

DOCKETED	
Docket Number:	23-AFC-02
Project Title:	Elmore North Geothermal Project (ENGP)
TN #:	252490-4
Document Title:	Elmore North Geothermal Project Data Request Response Set 1 Part 4
Description:	N/A
Filer:	Jerry Salamy
Organization:	Jacobs
Submitter Role:	Applicant Consultant
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LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-1				Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)											
Est. GWT (ft): 5															
Base	Base	Avg		1											
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Norm.	Est.	Rel.	Nk:	17	
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	% Fines	Dens. Dr (%)	Phi (deg.)	Su (tsf)	OCR
0.15	0.5	41.84	3.83	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	17	55			2.48	>10
0.30	1.0	29.64	7.47	3	3	Clay	CL/CH	very stiff	125	24	85			1.74	>10
0.45	1.5	19.74	6.64	3	3	Clay	CL/CH	very stiff	125	16	95			1.16	>10
0.60	2.0	13.98	8.36	3	3	Clay	CL/CH	stiff	125	11	100			0.82	>10
0.75	2.5	16.42	7.43	3	3	Clay	CL/CH	stiff	125	13	100			0.96	>10
0.93	3.0	10.04	6.02	3	3	Clay	CL/CH	stiff	125	8	100			0.58	>10
1.08	3.5	10.59	6.04	3	3	Clay	CL/CH	stiff	125	8	100			0.61	>10
1.23	4.0	7.42	4.03	3	3	Clay	CL/CH	firm	125	6	100			0.42	>10
1.38	4.5	4.58	6.15	3	3	Clay	CL/CH	firm	125	4	100			0.25	5.88
1.53	5.0	6.26	5.78	3	3	Clay	CL/CH	firm	125	5	100			0.35	9.27
1.68	5.5	6.19	5.76	3	3	Clay	CL/CH	firm	125	5	100			0.35	7.27
1.83	6.0	9.22	3.04	4	4	Silty Clay to Clay	CL	stiff	125	5	95			0.52	>10
1.98	6.5	10.15	2.36	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	4	85			0.58	>10
2.13	7.0	7.12	2.57	4	4	Silty Clay to Clay	CL	firm	125	4	100			0.40	>10
2.28	7.5	5.87	3.10	3	3	Clay	CL/CH	firm	125	5	100			0.32	5.00
2.45	8.0	10.79	1.50	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	4	75			0.61	>10
2.60	8.5	9.07	2.68	4	4	Silty Clay to Clay	CL	stiff	125	5	95			0.51	>10
2.75	9.0	5.91	2.68	3	3	Clay	CL/CH	firm	125	5	100			0.32	4.18
2.90	9.5	18.95	1.27	6	6	Sandy Silt to Clayey Silt	ML	loose	115	5	28.0	35	33		
3.05	10.0	38.29	1.05	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	9	55.8	30	55	36	
3.20	10.5	38.31	1.80	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	11	55.0	40	55	36	
3.35	11.0	25.81	1.31	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	7	36.5	45	43	34	
3.50	11.5	25.89	1.15	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	7	36.1	40	42	34	
3.65	12.0	34.08	1.33	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	8	46.9	40	50	35	
3.80	12.5	56.80	1.12	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	77.2	25	65	37	
3.95	13.0	74.83	1.33	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	17	100.4	25	73	38	
4.13	13.5	72.31	1.52	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	16	95.9	25	71	38	
4.28	14.0	64.25	1.51	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	84.1	30	67	37	
4.43	14.5	63.83	1.65	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	82.6	30	67	37	
4.58	15.0	52.87	1.95	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	12	67.6	40	61	37	
4.73	15.5	51.59	2.32	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	15	65.3	45	60	36	
4.88	16.0	79.66	2.25	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	18	99.7	35	72	38	
5.03	16.5	101.38	1.65	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	23	125.5	25	79	39	
5.18	17.0	32.16	4.14	4	4	Silty Clay to Clay	CL	very stiff	125	18	75			1.85	>10
5.33	17.5	16.86	3.22	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7	90			0.95	>10
5.48	18.0	73.20	1.22	8	8	Sand to Silty Sand	SP/SM	medium dense	115	13	87.6	25	69	38	
5.65	18.5	104.08	1.56	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	23	123.3	25	79	39	
5.80	19.0	63.13	1.78	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	74.1	40	64	37	
5.95	19.5	36.18	2.54	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	10	42.1	60	47	35	
6.10	20.0	14.31	4.13	3	3	Clay	CL/CH	stiff	125	11	100			0.80	7.41
6.25	20.5	14.67	4.06	3	3	Clay	CL/CH	stiff	125	12	100			0.82	7.41
6.40	21.0	12.25	4.41	3	3	Clay	CL/CH	stiff	125	10	100			0.68	5.31
6.55	21.5	14.05	4.97	3	3	Clay	CL/CH	stiff	125	11	100			0.78	6.43
6.70	22.0	14.00	5.41	3	3	Clay	CL/CH	stiff	125	11	100			0.78	6.21
6.85	22.5	13.92	5.14	3	3	Clay	CL/CH	stiff	125	11	100			0.77	6.00
7.00	23.0	12.81	5.65	3	3	Clay	CL/CH	stiff	125	10	100			0.71	5.00
7.18	23.5	51.36	0.86	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	55.1	35	55	36	
7.33	24.0	31.31	1.98	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	9	33.3	65	40	34	
7.48	24.5	8.70	2.94	4	4	Silty Clay to Clay	CL	firm	125	5	100			0.46	3.28
7.63	25.0	11.96	2.99	4	4	Silty Clay to Clay	CL	stiff	125	7	100			0.65	5.21
7.78	25.5	25.57	1.80	6	6	Sandy Silt to Clayey Silt	ML	loose	115	7	26.5	70	33	33	
7.93	26.0	35.57	1.31	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	8	36.6	50	43	34	
8.08	26.5	51.36	1.34	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	52.5	45	53	35	
8.23	27.0	44.22	1.79	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	44.8	55	49	35	
8.38	27.5	42.15	1.68	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	9	42.4	55	47	35	
8.53	28.0	76.34	1.24	8	8	Sand to Silty Sand	SP/SM	medium dense	115	14	76.3	35	65	37	
8.68	28.5	37.04	3.53	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	15	80			2.12	>10
8.85	29.0	54.80	1.83	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	12	54.0	50	54	36	
9.00	29.5	107.46	1.62	8	8	Sand to Silty Sand	SP/SM	dense	115	20	105.2	30	74	38	
9.15	30.0	111.06	1.79	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	25	108.0	35	75	38	
9.30	30.5	112.49	1.40	8	8	Sand to Silty Sand	SP/SM	dense	115	20	108.7	30	75	38	
9.45	31.0	98.16	1.78	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	22	94.2	35	71	38	
9.60	31.5	107.80	1.35	8	8	Sand to Silty Sand	SP/SM	dense	115	20	102.8	30	73	38	
9.75	32.0	113.53	1.62	8	8	Sand to Silty Sand	SP/SM	dense	115	21	107.6	35	75	38	
9.90	32.5	85.86	1.86	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	19	80.9	40	66	37	
10.05	33.0	61.61	1.85	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	57.7	50	56	36	
10.20	33.5	38.97	2.41	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	11	38.3	70	43	34	
10.38	34.0	15.64	3.54	4	4	Silty Clay to Clay	CL	stiff	125	9	100			0.85	5.42
10.53	34.5	14.02	6.14	3	3	Clay	CL/CH	stiff	125	11	100			0.76	3.50
10.68	35.0	8.50	5.38	3	3	Clay	CL/CH	firm	125	7	100			0.43	1.63
10.83	35.5	5.30	3.72	3	3	Clay	CL/CH	soft	125	4	100			0.24	0.88
10.98	36.0	5.24	3.36	3	3	Clay	CL/CH	soft	125	4	100			0.24	0.86
11.13	36.5	7.99	3.92	3	3	Clay	CL/CH	firm	125	6	100			0.40	1.43
11.28	37.0	9.77	4.15	3	3	Clay	CL/CH	stiff	125	8	100			0.50	1.92
11.43	37.5	9.55	3.95	3	3	Clay	CL/CH	firm	125	8	100			0.49	1.77
11.58	38.0	8.91	3.57	3	3	Clay	CL/CH	firm	125	7	100			0.45	1.56
11.73	38.5	7.94	3.13	4	4	Silty Clay to Clay	CL	firm	125	5	100			0.39	1.63
11.88	39.0	7.91	3.18	3	3	Clay	CL/CH	firm	125	6	100			0.39	1.25
12.05	39.5	7.23	2.93	4	4	Silty Clay to Clay	CL	firm	125	4	100			0.35	1.37
12.20	40.0	7.04	2.82	4	4	Silty Clay to Clay	CL	firm	125	4	100			0.34	1.25
12.35	40.5	7.12	2.75	4	4	Silty Clay to Clay	CL	firm	125	4	100			0.34	1.25
12.50	41.0	7.20	2.61	4	4	Silty Clay to Clay	CL	firm	125	4	100			0.35	1.25
12.65	41.5	11.74	3.00	4	4	Silty Clay to Clay	CL	stiff	125	7	100			0.61	2.65
12.80	42.0	17.98	2.58	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7	100			0.98	6.65

LANDMARK CONSULTANTS, INC.

CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

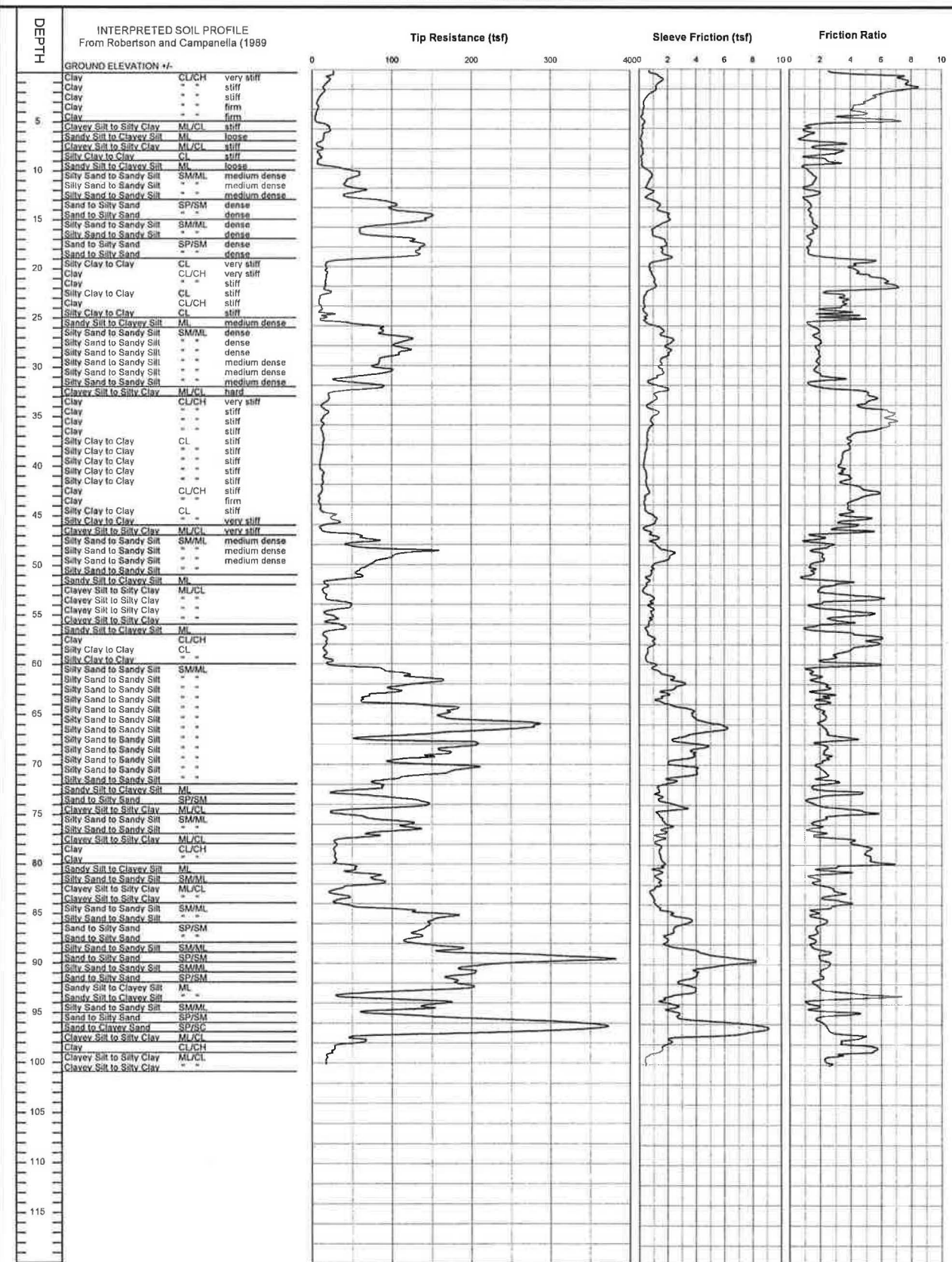
Date: 6/28/2011

CONE SOUNDING: CPT-1				Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)											
Est. GWT (ft): 5															
Base	Base	Avg	Avg	1					Est.			Est.	Rel.	Nk:	17
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Norm.	%	Dens.	Phi	Su	OCR
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dr (%)	(deg.)	(tsf)	
12.95	42.5	28.08	1.63	6	6	Sandy Silt to Clayey Silt	ML	loose	115	8	23.3	80	29	32	
13.10	43.0	15.80	2.91	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	8		100			0.85 5.21
13.25	43.5	24.13	2.13	6	6	Sandy Silt to Clayey Silt	ML	loose	115	7	19.8	95	25	31	
13.40	44.0	51.60	1.12	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	42.2	50	47	35	
13.58	44.5	43.64	1.74	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	35.6	65	42	34	
13.73	45.0	11.47	2.33	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5		100			0.59 3.00
13.88	45.5	8.52	1.94	5	5	Clayey Silt to Silty Clay	ML/CL	firm	120	3		100			0.42 1.84
14.03	46.0	8.58	1.76	5	5	Clayey Silt to Silty Clay	ML/CL	firm	120	3		100			0.42 1.84
14.18	46.5	8.62	2.40	4	4	Silty Clay to Clay	CL	firm	125	5		100			0.43 1.43
14.33	47.0	17.23	2.78	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7		100			0.93 5.21
14.48	47.5	14.87	3.12	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		100			0.79 4.00
14.63	48.0	10.27	3.10	4	4	Silty Clay to Clay	CL	stiff	125	6		100			0.51 1.77
14.78	48.5	8.17	2.37	4	4	Silty Clay to Clay	CL	firm	125	5		100			0.39 1.25
14.93	49.0	9.45	2.81	4	4	Silty Clay to Clay	CL	firm	125	5		100			0.46 1.50
15.10	49.5	17.53	3.58	4	4	Silty Clay to Clay	CL	stiff	125	10		100			0.94 3.66
15.25	50.0	24.47	2.17	6	6	Sandy Silt to Clayey Silt	ML	loose	115	7	18.9	100	23	31	

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight

DATE: 6/28/2011

CONE SOUNDING DATA CPT-2



END OF SOUNDING AT 100 ft.

Project No.
LE111138

LANDMARK

Geo-Engineers and Geologists

PLATE
B-37

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-2				Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)													
Est. GWT (ft): 4																	
Base	Base	Avg		1													
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Norm.	%	Rel.	Nk:				
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dens.	Phi	Su	OCR		
												Dr (%)	(deg.)	(tsf)			
0.15	0.5	26.72	3.36	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	65			1.57	>10		
0.30	1.0	20.89	7.37	3	3	Clay	CL/CH	very stiff	125	17	95			1.23	>10		
0.45	1.5	18.61	7.74	3	3	Clay	CL/CH	very stiff	125	15	100			1.09	>10		
0.60	2.0	14.76	8.10	3	3	Clay	CL/CH	stiff	125	12	100			0.86	>10		
0.75	2.5	14.24	6.45	3	3	Clay	CL/CH	stiff	125	11	100			0.83	>10		
0.93	3.0	9.42	5.53	3	3	Clay	CL/CH	stiff	125	8	100			0.54	>10		
1.08	3.5	6.52	5.00	3	3	Clay	CL/CH	firm	125	5	100			0.37	>10		
1.23	4.0	7.86	4.19	3	3	Clay	CL/CH	firm	125	6	100			0.45	>10		
1.38	4.5	5.76	4.60	3	3	Clay	CL/CH	firm	125	5	100			0.32	9.79		
1.53	5.0	4.25	4.11	3	3	Clay	CL/CH	soft	125	3	100			0.23	5.10		
1.68	5.5	10.82	4.51	3	3	Clay	CL/CH	stiff	125	9	100			0.62	>10		
1.83	6.0	22.25	1.12	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	6	39.9	45	45	34			
1.98	6.5	17.36	1.32	6	6	Sandy Silt to Clayey Silt	ML	loose	115	5	30.4	55	37	33			
2.13	7.0	14.62	0.84	6	6	Sandy Silt to Clayey Silt	ML	loose	115	4	25.1	50	32	32			
2.28	7.5	8.20	2.70	4	4	Silty Clay to Clay	CL	firm	125	5	100			0.46	>10		
2.45	8.0	11.59	1.78	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5	75			0.66	>10		
2.60	8.5	8.27	3.23	3	3	Clay	CL/CH	firm	125	7	100			0.46	9.39		
2.75	9.0	10.44	1.65	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	4	75			0.59	>10		
2.90	9.5	7.23	2.82	4	4	Silty Clay to Clay	CL	firm	125	4	100			0.40	8.41		
3.05	10.0	28.50	0.97	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	6	43.3	35	48	35			
3.20	10.5	55.95	1.31	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	12	83.7	30	67	37			
3.35	11.0	53.64	1.66	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	12	79.0	35	66	37			
3.50	11.5	42.64	1.63	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	9	61.9	35	58	36			
3.65	12.0	46.11	1.20	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	65.9	30	60	36			
3.80	12.5	59.88	1.59	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	84.4	30	67	37			
3.95	13.0	42.92	1.43	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	59.7	35	57	36			
4.13	13.5	88.90	1.13	8	8	Sand to Silty Sand	SP/SM	dense	115	16	122.0	20	78	39			
4.28	14.0	102.47	1.41	8	8	Sand to Silty Sand	SP/SM	dense	115	19	138.8	20	82	40			
4.43	14.5	111.70	1.29	8	8	Sand to Silty Sand	SP/SM	dense	115	20	149.4	20	84	40			
4.58	15.0	149.29	1.38	8	8	Sand to Silty Sand	SP/SM	very dense	115	27	197.3	15	93	41			
4.73	15.5	137.55	1.51	8	8	Sand to Silty Sand	SP/SM	dense	115	25	179.6	20	90	41			
4.88	16.0	80.80	1.72	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	18	104.3	30	74	38			
5.03	16.5	60.04	1.56	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	76.6	35	65	37			
5.18	17.0	94.83	1.25	8	8	Sand to Silty Sand	SP/SM	dense	115	17	119.4	20	78	39			
5.33	17.5	129.17	1.42	8	8	Sand to Silty Sand	SP/SM	dense	115	23	161.2	20	87	40			
5.48	18.0	138.28	1.29	8	8	Sand to Silty Sand	SP/SM	dense	115	25	170.7	15	88	40			
5.65	18.5	132.03	1.24	8	8	Sand to Silty Sand	SP/SM	dense	115	24	161.3	20	87	40			
5.80	19.0	121.24	1.75	8	8	Sand to Silty Sand	SP/SM	dense	115	22	146.6	25	84	40			
5.95	19.5	34.33	4.91	3	3	Clay	CL/CH	very stiff	125	27	80			1.98	>10		
6.10	20.0	17.62	4.16	4	4	Silty Clay to Clay	CL	stiff	125	10	95			1.00	>10		
6.25	20.5	18.32	4.40	3	3	Clay	CL/CH	very stiff	125	15	100			1.04	>10		
6.40	21.0	18.72	4.99	3	3	Clay	CL/CH	very stiff	125	15	100			1.06	>10		
6.55	21.5	17.37	6.31	3	3	Clay	CL/CH	stiff	125	14	100			0.98	>10		
6.70	22.0	17.26	6.74	3	3	Clay	CL/CH	stiff	125	14	100			0.97	>10		
6.85	22.5	18.52	4.94	3	3	Clay	CL/CH	very stiff	125	15	100			1.05	>10		
7.00	23.0	15.74	3.10	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	6	100			0.88	>10		
7.18	23.5	9.77	3.56	3	3	Clay	CL/CH	stiff	125	8	100			0.53	3.50		
7.33	24.0	10.09	3.56	3	3	Clay	CL/CH	stiff	125	8	100			0.55	3.58		
7.48	24.5	12.00	2.73	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5	100			0.66	8.00		
7.63	25.0	17.10	3.51	4	4	Silty Clay to Clay	CL	stiff	125	10	100			0.96	>10		
7.78	25.5	13.83	3.29	4	4	Silty Clay to Clay	CL	stiff	125	8	100			0.76	6.88		
7.93	26.0	55.70	1.25	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	12	58.4	40	57	36			
8.08	26.5	88.12	1.84	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	20	91.7	35	70	38			
8.23	27.0	99.58	1.67	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	22	102.8	30	73	38			
8.38	27.5	120.17	1.99	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	27	123.2	35	79	39			
8.53	28.0	104.81	1.91	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	23	106.6	35	74	38			
8.68	28.5	117.45	1.86	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	26	118.6	30	78	39			
8.85	29.0	104.58	1.96	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	23	104.9	35	74	38			
9.00	29.5	85.11	1.84	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	19	84.8	40	68	37			
9.15	30.0	80.17	1.90	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	79.3	40	66	37			
9.30	30.5	94.19	1.68	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	21	92.6	35	70	38			
9.45	31.0	78.07	2.00	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	17	76.2	45	64	37			
9.60	31.5	35.04	2.88	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	10	34.0	75	41	34			
9.75	32.0	70.81	1.32	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	68.0	40	61	37			
9.90	32.5	68.99	3.13	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	20	66.0	60	60	36			
10.05	33.0	22.63	5.16	3	3	Clay	CL/CH	very stiff	125	18	100			1.27	8.56		
10.20	33.5	21.49	5.58	3	3	Clay	CL/CH	very stiff	125	17	100			1.20	7.58		
10.38	34.0	15.22	4.87	3	3	Clay	CL/CH	stiff	125	12	100			0.83	4.18		
10.53	34.5	14.25	5.36	3	3	Clay	CL/CH	stiff	125	11	100			0.77	3.74		
10.68	35.0	19.51	6.75	3	3	Clay	CL/CH	very stiff	125	16	100			1.08	6.00		
10.83	35.5	13.71	6.54	3	3	Clay	CL/CH	stiff	125	11	100			0.74	3.43		
10.98	36.0	13.59	6.73	3	3	Clay	CL/CH	stiff	125	11	100			0.73	3.28		
11.13	36.5	12.35	5.92	3	3	Clay	CL/CH	stiff	125	10	100			0.66	2.82		
11.28	37.0	13.81	4.19	3	3	Clay	CL/CH	stiff	125	11	100			0.74	3.28		
11.43	37.5	14.96	3.89	4	4	Silty Clay to Clay	CL	stiff	125	9	100			0.81	4.47		
11.58	38.0	14.01	3.92	4	4	Silty Clay to Clay	CL	stiff	125	8	100			0.75	3.91		
11.73	38.5	13.61	3.87	4	4	Silty Clay to Clay	CL	stiff	125	8	100			0.73	3.74		
11.88	39.0	12.55	3.49	4	4	Silty Clay to Clay	CL	stiff	125	7	100			0.67	3.28		
12.05	39.5	11.28	3.44	4	4	Silty Clay to Clay	CL	stiff	125	6	100			0.59	2.73		
12.20	40.0	10.24	3.31	4	4	Silty Clay to Clay	CL	stiff	125	6	100			0.53	2.34		
12.35	40.5	10.90	3.42	4	4	Silty Clay to Clay	CL	stiff	125	6	100			0.57	2.49		
12.50	41.0	14.31	3.56	4	4	Silty Clay to Clay	CL	stiff	125	8	100			0.77	3.66		
12.65	41.5	13.39	3.87	3	3	Clay	CL/CH	stiff	125	11	100			0.71	2.65		
12.80	42.0	13.64	3.69	4	4	Silty Clay to Clay	CL	stiff	125	8	100			0.72	3.28		

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-2										Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)							
Est. GWT (ft): 4																	
Base Depth	Base Depth	Avg Tip	Avg Friction	1 Soil	Soil		Density or	Est.	SPT	Norm.	Est.	Rel.	Nk:				
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	Density (pcf)	N(60)	Qc1n	% Fines	Dens. Dr (%)	Phi (deg.)	Su (tsf)	OCR		
12.95	42.5	12.83	4.78	3	3	Clay	CL/CH	stiff	125	10	100			0.68	2.41		
13.10	43.0	11.35	5.67	3	3	Clay	CL/CH	stiff	125	9	100			0.59	2.00		
13.25	43.5	9.22	4.56	3	3	Clay	CL/CH	firm	125	7	100			0.46	1.43		
13.40	44.0	9.42	3.88	3	3	Clay	CL/CH	firm	125	8	100			0.47	1.43		
13.58	44.5	10.88	3.65	3	3	Clay	CL/CH	stiff	125	9	100			0.58	1.77		
13.73	45.0	20.13	3.76	4	4	Silty Clay to Clay	CL	very stiff	125	12	100			1.10	5.42		
13.88	45.5	24.96	4.70	3	3	Clay	CL/CH	very stiff	125	20	100			1.38	5.88		
14.03	46.0	29.68	3.68	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12	100			1.66	>10		
14.18	46.5	11.38	3.38	4	4	Silty Clay to Clay	CL	stiff	125	7	100			0.58	2.20		
14.33	47.0	38.27	3.18	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	15	90			2.16	>10		
14.48	47.5	72.77	1.64	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	57.8	56	36				
14.63	48.0	48.61	2.49	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	14	38.5	75	44	34			
14.78	48.5	104.06	1.82	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	23	82.0	45	67	37			
14.93	49.0	111.08	2.13	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	25	87.2	45	68	38			
15.10	49.5	90.68	2.21	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	20	70.8	55	62	37			
15.25	50.0	74.38	1.50	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	17	57.9	50	66	36			
15.40	50.5	62.78	1.48	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	48.6	55	51	35			
15.55	51.0	57.19	1.49	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	44.1	60	48	35			
15.70	51.5	46.81	1.52	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	36.0	65	42	34			
15.85	52.0	16.71	3.42	4	4	Silty Clay to Clay	CL	stiff	125	10	100			0.89	3.35		
16.00	52.5	16.43	2.00	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7	100			0.87	4.18		
16.15	53.0	16.01	2.96	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	6	100			0.84	4.00		
16.30	53.5	17.82	5.66	3	3	Clay	CL/CH	stiff	125	14	100			0.95	2.82		
16.45	54.0	43.32	1.86	6	6	Sandy Silt to Clayey Silt	ML	loose	115	12	32.6	75	39	34			
16.60	54.5	42.39	2.29	6	6	Sandy Silt to Clayey Silt	ML	loose	115	12	31.7	80	39	33			
16.78	55.0	17.41	5.01	3	3	Clay	CL/CH	stiff	125	14	100			0.92	2.65		
16.93	55.5	29.67	2.99	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12	100			1.64	>10		
17.08	56.0	22.94	3.22	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9	100			1.25	6.65		
17.23	56.5	40.92	1.29	7	7	Silty Sand to Sandy Silt	SM/ML	loose	115	9	30.1	70	37	33			
17.38	57.0	18.28	3.48	4	4	Silty Clay to Clay	CL	stiff	125	10	100			0.97	3.35		
17.53	57.5	17.31	5.65	3	3	Clay	CL/CH	stiff	125	14	100			0.91	2.41		
17.68	58.0	18.00	5.63	3	3	Clay	CL/CH	stiff	125	14	100			0.95	2.57		
17.83	58.5	15.32	4.10	3	3	Clay	CL/CH	stiff	125	12	100			0.79	2.00		
17.98	59.0	17.96	3.13	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7	100			0.95	4.00		
18.13	59.5	19.16	2.56	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	8	100			1.02	4.47		
18.30	60.0	21.60	4.73	3	3	Clay	CL/CH	very stiff	125	17	100			1.16	3.21		
18.45	60.5	71.43	1.63	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	50.8	60	53	35			
18.60	61.0	110.42	1.49	8	8	Sand to Silty Sand	SP/SM	medium dense	115	20	78.3	45	65	37			
18.75	61.5	140.15	1.75	8	8	Sand to Silty Sand	SP/SM	dense	115	25	99.1	40	72	38			
18.90	62.0	143.81	2.19	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	32	101.3	45	73	38			
19.05	62.5	101.94	2.46	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	23	71.6	60	63	37			
19.20	63.0	94.41	2.09	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	21	66.1	55	60	36			
19.35	63.5	66.51	2.17	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	46.4	70	50	35			
19.50	64.0	84.79	2.29	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	19	58.9	60	57	36			
19.65	64.5	172.08	1.81	8	8	Sand to Silty Sand	SP/SM	dense	115	31	119.2	40	78	39			
19.80	65.0	169.30	2.24	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	38	116.9	45	77	39			
19.98	65.5	165.21	2.37	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	37	113.7	45	76	39			
20.13	66.0	257.75	1.97	8	8	Sand to Silty Sand	SP/SM	dense	115	47	176.7	35	89	41			
20.28	66.5	270.49	2.26	7	7	Silty Sand to Sandy Silt	SM/ML	very dense	115	60	184.9	35	91	41			
20.43	67.0	177.47	2.46	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	39	120.9	45	78	39			
20.58	67.5	77.84	3.78	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	31	80			4.46	>10		
20.73	68.0	175.89	2.21	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	39	119.0	45	78	39			
20.88	68.5	166.26	2.39	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	37	112.2	45	76	39			
21.03	69.0	162.60	2.41	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	36	109.3	50	75	39			
21.18	69.5	122.87	2.37	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	27	82.4	55	67	37			
21.33	70.0	130.05	1.87	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	29	86.9	50	68	38			
21.50	70.5	195.10	2.09	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	43	130.0	40	80	39			
21.65	71.0	157.98	2.44	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	35	104.9	50	74	38			
21.80	71.5	103.53	2.29	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	23	68.5	60	61	37			
21.95	72.0	80.90	2.40	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	53.4	70	54	36			
22.10	72.5	77.02	1.82	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	17	50.7	65	52	35			
22.25	73.0	37.89	3.96	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	15	100			2.10	>10		
22.40	73.5	108.31	1.42	8	8	Sand to Silty Sand	SP/SM	medium dense	115	20	70.8	50	62	37			
22.55	74.0	143.12	1.60	8	8	Sand to Silty Sand	SP/SM	dense	115	26	93.3	45	70	38			
22.70	74.5	91.38	3.54	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	26	59.4	75	57	36			
22.85	75.0	29.80	4.69	4	4	Silty Clay to Clay	CL	very stiff	125	17	100			1.62	4.89		
23.00	75.5	70.08	2.27	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	45.3	75	49	35			
23.18	76.0	119.63	1.58	8	8	Sand to Silty Sand	SP/SM	medium dense	115	22	77.1	50	65	37			
23.33	76.5	123.17	1.58	8	8	Sand to Silty Sand	SP/SM	medium dense	115	22	79.1	50	66	37			
23.48	77.0	83.10	1.96	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	53.2	65	54	36			
23.63	77.5	60.34	2.97	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	17	38.5	90	44	34			
23.78	78.0	28.81	4.18	4	4	Silty Clay to Clay	CL	very stiff	125	16	100			1.56	4.28		
23.93	78.5	28.50	5.18	3	3	Clay	CL/CH	very stiff	125	23	100			1.54	3.35		
24.08	79.0	28.51	5.07	3	3	Clay	CL/CH	very stiff	125	23	100			1.54	3.35		
24.23	79.5	29.20	5.30	3	3	Clay	CL/CH	very stiff	125	23	100			1.58	3.43		
24.38	80.0	34.82	5.32	3	3	Clay	CL/CH	very stiff	125	28	100			1.91	4.37		
24.53	80.5	54.23	2.47	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	15	34.0	90	41	34			
24.68	81.0	61.58	2.55	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	18	38.5	85	44	34			
24.83	81.5	76.81	1.78	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	17	47.9	65	51	35			
24.98	82.0	85.15	1.72	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	19	52.9	65	54	36			
25.13	82.5	36.79	2.78	6	6	Sandy Silt to Clayey Silt	ML	loose	115	11	22.8	100	29	32			
25.28	83.0	24.86	3.22	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10	100			1.32	4.18		
25.43	83.5	42.33	2.45	6	6	Sandy Silt to Clayey Silt	ML	loose	115	12	26.1	100	33	33			
25.58	84.0	30.89	3.61	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12	100			1.67	5.88		

