APPENDIX G

SPT LIQUEFACTION ASSESSMENT

2004-0049 Newby Island Landfill
11/26/2007 RMW

Liquefaction Assessment per Youd, et al., ASCE, 2001

Boring: RB-1

Adj. CPT Boring: CPT-6

Material	Unit Weight:
dike	120 pcf
OBA	127
sand	125
YBM	113

P_{elm} = 1.058 tsf

Groundwater Elev. @ drill:	-2.4 ft
Design Groundwater Elev.:	-6 ft
Boring Elevation:	15.5 ft

Note: **BLUE** fields require user input

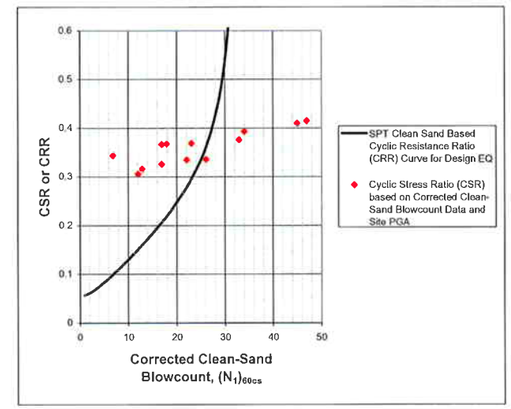
Depth Profile: Top of Layer	Fines Content, FC (%)	Sand Particle Size, D_{50} (mm)	Age of Deposit (years)	Overconsol. Ratio, OCR
0 dike				
13.4 YBM				
20 sand	19.0%	0.2	3.00E+03	1.0
26 sand	39.6%	0.1	3.00E+03	1.0
30.5 OBA				
39.2 sand	10.0%	0.35	2.00E+04	1.5
46.1 OBA				
61.8 sand				
62.1 OBA				
63.2 sand	26%	0.15	2.00E+04	1.5
69.5 sand	20%	0.15	2.00E+04	1.5
69.5 sand	12.1	0.23	2.00E+04	1.5
69.5 OBA				

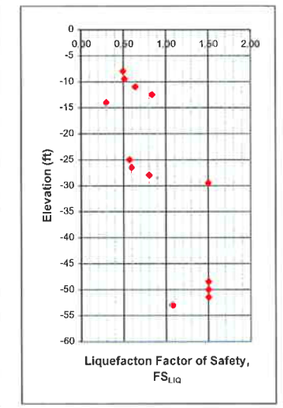
EQ Mag. (M_w)	PGA
7.1	0.45

Static Normal Stress Correction, K_σ	
D_r (%)	f
0	0.8
0.6	0.7
0.8	0.6

Mod Cal to SPT Correction
0.62

SPT Equipment Variable Corrections		
Range	Used	
Energy Ratio, C_E		
0.5-1.0	1.0	Donut Hammer
0.7-1.2		Safety Hammer
0.8-1.3		Automatic-trip Donut-type Hammer
Borehole Diameter, C_B		
1.0	1.05	2.5 inch to 4.5 inch
1.05		6 inch
1.15		8 inch
Sampling Method, C_S		
1.0	1.2	Standard Sampler
1.1-1.3		Sampler without liners
Rod Length, C_R		
0	0.75	< 3 m
3	0.8	3-4 m
4	0.85	4-6 m
6	0.95	6-10 m
10	1.0	10-30 m
30	1.0	





Note: Calculations per this method are **only valid for $(N_1)_{60cs}$ < 30. For $(N_1)_{60cs}$ >30, soils are classed as non-liquefiable.**
These procedures have been validated for level to gently-sloping sites with potentially liquefiable materials at shallow depths (<15 m = 49 ft.).

