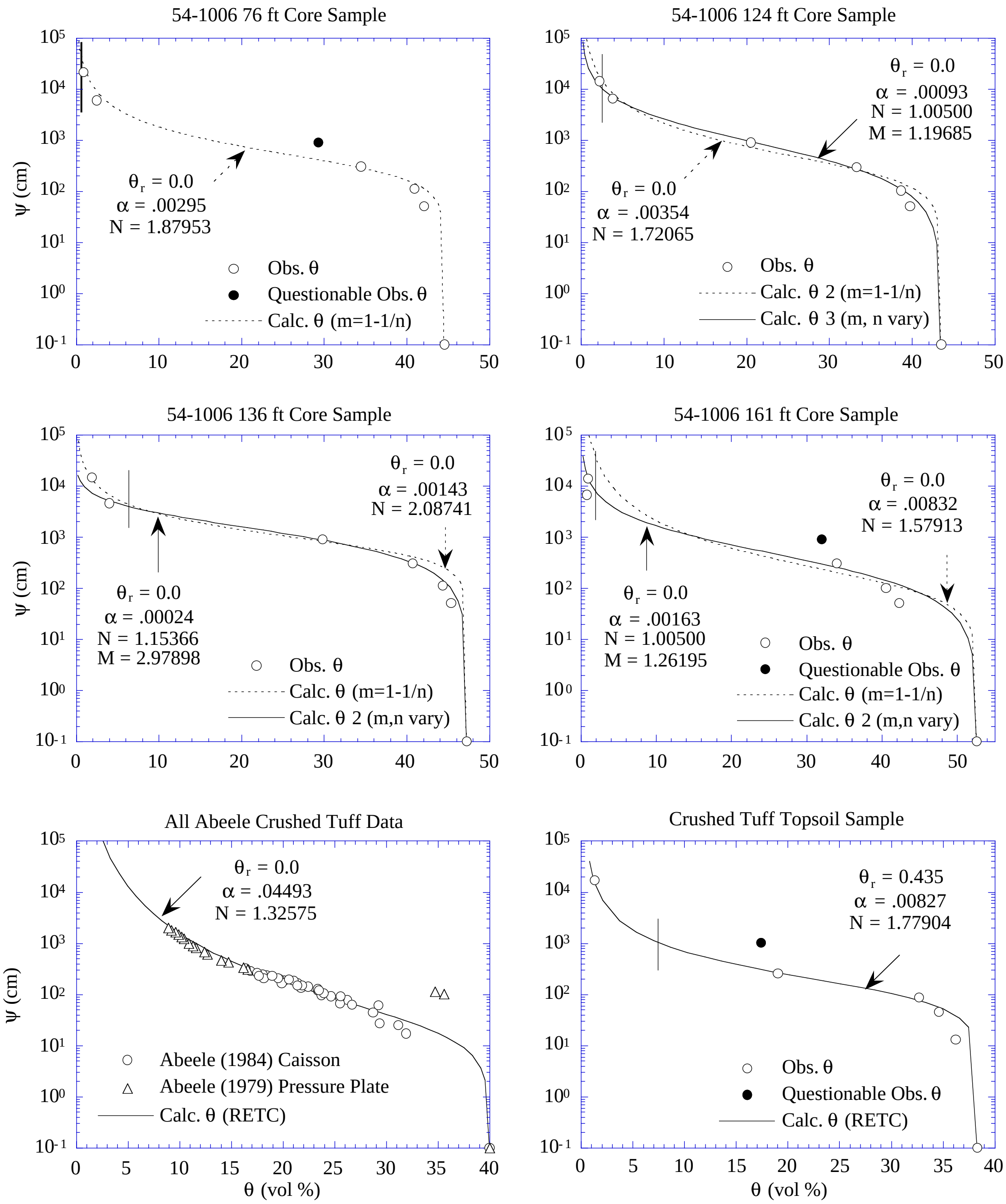
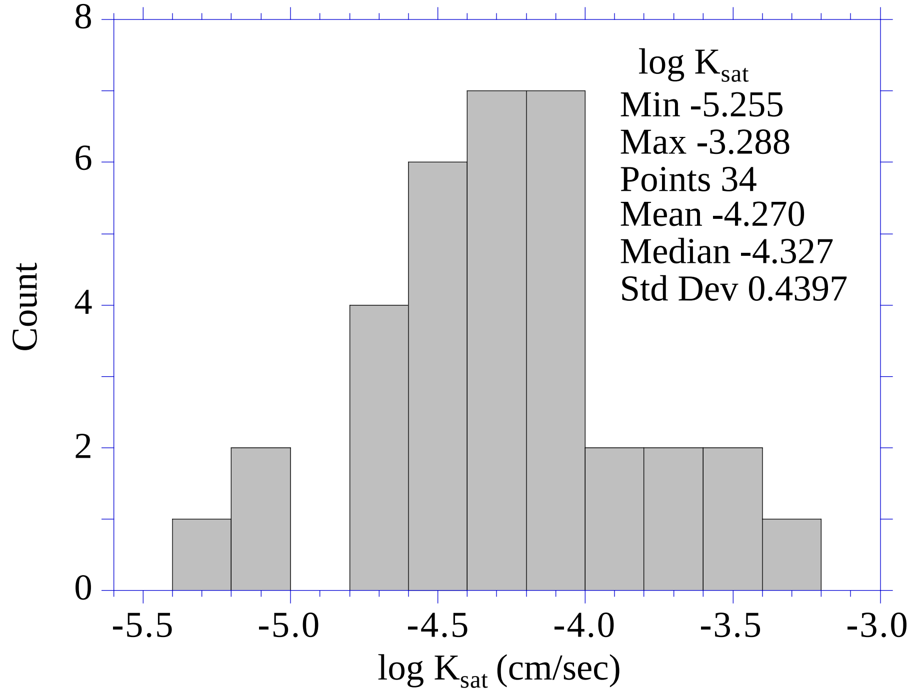