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-2				Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)													
Est. GWT (ft): 4																	
Base	Base	Avg	Avg	1					Est.								
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Nom.	%	Est.	Rel.	Nk:			
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dens.	Dr (%)	Phi (deg.)	Su (tsf)	OCR	
25.73	84.5	70.10	2.25	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	43.0	75	48	35			
25.88	85.0	139.58	1.84	8	8	Sand to Silty Sand	SP/SM	medium dense	115	25	85.3	50	68	37			
26.03	85.5	168.60	1.93	8	8	Sand to Silty Sand	SP/SM	dense	115	31	102.8	45	73	38			
26.17	86.0	147.57	2.29	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	33	89.7	55	69	38			
26.32	86.5	143.40	1.74	8	8	Sand to Silty Sand	SP/SM	medium dense	115	26	87.0	50	68	38			
26.47	87.0	129.58	1.77	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	29	78.4	50	65	37			
26.62	87.5	132.92	1.40	8	8	Sand to Silty Sand	SP/SM	medium dense	115	24	80.2	45	66	37			
26.77	88.0	119.22	1.57	8	8	Sand to Silty Sand	SP/SM	medium dense	115	22	71.8	50	63	37			
26.92	88.5	166.25	1.56	8	8	Sand to Silty Sand	SP/SM	dense	115	30	99.8	45	72	38			
27.07	89.0	197.97	2.35	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	44	118.6	50	78	39			
27.22	89.5	350.67	2.02	8	8	Sand to Silty Sand	SP/SM	very dense	115	64	209.5	35	94	41			
27.37	90.0	268.23	2.60	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	60	159.9	45	86	40			
27.52	90.5	191.47	2.27	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	43	113.8	50	76	39			
27.67	91.0	203.55	2.01	8	8	Sand to Silty Sand	SP/SM	dense	115	37	120.7	45	78	39			
27.82	91.5	172.87	2.06	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	38	102.3	50	73	38			
27.97	92.0	181.78	1.60	8	8	Sand to Silty Sand	SP/SM	dense	115	33	107.3	45	75	38			
28.12	92.5	196.71	1.98	8	8	Sand to Silty Sand	SP/SM	dense	115	36	115.8	45	77	39			
28.27	93.0	89.76	4.13	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	36		90			5.12	>10	
28.42	93.5	48.26	4.86	4	4	Silty Clay to Clay	CL	hard	125	28		100			2.68	7.70	
28.57	94.0	157.29	1.22	8	8	Sand to Silty Sand	SP/SM	medium dense	115	29	91.9	40	70	38			
28.72	94.5	143.64	1.67	8	8	Sand to Silty Sand	SP/SM	medium dense	115	26	83.7	50	67	37			
28.87	95.0	76.59	3.67	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	31		90			4.34	>10	
29.02	95.5	153.02	1.93	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	34	88.7	50	69	38			
29.17	96.0	299.19	2.13	8	8	Sand to Silty Sand	SP/SM	dense	115	54	173.1	40	89	40			
29.32	96.5	365.38	2.44	12	12	Sand to Clayey Sand	SP/SC	very dense	115	183	210.9	35	95	41			
29.47	97.0	270.78	2.92	12	12	Sand to Clayey Sand	SP/SC	dense	115	135	155.9	50	86	40			
29.72	97.5	69.10	4.69	11	11	Overconsolidated Soil	??	medium dense	120	69	39.7	100	45	34			
29.87	98.0	63.63	3.36	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	18	36.6	100	43	34			
30.02	98.5	30.01	5.50	3	3	Clay	CL/CH	very stiff	125	24		100			1.60	2.73	
30.18	99.0	24.28	4.39	4	4	Silty Clay to Clay	CL	very stiff	125	14		100			1.26	2.41	
30.33	99.5	18.39	2.34	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7		100			0.91	2.06	
30.48	100.0	17.33	2.57	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7		100			0.85	1.84	

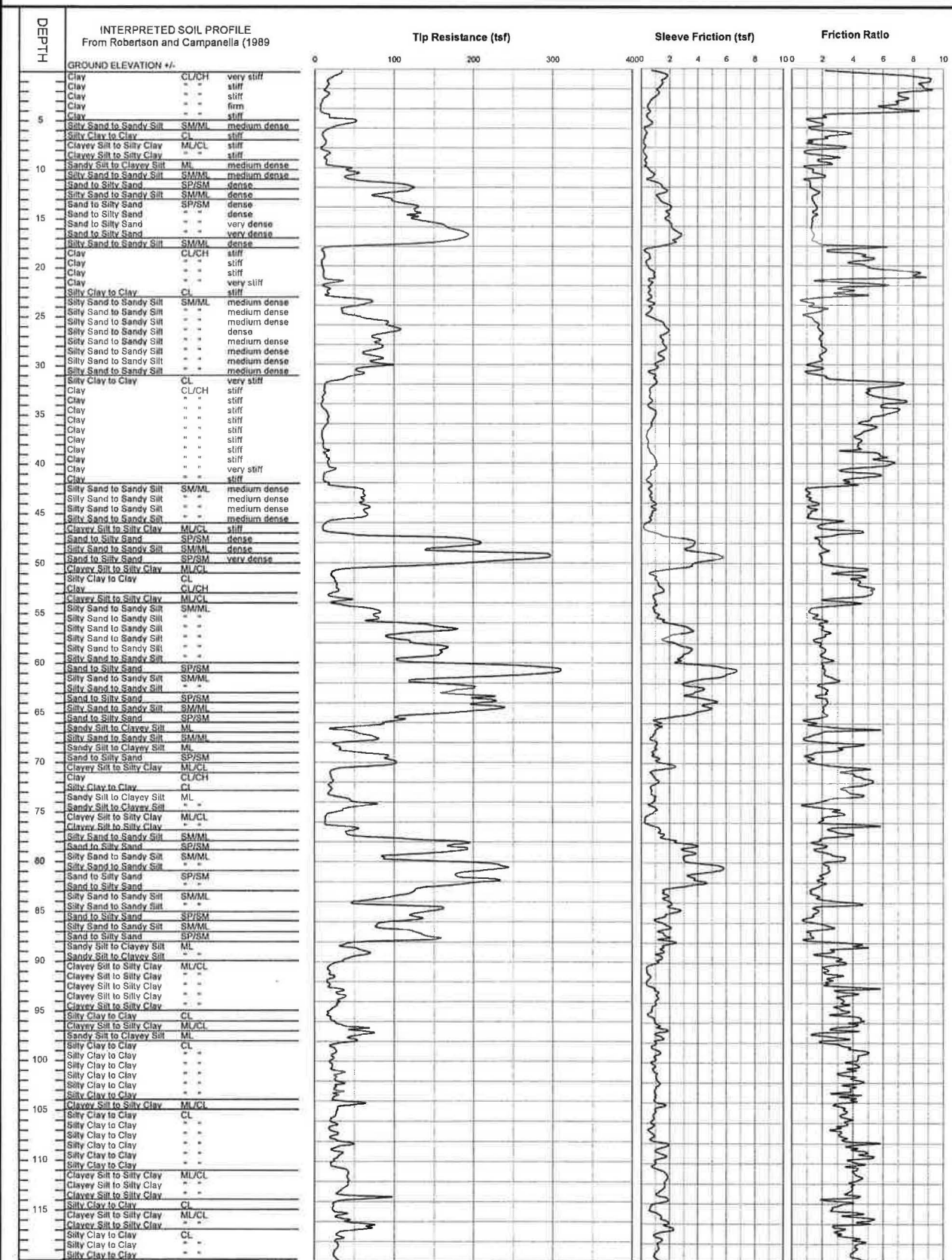
CLIENT: Cal Energy
PROJECT: Black Rock 5-6 Geothermal Plant -- Calipatria, CA

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric
Cone with 23 ton reaction weight

LOCATION: See Site and Boring Location Plan

DATE: 6/28/2011

CONE SOUNDING DATA CPT-3



Project No.
LE111138

LANDMARK
Geo-Engineers and Geologists

PLATE
B-38

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-3				Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)													
Est. GWT (ft): 4																	
Base	Base	Avg		1													
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Norm.	%	Rel.	Nk:				
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dens.	Phi	Su	OCR		
												Dr (%)	(deg.)	(tsf)			
0.15	0.5	32.79	3.81	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		60		1.93	>10		
0.30	1.0	21.60	8.31	3	3	Clay	CL/CH	very stiff	125	17		100		1.27	>10		
0.45	1.5	16.79	8.86	3	3	Clay	CL/CH	stiff	125	13		100		0.98	>10		
0.60	2.0	15.37	8.63	3	3	Clay	CL/CH	stiff	125	12		100		0.90	>10		
0.75	2.5	15.33	7.98	3	3	Clay	CL/CH	stiff	125	12		100		0.89	>10		
0.93	3.0	14.22	7.25	3	3	Clay	CL/CH	stiff	125	11		100		0.83	>10		
1.08	3.5	9.22	7.06	3	3	Clay	CL/CH	stiff	125	7		100		0.53	>10		
1.23	4.0	7.38	6.27	3	3	Clay	CL/CH	firm	125	6		100		0.42	>10		
1.38	4.5	8.21	7.08	3	3	Clay	CL/CH	firm	125	7		100		0.47	>10		
1.53	5.0	18.37	2.19	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	7		65		1.07	>10		
1.68	5.5	46.91	1.47	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	86.6	35	68	38			
1.83	6.0	22.01	1.44	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	6	39.7	50	45	34			
1.98	6.5	11.25	3.11	4	4	Silty Clay to Clay	CL	stiff	125	6		90		0.64	>10		
2.13	7.0	10.89	2.46	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	4		85		0.62	>10		
2.28	7.5	13.97	1.14	6	6	Sandy Silt to Clayey Silt	ML	loose	115	4	23.5	60	30	32			
2.45	8.0	9.62	3.01	4	4	Silty Clay to Clay	CL	stiff	125	5		95		0.55	>10		
2.60	8.5	16.11	1.00	6	6	Sandy Silt to Clayey Silt	ML	loose	115	5	26.0	50	33	33			
2.75	9.0	13.76	2.46	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		75		0.79	>10		
2.90	9.5	14.98	1.95	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		70		0.86	>10		
3.05	10.0	29.66	1.46	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	9	45.6	45	49	35			
3.20	10.5	46.91	1.39	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	70.5	30	62	37			
3.35	11.0	42.18	2.07	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	12	62.5	40	59	36			
3.50	11.5	66.37	1.05	8	8	Sand to Silty Sand	SP/SM	dense	115	12	96.8	20	72	38			
3.65	12.0	119.18	1.20	8	8	Sand to Silty Sand	SP/SM	dense	115	22	171.3	15	88	40			
3.80	12.5	111.73	1.59	8	8	Sand to Silty Sand	SP/SM	dense	115	20	158.4	20	86	40			
3.95	13.0	79.86	1.50	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	18	111.6	25	76	39			
4.13	13.5	98.73	1.36	8	8	Sand to Silty Sand	SP/SM	dense	115	18	136.2	20	82	39			
4.28	14.0	123.92	1.55	8	8	Sand to Silty Sand	SP/SM	dense	115	23	168.7	20	88	40			
4.43	14.5	126.46	1.55	8	8	Sand to Silty Sand	SP/SM	dense	115	23	170.0	20	88	40			
4.58	15.0	126.89	1.52	8	8	Sand to Silty Sand	SP/SM	dense	115	23	168.5	20	88	40			
4.73	15.5	130.24	1.36	8	8	Sand to Silty Sand	SP/SM	dense	115	24	170.8	20	88	40			
4.88	16.0	161.59	1.31	8	8	Sand to Silty Sand	SP/SM	very dense	115	29	209.5	15	94	41			
5.03	16.5	183.53	1.32	8	8	Sand to Silty Sand	SP/SM	very dense	115	33	235.2	15	98	42			
5.18	17.0	191.35	1.45	8	8	Sand to Silty Sand	SP/SM	very dense	115	35	242.4	15	99	42			
5.33	17.5	166.23	1.45	8	8	Sand to Silty Sand	SP/SM	very dense	115	30	208.3	15	94	41			
5.48	18.0	67.85	3.54	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	19	84.1	50	67	37			
5.65	18.5	10.24	3.00	4	4	Silty Clay to Clay	CL	stiff	125	6		100		0.57	6.76		
5.80	19.0	12.13	4.59	3	3	Clay	CL/CH	stiff	125	10		100		0.68	6.65		
5.95	19.5	10.05	4.90	3	3	Clay	CL/CH	stiff	125	8		100		0.55	4.68		
6.10	20.0	9.13	4.42	3	3	Clay	CL/CH	firm	125	7		100		0.50	3.91		
6.25	20.5	10.97	6.19	3	3	Clay	CL/CH	stiff	125	9		100		0.60	5.00		
6.40	21.0	11.16	8.22	3	3	Clay	CL/CH	stiff	125	9		100		0.61	5.00		
6.55	21.5	21.09	4.54	3	3	Clay	CL/CH	very stiff	125	17		95		1.20	>10		
6.70	22.0	15.39	5.10	3	3	Clay	CL/CH	stiff	125	12		100		0.86	8.00		
6.85	22.5	17.06	3.49	4	4	Silty Clay to Clay	CL	stiff	125	10		100		0.96	>10		
7.00	23.0	15.61	3.74	4	4	Silty Clay to Clay	CL	stiff	125	9		100		0.87	>10		
7.18	23.5	50.51	1.49	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	55.4	40	55	36			
7.33	24.0	65.49	1.27	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	71.3	35	62	37			
7.48	24.5	37.52	1.86	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	11	40.5	55	46	34			
7.63	25.0	37.79	1.32	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	8	40.5	50	46	34			
7.78	25.5	64.83	1.26	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	68.9	35	61	37			
7.93	26.0	91.56	1.66	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	20	96.5	35	71	38			
8.08	26.5	102.84	1.78	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	23	107.6	30	75	38			
8.23	27.0	81.61	1.98	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	84.7	40	68	37			
8.38	27.5	78.79	1.85	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	81.2	40	66	37			
8.53	28.0	80.44	1.93	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	82.3	40	67	37			
8.68	28.5	78.83	2.17	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	80.1	45	66	37			
8.85	29.0	64.34	1.99	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	64.9	45	60	36			
9.00	29.5	81.29	1.92	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	81.4	40	66	37			
9.15	30.0	83.38	1.33	8	8	Sand to Silty Sand	SP/SM	medium dense	115	15	82.9	35	67	37			
9.30	30.5	61.19	1.81	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	60.4	45	58	36			
9.45	31.0	58.58	1.23	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	57.5	40	58	36			
9.60	31.5	40.03	2.47	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	11	39.0	65	45	34			
9.75	32.0	16.59	6.58	3	3	Clay	CL/CH	stiff	125	13		100		0.92	5.31		
9.90	32.5	12.44	5.69	3	3	Clay	CL/CH	stiff	125	10		100		0.87	3.35		
10.05	33.0	12.65	5.02	3	3	Clay	CL/CH	stiff	125	10		100		0.88	3.35		
10.20	33.5	10.58	5.96	3	3	Clay	CL/CH	stiff	125	8		100		0.56	2.57		
10.38	34.0	9.72	7.05	3	3	Clay	CL/CH	stiff	125	8		100		0.51	2.20		
10.53	34.5	9.57	6.28	3	3	Clay	CL/CH	firm	125	8		100		0.50	2.13		
10.68	35.0	15.24	6.71	3	3	Clay	CL/CH	stiff	125	12		100		0.83	4.00		
10.83	35.5	17.34	5.49	3	3	Clay	CL/CH	stiff	125	14		100		0.95	4.89		
10.98	36.0	16.46	4.70	3	3	Clay	CL/CH	stiff	125	13		100		0.90	4.37		
11.13	36.5	12.61	5.28	3	3	Clay	CL/CH	stiff	125	10		100		0.67	2.91		
11.28	37.0	9.49	4.56	3	3	Clay	CL/CH	firm	125	8		100		0.49	1.92		
11.43	37.5	9.66	4.27	3	3	Clay	CL/CH	firm	125	8		100		0.50	1.92		
11.58	38.0	11.02	4.44	3	3	Clay	CL/CH	stiff	125	9		100		0.58	2.27		
11.73	38.5	11.56	4.39	3	3	Clay	CL/CH	stiff	125	9		100		0.61	2.34		
11.88	39.0	14.51	4.81	3	3	Clay	CL/CH	stiff	125	12		100		0.78	3.28		
12.05	39.5	16.36	5.80	3	3	Clay	CL/CH	stiff	125	13		100		0.89	3.74		
12.20	40.0	16.69	6.46	3	3	Clay	CL/CH	stiff	125	13		100		0.91	3.83		
12.35	40.5	20.82	4.97	3	3	Clay	CL/CH	very stiff	125	17		100		1.15	5.31		
12.50	41.0	17.81	4.11	4	4	Silty Clay to Clay	CL	stiff	125	10		100		0.97	5.21		
12.65	41.5	11.83	4.98	3	3	Clay	CL/CH	stiff	125	9		100		0.61	2.13		
12.80	42.0	14.10	3.54	4	4	Silty Clay to Clay	CL	stiff	125	8		100		0.75	3.50		

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-3				Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)													
Est. GWT (ft): 4																	
Base	Base	Avg		1					Est.				Est.	Rel.	Nk:	17	
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Norm.	%	Dens.	Phi	Su	OCR		
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dr (%)	(deg.)	(tsf)			
12.95	42.5	33.36	2.55	6	6	Sandy Silt to Clayey Silt	ML	loose	115	10	28.0	85	35	33			
13.10	43.0	61.83	1.08	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	51.7	45	53	35			
13.25	43.5	61.67	1.09	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	51.3	45	53	35			
13.40	44.0	60.44	1.40	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	50.1	50	52	35			
13.58	44.5	65.78	1.33	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	54.3	50	54	36			
13.73	45.0	63.19	1.41	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	51.9	50	53	35			
13.88	45.5	63.65	1.07	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	52.0	45	53	35			
14.03	46.0	23.51	2.64	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		100			1.30	>10	
14.18	46.5	11.41	1.82	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5		100			0.59	3.00	
14.33	47.0	21.37	3.67	4	4	Silty Clay to Clay	CL	very stiff	125	12		100			1.17	5.78	
14.48	47.5	136.99	1.95	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	30	109.7	40	75	39			
14.63	48.0	207.02	1.82	8	8	Sand to Silty Sand	SP/SM	dense	115	38	165.1	30	87	40			
14.78	48.5	167.62	2.02	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	37	133.1	35	81	39			
14.93	49.0	216.53	2.10	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	48	171.1	30	88	40			
15.10	49.5	290.09	1.94	8	8	Sand to Silty Sand	SP/SM	very dense	115	53	228.3	25	97	42			
15.25	50.0	209.41	1.97	8	8	Sand to Silty Sand	SP/SM	dense	115	38	164.1	30	87	40			
15.40	50.5	91.52	3.72	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	26	71.4	65	63	37			
15.55	51.0	23.78	3.62	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		100			1.31	8.41	
15.70	51.5	22.46	4.42	4	4	Silty Clay to Clay	CL	very stiff	125	13		100			1.23	5.42	
15.85	52.0	26.32	4.41	4	4	Silty Clay to Clay	CL	very stiff	125	15		100			1.45	6.88	
16.00	52.5	27.72	4.90	3	3	Clay	CL/CH	very stiff	125	22		100			1.54	5.76	
16.15	53.0	27.27	5.26	3	3	Clay	CL/CH	very stiff	125	22		100			1.51	5.53	
16.30	53.5	22.79	4.11	4	4	Silty Clay to Clay	CL	very stiff	125	13		100			1.24	5.21	
16.45	54.0	32.68	3.34	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		100			1.82	>10	
16.60	54.5	46.11	2.32	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	13	34.7	80	41	34			
16.78	55.0	80.36	1.22	8	8	Sand to Silty Sand	SP/SM	medium dense	115	15	60.2	45	57	36			
16.93	55.5	76.63	1.56	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	17	57.2	55	56	36			
17.08	56.0	81.70	2.09	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	60.7	55	58	36			
17.23	56.5	151.78	1.96	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	34	112.3	40	76	39			
17.38	57.0	155.00	2.27	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	34	114.3	45	76	39			
17.53	57.5	97.16	1.92	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	22	71.4	50	63	37			
17.68	58.0	124.50	1.78	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	28	91.1	45	70	38			
17.83	58.5	163.38	2.02	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	36	119.1	40	78	39			
17.98	59.0	158.48	2.07	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	35	115.1	40	77	39			
18.13	59.5	128.55	2.19	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	29	93.0	50	70	38			
18.30	60.0	138.35	2.23	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	31	99.8	45	72	38			
18.45	60.5	280.90	2.08	8	8	Sand to Silty Sand	SP/SM	very dense	115	51	201.9	30	93	41			
18.60	61.0	301.64	2.14	8	8	Sand to Silty Sand	SP/SM	very dense	115	55	216.0	30	95	41			
18.75	61.5	207.27	2.58	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	46	147.9	40	84	40			
18.90	62.0	130.93	2.58	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	29	93.1	50	70	38			
19.05	62.5	195.28	1.99	8	8	Sand to Silty Sand	SP/SM	dense	115	36	138.4	35	82	39			
19.20	63.0	168.91	2.30	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	38	119.3	45	78	39			
19.35	63.5	205.40	1.84	8	8	Sand to Silty Sand	SP/SM	dense	115	37	144.5	35	83	40			
19.50	64.0	219.87	2.31	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	49	154.2	40	85	40			
19.65	64.5	221.68	2.11	8	8	Sand to Silty Sand	SP/SM	dense	115	40	154.9	35	85	40			
19.80	65.0	197.37	2.10	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	44	137.5	40	82	39			
19.98	65.5	113.90	2.03	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	25	79.1	50	66	37			
20.13	66.0	100.06	1.18	8	8	Sand to Silty Sand	SP/SM	medium dense	115	18	69.2	45	62	37			
20.28	66.5	62.95	2.21	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	43.4	70	48	35			
20.43	67.0	38.51	3.32	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	15		100			2.15	>10	
20.58	67.5	68.45	1.17	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	46.9	55	50	35			
20.73	68.0	53.92	2.42	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	15	36.8	80	43	34			
20.88	68.5	29.82	3.51	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12		100			1.63	7.85	
21.03	69.0	49.41	1.92	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	33.5	80	40	34			
21.18	69.5	90.75	1.18	8	8	Sand to Silty Sand	SP/SM	medium dense	115	17	61.3	50	58	36			
21.33	70.0	100.39	1.37	8	8	Sand to Silty Sand	SP/SM	medium dense	115	18	67.6	50	61	37			
21.50	70.5	63.83	3.81	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	26		90			3.63	>10	
21.65	71.0	20.79	3.71	4	4	Silty Clay to Clay	CL	very stiff	125	12		100			1.10	3.14	
21.80	71.5	20.59	4.44	3	3	Clay	CL/CH	very stiff	125	16		100			1.09	2.41	
21.95	72.0	22.34	5.22	3	3	Clay	CL/CH	very stiff	125	18		100			1.19	2.73	
22.10	72.5	18.90	3.85	4	4	Silty Clay to Clay	CL	stiff	125	11		100			0.98	2.65	
22.25	73.0	19.76	3.70	4	4	Silty Clay to Clay	CL	very stiff	125	11		100			1.03	2.82	
22.40	73.5	24.94	3.99	4	4	Silty Clay to Clay	CL	very stiff	125	14		100			1.34	3.83	
22.55	74.0	47.52	1.86	7	7	Silty Sand to Sandy Silt	SM/ML	loose	115	11	31.1	85	38	33			
22.70	74.5	62.92	1.38	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	41.1	65	48	34			
22.85	75.0	32.24	3.04	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		100			1.77	7.70	
23.00	75.5	14.88	2.63	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		100			0.74	2.20	
23.18	76.0	13.42	1.92	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5		100			0.66	1.92	
23.33	76.5	23.64	4.30	4	4	Silty Clay to Clay	CL	very stiff	125	14		100			1.26	3.35	
23.48	77.0	48.12	2.72	6	6	Sandy Silt to Clayey Silt	ML	loose	115	14	30.9	95	38	33			
23.63	77.5	47.15	3.34	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	19		100			2.64	>10	
23.78	78.0	139.16	1.66	8	8	Sand to Silty Sand	SP/SM	medium dense	115	25	88.9	45	69				

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING:				CPT-3		Phi Correlation: 0 0-Schm(78),1-R&C(83),2-PHT(74)									
Est. GWT (ft): 4				4											
Base	Base	Avg	Avg	1											
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Norm.	%	Rel.	Nk:		
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dens.	Phi	Su	OCR
												Dr (%)	(deg.)	(tsf)	
25.73	84.5	101.94	2.61	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	23	62.8	70	59	36	
25.88	85.0	150.14	1.68	8	8	Sand to Silty Sand	SP/SM	dense	115	27	92.3	45	70	38	
26.03	85.5	124.05	1.27	8	8	Sand to Silty Sand	SP/SM	medium dense	115	23	76.1	45	64	37	
26.17	86.0	116.10	1.07	8	8	Sand to Silty Sand	SP/SM	medium dense	115	21	71.0	45	62	37	
26.32	86.5	78.29	2.46	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	22	47.8	75	51	35	
26.47	87.0	109.25	1.40	8	8	Sand to Silty Sand	SP/SM	medium dense	115	20	66.5	50	60	36	
26.62	87.5	137.94	1.30	8	8	Sand to Silty Sand	SP/SM	medium dense	115	25	83.7	45	67	37	
26.77	88.0	122.64	1.96	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	27	74.2	55	64	37	
26.92	88.5	36.72	4.53	4	4	Silty Clay to Clay	CL	hard	125	21	100			2.01	5.42
27.07	89.0	60.95	2.31	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	17	36.7	85	43	34	
27.22	89.5	52.53	2.78	6	6	Sandy Silt to Clayey Silt	ML	loose	115	15	31.5	95	38	33	
27.37	90.0	32.69	3.33	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13	100			1.77	6.00
27.52	90.5	18.87	2.26	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	8	100			0.95	2.49
27.67	91.0	18.28	2.29	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7	100			0.92	2.34
27.82	91.5	22.64	2.80	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9	100			1.17	3.21
27.97	92.0	16.44	2.45	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7	100			0.81	2.00
28.12	92.5	18.41	3.96	4	4	Silty Clay to Clay	CL	stiff	125	11	100			0.92	1.77
28.27	93.0	32.50	3.47	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13	100			1.75	5.53
28.42	93.5	35.06	3.29	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	14	100			1.90	6.21
28.57	94.0	30.84	3.33	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12	100			1.65	5.00
28.72	94.5	26.94	3.22	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	100			1.42	4.00
28.87	95.0	19.38	3.46	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	8	100			0.98	2.41
29.02	95.5	17.61	3.72	4	4	Silty Clay to Clay	CL	stiff	125	10	100			0.87	1.56
29.17	96.0	21.95	4.31	4	4	Silty Clay to Clay	CL	very stiff	125	13	100			1.13	2.20
29.32	96.5	33.37	3.69	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13	100			1.80	5.42
29.47	97.0	58.57	2.91	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	17	33.8	95	40	34	
29.72	97.5	60.47	2.21	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	17	34.8	90	41	34	
29.87	98.0	49.04	2.50	6	6	Sandy Silt to Clayey Silt	ML	loose	115	14	28.2	100	35	33	
30.02	98.5	25.35	3.39	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10	100			1.32	3.43
30.18	99.0	25.80	4.56	4	4	Silty Clay to Clay	CL	very stiff	125	15	100			1.35	2.65
30.33	99.5	22.41	4.34	4	4	Silty Clay to Clay	CL	very stiff	125	13	100			1.15	2.13
30.48	100.0	20.56	3.95	4	4	Silty Clay to Clay	CL	very stiff	125	12	100			1.04	1.92
30.63	100.5	21.97	4.12	4	4	Silty Clay to Clay	CL	very stiff	125	13	100			1.12	2.06
30.78	101.0	27.92	3.56	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	100			1.47	3.83
30.94	101.5	28.10	3.81	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	100			1.48	3.83
31.09	102.0	27.33	4.45	4	4	Silty Clay to Clay	CL	very stiff	125	16	100			1.43	2.82
31.24	102.5	30.40	3.78	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12	100			1.61	4.18
31.39	103.0	28.79	3.42	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12	100			1.52	3.83
31.55	103.5	26.05	3.95	4	4	Silty Clay to Clay	CL	very stiff	125	15	100			1.35	2.57
31.70	104.0	28.00	3.74	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	100			1.47	3.66
31.85	104.5	48.25	3.09	6	6	Sandy Silt to Clayey Silt	ML	loose	115	14	26.8	100	34	33	
32.00	105.0	28.10	3.49	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	100			1.47	3.58
32.16	105.5	26.47	3.31	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	100			1.38	3.28
32.31	106.0	20.15	3.68	4	4	Silty Clay to Clay	CL	very stiff	125	12	100			1.00	1.63
32.46	106.5	24.73	3.27	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10	100			1.27	3.00
32.61	107.0	19.69	2.97	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	8	100			0.97	2.06
32.77	107.5	26.28	3.30	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	100			1.36	3.21
32.92	108.0	24.94	4.24	4	4	Silty Clay to Clay	CL	very stiff	125	14	100			1.28	2.27
33.07	108.5	42.37	4.06	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	17	100			2.31	6.65
33.22	109.0	24.07	4.56	3	3	Clay	CL/CH	very stiff	125	19	100			1.23	1.70
33.38	109.5	31.76	4.65	4	4	Silty Clay to Clay	CL	very stiff	125	18	100			1.68	3.14
33.53	110.0	22.89	4.32	4	4	Silty Clay to Clay	CL	very stiff	125	13	100			1.16	1.92
33.68	110.5	23.51	4.03	4	4	Silty Clay to Clay	CL	very stiff	125	13	100			1.19	2.00
33.83	111.0	40.82	4.07	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	16	100			2.21	6.10
33.99	111.5	41.46	4.49	4	4	Silty Clay to Clay	CL	hard	125	24	100			2.25	4.47
34.14	112.0	42.19	3.99	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	17	100			2.29	6.32
34.29	112.5	40.75	3.93	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	16	100			2.20	5.88
34.44	113.0	32.45	3.66	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13	100			1.71	4.00
34.59	113.5	55.25	3.54	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	22	100			3.05	>10
34.75	114.0	42.76	3.40	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	17	100			2.32	6.21
34.90	114.5	23.36	2.79	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9	100			1.18	2.41
35.05	115.0	23.59	3.82	4	4	Silty Clay to Clay	CL	very stiff	125	13	100			1.19	1.84
35.20	115.5	32.92	4.41	4	4	Silty Clay to Clay	CL	very stiff	125	19	100			1.74	3.07
35.36	116.0	38.76	4.81	4	4	Silty Clay to Clay	CL	hard	125	22	100			2.08	3.83
35.51	116.5	66.32	2.97	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	19	34.9	100	41	34	
35.66	117.0	52.19	3.04	6	6	Sandy Silt to Clayey Silt	ML	loose	115	15	27.4	100	34	33	
35.81	117.5	29.21	3.72	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12	100			1.52	3.28
35.97	118.0	29.86	4.39	4	4	Silty Clay to Clay	CL	very stiff	125	17	100			1.55	2.57
36.12	118.5	29.01	4.20	4	4	Silty Clay to Clay	CL	very stiff	125	17	100			1.50	2.41
36.27	119.0	28.69	4.02	4	4	Silty Clay to Clay	CL	very stiff	125	15	100			1.36	2.13
36.42	119.5	23.87	4.05	4	4	Silty Clay to Clay	CL	very stiff	125	14	100			1.20	1.77
36.58	120.0	29.29	5.14	4	4	Silty Clay to Clay	CL	very stiff	125	17	100			1.52	2.41

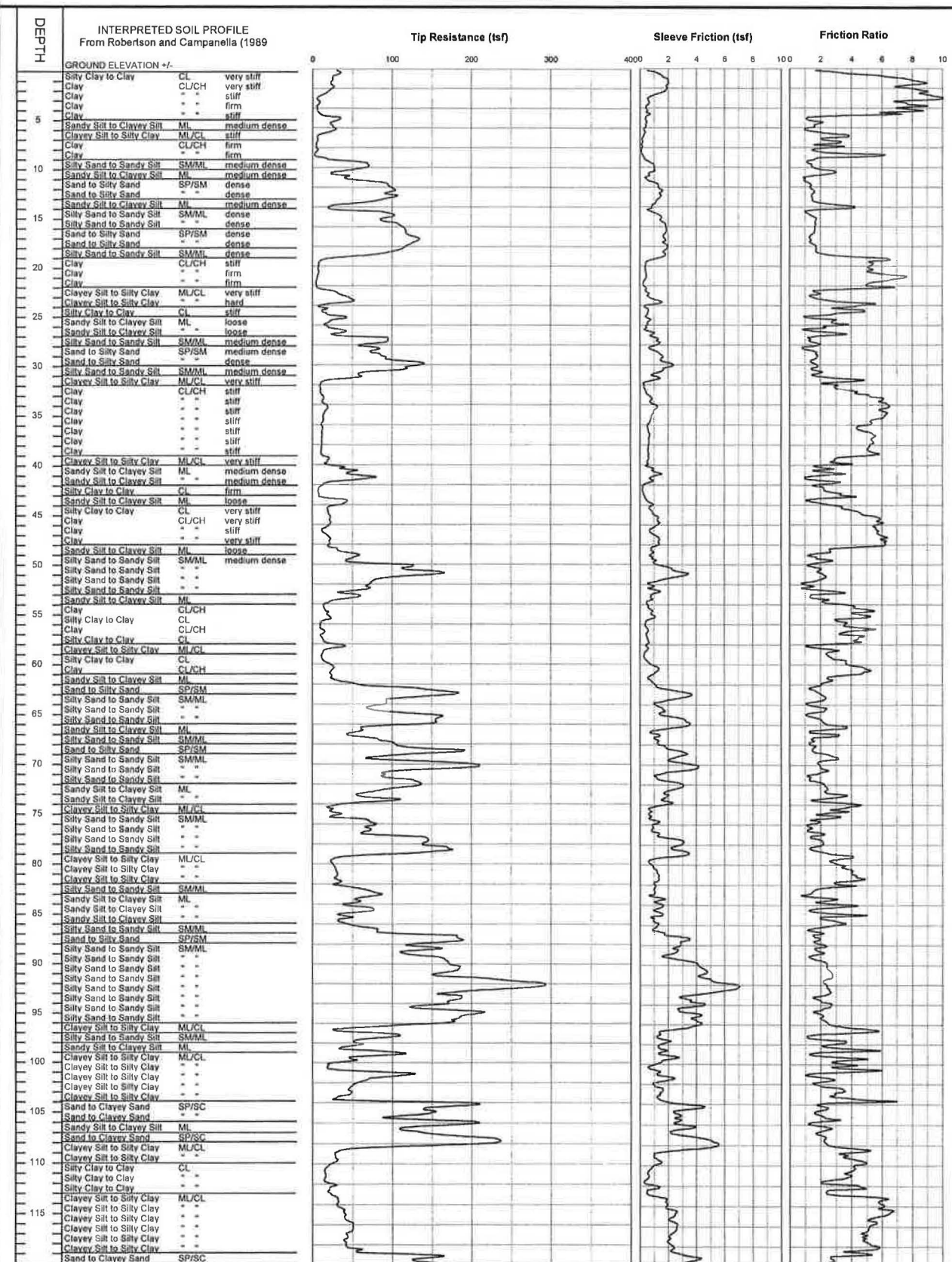
CLIENT: Cal Energy
PROJECT: Black Rock 5-6 Geothermal Plant -- Calipatria, CA

