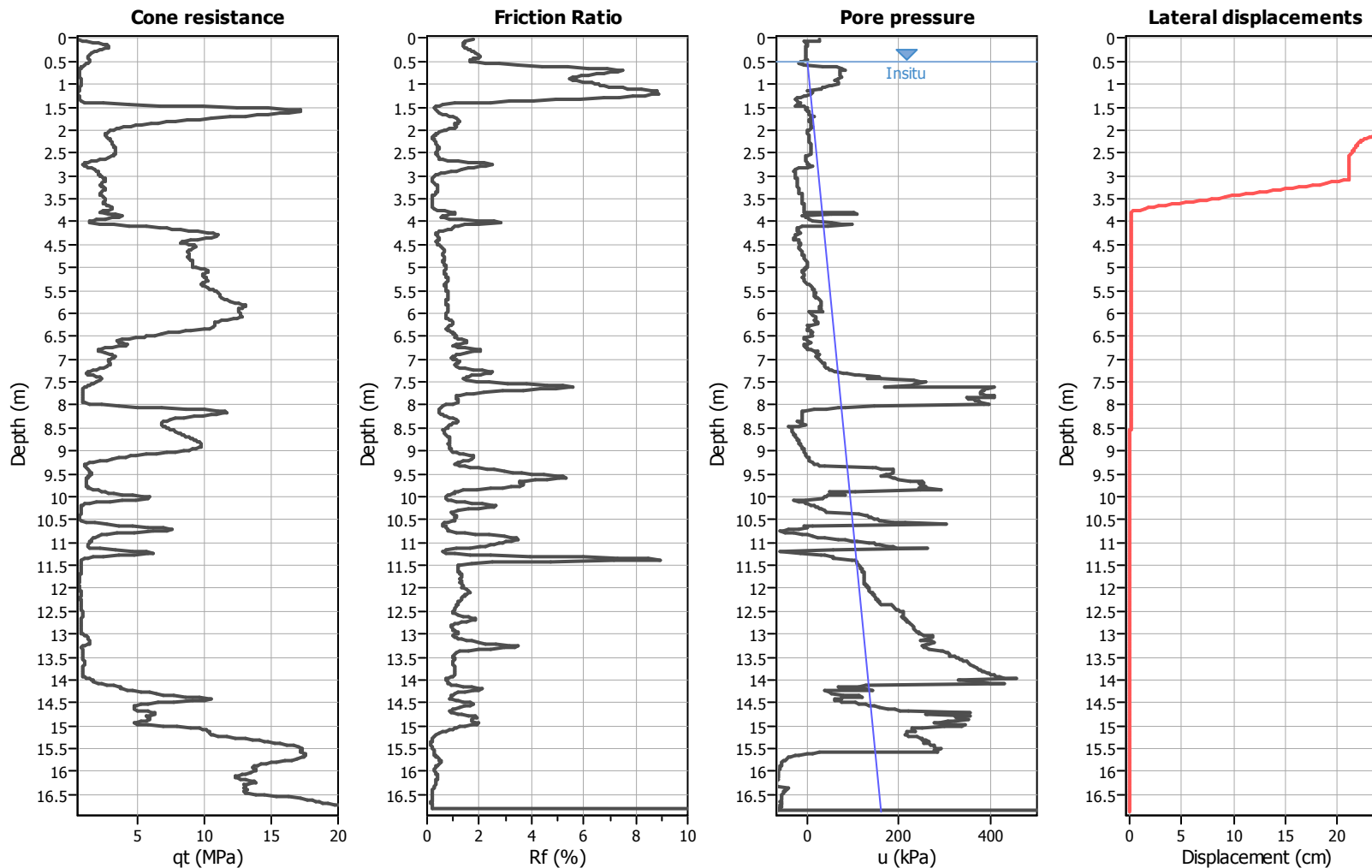


Project: Lateral Spread Analyses

Location: Peacockes Road, Hamilton East

CPT: CPT9 River

Total depth: 16.88 m



Analysis method:	NCEER (1998)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	Sands only
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	N/A
Peak ground acceleration:	0.15	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method based

Vs BASED LIQUEFACTION ANALYSIS REPORT (Kayen et al. 2013)

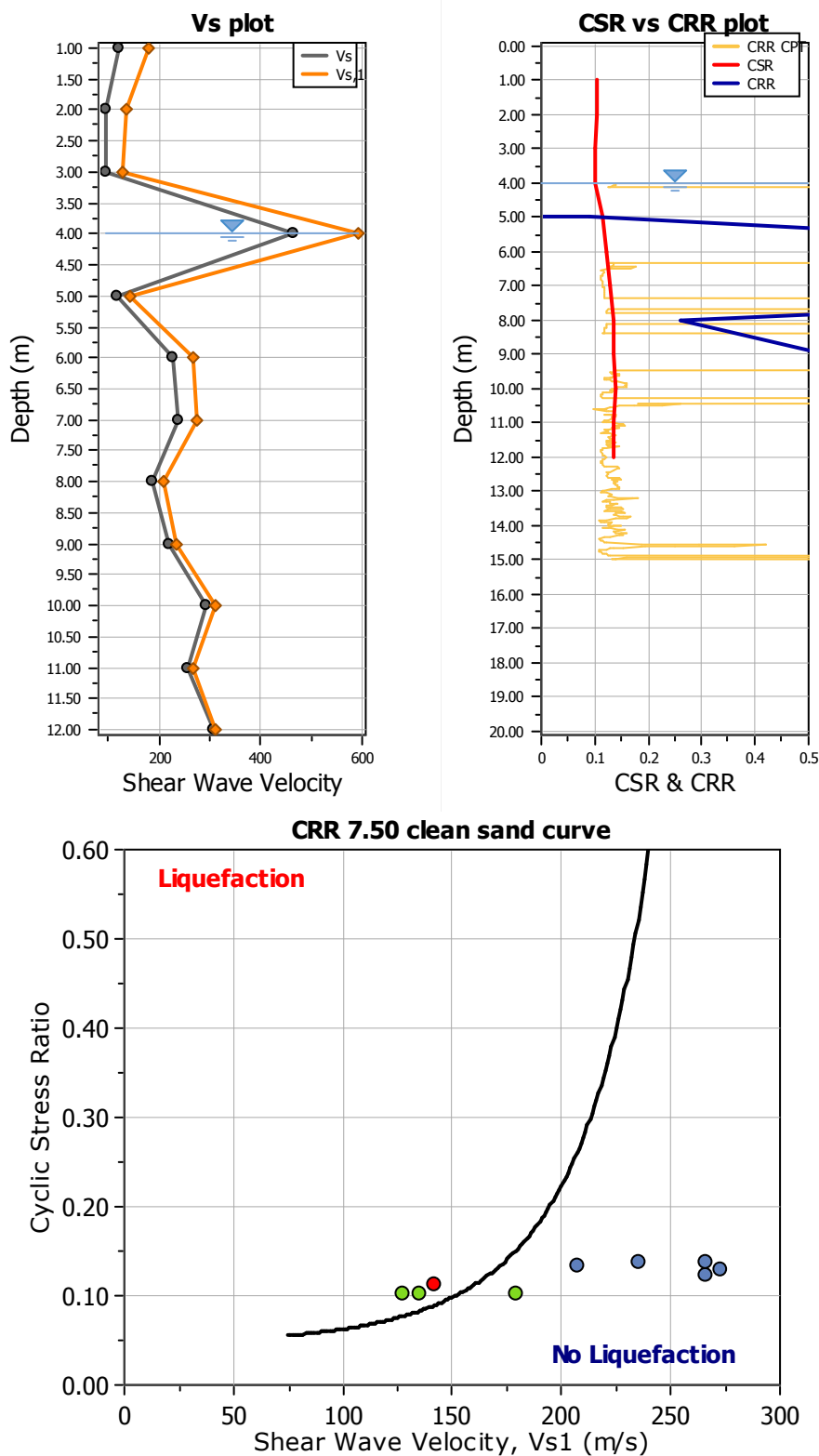
Project title : Peacocks Road

Location : Hamilton

CPT file : CPT16 SCPT01

:: Input parameters and analysis properties ::

Calculation method: Kayen et. al (2013)
G.W.T. (in-situ): 1.00 m
G.W.T. (earthq.): 4.00 m
Earthquake magnitude M_w : 5.90
Peak ground acceleration: 0.22g



15 June 2018

:: Cyclic Stress Ratio fully adjusted (CSR*) numeric results ::

No	Depth (m)	Weight (kN/m ³)	u ₀ (kPa)	σ _v (kPa)	σ' _v (kPa)	r _d	CSR	K _σ	MSF	CSR*	Can Liquefy
1	1.00	17.00	0.00	17.00	17.00	1.00	0.143	1.00	1.39	2.000	No
2	2.00	17.00	9.81	24.19	34.00	0.99	0.142	1.00	1.39	2.000	No
3	3.00	17.00	19.62	31.38	51.00	0.99	0.141	1.00	1.39	2.000	No
4	4.00	17.00	29.43	38.57	68.00	0.98	0.140	1.00	1.39	0.101	Yes
5	5.00	17.00	39.24	45.76	85.00	0.97	0.157	1.00	1.39	0.113	Yes
6	6.00	17.00	49.05	52.95	102.00	0.96	0.170	1.00	1.39	0.123	Yes
7	7.00	17.00	58.86	60.14	119.00	0.94	0.179	1.00	1.39	0.129	Yes
8	8.00	17.00	68.67	67.33	136.00	0.92	0.186	1.00	1.39	0.134	Yes
9	9.00	17.00	78.48	74.52	153.00	0.90	0.189	1.00	1.39	0.137	Yes
10	10.00	17.00	88.29	81.71	170.00	0.87	0.190	1.00	1.39	0.137	Yes
11	11.00	17.00	98.10	88.90	187.00	0.84	0.190	1.00	1.39	0.137	Yes
12	12.00	17.00	107.91	96.09	204.00	0.81	0.187	1.00	1.39	0.135	Yes

Abbreviations

Depth: Depth from free surface where SPT was performed (m)
u₀: Water pressure at test point (kPa)
σ_v: Total overburden pressure at test point (kPa)
σ'_v: Effective overburden pressure based on GWT during earthquake (kPa)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio ()
MSF: Effective overburden stress factor
K_σ: Magnitude Scaling Factor
CSR*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) numeric results ::

No	Depth (m)	V _s (m/s)	Fines %	n	V _{s1} (m/s)	CRR _{7.5}	F.S.	Can Liquefy
1	1.00	119.40	1.00	1.50	179.10	4.000	2.00	No
2	2.00	94.70	1.00	1.43	135.48	4.000	2.00	No
3	3.00	95.30	1.00	1.34	127.75	4.000	2.00	No
4	4.00	465.80	1.00	1.27	593.02	35682 560.00	0/441 8176.0	Yes
5	5.00	116.50	1.00	1.22	142.11	0.089	0.79	Yes
6	6.00	226.00	1.00	1.18	265.81	1.354	11.04	Yes
7	7.00	239.20	1.00	1.14	272.52	1.718	13.27	Yes
8	8.00	187.50	1.00	1.11	207.67	0.262	1.96	Yes
9	9.00	218.30	1.00	1.08	235.73	0.529	3.87	Yes
10	10.00	293.40	1.00	1.06	309.61	7.825	56.92	Yes
11	11.00	257.10	1.00	1.03	265.65	1.346	9.84	Yes
12	12.00	306.20	1.00	1.01	310.29	8.070	59.68	Yes

Abbreviations

Depth: Depth from free surface where Vs was performed (m)
V_s: Estimated Vs (m/s)
n: Stress exponent normalization factor
V_{s1}: Normalized Vs (m/s)
V_{s1c}: Critical value of Vs1, which separates contractive and dilative behavior (kPa)
CRR_{7.5}: Cyclic Resistance Ratio for M_w 7.50
F.S.: Factor of safety against liquefaction

Vs BASED LIQUEFACTION ANALYSIS REPORT (Kayen et al. 2013)

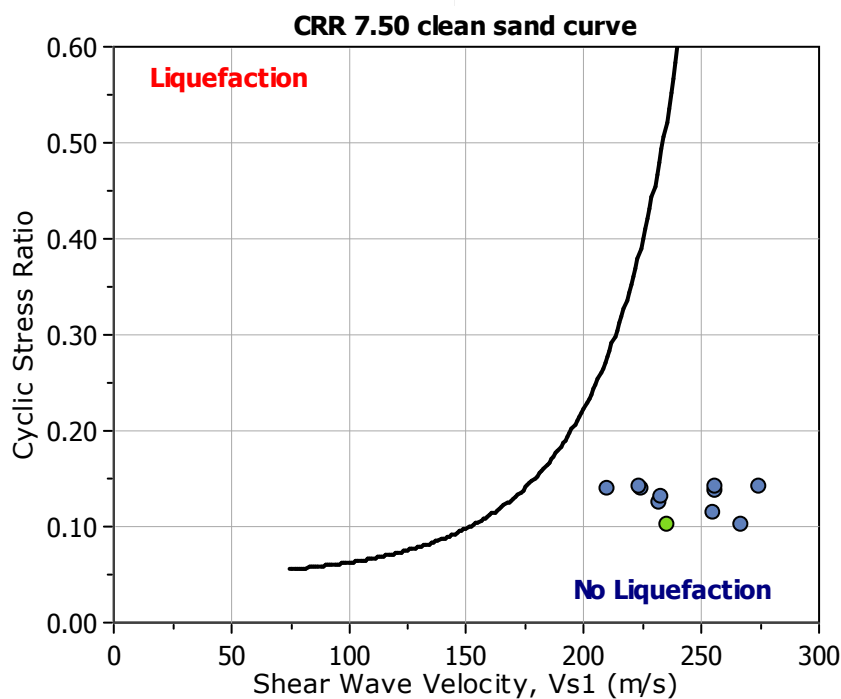
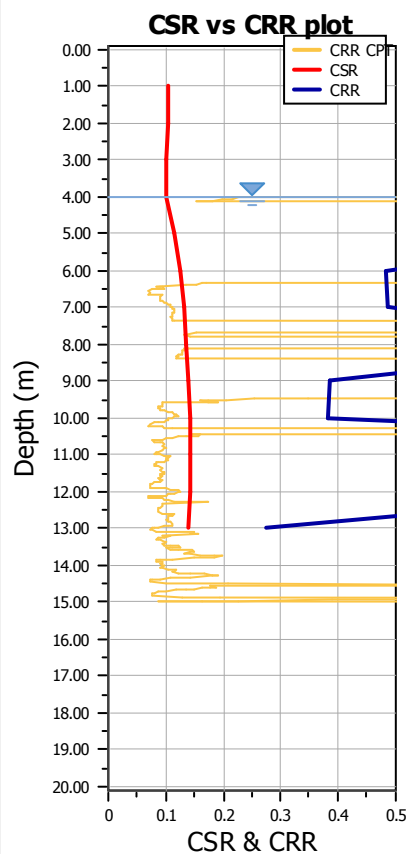
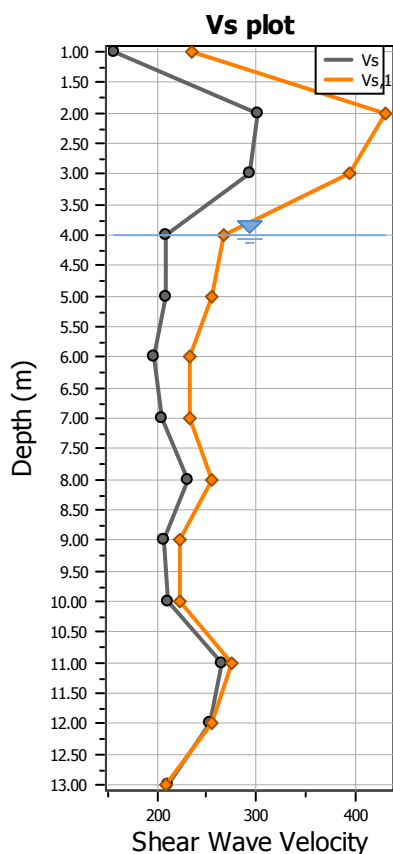
Project title : Peacocks Road

Location : Hamilton

CPT file : CPT16 SCPT02

:: Input parameters and analysis properties ::

Calculation method: Kayen et. al (2013)
G.W.T. (in-situ): 1.00 m
G.W.T. (earthq.): 4.00 m
Earthquake magnitude M_w : 5.90
Peak ground acceleration: 0.22g



15 June 2018

:: Cyclic Stress Ratio fully adjusted (CSR*) numeric results ::

No	Depth (m)	Weight (kN/m ³)	u ₀ (kPa)	σ _v (kPa)	σ' _v (kPa)	r _d	CSR	K _σ	MSF	CSR*	Can Liquefy
1	1.00	17.00	0.00	17.00	17.00	1.00	0.143	1.00	1.39	2.000	No
2	2.00	17.00	9.81	24.19	34.00	1.00	0.142	1.00	1.39	2.000	No
3	3.00	17.00	19.62	31.38	51.00	0.99	0.142	1.00	1.39	2.000	No
4	4.00	17.00	29.43	38.57	68.00	0.99	0.141	1.00	1.39	0.102	Yes
5	5.00	17.00	39.24	45.76	85.00	0.98	0.158	1.00	1.39	0.114	Yes
6	6.00	17.00	49.05	52.95	102.00	0.97	0.172	1.00	1.39	0.124	Yes
7	7.00	17.00	58.86	60.14	119.00	0.96	0.182	1.00	1.39	0.132	Yes
8	8.00	17.00	68.67	67.33	136.00	0.94	0.190	1.00	1.39	0.137	Yes
9	9.00	17.00	78.48	74.52	153.00	0.92	0.195	1.00	1.39	0.140	Yes
10	10.00	17.00	88.29	81.71	170.00	0.90	0.197	1.00	1.39	0.142	Yes
11	11.00	17.00	98.10	88.90	187.00	0.87	0.198	1.00	1.39	0.143	Yes
12	12.00	17.00	107.91	96.09	204.00	0.85	0.196	1.00	1.39	0.142	Yes
13	13.00	17.00	117.72	103.28	221.00	0.81	0.194	1.00	1.39	0.140	Yes

Abbreviations

Depth: Depth from free surface where SPT was performed (m)
u₀: Water pressure at test point (kPa)
σ_v: Total overburden pressure at test point (kPa)
σ'_v: Effective overburden pressure based on GWT during earthquake (kPa)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio ()
MSF: Effective overburden stress factor
K_σ: Magnitude Scaling Factor
CSR*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) numeric results ::

No	Depth (m)	V _s (m/s)	Fines %	n	V _{s1} (m/s)	CRR _{7.5}	F.S.	Can Liquefy
1	1.00	156.70	1.00	1.50	235.05	4.000	2.00	No
2	2.00	300.90	1.00	1.43	430.47	4.000	2.00	No
3	3.00	294.00	1.00	1.34	394.11	4.000	2.00	No
4	4.00	209.70	1.00	1.27	266.97	1.410	13.84	Yes
5	5.00	208.70	1.00	1.22	254.58	0.931	8.14	Yes
6	6.00	197.50	1.00	1.18	232.29	0.481	3.88	Yes
7	7.00	204.20	1.00	1.14	232.65	0.486	3.69	Yes
8	8.00	230.70	1.00	1.11	255.52	0.959	7.01	Yes
9	9.00	207.40	1.00	1.08	223.96	0.386	2.75	Yes
10	10.00	211.90	1.00	1.06	223.61	0.383	2.69	Yes
11	11.00	265.70	1.00	1.03	274.53	1.849	12.96	Yes
12	12.00	252.40	1.00	1.01	255.77	0.967	6.82	Yes
13	13.00	210.90	1.00	1.00	209.89	0.275	1.97	Yes

Abbreviations

Depth: Depth from free surface where Vs was performed (m)
V_s: Estimated Vs (m/s)
n: Stress exponent normalization factor
V_{s1}: Normalized Vs (m/s)
V_{s1c}: Critical value of Vs1, which separates contractive and dilative behavior (kPa)
CRR_{7.5}: Cyclic Resistance Ratio for M_w 7.50
F.S.: Factor of safety against liquefaction

Vs BASED LIQUEFACTION ANALYSIS REPORT (Kayen et al. 2013)

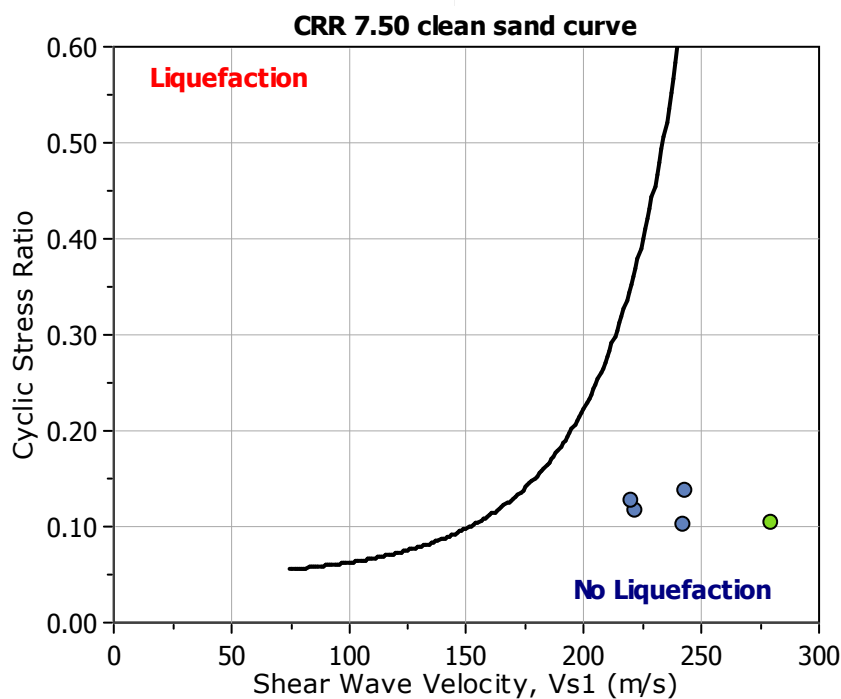
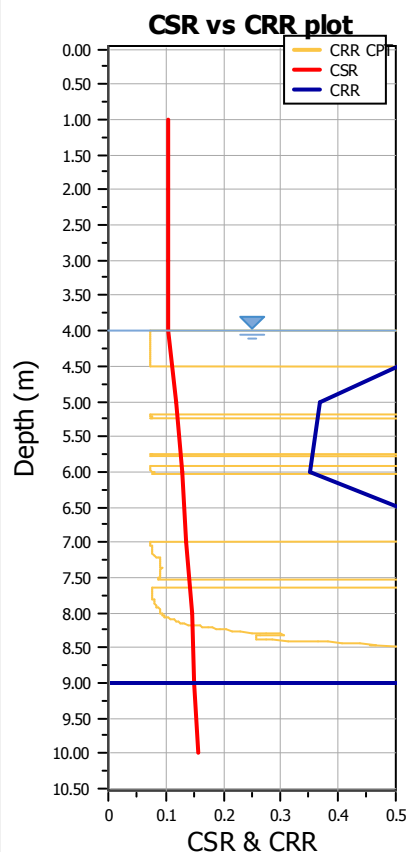
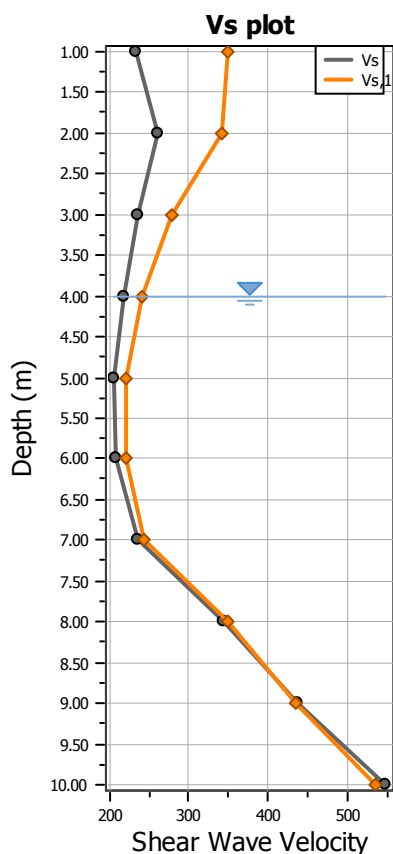
Project title : Peacocks Road

Location : Hamilton

CPT file : SCPT03

:: Input parameters and analysis properties ::

Calculation method: Kayen et. al (2013)
G.W.T. (in-situ): 4.00 m
G.W.T. (earthq.): 4.00 m
Earthquake magnitude M_w : 5.90
Peak ground acceleration: 0.22g



15 June 2018

:: Cyclic Stress Ratio fully adjusted (CSR*) numeric results ::

No	Depth (m)	Weight (kN/m ³)	u ₀ (kPa)	σ _v (kPa)	σ' _v (kPa)	r _d	CSR	K _σ	MSF	CSR*	Can Liquefy
1	1.00	17.00	0.00	17.00	17.00	1.00	0.143	1.00	1.39	2.000	No
2	2.00	17.00	0.00	34.00	34.00	1.00	0.143	1.00	1.39	2.000	No
3	3.00	17.00	0.00	51.00	51.00	1.00	0.143	1.00	1.39	2.000	No
4	4.00	17.00	0.00	68.00	68.00	1.00	0.143	1.00	1.39	0.103	Yes
5	5.00	17.00	9.81	75.19	85.00	1.00	0.161	1.00	1.39	0.116	Yes
6	6.00	17.00	19.62	82.38	102.00	1.00	0.177	1.00	1.39	0.127	Yes
7	7.00	17.00	29.43	89.57	119.00	1.00	0.189	1.00	1.39	0.137	Yes
8	8.00	17.00	39.24	96.76	136.00	1.00	0.200	1.00	1.39	0.144	Yes
9	9.00	17.00	49.05	103.95	153.00	0.99	0.209	1.00	1.39	0.151	Yes
10	10.00	17.00	58.86	111.14	170.00	0.99	0.217	1.00	1.39	0.156	Yes

Abbreviations

Depth: Depth from free surface where SPT was performed (m)
u₀: Water pressure at test point (kPa)
σ_v: Total overburden pressure at test point (kPa)
σ'_v: Effective overburden pressure based on GWT during earthquake (kPa)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio ()
MSF: Effective overburden stress factor
K_σ: Magnitude Scaling Factor
CSR*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) numeric results ::

No	Depth (m)	V _s (m/s)	Fines %	n	V _{s1} (m/s)	CRR _{7.5}	F.S.	Can Liquefy
1	1.00	232.60	1.00	1.50	348.90	4.000	2.00	No
2	2.00	260.40	1.00	1.31	342.14	4.000	2.00	No
3	3.00	235.40	1.00	1.19	279.48	4.000	2.00	No
4	4.00	219.30	1.00	1.10	242.29	0.638	6.19	Yes
5	5.00	206.10	1.00	1.08	222.06	0.368	3.16	Yes
6	6.00	209.10	1.00	1.05	220.21	0.352	2.76	Yes
7	7.00	235.90	1.00	1.03	243.29	0.657	4.81	Yes
8	8.00	345.10	1.00	1.01	349.10	58.760	407.03	Yes
9	9.00	437.00	1.00	0.99	434.21	22531.156	14934.231	Yes
10	10.00	547.70	1.00	0.98	535.19	0224.0	34048.	Yes

Abbreviations

Depth: Depth from free surface where Vs was performed (m)
V_s: Estimated Vs (m/s)
n: Stress exponent normalization factor
V_{s1}: Normalized Vs (m/s)
V_{s1c}: Critical value of Vs1, which separates contractive and dilative behavior (kPa)
CRR_{7.5}: Cyclic Resistance Ratio for M_w 7.50
F.S.: Factor of safety against liquefaction

Vs BASED LIQUEFACTION ANALYSIS REPORT (Kayen et al. 2013)

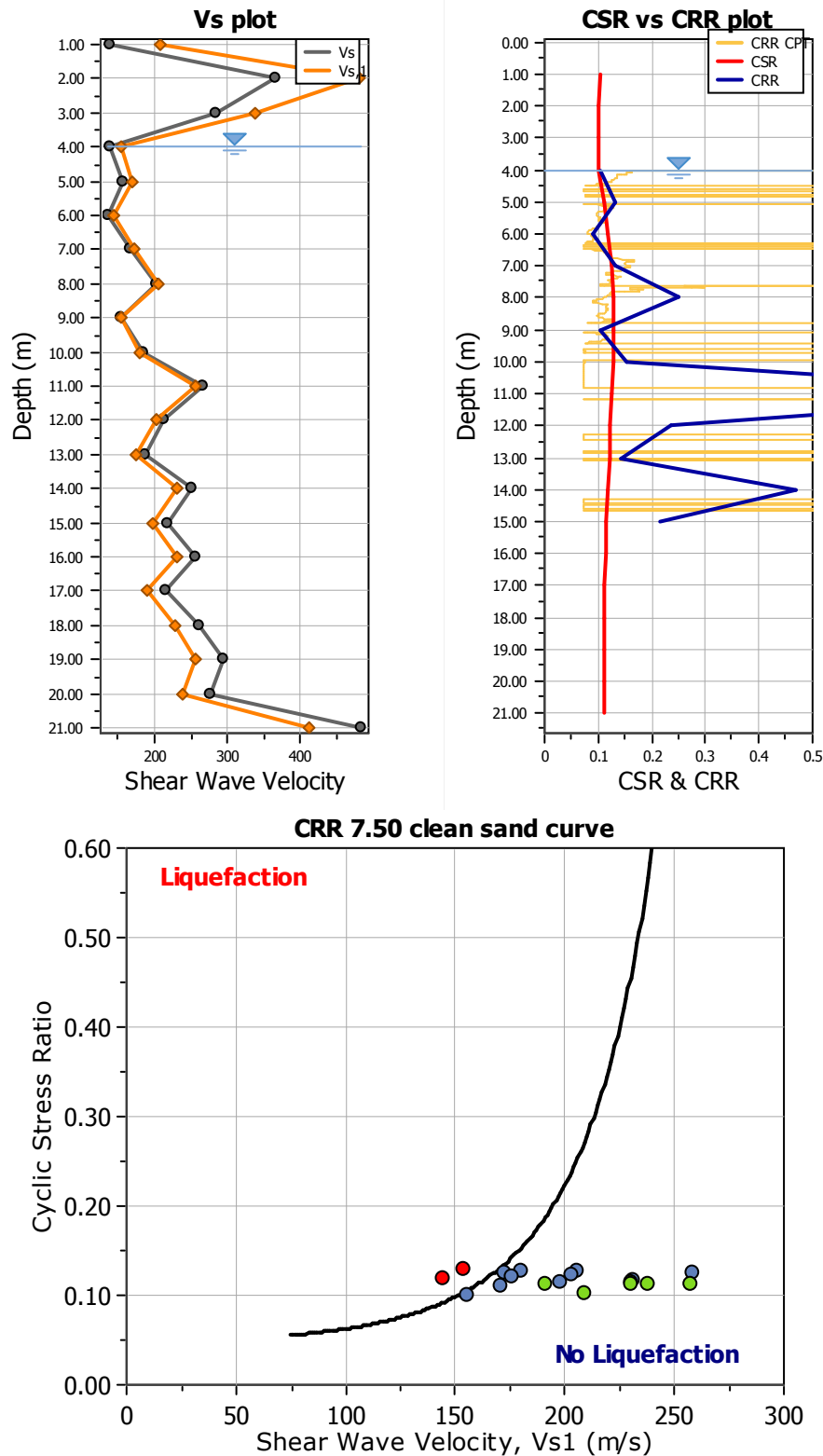
Project title : Peacocks Road

Location : Hamilton

CPT file : SCPT04a

:: Input parameters and analysis properties ::