Figure D19. TA-54 well 54-1006 core sample and crushed tuff moisture retention curves. The Abeele crushed tuff data are a combination of pressure plate (Abeele, 1979) and caisson (Abeele, 1984) data. The Stephens (1994a) crushed tuff data are from one laboratory sample. See Figure D1 for explanation.

Appendix E. Hydraulic Properties Histograms by Lithologic Unit



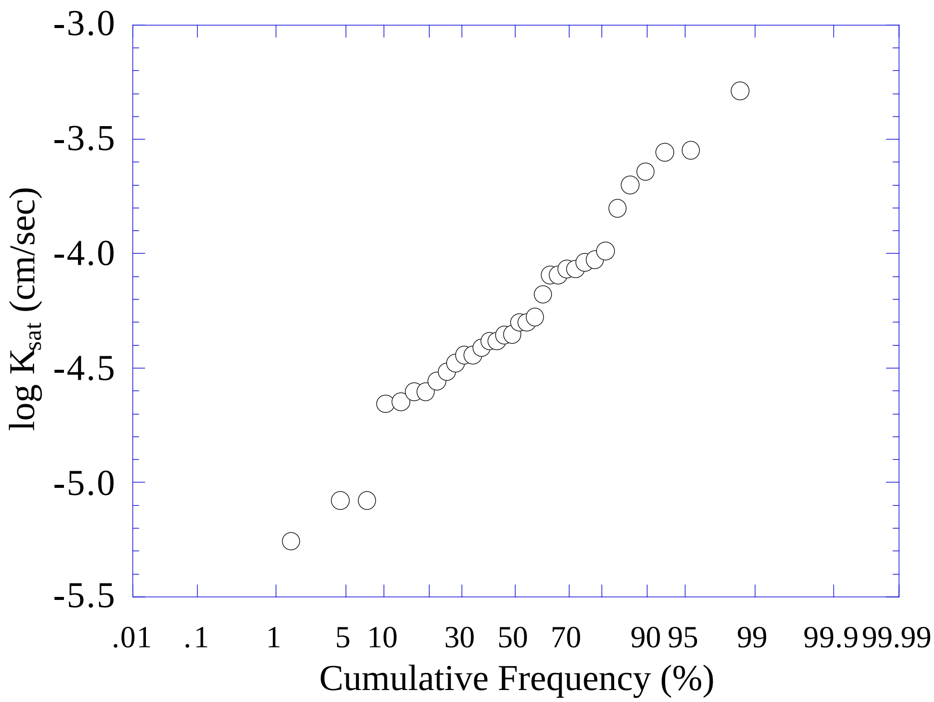


Figure E1. Histogram (top) and probability (bottom) plots of all Tshirege Unit 3 hydraulic conductivity data.