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric
Cone with 23 ton reaction weight

LOCATION: See Site and Boring Location Plan

DATE: 6/28/2011

CONE SOUNDING DATA CPT-4



Project No.
LE111138

LANDMARK
Geo-Engineers and Geologists

PLATE
B-39

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-4				Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)														
Est. GWT (ft): 4																		
Base	Base	Avg		1														
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Norm.	%	Dens.	Phi	Su				
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dr (%)	(deg.)	(tsf)	OCR			
0.15	0.5	33.36	2.84	6	6	Sandy Silt to Clayey Silt	ML	very dense	115	10	63.1	55	102	42				
0.30	1.0	25.86	6.55	3	3	Clay	CL/CH	very stiff	125	21		85			1.52	>10		
0.45	1.5	23.57	8.50	3	3	Clay	CL/CH	very stiff	125	19		100			1.38	>10		
0.60	2.0	25.41	7.47	3	3	Clay	CL/CH	very stiff	125	20		90			1.49	>10		
0.75	2.5	19.30	8.66	3	3	Clay	CL/CH	very stiff	125	15		100			1.13	>10		
0.93	3.0	8.44	9.57	1	1	Organic Material	OL/OH	firm	120	8		100			0.49	>10		
1.08	3.5	7.85	7.97	3	3	Clay	CL/CH	firm	125	6		100			0.45	>10		
1.23	4.0	6.10	7.89	3	3	Clay	CL/CH	firm	125	5		100			0.35	>10		
1.38	4.5	6.55	7.45	3	3	Clay	CL/CH	firm	125	5		100			0.37	>10		
1.53	5.0	19.94	3.87	4	4	Silty Clay to Clay	CL	very stiff	125	11		75			1.16	>10		
1.68	5.5	27.52	1.59	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	8	50.9	45	53	35				
1.83	6.0	27.00	1.38	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	8	48.8	45	51	35				
1.98	6.5	19.98	1.79	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	6	35.3	55	42	34				
2.13	7.0	6.42	3.24	3	3	Clay	CL/CH	firm	125	5		100			0.36	7.56		
2.28	7.5	5.75	2.86	3	3	Clay	CL/CH	firm	125	5		100			0.32	5.76		
2.45	8.0	4.77	2.42	3	3	Clay	CL/CH	firm	125	4		100			0.26	4.00		
2.60	8.5	5.09	1.97	4	4	Silty Clay to Clay	CL	firm	125	3		100			0.28	5.31		
2.75	9.0	7.53	4.52	3	3	Clay	CL/CH	firm	125	6		100			0.42	7.27		
2.90	9.5	46.98	1.30	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	72.8	30	63	37				
3.05	10.0	68.46	1.46	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	15	104.3	25	74	38				
3.20	10.5	37.70	2.60	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	11	56.5	50	58	36				
3.35	11.0	36.61	1.63	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	8	54.1	40	54	36				
3.50	11.5	65.96	1.03	8	8	Sand to Silty Sand	SP/SM	dense	115	12	95.9	20	71	38				
3.65	12.0	95.98	1.34	8	8	Sand to Silty Sand	SP/SM	dense	115	17	137.6	20	82	39				
3.80	12.5	100.43	1.52	8	8	Sand to Silty Sand	SP/SM	dense	115	18	142.0	20	83	40				
3.95	13.0	99.82	1.45	8	8	Sand to Silty Sand	SP/SM	dense	115	18	139.2	20	82	40				
4.13	13.5	81.81	1.51	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	18	112.6	25	76	39				
4.28	14.0	32.67	3.20	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		60			1.89	>10		
4.43	14.5	44.76	2.28	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	13	60.0	45	57	36				
4.58	15.0	99.77	1.30	8	8	Sand to Silty Sand	SP/SM	dense	115	18	132.0	20	81	39				
4.73	15.5	88.33	1.69	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	20	115.5	25	77	39				
4.88	16.0	109.71	1.65	8	8	Sand to Silty Sand	SP/SM	dense	115	20	141.7	25	83	40				
5.03	16.5	116.53	1.61	8	8	Sand to Silty Sand	SP/SM	dense	115	21	148.8	20	84	40				
5.18	17.0	124.96	1.36	8	8	Sand to Silty Sand	SP/SM	dense	115	23	157.8	20	86	40				
5.33	17.5	130.66	1.33	8	8	Sand to Silty Sand	SP/SM	dense	115	24	163.2	20	87	40				
5.48	18.0	118.58	1.62	8	8	Sand to Silty Sand	SP/SM	dense	115	22	146.6	25	84	40				
5.65	18.5	104.48	1.70	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	23	127.8	25	80	39				
5.80	19.0	64.06	2.95	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	18	77.5	45	65	37				
5.95	19.5	12.88	6.02	3	3	Clay	CL/CH	stiff	125	10		100			0.72	7.00		
6.10	20.0	7.71	5.30	3	3	Clay	CL/CH	firm	125	6		100			0.41	3.14		
6.25	20.5	7.30	5.21	3	3	Clay	CL/CH	firm	125	6		100			0.39	2.82		
6.40	21.0	6.83	6.54	3	3	Clay	CL/CH	firm	125	5		100			0.36	2.41		
6.55	21.5	5.33	6.75	3	3	Clay	CL/CH	firm	125	4		100			0.27	1.63		
6.70	22.0	4.68	5.10	3	3	Clay	CL/CH	soft	125	4		100			0.23	1.31		
6.85	22.5	14.47	4.07	3	3	Clay	CL/CH	stiff	125	12		100			0.81	6.88		
7.00	23.0	34.56	1.67	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	10	38.3	55	44	34				
7.18	23.5	48.80	1.92	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	53.7	50	54	36				
7.33	24.0	26.29	4.54	4	4	Silty Clay to Clay	CL	very stiff	125	15		90			1.50	>10		
7.48	24.5	13.11	3.87	3	3	Clay	CL/CH	stiff	125	10		100			0.72	5.21		
7.63	25.0	16.52	3.52	4	4	Silty Clay to Clay	CL	stiff	125	9		100			0.92	>10		
7.78	25.5	36.46	1.76	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	10	38.7	55	44	34				
7.93	26.0	18.57	3.11	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	7		95			1.04	>10		
8.08	26.5	29.50	1.72	6	6	Sandy Silt to Clayey Silt	ML	loose	115	8	30.8	65	38	33				
8.23	27.0	32.04	2.84	6	6	Sandy Silt to Clayey Silt	ML	loose	115	9	33.2	75	40	34				
8.38	27.5	94.50	1.28	8	8	Sand to Silty Sand	SP/SM	dense	115	17	97.1	30	72	38				
8.53	28.0	71.45	1.78	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	72.9	40	63	37				
8.68	28.5	79.08	1.04	8	8	Sand to Silty Sand	SP/SM	medium dense	115	14	80.1	30	66	37				
8.85	29.0	81.11	1.75	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	81.6	40	66	37				
9.00	29.5	96.48	1.61	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	21	96.4	35	71	38				
9.15	30.0	135.12	1.58	8	8	Sand to Silty Sand	SP/SM	dense	115	25	134.0	25	81	39				
9.30	30.5	113.73	1.59	8	8	Sand to Silty Sand	SP/SM	dense	115	21	112.0	30	76	39				
9.45	31.0	61.39	1.78	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	60.1	45	57	36				
9.60	31.5	42.27	3.33	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	17		75			2.43	>10		
9.75	32.0	10.92	2.97	4	4	Silty Clay to Clay	CL	stiff	125	6		100			0.58	3.50		
9.90	32.5	9.80	3.17	4	4	Silty Clay to Clay	CL	stiff	125	6		100			0.52	3.00		
10.05	33.0	10.40	4.58	3	3	Clay	CL/CH	stiff	125	8		100			0.55	2.49		
10.20	33.5	13.93	5.77	3	3	Clay	CL/CH	stiff	125	11		100			0.76	3.74		
10.38	34.0	13.99	6.13	3	3	Clay	CL/CH	stiff	125	11		100			0.76	3.66		
10.53	34.5	18.91	6.19	3	3	Clay	CL/CH	very stiff	125	15		100			1.05	5.76		
10.68	35.0	15.09	6.24	3	3	Clay	CL/CH	stiff	125	12		100			0.82	3.91		
10.83	35.5	13.56	5.87	3	3	Clay	CL/CH	stiff	125	11		100			0.73	3.35		
10.98	36.0	12.43	5.25	3	3	Clay	CL/CH	stiff	125	10		100	</					

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-4				Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)													
Base		Est. GWT (ft)		Avg		1				Est.		Est.		0		17	
Depth	Depth	Tip	Friction		Soil	Soil		Density or	Density	SPT	Norm.	%	Dens.	Phi	Su	OCR	
(m)	(ft)	Qc, tsf	Ratio, %		Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dr (%)	(deg.)	(tsf)		
12.95	42.5	8.22	2.17	4	4	Silty Clay to Clay	CL	firm	125	5		100			0.41	1.56	
13.10	43.0	7.77	3.04	4	4	Silty Clay to Clay	CL	firm	125	4		100			0.38	1.37	
13.25	43.5	22.92	2.47	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		100			1.27	>10	
13.40	44.0	40.11	2.03	6	6	Sandy Silt to Clayey Silt	ML	loose	115	11	33.2	75	40	34			
13.58	44.5	19.83	3.56	4	4	Silty Clay to Clay	CL	very stiff	125	11		100			1.08	5.42	
13.73	45.0	20.07	4.58	3	3	Clay	CL/CH	very stiff	125	16		100			1.10	4.28	
13.88	45.5	22.16	5.74	3	3	Clay	CL/CH	very stiff	125	18		100			1.22	4.89	
14.03	46.0	22.43	5.82	3	3	Clay	CL/CH	very stiff	125	18		100			1.23	4.89	
14.18	46.5	16.80	5.54	3	3	Clay	CL/CH	stiff	125	13		100			0.90	3.14	
14.33	47.0	15.18	5.82	3	3	Clay	CL/CH	stiff	125	12		100			0.81	2.65	
14.48	47.5	21.88	6.18	3	3	Clay	CL/CH	very stiff	125	18		100			1.20	4.47	
14.63	48.0	20.86	6.16	3	3	Clay	CL/CH	very stiff	125	17		100			1.14	4.09	
14.78	48.5	27.61	3.10	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11		100			1.54	>10	
14.93	49.0	49.99	1.81	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	39.3	65	45	34			
15.10	49.5	47.94	2.07	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	14	37.5	70	44	34			
15.25	50.0	78.94	1.62	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	61.5	50	58	36			
15.40	50.5	118.69	1.83	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	26	92.1	40	70	38			
15.55	51.0	157.07	2.01	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	35	121.4	40	78	39			
15.70	51.5	93.43	2.13	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	21	71.9	50	63	37			
15.85	52.0	73.17	1.11	8	8	Sand to Silty Sand	SP/SM	medium dense	115	13	56.1	45	55	36			
16.00	52.5	68.84	1.31	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	52.5	50	53	35			
16.15	53.0	44.29	2.67	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	13	33.7	85	40	34			
16.30	53.5	50.02	1.74	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	11	37.9	70	44	34			
16.45	54.0	19.52	2.87	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	8		100			1.05	5.42	
16.60	54.5	14.49	4.49	3	3	Clay	CL/CH	stiff	125	12		100			0.75	2.06	
16.78	55.0	18.22	4.70	3	3	Clay	CL/CH	stiff	125	15		100			0.97	2.82	
16.93	55.5	21.82	4.33	4	4	Silty Clay to Clay	CL	very stiff	125	12		100			1.18	4.57	
17.08	56.0	11.95	3.44	4	4	Silty Clay to Clay	CL	stiff	125	7		100			0.60	1.84	
17.23	56.5	10.01	4.53	3	3	Clay	CL/CH	firm	125	8		100			0.49	1.14	
17.38	57.0	14.38	3.58	4	4	Silty Clay to Clay	CL	stiff	125	8		100			0.74	2.34	
17.53	57.5	11.85	4.47	3	3	Clay	CL/CH	stiff	125	9		100			0.59	1.37	
17.68	58.0	24.37	2.77	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		100			1.33	6.88	
17.83	58.5	26.97	2.33	6	6	Sandy Silt to Clayey Silt	ML	loose	115	8	19.5	100	24	31			
17.98	59.0	12.74	2.44	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5		100			0.64	2.41	
18.13	59.5	12.05	3.03	4	4	Silty Clay to Clay	CL	stiff	125	7		100			0.60	1.70	
18.30	60.0	19.63	3.77	4	4	Silty Clay to Clay	CL	very stiff	125	11		100			1.05	3.50	
18.45	60.5	26.07	4.99	3	3	Clay	CL/CH	very stiff	125	21		100			1.42	4.09	
18.60	61.0	22.91	4.32	4	4	Silty Clay to Clay	CL	very stiff	125	13		100			1.24	4.28	
18.75	61.5	25.15	2.58	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		100			1.37	6.65	
18.90	62.0	46.65	2.17	6	6	Sandy Silt to Clayey Silt	ML	loose	115	13	32.9	80	40	34			
19.05	62.5	113.74	1.46	8	8	Sand to Silty Sand	SP/SM	medium dense	115	21	79.8	45	66	37			
19.20	63.0	174.93	1.93	8	8	Sand to Silty Sand	SP/SM	dense	115	32	122.4	40	78	39			
19.35	63.5	118.51	2.27	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	26	82.6	50	67	37			
19.50	64.0	92.21	1.33	8	8	Sand to Silty Sand	SP/SM	medium dense	115	17	64.1	50	59	36			
19.65	64.5	71.69	2.15	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	49.6	65	52	35			
19.80	65.0	109.63	1.50	8	8	Sand to Silty Sand	SP/SM	medium dense	115	20	75.7	45	64	37			
19.98	65.5	159.54	1.72	8	8	Sand to Silty Sand	SP/SM	dense	115	29	109.8	40	75	39			
20.13	66.0	151.25	2.27	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	34	103.7	45	74	38			
20.28	66.5	70.71	3.27	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	20	48.3	80	51	35			
20.43	67.0	53.21	1.94	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	12	36.2	75	43	34			
20.58	67.5	63.14	2.03	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	42.9	70	47	35			
20.73	68.0	97.64	1.45	8	8	Sand to Silty Sand	SP/SM	medium dense	115	18	66.1	50	60	36			
20.88	68.5	148.78	1.50	8	8	Sand to Silty Sand	SP/SM	dense	115	27	100.4	40	73	38			
21.03	69.0	143.78	2.27	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	32	96.7	50	71	38			
21.18	69.5	80.49	2.79	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	23	54.0	70	54	36			
21.33	70.0	183.64	1.88	8	8	Sand to Silty Sand	SP/SM	dense	115	33	122.8	40	79	39			
21.50	70.5	173.65	2.21	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	39	115.7	45	77	39			
21.65	71.0	91.71	1.66	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	20	60.9	55	58	36			
21.80	71.5	101.98	1.30	8	8	Sand to Silty Sand	SP/SM	medium dense	115	19	67.5	50	61	37			
21.95	72.0	133.79	2.11	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	30	88.3	50	69	38			
22.10	72.5	106.61	2.40	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	24	71.5	60	63	37			
22.25	73.0	66.99	2.85	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	19	44.0	80	48	35			
22.40	73.5	80.16	2.33	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	52.5	70	53	35			
22.55	74.0	65.27	3.49	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	19	42.6	90	47	35			
22.70	74.5	23.33	3.33	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		100			1.24	4.47	
22.85	75.0	28.33	2.67	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11		100			1.53	6.10	
23.00	75.5	37.00	2.47	6	6	Sandy Silt to Clayey Silt	ML	loose	115	11	23.9	100	30	32			
23.18	76.0	74.38	1.60	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	17	47.9	65	51	35			
23.33	76.5	71.09	1.27	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	45.7	60	49	35			
23.48	77.0	66.00	1.82	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	42.3	70	47	35			
23.63	77.5	125.58	1.55	8	8	Sand to Silty Sand	SP/SM	medium dense	115	23	80.2	45	66	37			
23.78	78.0	142.46	2.14	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	32	90.8	50	70	38			
23.93	78.5	163.03	1.57	8	8	Sand to Silty Sand	SP/SM	dense	115	30	103.6	40	74	38			
24.08	79.0	114.69	3.06	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	33	72.7	65	63	37			
24.23	79.5	30.27	3.28	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120								

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

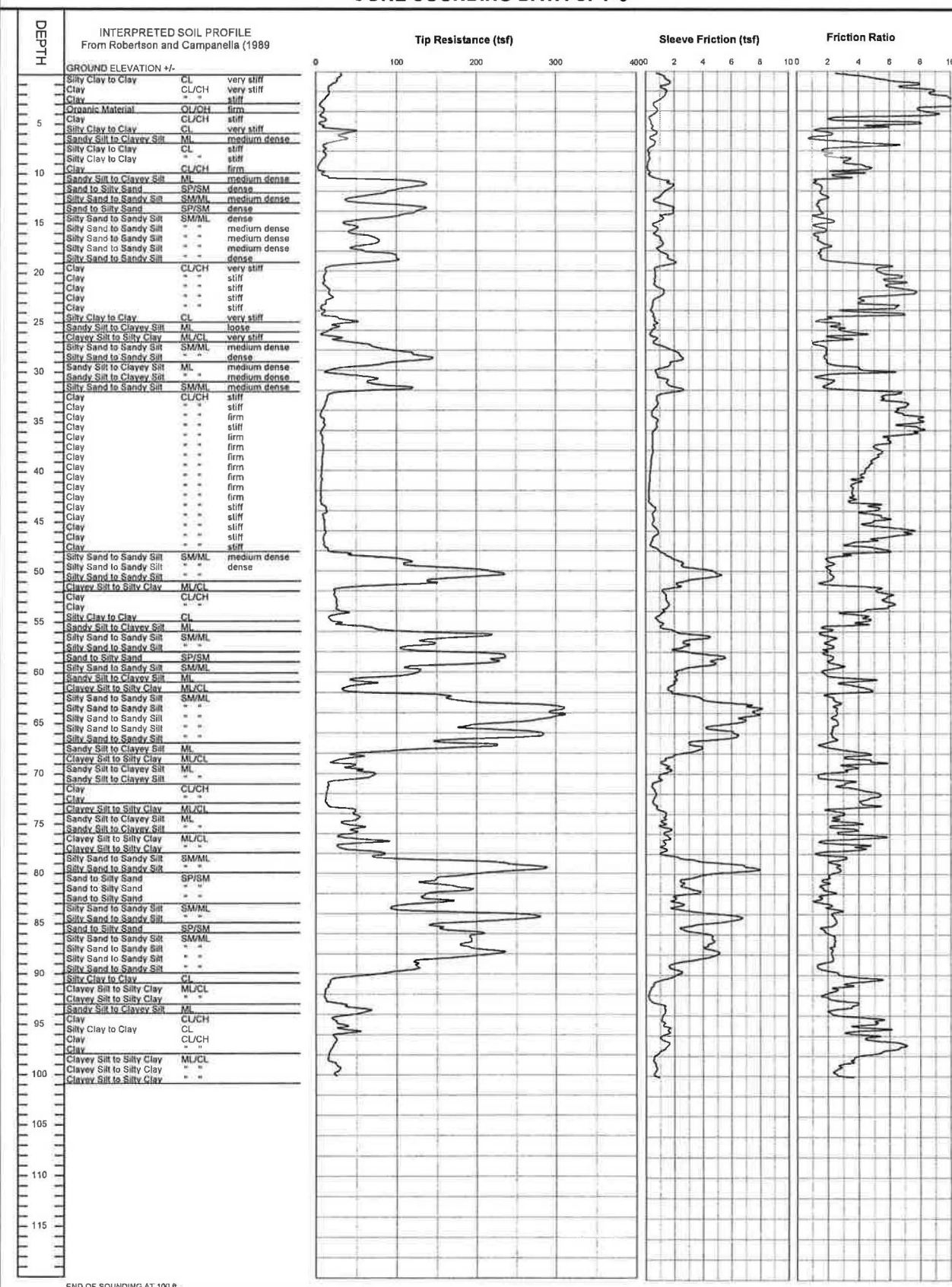
Date: 6/28/2011

CONE SOUNDING: CPT-4		Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)																
Est. GWT (ft): 4																		
Base Depth (m)	Base Depth (ft)	Avg Tip Qc, tsf	Avg Friction Ratio, %	1 Soil Type	Soil Classification	USCS	Density or Consistency	Est. Density (pcf)	SPT N(60)	Norm. Qc1n	% Fines	Est. Rel. Dens. Dr (%)	Nk: Phi (deg.)	17 Su (tsf)	OCR			
25.73	84.5	65.54	2.06	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	40.2	75	46	34					
25.88	85.0	53.32	3.26	6	Sandy Silt to Clayey Silt	ML	loose	115	15	32.6	100	39	34					
26.03	85.5	41.53	2.23	6	Sandy Silt to Clayey Silt	ML	loose	115	12	25.4	100	32	32					
26.17	86.0	37.41	3.23	5	Clayey Silt to Silty Clay	ML/CL	hard	120	15		100			2.05	8.00			
26.32	86.5	66.69	1.64	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	40.5	70	46	34					
26.47	87.0	91.91	1.83	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	20	55.7	65	55	36					
26.62	87.5	182.37	1.80	8	Sand to Silty Sand	SP/SM	dense	115	33	110.2	45	75	39					
26.77	88.0	161.46	1.84	8	Sand to Silty Sand	SP/SM	dense	115	29	97.3	45	72	38					
26.92	88.5	141.27	1.87	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	31	84.9	50	68	37					
27.07	89.0	121.57	1.78	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	27	72.9	55	63	37					
27.22	89.5	162.26	1.73	8	Sand to Silty Sand	SP/SM	dense	115	30	97.1	45	72	38					
27.37	90.0	171.67	2.39	7	Silty Sand to Sandy Silt	SM/ML	dense	115	38	102.4	50	73	38					
27.52	90.5	184.22	2.49	7	Silty Sand to Sandy Silt	SM/ML	dense	115	41	109.6	50	75	39					
27.67	91.0	162.26	2.73	7	Silty Sand to Sandy Silt	SM/ML	dense	115	36	96.3	55	71	38					
27.82	91.5	202.24	2.43	7	Silty Sand to Sandy Silt	SM/ML	dense	115	45	119.8	50	78	39					
27.97	92.0	277.68	2.30	7	Silty Sand to Sandy Silt	SM/ML	dense	115	62	164.2	40	87	40					
28.12	92.5	264.72	2.49	7	Silty Sand to Sandy Silt	SM/ML	dense	115	59	156.0	45	86	40					
28.27	93.0	176.46	2.44	7	Silty Sand to Sandy Silt	SM/ML	dense	115	39	103.8	55	74	38					
28.42	93.5	188.21	1.74	8	Sand to Silty Sand	SP/SM	dense	115	34	109.2	45	75	39					
28.57	94.0	170.99	2.48	7	Silty Sand to Sandy Silt	SM/ML	dense	115	38	100.1	55	73	38					
28.72	94.5	132.85	2.29	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	30	77.6	60	65	37					
28.87	95.0	202.89	1.81	8	Sand to Silty Sand	SP/SM	dense	115	37	118.2	45	77	39					
29.02	95.5	186.85	2.09	7	Silty Sand to Sandy Silt	SM/ML	dense	115	42	108.6	50	75	38					
29.17	96.0	171.91	2.47	7	Silty Sand to Sandy Silt	SM/ML	dense	115	38	99.7	55	72	38					
29.32	96.5	81.68	4.16	5	Clayey Silt to Silty Clay	ML/CL	hard	120	33		95			4.64	>10			
29.47	97.0	46.72	3.89	5	Clayey Silt to Silty Clay	ML/CL	hard	120	19		100			2.58	>10			
29.72	97.5	100.40	1.39	8	Sand to Silty Sand	SP/SM	medium dense	115	18	57.8	60	56	36					
29.87	98.0	54.66	3.36	5	Clayey Silt to Silty Clay	ML/CL	hard	120	22		100			3.05	>10			
30.02	98.5	49.39	2.96	6	Sandy Silt to Clayey Silt	ML	loose	115	14	28.3	100	35	33					
30.18	99.0	81.96	2.71	6	Sandy Silt to Clayey Silt	ML	medium dense	115	23	46.8	80	50	35					
30.33	99.5	59.01	3.91	5	Clayey Silt to Silty Clay	ML/CL	hard	120	24		100			3.30	>10			
30.48	100.0	36.37	3.49	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	15		100			1.97	6.00			
30.63	100.5	19.18	4.16	4	Silty Clay to Clay	CL	stiff	125	11		100			0.95	1.70			
30.78	101.0	81.48	2.14	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	46.1	75	50	35					
30.94	101.5	94.89	2.39	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	21	53.6	75	54	36					
31.09	102.0	61.26	1.81	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	34.5	85	41	34					
31.24	102.5	48.26	2.97	6	Sandy Silt to Clayey Silt	ML	loose	115	14	27.1	100	34	33					
31.39	103.0	46.99	3.14	6	Sandy Silt to Clayey Silt	ML	loose	115	13	26.4	100	33	33					
31.55	103.5	35.91	3.75	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	14		100			1.93	5.53			
31.70	104.0	106.88	3.69	6	Sandy Silt to Clayey Silt	ML	medium dense	115	31	59.7	80	57	36					
31.85	104.5	175.25	2.30	7	Silty Sand to Sandy Silt	SM/ML	dense	115	39	97.6	55	72	38					
32.00	105.0	147.41	1.72	8	Sand to Silty Sand	SP/SM	medium dense	115	27	81.9	55	67	37					
32.16	105.5	109.42	2.59	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	24	60.7	70	58	36					
32.31	106.0	183.47	1.54	8	Sand to Silty Sand	SP/SM	dense	115	33	101.5	45	73	38					
32.46	106.5	138.22	2.44	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	31	76.3	65	65	37					
32.61	107.0	128.33	1.86	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	29	70.7	60	62	37					
32.77	107.5	195.72	2.27	7	Silty Sand to Sandy Silt	SM/ML	dense	115	43	107.6	50	75	38					
32.92	108.0	231.89	2.34	7	Silty Sand to Sandy Silt	SM/ML	dense	115	52	127.3	50	80	39					
33.07	108.5	110.97	4.18	11	Overconsolidated Soil	??	medium dense	120	111	60.8	85	58	36					
33.22	109.0	32.11	3.88	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13		100			1.70	4.18			
33.38	109.5	29.28	4.18	4	Silty Clay to Clay	CL	very stiff	125	17		100			1.54	2.82			
33.53	110.0	25.10	4.44	4	Silty Clay to Clay	CL	very stiff	125	14		100			1.29	2.20			
33.68	110.5	17.01	4.08	4	Silty Clay to Clay	CL	stiff	125	10		100			0.81	1.20			
33.83	111.0	15.86	3.79	4	Silty Clay to Clay	CL	stiff	125	9		100			0.74	1.09			
33.99	111.5	15.44	2.69	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	6		100			0.72	1.31			
34.14	112.0	22.46	3.69	4	Silty Clay to Clay	CL	very stiff	125	13		100			1.13	1.84			
34.29	112.5	22.16	3.26	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		100			1.11	2.34			
34.44	113.0	21.76	3.62	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		100			1.09	2.20			
34.59	113.5	30.75	6.05	3	Clay	CL/CH	very stiff	125	25		100			1.61	2.27			
34.75	114.0	31.32	6.02	3	Clay	CL/CH	very stiff	125	25		100			1.65	2.34			
34.90	114.5	36.17	6.37	3	Clay	CL/CH	very stiff	125	29		100			1.93	2.91			
35.05	115.0	39.87	6.11	3	Clay	CL/CH	hard	125	32		100			2.15	3.28			
35.20	115.5	40.44	5.30	3	Clay	CL/CH	hard	125	32		100			2.18	3.35			
35.36	116.0	48.81	5.35	3	Clay	CL/CH	hard	125	39		100			2.67	4.37			
35.51	116.5	50.24	5.05	4	Silty Clay to Clay	CL	hard	125	29		100			2.76	5.88			
35.66	117.0	44.54	4.80	4	Silty Clay to Clay	CL	hard	125	25		100			2.42	4.78			
35.81	117.5	42.07	4.86	4	Silty Clay to Clay	CL	hard	125	24		100			2.27	4.28			
35.97	118.0	40.91	5.41	3	Clay	CL/CH	hard	125	33		100			2.20	3.28			
36.12	118.5	49.36	4.78	3	Clay	CL/CH	hard	125	39		100			2.70	4.28			
36.27	119.0	81.96	4.27	3	Clay	CL/CH	hard	125	66		100			4.62	>10			
36.42	119.5	145.44	2.76	3	Clay	CL/CH	hard	125	116		70			8.35	>10			
36.58	120.0	152.86	1.68	3	Clay	CL/CH	hard	125	122		55			8.79	>10			

CONE PENETROMETER: Middle Earth Geotesting Truck Mounted Electric Cone with 23 ton reaction weight

DATE: 6/28/2011

CONE SOUNDING DATA CPT-5



Project No.
LE111138

LANDMARK

Geo-Engineers and Geologists

PLATE
B-40

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-5					Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)													
Est. GWT (ft): 4																		
Base	Base	Avg		1					Est.									
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Norm.	%	Rel.	Nk:					
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dens.	Phi	Su	OCR			
												Dr (%)	(deg.)	(tsf)				
0.15	0.5	30.84	3.48	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	12	60			1.81	>10			
0.30	1.0	26.34	5.72	3	3	Clay	CL/CH	very stiff	125	21	80			1.55	>10			
0.45	1.5	18.84	7.48	3	3	Clay	CL/CH	very stiff	125	15	100			1.10	>10			
0.60	2.0	15.90	8.34	3	3	Clay	CL/CH	stiff	125	13	100			0.93	>10			
0.75	2.5	15.32	9.05	3	3	Clay	CL/CH	stiff	125	12	100			0.89	>10			
0.93	3.0	10.13	10.19	3	3	Clay	CL/CH	stiff	125	8	100			0.59	>10			
1.08	3.5	5.38	10.89	1	1	Organic Material	OL/OH	firm	120	5	100			0.30	>10			
1.23	4.0	9.72	7.97	3	3	Clay	CL/CH	stiff	125	8	100			0.56	>10			
1.38	4.5	6.88	8.73	3	3	Clay	CL/CH	firm	125	6	100			0.39	>10			
1.53	5.0	11.55	2.44	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5	80			0.66	>10			
1.68	5.5	7.20	6.59	3	3	Clay	CL/CH	firm	125	6	100			0.41	>10			
1.83	6.0	39.50	1.54	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	9	71.1	35	62	37				
1.98	6.5	31.79	1.85	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	9	56.0	45	55	36				
2.13	7.0	29.74	1.98	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	8	51.3	50	53	35				
2.28	7.5	10.52	5.32	3	3	Clay	CL/CH	stiff	125	8	100			0.60	>10			
2.45	8.0	10.80	1.78	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	4	75			0.81	>10			
2.60	8.5	12.29	2.04	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5	75			0.70	>10			
2.75	9.0	7.79	3.31	3	3	Clay	CL/CH	firm	125	6	100			0.44	7.85			
2.90	9.5	3.75	3.91	3	3	Clay	CL/CH	soft	125	3	100			0.20	2.41			
3.05	10.0	5.57	3.78	3	3	Clay	CL/CH	firm	125	4	100			0.30	4.00			
3.20	10.5	10.33	3.07	4	4	Silty Clay to Clay	CL	stiff	125	6	95			0.58	>10			
3.35	11.0	80.55	2.01	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	18	118.3	30	77	39				
3.50	11.5	132.23	1.37	8	8	Sand to Silty Sand	SP/SM	very dense	115	24	191.3	15	92	41				
3.65	12.0	98.28	1.60	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	22	140.2	20	82	40				
3.80	12.5	70.38	1.69	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	16	99.0	30	72	38				
3.95	13.0	39.66	1.75	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	9	55.0	40	55	36				
4.13	13.5	93.31	1.35	8	8	Sand to Silty Sand	SP/SM	dense	115	17	127.8	20	80	39				
4.28	14.0	131.20	1.49	8	8	Sand to Silty Sand	SP/SM	dense	115	24	177.3	20	89	41				
4.43	14.5	110.67	1.46	8	8	Sand to Silty Sand	SP/SM	dense	115	20	147.7	20	84	40				
4.58	15.0	65.24	1.93	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	86.0	35	68	38				
4.73	15.5	39.46	1.67	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	9	51.4	40	53	35				
4.88	16.0	46.02	1.76	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	10	59.3	40	57	36				
5.03	16.5	61.36	1.22	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	78.1	30	65	37				
5.18	17.0	77.47	1.42	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	17	97.5	25	72	38				
5.33	17.5	59.65	2.00	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	74.3	40	64	37				
5.48	18.0	54.73	1.64	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	12	67.4	35	61	37				
5.65	18.5	97.19	1.51	8	8	Sand to Silty Sand	SP/SM	dense	115	18	118.5	25	77	39				
5.80	19.0	97.40	1.84	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	22	117.6	30	77	39				
5.95	19.5	36.34	4.93	4	4	Silty Clay to Clay	CL	hard	125	21	75			2.10	>10			
6.10	20.0	12.59	5.26	3	3	Clay	CL/CH	stiff	125	10	100			0.70	6.54			
6.25	20.5	11.41	6.03	3	3	Clay	CL/CH	stiff	125	9	100			0.63	5.31			
6.40	21.0	10.83	6.10	3	3	Clay	CL/CH	stiff	125	9	100			0.60	4.68			
6.55	21.5	10.38	6.30	3	3	Clay	CL/CH	stiff	125	8	100			0.57	4.28			
6.70	22.0	16.24	6.95	3	3	Clay	CL/CH	stiff	125	13	100			0.91	8.70			
6.85	22.5	17.42	7.07	3	3	Clay	CL/CH	stiff	125	14	100			0.98	9.79			
7.00	23.0	17.27	4.19	4	4	Silty Clay to Clay	CL	stiff	125	10	100			0.97	>10			
7.18	23.5	11.24	4.90	3	3	Clay	CL/CH	stiff	125	9	100			0.61	4.28			
7.33	24.0	8.50	5.22	3	3	Clay	CL/CH	firm	125	7	100			0.45	2.73			
7.48	24.5	9.15	5.98	3	3	Clay	CL/CH	firm	125	7	100			0.49	3.00			
7.63	25.0	31.74	1.95	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	9	33.8	60	40	34				
7.78	25.5	34.86	2.27	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	10	36.8	65	43	34				
7.93	26.0	23.22	2.67	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9	85			1.32	>10			
8.08	26.5	13.33	3.38	4	4	Silty Clay to Clay	CL	stiff	125	8	100			0.73	6.10			
8.23	27.0	29.91	2.59	6	6	Sandy Silt to Clayey Silt	ML	loose	115	9	30.8	75	38	33				
8.38	27.5	62.95	1.29	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	64.4	40	59	36				
8.53	28.0	90.35	1.91	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	20	91.7	40	70	38				
8.68	28.5	125.00	1.88	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	28	126.0	30	79	39				
8.85	29.0	133.89	1.87	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	30	134.0	30	81	39				
9.00	29.5	78.60	2.23	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	17	78.1	45	65	37				
9.15	30.0	23.90	4.18	4	4	Silty Clay to Clay	CL	very stiff	125	14	100			1.35	>10			
9.30	30.5	31.32	3.55	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	13	85			1.78	>10			
9.45	31.0	71.20	1.82	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	69.2	45	62	37				
9.60	31.5	75.20	2.08	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	17	72.7	45	63	37				
9.75	32.0	99.92	2.71	6	6	Sandy Silt to Clayey Silt	ML	dense	115	29	95.9	45	71	38				
9.90	32.5	20.35	6.38	3	3	Clay	CL/CH	very stiff	125	16	100			1.14	7.13			
10.05	33.0	14.19	5.55	3	3	Clay	CL/CH	stiff	125	11	100			0.77	3.91			
10.20	33.5	12.05	7.06	3	3	Clay	CL/CH	stiff	125	10	100			0.65	3.07			
10.38	34.0	9.49	6.73	3	3	Clay	CL/CH	firm	125	8	100			0.49	2.06			
10.53	34.5	6.54	6.73	3	3	Clay	CL/CH	firm	125	5	100			0.32	1.20			
10.68	35.0	8.97	8.01	3	3	Clay	CL/CH	firm	125	7	100			0.46	1.84			
10.83	35.5	10.72	7.40	3	3	Clay	CL/CH	stiff	125	9	100			0.56	2.34			
10.98	36.0	9.32	7.99	3	3	Clay	CL/CH	firm	125	7	100			0.48	1.84			
11.13	36.5	7.18	6.96	3	3	Clay	CL/CH	firm	125	6	100			0.35	1.25			
11.28	37.0	8.16	5.99	3	3	Clay	CL/CH	firm	125	7	100			0.41	1.50			
11.43	37.5	9.16	5.39	3	3	Clay	CL/CH	firm	125	7	100			0.47	1.70			
11.58	38.0	9.42	5.30	3	3	Clay	CL/CH	firm	125	8	100			0.48	1.77			
11.73	38.5	8.79	5.36	3	3	Clay	CL/CH	firm	125	7	100			0.44	1.56			
11.88	39.0	8.08	4.96	3	3	Clay	CL/CH	firm	125	6	100			0.40	1.37			
12.05	39.5	8.08	4.76	3	3	Clay	CL/CH	firm	125	6	100			0.40	1.31			
12.20	40.0	7.65	4.47	3	3	Clay	CL/CH	firm	125	6	100			0.38	1.20			
12.35	40.5	7.05	4.24	3	3	Clay	CL/CH	firm	125	6	100			0.34	1.05			
12.50	41.0	7.58	4.02	3	3	Clay	CL/CH	firm	125	6	100			0.37	1.14			