Depth (ft)	Depth (m)	Elevation (ft)	Material	SPT or Modified California Sampler? [SPT or MC]	Measured 12-inch Drive Blowcount	FS_{LIQ}	Equivalent SPT N-value	Overburden Stress Factor, C_N	Rod Length Factor, C_R	Corrected SPT $(N_1)_{60}$ (≥30 shaded yellow = non-liquefiable)	Fines Content Adj. Coeff., α	Fines Content Adj. Coeff., β	Clean-Sand $(N_1)_{60cs}$	D_R corrections per Kulhawy and Mayne, 1990: Relative Density: Particle Size Correction, C_P	Relative Density: Aging Correction, C_A	Relative Density: Overconsol. Correction, C_{OCR}	Relative Density, D_r (%)	$CRR_{7.5}$	Stress Reduction Coefficient (r_d)	CSR_{EQ}	MSF	Corr. Static Normal Stress, K_σ	Design Groundwater Level: GW	γ' (psf)	σ'_{vo} (tsf)	Groundwater level at time of Drilling: GW	γ (psf)	γ' (psf)	σ_{vo} (tsf)	σ'_{vo} (tsf)
23.50	7.16	-8.00	sand	SPT	7	0.493	7	0.9387	0.95	8	3.4339	1.0728	12	42.5257	1.2739	1.0000	38.4%	0.1312	0.9452	0.293	1.15	0.957	BelowGW	62.6	1.32	BelowGW	125	62.6	1.40	1.21
25.00	7.62	-9.50	sand	SPT	8	0.511	8	0.9212	0.95	9	3.4339	1.0728	13	42.5257	1.2739	1.0000	40.8%	0.1405	0.9417	0.301	1.15	0.950	BelowGW	62.6	1.37	BelowGW	125	62.6	1.49	1.26
26.50	8.08	-11.00	sand	SPT	9	0.638	9	0.9044	0.95	10	5.0000	1.2000	17	35.0000	1.2739	1.0000	47.4%	0.1808	0.9382	0.308	1.15	0.944	BelowGW	62.6	1.41	BelowGW	125	62.6	1.58	1.30
28.00	8.53	-12.50	sand	SPT	13	0.830	13	0.8882	0.95	14	5.0000	1.2000	22	35.0000	1.2739	1.0000	56.0%	0.2420	0.9347	0.314	1.15	0.938	BelowGW	62.6	1.46	BelowGW	125	62.6	1.68	1.35
29.50	8.99	-14.00	sand	SPT	2	0.293	2	0.8726	0.95	2	5.0000	1.2000	7	35.0000	1.2739	1.0000	21.2%	0.0877	0.9312	0.320	1.15	0.932	BelowGW	62.6	1.51	BelowGW	125	62.6	1.77	1.40
40.50	12.34	-25.00	sand	SPT	16	0.567	16	0.7705	1	16	0.8694	1.0216	17	48.6017	1.3151	1.0757	48.2%	0.1808	0.8444	0.328	1.15	0.893	BelowGW	62.6	1.86	BelowGW	125	62.6	2.47	1.75
42.00	12.80	-26.50	sand	SPT	18	0.600	18	0.7587	1	17	0.8694	1.0216	18	48.6017	1.3151	1.0757	49.7%	0.1918	0.8322	0.327	1.15	0.889	BelowGW	62.6	1.91	BelowGW	125	62.6	2.56	1.80
43.50	13.26	-28.00	sand	SPT	23	0.802	23	0.7473	1	22	0.8694	1.0216	23	48.6017	1.3151	1.0757	56.6%	0.2569	0.8200	0.326	1.15	0.885	BelowGW	62.6	1.95	BelowGW	125	62.6	2.66	1.85
45.00	13.72	-29.50	sand	MC	57	(N1)60>30: Non-Liq.	35	0.7362	1	32	0.8694	1.0216	34	48.6017	1.3151	1.0757	68.2%	#DIV/0!	0.8078	0.325	1.15	0.826	BelowGW	62.6	2.00	BelowGW	125	62.6	2.75	1.89
64.00	19.51	-48.50	sand	SPT	49	(N1)60>30: Non-Liq.	49	0.6169	1	38	4.4071	1.1241	47	39.4023	1.3151	1.0757	82.6%	0.2664	0.6532	0.289	1.15	0.697	BelowGW	62.6	2.61	BelowGW	125	62.6	3.95	2.50
65.50	19.96	-50.00	sand	SPT	32	(N1)60>30: Non-Liq.	32	0.6094	1	25	4.4071	1.1241	33	39.4023	1.3151	1.0757	67.0%	1.2398	0.6410	0.285	1.15	0.758	BelowGW	62.6	2.66	BelowGW	125	62.6	4.05	2.55
67.00	20.42	-51.50	sand	SPT	48	(N1)60>30: Non-Liq.	48	0.6020	1	36	4.4071	1.1241	45	39.4023	1.3151	1.0757	80.4%	0.2376	0.6287	0.281	1.15	0.687	BelowGW	62.6	2.71	BelowGW	125	62.6	4.14	2.60
68.50	20.88	-53.00	sand	SPT	26		26	0.5947	1	19	4.4071	1.1241	26	39.4023	1.3151	1.0757	58.4%	0.3131	0.6165	0.277	1.15	0.826	BelowGW	62.6	2.75	BelowGW	125	62.6	4.24	2.64

2004-0049 Newby Island Landfill
11/26/2007 RMW

Liquefaction Assessment per Youd, et al., ASCE, 2001

Boring: RB-2

Adj. CPT Boring: CPT-4

Material	Unit Weight:
dike	120 pcf
OBA	127
sand	125
YBM	113

P_{atm} =	1.058 tsf

Groundwater Elev. @ drill:	3 ft
Design Groundwater Elev.:	-6 ft
Boring Elevation:	14 ft

Note: BLUE fields require user input

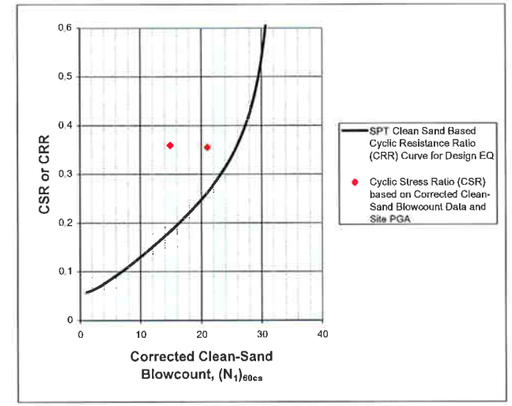
Depth Profile: Top of Layer	Fines Content, FC (%)	Sand Particle Size, D_{50} (mm)	Age of Deposit (years)	Overconsol. Ratio, OCR
0 dike				
17.8 YBM				
28 sand	36.0%	0.3	3.00E+03	1.0
35 OBA				