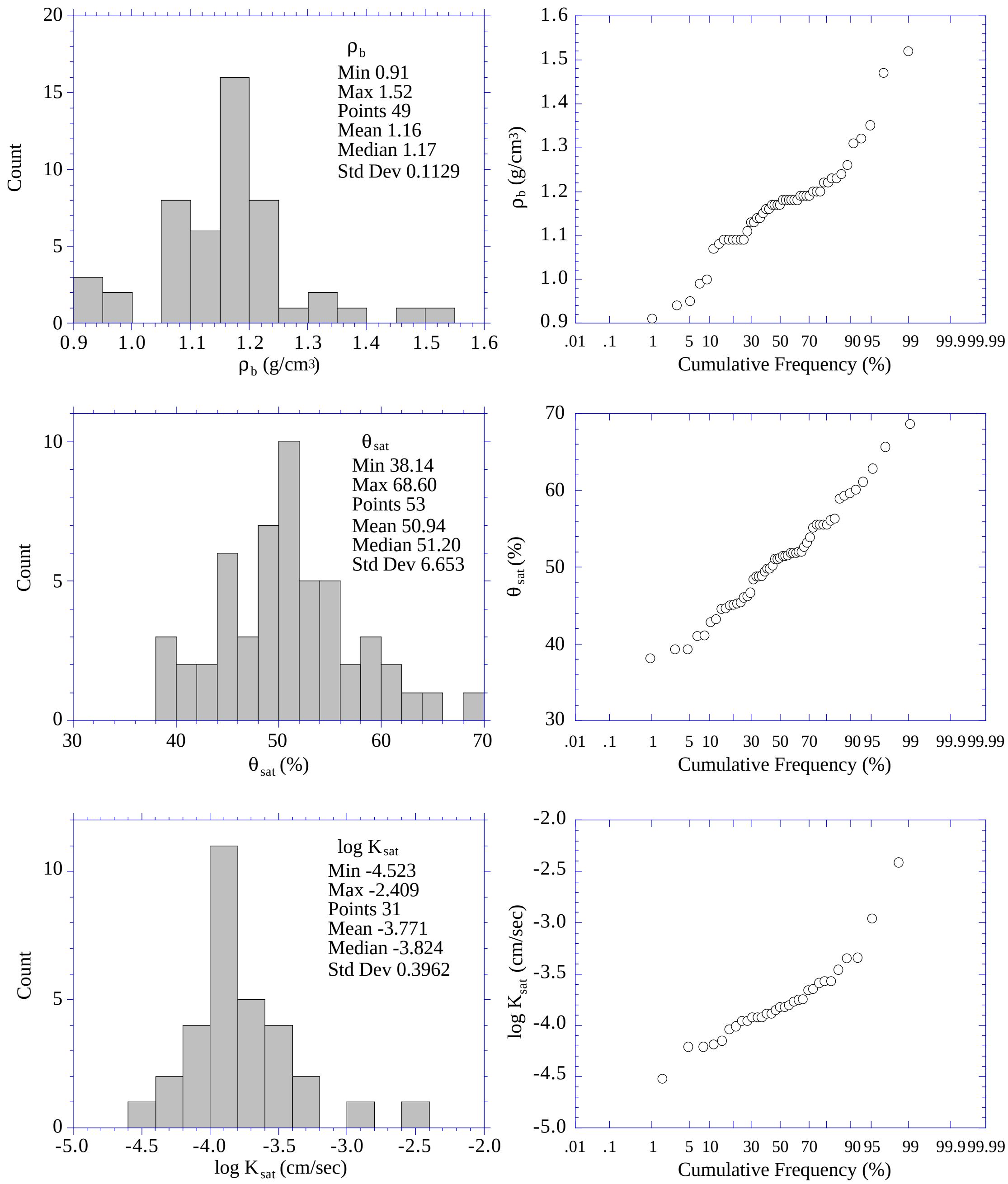


Figure E2. Histograms and probability plots of all Tshirege Unit 1a bulk density (top), saturated moisture content (center), and hydraulic conductivity (bottom) data.

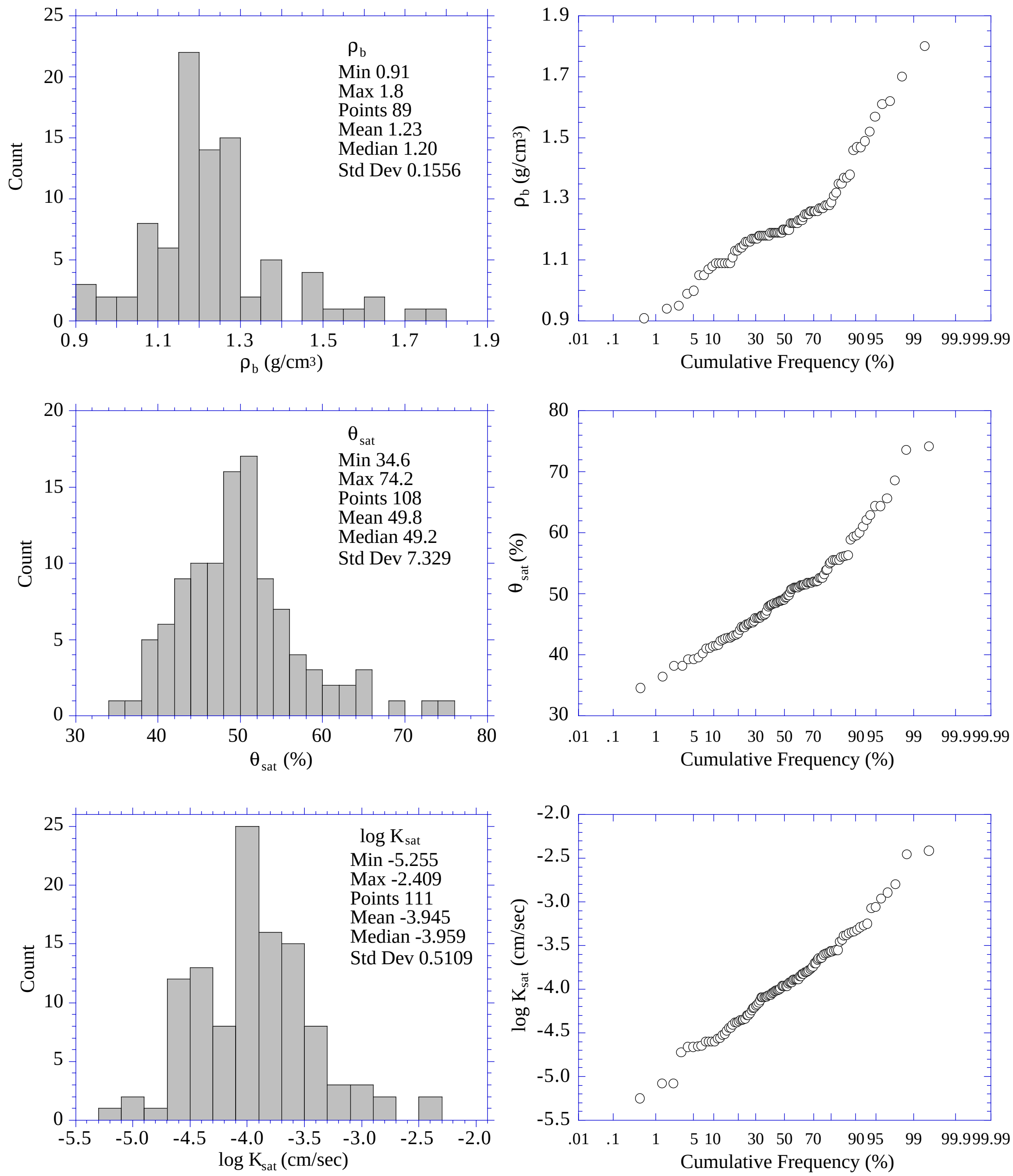


Figure E3. Histograms and probability plots of all Tshirege Member bulk density (top), saturated moisture content (center), and hydraulic conductivity (bottom) data.