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-5				Phi Correlation: 0 0-Schm(78),1-R&C(83),2-PHT(74)												
Est. GWT (ft): 4																
Base	Base	Avg	Avg	1												
Depth	Depth	Tip	Friction	Soil	Soil		Density or	Density	SPT	Norm.	%	Rel.	Nk:	17		
(m)	(ft)	Qc, tsf	Ratio, %	Type	Classification	USCS	Consistency	(pcf)	N(60)	Qc1n	Fines	Dens.	Phi	Su	OCR	
												Dr (%)	(deg.)	(tsf)		
12.95	42.5	6.37	3.63	3	3	Clay	CL/CH	firm	125	5	100			0.30	0.91	
13.10	43.0	6.58	3.54	3	3	Clay	CL/CH	firm	125	5	100			0.31	0.93	
13.25	43.5	8.18	4.52	3	3	Clay	CL/CH	firm	125	7	100			0.40	1.20	
13.40	44.0	13.11	5.18	3	3	Clay	CL/CH	stiff	125	10	100			0.69	2.34	
13.58	44.5	10.81	4.80	3	3	Clay	CL/CH	stiff	125	9	100			0.55	1.70	
13.73	45.0	10.26	5.53	3	3	Clay	CL/CH	stiff	125	8	100			0.52	1.56	
13.88	45.5	10.69	4.65	3	3	Clay	CL/CH	stiff	125	9	100			0.54	1.63	
14.03	46.0	11.24	6.86	3	3	Clay	CL/CH	stiff	125	9	100			0.58	1.70	
14.18	46.5	11.74	6.95	3	3	Clay	CL/CH	stiff	125	9	100			0.60	1.84	
14.33	47.0	9.75	4.89	3	3	Clay	CL/CH	firm	125	8	100			0.49	1.37	
14.48	47.5	10.79	3.75	3	3	Clay	CL/CH	stiff	125	9	100			0.55	1.56	
14.63	48.0	15.82	5.78	3	3	Clay	CL/CH	stiff	125	13	100			0.84	2.73	
14.78	48.5	52.27	2.98	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	15	41.0	75	46	34		
14.93	49.0	110.68	1.98	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	25	86.3	45	68	38		
15.10	49.5	119.19	2.20	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	26	92.6	45	70	38		
15.25	50.0	202.04	2.10	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	45	156.3	35	86	40		
15.40	50.5	223.91	2.26	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	50	172.5	35	89	40		
15.55	51.0	148.89	2.16	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	33	114.2	40	76	39		
15.70	51.5	103.46	2.64	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	23	79.1	55	66	37		
15.85	52.0	26.02	5.28	3	3	Clay	CL/CH	very stiff	125	21	100			1.43	5.10	
16.00	52.5	23.43	5.94	3	3	Clay	CL/CH	very stiff	125	19	100			1.28	4.18	
16.15	53.0	25.57	5.70	3	3	Clay	CL/CH	very stiff	125	20	100			1.41	4.78	
16.30	53.5	26.04	6.16	3	3	Clay	CL/CH	very stiff	125	21	100			1.43	4.89	
16.45	54.0	27.66	4.91	3	3	Clay	CL/CH	very stiff	125	22	100			1.53	5.31	
16.60	54.5	28.67	3.77	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	100			1.59	>10	
16.78	55.0	17.89	4.52	3	3	Clay	CL/CH	stiff	125	14	100			0.95	2.73	
16.93	55.5	38.09	3.40	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	15	100			2.14	>10	
17.08	56.0	82.58	1.98	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	18	60.6	55	58	36		
17.23	56.5	196.71	1.72	8	8	Sand to Silty Sand	SP/SM	dense	115	36	143.8	35	83	40		
17.38	57.0	145.98	2.30	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	32	106.4	45	74	38		
17.53	57.5	128.43	2.15	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	29	93.2	45	70	38		
17.68	58.0	147.69	1.80	8	8	Sand to Silty Sand	SP/SM	dense	115	27	106.8	40	74	38		
17.83	58.5	235.45	2.18	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	52	169.7	35	88	40		
17.98	59.0	222.01	2.15	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	49	159.4	35	86	40		
18.13	59.5	134.42	2.78	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	30	96.2	55	71	38		
18.30	60.0	127.97	1.75	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	28	91.2	45	70	38		
18.45	60.5	92.87	2.46	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	21	66.0	60	60	36		
18.60	61.0	56.67	3.89	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	23	90			3.22	>10	
18.75	61.5	44.31	3.94	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	18	100			2.49	>10	
18.90	62.0	46.13	4.14	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	18	100			2.60	>10	
19.05	62.5	159.84	2.09	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	36	111.9	45	76	39		
19.20	63.0	187.72	2.59	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	42	131.0	45	80	39		
19.35	63.5	296.50	2.54	7	7	Silty Sand to Sandy Silt	SM/ML	very dense	115	66	206.1	35	94	41		
19.50	64.0	297.66	2.57	7	7	Silty Sand to Sandy Silt	SM/ML	very dense	115	66	206.3	35	94	41		
19.65	64.5	301.38	2.37	7	7	Silty Sand to Sandy Silt	SM/ML	very dense	115	67	208.1	35	94	41		
19.80	65.0	258.83	2.60	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	58	178.2	40	90	41		
19.98	65.5	188.04	2.43	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	42	129.0	45	80	39		
20.13	66.0	255.39	2.25	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	57	174.6	35	89	40		
20.28	66.5	269.16	2.33	7	7	Silty Sand to Sandy Silt	SM/ML	very dense	115	60	183.5	35	90	41		
20.43	67.0	162.55	2.21	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	36	110.4	45	75	39		
20.58	67.5	208.08	1.80	8	8	Sand to Silty Sand	SP/SM	dense	115	38	140.9	35	83	40		
20.73	68.0	77.38	4.04	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	31	85			4.43	>10	
20.88	68.5	44.86	3.66	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	18	100			2.52	>10	
21.03	69.0	30.13	4.50	4	4	Silty Clay to Clay	CL	very stiff	125	17	100			1.65	5.53	
21.18	69.5	46.83	3.55	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	19	100			2.63	>10	
21.33	70.0	65.35	2.13	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	15	43.5	70	48	35		
21.50	70.5	59.61	1.77	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	13	39.6	70	45	34		
21.65	71.0	17.35	3.34	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	7	100			0.89	3.07	
21.80	71.5	15.12	3.36	4	4	Silty Clay to Clay	CL	stiff	125	9	100			0.76	1.84	
21.95	72.0	13.63	5.07	3	3	Clay	CL/CH	stiff	125	11	100			0.67	1.25	
22.10	72.5	12.58	4.89	3	3	Clay	CL/CH	stiff	125	10	100			0.61	1.14	
22.25	73.0	12.71	4.15	3	3	Clay	CL/CH	stiff	125	10	100			0.62	1.14	
22.40	73.5	26.72	3.68	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	11	100			1.44	5.53	
22.55	74.0	47.69	2.81	6	6	Sandy Silt to Clayey Silt	ML	loose	115	14	30.9	95	38	33		
22.70	74.5	52.89	2.59	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	15	34.2	90	41	34		
22.85	75.0	37.88	3.40	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	15	100			2.09	>10	
23.00	75.5	51.69	2.65	6	6	Sandy Silt to Clayey Silt	ML	loose	115	15	33.2	90	40	34		
23.18	76.0	46.88	3.09	6	6	Sandy Silt to Clayey Silt	ML	loose	115	13	30.0	100	37	33		
23.33	76.5	33.11	4.98	3	3	Clay	CL/CH	very stiff	125	26	100			1.81	4.28	
23.48	77.0	71.23	1.91	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	16	45.3	70	49	35		
23.63	77.5	27.98	4.33	4	4	Silty Clay to Clay	CL	very stiff	125	16	100			1.51	4.09	
23.78	78.0	64.77	2.20	7	7	Silty Sand to Sandy Silt	SM/ML	medium dense	115	14	41.0	75	46	34		
23.93	78.5	87.43	2.69	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	25	55.2	70	55	36		
24.08	79.0	223.26	2.38	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	50	140.5	45	83	40		
24.23	79.5	281.03	2.68	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	62	176.3	40	89	40		
24.38	80.0	218.08	2.39	7	7	Silty Sand to Sandy Silt										

LANDMARK CONSULTANTS, INC.
CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Cal Energy Black Rock 5-6

Project No: LE11138

Date: 6/28/2011

CONE SOUNDING: CPT-5				Phi Correlation: 0 0-Schm(78), 1-R&C(83), 2-PHT(74)													
Est. GWT (ft): 4																	
Base	Base	Avg	Avg	1	Soil	Soil		Density or	Est.	SPT	Norm.	Est.	Rel.	Nk:	17		
Depth	Depth	Tip	Friction		Type	Classification	USCS	Consistency	Density	N(60)	Qc1n	%	Dens.	Phi	Su	OCR	
(m)	(ft)	Qc, tsf	Ratio, %						(pcf)			Fines	Dr (%)	(deg.)	(tsf)		
25.73	84.5	272.22	2.41	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	60	166.3	40	88	40			
25.88	85.0	189.03	2.50	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	42	115.2	50	77	39			
26.03	85.5	150.67	1.81	8	8	Sand to Silty Sand	SP/SM	medium dense	115	27	91.6	50	70	38			
26.17	86.0	191.91	1.94	8	8	Sand to Silty Sand	SP/SM	dense	115	35	116.3	45	77	39			
26.32	86.5	192.32	2.41	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	43	116.3	50	77	39			
26.47	87.0	189.56	2.43	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	42	114.3	50	76	39			
26.62	87.5	188.22	2.28	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	42	113.2	50	76	39			
26.77	88.0	226.18	2.24	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	50	135.7	45	82	39			
26.92	88.5	182.16	2.30	7	7	Silty Sand to Sandy Silt	SM/ML	dense	115	40	109.0	50	75	39			
27.07	89.0	124.75	1.69	8	8	Sand to Silty Sand	SP/SM	medium dense	115	23	74.5	55	64	37			
27.22	89.5	123.36	1.67	8	8	Sand to Silty Sand	SP/SM	medium dense	115	22	73.5	55	63	37			
27.37	90.0	81.66	2.81	6	6	Sandy Silt to Clayey Silt	ML	medium dense	115	23	48.5	80	51	35			
27.52	90.5	27.96	4.82	3	3	Clay	CL/CH	very stiff	125	22		100			1.49	2.73	
27.67	91.0	16.64	3.42	4	4	Silty Clay to Clay	CL	stiff	125	10		100			0.82	1.50	
27.82	91.5	13.61	2.47	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5		100			0.64	1.43	
27.97	92.0	11.16	1.81	5	5	Clayey Silt to Silty Clay	ML/CL	firm	120	4		100			0.50	1.05	
28.12	92.5	11.40	2.33	5	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	5		100			0.51	1.09	
28.27	93.0	26.12	3.84	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		100			1.37	3.83	
28.42	93.5	52.95	2.68	6	6	Sandy Silt to Clayey Silt	ML	loose	115	15	30.9	100	38	33			
28.57	94.0	52.84	2.45	6	6	Sandy Silt to Clayey Silt	ML	loose	115	15	30.7	95	38	33			
28.72	94.5	22.68	5.03	3	3	Clay	CL/CH	very stiff	125	18		100			1.17	1.84	
28.87	95.0	28.77	4.61	4	4	Silty Clay to Clay	CL	very stiff	125	16		100			1.53	3.28	
29.02	95.5	34.84	4.86	3	3	Clay	CL/CH	very stiff	125	28		100			1.88	3.43	
29.17	96.0	38.25	4.06	5	5	Clayey Silt to Silty Clay	ML/CL	hard	120	15		100			2.08	6.78	
29.32	96.5	24.05	4.72	3	3	Clay	CL/CH	very stiff	125	19		100			1.25	2.00	
29.47	97.0	23.38	6.86	3	3	Clay	CL/CH	very stiff	125	19		100			1.21	1.84	
29.72	97.5	20.01	6.29	3	3	Clay	CL/CH	very stiff	125	16		100			1.01	1.43	
29.87	98.0	16.79	4.85	3	3	Clay	CL/CH	stiff	125	13		100			0.82	1.14	
30.02	98.5	15.23	3.64	4	4	Silty Clay to Clay	CL	stiff	125	9		100			0.72	1.20	
30.18	99.0	22.69	3.06	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	9		100			1.16	2.82	
30.33	99.5	29.17	2.47	6	6	Sandy Silt to Clayey Silt	ML	very loose	115	8	16.5	100	19	31			
30.48	100.0	23.98	2.95	5	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	10		100			1.24	3.07	

DEFINITION OF TERMS

PRIMARY DIVISIONS

SYMBOLS

SECONDARY DIVISIONS

Coarse grained soils More than half of material is larger that No. 200 sieve	Gravels	Clean gravels (less than 5% fines)		GW	Well graded gravels, gravel-sand mixtures, little or no fines
		Gravel with fines		GP	Poorly graded gravels, or gravel-sand mixtures, little or no fines
				GM	Silly gravels, gravel-sand-silt mixtures, non-plastic fines
				GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	Sands	Clean sands (less than 5% fines)		SW	Well graded sands, gravelly sands, little or no fines
		Sands with fines		SP	Poorly graded sands or gravelly sands, little or no fines
				SM	Silty sands, sand-silt mixtures, non-plastic fines
				SC	Clayey sands, sand-clay mixtures, plastic fines

Fine grained soils More than half of material is smaller than No. 200 sieve	Silts and clays			ML	Inorganic silts, clayey silts with slight plasticity
	Liquid limit is less than 50%		CL	Inorganic clays of low to medium plasticity, gravelly, sandy, or lean clays	
			OL	Organic silts and organic clays of low plasticity	
	Silts and clays			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
	Liquid limit is more than 50%		CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity, organic silts	
Highly organic soils			PT	Peat and other highly organic soils	

GRAIN SIZES

Silts and Clays	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		
	200	40	10	4	3/4"	3"	12"
	US Standard Series Sieve				Clear Square Openings		

Sands, Gravels, etc.	Blows/ft. *
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Clays & Plastic Silts	Strength **	Blows/ft. *
Very Soft	0-0.25	0-2
Soft	0.25-0.5	2-4
Firm	0.5-1.0	4-8
Stiff	1.0-2.0	8-16
Very Stiff	2.0-4.0	16-32
Hard	Over 4.0	Over 32

* Number of blows of 140 lb. hammer falling 30 inches to drive a 2 inch O.D. (1 3/8 in. I.D.) split spoon (ASTM D1586).

** Unconfined compressive strength in tons/s.f. as determined by laboratory testing or approximated by the Standard Penetration Test (ASTM D1586), Pocket Penetrometer, Torvane, or visual observation.

Type of Samples:

☒ Ring Sample
 ☒ Standard Penetration Test
 ☒ Shelby Tube
 ☒ Bulk (Bag) Sample

Drilling Notes:

- Sampling and Blow Counts
 - Ring Sampler - Number of blows per foot of a 140 lb. hammer falling 30 inches.
 - Standard Penetration Test - Number of blows per foot.
 - Shelby Tube - Three (3) inch nominal diameter tube hydraulically pushed.
- P. P. = Pocket Penetrometer (tons/s.f.).
- NR = No recovery.
- GWT  = Ground Water Table observed @ specified time.

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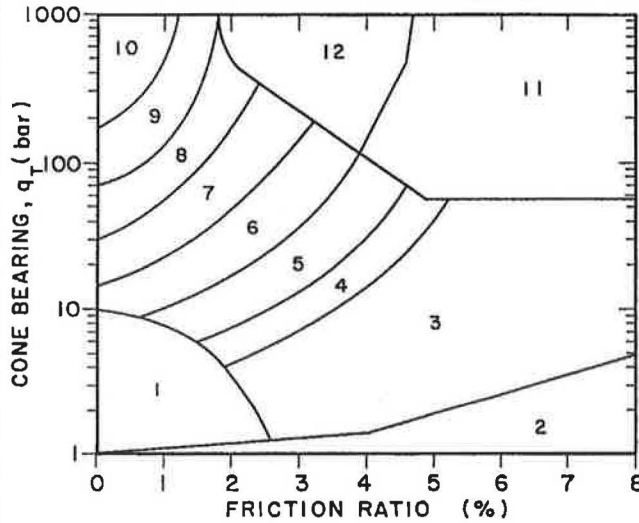
Project No. LE11138

Key to Logs

Plate
B-41

Simplified Soil Classification Chart

After Robertson & Campanella (1989)



Geotechnical Parameters from CPT Data:

Equivalent SPT N(60) blow count = $Q_c/(Q_c/N \text{ Ratio})$

$N1(60) = C_n \cdot N(60)$ Normalized SPT blow count

$C_n = 1/(p'_o)^{0.5} < 1.6$ max. from Liao & Whitman (1986)

p'_o = effective overburden pressure (tsf) using unit densities given below and estimated groundwater table.

Dr = Relative density (%) from Jamiolkowski et. al. (1986) relationship

= $-98 + 68 \cdot \log(Q_c/p'_o^{0.5})$ where Q_c, p'_o in tonne/sqm

Note: 1 tonne/sqm = 0.1024 tsf, 1 bar = 1.0443 tsf

Phi = Friction Angle estimated from either:

1. Robertson & Campanella (1983) chart:

$$\Phi = 5.3 + 24 \cdot (\log(Q_c/p'_o)) + 3 \cdot (\log(Q_c/p'_o))^2$$

2. Peck, Hansen & Thornburn (1974) N-Phi Correlation

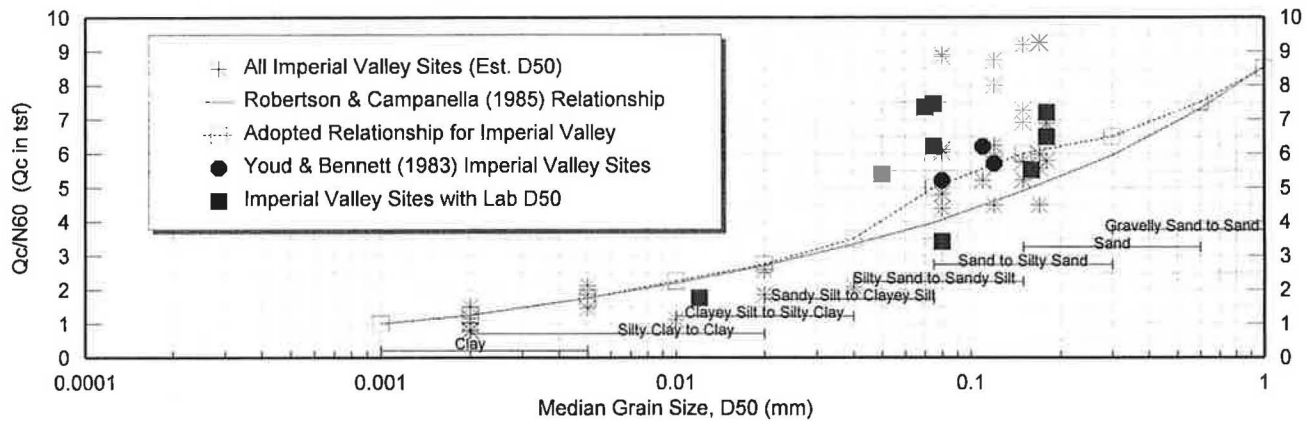
3. Schmertman (1978) chart [$\Phi = 28 + 0.14 \cdot Dr$ for fine uniform sands]

Su = undrained shear strength (tsf)

= $(Q_c - p'_o)/N_k$ where N_k varies from 10 to 22, 17 for OC clays

OCR = Overconsolidation Ratio estimated from Schmertman (1978) chart using Su/p'_o ratio and estimated normal consolidated Su/p'_o

Variation of Q_c/N Ratio with Grain Size



Note: Assumed Properties and Adopted Q_c/N Ratio based on correlations from Imperial Valley, California soils

Table of Soil Types and Assumed Properties

Zone	Soil Classification	UCS	Density (pcf)	R&C Q_c/N	Adopted Q_c/N	Est. PI	Fines (%)	D50 (mm)	Su (tsf)	Consistency
1	Sensitive fine grained	ML	120	2	2	NP-15	65-100	0.020	0-0.13	very soft
2	Organic Material	OL/OH	120	1	1	--	--	--	0.13-.25	soft
3	Clay	CL/CH	125	1	1.25	25-40+	90-100	0.002	0.25-0.5	firm
4	Silty Clay to Clay	CL	125	1.5	2	15-40	90-100	0.010	0.5-1.0	stiff
5	Clayey Silt to Silty Clay	ML/CL	120	2	2.75	5-25	90-100	0.020	1.0-2.0	very stiff
6	Sandy Silt to Clayey Silt	ML	115	2.5	3.5	NP-10	65-100	0.040	>2.0	hard
7	Silty Sand to Sandy Silt	SM/ML	115	3	5	NP	35-75	0.075	Dr (%) Relative Density	
8	Sand to Silty Sand	SP/SM	115	4	6	NP	5-35	0.150		
9	Sand	SP	110	5	6.5	NP	0-5	0.300	0-15	very loose
10	Gravelly Sand to Sand	SW	115	6	7.5	NP	0-5	0.600	15-35	loose
11	Overconsolidated Soil	--	120	1	1	NP	90-100	0.010	35-65	medium dense
12	Sand to Clayey Sand	SP/SC	115	2	2	NP-5	--	--	65-85	dense
									>85	very dense

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Key to CPT Interpretation of Logs

Plate
B-42

APPENDIX C

LANDMARK CONSULTANTS, INC.

CLIENT: Cal Energy

PROJECT: Black Rock 5-6 Geothermal Plant -- Calipatria, CA

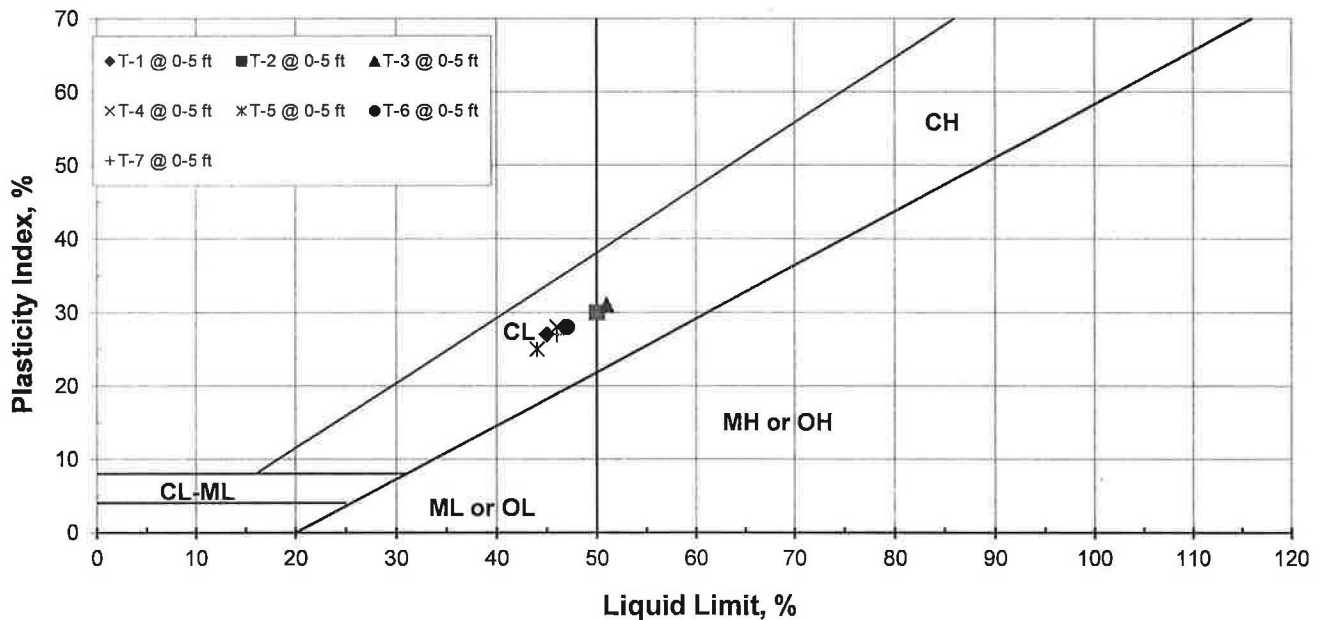
JOB No.: LE11138

DATE: 08/02/11

ATTERBERG LIMITS (ASTM D4318)

Sample Location	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Classification
T-1	0-5	45	18	27	CL
T-2	0-5	50	20	30	CL-CH
T-3	0-5	51	20	31	CH
T-4	0-5	46	18	28	CL
T-5	0-5	44	19	25	CL
T-6	0-5	47	19	28	CL
T-7	0-5	46	19	27	CL

PLASTICITY CHART



LANDMARK
Geo-Engineers and Geologists

Project No.: LE11138

Atterberg Limits
Test Results

Plate
C-1

LANDMARK CONSULTANTS, INC.

CLIENT: Cal Energy

PROJECT: Black Rock 5-6 Geothermal Plant -- Calipatria, CA

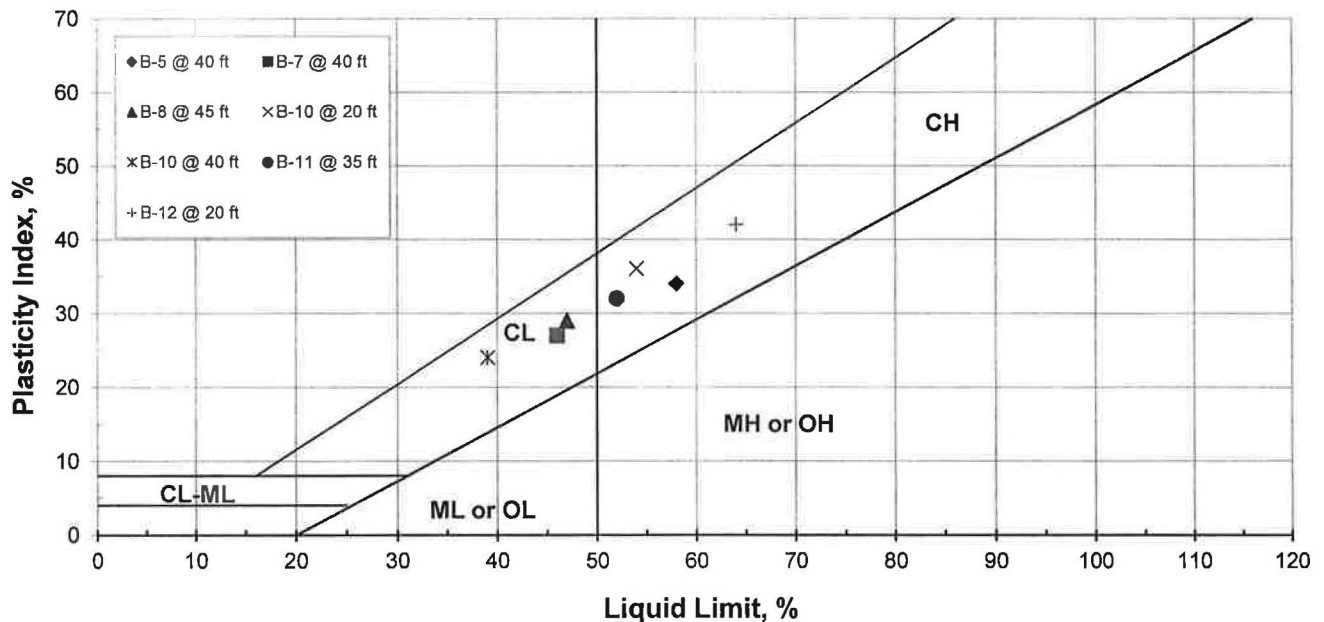
JOB No.: LE11138

DATE: 08/02/11

ATTERBERG LIMITS (ASTM D4318)

Sample Location	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Classification
B-5	40	58	24	34	CH
B-7	40	46	19	27	CL
B-8	45	47	18	29	CL
B-10	20	54	18	36	CH
B-10	40	39	15	24	CL
B-11	35	52	20	32	CH
B-12	20	64	22	42	CH

PLASTICITY CHART



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Project No.: LE11138

Atterberg Limits
Test Results

Plate
C-2

LANDMARK CONSULTANTS, INC.

CLIENT: Cal Energy

PROJECT: Black Rock 5-6 Geothermal Plant -- Calipatria, CA

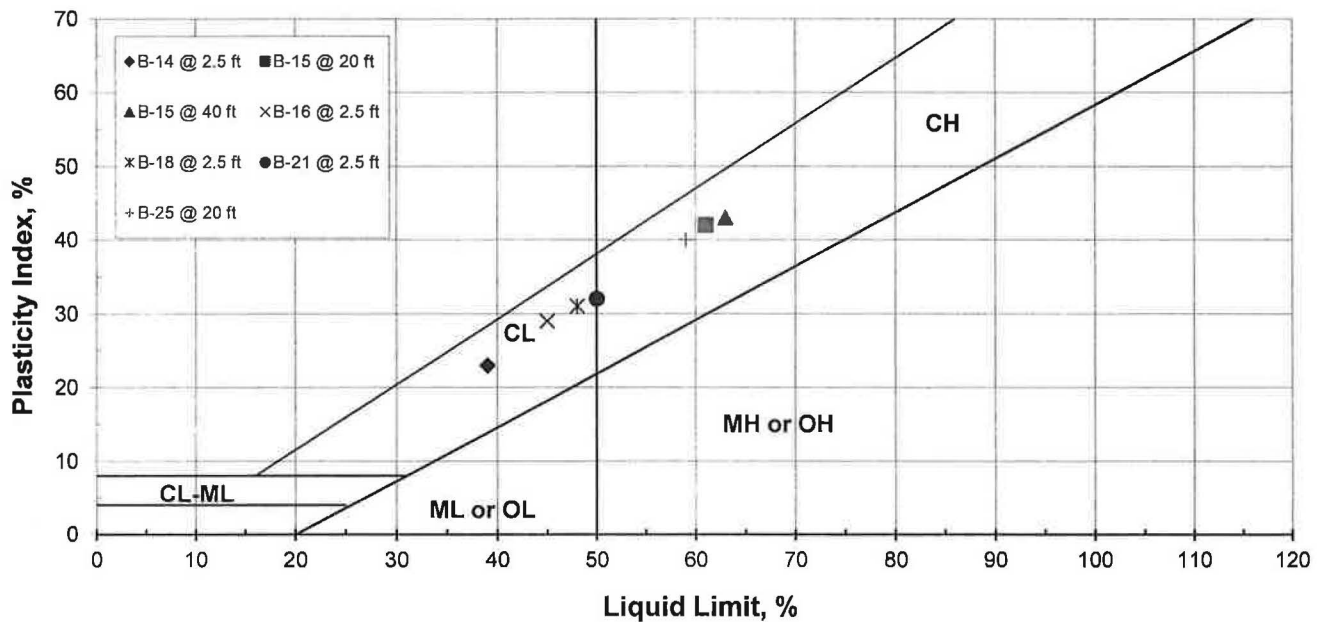
JOB No.: LE11138

DATE: 08/02/11

ATTERBERG LIMITS (ASTM D4318)

Sample Location	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Classification
B-14	2.5	39	16	23	CL
B-15	20	61	19	42	CH
B-15	40	63	20	43	CH
B-16	2.5	45	16	29	CL
B-18	2.5	48	17	31	CL
B-21	2.5	50	18	32	CL-CH
B-25	20	59	19	40	CH

PLASTICITY CHART



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Project No.: LE11138

Atterberg Limits
Test Results

Plate
C-3

LANDMARK CONSULTANTS, INC.