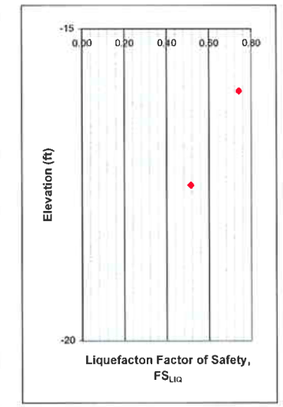
EQ Mag. (M_w)	PGA
7.1	0.45

Static Normal Stress Correction, K_σ	
D_r (%)	f
0	0.8
0.6	0.7
0.8	0.6

Mod Cal to SPT Correction
0.62

SPT Equipment Variable Corrections		
Range	Used	
Energy Ratio, C_E		
0.5-1.0		Donut Hammer
0.7-1.2	1.0	Safety Hammer
0.8-1.3		Automatic-trip Donut-type Hammer
Borehole Diameter, C_B		
1.0		2.5 inch to 4.5 inch
1.05	1.05	6 inch
1.15		8 inch
Sampling Method, C_S		
1.0		Standard Sampler
1.1-1.3	1.2	Sampler without liners
Rod Length, C_R		
0	0.75	< 3 m
3	0.8	3-4 m
4	0.85	4-6 m
6	0.95	6-10 m
10	1.0	10-30 m
30	1.0	





Note: Calculations per this method are **only valid for $(N_1)_{60cs}$ < 30. For $(N_1)_{60cs}$ >30, soils are classed as non-liquefiable.**
These procedures have been validated for level to gently-sloping sites with potentially liquefiable materials at shallow depths (<15 m = 49 ft.).

													D_R corrections per Kulhawy and Mayne, 1990									Design Groundwater Level			Groundwater level at time of Drilling			
Depth (ft)	Depth (m)	Elevation (ft)	Material	SPT or Modified California Sampler? [SPT or MC]	Measured 12-Inch Drive Blowcount	FS_{LIQ}	Equivalent SPT N-value	Overburden Stress Factor, C_N	Rod Length Factor, C_R	Corrected SPT $(N_1)_{60}$ (≥30 shaded yellow = non-liquefiable)	Fines Content Adj. Coeff., α	Fines Content Adj. Coeff., β	Clean-Sand $(N_1)_{60cs}$	Relative Density: Particle Size Correction, C_P	Relative Density: Aging Correction, C_A	Relative Density: Overconsol. Correction, C_{OCR}	Relative Density, D_r (%)	$CRR_{7.5}$	Stress Reduction Coefficient (r_d)	CSR_{EQ}	MSF	Corr. Static Normal Stress, K_σ	GW	γ' (psf)	σ'_{vo} (tsf)	GW	γ (psf)	γ' (psf)	σ_{vo} (tsf)	σ'_{vo} (tsf)
30.00	9.14	-16.00	sand	SPT	11	0.739	11	0.9569	0.95	13	5.0000	1.2000	21	46.9280	1.2739	1.0000	46.6%	0.2282	0.9300	0.334	1.15	0.940	BelowGW	62.6	1.44	BelowGW	125	62.6	1.77	1.16
31.50	9.60	-17.50	sand	MC	11	0.512	7	0.9388	0.95	8	5.0000	1.2000	15	46.9280	1.2739	1.0000	36.6%	0.1601	0.9176	0.336	1.15	0.934	BelowGW	62.6	1.49	BelowGW	125	62.6	1.87	1.21

2004-0049 Newby Island Landfill
11/26/2007 RMW

Liquefaction Assessment per Youd, et al.,

Boring: RB-4

Adj. CPT Boring: CPT-14

Material	Unit Weight:
dike	120 pcf
OBA	127
sand	125
YBM	113

P_{atm} =	1.058 tsf

Groundwater Elev. @ drill:	8 ft
Design Groundwater Elev.:	8 ft
Boring Elevation:	19.5 ft

Note: **BLUE** fields require user input

0 dike
13.4 YBM
21.5 sand
22.2 YBM
23.3 sand
28.6 YBM
30.2 OBA
39.2 sand
42.4 OBA
61.8 sand
62.1 OBA
63.2 sand
68.8 OBA

Depth Profile: Top of Layer	Fines Content, FC (%)	Sand Particle Size, D_{50} (mm)	Age of Deposit (years)	Overconsol. Ratio, OCR
0 dike				
18.9 YBM				
28 OBA				
55 sand	40.7%	0.09	2.00E+04	1.5
57.5 sand	47.1%	0.08	2.00E+04	1.5
59 sand	10.0%	0.12	2.00E+04	1.5
60.5 sand	20%	0.1	2.00E+04	1.5
62 OBA				

EQ Mag. (M_w)	PGA
7.1	0.45

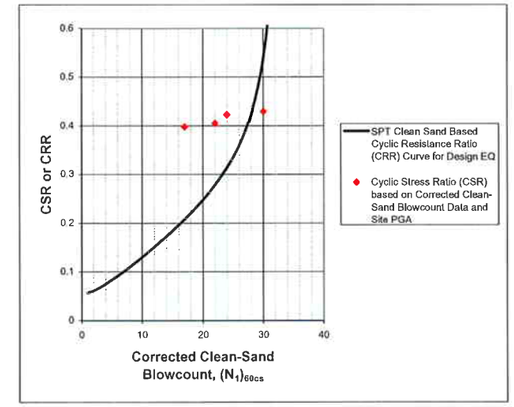
Static Normal Stress Correction, K_σ

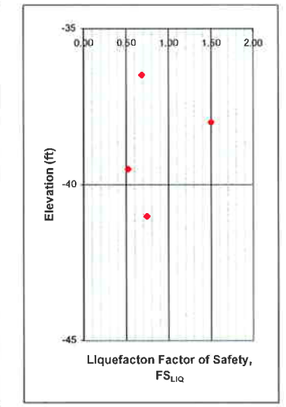
D_r (%)	f
0	0.8
0.6	0.7
0.8	0.6

Mod Cal to SPT Correction
0.62

SPT Equipment Variable Corrections

Range	Used	
Energy Ratio, C_E		
0.5-1.0	1.0	Donut Hammer
0.7-1.2		Safety Hammer
0.8-1.3		Automatic-trip Donut-type Hammer
Borehole Diameter, C_B		
1.0	1.05	2.5 inch to 4.5 inch
1.05		6 inch
1.15		8 inch
Sampling Method, C_S		
1.0	1.2	Standard Sampler
1.1-1.3		Sampler without liners
Rod Length, C_R		
0	0.75	< 3 m
3	0.8	3-4 m
4	0.85	4-6 m
6	0.95	6-10 m
10	1.0	10-30 m
30	1.0	