Calculation method: Kayen et. al (2013)
G.W.T. (in-situ): 4.00 m
G.W.T. (earthq.): 4.00 m
Earthquake magnitude M_w : 5.90
Peak ground acceleration: 0.22g



15 June 2018

:: Cyclic Stress Ratio fully adjusted (CSR*) numeric results ::

No	Depth (m)	Weight (kN/m³)	u ₀ (kPa)	σ _v (kPa)	σ' _v (kPa)	r _d	CSR	K _σ	MSF	CSR*	Can Liquefy
1	1.00	17.00	0.00	17.00	17.00	1.00	0.142	1.00	1.39	2.000	No
2	2.00	17.00	0.00	34.00	34.00	0.99	0.141	1.00	1.39	2.000	No
3	3.00	17.00	0.00	51.00	51.00	0.98	0.140	1.00	1.39	2.000	No
4	4.00	17.00	0.00	68.00	68.00	0.97	0.138	1.00	1.39	0.100	Yes
5	5.00	17.00	9.81	75.19	85.00	0.95	0.154	1.00	1.39	0.111	Yes
6	6.00	17.00	19.62	82.38	102.00	0.93	0.165	1.00	1.39	0.119	Yes
7	7.00	17.00	29.43	89.57	119.00	0.91	0.173	1.00	1.39	0.125	Yes
8	8.00	17.00	39.24	96.76	136.00	0.88	0.177	1.00	1.39	0.128	Yes
9	9.00	17.00	49.05	103.95	153.00	0.85	0.178	1.00	1.39	0.128	Yes
10	10.00	17.00	58.86	111.14	170.00	0.81	0.177	1.00	1.39	0.128	Yes
11	11.00	17.00	68.67	118.33	187.00	0.77	0.174	1.00	1.39	0.126	Yes
12	12.00	17.00	78.48	125.52	204.00	0.73	0.170	1.00	1.39	0.123	Yes
13	13.00	17.00	88.29	132.71	221.00	0.70	0.166	1.00	1.39	0.120	Yes
14	14.00	17.00	98.10	139.90	238.00	0.67	0.163	1.00	1.39	0.118	Yes
15	15.00	17.00	107.91	147.09	255.00	0.64	0.160	1.00	1.39	0.115	Yes
16	16.00	17.00	117.72	154.28	272.00	0.62	0.157	1.00	1.39	2.000	No
17	17.00	17.00	127.53	161.47	289.00	0.61	0.156	1.00	1.39	2.000	No
18	18.00	17.00	137.34	168.66	306.00	0.60	0.155	1.00	1.39	2.000	No
19	19.00	17.00	147.15	175.85	323.00	0.59	0.154	1.00	1.39	2.000	No
20	20.00	17.00	156.96	183.04	340.00	0.58	0.154	1.00	1.39	2.000	No
21	21.00	17.00	166.77	190.23	357.00	0.58	0.155	1.00	1.39	2.000	No

Abbreviations

Depth: Depth from free surface where SPT was performed (m)
u₀: Water pressure at test point (kPa)
σ_v: Total overburden pressure at test point (kPa)
σ'_v: Effective overburden pressure based on GWT during earthquake (kPa)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio ()
MSF: Effective overburden stress factor
K_σ: Magnitude Scaling Factor
CSR*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) numeric results ::

No	Depth (m)	V _s (m/s)	Fines %	n	V _{s1} (m/s)	CRR _{7.5}	F.S.	Can Liquefy
1	1.00	139.30	1.00	1.50	208.95	4.000	2.00	No
2	2.00	366.00	1.00	1.31	480.88	4.000	2.00	No
3	3.00	284.40	1.00	1.19	337.65	4.000	2.00	No
4	4.00	140.60	1.00	1.10	155.34	0.105	1.05	Yes
5	5.00	158.60	1.00	1.08	170.88	0.131	1.18	Yes
6	6.00	137.10	1.00	1.05	144.38	0.091	0.77	Yes
7	7.00	166.90	1.00	1.03	172.13	0.134	1.07	Yes
8	8.00	203.30	1.00	1.01	205.66	0.251	1.97	Yes
9	9.00	155.20	1.00	0.99	154.21	0.103	0.80	Yes
10	10.00	184.40	1.00	0.98	180.19	0.153	1.20	Yes
11	11.00	268.40	1.00	0.96	258.19	1.047	8.33	Yes
12	12.00	213.90	1.00	0.95	202.75	0.235	1.91	Yes
13	13.00	188.00	1.00	0.93	175.74	0.142	1.18	Yes
14	14.00	250.70	1.00	0.92	231.28	0.468	3.98	Yes
15	15.00	217.80	1.00	0.91	198.42	0.215	1.87	Yes
16	16.00	256.00	1.00	0.90	230.46	4.000	2.00	No

15 June 2018

:: Cyclic Resistance Ratio (CRR) numeric results ::

No	Depth (m)	V _s (m/s)	Fines %	n	V _{s1} (m/s)	CRR _{7.5}	F.S.	Can Liquefy
17	17.00	214.90	1.00	0.89	191.27	4.000	2.00	No
18	18.00	261.40	1.00	0.88	230.13	4.000	2.00	No
19	19.00	295.20	1.00	0.87	257.19	4.000	2.00	No
20	20.00	276.20	1.00	0.86	238.24	4.000	2.00	No
21	21.00	484.00	1.00	0.85	413.48	4.000	2.00	No

Abbreviations

Depth: Depth from free surface where Vs was performed (m)
V_s: Estimated Vs (m/s)
n: Stress exponent normalization factor
V_{s1}: Normalized Vs (m/s)
V_{s1c}: Critical value of Vs1, which separates contractive and dilative behavior (kPa)
CRR_{7.5}: Cyclic Resistance Ratio for M_w 7.50
F.S.: Factor of safety against liquefaction

Vs BASED LIQUEFACTION ANALYSIS REPORT (Kayen et al. 2013)

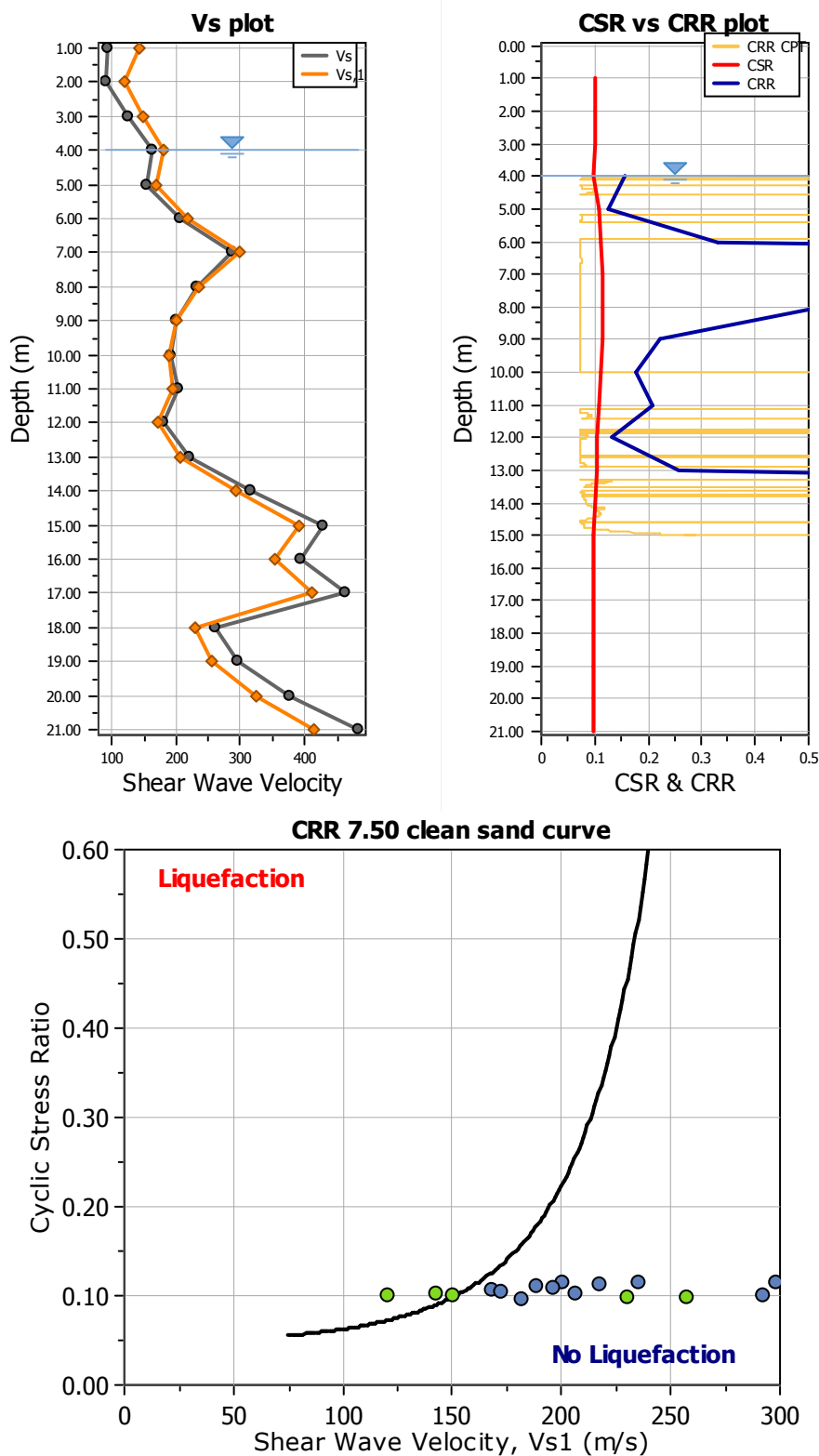
Project title : Peacocks Road

Location : Hamilton

CPT file : SCPT05

:: Input parameters and analysis properties ::

Calculation method: Kayen et. al (2013)
G.W.T. (in-situ): 4.00 m
G.W.T. (earthq.): 4.00 m
Earthquake magnitude M_w : 5.90
Peak ground acceleration: 0.22g



15 June 2018

:: Cyclic Stress Ratio fully adjusted (CSR*) numeric results ::

No	Depth (m)	Weight (kN/m³)	u ₀ (kPa)	σ _v (kPa)	σ' _v (kPa)	r _d	CSR	K _σ	MSF	CSR*	Can Liquefy
1	1.00	17.00	0.00	17.00	17.00	0.99	0.142	1.00	1.39	2.000	No
2	2.00	17.00	0.00	34.00	34.00	0.98	0.140	1.00	1.39	2.000	No
3	3.00	17.00	0.00	51.00	51.00	0.96	0.137	1.00	1.39	2.000	No
4	4.00	17.00	0.00	68.00	68.00	0.94	0.134	1.00	1.39	0.097	Yes
5	5.00	17.00	9.81	75.19	85.00	0.91	0.147	1.00	1.39	0.106	Yes
6	6.00	17.00	19.62	82.38	102.00	0.88	0.155	1.00	1.39	0.112	Yes
7	7.00	17.00	29.43	89.57	119.00	0.84	0.159	1.00	1.39	0.115	Yes
8	8.00	17.00	39.24	96.76	136.00	0.79	0.159	1.00	1.39	0.115	Yes
9	9.00	17.00	49.05	103.95	153.00	0.75	0.158	1.00	1.39	0.114	Yes
10	10.00	17.00	58.86	111.14	170.00	0.70	0.154	1.00	1.39	0.111	Yes
11	11.00	17.00	68.67	118.33	187.00	0.66	0.150	1.00	1.39	0.108	Yes
12	12.00	17.00	78.48	125.52	204.00	0.63	0.146	1.00	1.39	0.105	Yes
13	13.00	17.00	88.29	132.71	221.00	0.60	0.142	1.00	1.39	0.102	Yes
14	14.00	17.00	98.10	139.90	238.00	0.57	0.139	1.00	1.39	0.100	Yes
15	15.00	17.00	107.91	147.09	255.00	0.55	0.137	1.00	1.39	0.099	Yes
16	16.00	17.00	117.72	154.28	272.00	0.54	0.135	1.00	1.39	2.000	No
17	17.00	17.00	127.53	161.47	289.00	0.53	0.135	1.00	1.39	2.000	No
18	18.00	17.00	137.34	168.66	306.00	0.52	0.134	1.00	1.39	2.000	No
19	19.00	17.00	147.15	175.85	323.00	0.51	0.134	1.00	1.39	2.000	No
20	20.00	17.00	156.96	183.04	340.00	0.51	0.135	1.00	1.39	2.000	No
21	21.00	17.00	166.77	190.23	357.00	0.50	0.135	1.00	1.39	2.000	No

Abbreviations

Depth: Depth from free surface where SPT was performed (m)
u₀: Water pressure at test point (kPa)
σ_v: Total overburden pressure at test point (kPa)
σ'_v: Effective overburden pressure based on GWT during earthquake (kPa)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio ()
MSF: Effective overburden stress factor
K_σ: Magnitude Scaling Factor
CSR*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) numeric results ::

No	Depth (m)	V _s (m/s)	Fines %	n	V _{s1} (m/s)	CRR _{7.5}	F.S.	Can Liquefy
1	1.00	95.10	1.00	1.50	142.65	4.000	2.00	No
2	2.00	91.60	1.00	1.31	120.35	4.000	2.00	No
3	3.00	126.50	1.00	1.19	150.19	4.000	2.00	No
4	4.00	164.30	1.00	1.10	181.53	0.156	1.61	Yes
5	5.00	156.50	1.00	1.08	168.62	0.126	1.19	Yes
6	6.00	206.70	1.00	1.05	217.68	0.331	2.95	Yes
7	7.00	289.10	1.00	1.03	298.15	4.718	41.13	Yes
8	8.00	232.50	1.00	1.01	235.20	0.521	4.53	Yes
9	9.00	201.60	1.00	0.99	200.32	0.224	1.97	Yes
10	10.00	193.10	1.00	0.98	188.69	0.178	1.60	Yes
11	11.00	204.50	1.00	0.96	196.72	0.208	1.92	Yes
12	12.00	181.60	1.00	0.95	172.13	0.134	1.27	Yes
13	13.00	221.20	1.00	0.93	206.77	0.257	2.51	Yes
14	14.00	317.10	1.00	0.92	292.53	3.727	37.15	Yes
15	15.00	428.50	1.00	0.91	390.38	787.50 7	793.1 7	Yes
16	16.00	393.70	1.00	0.90	354.42	4.000	2.00	No

15 June 2018

:: Cyclic Resistance Ratio (CRR) numeric results ::

No	Depth (m)	V _s (m/s)	Fines %	n	V _{s1} (m/s)	CRR _{7.5}	F.S.	Can Liquefy
17	17.00	463.40	1.00	0.89	412.44	4.000	2.00	No
18	18.00	261.40	1.00	0.88	230.13	4.000	2.00	No
19	19.00	295.20	1.00	0.87	257.19	4.000	2.00	No
20	20.00	376.20	1.00	0.86	324.50	4.000	2.00	No
21	21.00	484.00	1.00	0.85	413.48	4.000	2.00	No

Abbreviations

Depth: Depth from free surface where Vs was performed (m)
V_s: Estimated Vs (m/s)
n: Stress exponent normalization factor
V_{s1}: Normalized Vs (m/s)
V_{s1c}: Critical value of Vs1, which separates contractive and dilative behavior (kPa)
CRR_{7.5}: Cyclic Resistance Ratio for M_w 7.50
F.S.: Factor of safety against liquefaction

Vs BASED LIQUEFACTION ANALYSIS REPORT (NCEER 1998)

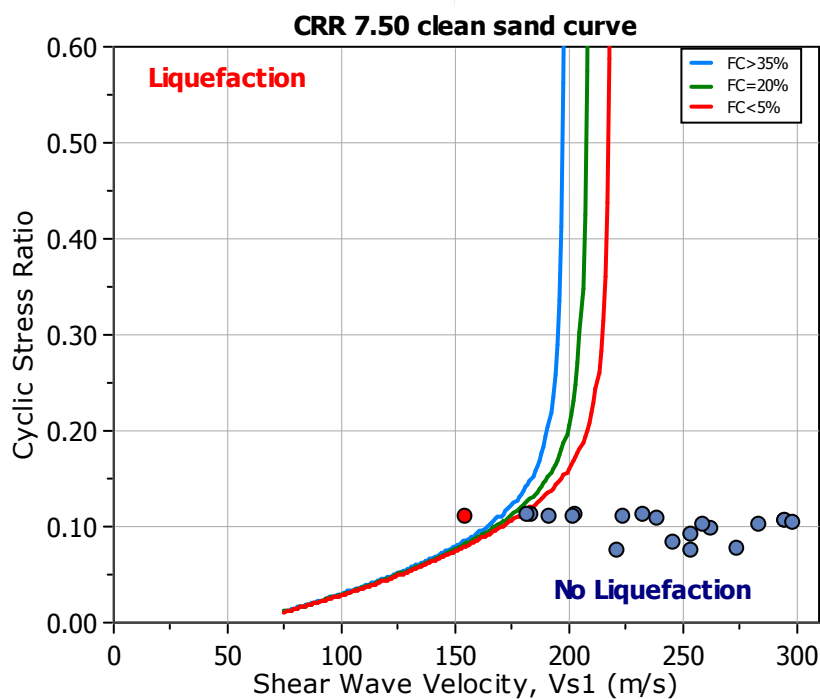
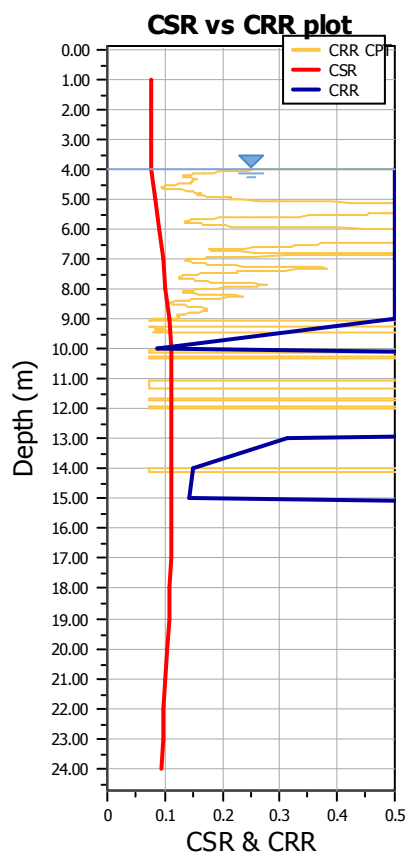
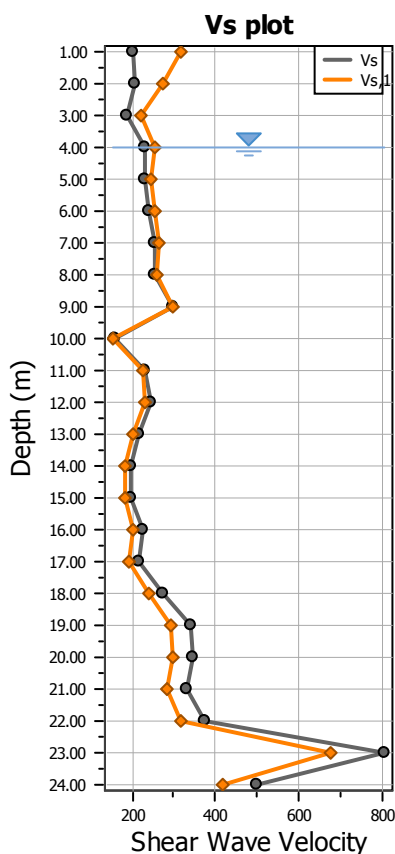
Project title : Peacocks Road

Location : Hamilton

CPT file : SCPT06

:: Input parameters and analysis properties ::

Calculation method: NCEER (1998)
G.W.T. (in-situ): 4.00 m
G.W.T. (earthq.): 4.00 m
Earthquake magnitude M_w : 5.90
Peak ground acceleration: 0.22g



15 June 2018

:: Cyclic Stress Ratio fully adjusted (CSR*) numeric results ::

No	Depth (m)	Weight (kN/m³)	u ₀ (kPa)	σ _v (kPa)	σ' _v (kPa)	r _d	CSR	K _σ	MSF	CSR*	Can Liquefy
1	1.00	17.00	0.00	17.00	17.00	0.99	0.142	1.00	1.85	2.000	Yes
2	2.00	17.00	0.00	34.00	34.00	0.98	0.141	1.00	1.85	2.000	Yes
3	3.00	17.00	0.00	51.00	51.00	0.98	0.140	1.00	1.85	2.000	Yes
4	4.00	17.00	0.00	68.00	68.00	0.97	0.139	1.00	1.85	0.075	Yes
5	5.00	17.00	9.81	85.00	75.19	0.96	0.155	1.00	1.85	0.084	Yes
6	6.00	17.00	19.62	102.00	82.38	0.95	0.169	1.00	1.85	0.091	Yes
7	7.00	17.00	29.43	119.00	89.57	0.95	0.180	1.00	1.85	0.097	Yes
8	8.00	17.00	39.24	136.00	96.76	0.94	0.189	1.00	1.85	0.102	Yes
9	9.00	17.00	49.05	153.00	103.95	0.93	0.196	0.99	1.85	0.107	Yes
10	10.00	17.00	58.86	170.00	111.14	0.91	0.199	0.98	1.85	0.110	Yes
11	11.00	17.00	68.67	187.00	118.33	0.88	0.199	0.97	1.85	2.000	Yes
12	12.00	17.00	78.48	204.00	125.52	0.85	0.199	0.96	1.85	2.000	Yes
13	13.00	17.00	88.29	221.00	132.71	0.83	0.197	0.95	1.85	0.113	Yes
14	14.00	17.00	98.10	238.00	139.90	0.80	0.195	0.94	1.85	0.113	Yes
15	15.00	17.00	107.91	255.00	147.09	0.77	0.192	0.93	1.85	0.112	Yes
16	16.00	17.00	117.72	272.00	154.28	0.75	0.189	0.92	1.85	2.000	Yes
17	17.00	17.00	127.53	289.00	161.47	0.72	0.185	0.91	1.85	2.000	Yes
18	18.00	17.00	137.34	306.00	168.66	0.69	0.180	0.90	1.85	2.000	Yes
19	19.00	17.00	147.15	323.00	175.85	0.67	0.175	0.90	1.85	2.000	Yes
20	20.00	17.00	156.96	340.00	183.04	0.64	0.170	0.89	1.85	2.000	Yes
21	21.00	17.00	166.77	357.00	190.23	0.61	0.165	0.88	1.85	2.000	Yes
22	22.00	17.00	176.58	374.00	197.42	0.59	0.159	0.87	1.85	2.000	Yes
23	23.00	17.00	186.39	391.00	204.61	0.56	0.153	0.87	1.85	2.000	Yes
24	24.00	17.00	196.20	408.00	211.80	0.55	0.152	0.86	1.85	2.000	Yes

Abbreviations

Depth: Depth from free surface where SPT was performed (m)
u₀: Water pressure at test point (kPa)
σ_v: Total overburden pressure at test point (kPa)
σ'_v: Effective overburden pressure based on GWT during earthquake (kPa)
r_d: Nonlinear shear mass factor
CSR: Cyclic Stress Ratio ()
MSF: Effective overburden stress factor
K_σ: Magnitude Scaling Factor
CSR*: CSR fully adjusted

:: Cyclic Resistance Ratio (CRR) numeric results ::

No	Depth (m)	V _s (m/s)	Fines %	n	V _{s1} (m/s)	V _{s1c} (m/s)	CRR _{7.5}	F.S.	Can Liquefy
1	1.00	203.00	1.00	0.25	317.19	215.00	4.000	2.00	Yes
2	2.00	208.60	1.00	0.25	274.08	215.00	4.000	2.00	Yes
3	3.00	186.30	1.00	0.25	221.18	215.00	4.000	2.00	Yes
4	4.00	229.90	1.00	0.25	254.00	215.00	0.500	6.66	Yes
5	5.00	228.50	1.00	0.25	246.19	215.00	0.500	5.94	Yes
6	6.00	241.30	1.00	0.25	254.12	215.00	0.500	5.47	Yes
7	7.00	254.80	1.00	0.25	262.78	215.00	0.500	5.14	Yes
8	8.00	256.00	1.00	0.25	258.97	215.00	0.500	4.90	Yes
9	9.00	297.30	1.00	0.25	295.41	215.00	0.500	4.69	Yes
10	10.00	158.00	1.00	0.25	154.39	215.00	0.086	0.78	Yes
11	11.00	233.10	1.00	0.25	224.23	215.00	4.000	2.00	Yes
12	12.00	245.80	1.00	0.25	232.99	215.00	4.000	2.00	Yes
13	13.00	217.20	1.00	0.25	203.03	215.00	0.312	2.77	Yes

:: Cyclic Resistance Ratio (CRR) numeric results ::

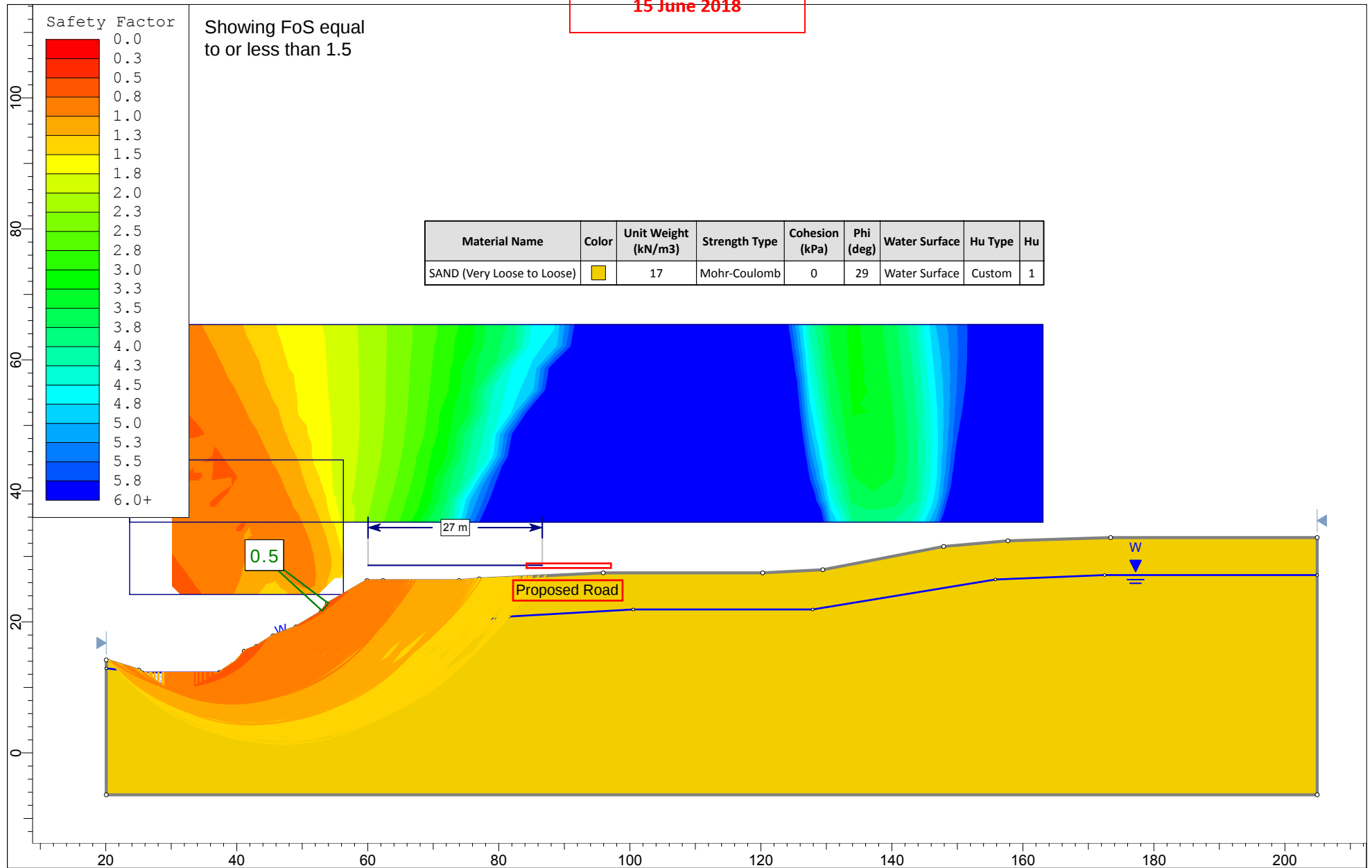
15 June 2018

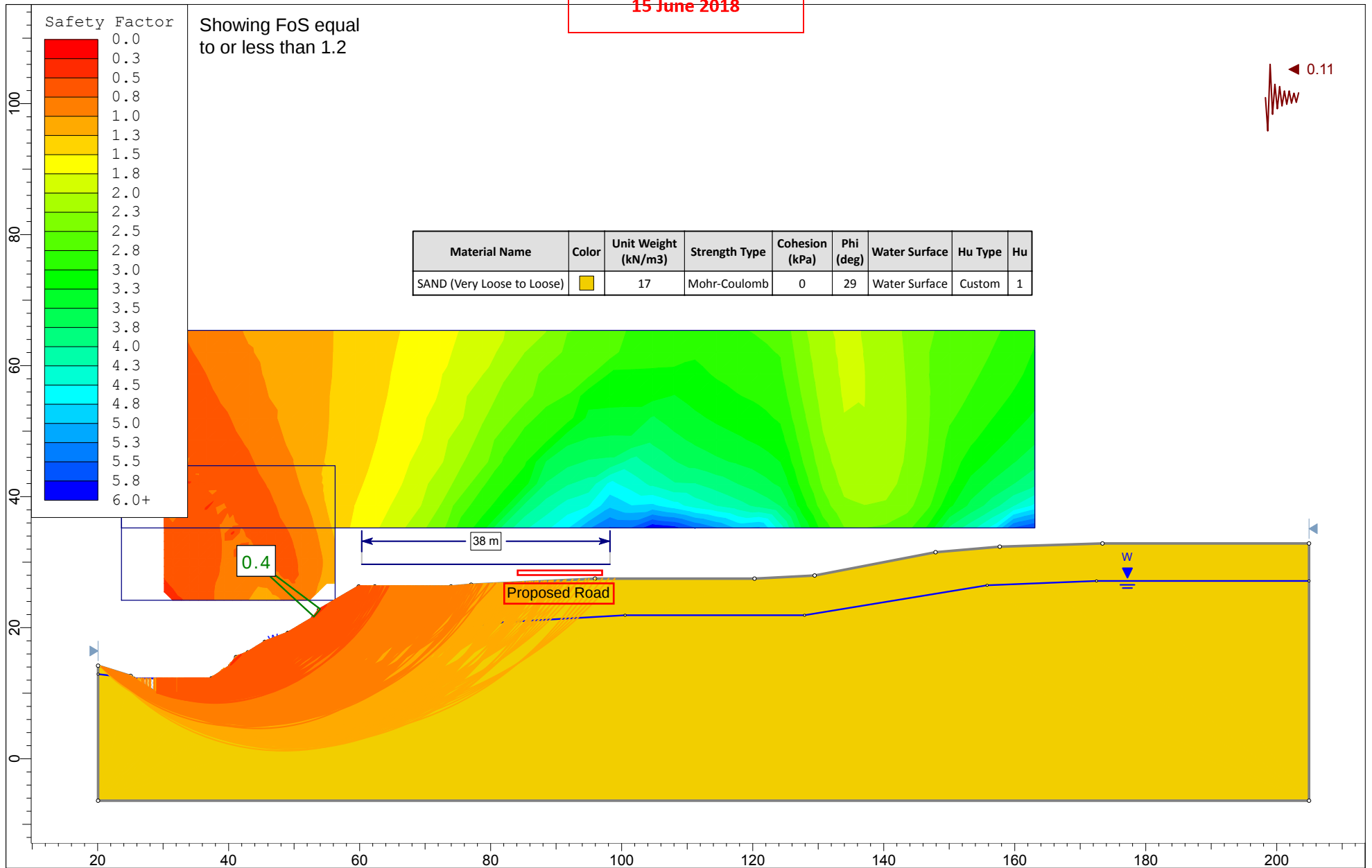
No	Depth (m)	V _s (m/s)	Fines %	n	V _{s1} (m/s)	V _{s1c} (m/s)	CRR _{7.5}	F.S.	Can Liquefy
14	14.00	198.80	1.00	0.25	183.40	215.00	0.150	1.33	Yes
15	15.00	199.50	1.00	0.25	181.75	215.00	0.144	1.28	Yes
16	16.00	224.00	1.00	0.25	201.65	215.00	4.000	2.00	Yes
17	17.00	215.40	1.00	0.25	191.71	215.00	4.000	2.00	Yes
18	18.00	271.80	1.00	0.25	239.29	215.00	4.000	2.00	Yes
19	19.00	338.30	1.00	0.25	294.74	215.00	4.000	2.00	Yes
20	20.00	346.40	1.00	0.25	298.79	215.00	4.000	2.00	Yes
21	21.00	332.40	1.00	0.25	283.97	215.00	4.000	2.00	Yes
22	22.00	374.60	1.00	0.25	317.07	215.00	4.000	2.00	Yes
23	23.00	803.20	1.00	0.25	673.78	215.00	4.000	2.00	Yes
24	24.00	499.10	1.00	0.25	415.08	215.00	4.000	2.00	Yes