CLIENT: Cal Energy

PROJECT: Black Rock 5-6 -- Calipatria, CA

JOB NO: LE11138

DATE: 8/1/2011

EXPANSION INDEX TEST (UBC 29-2 & ASTM D4829)

Sample Location & Depth (ft)	Initial Moisture (%)	Compacted Dry Density (pcf)	Final Moisture (%)	Volumetric Swell (%)	Expansion Index (EI)	Expansive Potential
B-6 0-5 ft.	9.5	108.2	27.4	11.0	106	High
B-11 0-5 ft.	10.4	104.0	28.2	13.7	132	Very High
B-20 0-5 ft.	11.8	106.5	26.4	11.0	115	High

UBC CLASSIFICATION

0-20	Very Low
20-50	Low
50-90	Medium
90-130	High
130+	Very High

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Project No.: LE11138

**Expansion Index
Test Results**

**Plate
C-6**

LANDMARK CONSULTANTS, INC.

CLIENT: Cal Energy
PROJECT: Black Rock 5-6 Geothermal Plant -- Calipatria, CA
JOB No.: LE11138
DATE: 08/02/11

CHEMICAL ANALYSIS

Boring: Sample Depth, ft:	B-20 0-5	B-21 0-5	B-25 0-5	Caltrans Method
pH:	7.4	7.4	7.5	643
Electrical Conductivity (mmhos):	3.1	2.1	2.1	424
Resistivity (ohm-cm):	310	300	310	643
Chloride (Cl), ppm:	760	820	280	422
Sulfate (SO ₄), ppm:	5,981	3,079	4,083	417

General Guidelines for Soil Corrosivity

Material Affected	Chemical Agent	Amount in Soil (ppm)	Degree of Corrosivity
Concrete	Soluble Sulfates	0 - 1,000	Low
		1,000 - 2,000	Moderate
		2,000 - 20,000	Severe
		> 20,000	Very Severe
Normal Grade Steel	Soluble Chlorides	0 - 200	Low
		200 - 700	Moderate
		700 - 1,500	Severe
		> 1,500	Very Severe
Normal Grade Steel	Resistivity	1 - 1,000	Very Severe
		1,000 - 2,000	Severe
		2,000 - 10,000	Moderate
		> 10,000	Low

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Project No.: LE11138

**Selected Chemical
Test Results**

**Plate
C-8**

LANDMARK CONSULTANTS, INC.

CLIENT: Cal Energy

PROJECT: Black Rock 5-6 Geothermal Plant -- Calipatria, CA

JOB No.: LE11138

DATE: 08/02/11

CHEMICAL ANALYSIS

Boring:	B-7	B-12	B-15	Caltrans
Sample Depth, ft:	0-5	0-5	0-5	Method
pH:	7.3	7.4	7.6	643
Electrical Conductivity (mmhos):	2.9	2.5	2.2	424
Resistivity (ohm-cm):	290	330	290	643
Chloride (Cl), ppm:	1,150	610	580	422
Sulfate (SO ₄), ppm:	5,337	4,641	3,614	417

General Guidelines for Soil Corrosivity

Material Affected	Chemical Agent	Amount in Soil (ppm)	Degree of Corrosivity
Concrete	Soluble Sulfates	0 - 1,000	Low
		1,000 - 2,000	Moderate
		2,000 - 20,000	Severe
		> 20,000	Very Severe
Normal Grade Steel	Soluble Chlorides	0 - 200	Low
		200 - 700	Moderate
		700 - 1,500	Severe
		> 1,500	Very Severe
Normal Grade Steel	Resistivity	1 - 1,000	Very Severe
		1,000 - 2,000	Severe
		2,000 - 10,000	Moderate
		> 10,000	Low

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Project No.: LE11138

**Selected Chemical
Test Results**

**Plate
C-7**

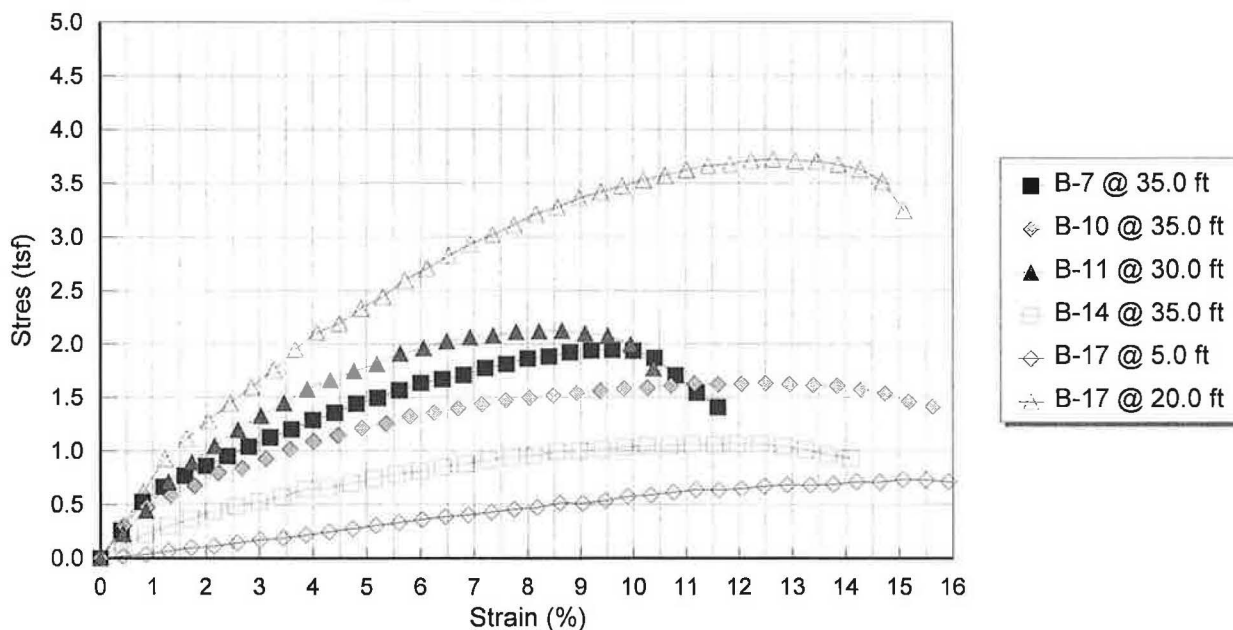
LANDMARK CONSULTANTS, INC.

CLIENT: Cal Energy
PROJECT: Black Rock 5-6
JOB NO: LE11138
DATE: 07/25/11

UNCONFINED COMPRESSION TEST (ASTM D2166)

Boring No.	Sample Depth (ft)	Natural Moisture Content (%)	Unit Dry Weight (pcf)	Maximum Compressive Strength (tsf)	Cohesion (tsf)	Failure Strain (%)
B-7	35.0	32.3	88.5	1.77	0.89	7.2
B-10	35.0	35.2	83.6	1.63	0.81	12.5
B-11	30.0	30.5	89.9	2.12	1.06	8.7
B-14	35.0	38.3	80.3	0.94	0.47	7.7
B-17	5.0	27.2	95.4	0.46	0.23	7.7
B-17	20.0	24.6	99.7	3.57	1.79	10.6

STRESS-STRAIN PLOT



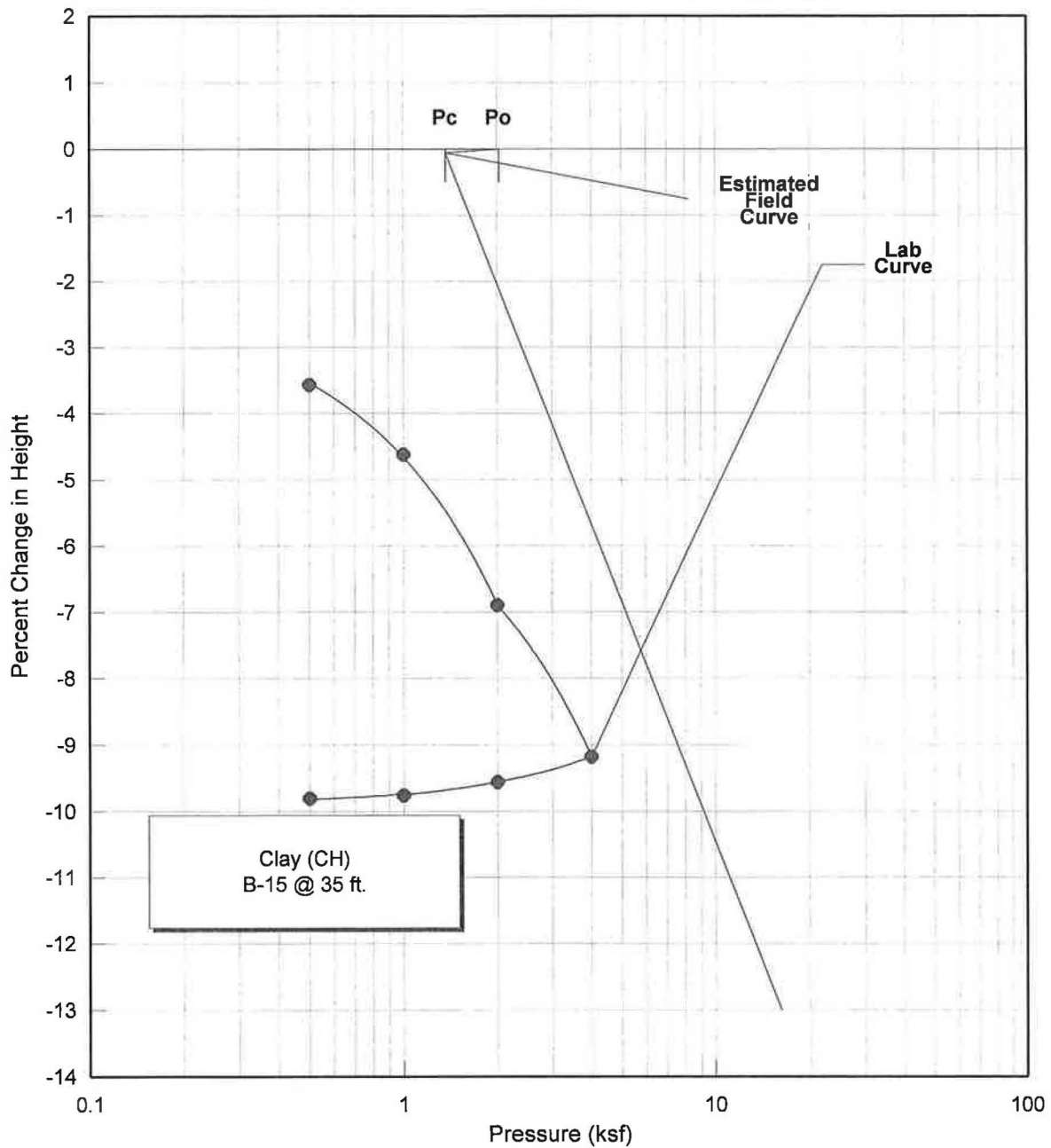
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Project No: LE11138

Unconfined Compression
Test Results

Plate
C-9

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D2435)



Results of Test:

Overburden Pressure, Po: 2.0 ksf
 Preconsol. Pressure, Pc: 1.4 ksf
 Compression Index, Cc: 0.251
 Recompression. Index, Cr: -0.007

	Initial	Final
Dry Density, pcf:	82.3	86.0
Water Content, %:	35.9	30.2
Void Ratio, e:	1.085	0.995
Saturation, %:	91.0	83.5

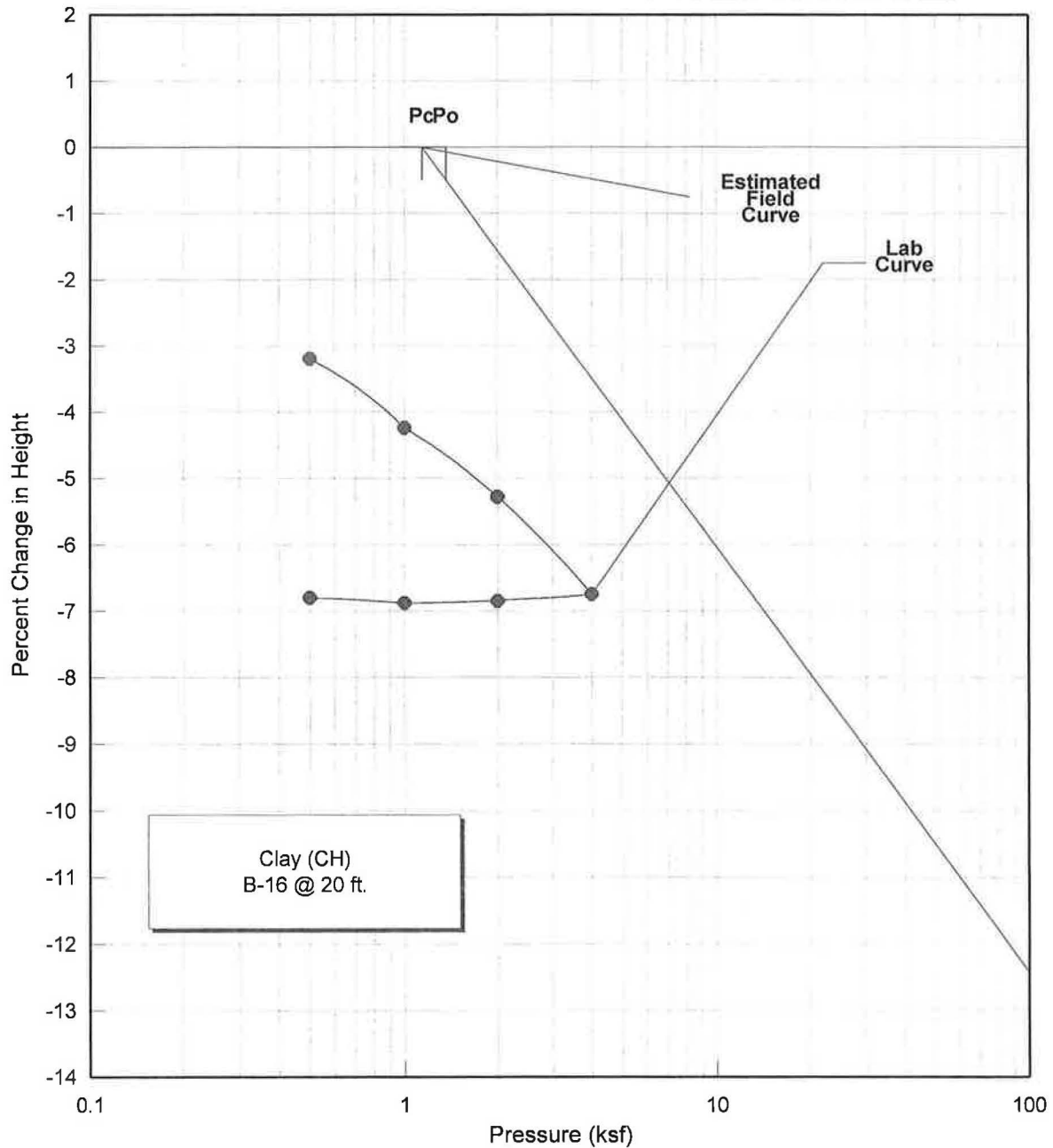
LANDMARK
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Project No: LE11138

**Consolidation
 Test Results**

**Plate
 C-10**

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D2435)



Results of Test:

			Initial	Final
Overburden Pressure, Po:	1.4 ksf	Dry Density, pcf:	90.6	97.6
Preconsol. Pressure, Pc:	1.1 ksf	Water Content, %:	27.3	22.0
Compression Index, Cc:	0.121	Void Ratio, e:	0.895	0.759
Recompression. Index, Cr:	-0.001	Saturation, %:	83.9	79.9

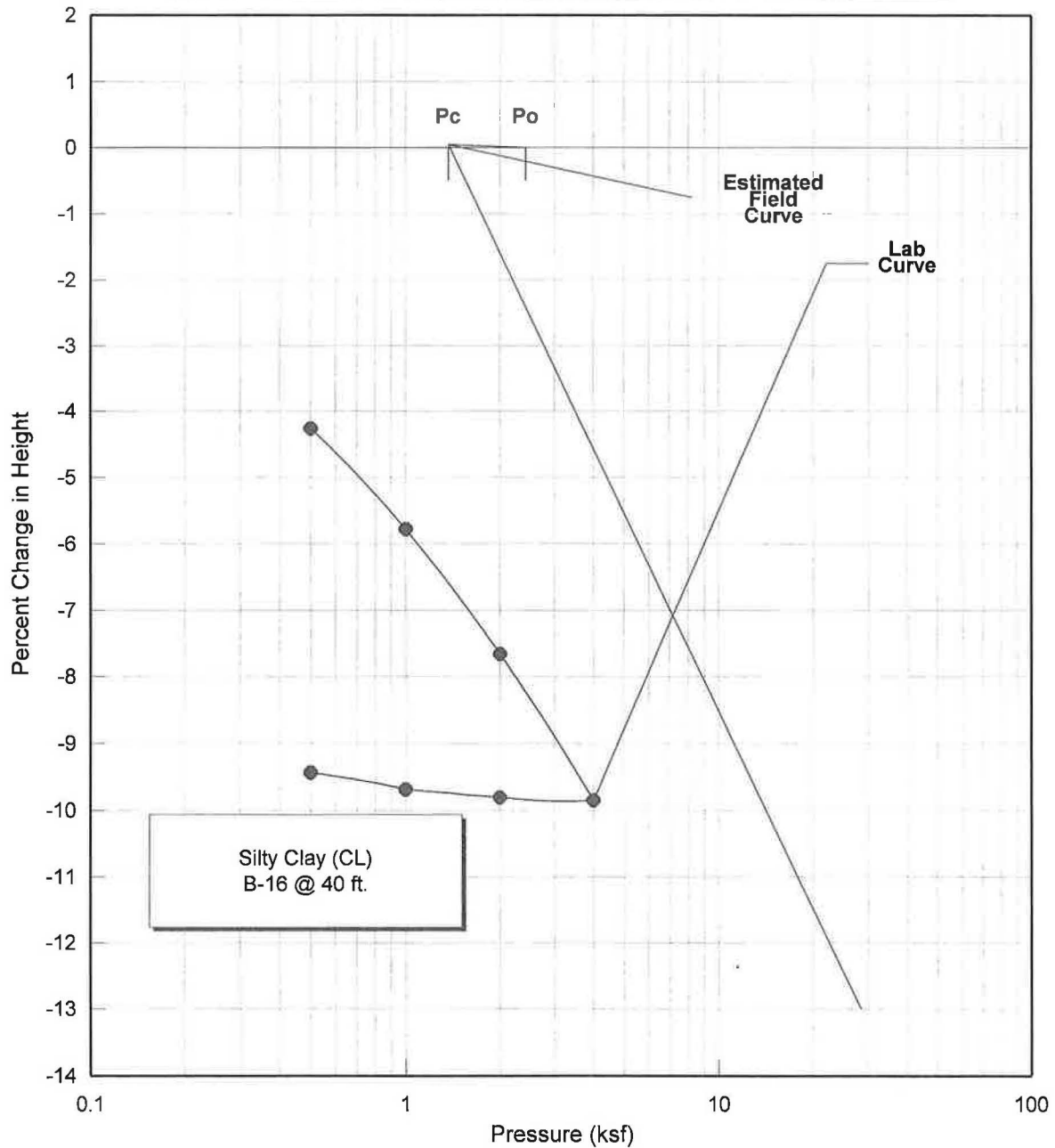
LANDMARK
Geo-Engineers and Geologists

Project No: LE11138

**Consolidation
Test Results**

**Plate
C-11**

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D2435)



Results of Test:

Overburden Pressure, P_o : 2.4 ksf
 Preconsol. Pressure, P_c : 1.4 ksf
 Compression Index, C_c : 0.191
 Recompression. Index, C_r : 0.004

	Initial	Final
Dry Density, pcf:	89.2	98.6
Water Content, %:	29.3	22.7
Void Ratio, e :	0.924	0.741
Saturation, %:	87.2	84.4

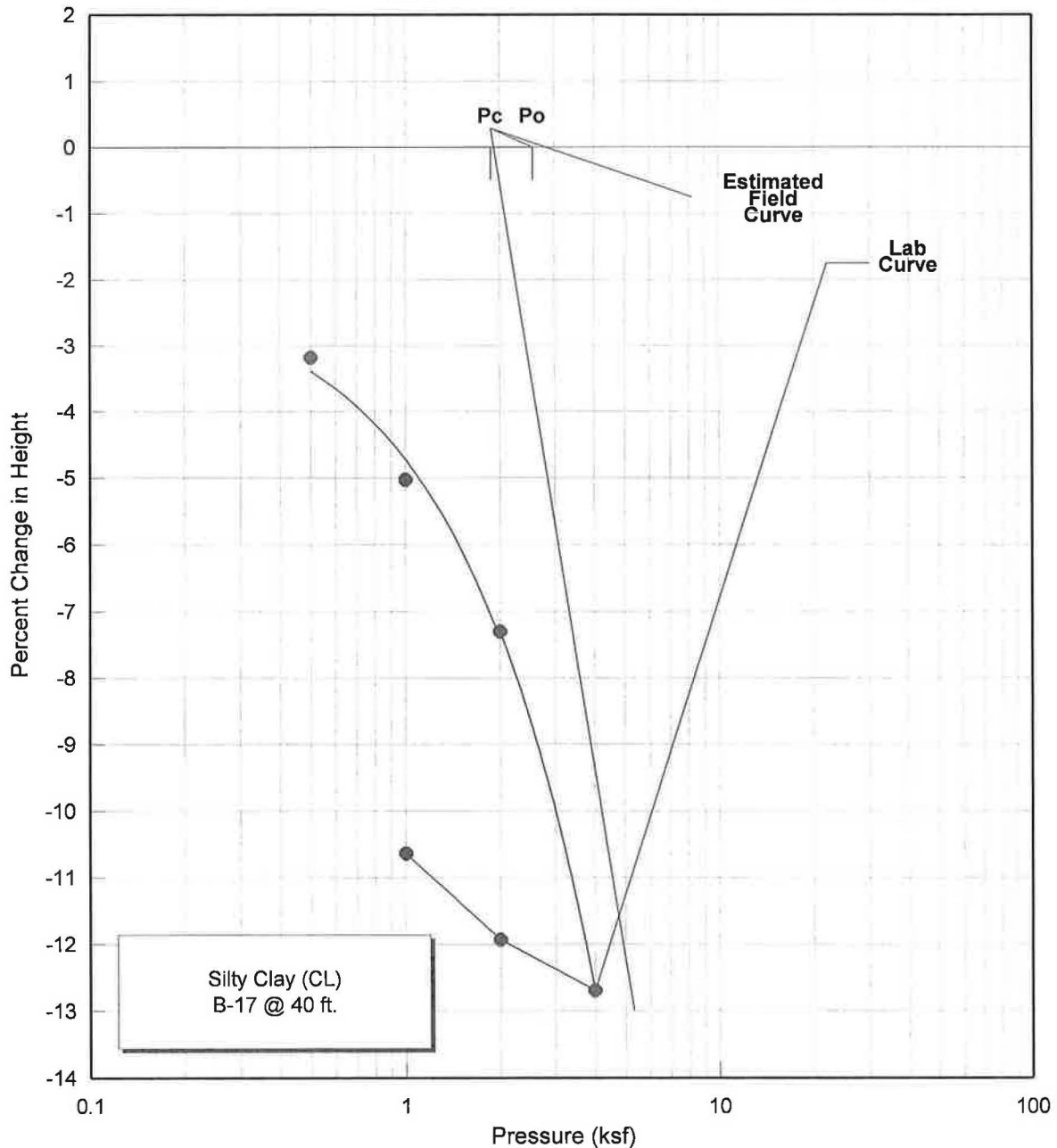
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Project No: LE11138

**Consolidation
 Test Results**

**Plate
 C-12**

ONE DIMENSIONAL CONSOLIDATION TEST (ASTM D2435)



Results of Test:

Overburden Pressure, Po: 2.6 ksf
 Preconsol. Pressure, Pc: 1.9 ksf
 Compression Index, Cc: 0.587
 Recompression. Index, Cr: 0.043

	Initial	Final
Dry Density, pcf:	85.6	95.9
Water Content, %:	38.3	37.1
Void Ratio, e:	1.006	0.790
Saturation, %:	104.9	100.0

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 Geo-Engineers and Geologists

Project No: LE11138

**Consolidation
 Test Results**

**Plate
 C-13**

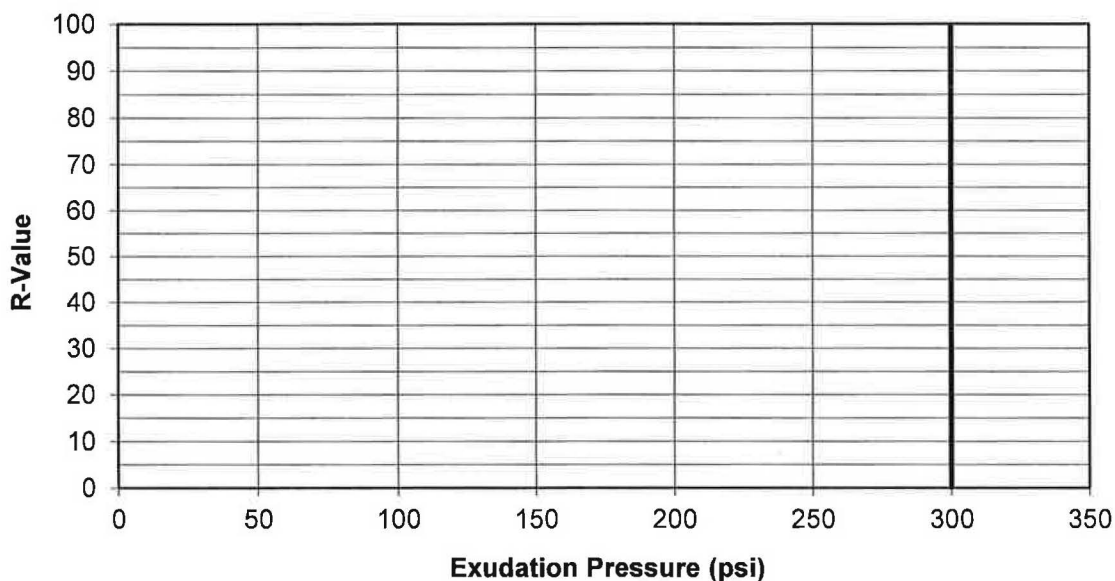
LANDMARK CONSULTANTS, INC.

Client: Cal Energy
Project: Black Rock 5-6 Geothermal Plant -- Calipatria, CA
Project No.: LE11138
Date: 8/4/2011

R-Value By Exudation Pressure (ASTM D2844)

Sample Location: B-10
Sample Depth: 0-3 ft.

Sample	A	B	C
Moisture Content, %:	23.6%	21.9%	17.7%
Dry Density, pcf:	98.0	101.3	104.5
Compaction foot pressure, psi:	70	85	180
Specimen Height, in.:	2.45	2.55	2.46
Stabilometer, Ph @ 1000 lb:			
Stabilometer, Ph @ 2000 lb:			
Displacement:			
Exudation pressure, psi:			
Equilibrium R Value:	<5	>5	<5
R-Value	<5		



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Project No.: LE11138

R-Value Test

Plate
C-15

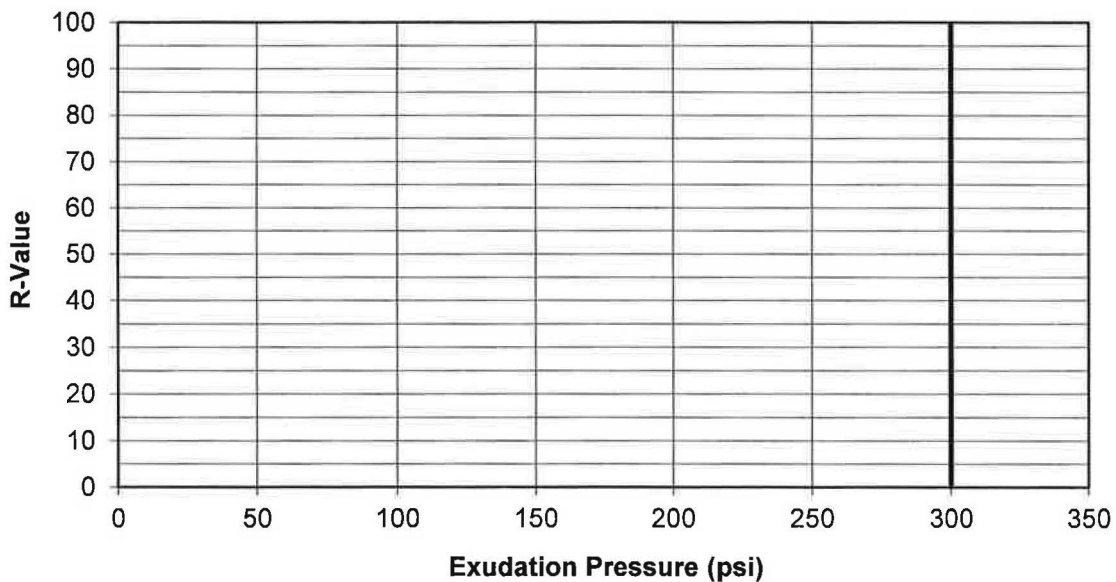
LANDMARK CONSULTANTS, INC.

Client: Cal Energy
Project: Black Rock 5-6 Geothermal Plant -- Calipatria, CA
Project No.: LE11138
Date: 8/4/2011

R-Value By Exudation Pressure (ASTM D2844)

Sample Location: B-16
Sample Depth: 0-5 ft.