Note: Calculations per this method are **only valid for $(N_1)_{60cs}$ < 30. For $(N_1)_{60cs}$ >30, soils are classed as non-liquefiable.**
These procedures have been validated for level to gently-sloping sites with potentially liquefiable materials at shallow depths (<15 m = 49 ft.).

Depth (ft)	Depth (m)	Elevation (ft)	Material	SPT or Modified California Sampler? [SPT or MC]	Measured 12-inch Drive Blowcount	FS_{LIQ}	Equivalent SPT N-value	Overburden Stress Factor, C_N	Rod Length Factor, C_R	Corrected SPT $(N_1)_{60}$ (≥30 shaded yellow = non-liquefiable)	Fines Content Adj. Coeff., α	Fines Content Adj. Coeff., β	Clean-Sand $(N_1)_{60cs}$
56.00	17.07	-36.50	sand	MC	26	0.687	16	0.7070	1	14	5.0000	1.2000	22
57.50	17.53	-38.00	sand	SPT	24	(N1)60>30: Non-Liq.	24	0.6970	1	21	5.0000	1.2000	30
59.00	17.98	-39.50	sand	SPT	19	0.522	19	0.6874	1	16	0.8694	1.0216	17
60.50	18.44	-41.00	sand	SPT	22	0.743	22	0.6780	1	19	3.6147	1.0794	24

Depth (ft)	D_R corrections per Kulhawy and Mayne, 1990: Relative Density: Particle Size Correction, C_P	Relative Density: Aging Correction, C_A	Relative Density: Overconsol. Correction, C_{OCR}	Relative Density, D_r (%)	$CRR_{7.5}$	Stress Reduction Coefficient (r_d)	CSR_{EQ}	MSF	Corr. Static Normal Stress, K_σ	Design Groundwater Level: GW	γ' (psf)	σ'_{vo} (tsf)	Groundwater level at time of Drilling: GW	γ (psf)	γ' (psf)	σ_{vo} (tsf)	σ'_{vo} (tsf)
56.00	33.8561	1.3151	1.0757	54.1%	0.2420	0.7183	0.356	1.15	0.878	BelowGW	62.6	2.02	BelowGW	125	62.6	3.43	2.02
57.50	32.5772	1.3151	1.0757	67.5%	0.4676	0.7061	0.351	1.15	0.818	BelowGW	62.6	2.07	BelowGW	125	62.6	3.52	2.07
59.00	36.9795	1.3151	1.0757	55.3%	0.1808	0.6938	0.347	1.15	0.870	BelowGW	62.6	2.12	BelowGW	125	62.6	3.61	2.12
60.50	35.0000	1.3151	1.0757	61.9%	0.2734	0.6816	0.342	1.15	0.807	BelowGW	62.6	2.16	BelowGW	125	62.6	3.71	2.16

2004-0049 Newby Island Landfill
11/26/2007 RMW

Liquefaction Assessment per Youd, et al.,

Boring: RB-5

Adj. CPT Boring: CPT-9

Material	Unit Weight:
dike	120 pcf
OBA	127
sand	125
YBM	113

P_{atm} =	1.058 tsf

Groundwater Elev. @ drill:	-6 ft
Design Groundwater Elev.:	-6 ft
Boring Elevation:	18 ft

Note: **BLUE** fields require user input

0 dike
13.4 YBM
21.5 sand
22.2 YBM
23.3 sand
28.6 YBM
30.2 OBA
39.2 sand
42.4 OBA
61.8 sand
62.1 OBA
63.2 sand
68.8 OBA

Depth Profile: Top of Layer	Fines Content, FC (%)	Sand Particle Size, D_{50} (mm)	Age of Deposit (years)	Overconsol. Ratio, OCR
0 dike				
19.8 YBM				
26.6 OBA				
61 sand	41.3%	0.08	2.00E+04	1.5
63 sand	45.9%	0.1	2.00E+04	1.5
64.5 sand	30.0%	0.12	2.00E+04	1.5
66 sand	25%	0.14	2.00E+04	1.5
69 sand	12%	0.2	2.00E+04	1.5
75 OBA				