Abbreviations

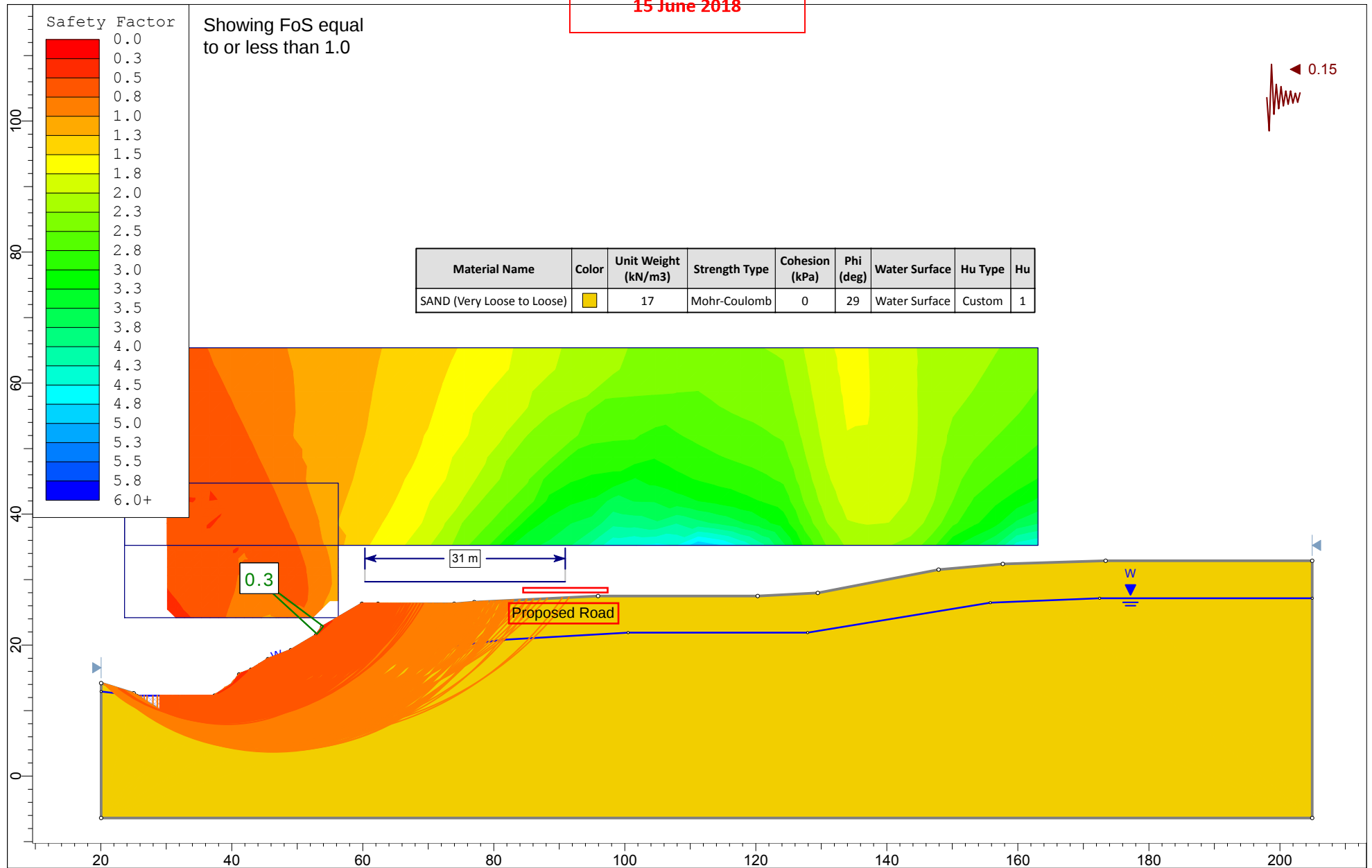
Depth:	Depth from free surface where Vs was performed (m)
V _s :	Estimated Vs (m/s)
n:	Stress exponent normalization factor
V _{s1} :	Normalized Vs (m/s)
V _{s1c} :	Critical value of Vs1, which separates contractive and dilative behavior (kPa)
CRR _{7.5} :	Cyclic Resistance Ratio for M _w 7.50
F.S.:	Factor of safety against liquefaction

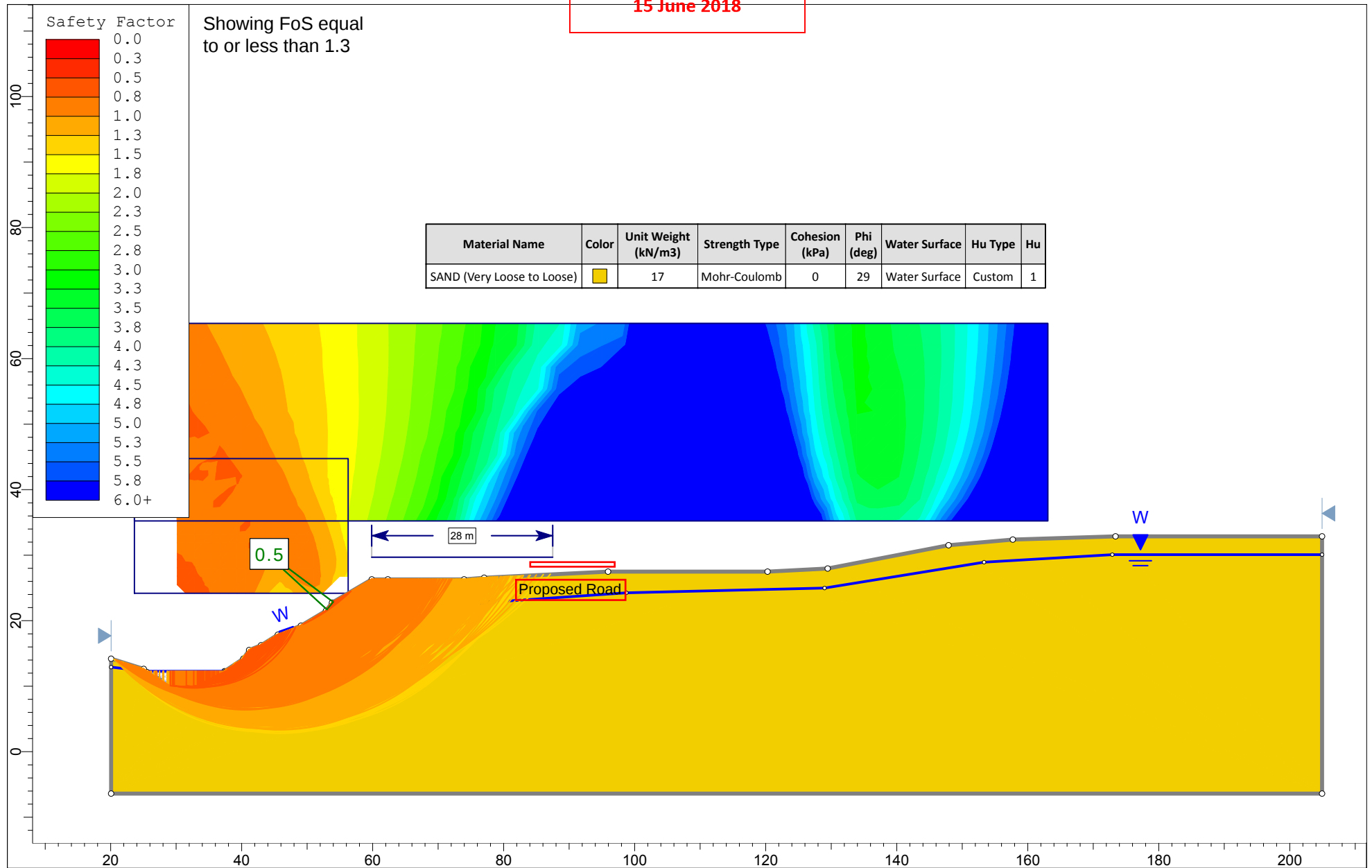
APPENDIX 7:
Slope Stability Analysis Outputs

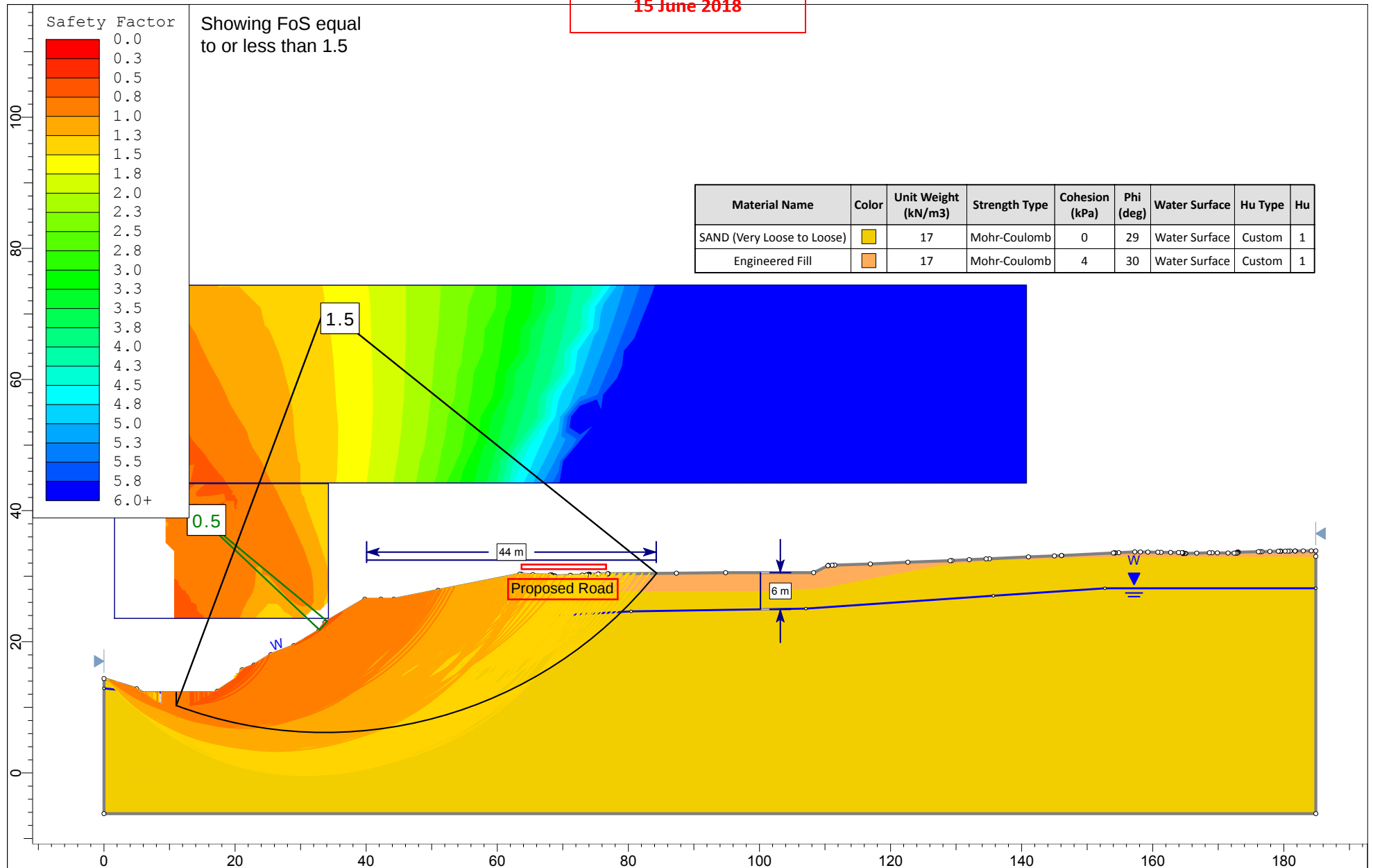


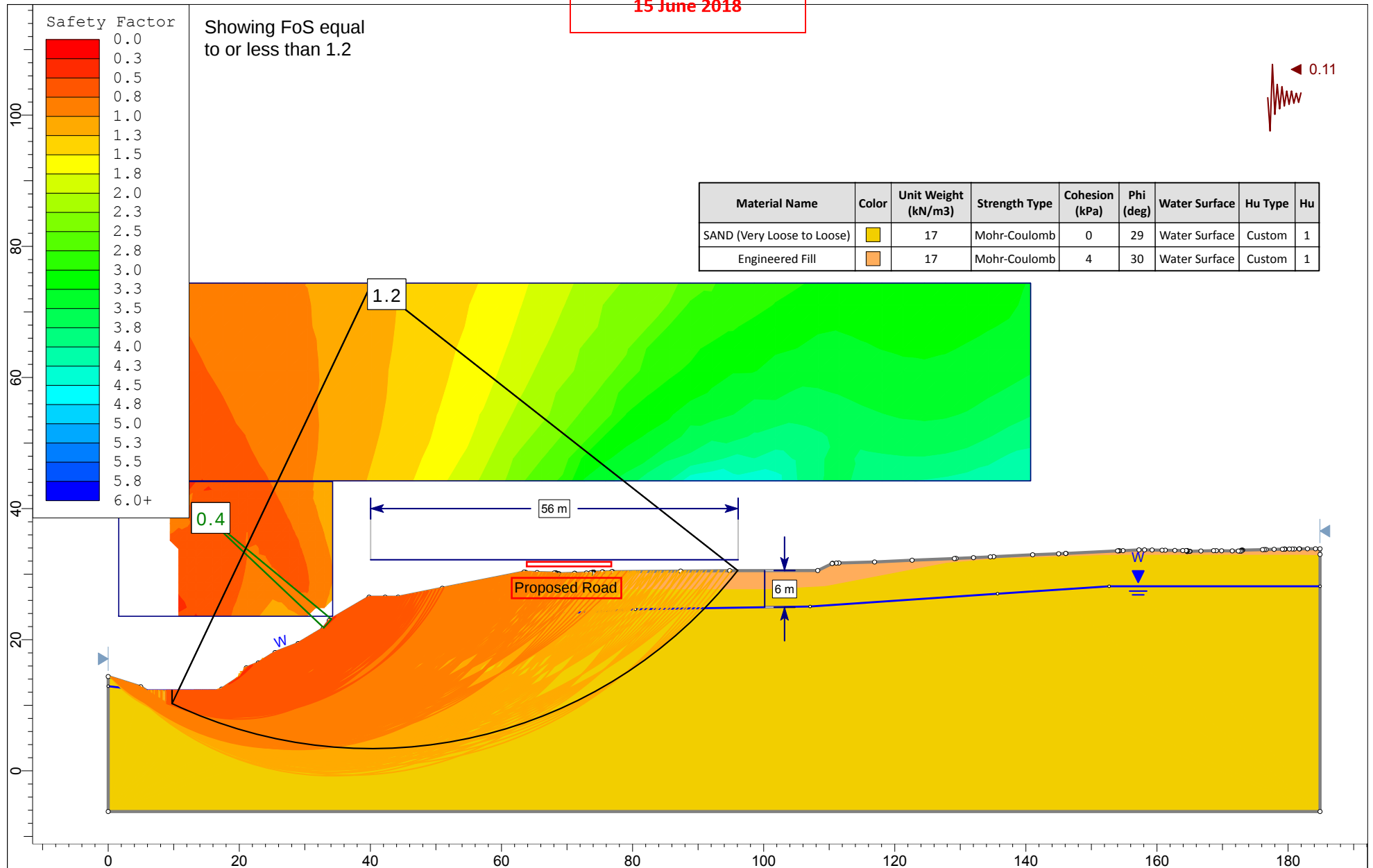


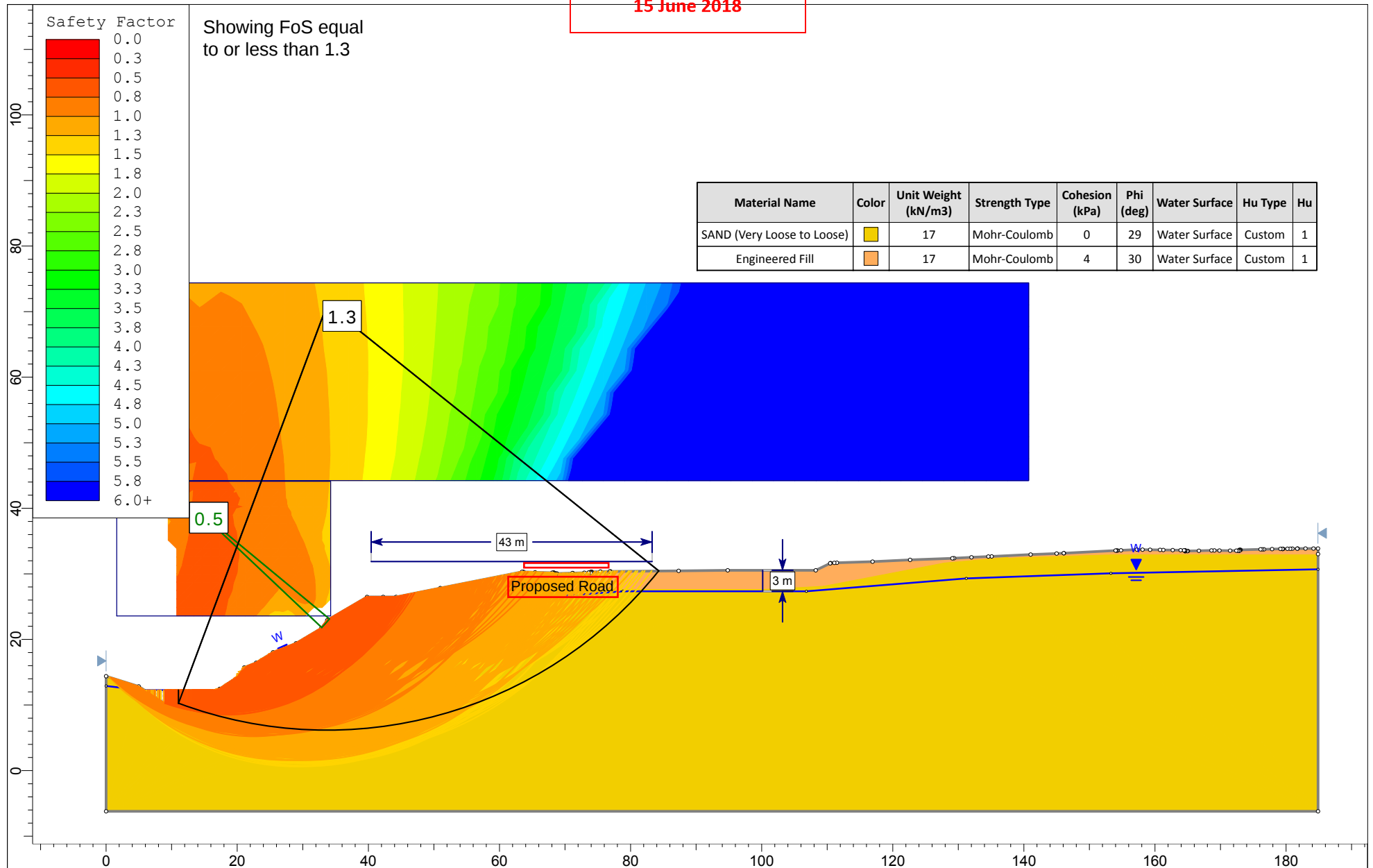
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	Date 13/02/2018	Revision		
	Scale 1:800	Page Size A4	Reference	