Sample	A	B	C
Moisture Content, %:	21.7%	20.9%	16.7%
Dry Density, pcf:	99.7	100.8	104.0
Compaction foot pressure, psi:	75	80	160
Specimen Height, in.:	2.52	2.49	2.53
Stabilometer, Ph @ 1000 lb:			
Stabilometer, Ph @ 2000 lb:			
Displacement:			
Exudation pressure, psi:			
Equilibrium R Value:	<5	>5	<5
R-Value	<5		



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Project No.: LE11138

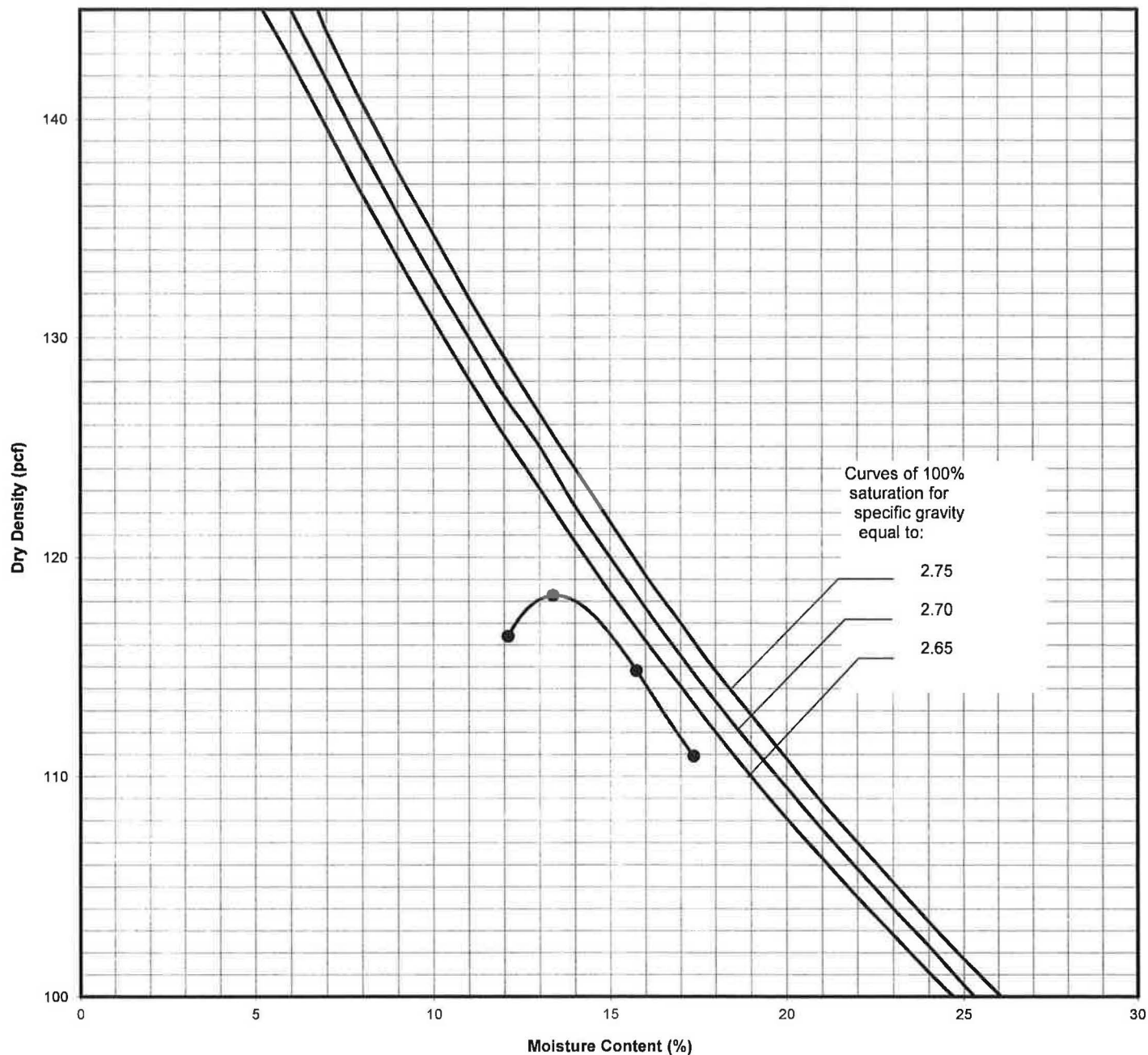
R-Value Test

Plate

C-16

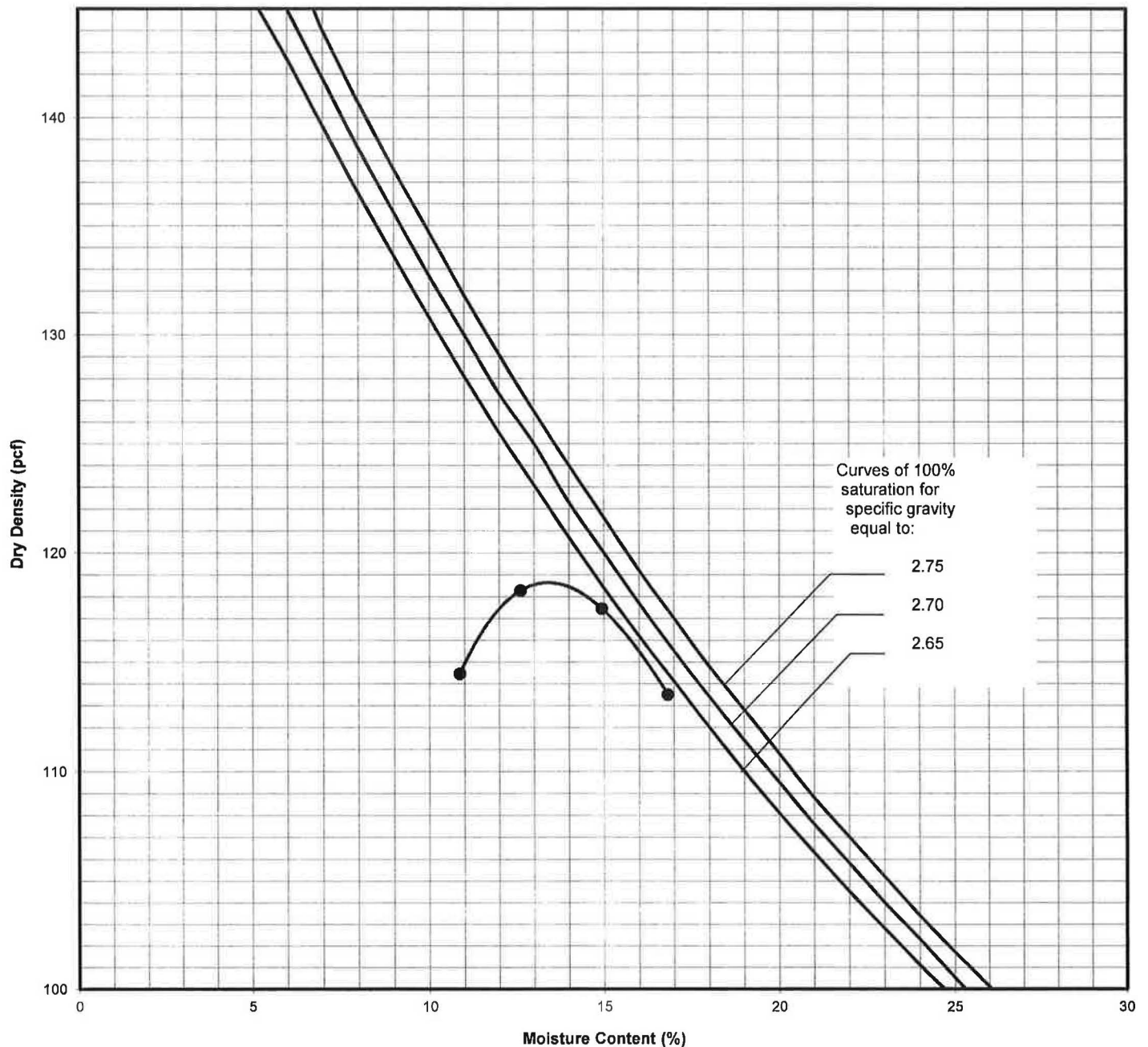
Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 6/28/2011
Lab. No.: EC11-0646

Soil Description: Silty Clay (CL)
Sample Location: B-15 @ 0-5 ft.
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 118.5
Optimum Moisture Content (%): 13.5



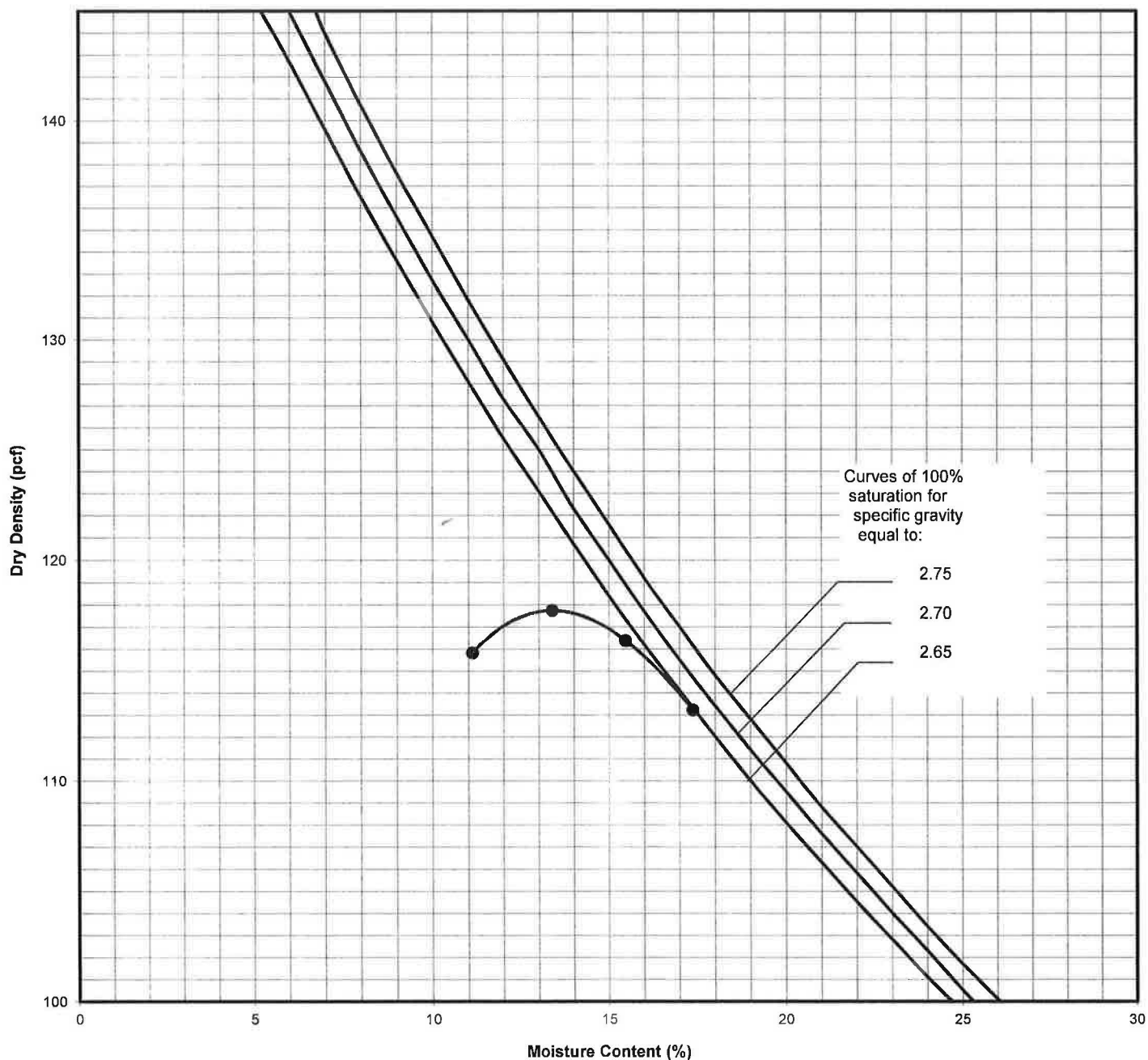
Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 6/28/2011
Lab. No.: EC11-0678

Soil Description: Silty Clay (CL)
Sample Location: B-20 @ 0-5 ft.
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 118.5
Optimum Moisture Content (%): 13.5



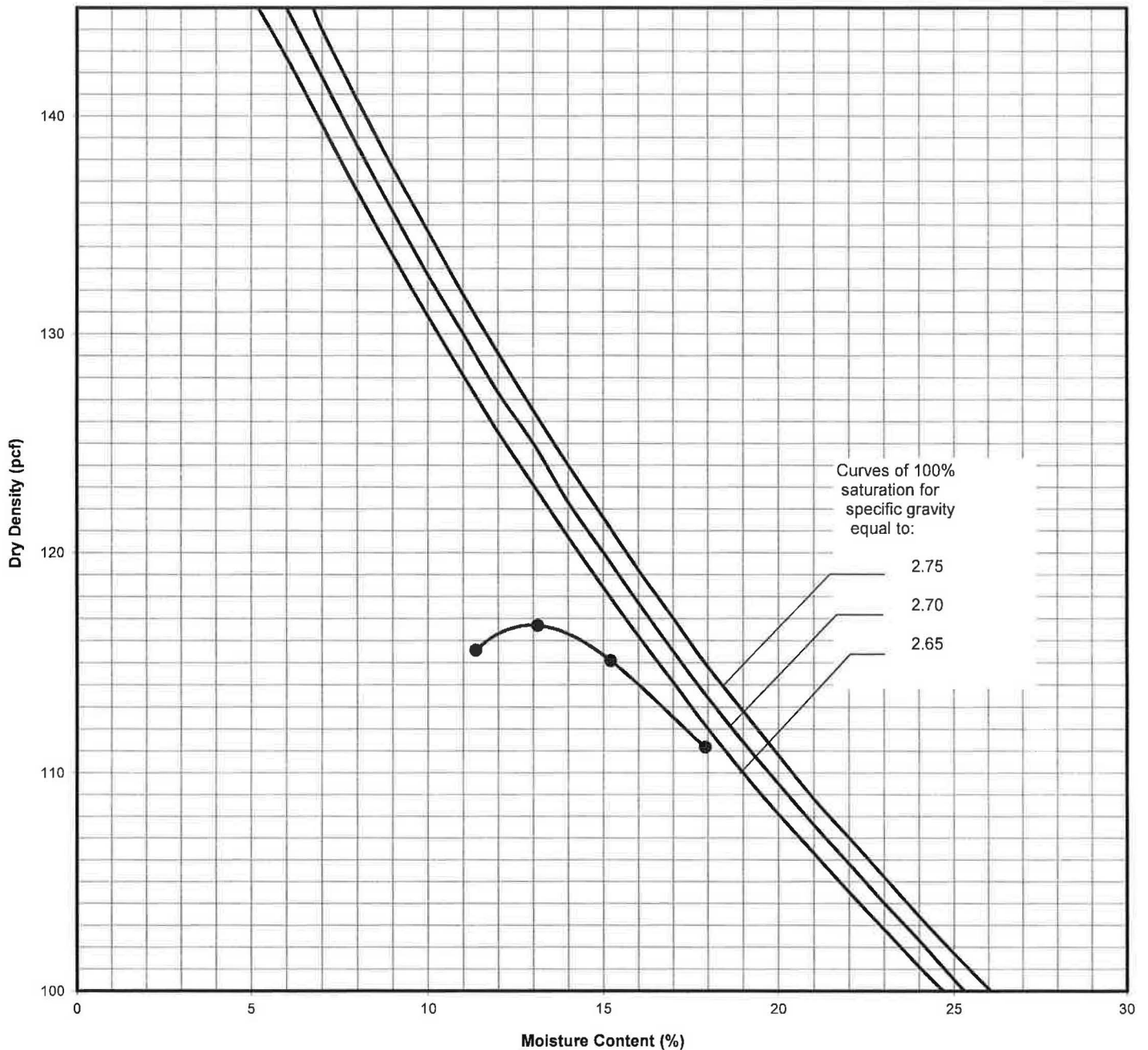
Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 6/29/2011
Lab. No.: EC11-0651

Soil Description: Silty Clay (CL)
Sample Location: B-21 @ 0-5 ft.
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 117.5
Optimum Moisture Content (%): 13.5



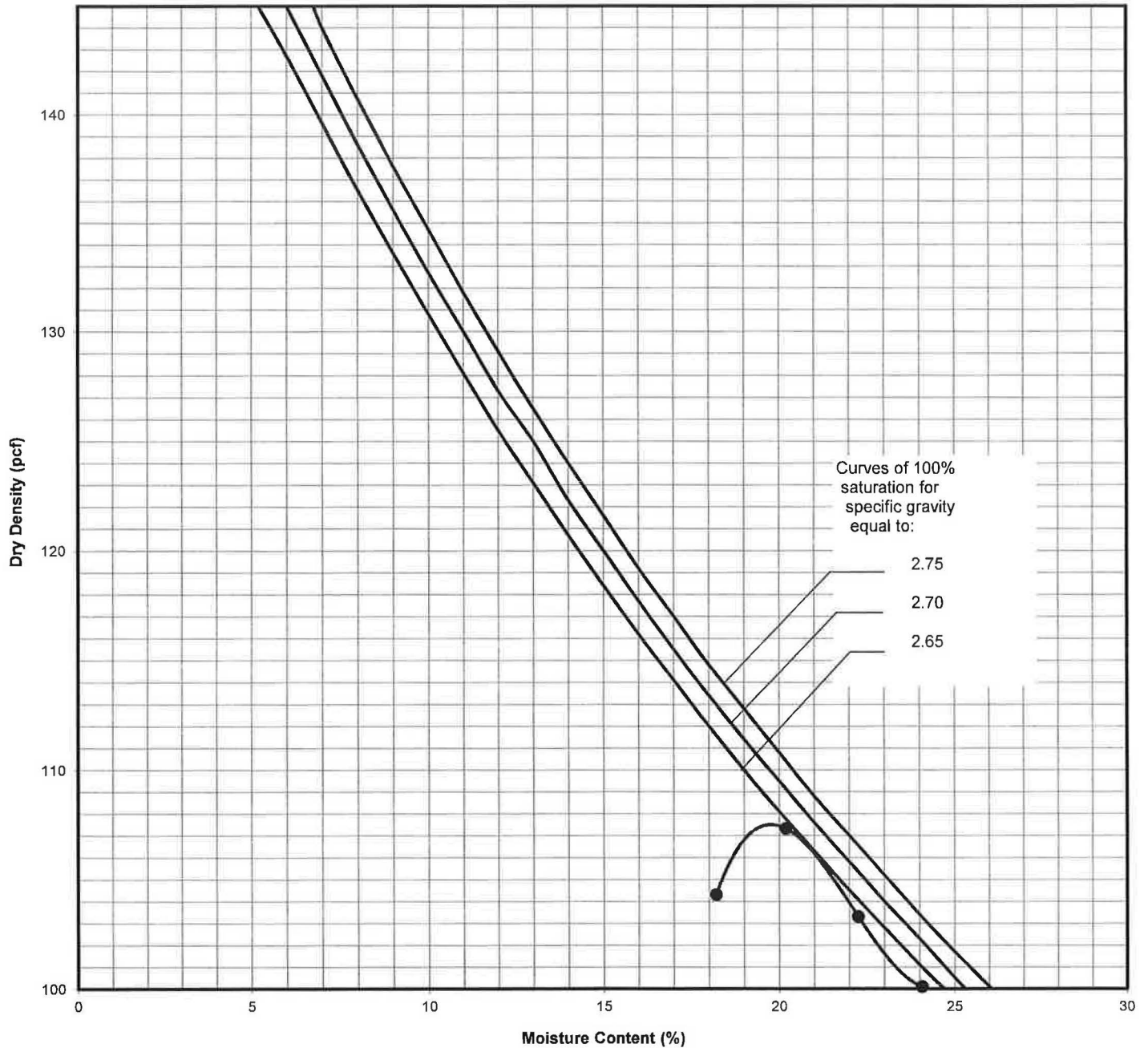
Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 6/28/2011
Lab. No.: EC11-0636

Soil Description: Silty Clay (CL)
Sample Location: Test Pit #1
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 116.5
Optimum Moisture Content (%): 13.0



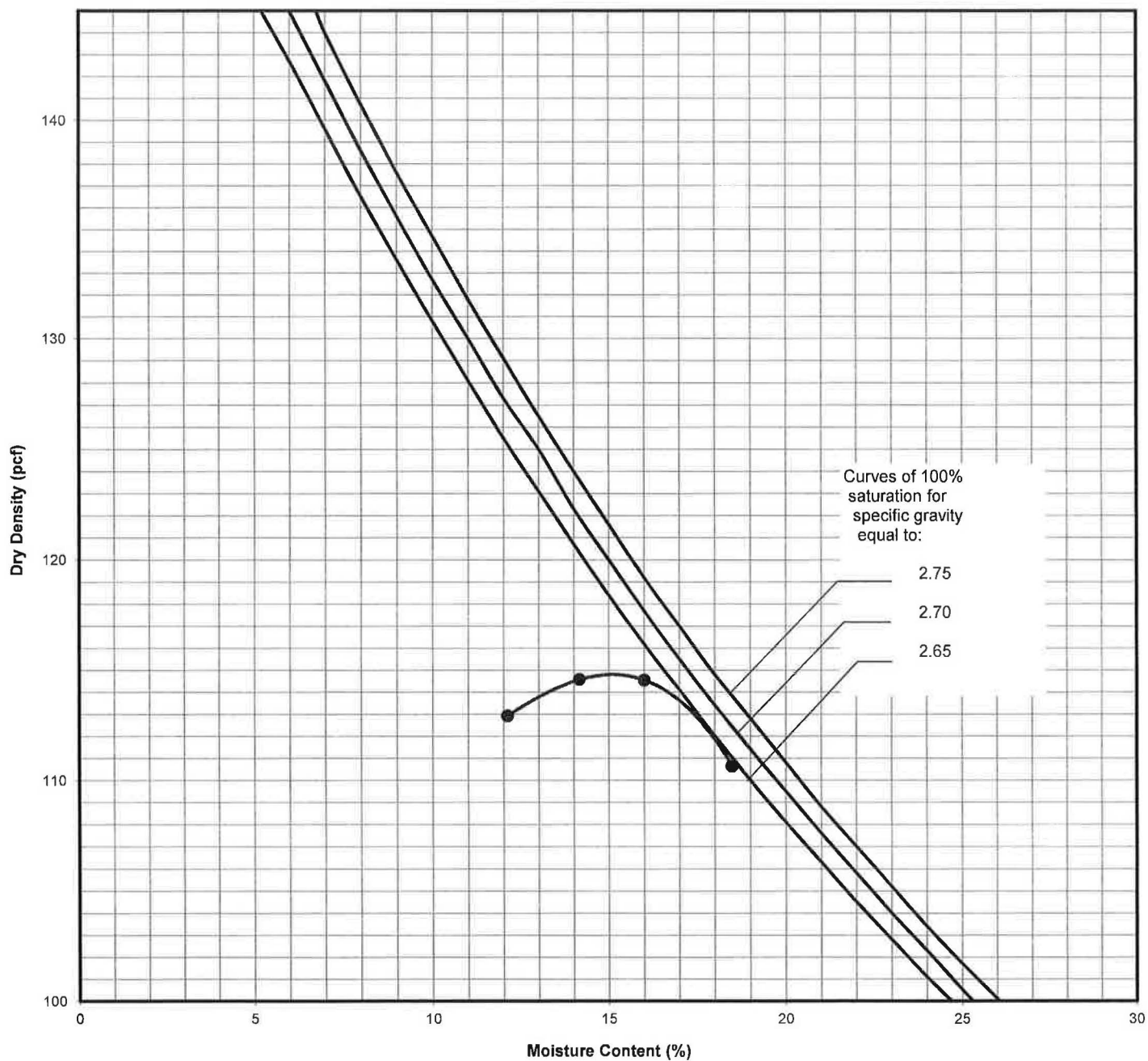
Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 6/28/2011
Lab. No.: EC11-0637

Soil Description: Silty Clay (CL)
Sample Location: Test Pit #2
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 107.5
Optimum Moisture Content (%): 19.5



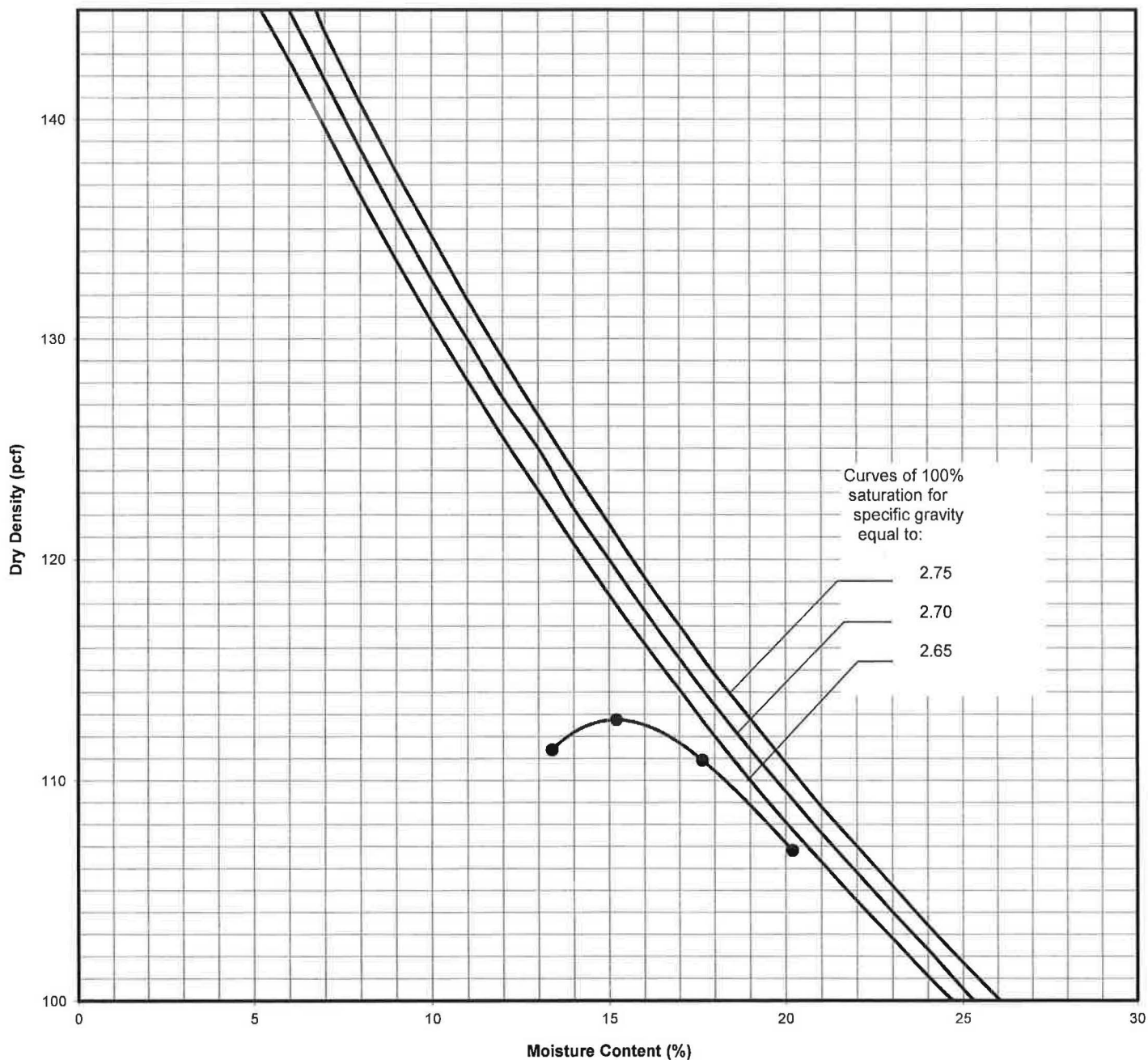
Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 6/28/2011
Lab. No.: EC11-0638

Soil Description: Silty Clay (CL)
Sample Location: Test Pit #3
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 115.0
Optimum Moisture Content (%): 15.0



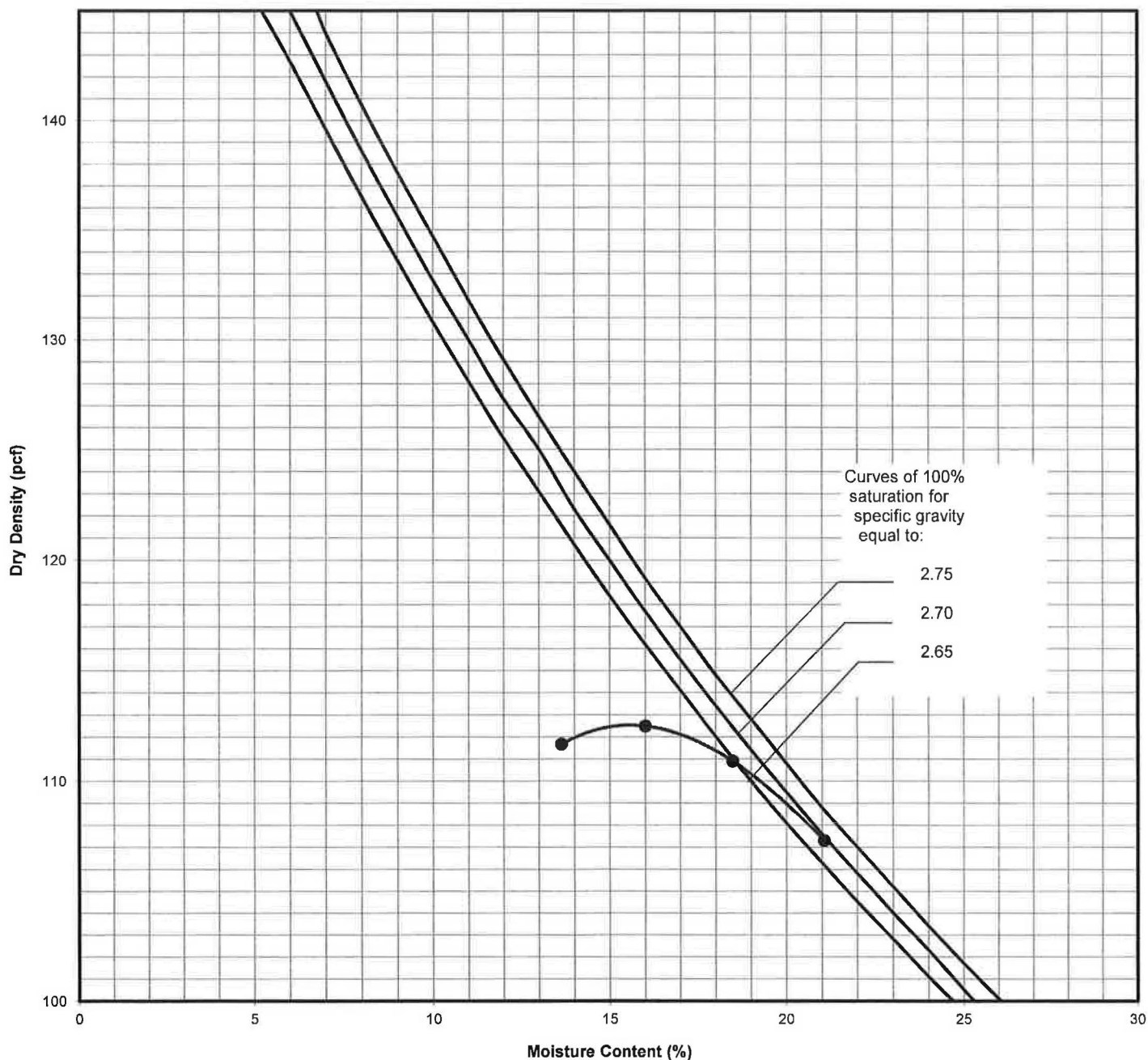
Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 6/28/2011
Lab. No.: EC11-0639

Soil Description: Silty Clay (CL)
Sample Location: Test Pit #4
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 113.0
Optimum Moisture Content (%): 15.0



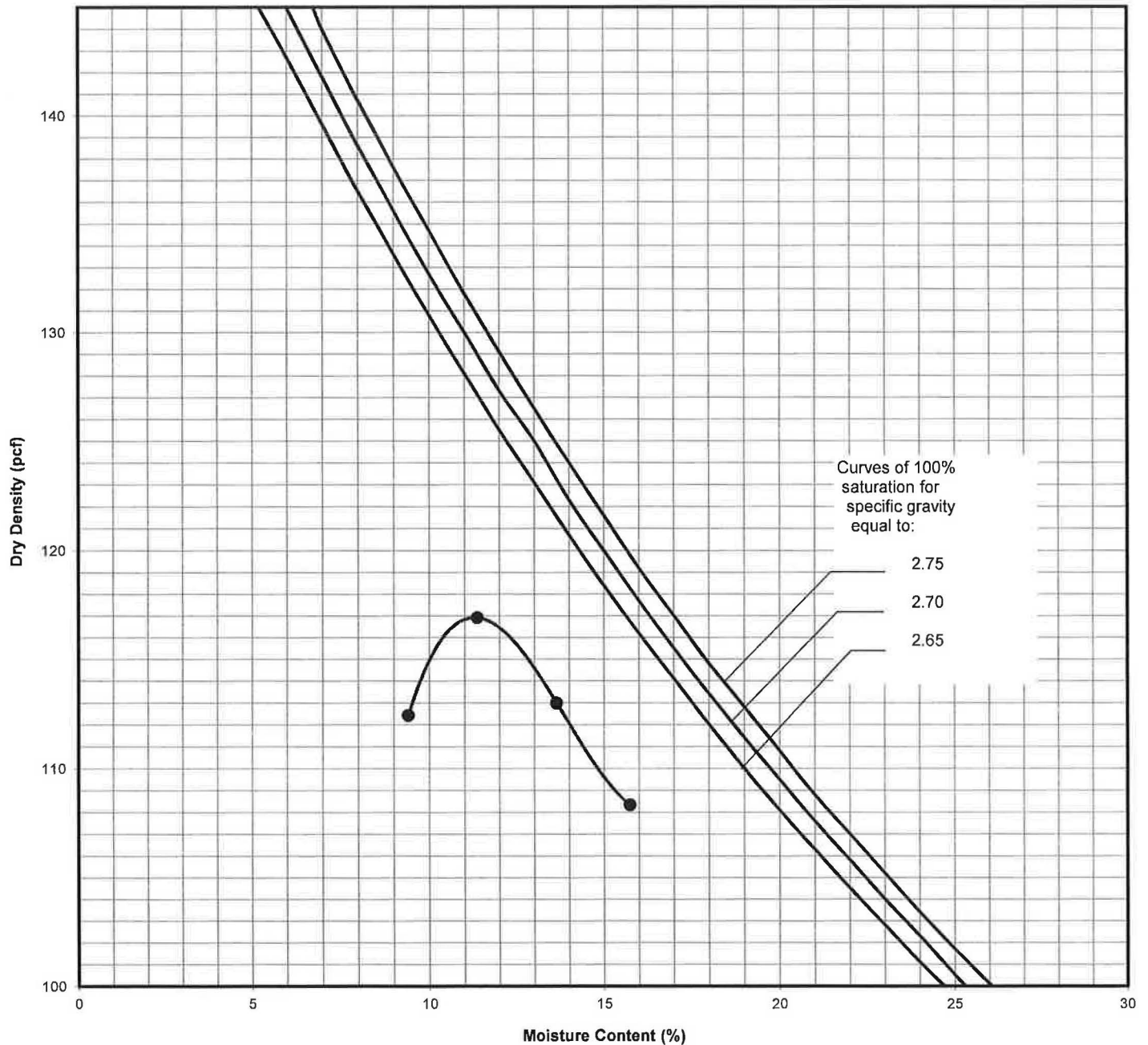
Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 6/28/2011
Lab. No.: EC11-0640

Soil Description: Silty Clay (CL)
Sample Location: Test Pit #5
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 112.5
Optimum Moisture Content (%): 15.5