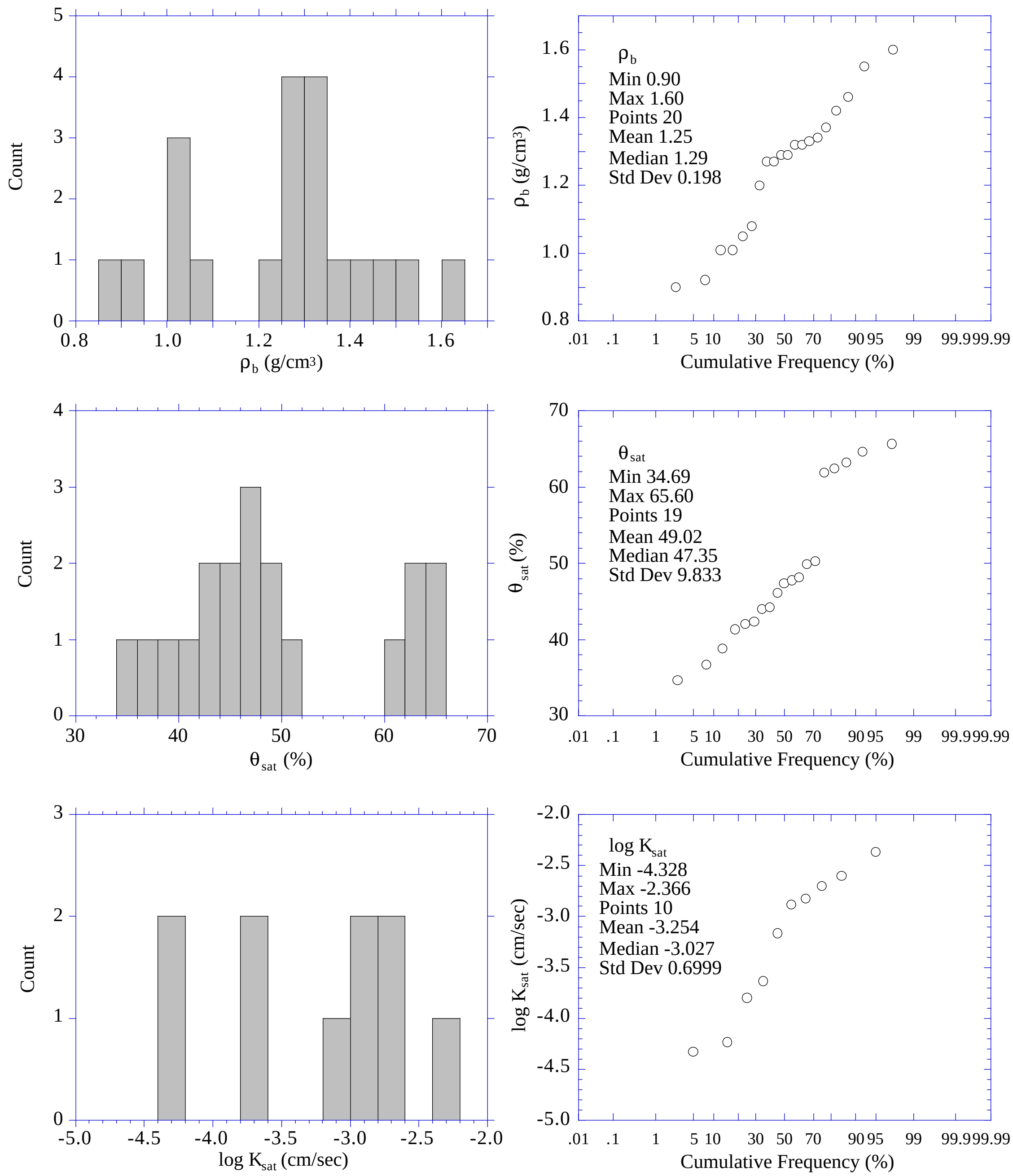


Figure E4. Histograms and probability plots of all Tsankawi/Cerro Toledo Sequence bulk density (top), saturated moisture content (center), and hydraulic conductivity (bottom) data.