EQ Mag. (M_w)	PGA
7.1	0.45

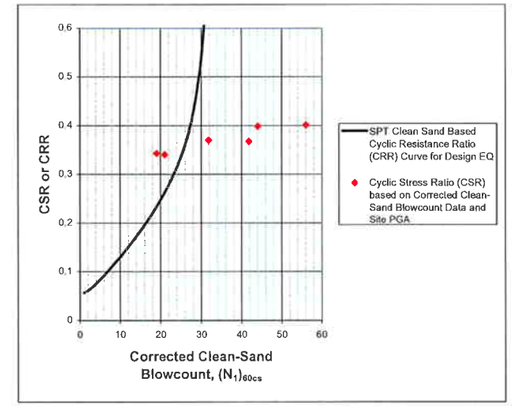
Static Normal Stress Correction, K_σ

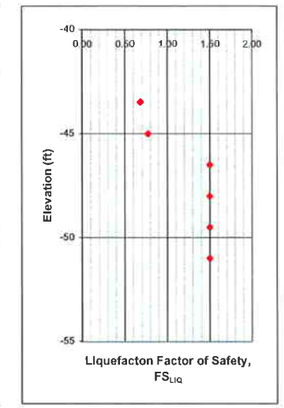
D_r (%)	f
0	0.8
0.6	0.7
0.8	0.6

Mod Cal to SPT Correction
0.62

SPT Equipment Variable Corrections

Range	Used	
Energy Ratio, C_E		
0.5-1.0	1.0	Donut Hammer
0.7-1.2		Safety Hammer
0.8-1.3		Automatic-trip Donut-type Hammer
Borehole Diameter, C_B		
1.0	1.05	2.5 inch to 4.5 inch
1.05		6 inch
1.15		8 inch
Sampling Method, C_S		
1.0	1.2	Standard Sampler
1.1-1.3		Sampler without liners
Rod Length, C_R		
0	0.75	< 3 m
3	0.8	3-4 m
4	0.85	4-6 m
6	0.95	6-10 m
10	1.0	10-30 m
30	1.0	





Note: Calculations per this method are **only valid for $(N_1)_{60cs}$ < 30. For $(N_1)_{60cs}$ >30, soils are classed as non-liquefiable.**
These procedures have been validated for level to gently-sloping sites with potentially liquefiable materials at shallow depths (<15 m = 49 ft.).

Depth (ft)	Depth (m)	Elevation (ft)	Material	SPT or Modified California Sampler? [SPT or MC]	Measured 12-inch Drive Blowcount	FS_{LIQ}	Equivalent SPT N-value	Overburden Stress Factor, C_N	Rod Length Factor, C_R	Corrected SPT $(N_1)_{60}$ (≥30 shaded yellow = non-liquefieable)	Fines Content Adj. Coeff., α	Fines Content Adj. Coeff., β	Clean-Sand $(N_1)_{60cs}$
61.50	18.75	-43.50	sand	SPT	16	0.681	16	0.6013	1	12	5.0000	1.2000	19
63.00	19.20	-45.00	sand	SPT	18	0.771	18	0.5941	1	13	5.0000	1.2000	21
64.50	19.66	-46.50	sand	SPT	33	(N1)60>30: Non-Liq.	33	0.5871	1	24	4.7062	1.1543	32
66.00	20.12	-48.00	sand	SPT	46	(N1)60>30: Non-Liq.	46	0.5802	1	34	4.2353	1.1113	42
67.50	20.57	-49.50	sand	SPT	65	(N1)60>30: Non-Liq.	65	0.5735	1	47	4.2353	1.1113	56
69.00	21.03	-51.00	sand	SPT	57	(N1)60>30: Non-Liq.	57	0.5669	1	41	1.6893	1.0337	44

Depth (ft)	D_R corrections per Kulhawy and Mayne, 1990: Relative Density: Particle Size Correction, C_P	Relative Density: Aging Correction, C_A	Relative Density: Overconsol. Correction, C_{OCR}	Relative Density, D_r (%)	$CRR_{7.5}$	Stress Reduction Coefficient (r_d)	CSR_{EQ}	MSF	Corr. Static Normal Stress, K_σ	Design Groundwater Level: GW	γ' (psf)	σ'_{vo} (tsf)	Groundwater level at time of Drilling: GW	γ (psf)	γ' (psf)	σ_{vo} (tsf)	σ'_{vo} (tsf)
61.50	32.5772	1.3151	1.0757	51.0%	0.2033	0.6735	0.287	1.15	0.835	BelowGW	62.6	2.60	BelowGW	125	62.6	3.79	2.60
63.00	35.0000	1.3151	1.0757	51.2%	0.2282	0.6613	0.283	1.15	0.832	BelowGW	62.6	2.65	BelowGW	125	62.6	3.88	2.65
64.50	36.9795	1.3151	1.0757	67.7%	0.7324	0.6491	0.280	1.15	0.755	BelowGW	62.6	2.70	BelowGW	125	62.6	3.97	2.70
66.00	38.6532	1.3151	1.0757	78.9%	0.1813	0.6369	0.276	1.15	0.751	BelowGW	62.6	2.74	BelowGW	125	62.6	4.07	2.74
67.50	38.6532	1.3151	1.0757	92.7%	0.3645	0.6247	0.273	1.15	0.679	BelowGW	62.6	2.79	BelowGW	125	62.6	4.16	2.79
69.00	42.5257	1.3151	1.0757	82.6%	0.2211	0.6125	0.269	1.15	0.674	BelowGW	62.6	2.84	BelowGW	125	62.6	4.26	2.84

2004-0049 Newby Island Landfill
11/26/2007 RMW

Liquefaction Assessment per Youd, et al., ASCE, 2001

Boring: RB-6

Adj. CPT Boring: CPT-12

Material	Unit Weight:
dike	120 pcf
OBA	127
sand	125
YBM	113

P_{atm} = 1.058 tsf

Groundwater Elev. @ drill:	2 ft
Design Groundwater Elev.:	2 ft
Boring Elevation:	21 ft