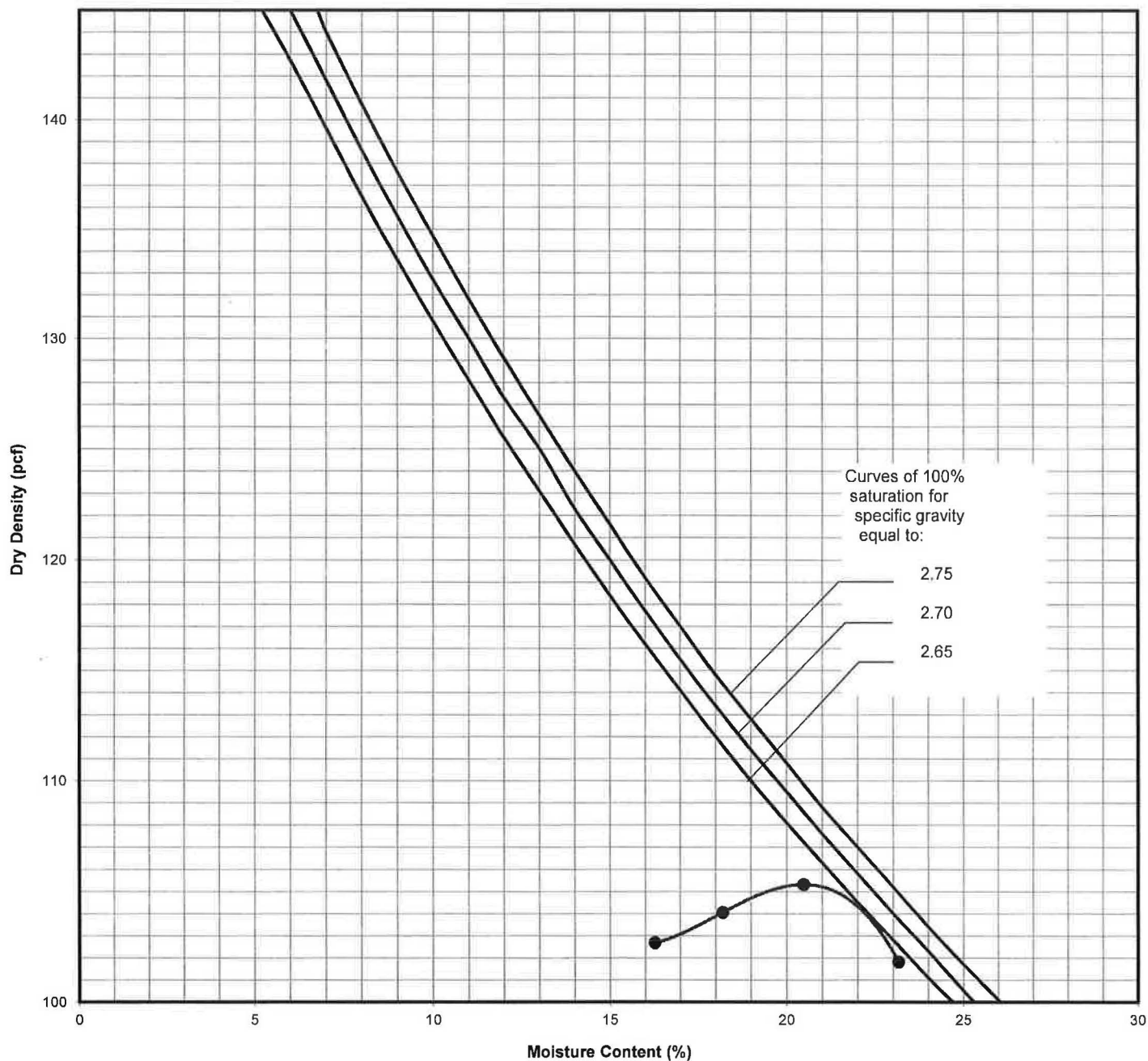
Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 6/28/2011
Lab. No.: EC11-0641

Soil Description: Silty Clay (CL)
Sample Location: Test Pit #6
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 117.0
Optimum Moisture Content (%): 11.5

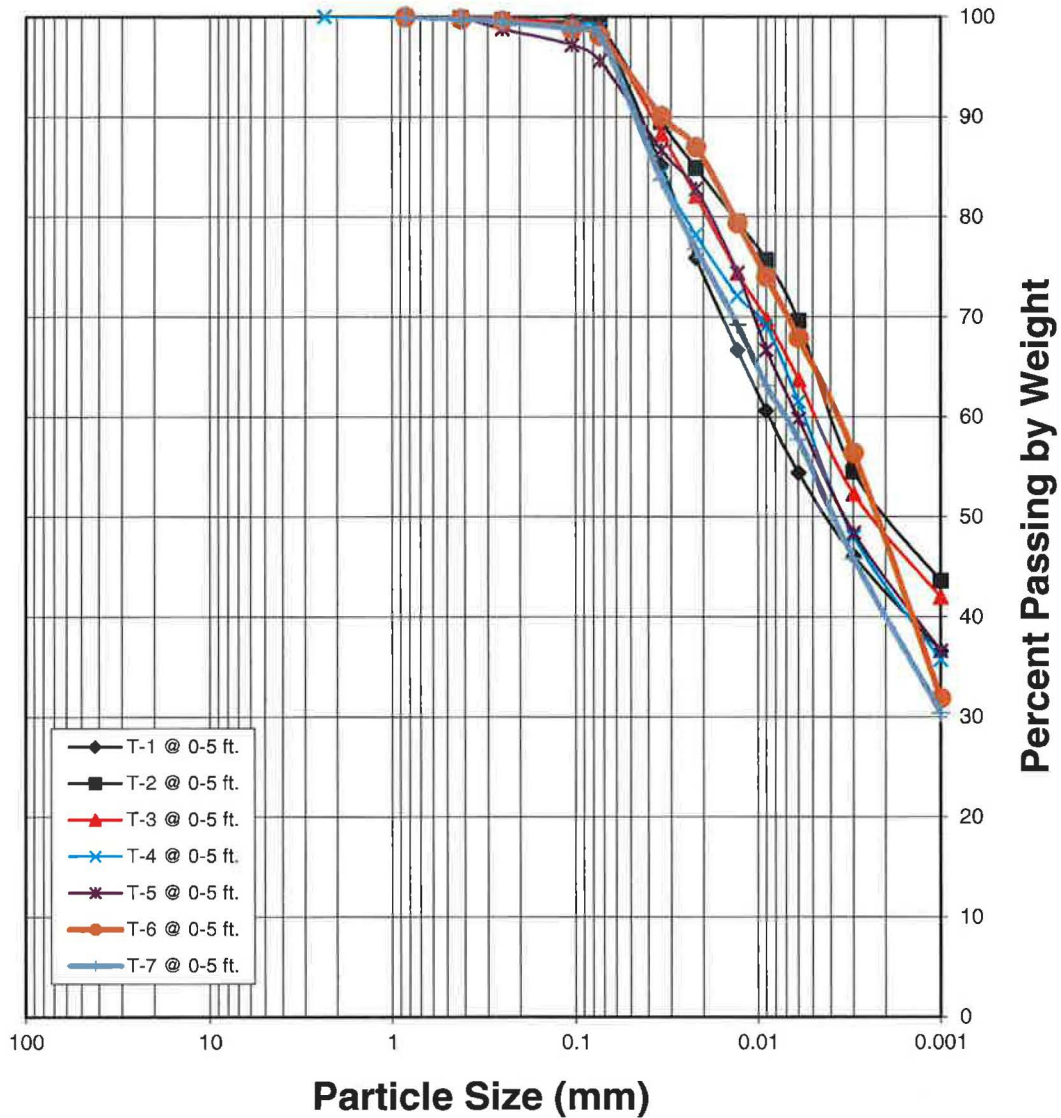


Client: Cal Energy
Project: Black Rock 5-6
Project No.: LE11138
Date: 7/7/2011
Lab. No.: EC11-0642

Soil Description: Silty Clay (CL)
Sample Location: Test Pit #7
Test Method: ASTM D-1157 A
Maximum Dry Density (pcf): 105.5
Optimum Moisture Content (%): 20.5



SIEVE ANALYSIS					HYDROMETER ANALYSIS
Gravel		Sand			Silt and Clay Fraction
Coarse	Fine	Coarse	Medium	Fine	



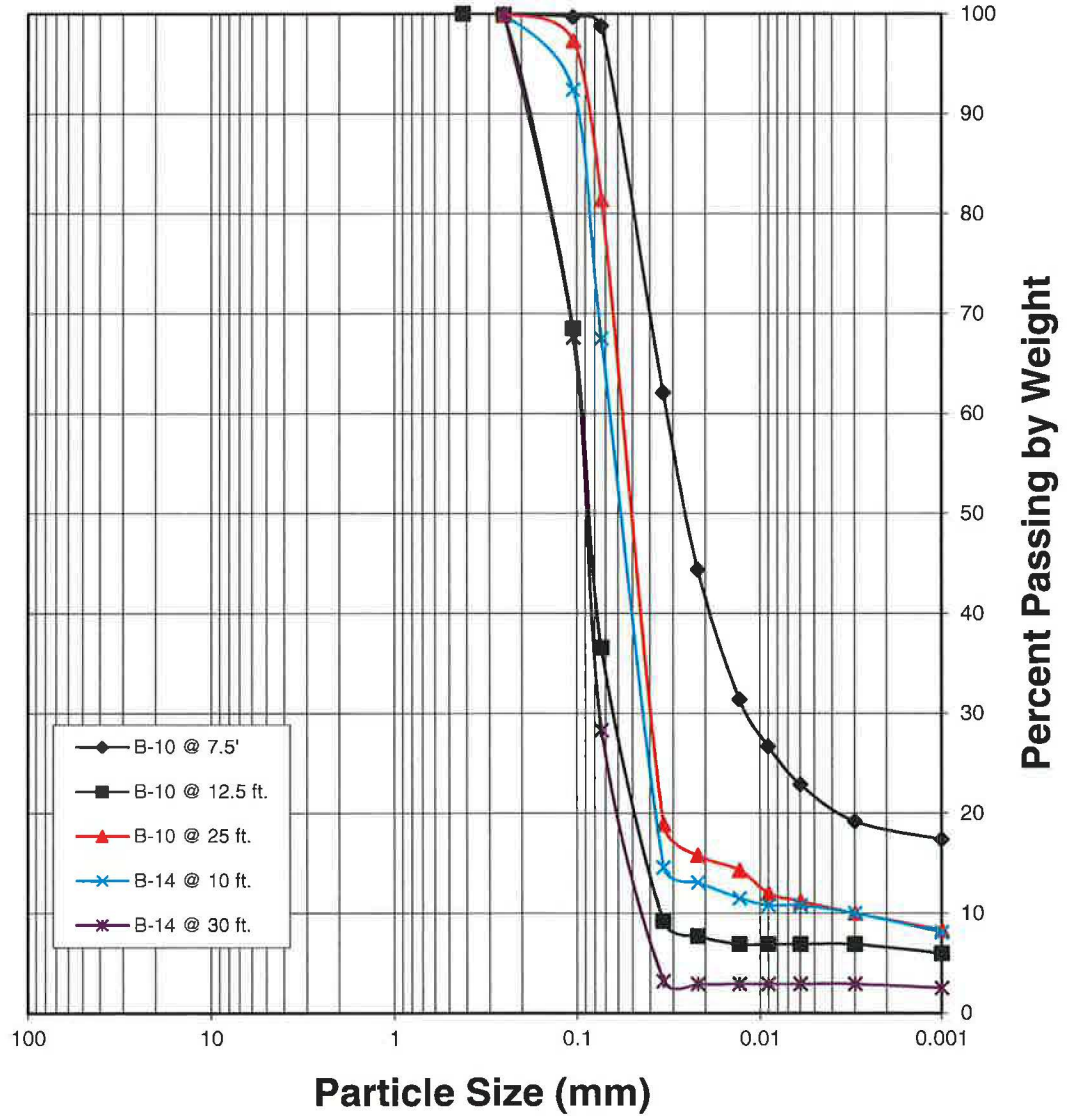
LANDMARK
Geo-Engineers and Geologists

Project No.: LE11138

Grain Size Analysis

Plate
C-27

SIEVE ANALYSIS					HYDROMETER ANALYSIS
Gravel		Sand			Silt and Clay Fraction
Coarse	Fine	Coarse	Medium	Fine	



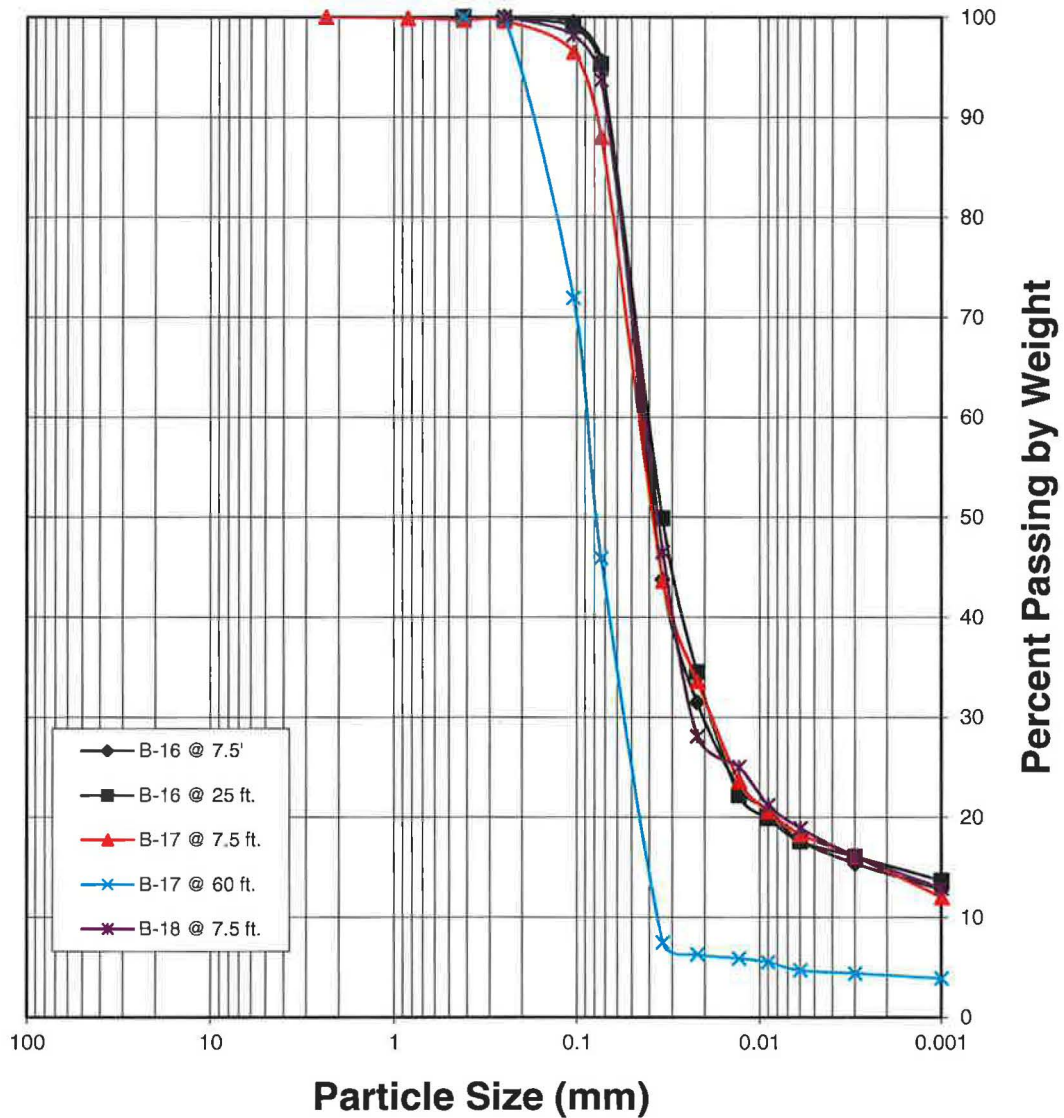
LANDMARK
Geo-Engineers and Geologists

Project No.: LE11138

Grain Size Analysis

Plate
C-28

SIEVE ANALYSIS					HYDROMETER ANALYSIS
Gravel		Sand			Silt and Clay Fraction
Coarse	Fine	Coarse	Medium	Fine	



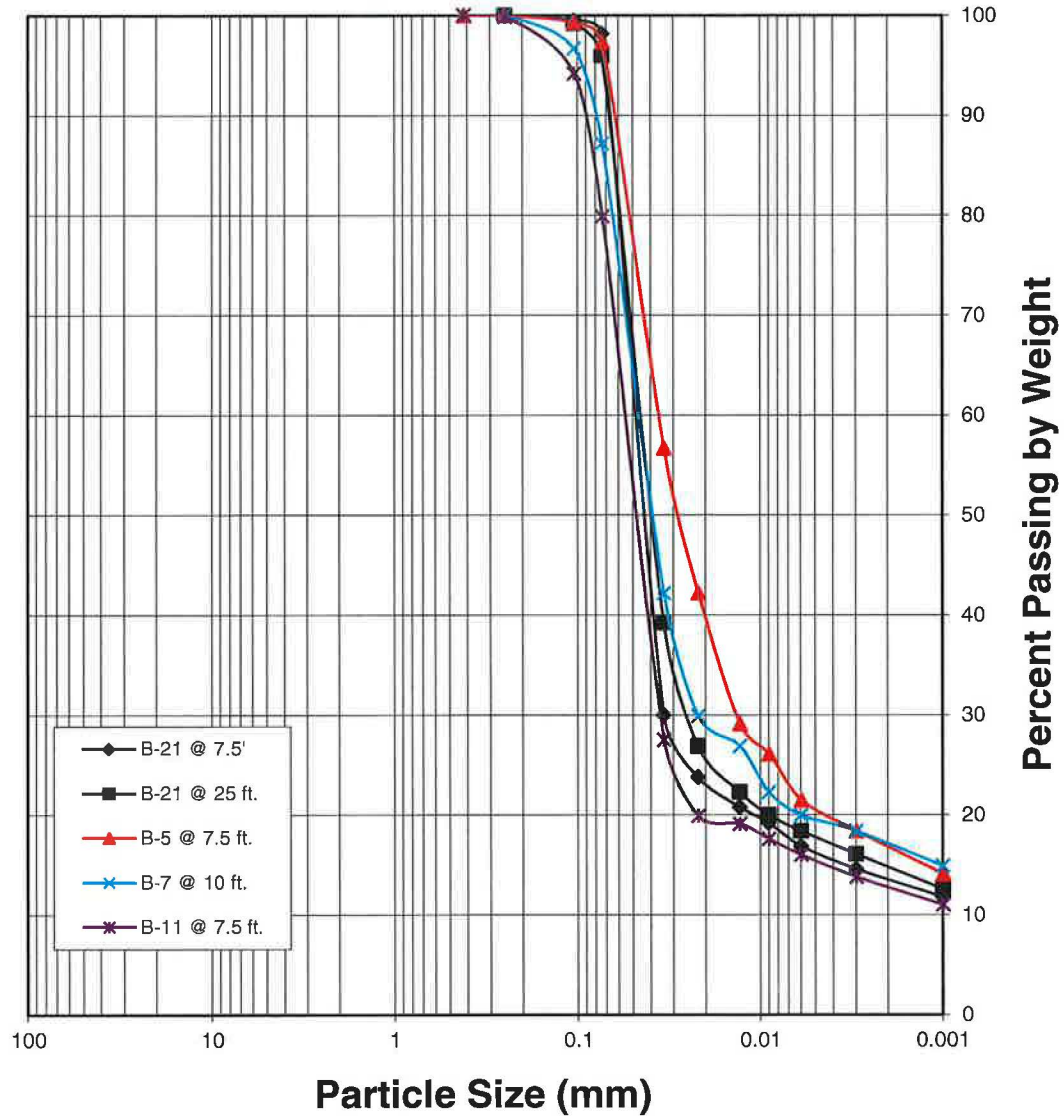
LANDMARK
Geo-Engineers and Geologists

Project No.: LE11138

Grain Size Analysis

Plate
C-29

SIEVE ANALYSIS					HYDROMETER ANALYSIS
Gravel		Sand			Silt and Clay Fraction
Coarse	Fine	Coarse	Medium	Fine	



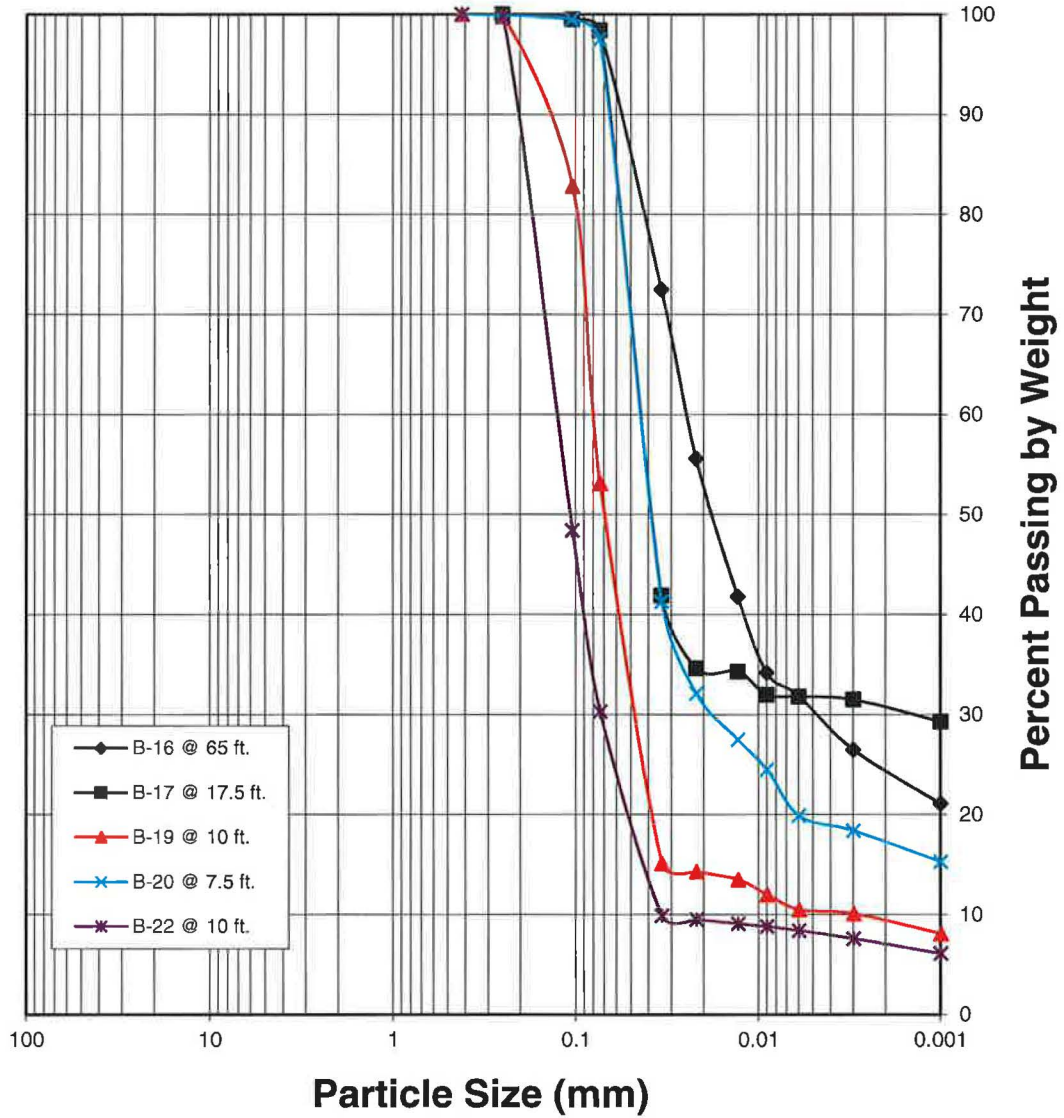
LANDMARK
Geo-Engineers and Geologists

Project No.: LE11138

Grain Size Analysis

Plate
C-30

SIEVE ANALYSIS					HYDROMETER ANALYSIS
Gravel		Sand			Silt and Clay Fraction
Coarse	Fine	Coarse	Medium	Fine	



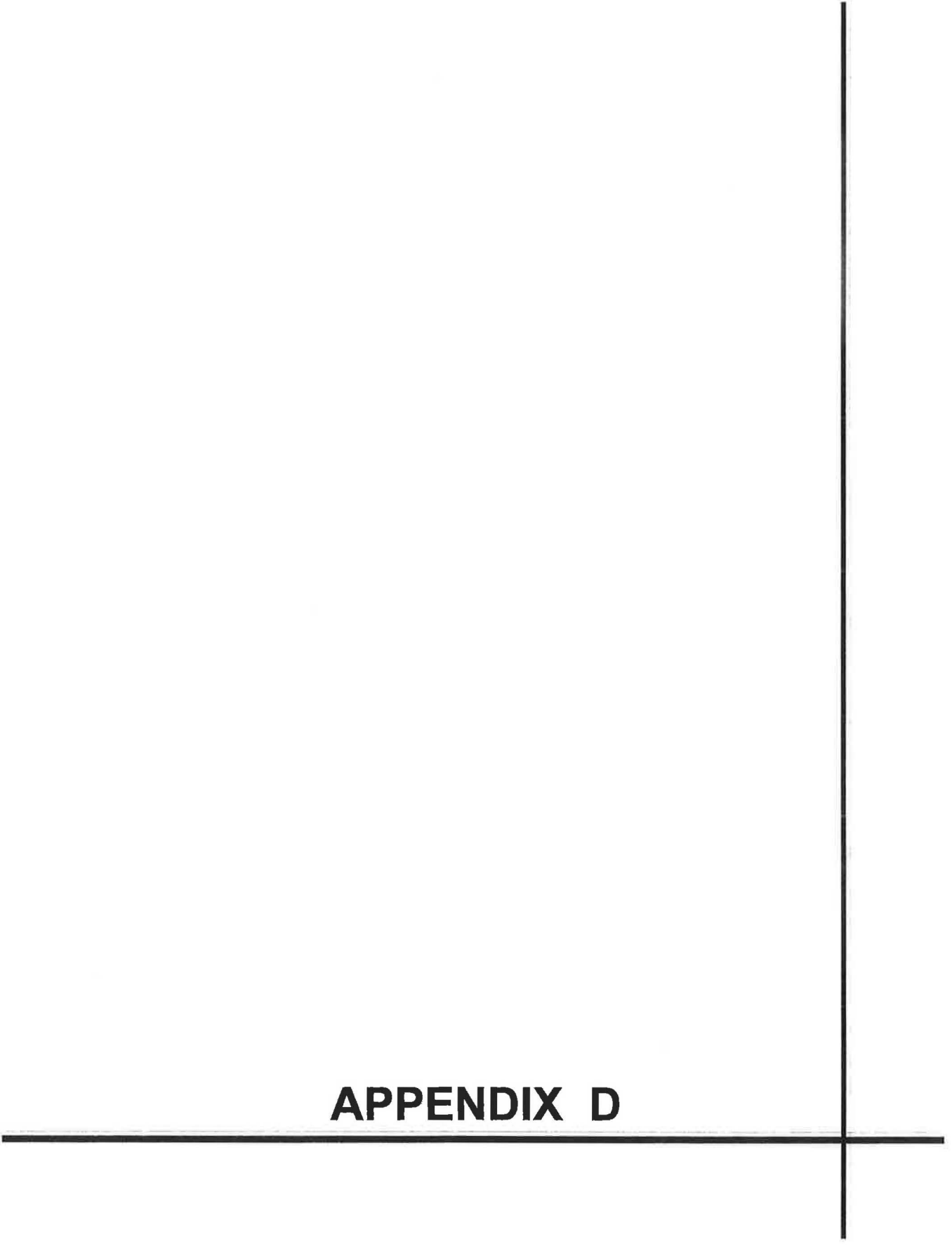
LANDMARK
Geo-Engineers and Geologists

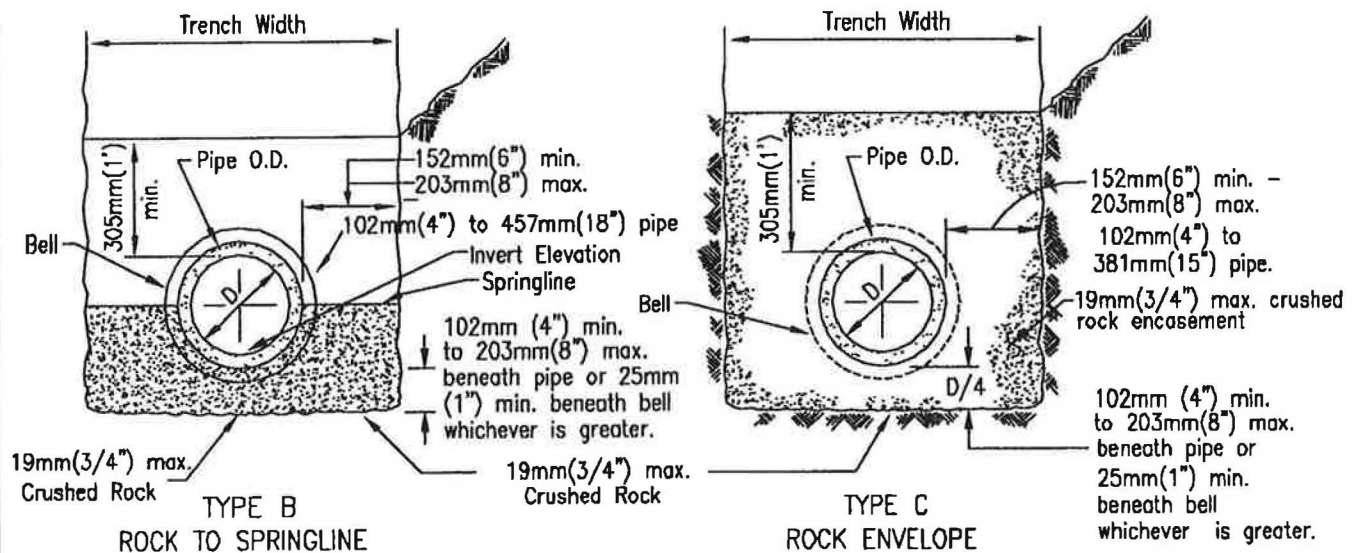
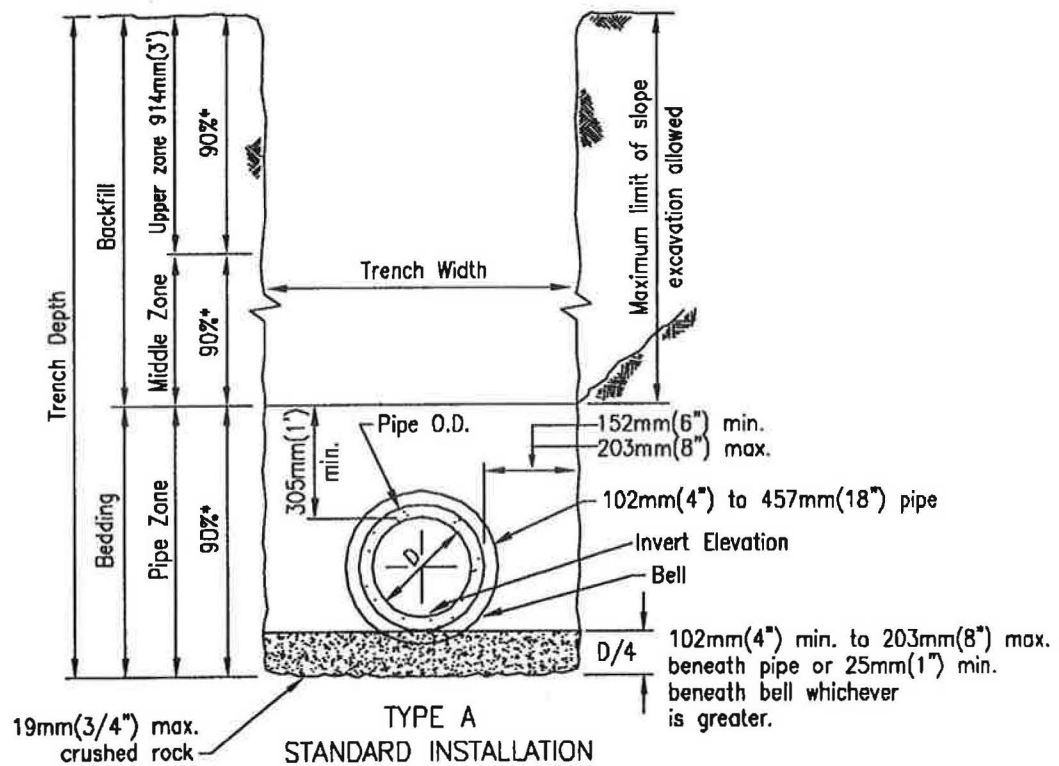
Project No.: LE11138

Grain Size Analysis

Plate
C-31

APPENDIX D





NOTES

1. For trenching in improved streets, see Standard Drawings G-24 or G-25 for trench resurfacing.
2. (*) indicates minimum relative compaction.
3. Minimum depth of cover from the top of pipe to finish grade for all sanitary sewer installations shall be 914mm(3') For cover less than 914mm(3'), see Standard Drawing S-7 for concrete encasement.
4. See Type A installation for details not shown for Types B and C.