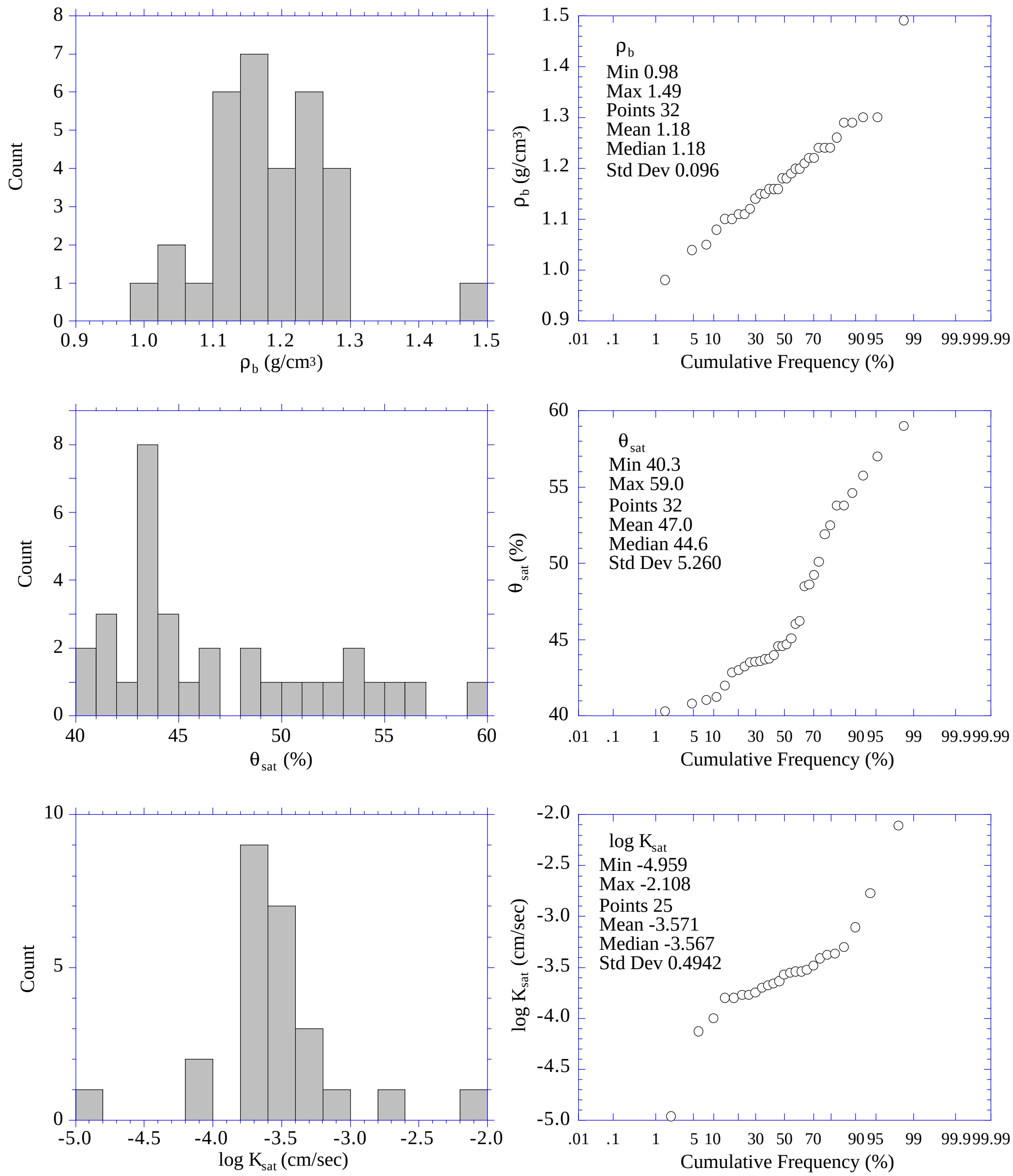


Figure E5. Histograms and probability plots of all Otowi Member bulk density (top), saturated moisture content (center), and hydraulic conductivity (bottom) data.