Note: **BLUE** fields require user input

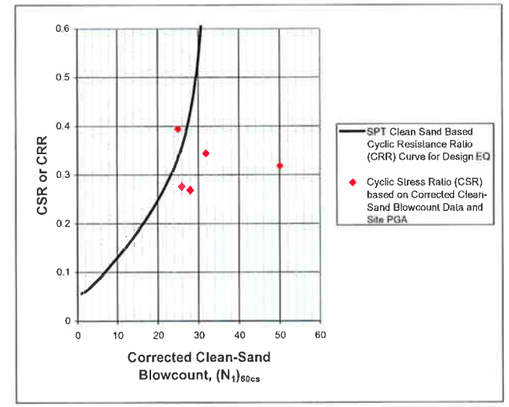
Depth Profile: Top of Layer	Fines Content, FC (%)	Sand Particle Size, D_{50} (mm)	Age of Deposit (years)	Overconsol. Ratio, OCR
0 dike				
26 YBM				
36 sand	11.3%	0.3	3.00E+03	1.0
42 OBA				
75 sand	30.0%	0.1	2.00E+04	1.5
83 OBA				
93 sand	4.7%	0.3	2.00E+04	1.5

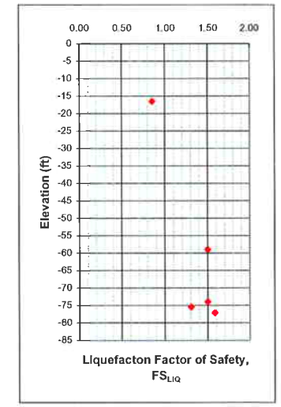
EQ Mag. (M_w)	PGA
7.1	0.45

Static Normal Stress Correction, K_σ	
D_r (%)	f
0	0.8
0.6	0.7
0.8	0.6

Mod Cal to SPT Correction
0.62

SPT Equipment Variable Corrections		
Range	Used	
Energy Ratio, C_E		
0.5-1.0	1.0	Donut Hammer
0.7-1.2		Safety Hammer
0.8-1.3		Automatic-trip Donut-type Hammer
Borehole Diameter, C_B		
1.0	1.05	2.5 inch to 4.5 inch
1.05		6 inch
1.15		8 inch
Sampling Method, C_S		
1.0	1.2	Standard Sampler
1.1-1.3		Sampler without liners
Rod Length, C_R		
0	0.75	< 3 m
3	0.8	3-4 m
4	0.85	4-6 m
6	0.95	6-10 m
10	1.0	10-30 m
30	1.0	





Note: Calculations per this method are **only valid for $(N_1)_{60cs}$ < 30. For $(N_1)_{60cs}$ >30, soils are classed as non-liquefiable.**
These procedures have been validated for level to gently-sloping sites with potentially liquefiable materials at shallow depths (<15 m = 49 ft.).

Depth (ft)	Depth (m)	Elevation (ft)	Material	SPT or Modified California Sampler? [SPT or MC]	Measured 12-Inch Drive Blowcount	FS_{LIQ}	Equivalent SPT N-value	Overburden Stress Factor, C_N	Rod Length Factor, C_R	Corrected SPT $(N_1)_{60}$ (≥30 shaded yellow = non-liquefiable)	Fines Content Adj. Coeff., α	Fines Content Adj. Coeff., β	Clean-Sand $(N_1)_{60cs}$	D_R corrections per Kulhawy and Mayne, 1990: Relative Density: Particle Size Correction, C_P	Relative Density: Aging Correction, C_A	Relative Density: Overconsol. Correction, C_{OCR}	Relative Density, D_r (%)	$CRR_{7.5}$	Stress Reduction Coefficient (r_d)	CSR_{EQ}	MSF	Corr. Static Normal Stress, K_σ	Design Groundwater Level: GW	γ' (psf)	σ'_{vo} (tsf)	Groundwater level at time of Drilling: GW	γ (psf)	γ' (psf)	σ_{vo} (tsf)	σ'_{vo} (tsf)
37.50	11.43	-16.50	sand	SPT	23	0.851	23	0.8035	1	23	1.3126	1.0280	25	46.9280	1.2739	1.0000	62.0%	0.2919	0.8688	0.347	1.15	0.879	BelowGW	62.6	1.63	BelowGW	125	62.6	2.22	1.63
80.00	24.38	-59.00	sand	MC	57	(N1)60>30: Non-Liq.	35	0.5464	1	24	4.7062	1.1543	32	35.0000	1.3151	1.0757	69.6%	0.7324	0.5229	0.251	1.15	0.732	BelowGW	62.6	2.99	BelowGW	125	62.6	4.91	2.99
95.00	28.96	-74.00	sand	SPT	80	(N1)60>30: Non-Liq.	80	0.4911	1	50	0.0000	1.0000	50	46.9280	1.3151	1.0757	86.8%	0.3030	0.4009	0.198	1.15	0.622	BelowGW	62.6	3.47	BelowGW	125	62.6	5.86	3.47
96.50	29.41	-75.50	sand	SPT	42	1.306	42	0.4863	1	26	0.0000	1.0000	26	46.9280	1.3151	1.0757	62.6%	0.3131	0.3887	0.192	1.15	0.697	BelowGW	62.6	3.52	BelowGW	125	62.6	5.95	3.52
98.00	29.87	-77.00	sand	SPT	46	1.581	46	0.4816	1	28	0.0000	1.0000	28	46.9280	1.3151	1.0757	64.9%	0.3695	0.3765	0.187	1.15	0.695	BelowGW	62.6	3.56	BelowGW	125	62.6	6.04	3.56

2004-0049 Newby Island Landfill
11/26/2007 RMW

Liquefaction Assessment per Youd, et al., ASCE, 2001

Boring: RB-7

Adj. CPT Boring: CPT-22

Material	Unit Weight:
dike	120 pcf
OBA	127
sand	125
YBM	113

P_{atm} =	1.058 tsf

Groundwater Elev. @ drill:	-15 ft
Design Groundwater Elev.:	-40 ft
Boring Elevation:	0 ft