LANDMARK
Geo-Engineers and Geologists

Project No.: LE11138

**Pipe Bedding and Trench Backfill
Recommendations**

**Plate
D-1**

APPENDIX E

Liquefaction Evaluation and Settlement Calculation

Project Name: Black Rock 5-6

Project No.: LE11138

Location: B-5

Maximum Credible Earthquake 7
 Design Ground Motion 0.40 g
 Total Unit Weight, 115 pcf
 Water Unit Weight, 62.4 pcf
 Depth to Groundwater 4 ft
 Hammer Efficiency 90
 Required Factor of Safety 1.0

Boring Data						Sampling Corrections							Corrected	Fines	SPT Clean	Cyclical	Cyclical	Factor	Volumetric	Induced
Depth		Blow Counts		Liquefiable	Overburden	Sampler	SPT	Energy	Borehole	Rod	Liner	Overburden	SPT	Content	Sands	Resistance	Stress	of	Strain (%)	Subsidence
(ft)	(m)	SPT	Mod. Cal.	Soil (0 / 1)	Pressure	Diameter	N _m	C _E	C _B	C _R	C _L	C _N	(N ₁) ₆₀	%	(N ₁) _{60CS}	CRR _{MTS}	CSR	Safety		(inch)
2.5	0.76		12	0	288	0.67	8	1.5	1.0	0.75	1	2.64	24	100	34		0.259	Non-Liq.	0.00	0.00
5	1.52	8		0	513	1	8	1.5	1.0	0.75	1.1	1.98	20	100	28	0.356	0.289	1.47	0.00	0.00
7.5	2.29		5	1	644	0.67	3	1.5	1.0	0.75	1	1.76	7	97	13	0.140	0.343	0.49	2.30	0.69
10	3.05	7		1	776	1	7	1.5	1.0	0.80	1.1	1.61	15	40	23	0.251	0.377	0.79	1.43	0.43
12.5	3.81		12	1	907	0.67	8	1.5	1.0	0.80	1	1.48	14	40	22	0.243	0.401	0.72	1.43	0.43
15	4.57	7		1	1039	1	7	1.5	1.0	0.85	1.1	1.39	14	45	21	0.232	0.418	0.66	1.50	0.45
17.5	5.33		6	1	1170	0.67	4	1.5	1.0	0.85	1	1.31	7	75	13	0.141	0.431	0.39	2.15	0.65
20	6.10	28		1	1302	1	28	1.5	1.0	0.95	1.1	1.24	54	30	68		0.440	Non-Liq.	0.00	0.00
25	7.62		24	1	1565	0.67	16	1.5	1.0	0.95	1	1.13	26	75	36		0.450	Non-Liq.	0.00	0.00
30	9.14	8		1	1828	1	8	1.5	1.0	0.95	1.1	1.05	13	75	21	0.225	0.452	0.59	1.57	0.94
35	10.67		16	0	2091	0.67	11	1.5	1.0	1.00	1	0.98	16	95	24	0.265	0.446	0.71	0.00	0.00
40	12.19	3		0	2354	1	3	1.5	1.0	1.00	1.1	0.92	5	95	10	0.114	0.432	0.31	0.00	0.00
45	13.72		10	0	2617	0.67	7	1.5	1.0	1.00	1	0.87	9	95	16	0.168	0.413	0.48	0.00	0.00
50	15.24	5		0	2880	1	5	1.5	1.0	1.00	1.1	0.83	7	95	13	0.143	0.391	0.44	0.00	0.00

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997.

Total Settlement

3.59

Corrections to SPT (Modified from Skempton, 1986) as listed by Robertson and Wride.

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C _N	$(P_a/\sigma_{vo})^{0.5}$ C _N ≤2
Energy Ratio	Donut Hammer Safety Hammer Automatic-trip Donut type Hammer	C _E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.6 inch to 6 inch 6 inch 8 inch	C _B	1 1.05 1.15
Rod Length	10 feet to 13 feet 13 feet to 19.8 ft. 19.8 ft. to 33 ft. 33 ft. to 98 ft. > 98 ft.	C _R	0.75 0.85 0.95 1 <1.0
Sampling Method	Standard Sampler Sampler without liners	C _L	1 1.1 to 1.3

Liquefaction Evaluation and Settlement Calculation

Project Name: Black Rock 5-6

Project No.: LE11138

Location: B-7

Maximum Credible Earthquake 7
 Design Ground Motion 0.40 g
 Total Unit Weight, 115 pcf
 Water Unit Weight, 62.4 pcf
 Depth to Groundwater 4 ft
 Hammer Efficiency 90
 Required Factor of Safety 1.0

Boring Data						Sampling Corrections							Corrected	Fines	SPT Clean	Cyclical	Cyclical	Factor	Volumetric	Induced
Depth		Blow Counts		Liquefiable	Overburden	Sampler	SPT	Energy	Borehole	Rod	Liner	Overburden	SPT	Content	Sands	Resistance	Stress	of	Strain (%)	Subsidence
(ft)	(m)	SPT	Mod. Cal.	Soil (0 / 1)	Pressure	Diameter	N _m	C _E	C _B	C _R	C _L	C _N	(N ₁) ₆₀	%	(N ₁) _{60CS}	CRR _{M7.5}	CSR	Safety		(inch)
2.5	0.76		12	0	288	0.67	8	1.5	1.0	0.75	1	2.64	24	100	34		0.259	Non-Liq.	0.00	0.00
5	1.52	9		1	513	1	9	1.5	1.0	0.75	1.1	1.98	22	95	31		0.289	Non-Liq.	0.00	0.00
7.5	2.29		3	1	644	0.67	2	1.5	1.0	0.75	1	1.76	4	90	10	0.106	0.343	0.37	2.70	0.81
10	3.05	4		1	776	1	4	1.5	1.0	0.80	1.1	1.61	8	87	15	0.164	0.377	0.52	1.91	0.57
12.5	3.81		5	1	907	0.67	3	1.5	1.0	0.80	1	1.48	6	49	12	0.132	0.401	0.39	2.30	0.69
15	4.57	7		1	1039	1	7	1.5	1.0	0.85	1.1	1.39	14	45	21	0.232	0.418	0.66	1.50	0.45
17.5	5.33		18	1	1170	0.67	12	1.5	1.0	0.85	1	1.31	20	40	29	0.380	0.431	1.05	0.00	0.00
20	6.10	6		1	1302	1	6	1.5	1.0	0.95	1.1	1.24	12	30	18	0.196	0.440	0.53	1.71	0.51
25	7.62		4	0	1565	0.67	3	1.5	1.0	0.95	1	1.13	4	100	10	0.110	0.450	0.29	0.00	0.00
30	9.14	3		1	1828	1	3	1.5	1.0	0.95	1.1	1.05	5	24	10	0.105	0.452	0.28	2.70	1.62
35	10.67		5	0	2091	0.67	3	1.5	1.0	1.00	1	0.98	5	95	11	0.118	0.446	0.32	0.00	0.00
40	12.19	12		0	2354	1	12	1.5	1.0	1.00	1.1	0.92	18	95	27	0.317	0.432	0.88	0.00	0.00
45	13.72		5	0	2617	0.67	3	1.5	1.0	1.00	1	0.87	4	95	10	0.111	0.413	0.32	0.00	0.00
50	15.24	4		0	2880	1	4	1.5	1.0	1.00	1.1	0.83	6	95	12	0.126	0.391	0.38	0.00	0.00

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997.

Total Settlement

4.66

Corrections to SPT (Modified from Skempton, 1986) as listed by Robertson and Wride.

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C _N	$(P_v/\sigma_{vo})^{0.5}$ C _N ≤ 2
Energy Ratio	Donut Hammer Safety Hammer Automatic-trip Donut type Hammer	C _E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.6 inch to 6 inch 6 inch 8 inch	C _B	1 1.05 1.15
Rod Length	10 feet to 13 feet 13 feet to 19.8 ft. 19.8 ft. to 33 ft. 33 ft. to 98 ft. > 98 ft.	C _R	0.75 0.85 0.95 1 <1.0
Sampling Method	Standard Sampler Sampler without liners	C _L	1 1.1 to 1.3

Liquefaction Evaluation and Settlement Calculation

Project Name: Black Rock 5-6

Project No.: LE11138

Location: B-8

Maximum Credible Earthquake 7
 Design Ground Motion 0.40 g
 Total Unit Weight, 115 pcf
 Water Unit Weight, 62.4 pcf
 Depth to Groundwater 4 ft
 Hammer Efficiency 90
 Required Factor of Safety 1.0

Boring Data						Sampling Corrections							Corrected	Fines	SPT Clean	Cyclical	Cyclical	Factor	Volumetric	Induced
Depth		Blow Counts		Liquefiable	Overburden	Sampler	SPT	Energy	Borehole	Rod	Liner	Overburden	SPT	Content	Sands	Resistance	Stress	of	Strain (%)	Subsidence
(ft)	(m)	SPT	Mod. Cal.	Soil (0 / 1)	Pressure	Diameter	N _m	C _E	C _B	C _R	C _L	C _N	(N ₁) ₆₀	%	(N ₁) _{60CS}	CRR _{M7.5}	CSR	Safety		
2.5	0.76	3		0	288	1	3	1.5	1.0	0.75	1.1	2.64	10	100	17	0.181	0.259	Non-Liq.	0.00	0.00
5	1.52		13	0	513	0.67	9	1.5	1.0	0.75	1	1.98	19	100	28	0.349	0.289	1.44	0.00	0.00
7.5	2.29	2		1	644	1	2	1.5	1.0	0.75	1.1	1.76	4	95	10	0.111	0.343	0.39	2.60	0.78
10	3.05		21	1	776	0.67	14	1.5	1.0	0.80	1	1.61	27	45	38		0.377	Non-Liq.	0.00	0.00
12.5	3.81	8		1	907	1	8	1.5	1.0	0.80	1.1	1.48	16	45	24	0.265	0.401	0.79	1.35	0.41
15	4.57		17	1	1039	0.67	11	1.5	1.0	0.85	1	1.39	20	45	29	0.383	0.418	1.09	0.00	0.00
17.5	5.33	7		1	1170	1	7	1.5	1.0	0.85	1.1	1.31	13	40	20	0.221	0.431	0.61	1.57	0.47
20	6.10		13	1	1302	0.67	9	1.5	1.0	0.95	1	1.24	15	30	22	0.246	0.440	0.67	1.43	0.43
25	7.62	7		1	1565	1	7	1.5	1.0	0.95	1.1	1.13	12	95	20	0.215	0.450	0.57	1.64	0.98
30	9.14		5	1	1828	0.67	3	1.5	1.0	0.95	1	1.05	5	95	11	0.119	0.452	0.31	2.60	1.56
35	10.67	3		0	2091	1	3	1.5	1.0	1.00	1.1	0.98	5	95	11	0.117	0.446	0.31	0.00	0.00
40	12.19		6	0	2354	0.67	4	1.5	1.0	1.00	1	0.92	6	95	12	0.126	0.432	0.35	0.00	0.00
45	13.72	6		0	2617	1	6	1.5	1.0	1.00	1.1	0.87	9	95	15	0.166	0.413	0.48	0.00	0.00
50	15.24		5	0	2880	0.67	3	1.5	1.0	1.00	1	0.83	4	95	10	0.109	0.391	0.33	0.00	0.00

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997.

Total Settlement

4.63

Corrections to SPT (Modified from Skempton, 1986) as listed by Robertson and Wride.

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C _N	$(P_u/\sigma_{vo})^{0.5}$ C _N ≤ 2
Energy Ratio	Donut Hammer Safety Hammer Automatic-trip Donut type Hammer	C _E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.6 inch to 6 inch 6 inch 8 inch	C _B	1 1.05 1.15
Rod Length	10 feet to 13 feet 13 feet to 19.8 ft. 19.8 ft. to 33 ft. 33 ft. to 98 ft. > 98 ft.	C _R	0.75 0.85 0.95 1 <1.0
Sampling Method	Standard Sampler Sampler without liners	C _L	1 1.1 to 1.3

Liquefaction Evaluation and Settlement Calculation

Project Name: Black Rock 5-6
Project No.: LE11138
Location: B-10

Maximum Credible Earthquake 7
 Design Ground Motion 0.40 g
 Total Unit Weight, 115 pcf
 Water Unit Weight, 62.4 pcf
 Depth to Groundwater 4 ft
 Hammer Efficiency 90
 Required Factor of Safety 1.0

Boring Data						Sampling Corrections							Corrected	Fines	SPT Clean	Cyclical	Cyclical	Factor	Volumetric	Induced
Depth		Blow Counts		Liquefiable	Overburden	Sampler	SPT	Energy	Borehole	Rod	Liner	Overburden	SPT	Content	Sands	Resistance	Stress	of	Strain (%)	Subsidence
(ft)	(m)	SPT	Mod. Cal.	Soil (0 / 1)	Pressure	Diameter	N _m	C _E	C _B	C _R	C _L	C _N	(N ₁) ₆₀	%	(N ₁) _{60CS}	CRR _{M7.5}	CSR	Safety		(inch)
2.5	0.76		11	0	288	0.67	7	1.5	1.0	0.75	1	2.64	22	100	31		0.259	Non-Liq.	0.00	0.00
5	1.52	4		1	513	1	4	1.5	1.0	0.75	1.1	1.98	10	99	17	0.181	0.289	0.75	1.84	0.55
7.5	2.29		2	1	644	0.67	1	1.5	1.0	0.75	1	1.76	3	99	8	0.090	0.343	0.31	2.90	0.87
10	3.05	13		1	776	1	13	1.5	1.0	0.80	1.1	1.61	28	40	38		0.377	Non-Liq.	0.00	0.00
12.5	3.81		5	1	907	0.67	3	1.5	1.0	0.80	1	1.48	6	37	12	0.132	0.401	0.39	2.30	0.69
15	4.57	6		1	1039	1	6	1.5	1.0	0.85	1.1	1.39	12	28	18	0.193	0.418	0.55	1.78	0.53
17.5	5.33		6	0	1170	0.67	4	1.5	1.0	0.85	1	1.31	7	28	12	0.132	0.431	0.37	0.00	0.00
20	6.10	4		0	1302	1	4	1.5	1.0	0.95	1.1	1.24	8	100	14	0.155	0.440	0.42	0.00	0.00
25	7.62		9	1	1565	0.67	6	1.5	1.0	0.95	1	1.13	10	81	17	0.180	0.450	0.48	1.84	1.10
30	9.14	14		1	1828	1	14	1.5	1.0	0.95	1.1	1.05	23	25	30	0.438	0.452	1.16	0.00	0.00
35	10.67		12	0	2091	0.67	8	1.5	1.0	1.00	1	0.98	12	95	19	0.207	0.446	0.55	0.00	0.00
40	12.19	4		0	2354	1	4	1.5	1.0	1.00	1.1	0.92	6	95	12	0.133	0.432	0.37	0.00	0.00
45	13.72		6	0	2617	0.67	4	1.5	1.0	1.00	1	0.87	5	95	11	0.123	0.413	0.35	0.00	0.00
50	15.24	8		1	2880	1	8	1.5	1.0	1.00	1.1	0.83	11	95	18	0.196	0.391	0.60	1.71	1.03

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997.

Total Settlement

4.78

Corrections to SPT (Modified from Skempton, 1986) as listed by Robertson and Wride.

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C _N	(P _a /σ _{vo}) ^{0.5} C _N ≤ 2
Energy Ratio	Donut Hammer Safety Hammer Automatic-trip Donut type Hammer	C _E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.6 inch to 6 inch 6 inch 8 inch	C _B	1 1.05 1.15
Rod Length	10 feet to 13 feet 13 feet to 19.8 ft. 19.8 ft. to 33 ft. 33 ft. to 98 ft. > 98 ft.	C _R	0.75 0.85 0.95 1 <1.0
Sampling Method	Standard Sampler Sampler without liners	C _L	1 1.1 to 1.3

Liquefaction Evaluation and Settlement Calculation

Project Name: Black Rock 5-6

Project No.: LE11138

Location: B-11

Maximum Credible Earthquake 7
 Design Ground Motion 0.40 g
 Total Unit Weight, 115 pcf
 Water Unit Weight, 62.4 pcf
 Depth to Groundwater 4 ft
 Hammer Efficiency 90
 Required Factor of Safety 1.0

Boring Data						Sampling Corrections							Corrected	Fines	SPT Clean	Cyclical	Cyclical	Factor	Volumetric	Induced
Depth		Blow Counts		Liquefiable	Overburden	Sampler	SPT	Energy	Borehole	Rod	Liner	Overburden	SPT	Content	Sands	Resistance	Stress	of	Strain (%)	Subsidence
(ft)	(m)	SPT	Mod. Cal.	Soil (0 / 1)	Pressure	Diameter	N _m	C _E	C _B	C _R	C _L	C _N	(N ₁) ₆₀	%	(N ₁) _{60CS}	CRR _{M7.5}	CSR	Safety		(inch)
2.5	0.76	11		0	288	1	11	1.5	1.0	0.75	1.1	2.64	36	100	48		0.259	Non-Liq.	0.00	0.00
5	1.52		13	1	513	0.67	9	1.5	1.0	0.75	1	1.98	19	90	28	0.349	0.289	1.44	0.00	0.00
7.5	2.29	6		1	644	1	6	1.5	1.0	0.75	1.1	1.76	13	80	21	0.224	0.343	0.78	1.57	0.47
10	3.05		17	1	776	0.67	11	1.5	1.0	0.80	1	1.61	22	45	31		0.377	Non-Liq.	0.00	0.00
12.5	3.81	10		1	907	1	10	1.5	1.0	0.80	1.1	1.48	20	45	29	0.358	0.401	1.06	0.00	0.00
15	4.57		27	1	1039	0.67	18	1.5	1.0	0.85	1	1.39	32	45	43		0.418	Non-Liq.	0.00	0.00
17.5	5.33	14		1	1170	1	14	1.5	1.0	0.85	1.1	1.31	26	40	36		0.431	Non-Liq.	0.00	0.00
20	6.10		23	0	1302	0.67	15	1.5	1.0	0.95	1	1.24	27	100	38		0.440	Non-Liq.	0.00	0.00
25	7.62	5		1	1565	1	5	1.5	1.0	0.95	1.1	1.13	9	35	16	0.168	0.450	0.45	1.91	1.15
30	9.14		21	0	1828	0.67	14	1.5	1.0	0.95	1	1.05	21	95	30		0.452	Non-Liq.	0.00	0.00
35	10.67	4		0	2091	1	4	1.5	1.0	1.00	1.1	0.98	6	95	13	0.138	0.446	0.37	0.00	0.00
40	12.19		20	1	2354	0.67	13	1.5	1.0	1.00	1	0.92	19	90	27	0.325	0.432	0.90	1.07	0.64
45	13.72	7		0	2617	1	7	1.5	1.0	1.00	1.1	0.87	10	95	17	0.185	0.413	0.53	0.00	0.00
50	15.24		44	0	2880	0.67	29	1.5	1.0	1.00	1	0.83	37	95	49		0.391	Non-Liq.	0.00	0.00

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997.

Total Settlement

2.26

Corrections to SPT (Modified from Skempton, 1986) as listed by Robertson and Wride.

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C _N	$(P_a/\sigma_{v0})^{0.5}$ C _N ≤ 2
Energy Ratio	Donut Hammer Safety Hammer Automatic-trip Donut type Hammer	C _E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.6 inch to 6 inch 6 inch 8 inch	C _B	1 1.05 1.15
Rod Length	10 feet to 13 feet 13 feet to 19.8 ft. 19.8 ft. to 33 ft. 33 ft. to 98 ft. > 98 ft.	C _R	0.75 0.85 0.95 1 <1.0
Sampling Method	Standard Sampler Sampler without liners	C _L	1 1.1 to 1.3

Liquefaction Evaluation and Settlement Calculation

Project Name: Black Rock 5-6
Project No.: LE11138
Location: B-12

Maximum Credible Earthquake 7
 Design Ground Motion 0.40 g
 Total Unit Weight, 115 pcf
 Water Unit Weight, 62.4 pcf
 Depth to Groundwater 4 ft
 Hammer Efficiency 90
 Required Factor of Safety 1.0

Boring Data						Sampling Corrections							Corrected	Fines	SPT Clean	Cyclical	Cyclical	Factor	Volumetric	Induced
Depth		Blow Counts		Liquefiable	Overburden	Sampler	SPT	Energy	Borehole	Rod	Liner	Overburden	SPT	Content	Sands	Resistance	Stress	of	Strain (%)	Subsidence
(ft)	(m)	SPT	Mod. Cal.	Soil (0 / 1)	Pressure	Diameter	N _m	C _E	C _B	C _R	C _L	C _N	(N ₁) ₆₀	%	(N ₁) _{60CS}	CRF _{M7.5}	CSR	Safety		(inch)
2.5	0.76		14	0	288	0.67	9	1.5	1.0	0.75	1	2.64	28	100	38		0.259	Non-Liq.	0.00	0.00
5	1.52	5		1	513	1	5	1.5	1.0	0.75	1.1	1.98	12	90	20	0.212	0.289	0.88	1.64	0.49
7.5	2.29		12	1	644	0.67	8	1.5	1.0	0.75	1	1.76	16	90	24	0.269	0.343	0.94	1.28	0.38
10	3.05	4		1	776	1	4	1.5	1.0	0.80	1.1	1.61	8	40	15	0.164	0.377	0.52	1.91	0.57
12.5	3.81		24	1	907	0.67	16	1.5	1.0	0.80	1	1.48	29	40	39		0.401	Non-Liq.	0.00	0.00
15	4.57	13		1	1039	1	13	1.5	1.0	0.85	1.1	1.39	25	30	34		0.418	Non-Liq.	0.00	0.00
17.5	5.33		10	0	1170	0.67	7	1.5	1.0	0.85	1	1.31	11	95	18	0.199	0.431	0.55	0.00	0.00
20	6.10	6		0	1302	1	6	1.5	1.0	0.95	1.1	1.24	12	95	19	0.205	0.440	0.56	0.00	0.00
25	7.62		16	1	1565	0.67	11	1.5	1.0	0.95	1	1.13	17	80	26	0.295	0.450	0.78	1.21	0.73
30	9.14	6		0	1828	1	6	1.5	1.0	0.95	1.1	1.05	10	95	17	0.181	0.452	0.48	0.00	0.00
35	10.67		12	0	2091	0.67	8	1.5	1.0	1.00	1	0.98	12	95	19	0.207	0.446	0.55	0.00	0.00
40	12.19	3		0	2354	1	3	1.5	1.0	1.00	1.1	0.92	5	95	10	0.114	0.432	0.31	0.00	0.00
45	13.72		15	0	2617	0.67	10	1.5	1.0	1.00	1	0.87	13	95	21	0.226	0.413	0.65	0.00	0.00
50	15.24	9		1	2880	1	9	1.5	1.0	1.00	1.1	0.83	12	95	20	0.215	0.391	0.65	1.64	0.98

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997.

Total Settlement **3.16**

Corrections to SPT (Modified from Skempton, 1986) as listed by Robertson and Wride.

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C _N	$(P_a/\sigma_{vo})^{0.5}$ C _N ≤ 2
Energy Ratio	Donut Hammer Safety Hammer Automatic-trip Donut type Hammer	C _E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.6 inch to 6 inch 6 inch 8 inch	C _B	1 1.05 1.15
Rod Length	10 feet to 13 feet 13 feet to 19.8 ft. 19.8 ft. to 33 ft. 33 ft. to 98 ft. > 98 ft.	C _R	0.75 0.85 0.95 1 <1.0
Sampling Method	Standard Sampler Sampler without liners	C _L	1 1.1 to 1.3

Liquefaction Evaluation and Settlement Calculation

Project Name: Black Rock 5-6

Project No.: LE11138

Location: B-13

Maximum Credible Earthquake 7
 Design Ground Motion 0.40 g
 Total Unit Weight, 115 pcf
 Water Unit Weight, 62.4 pcf
 Depth to Groundwater 4 ft
 Hammer Efficiency 90
 Required Factor of Safety 1.0

Boring Data						Sampling Corrections							Corrected	Fines	SPT Clean	Cyclical	Cyclical	Factor	Volumetric	Induced
Depth		Blow Counts		Liquefiable	Overburden	Sampler	SPT	Energy	Borehole	Rod	Liner	Overburden	SPT	Content	Sands	Resistance	Stress	of	Strain (%)	Subsidence
(ft)	(m)	SPT	Mod. Cal.	Soil (0 / 1)	Pressure	Diameter	N _m	C _E	C _B	C _R	C _L	C _N	(N ₁) ₆₀	%	(N ₁) _{60CS}	CRR _{M7.5}	CSR	Safety		
2.5	0.76		10	0	288	0.67	7	1.5	1.0	0.75	1	2.64	20	100	29	0.369	0.259	Non-Liq.	0.00	0.00
5	1.52	6		1	513	1	6	1.5	1.0	0.75	1.1	1.98	15	90	23	0.248	0.289	1.02	0.00	0.00
7.5	2.29		4	1	644	0.67	3	1.5	1.0	0.75	1	1.76	5	90	11	0.123	0.343	0.43	2.40	0.72
10	3.05	1		1	776	1	1	1.5	1.0	0.80	1	1.61	2	78	7	0.083	0.377	0.26	3.10	0.93
12.5	3.81		12	1	907	0.67	8	1.5	1.0	0.80	1	1.48	14	85	22	0.243	0.401	0.72	1.43	0.43
15	4.57	8		1	1039	1	8	1.5	1.0	0.85	1.1	1.39	16	30	23	0.249	0.418	0.71	1.43	0.43
17.5	5.33		7	1	1170	0.67	5	1.5	1.0	0.85	1	1.31	8	30	14	0.149	0.431	0.41	2.15	0.65
20	6.10	2		0	1302	1	2	1.5	1.0	0.95	1.1	1.24	4	95	10	0.105	0.440	0.29	0.00	0.00
25	7.62		9	1	1565	0.67	6	1.5	1.0	0.95	1	1.13	10	90	17	0.180	0.450	0.48	1.84	1.10
30	9.14	5		1	1828	1	5	1.5	1.0	0.95	1.1	1.05	8	30	14	0.153	0.452	0.40	2.00	1.20
35	10.67		8	0	2091	0.67	5	1.5	1.0	1.00	1	0.98	8	95	14	0.156	0.446	0.42	0.00	0.00
40	12.19	6		1	2354	1	6	1.5	1.0	1.00	1.1	0.92	9	95	16	0.172	0.432	0.48	1.91	1.15
45	13.72		9	1	2617	0.67	6	1.5	1.0	1.00	1	0.87	8	95	14	0.157	0.413	0.45	2.00	1.20
50	15.24	2		1	2880	1	2	1.5	1.0	1.00	1.1	0.83	3	95	8	0.092	0.391	0.28	2.90	1.74

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997.

Total Settlement

9.54

Corrections to SPT (Modified from Skempton, 1986) as listed by Robertson and Wride.

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C _N	$(P_a/\sigma_{vo})^{0.5}$ C _N ≤ 2
Energy Ratio	Donut Hammer Safety Hammer Automatic-trip Donut type Hammer	C _E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.6 inch to 6 inch 6 inch 8 inch	C _B	1 1.05 1.15
Rod Length	10 feet to 13 feet 13 feet to 19.8 ft. 19.8 ft. to 33 ft. 33 ft. to 98 ft. > 98 ft.	C _R	0.75 0.85 0.95 1 <1.0
Sampling Method	Standard Sampler Sampler without liners	C _L	1 1.1 to 1.3

Liquefaction Evaluation and Settlement Calculation

Project Name: Black Rock 5-6

Project No.: LE11138

Location: B-14

Maximum Credible Earthquake 7
 Design Ground Motion 0.40 g
 Total Unit Weight, 115 pcf
 Water Unit Weight, 62.4 pcf
 Depth to Groundwater 4 ft
 Hammer Efficiency 90
 Required Factor of Safety 1.0

Boring Data					Sampling Corrections								Corrected	Fines	SPT Clean	Cyclical	Cyclical	Factor	Volumetric	Induced
Depth		Blow Counts		Liquefiable	Overburden	Sampler	SPT	Energy	Borehole	Rod	Liner	Overburden	SPT	Content	Sands	Resistance	Stress	of	Strain (%)	Subsidence
(ft)	(m)	SPT	Mod. Cal.	Soil (0 / 1)	Pressure	Diameter	N _m	C _E	C _B	C _R	C _L	C _N	(N ₁) ₆₀	%	(N ₁) _{60CS}	CRR _{M7.5}	CSR	Safety		(inch)
2.5	0.76		11	0	288	0.67	7	1.5	1.0	0.75	1	2.64	22	100	31		0.259	Non-Liq.	0.00	0.00
5	1.52	7		1	513	1	7	1.5	1.0	0.75	1.1	1.98	17	90	26	0.292	0.289	1.20	0.00	0.00
7.5	2.29		5	1	644	0.67	3	1.5	1.0	0.75	1	1.76	7	92	13	0.140	0.343	0.49	2.30	0.69
10	3.05	5		1	776	1	5	1.5	1.0	0.80	1.1	1.61	11	68	18	0.191	0.377	0.60	1.78	0.53
12.5	3.81		24	1	907	0.67	16	1.5	1.0	0.80	1	1.48	29	35	39		0.401	Non-Liq.	0.00	0.00
15	4.57	12		1	1039	1	12	1.5	1.0	0.85	1.1	1.39	23	35	33		0.418	Non-Liq.	0.00	0.00
17.5	5.33		12	1	1170	0.67	8	1.5	1.0	0.85	1	1.31	13	30	20	0.218	0.431	0.60	1.57	0.47
20	6.10	4		0	1302	1	4	1.5	1.0	0.95	1.1	1.24	8	100	14	0.155	0.440	0.42	0.00	0.00
25	7.62		13	1	1565	0.67	9	1.5	1.0	0.95	1	1.13	14	60	22	0.238	0.450	0.63	1.50	0.90
30	9.14	10		1	1828	1	10	1.5	1.0	0.95	1.1	1.05	16	28	23	0.256	0.452	0.68	1.35	0.81
35	10.67		15	0	2091	0.67	10	1.5	1.0	1.00	1	0.98	15	95	23	0.249	0.446	0.67	0.00	0.00
40	12.19	9		1	2354	1	9	1.5	1.0	1.00	1.1	0.92	14	95	21	0.233	0.432	0.64	1.50	0.90
45	13.72		26	0	2617	0.67	17	1.5	1.0	1.00	1	0.87	23	95	32		0.413	Non-Liq.	0.00	0.00
50	15.24	12		1	2880	1	12	1.5	1.0	1.00	1.1	0.83	17	30	24	0.264	0.391	0.80	1.35	0.81

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997.

Total Settlement

5.12

Corrections to SPT (Modified from Skempton, 1986) as listed by Robertson and Wride.

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C _N	$(P_a/\sigma_{vo})^{0.5}$ C _N ≤ 2
Energy Ratio	Donut Hammer Safety Hammer Automatic-trip Donut type Hammer	C _E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.6 inch to 6 inch 6 inch 8 inch	C _B	1 1.05 1.15
Rod Length	10 feet to 13 feet 13 feet to 19.8 ft. 19.8 ft. to 33 ft. 33 ft. to 98 ft. > 98 ft.	C _R	0.75 0.85 0.95 1 <1.0
Sampling Method	Standard Sampler Sampler without liners	C _L	1 1.1 to 1.3

Liquefaction Evaluation and Settlement Calculation

Project Name: Black Rock 5-6

Project No.: LE11138

Location: B-15

Maximum Credible Earthquake 7
 Design Ground Motion 0.40 g
 Total Unit Weight, 115 pcf
 Water Unit Weight, 62.4 pcf
 Depth to Groundwater 4 ft
 Hammer Efficiency 90
 Required Factor of Safety 1.0

Boring Data						Sampling Corrections							Corrected	Fines	SPT Clean	Cyclical	Cyclical	Factor	Volumetric	Induced
Depth		Blow Counts		Liquefiable	Overburden	Sampler	SPT	Energy	Borehole	Rod	Liner	Overburden	SPT	Content	Sands	Resistance	Stress	of	Strain (%)	Subsidence
(ft)	(m)	SPT	Mod. Cal.	Soil (0 / 1)	Pressure	Diameter	N _m	C _E	C _B	C _R	C _L	C _N	(N ₁) ₆₀	%	(N ₁) _{60CS}	CRR _{M7.5}	CSR	Safety		(inch)
2.5	0.76		11	0	288	0.67	7	1.5	1.0	0.75	1	2.64	22	100	31		0.259	Non-Liq.	0.00	0.00
5	1.52	5		1	513	1	5	1.5	1.0	0.75	1.1	1.98	12	100	20	0.212	0.289	0.88	1.64	0.49
7.5	2.29		4	1	644	0.67	3	1.5	1.0	0.75	1	1.76	5	99	11	0.123	0.343	0.43	2.40	0.72
10	3.05	5		1	776	1	5	1.5	1.0	0.80	1.1	1.61	11	58	18	0.191	0.377	0.60	1.78	0.53
12.5	3.81		26	1	907	0.67	17	1.5	1.0	0.80	1	1.48	31	35	42		0.401	Non-Liq.	0.00	0.00
15	4.57	5		1	1039	1	5	1.5	1.0	0.85	1.1	1.39	10	20	14	0.153	0.418	0.44	2.00	0.60
17.5	5.33		28	1	1170	0.67	19	1.5	1.0	0.85	1	1.31	31	20	37		0.431	Non-Liq.	0.00	0.00
20	6.10	6		0	1302	1	6	1.5	1.0	0.95	1.1	1.24	12	100	19	0.205	0.440	0.56	0.00	0.00
25	7.62		9	1	1565	0.67	6	1.5	1.0	0.95	1	1.13	10	80	17	0.180	0.450	0.48	1.84	1.10
30	9.14	12		1	1828	1	12	1.5	1.0	0.95	1.1	1.05	20	75	29	0.361	0.452	0.95	1.00	0.60
35	10.67		11	0	2091	0.67	7	1.5	1.0	1.00	1	0.98	11	95	18	0.194	0.446	0.52	0.00	0.00
40	12.19	3		0	2354	1	3	1.5	1.0	1.00	1.1	0.92	5	95	10	0.114	0.432	0.31	0.00	0.00
45	13.72		11	0	2617	0.67	7	1.5	1.0	1.00	1	0.87	10	95	17	0.179	0.413	0.52	0.00	0.00
50	15.24	13		1	2880	1	13	1.5	1.0	1.00	1.1	0.83	18	30	25	0.288	0.391	0.88	1.21	0.73

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997.

Total Settlement

4.78

Corrections to SPT (Modified from Skempton, 1986) as listed by Robertson and Wride.

Factor	Equipment Variable	Term	Correction
Overburden Pressure		C _N	$(P_a/\sigma_{vo})^{0.5}$ C _N ≤ 2
Energy Ratio	Donut Hammer Safety Hammer Automatic-trip Donut type Hammer	C _E	0.5 to 1.0 0.7 to 1.2 0.8 to 1.3
Borehole Diameter	2.6 inch to 6 inch 6 inch 8 inch	C _B	1 1.05 1.15
Rod Length	10 feet to 13 feet 13 feet to 19.8 ft. 19.8 ft. to 33 ft. 33 ft. to 98 ft. > 98 ft.	C _R	0.75 0.85 0.95 1 <1.0
Sampling Method	Standard Sampler Sampler without liners	C _L	1 1.1 to 1.3