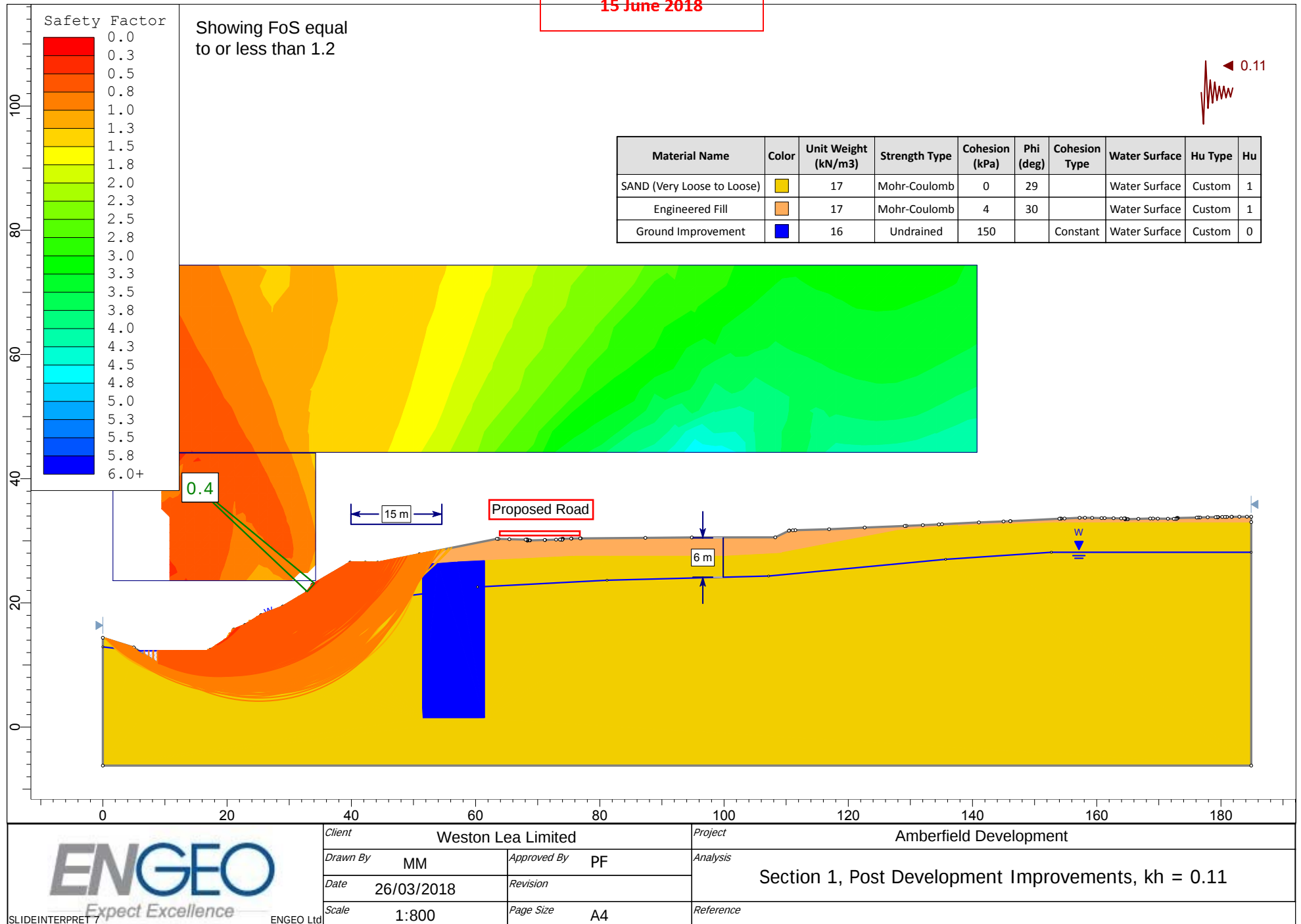


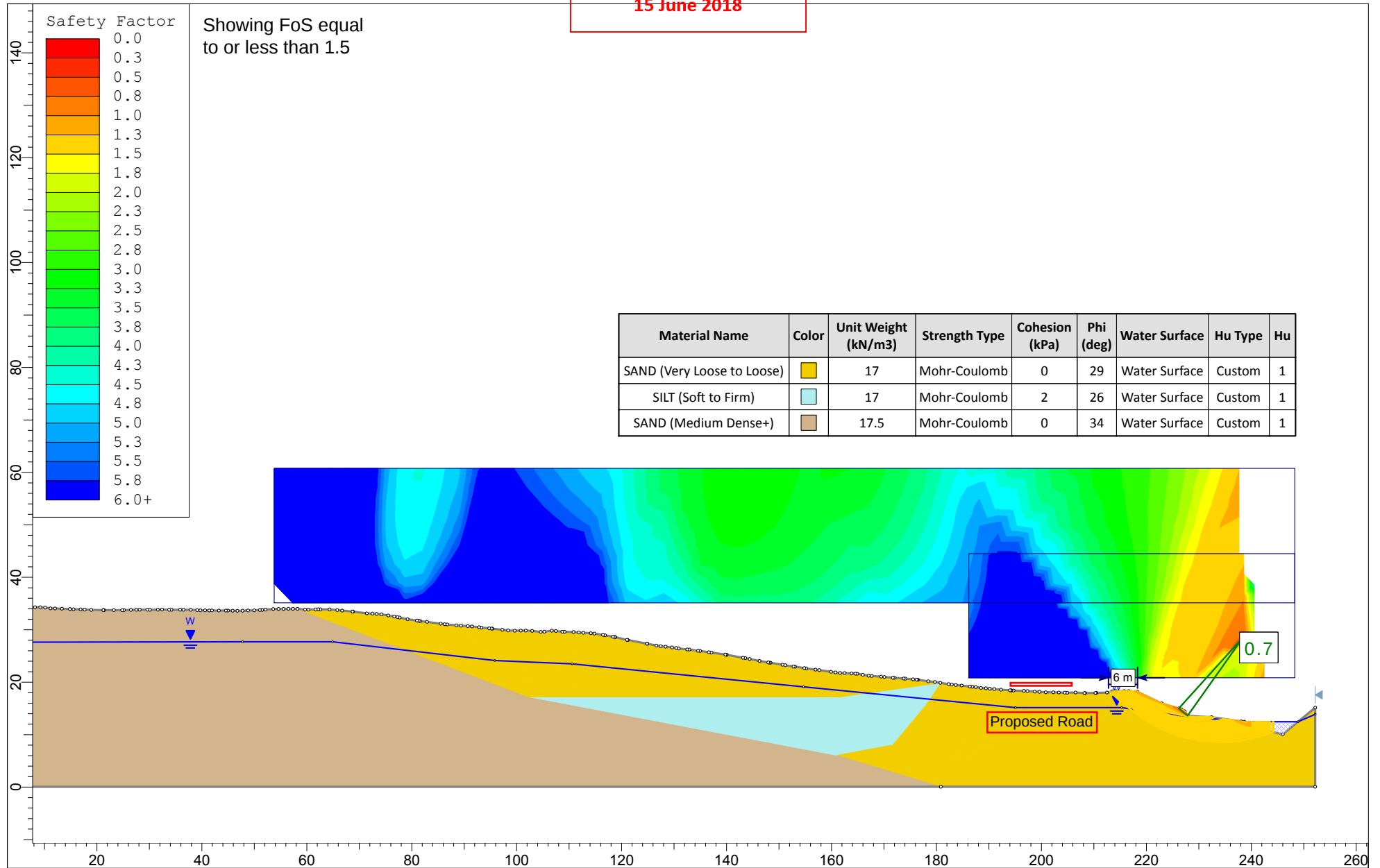




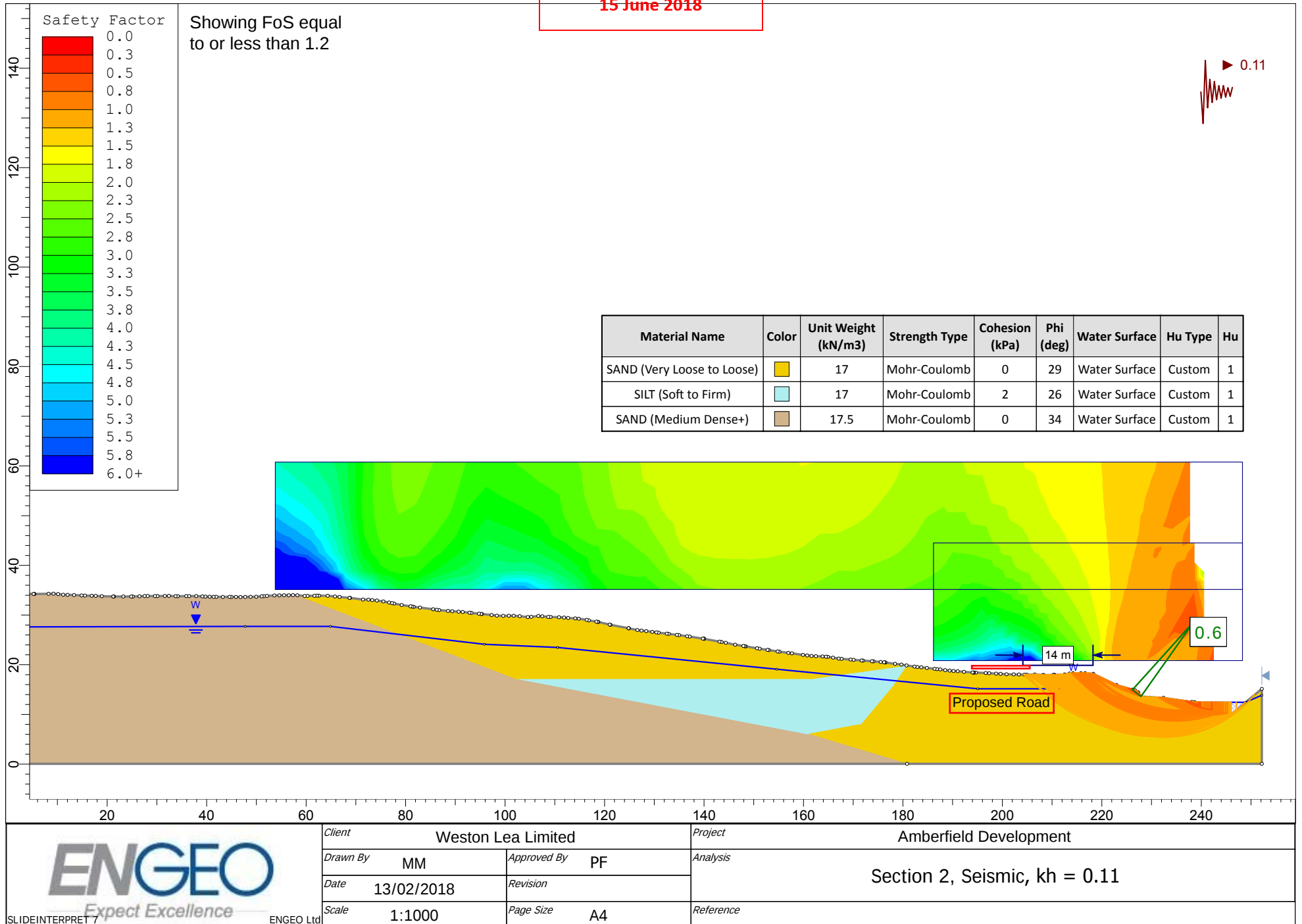


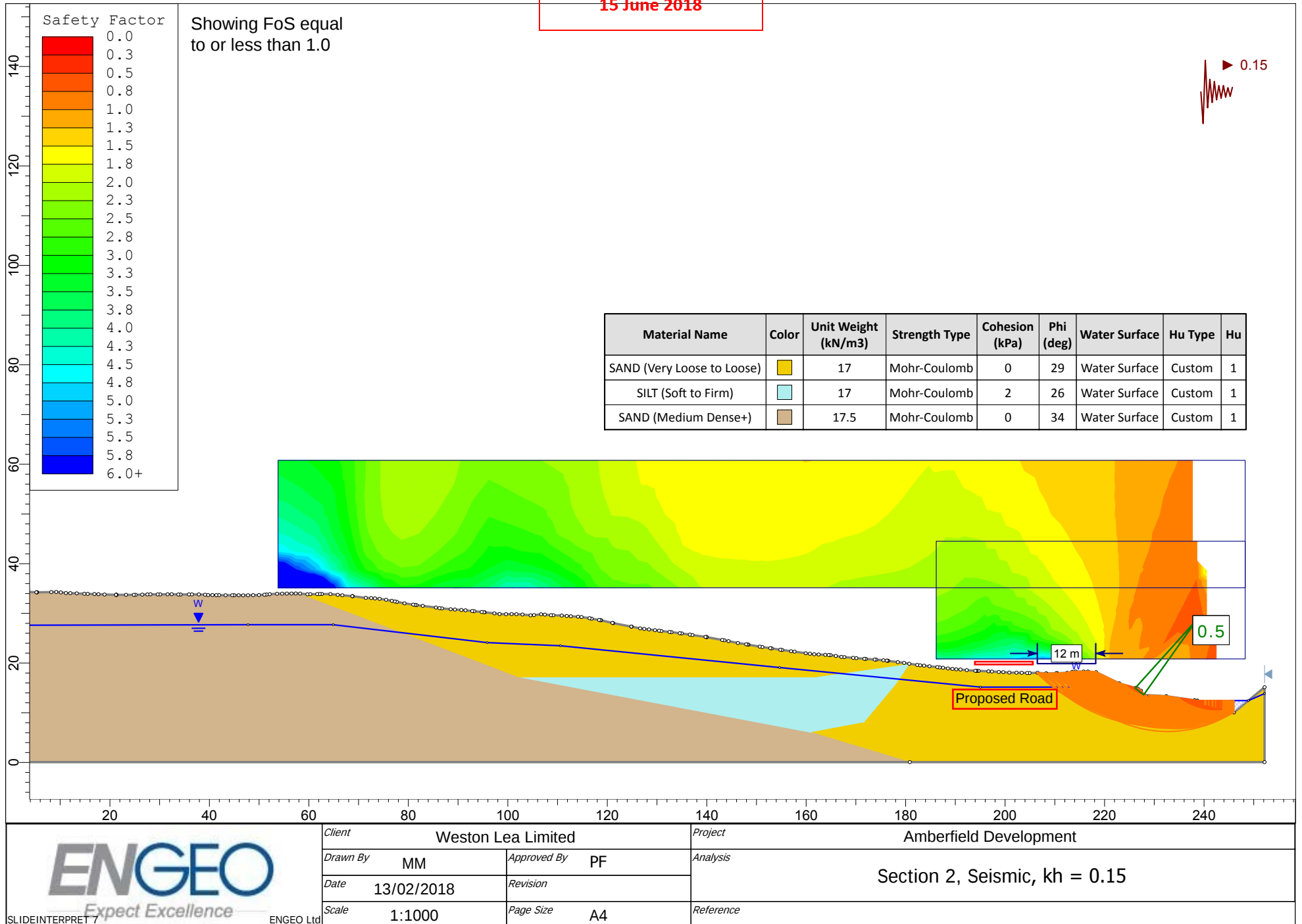


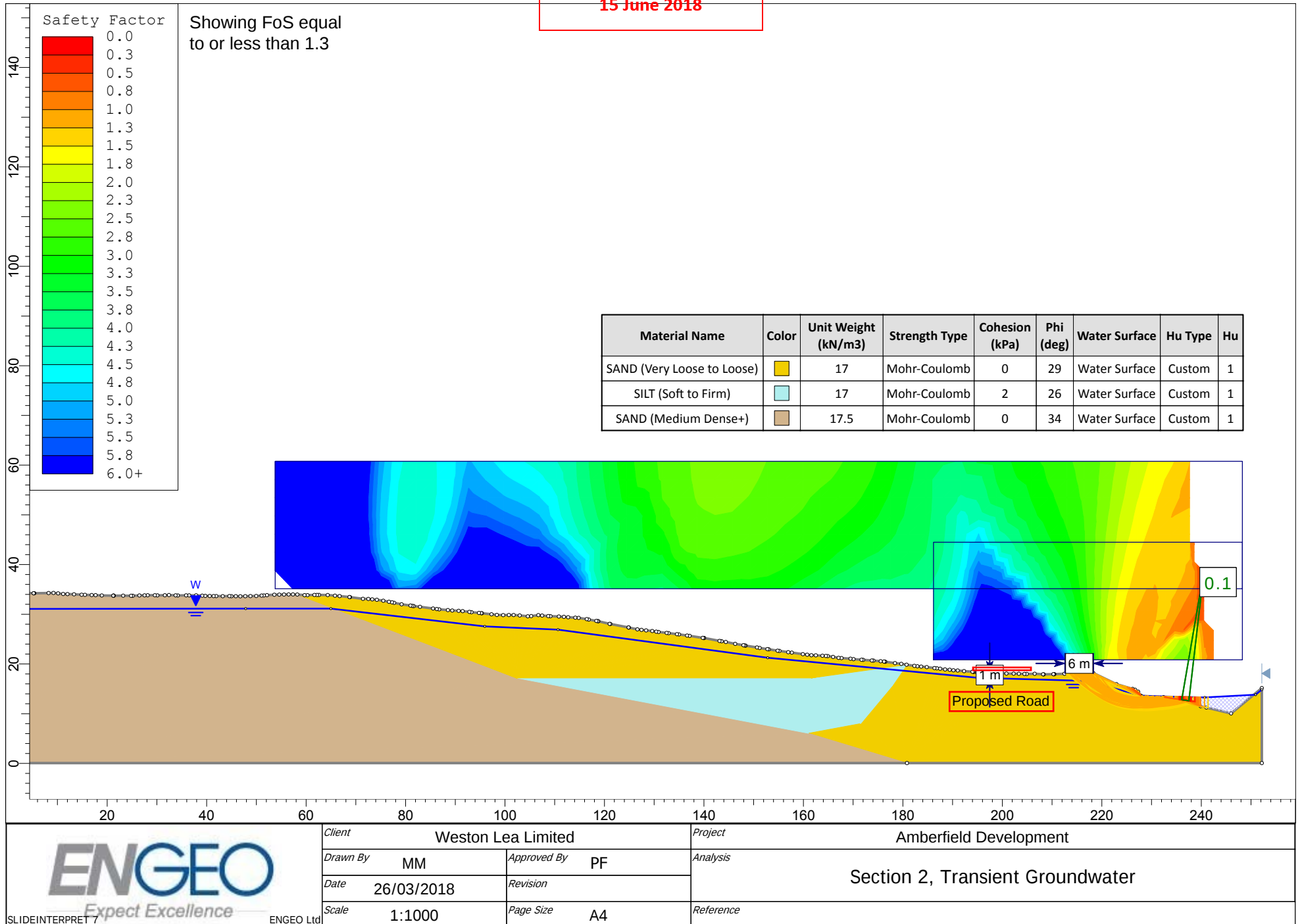


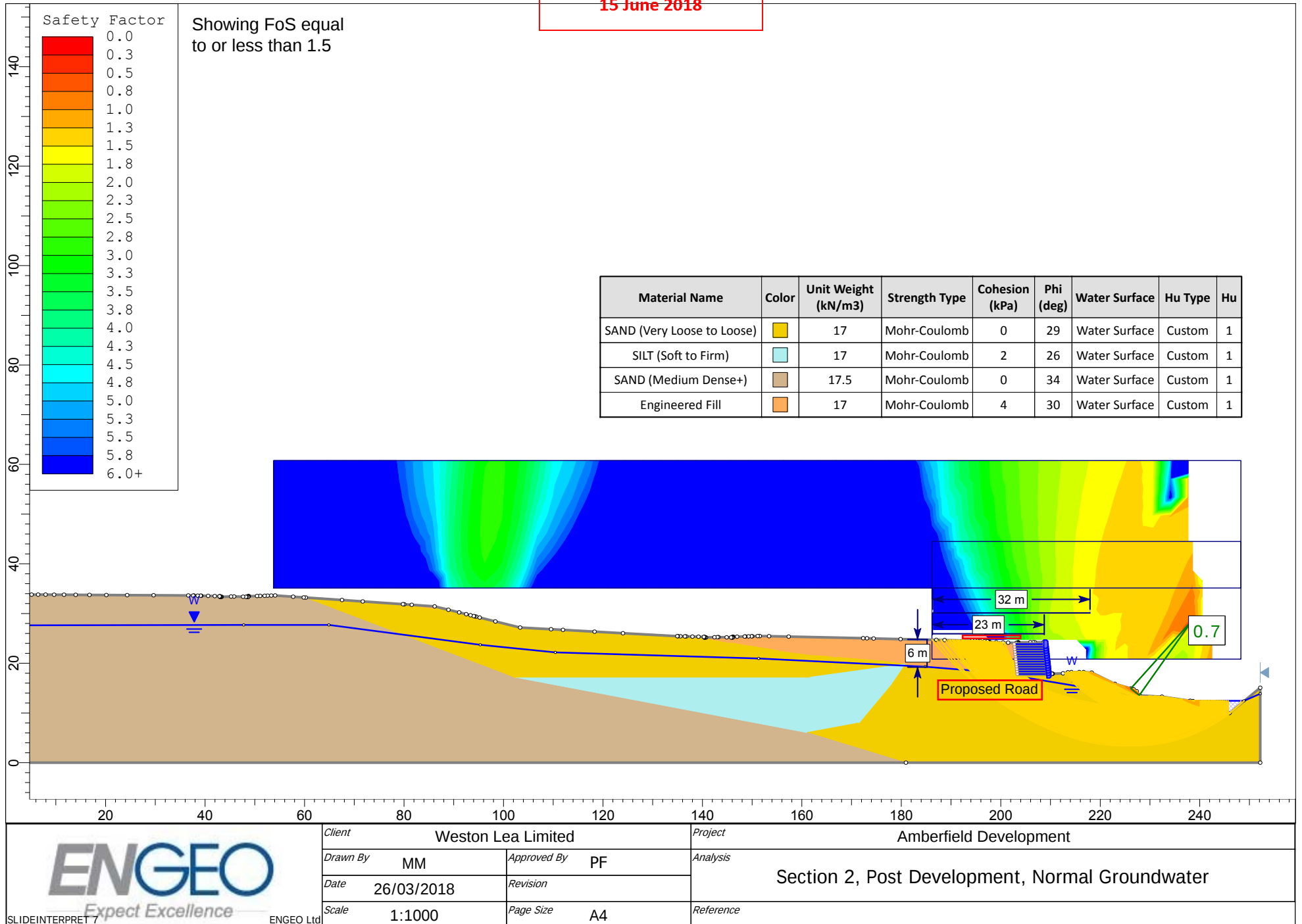


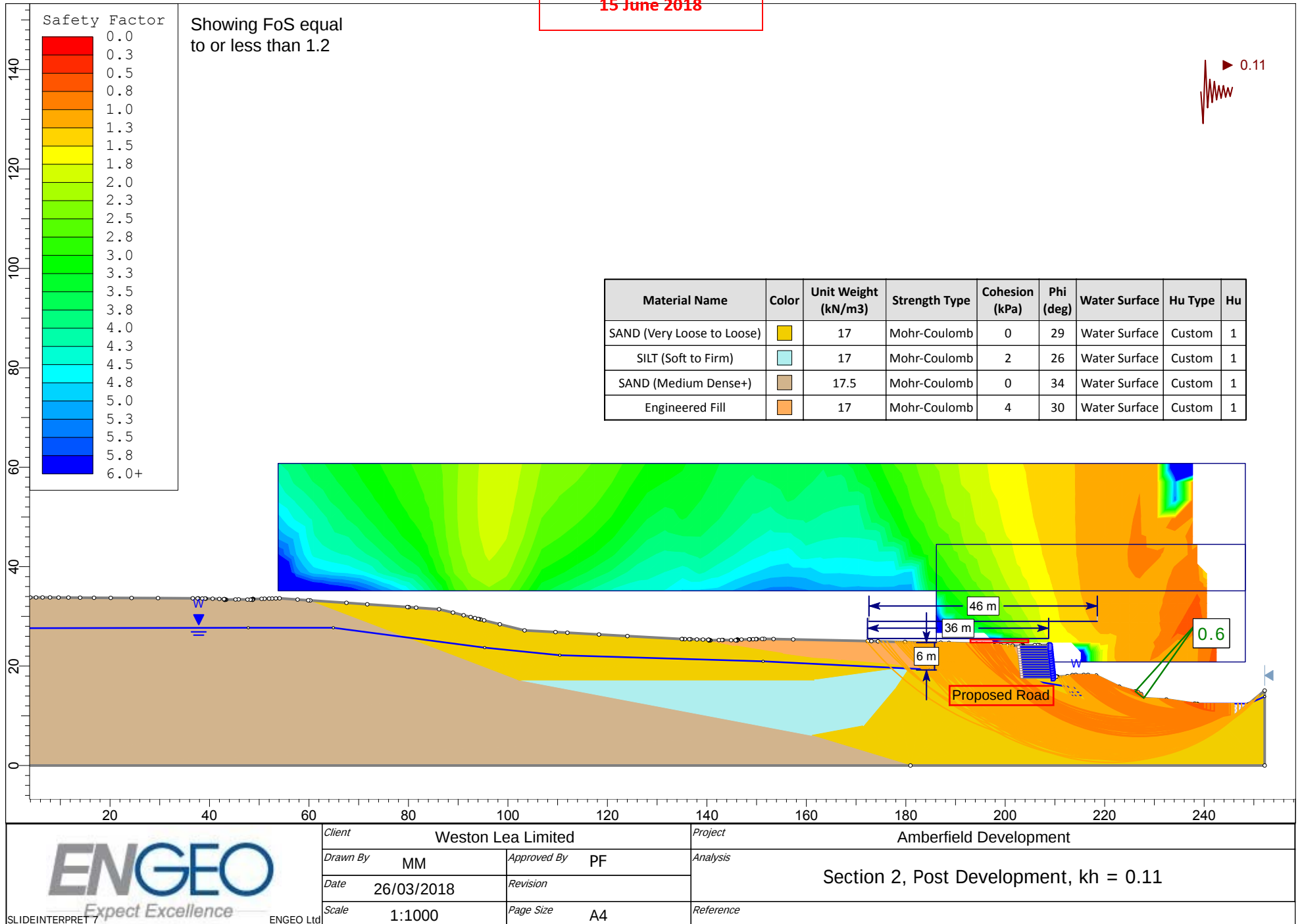
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	Date 12/02/2018	Revision		
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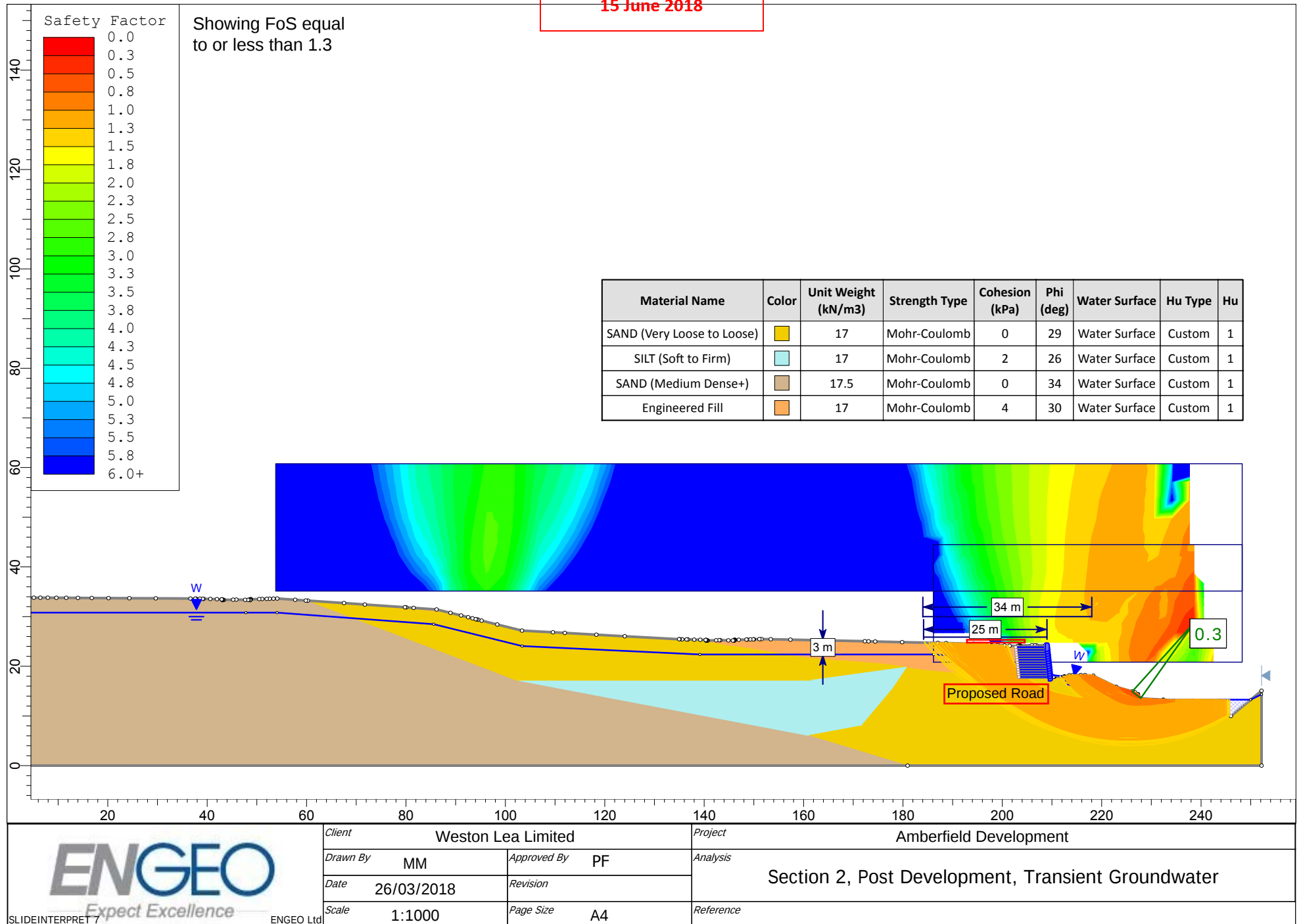