Note: BLUE fields require user input

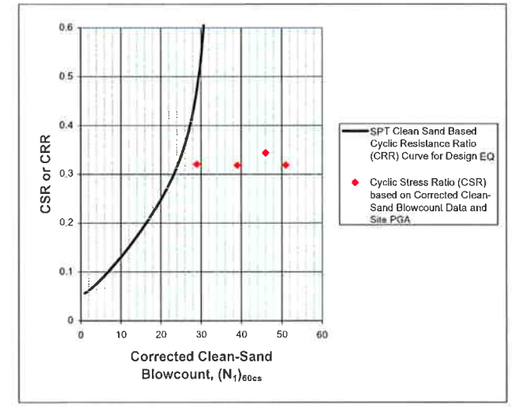
Depth Profile: Top of Layer	Fines Content, FC (%)	Sand Particle Size, D_{50} (mm)	Age of Deposit (years)	Overconsol. Ratio, OCR
0 fill				
32 OBA				
33 sand	6.0%	0.3	2.00E+04	1.5
36.5 sand	7.7%	0.9	2.00E+04	1.5
39.5 sand	6.0%	0.3	2.00E+04	1.5
41 OBA				

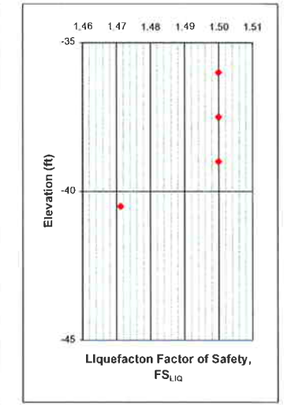
EQ Mag. (M_w)	PGA
7.1	0.45

Static Normal Stress Correction, K_σ	
D_r (%)	f
0	0.8
0.6	0.7
0.8	0.6

Mod Cal to SPT Correction
0.62

SPT Equipment Variable Corrections		
Range	Used	
Energy Ratio, C_E		
0.5-1.0	1.0	Donut Hammer
0.7-1.2		Safety Hammer
0.8-1.3		Automatic-trip Donut-type Hammer
Borehole Diameter, C_B		
1.0	1.05	2.5 inch to 4.5 inch
1.05		6 inch
1.15		8 inch
Sampling Method, C_S		
1.0	1.2	Standard Sampler
1.1-1.3		Sampler without liners
Rod Length, C_R		
0	0.75	< 3 m
3	0.8	3-4 m
4	0.85	4-6 m
6	0.95	6-10 m
10	1.0	10-30 m
30	1.0	





Note: Calculations per this method are **only valid for $(N_1)_{60cs}$ < 30. For $(N_1)_{60cs}$ >30, soils are classed as non-liquefiable.**
These procedures have been validated for level to gently-sloping sites with potentially liquefiable materials at shallow depths (<15 m = 49 ft.).

Depth (ft)	Depth (m)	Elevation (ft)	Material	SPT or Modified California Sampler? [SPT or MC]	Measured 12-inch Drive Blowcount	FS_{LIQ}	Equivalent SPT N-value	Overburden Stress Factor, C_N	Rod Length Factor, C_R	Corrected SPT $(N_1)_{60}$ (≥30 shaded yellow = non-liquefiable)	Fines Content Adj. Coeff., α	Fines Content Adj. Coeff., β	Clean-Sand $(N_1)_{60cs}$
36.00	10.97	-36.00	sand	SPT	43	AboveGW	43	0.8400	1	46	0.0297	1.0047	46
37.50	11.43	-37.50	sand	SPT	48	AboveGW	48	0.8260	1	50	0.2358	1.0114	51
39.00	11.89	-39.00	sand	SPT	37	AboveGW	37	0.8124	1	38	0.2358	1.0114	39
40.50	12.34	-40.50	sand	SPT	29	1.471	29	0.7993	1	29	0.0297	1.0047	29

Depth (ft)	D_R corrections per Kulhawy and Mayne, 1990: Relative Density: Particle Size Correction, C_P	Relative Density: Aging Correction, C_A	Relative Density: Overconsol. Correction, C_{OCR}	Relative Density, D_r (%)	$CRR_{7.5}$	Stress Reduction Coefficient (r_d)	CSR_{EQ}	MSF	Corr. Static Normal Stress, K_σ	Design Groundwater Level: GW	γ' (psf)	σ'_{vo} (tsf)	Groundwater level at time of Drilling: GW	γ (psf)	γ' (psf)	σ_{vo} (tsf)	σ'_{vo} (tsf)
36.00	46.9280	1.3151	1.0757	83.2%	0.2526	0.8810	0.258	1.15	0.750	AboveGW	125	2.17	BelowGW	125	62.6	2.17	1.50
37.50	58.8561	1.3151	1.0757	77.5%	0.3141	0.8688	0.254	1.15	0.796	AboveGW	125	2.27	BelowGW	125	62.6	2.27	1.55
39.00	58.8561	1.3151	1.0757	67.6%	0.0842	0.8566	0.251	1.15	0.786	AboveGW	125	2.36	BelowGW	125	62.6	2.36	1.60
40.50	46.9280	1.3151	1.0757	66.1%	0.4103	0.8444	0.250	1.15	0.780	BelowGW	62.6	2.42	BelowGW	125	62.6	2.45	1.64