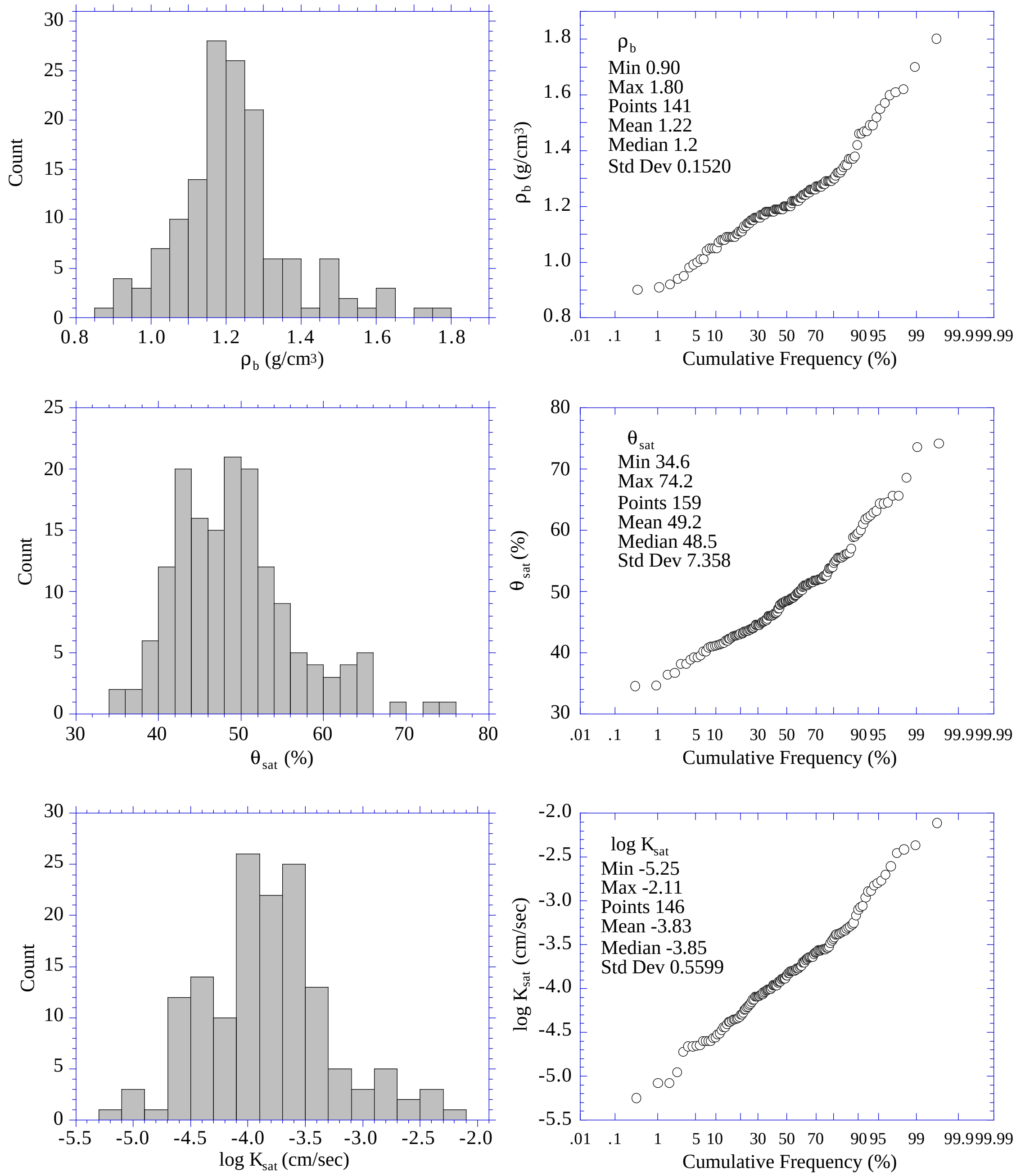


Figure E6. Histograms and probability plots of all Bandelier Tuff bulk density (top), saturated moisture content (center), and hydraulic conductivity (bottom) data.

Appendix F. Computed Hydraulic Properties Tables by Well

Table F1. Computed hydraulic properties for wells CDBM-1 and CDBM-2.

Unit	Depth (ft)	Effective Sat (%)	K_{sat} (cm/sec)	In situ K (cm/sec)	Suction (cm)	Head (cm)
			Well CDBM-1			
Tshirege 1a	24	5.5	6.2×10^{-5}	2.1×10^{-11}	7496	-8228
Tshirege 1a	34	12.7	2.2×10^{-4}	2.8×10^{-10}	4744	-5780
Tshirege 1a	44	20.8	7.0×10^{-5}	2.3×10^{-9}	2426	-3767
Tshirege 1a	54	20.1	4.6×10^{-4}	2.0×10^{-9}	3139	-4785
Tshirege 1a	64	24.0	1.2×10^{-4}	1.2×10^{-8}	1323	-3274
Tsankawi	89	39.9	2.3×10^{-4}	2.9×10^{-8}	633	-3346
Tsankawi	94	18.2	1.5×10^{-3}	8.7×10^{-9}	1055	-3920
Otowi	104	33.8	2.3×10^{-4}	2.0×10^{-8}	1396	-4566
Otowi	114	30.7	1.6×10^{-4}	8.0×10^{-8}	977	-4452
Otowi	124	25.1	2.9×10^{-4}	1.8×10^{-9}	2651	-6431
Otowi	134	24.1	1.6×10^{-4}	8.8×10^{-9}	1567	-5652
Otowi	144	15.7	4.2×10^{-4}	7.9×10^{-8}	743	-5132
Otowi	154	21.8	1.0×10^{-4}	1.7×10^{-8}	1377	-6071
Otowi	164	24.2	1.7×10^{-4}	1.5×10^{-9}	3030	-8028
Otowi	174	18.5	2.1×10^{-4}	1.6×10^{-8}	1217	-6520
Otowi	184	16.5	3.0×10^{-4}	1.3×10^{-8}	1203	-6811
Otowi	189	20.4	1.8×10^{-4}	3.9×10^{-9}	2029	-7790
			Well CDBM-2			
Weathered 1a	28	15.0	8.5×10^{-4}	1.1×10^{-10}	2851	-3704
Tshirege 1a	38	12.6	4.5×10^{-4}	2.6×10^{-9}	1923	-3081
Otowi	67	23.3	5.0×10^{-4}	1.4×10^{-8}	1342	-3385
Otowi	68	21.0	2.7×10^{-4}	5.8×10^{-8}	801	-2873

Table F2. Computed hydraulic properties for wells AB-6, AB-7, and SIMO-1.