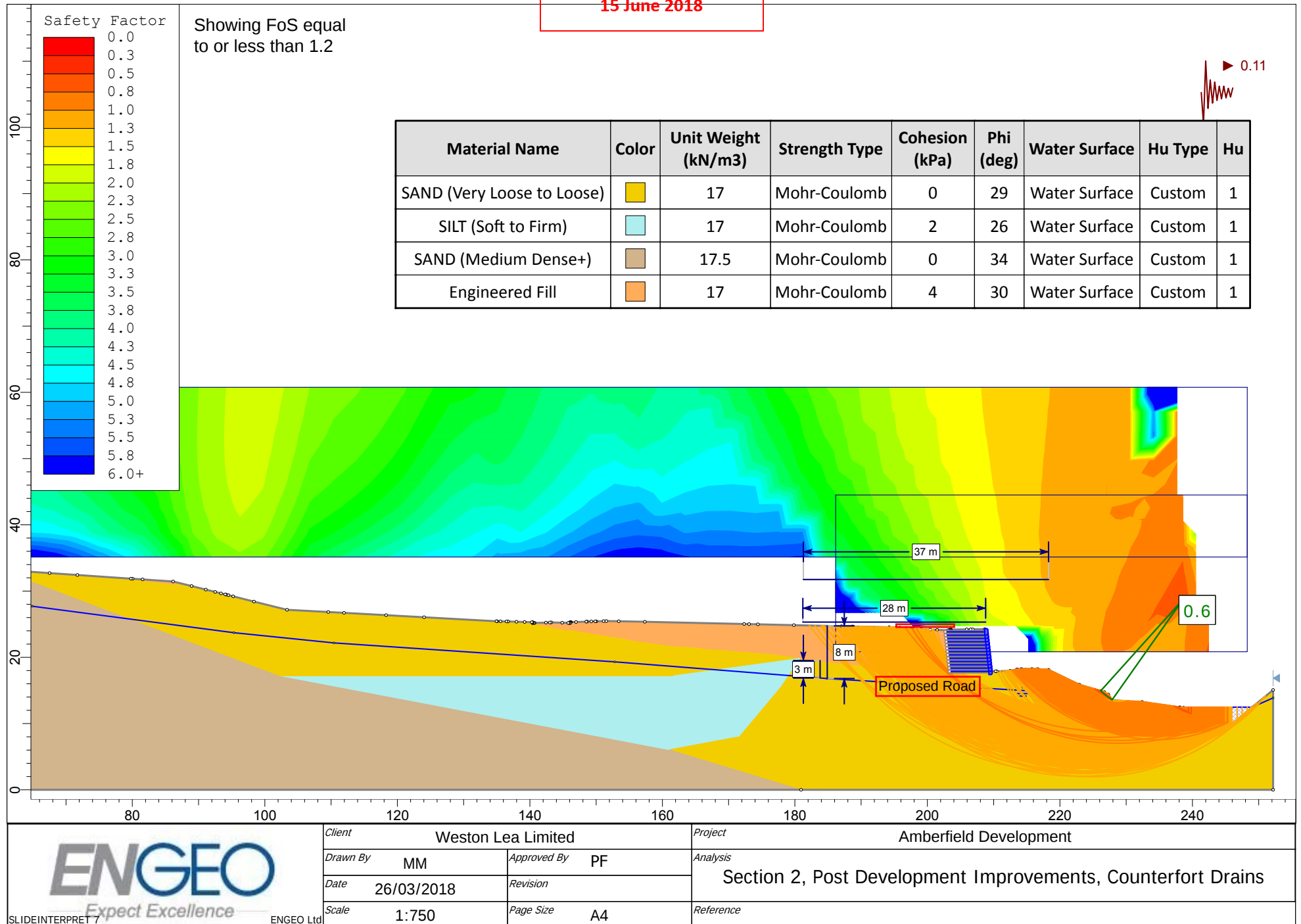


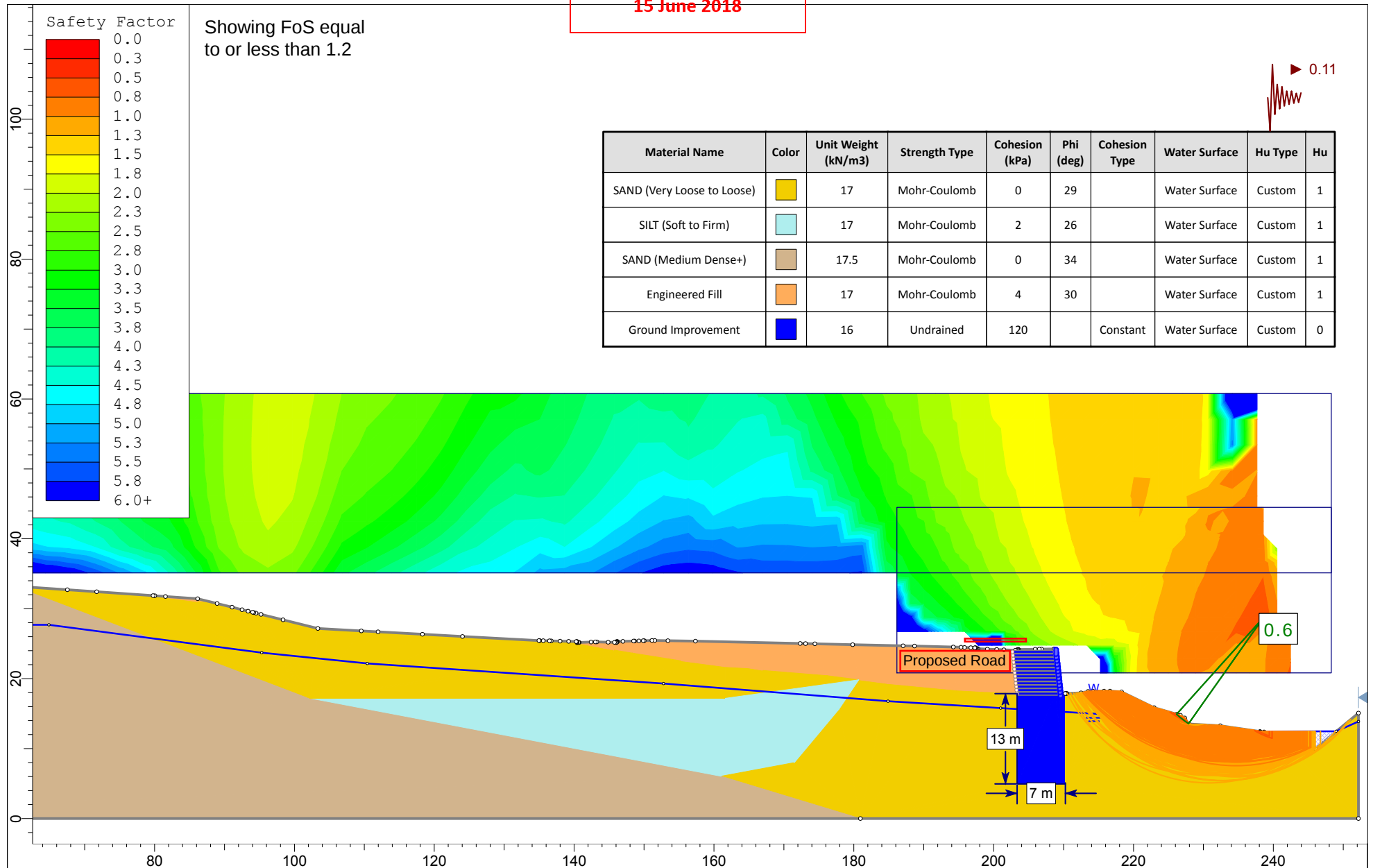


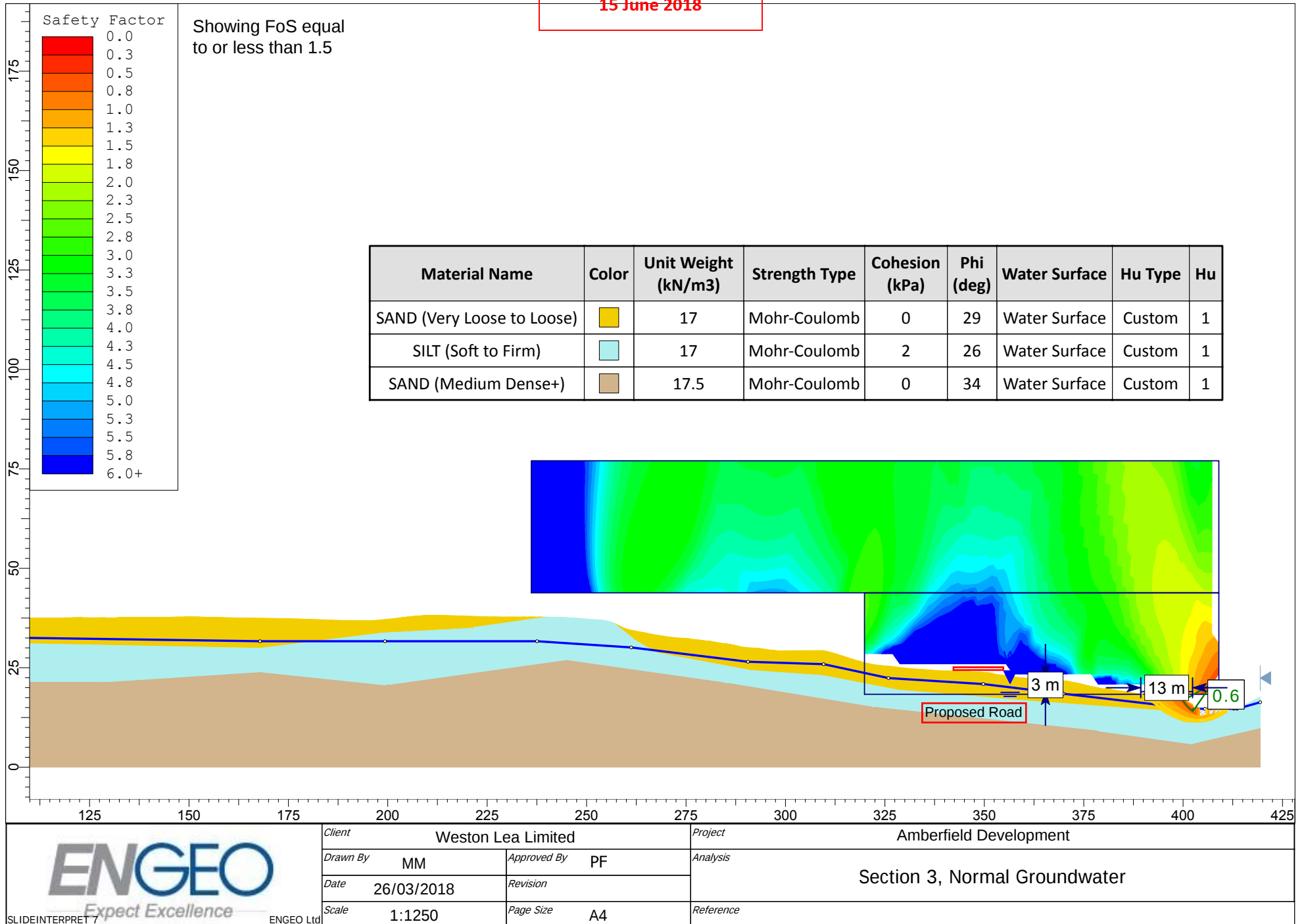


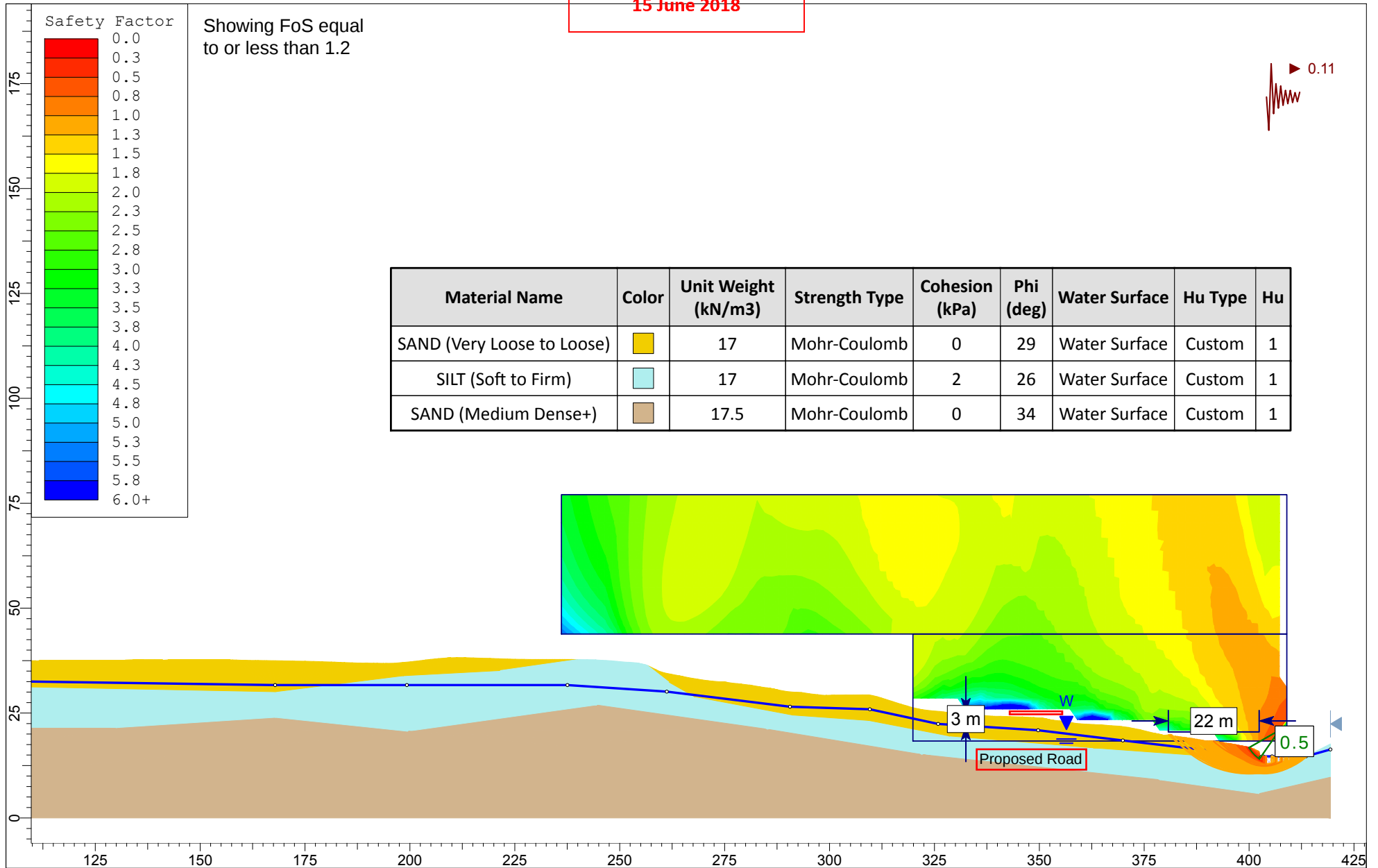


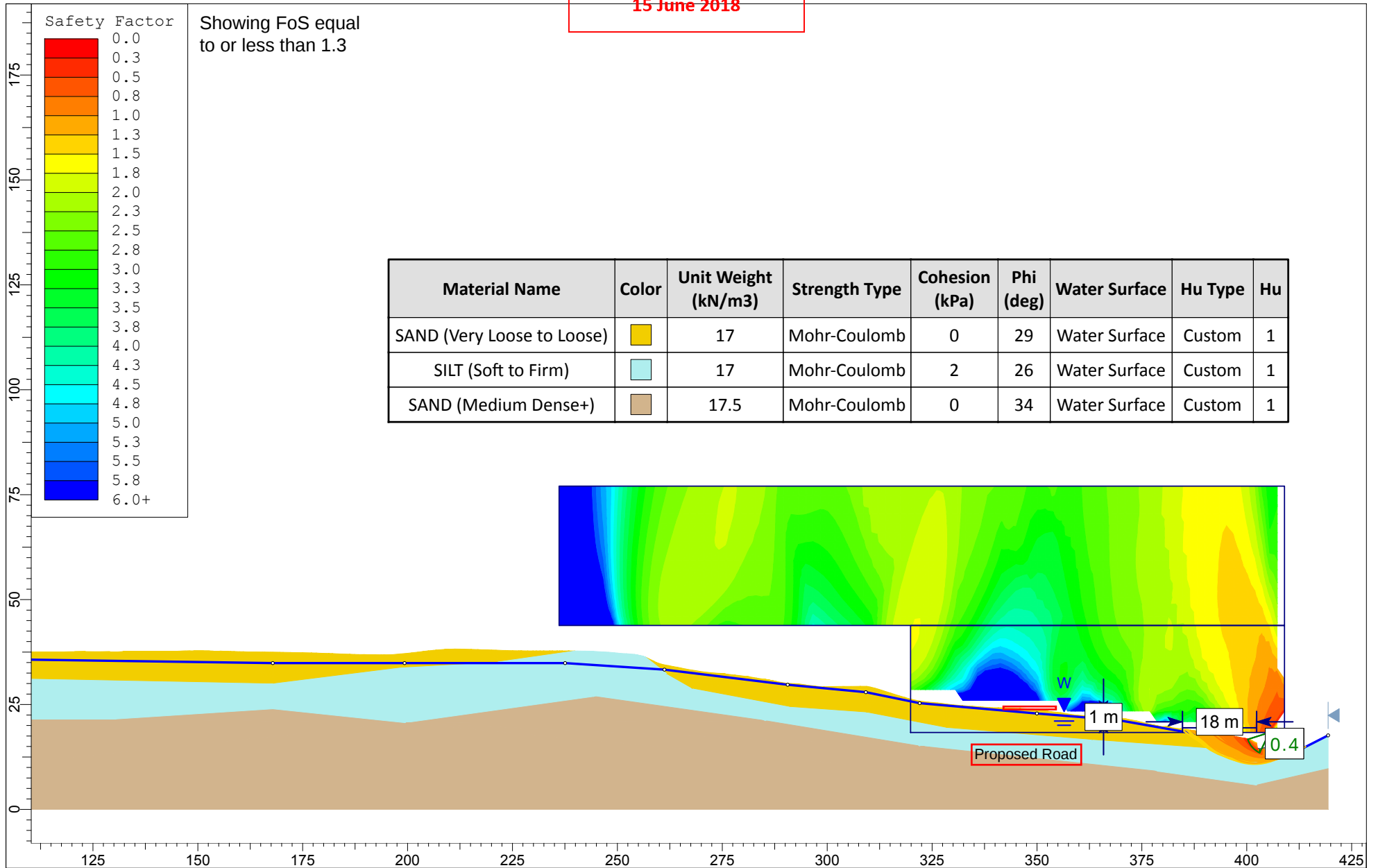


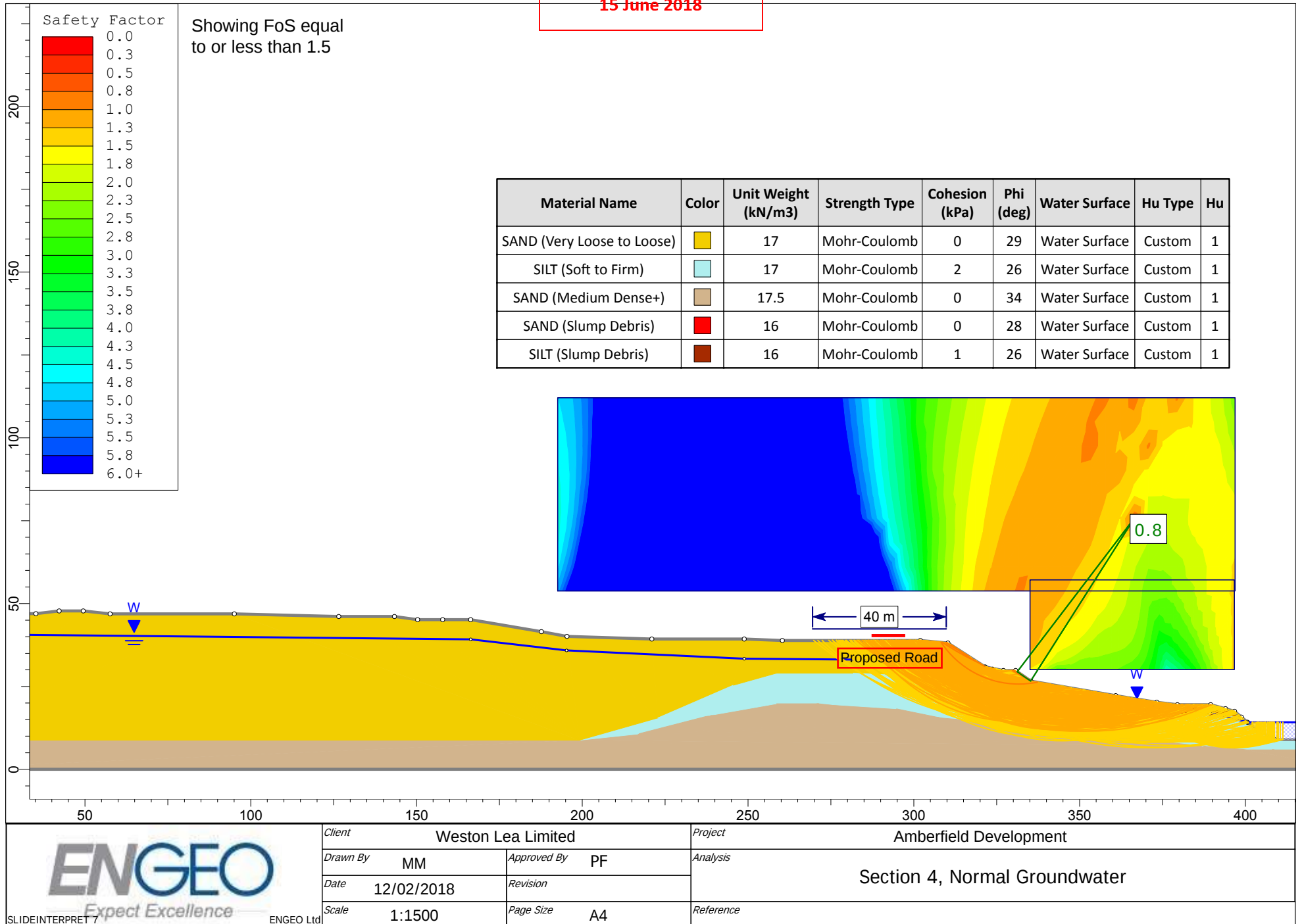


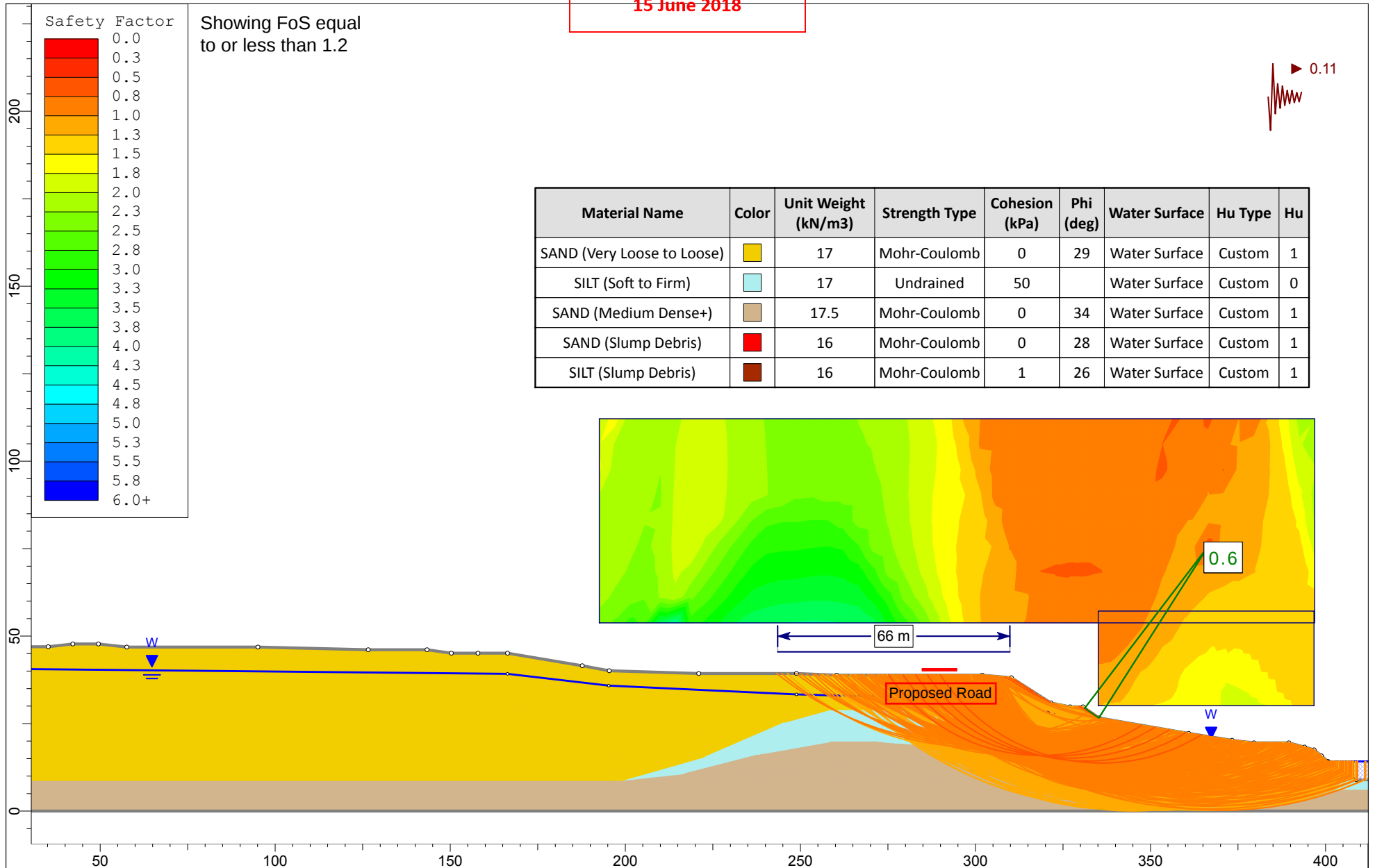


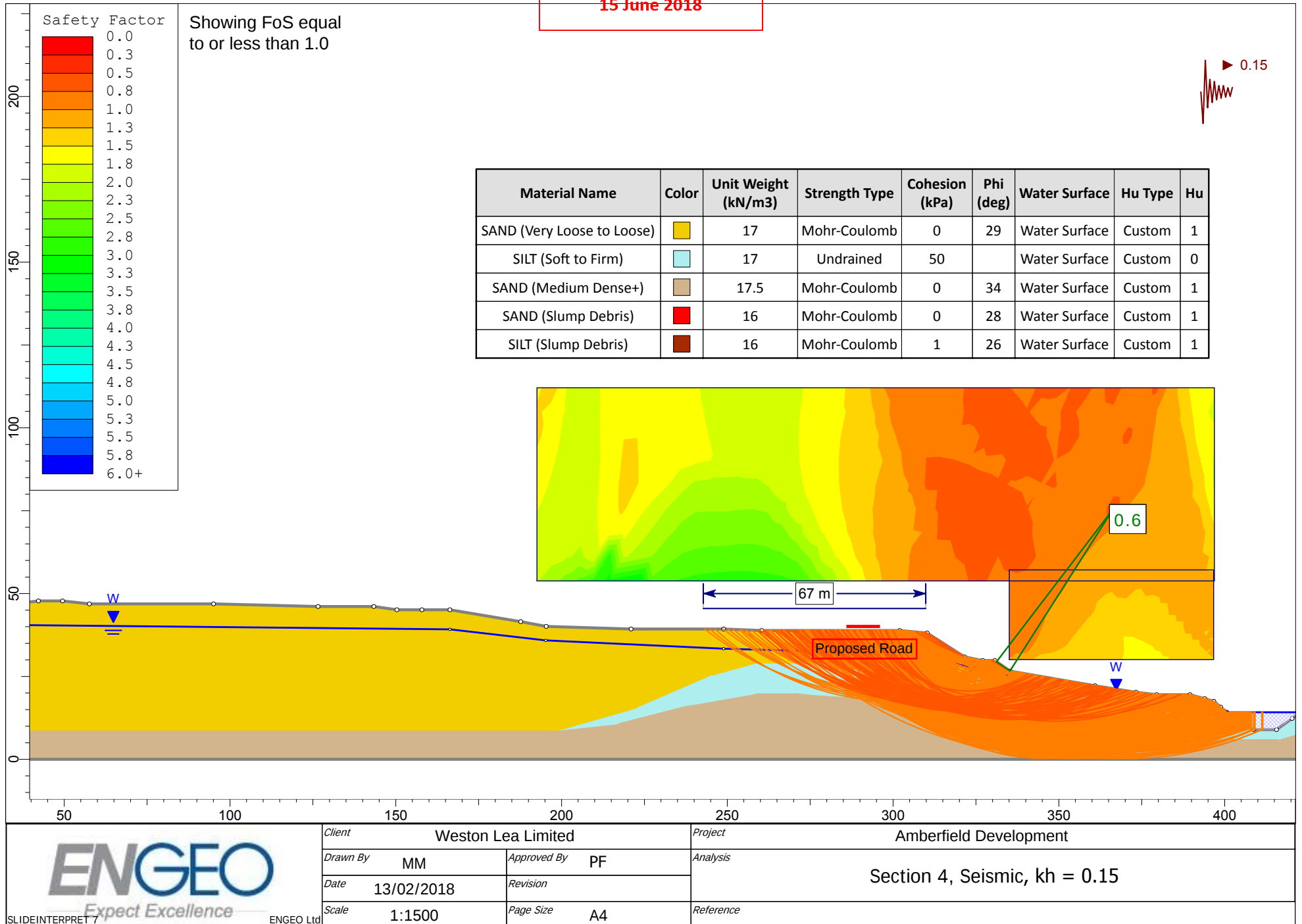


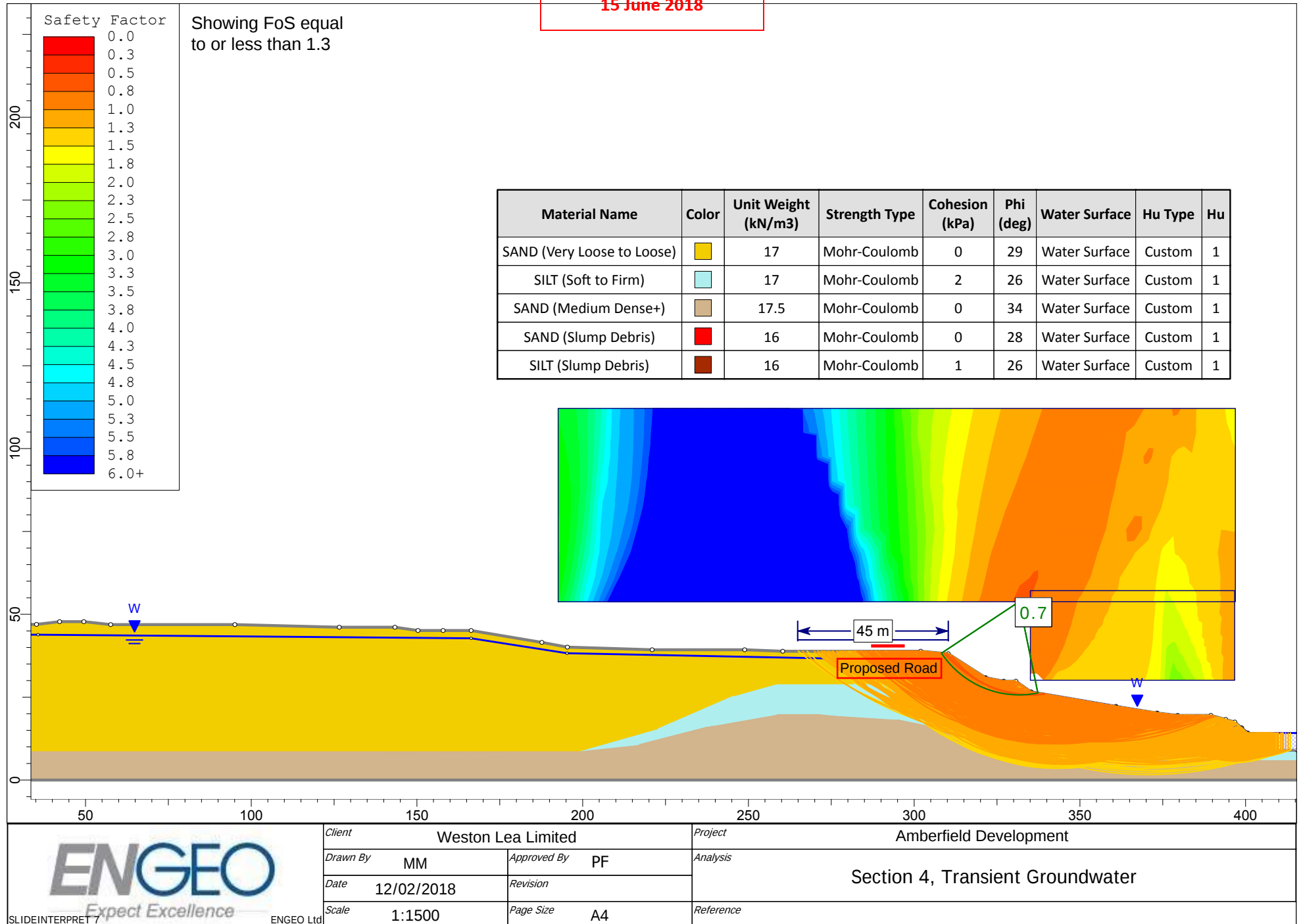


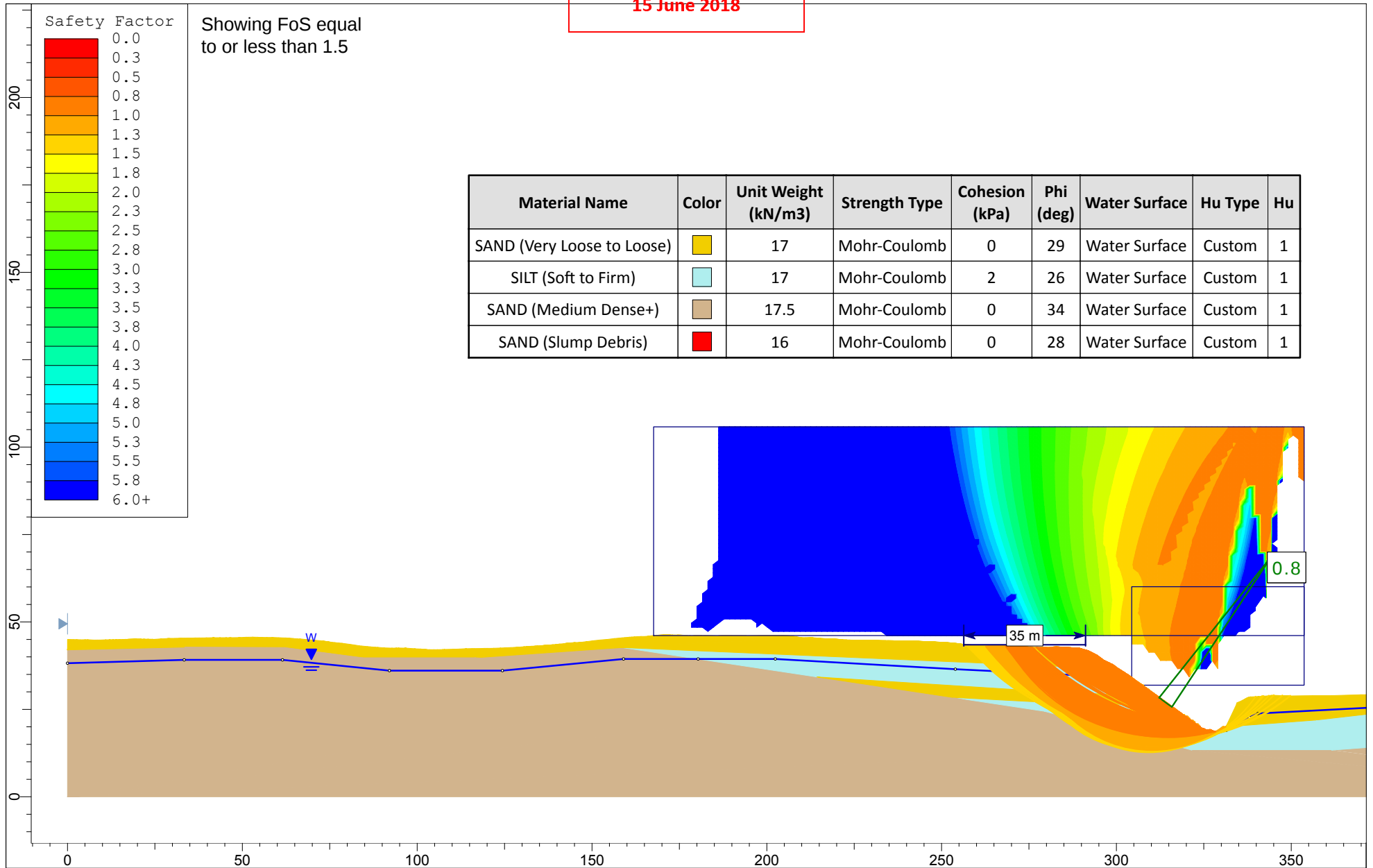




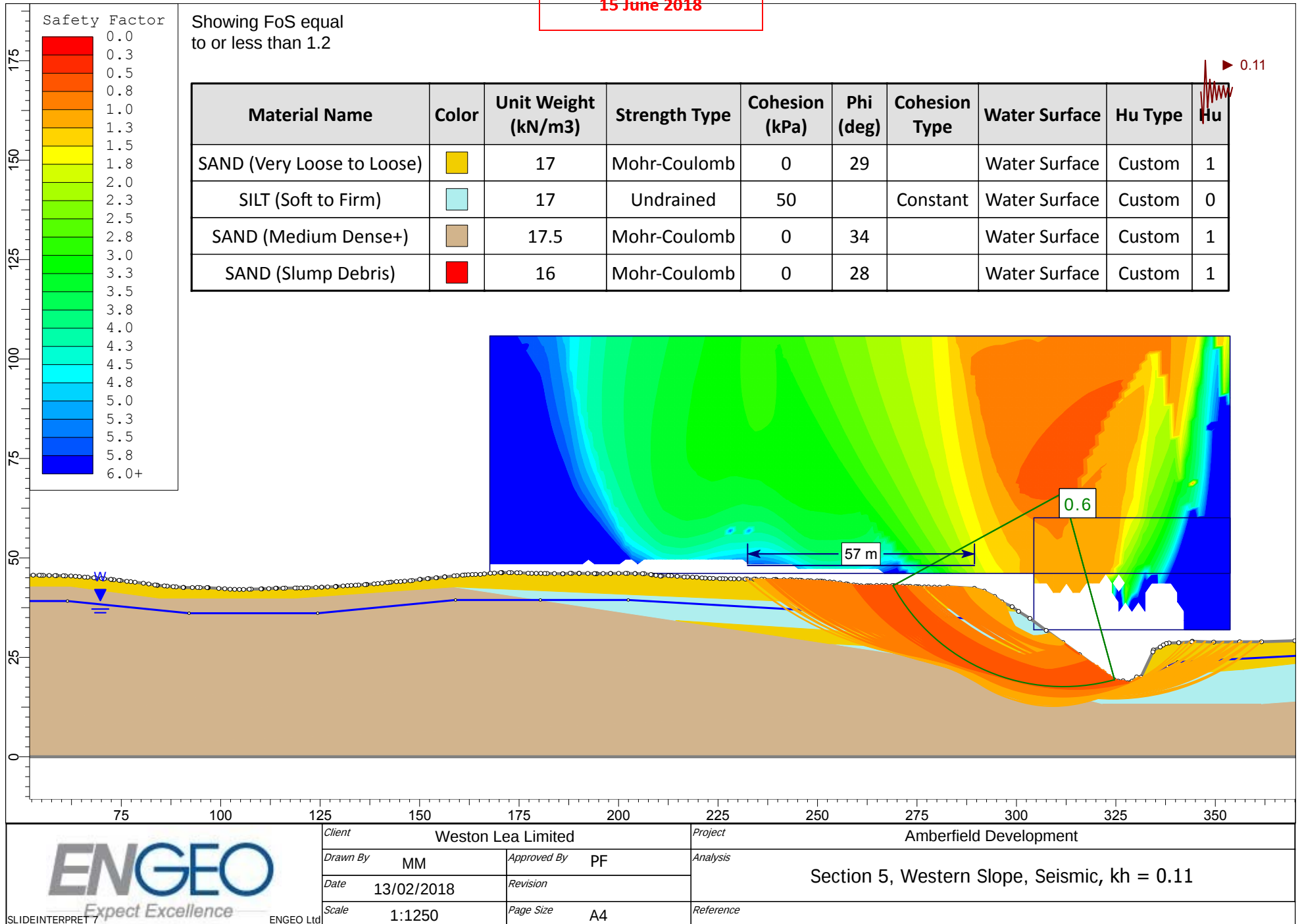


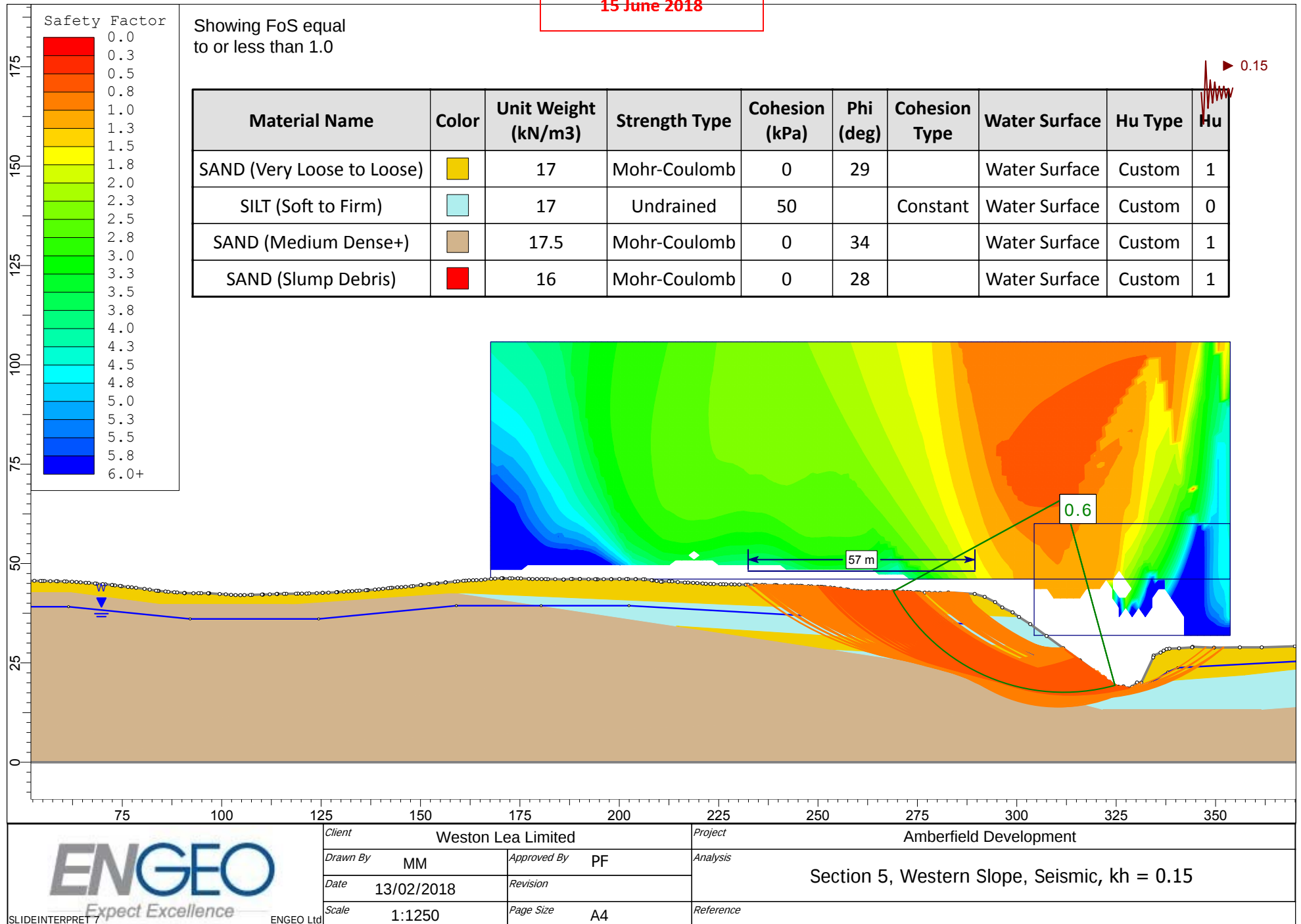


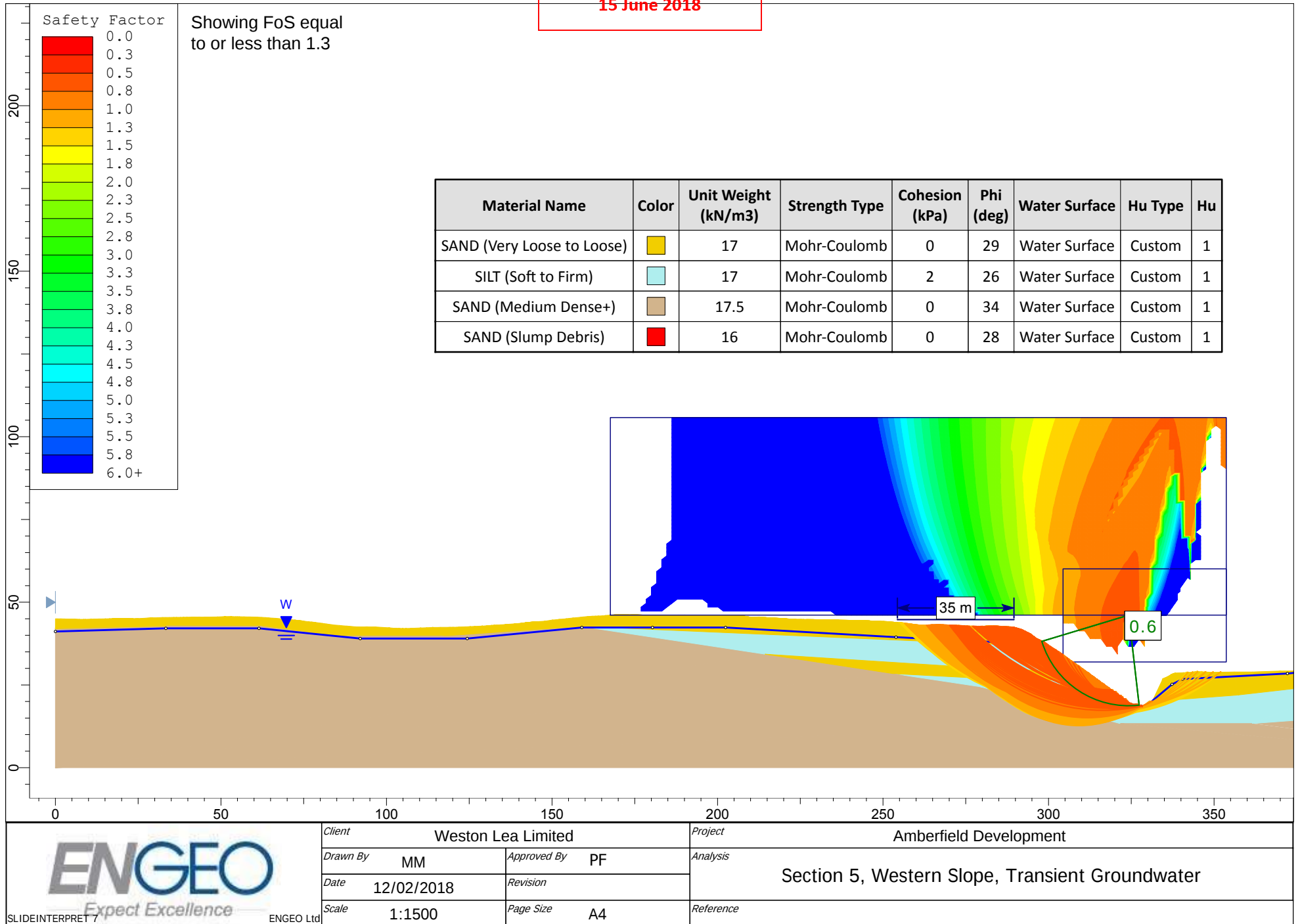


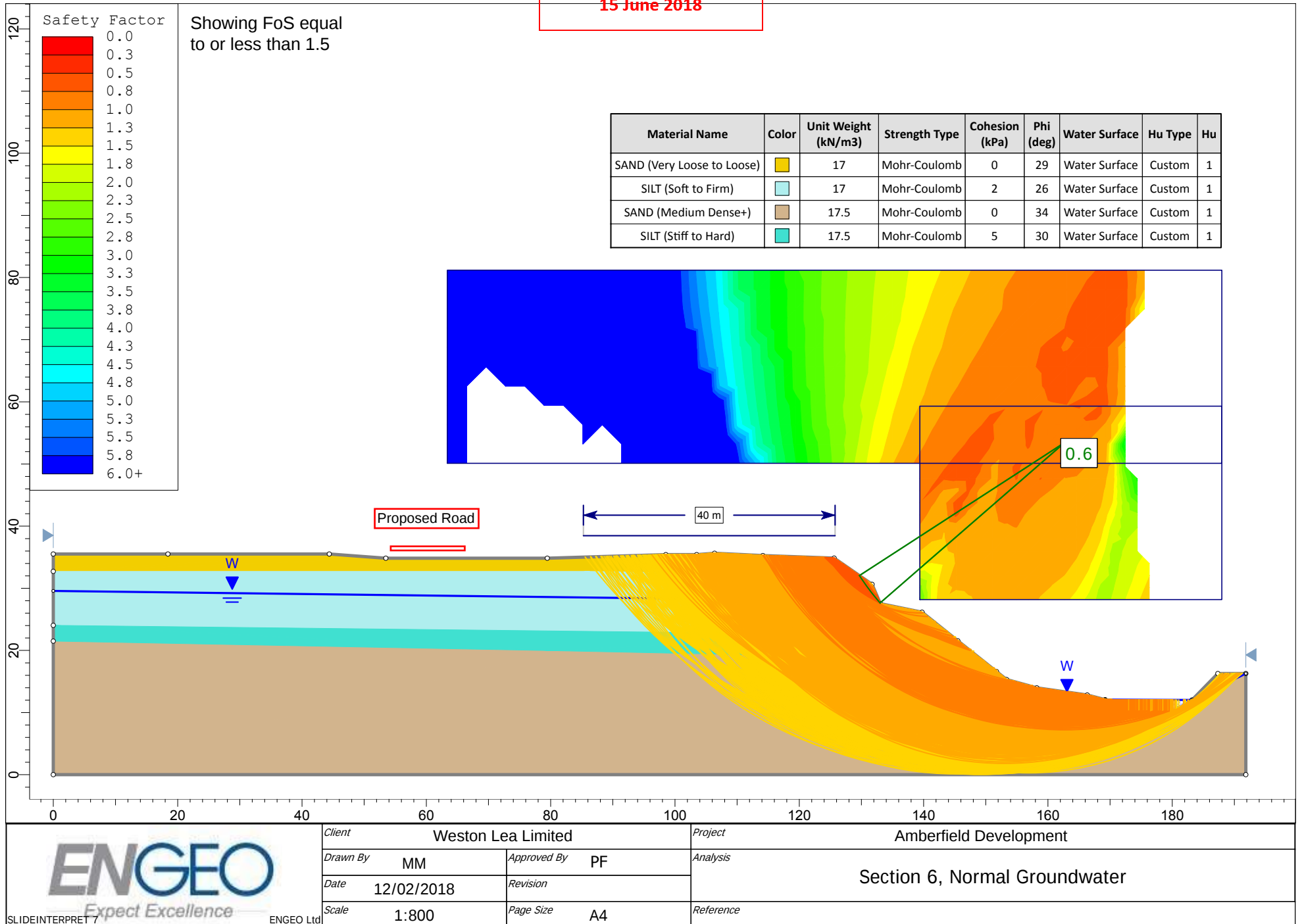


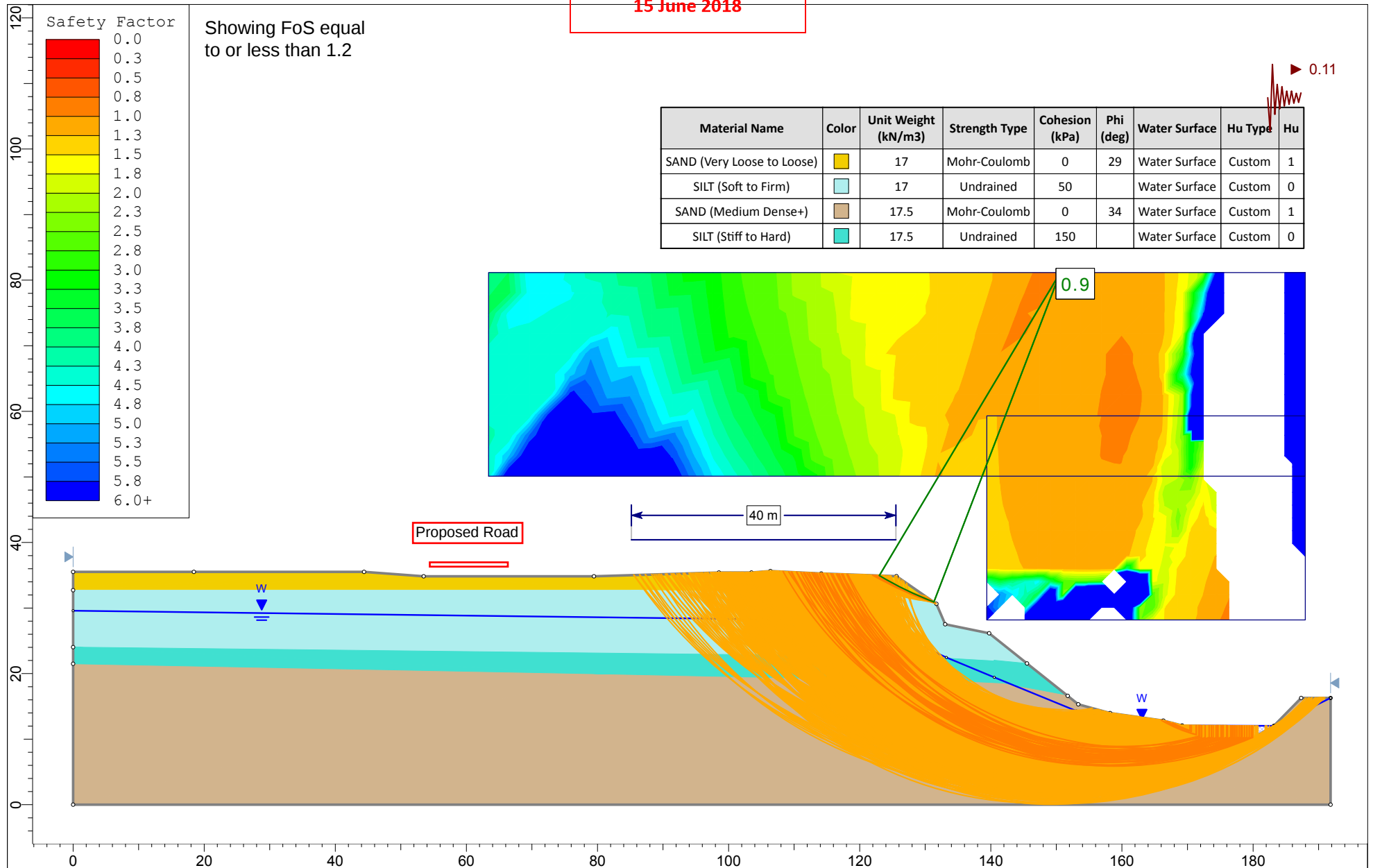