2004-0049 Newby Island Landfill
11/26/2007 RMW

Liquefaction Assessment per Youd, et al., ASCE, 2001

Boring: RB-8

Adj. CPT Boring: CPT-7

Material	Unit Weight:
dike	120 pcf
OBA	127
sand	125
YBM	113

P_{atm} =	1.058 tsf

Groundwater Elev. @ drill:	-12 ft
Design Groundwater Elev.:	-4 ft
Boring Elevation:	15 ft

Note: **BLUE** fields require user input

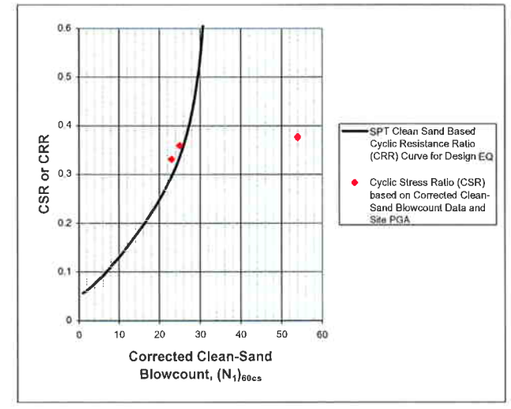
Depth Profile: Top of Layer	Fines Content, FC (%)	Sand Particle Size, D_{50} (mm)	Age of Deposit (years)	Overconsol. Ratio, OCR
0 dike				
17.5 YBM				
24 sand	20.0%	0.2	3.00E+03	1.0
25 sand	29.0%	0.15	3.00E+03	1.0
28 sand	12.8%	0.22	3.00E+03	1.0
29 sand	36.5%	0.15	3.00E+03	1.0
29.5 OBA				

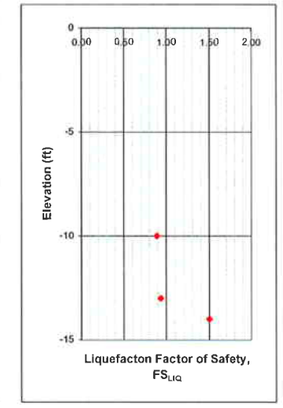
EQ Mag. (M_w)	PGA
7.1	0.45

Static Normal Stress Correction, K_σ	
D_r (%)	f
0	0.8
0.6	0.7
0.8	0.6

Mod Cal to SPT Correction
0.62

SPT Equipment Variable Corrections		
Range	Used	
Energy Ratio, C_E		
0.5-1.0		Donut Hammer
0.7-1.2	1.0	Safety Hammer
0.8-1.3		Automatic-trip Donut-type Hammer
Borehole Diameter, C_B		
1.0		2.5 inch to 4.5 inch
1.05	1.05	6 inch
1.15		8 inch
Sampling Method, C_S		
1.0		Standard Sampler
1.1-1.3	1.2	Sampler without liners
Rod Length, C_R		
0	0.75	< 3 m
3	0.8	3-4 m
4	0.85	4-6 m
6	0.95	6-10 m
10	1.0	10-30 m
30	1.0	





Note: Calculations per this method are **only valid for $(N_1)_{60cs}$ < 30. For $(N_1)_{60cs}$ >30, soils are classed as non-liquefiable.**
These procedures have been validated for level to gently-sloping sites with potentially liquefiable materials at shallow depths (<15 m = 49 ft.).

Depth (ft)	Depth (m)	Elevation (ft)	Material	SPT or Modified California Sampler? [SPT or MC]	Measured 12-inch Drive Blowcount	FS_{LIQ}	Equivalent SPT N-value	Overburden Stress Factor, C_N	Rod Length Factor, C_R	Corrected SPT $(N_1)_{60}$ (≥30 shaded yellow = non-liquefieable)	Fines Content Adj. Coeff., α	Fines Content Adj. Coeff., β	Clean-Sand $(N_1)_{60cs}$
25.00	7.62	-10.00	sand	SPT	16	0.892	16	0.8462	0.95	16	4.6371	1.1462	23
28.00	8.53	-13.00	sand	SPT	23	0.934	23	0.8050	0.95	22	1.8227	1.0358	25
29.00	8.84	-14.00	sand	SPT	43	(N1)60>30: Non-Liq.	43	0.7964	0.95	41	5.0000	1.2000	54

Depth (ft)	D_R corrections per Kulhawy and Mayne, 1990: Relative Density: Particle Size Correction, C_P	Relative Density: Aging Correction, C_A	Relative Density: Overconsol. Correction, C_{OCR}	Relative Density, D_r (%)	$CRR_{7.5}$	Stress Reduction Coefficient (r_d)	CSR_{EQ}	MSF	Corr. Static Normal Stress, K_σ
25.00	39.4023	1.2739	1.0000	56.5%	0.2569	0.9417	0.319	1.15	0.963
28.00	43.5606	1.2739	1.0000	63.0%	0.2919	0.9347	0.332	1.15	0.925
29.00	39.4023	1.2739	1.0000	90.4%	0.3451	0.9324	0.336	1.15	0.893

Depth (ft)	Design Groundwater Level: GW	γ' (psf)	σ'_{vo} (tsf)	Groundwater level at time of Drilling: GW	γ (psf)	γ' (psf)	σ_{vo} (tsf)	σ'_{vo} (tsf)
25.00	BelowGW	62.6	1.28	AboveGW	125	125	1.48	1.48
28.00	BelowGW	62.6	1.37	BelowGW	125	62.6	1.67	1.62
29.00	BelowGW	62.6	1.40	BelowGW	125	62.6	1.73	1.65