Unit	Depth (ft)	Effective Sat (%)	K_{sat} (cm/sec)	In situ K (cm/sec)	Suction (cm)	Head (cm)
			Well AB-6			
Tshirege 2b	40	44.7	3.7×10^{-4}	8.1×10^{-6}	-177	-1396
Tshirege 2b	60	90.1	3.5×10^{-3}	1.2×10^{-3}	-75	-1904
Tshirege 2a	100		8.8×10^{-4}			
Tshirege 2a	110	43.4	7.4×10^{-5}	7.7×10^{-7}	-625	-3977
Tshirege 1a	150	41.8	6.1×10^{-5}	1.8×10^{-7}	-1176	-5748
			Well AB-7			
Otowi	70		1.7×10^{-4}			
Otowi	80		2.2×10^{-4}			
			Well SIMO-1			
Tshirege 1a	33		2.7×10^{-4}			
Otowi	86		2.0×10^{-4}			
Otowi	90		1.1×10^{-5}			

Table F3. Computed hydraulic properties for well PC-4.

Unit	Depth (ft)	Effective Sat (%)	K_{sat} (cm/sec)	In situ K (cm/sec)	Suction (cm)	Head (cm)
Alluvium	4	65.3	8.2×10^{-4}	6.9×10^{-7}	58	-180
Alluvium	9	47.3	6.5×10^{-5}	3.9×10^{-7}	372	-647
Weathered 1a	14	49.3	4.3×10^{-5}	3.5×10^{-7}	309	-736
Weathered 1a	29	63.3	2.5×10^{-5}	8.8×10^{-9}	247	-1131
Weathered 1a	59	87.7	2.2×10^{-5}	3.6×10^{-6}	131	-1929
Tshirege 1a*	64		3.6×10^{-4}			
Tshirege 1a	64	89.7	9.7×10^{-5}	1.3×10^{-5}	131	-2082
Tshirege 1a*	78.5		3.3×10^{-5}			
Tshirege 1a*	78.5		7.1×10^{-5}			
Tshirege 1a*	79		3.0×10^{-5}			
Tshirege 1a*	84		5.6×10^{-4}			
Tshirege 1a	84	40.9	3.5×10^{-4}	3.4×10^{-8}	1163	-3723
Tsankawi*	88.5		5.3×10^{-4}			
Tsankawi	89	39.3	1.6×10^{-4}	4.6×10^{-7}	538	-3250
Tsankawi	104	18.5	2.5×10^{-3}	7.5×10^{-8}	190	-3360
Otowi	109		3.9×10^{-4}			
Otowi*	118.5		1.4×10^{-3}			
Otowi	118.5	28.4	3.3×10^{-4}	1.6×10^{-7}	845	-4457
Otowi*	119		1.8×10^{-4}			
Otowi*	148.5		9.4×10^{-5}			
Otowi	149	32.8	7.5×10^{-5}	3.6×10^{-8}	1023	-5565
Otowi*	149		9.4×10^{-5}			
Otowi	168.5	26.9	4.3×10^{-4}	4.6×10^{-8}	1180	-6316

*SPOC (submersible pressure outflow cell, Constantz and Herkelrath, 1984) measurements in the wet portion of the retention curve, not included in the present analysis due to lack of in situ moisture content measurements.

Table F4. Computed hydraulic properties for well MCM-5.1.

Unit	Depth (ft)	Effective Sat (%)	K_{sat} (cm/sec)	In situ K (cm/sec)	Suction (cm)	Head (cm)
Tshirege 1a	43.5	40.1	2.0×10^{-4}	2.2×10^{-7}	522	-1848
Tshirege 1a	54	3.5	1.5×10^{-4}			
Tshirege 1a	58	25.3	1.8×10^{-4}	1.1×10^{-8}	917	-2685
Tshirege 1a	64	18.0	1.3×10^{-4}	1.4×10^{-9}	1114	-3065
Tshirege 1a	67.5	34.7	1.1×10^{-4}	3.7×10^{-8}	610	-2667
Tshirege 1a	72.5	39.1	1.4×10^{-4}	2.5×10^{-8}	658	-2868
Tshirege 1a	82.5	34.9	1.2×10^{-4}	2.1×10^{-10}	3225	-5740
Tshirege 1a	87.5	66.1	1.1×10^{-4}	5.3×10^{-7}	231	-2898
Tsankawi	93	99.4	4.7×10^{-5}	1.8×10^{-5}	25	-2860
Tsankawi	95	73.9	6.8×10^{-4}	9.9×10^{-9}	693	-3588
Tsankawi	97.5	87.0	5.8×10^{-5}	6.9×10^{-6}	1316	-4288
Tsankawi	107.5	42.0	1.3×10^{-3}	5.4×10^{-8}	253	-3530

Table F5. Computed hydraulic properties for well MCM-5.9A.

Unit	Depth (ft)	Effective Sat (%)	K_{sat} (cm/sec)	In situ K (cm/sec)	Suction (cm)	Head (cm)
Tshirege 1a	86	56.5	3.9×10^{-3}	9.0×10^{-9}	183	-2804
Tshirege 1a	95	27.0	1.1×10^{-3}	6.8×10^{-11}	1854	-4749
Tsankawi	105		2.0×10^{-3}			
Tsankawi	109.5	68.8	4.3×10^{-3}	8.9×10^{-6}	451	-3788
Otowi	120	53.3	7.9×10^{-4}	5.4×10^{-7}	252	-3910
Otowi	125	30.0	2.8×10^{-4}	1.5×10^{-8}	1498	-5308
Otowi	130	28.7	7.8×10^{-3}	3.6×10^{-6}	778	-4740
Otowi	150	37.8	1.7×10^{-3}	4.0×10^{-7}	930	-5502
Otowi	165	25.2	2.9×10^{-4}	2.7×10^{-8}	1478	-6507

Table F6. Computed hydraulic properties for well P-16.