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	Drawn By MM	Approved By PF	Analysis Section 5, Western Slope, Normal Groundwater	
	Date 12/02/2018	Revision		
	Scale 1:1500	Page Size A4	Reference	



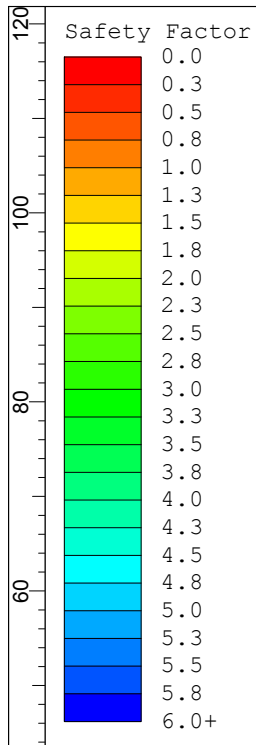






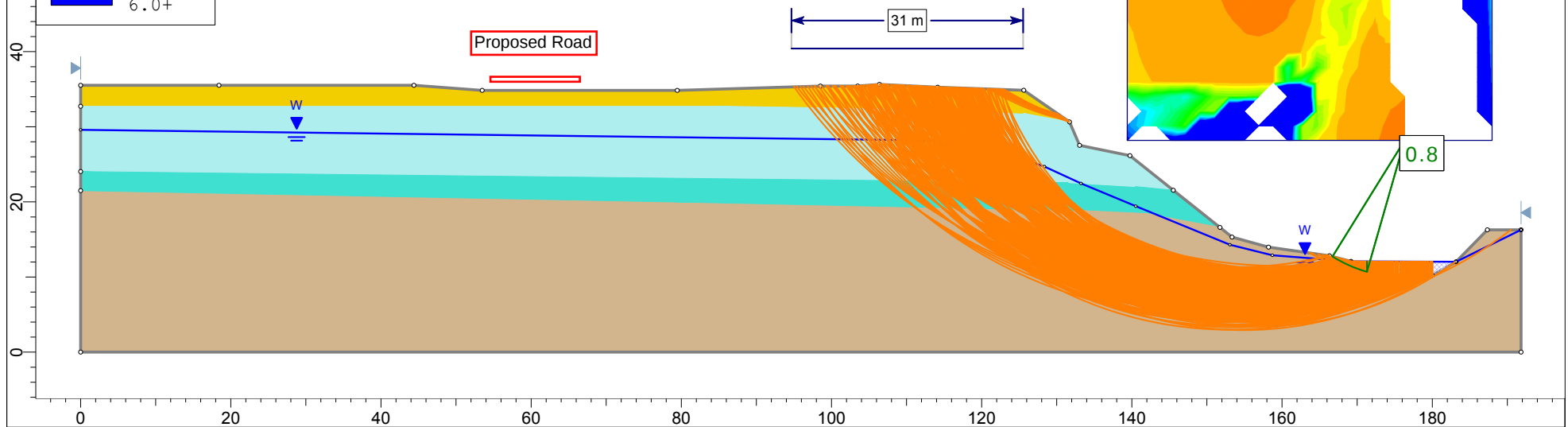
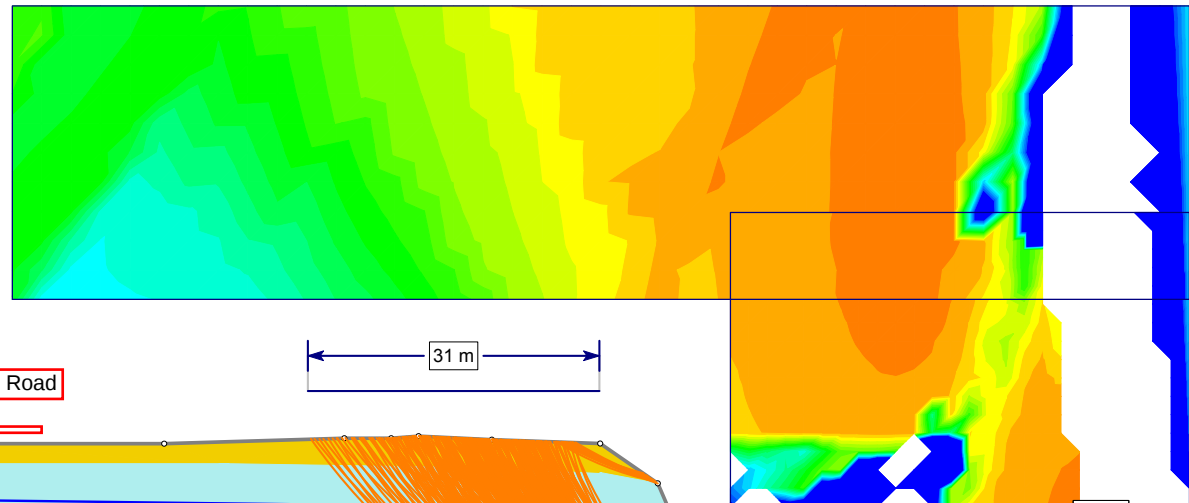


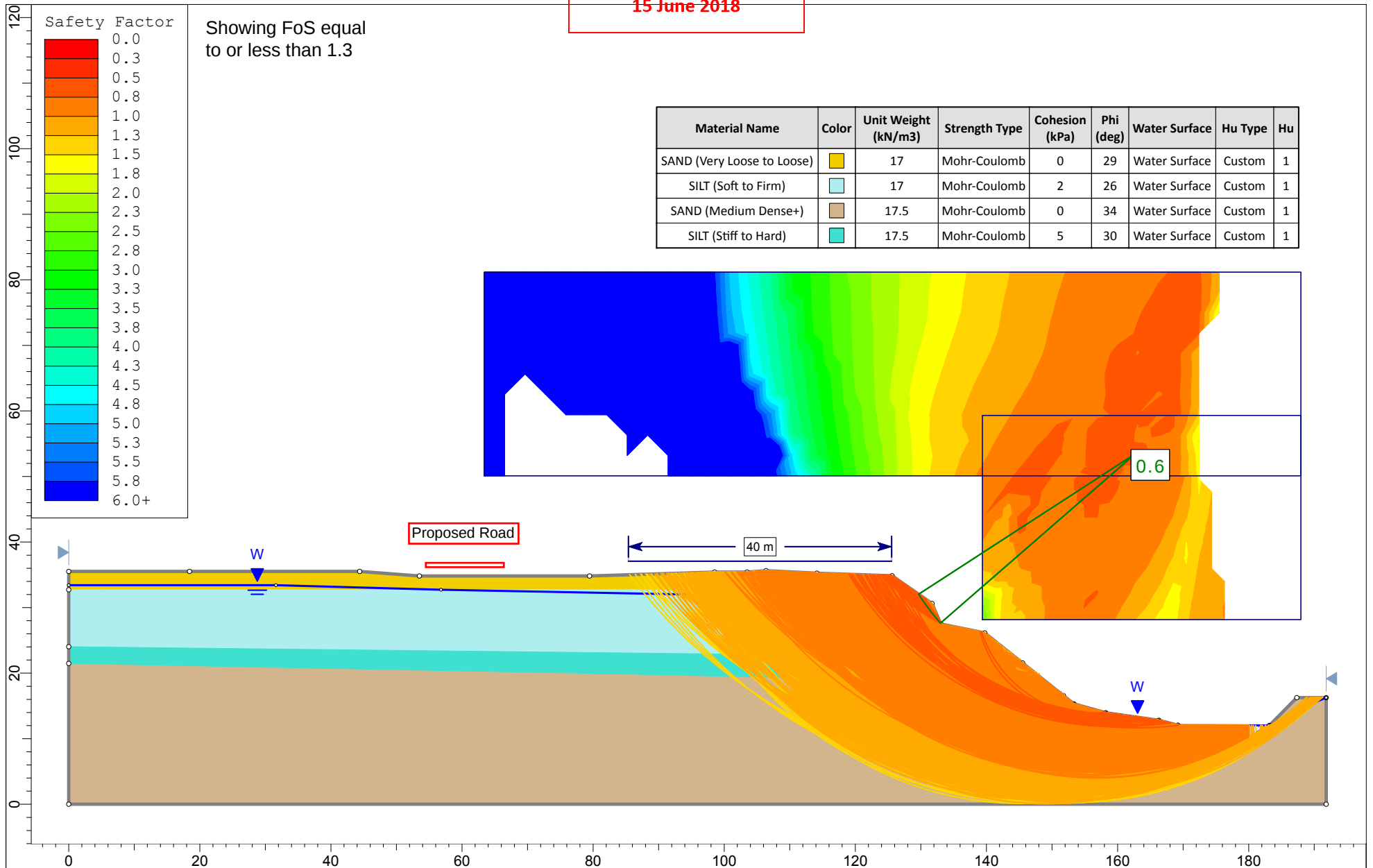
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	Drawn By MM	Approved By PF	Analysis 6, Seismic, kh = 0.11	
	Date 13/02/2018	Revision		
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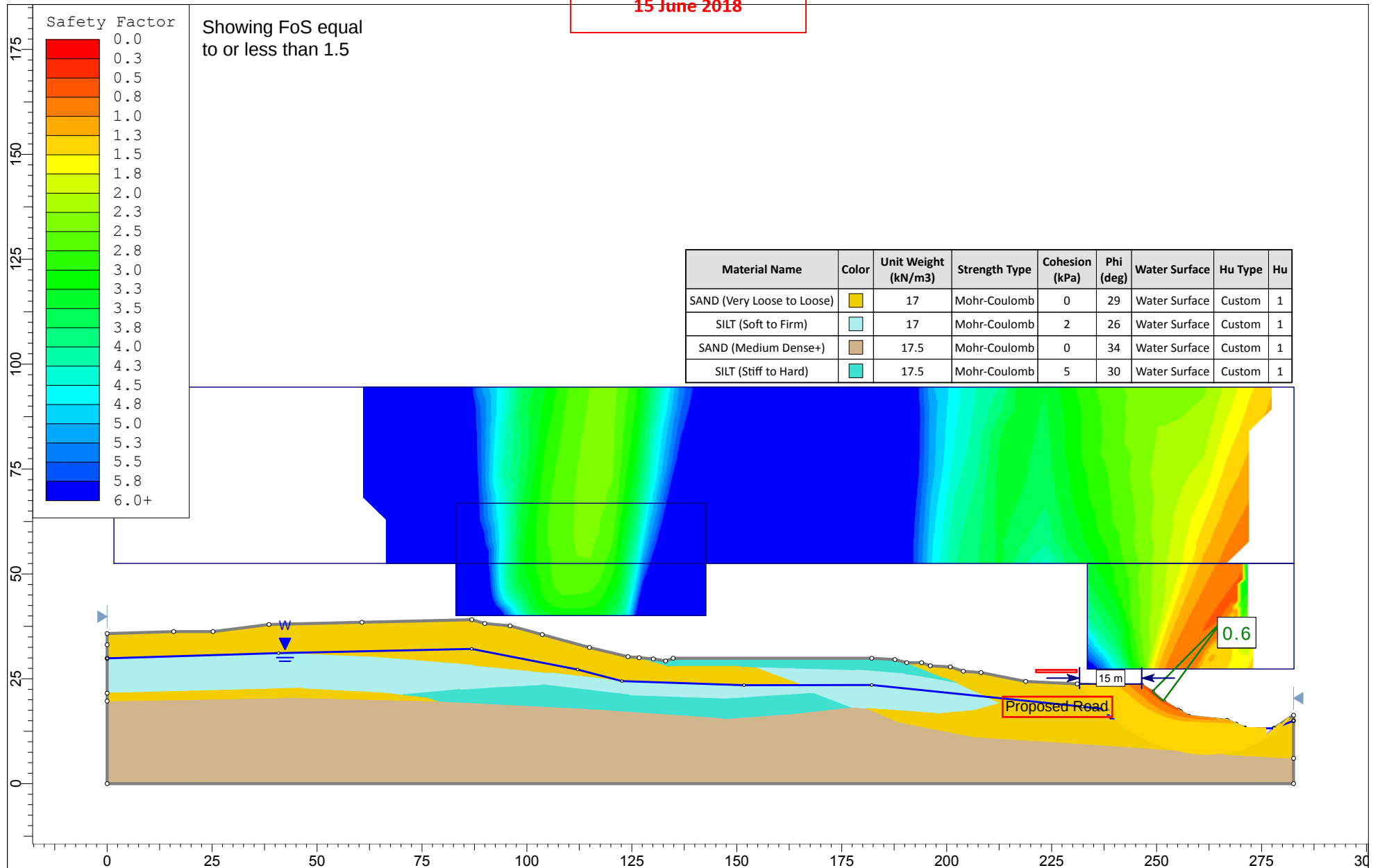
Showing FoS equal to or less than 1.0

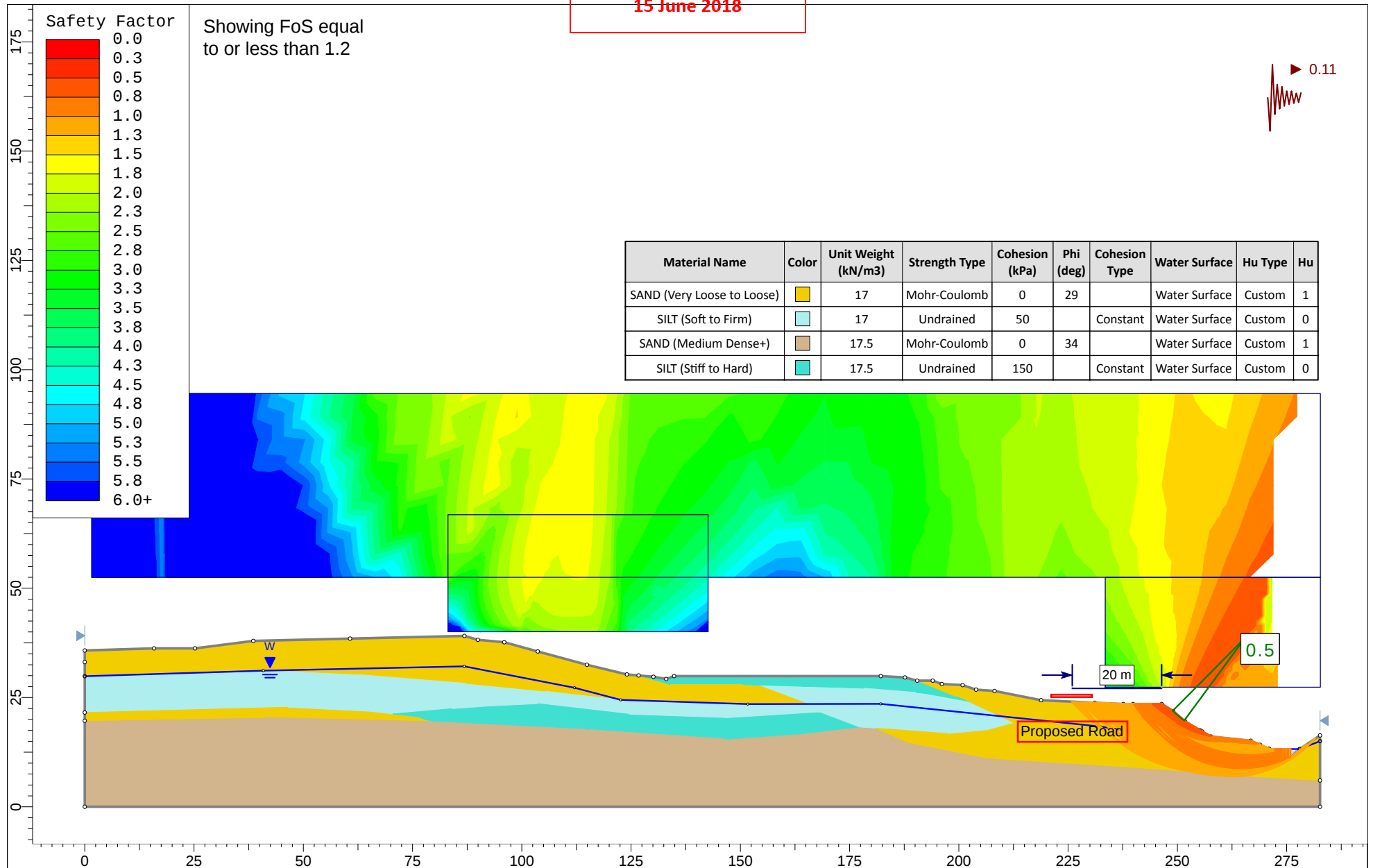
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
SAND (Very Loose to Loose)	■	17	Mohr-Coulomb	0	29	Water Surface	Custom	1
SILT (Soft to Firm)	■	17	Undrained	50		Water Surface	Custom	0
SAND (Medium Dense+)	■	17.5	Mohr-Coulomb	0	34	Water Surface	Custom	1
SILT (Stiff to Hard)	■	17.5	Undrained	150		Water Surface	Custom	0

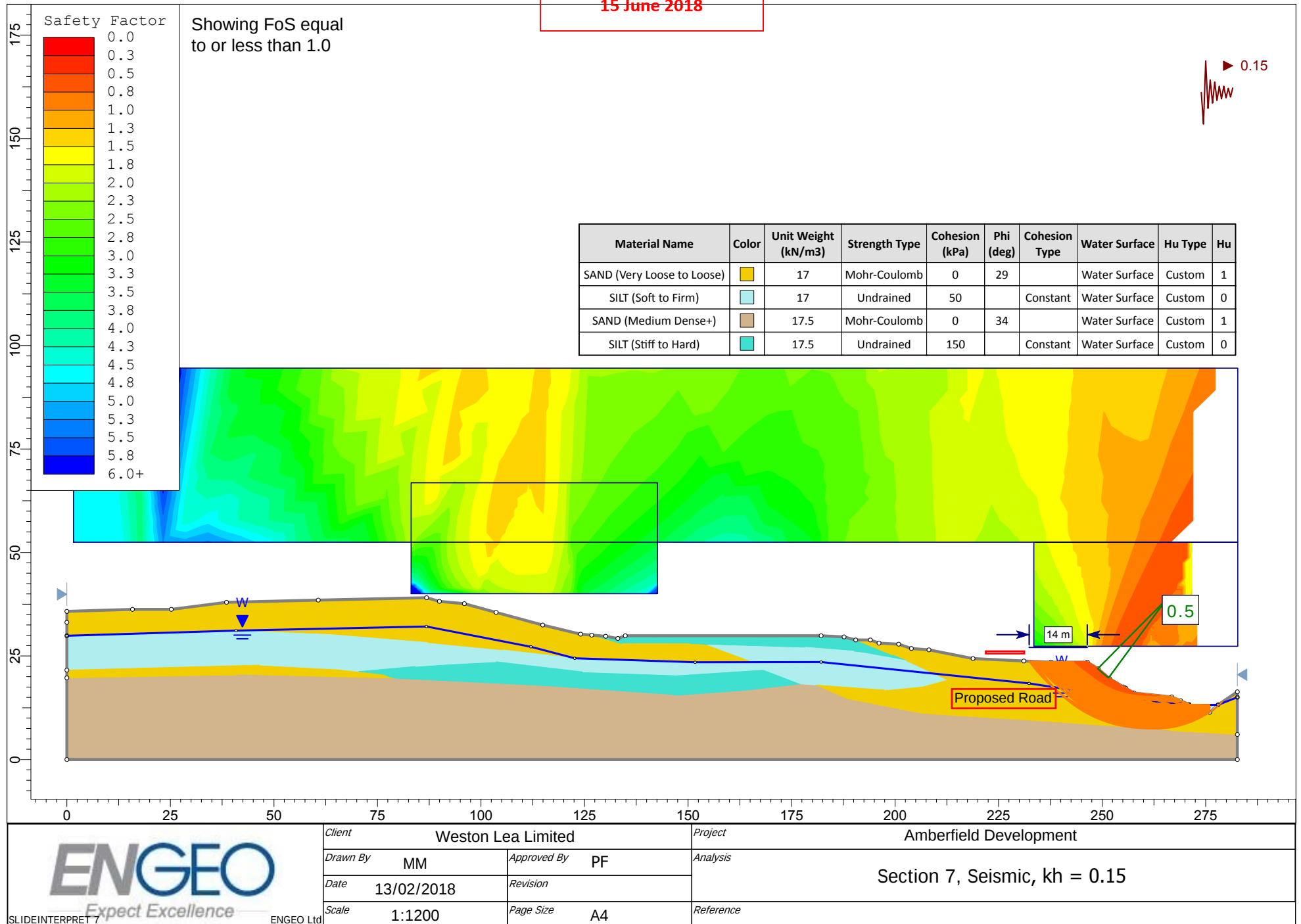


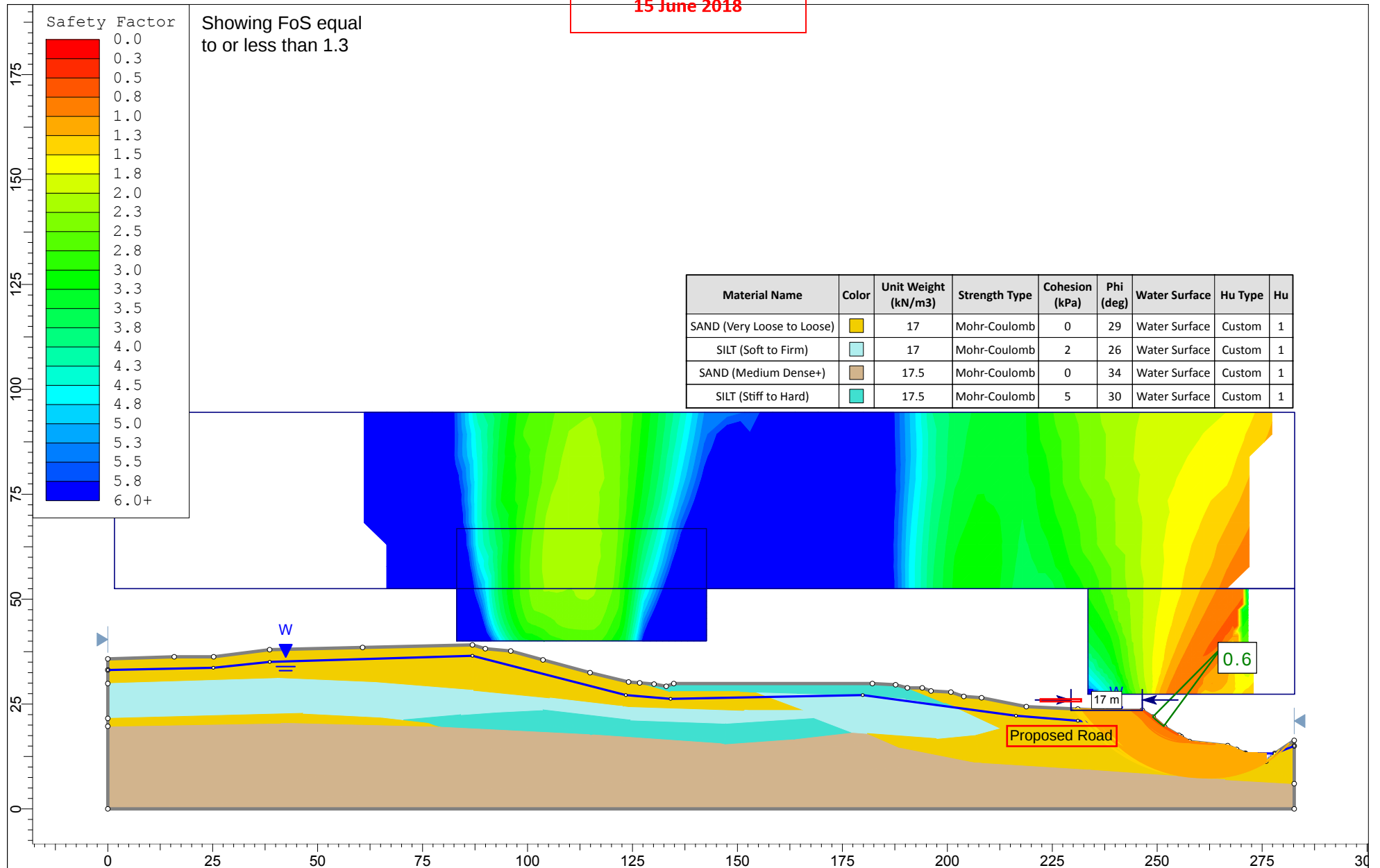


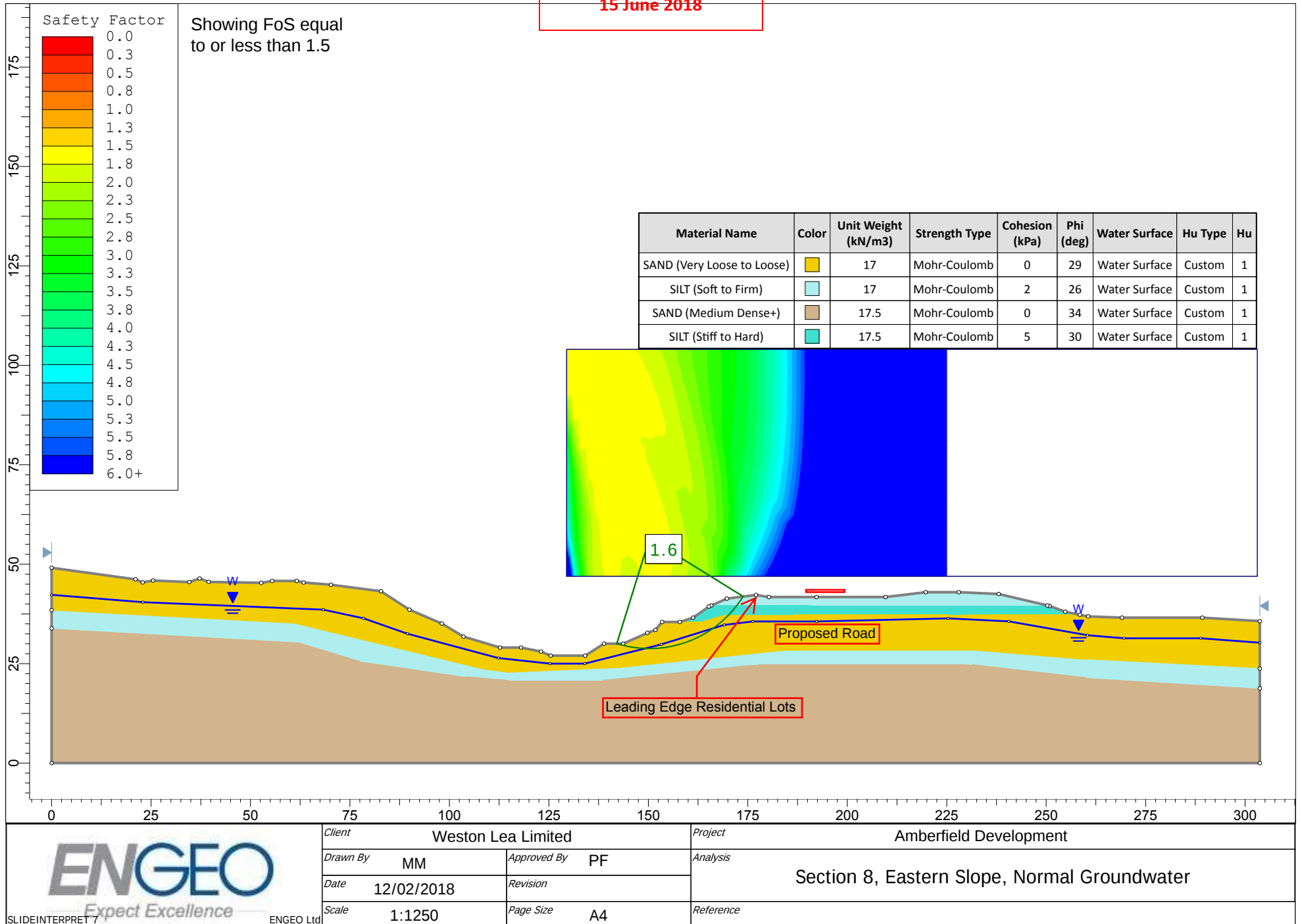
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	Date 12/02/2018	Revision		
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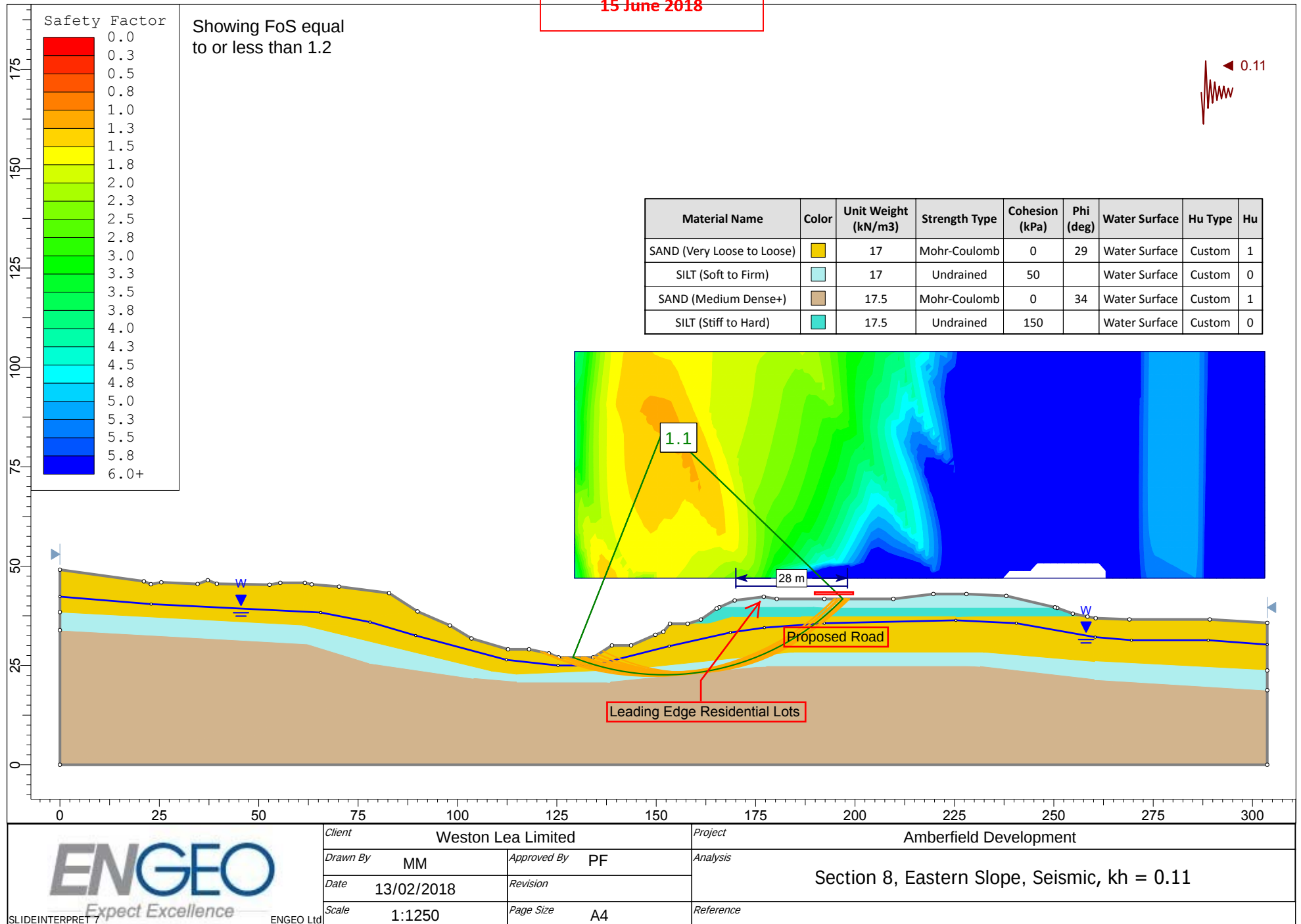