Unit	Depth (ft)	Effective Sat (%)	K_{sat} (cm/sec)	In situ K (cm/sec)	Suction (cm)	Head (cm)
Tshirege 3d	8	62.6	1.6×10^{-4}	1.6×10^{-5}	406	-649
Tshirege 3d	12	17.2	2.8×10^{-4}			
Tshirege 3d	17	17.1	2.8×10^{-4}			
Tshirege 3d	22	17.4	2.0×10^{-4}			
Tshirege 3d	26	22.6	9.2×10^{-5}			
Tshirege 3d	36	42.4	2.3×10^{-5}			
Tshirege 3c	43	82.0	8.6×10^{-5}			
Tshirege 3c	62	44.9	5.2×10^{-4}	1.7×10^{-6}	943	-2832
Tshirege 3c	76	55.6	2.3×10^{-4}	2.0×10^{-7}	824	-3141
Tshirege 3c	81	52.6	4.4×10^{-5}	9.7×10^{-8}	2736	-5205

Table F7. Computed hydraulic properties for wells LLC-85-14, LLC-85-15, and LLC-86-22.

Sample No./ Unit	Depth (ft)	Effective Sat (%)	K_{sat} (cm/sec)	In situ K (cm/sec)	Suction (cm)	Head (cm)
			Well LLC-85-14			
8/ Tshir 2b	30		4.2×10^{-4}			
			Well LLC-85-15			
5/ Tshir 2b	10.5		1.6×10^{-3}			
			Well LLC-86-22*			
2A/ Tshir 2a	54.5	1.1*	8.2×10^{-5}	1.9×10^{-13}	10647	-12308
2B/ Tshir 2a	54.5	2.7*	2.5×10^{-4}	3.0×10^{-12}	10726	-12388
7/ Tshir 2a	65	2.7*	1.4×10^{-4}	2.5×10^{-11}	5728	-7709
1/ Tshir 1b	131.5	38.0*	1.9×10^{-5}	8.9×10^{-9}	2372	-6380
1B/ Tshir 1b	131.5	33.7*	2.7×10^{-5}	1.5×10^{-8}	2168	-6176

*Moisture content and saturation values are from core measurements for this well (Kearl et al., 1986a and b).

Table F8. Computed hydraulic properties for wells 54-1001, -1002, -1003, and -1006.

Unit*	Depth (ft)	Effective Sat (%)	K_{sat} (cm/sec)	In situ K (cm/sec)	Suction (cm)	Head (cm)
			Well 54-1001			
Tshirege 2a/1v†	68†				11217	-13289
Tshirege 2a/1v†	68†	3.9	1.3×10^{-4}	5.9×10^{-12}	6100	-8173
Tshirege 2a/1v	83	5.6	1.1×10^{-4}	2.2×10^{-10}	4822	-7351
Tshirege 2a/1v	102	13.4	1.6×10^{-4}	1.2×10^{-9}	3761	-6870
Tshirege 1b/1v	122	19.4	2.2×10^{-5}	1.8×10^{-10}	4038	-7757
Tshirege 1b/1v	142	32.4	8.2×10^{-5}	2.3×10^{-9}	3649	-7977
			Well 54-1002			
Tshirege 2a/1v	92.5	3.3	8.1×10^{-5}	1.7×10^{-11}	8000	-10819
Tshirege 1b/1v	122	6.5	4.6×10^{-5}	7.7×10^{-12}	4900	-8619
Tshirege 1b/1v	142.5	20.7	2.5×10^{-5}	1.3×10^{-11}	3555	-7898
Tshirege 1a/1g	179.3	16.8	6.5×10^{-5}	1.9×10^{-9}	2060	-7525
Tshirege 1a/1g	244	19.1‡	1.7×10^{-4}	5.8×10^{-9}	1475	-8912
			Well 54-1003			
Tshirege 2a/1v	102	2.9	1.3×10^{-4}	2.3×10^{-13}	41533	-44642
Tshirege 1b/1v	119.5		9.9×10^{-5}			
Tshirege 1a/1g	157	5.8	1.3×10^{-4}	1.2×10^{-11}	10172	-14958
Tshirege 1a/1g	207		1.5×10^{-4}			
Tshirege 1a/1g	261		2.7×10^{-4}			
Tshirege 1a/1g	271.5		2.6×10^{-4}			
			Well 54-1006			
Tshirege 2b/2	42	10.5	4.1×10^{-4}	7.2×10^{-10}	3054	-4334
Tshirege 2a/1v	76.9	1.4	9.8×10^{-5}	3.4×10^{-14}	42136	-44480
Tshirege 1b/1v	124.5	5.7	4.5×10^{-5}	2.3×10^{-12}	14865	-18659
Tshirege 1b/1v	136.7	13.3	5.7×10^{-5}	2.5×10^{-9}	4411	-8578
Tshirege 1a/1g	161		1.2×10^{-4}			

*The second Tshirege Unit designation follows the correlation of Vaniman and Wohletz (1990) and Vaniman (1991) (R. H. Gilkeson, personal communication, 1994).

† First line calculated from van Genuchten fit, second interpolated from retention data.

‡ From field core moisture content of 7.5; Stephens et al. θ value of 27.0 seems unrealistic.