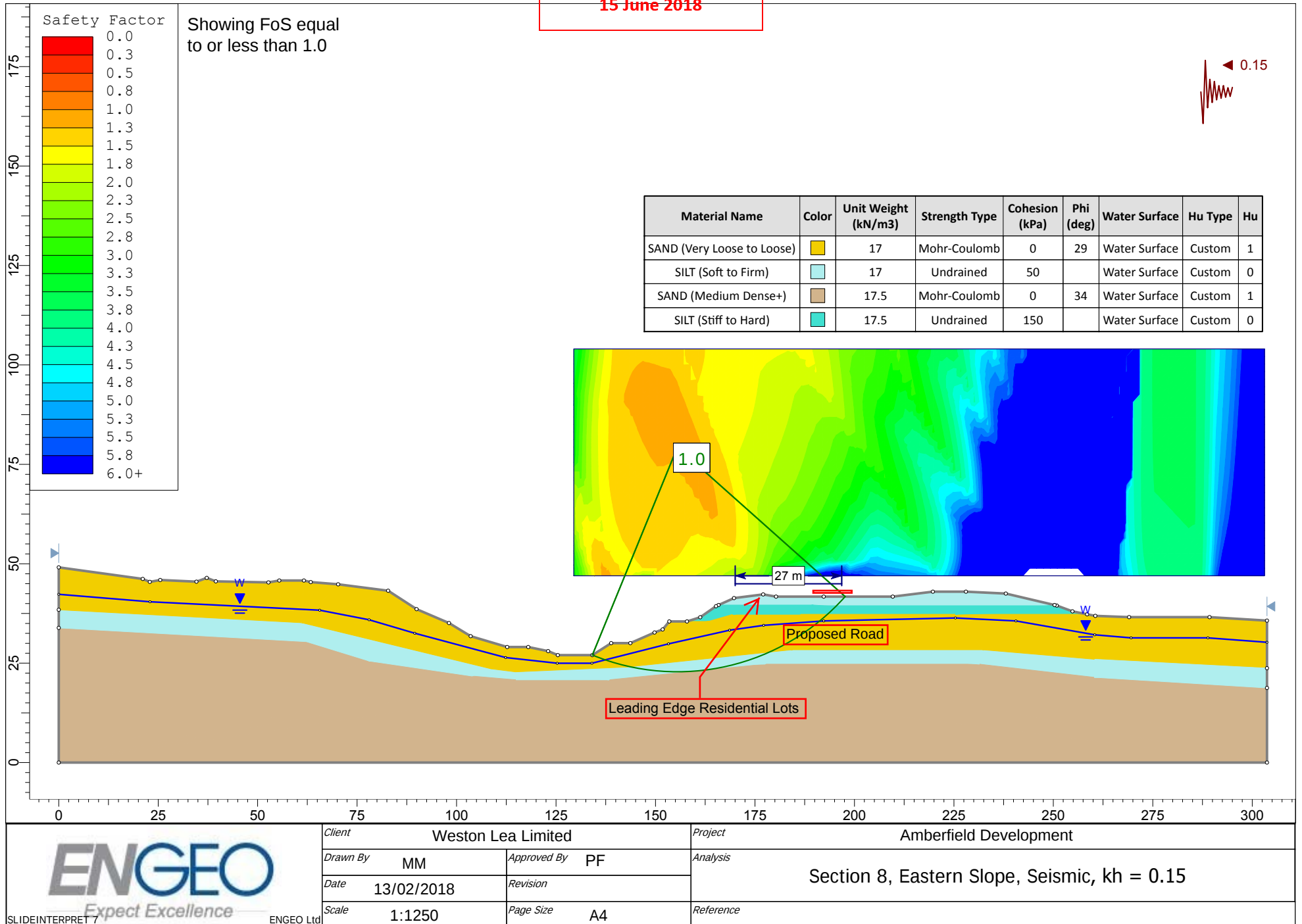


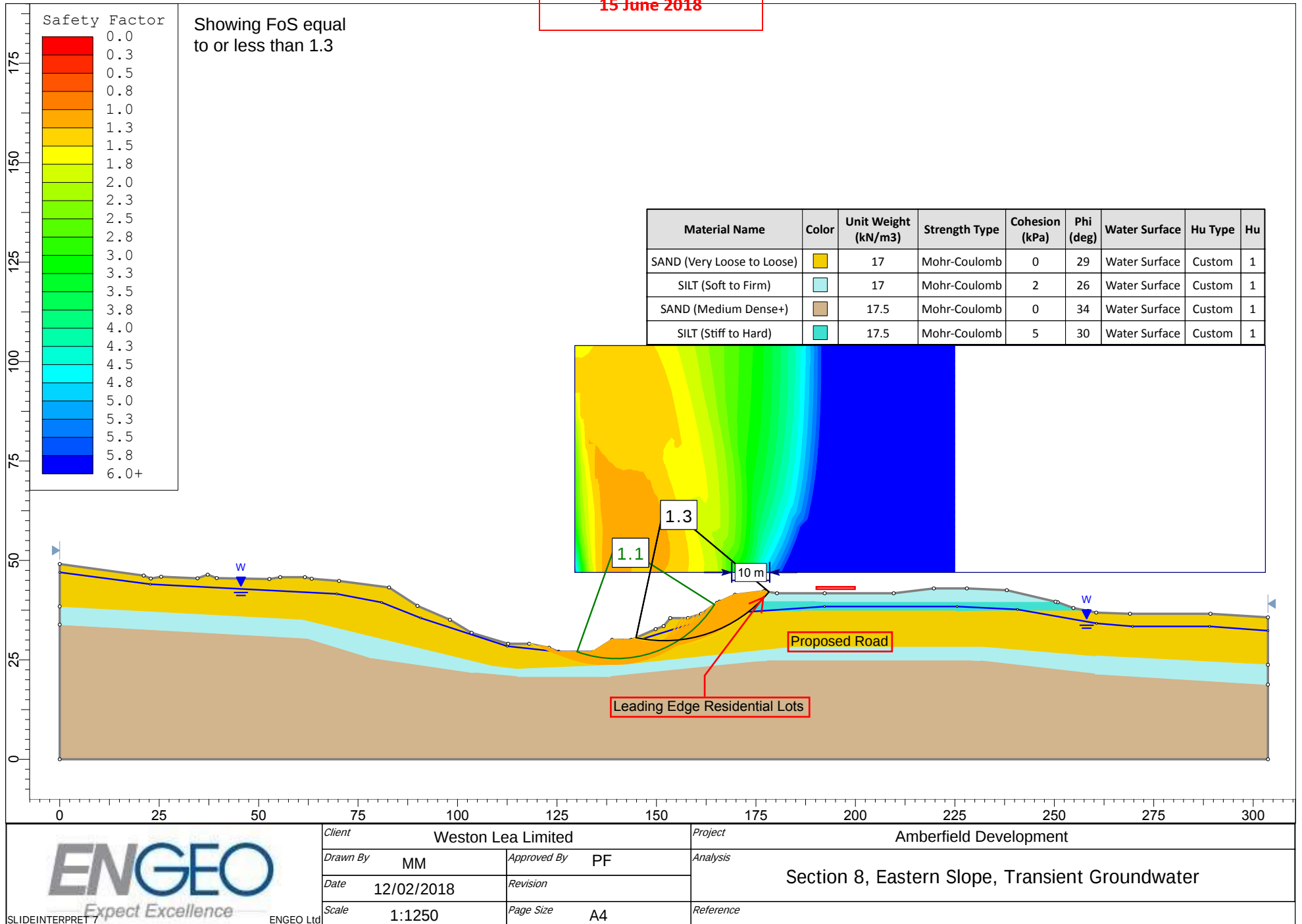


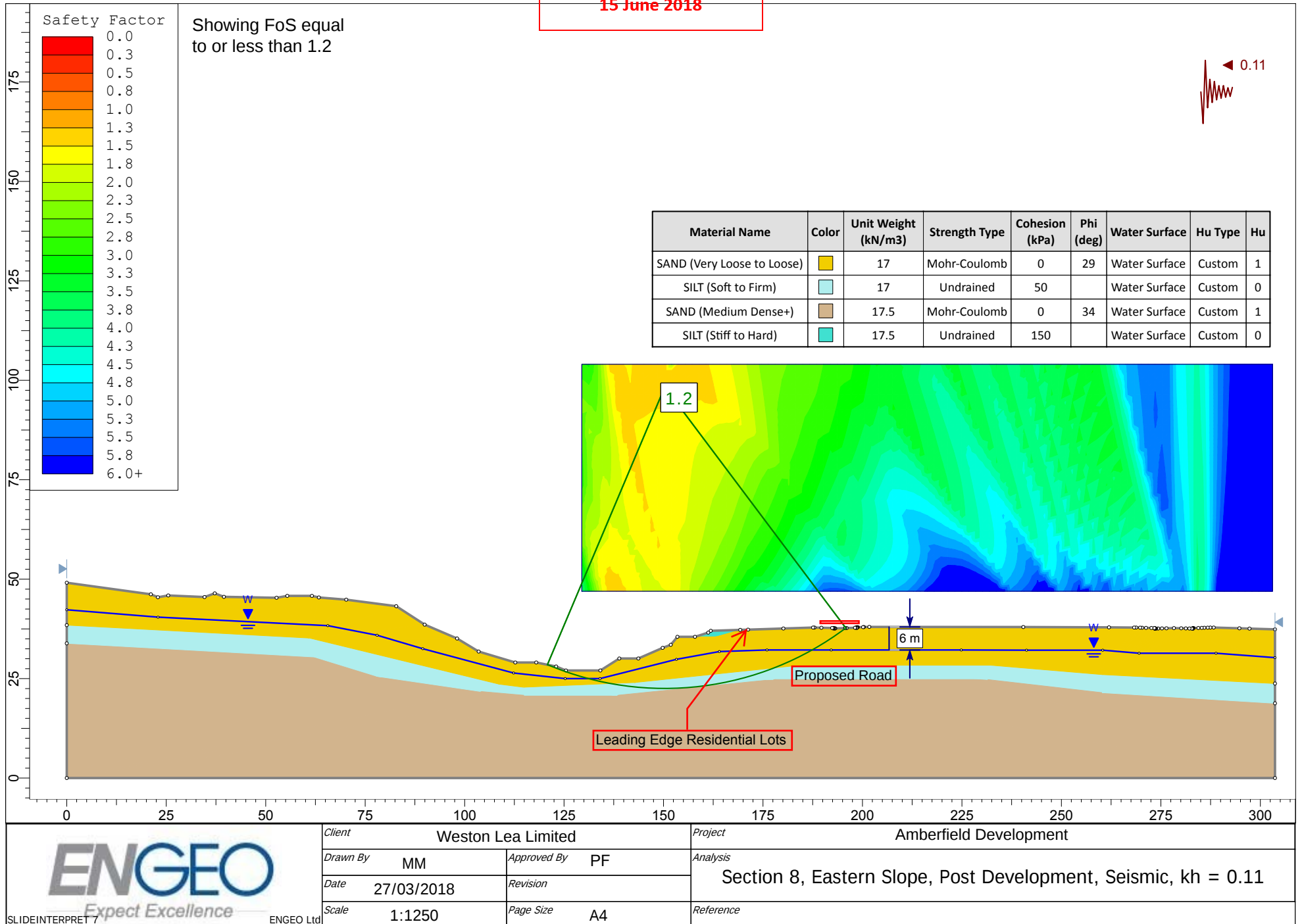


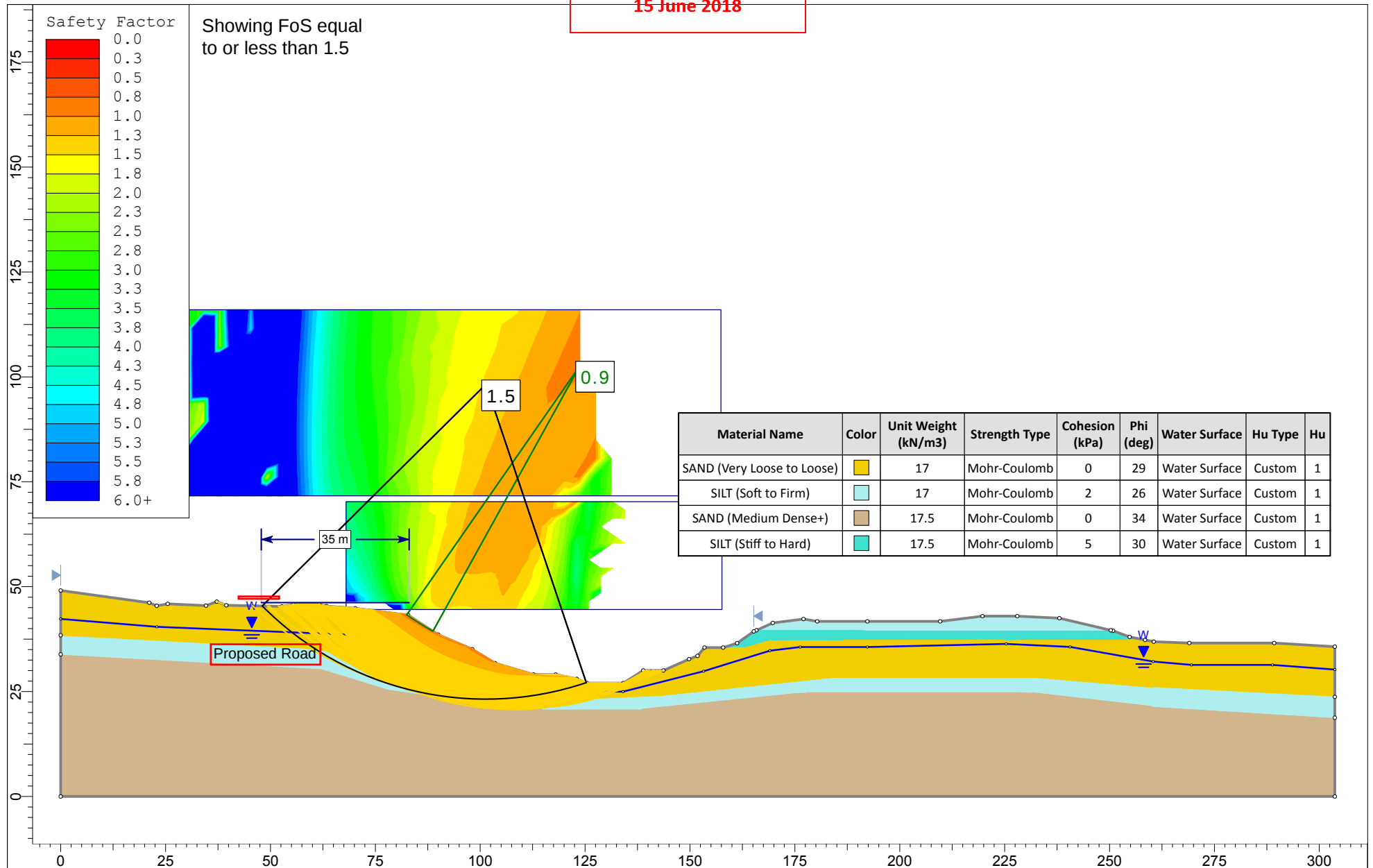




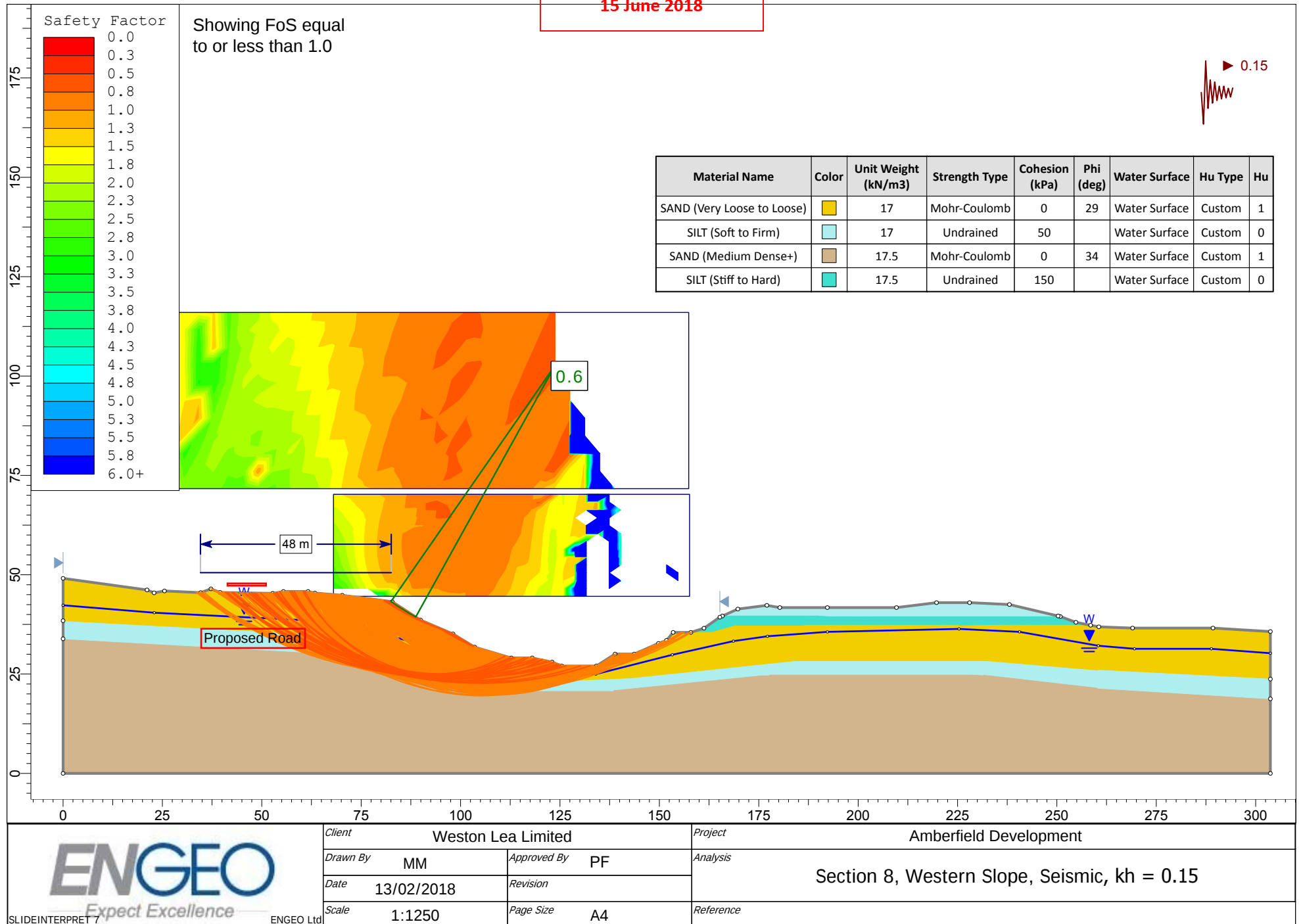


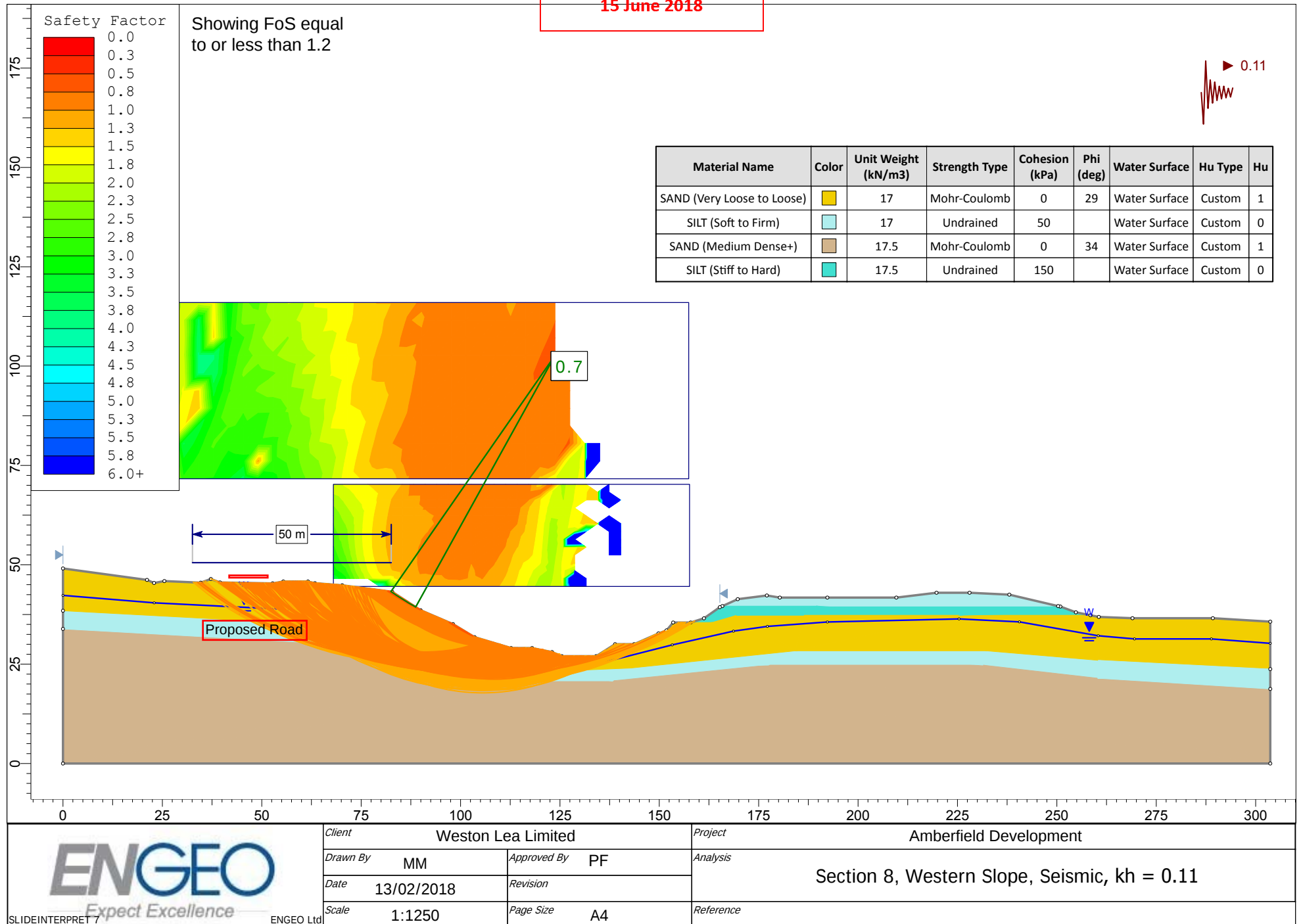


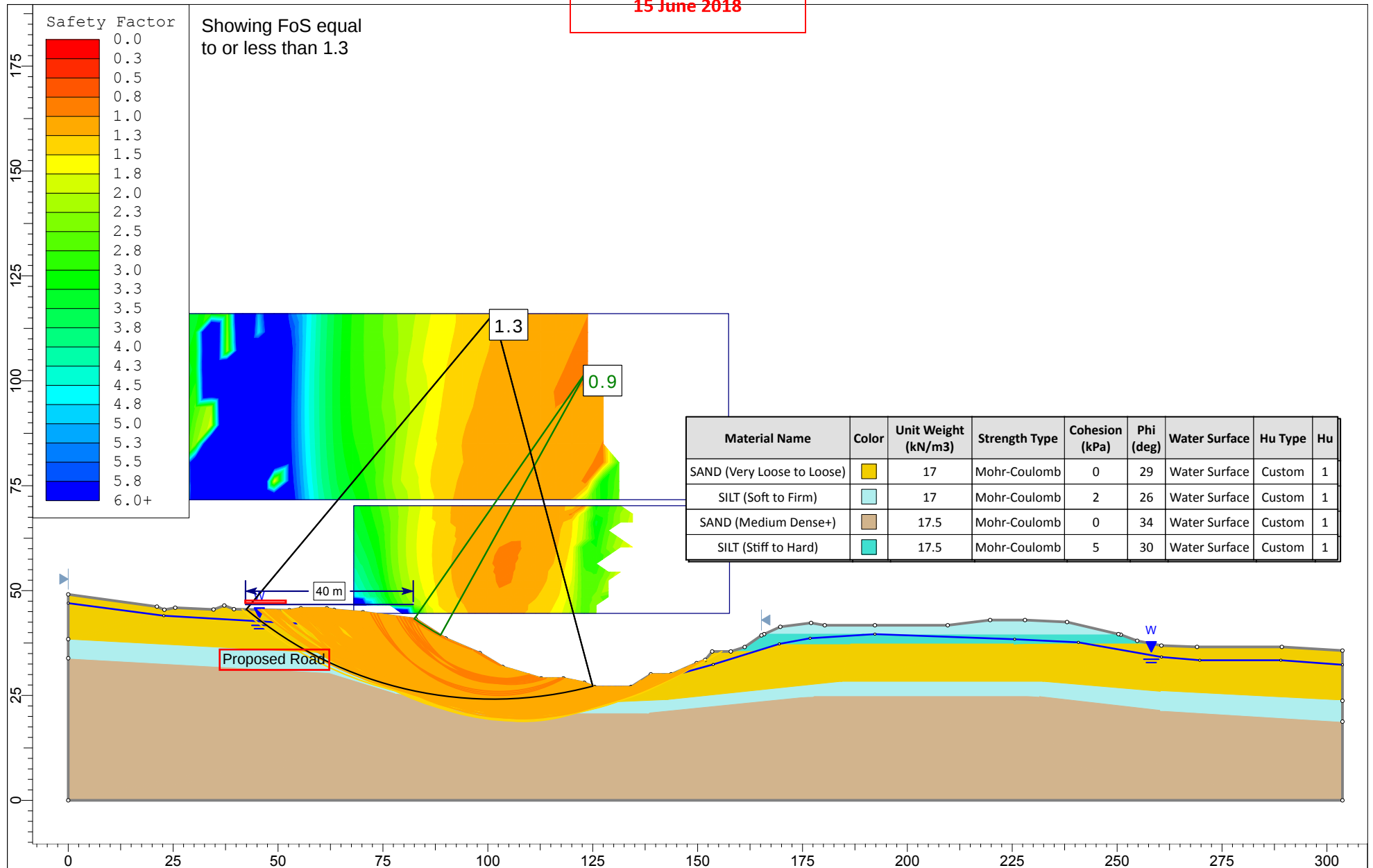


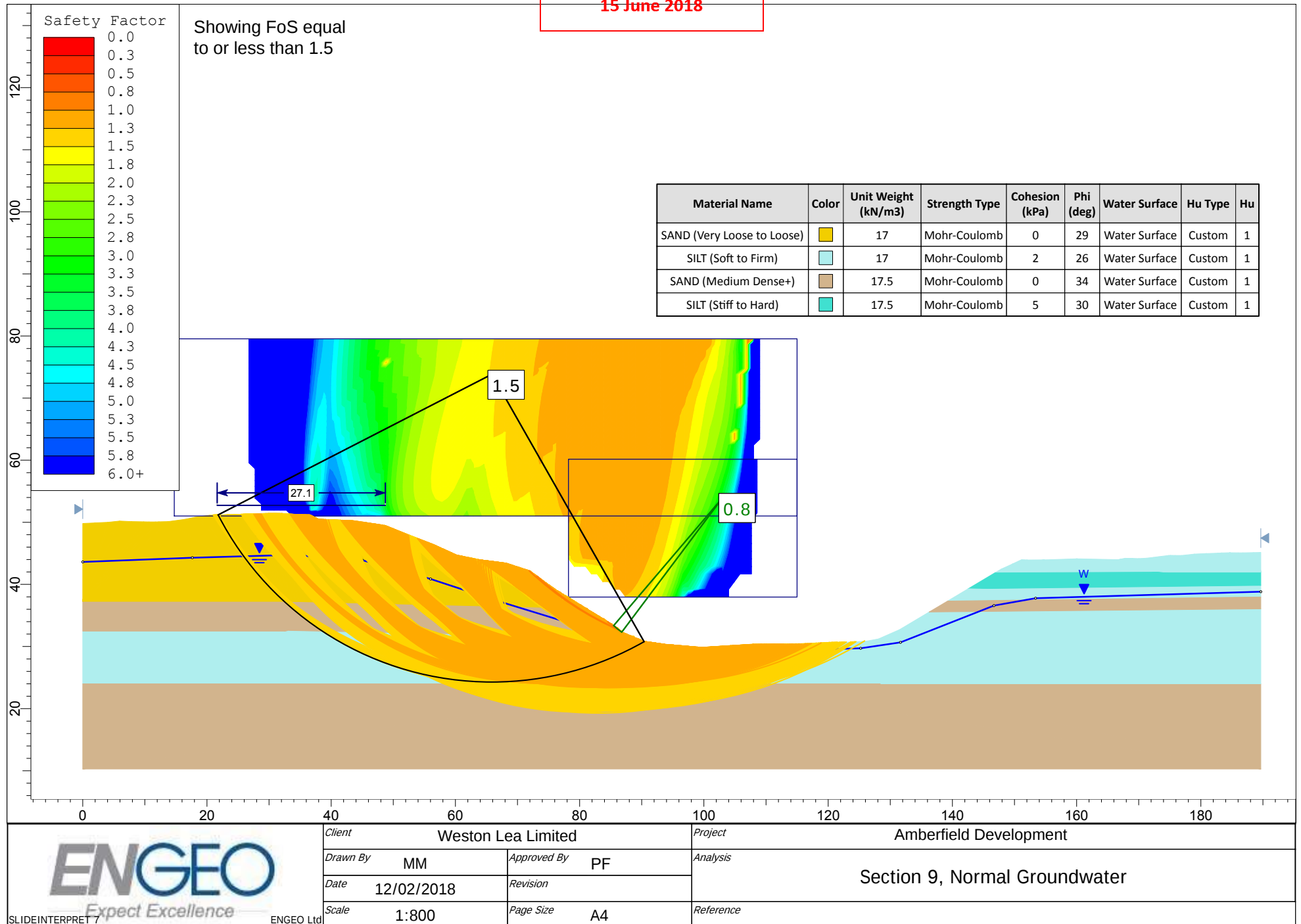


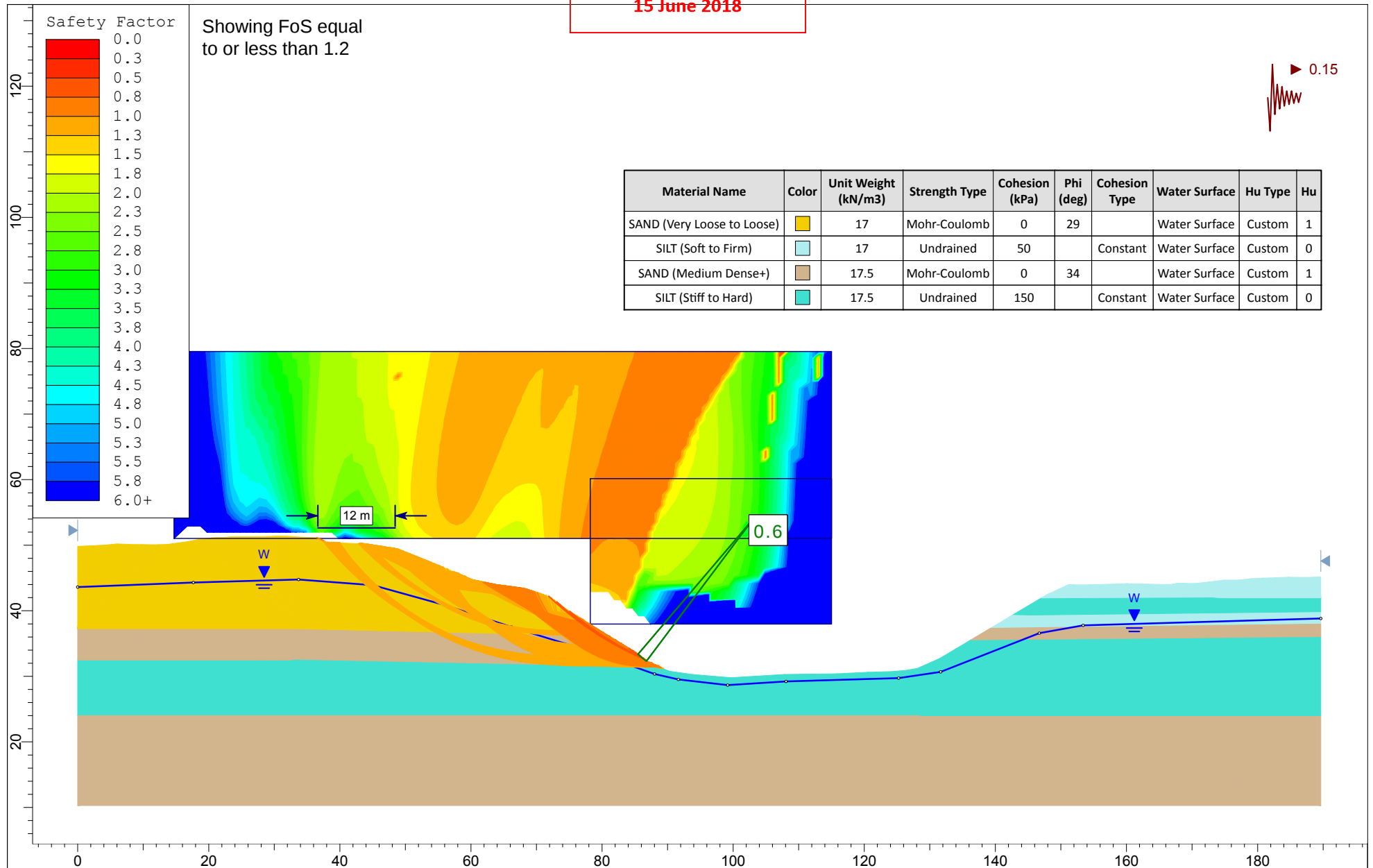
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	Date 12/02/2018	Revision		
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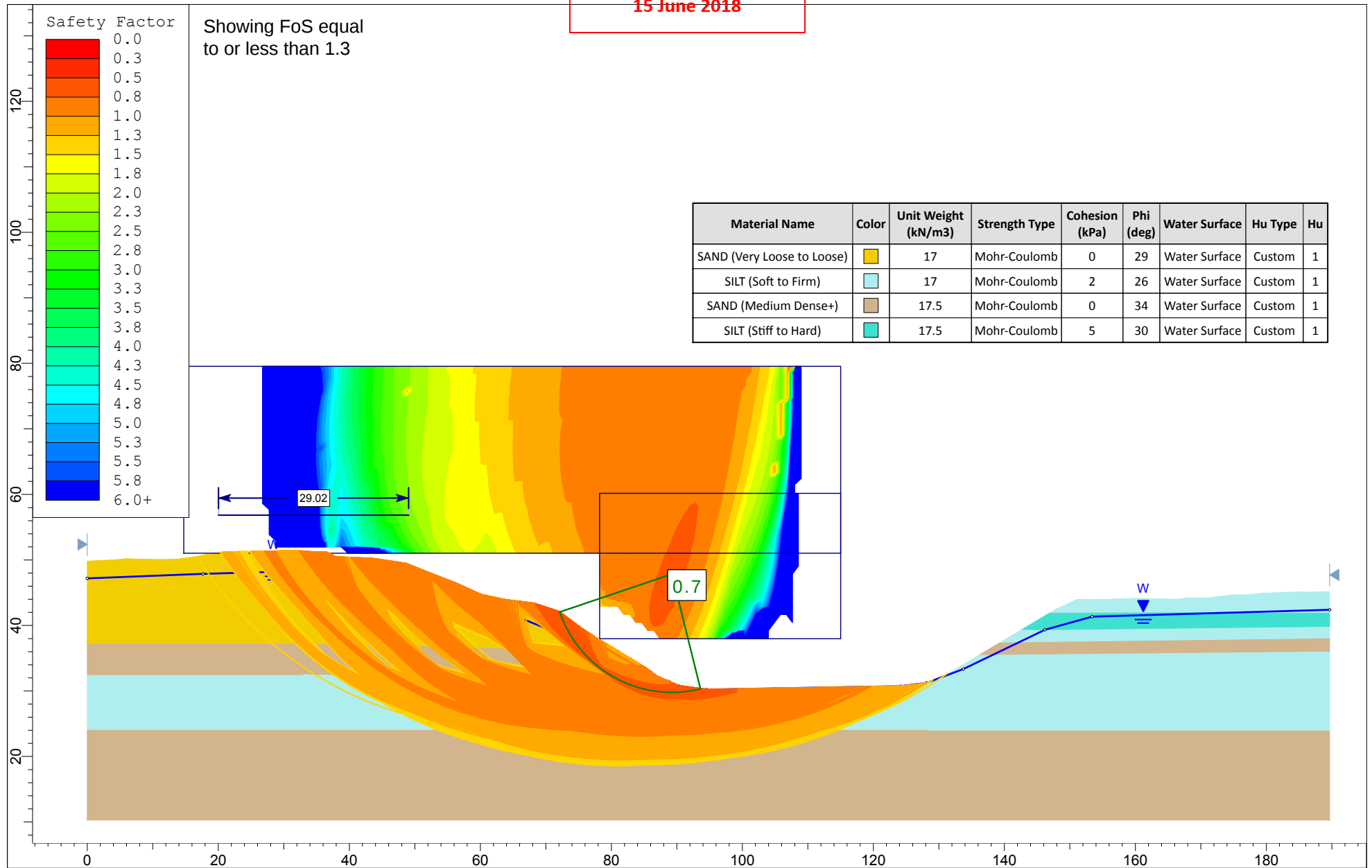


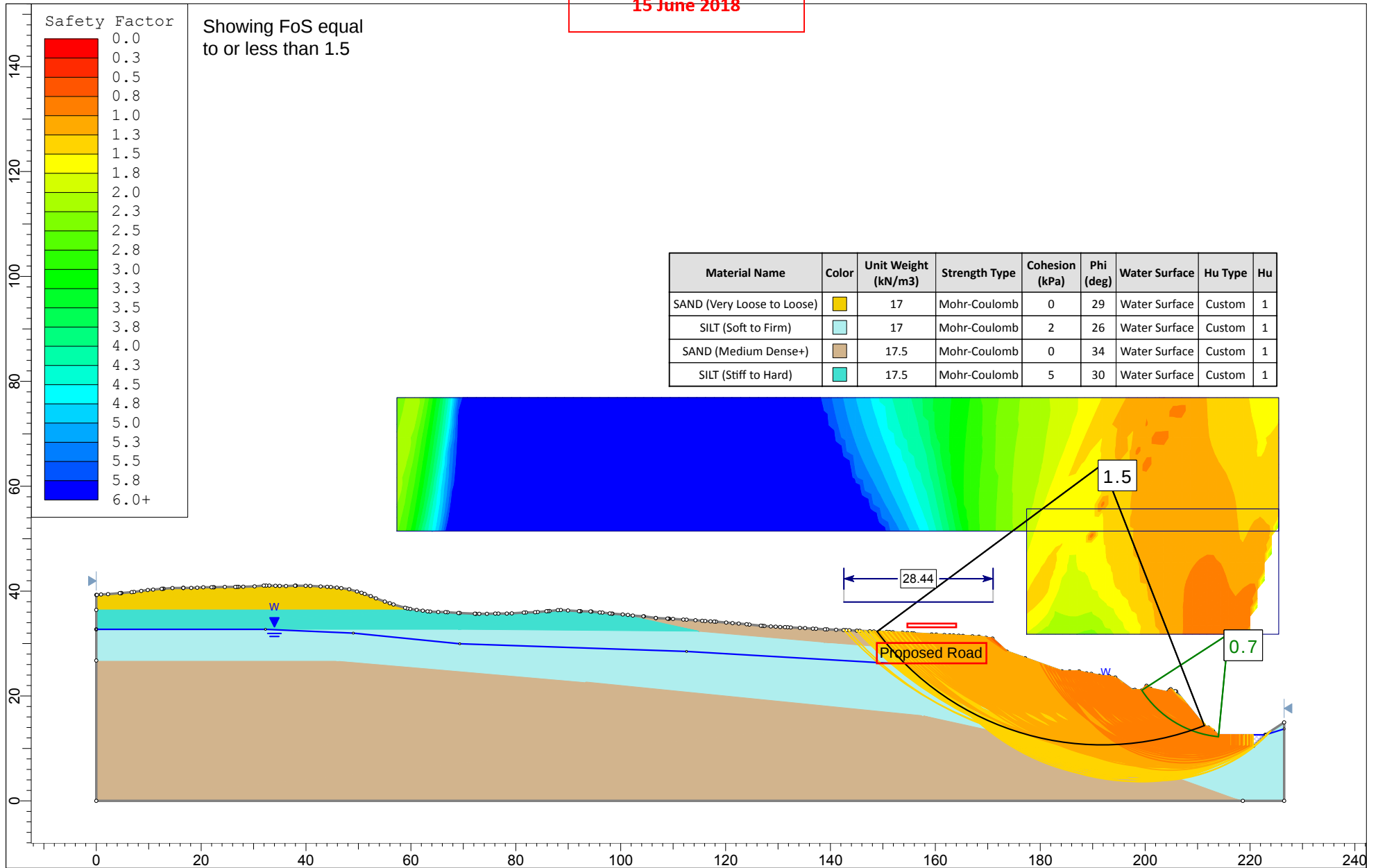




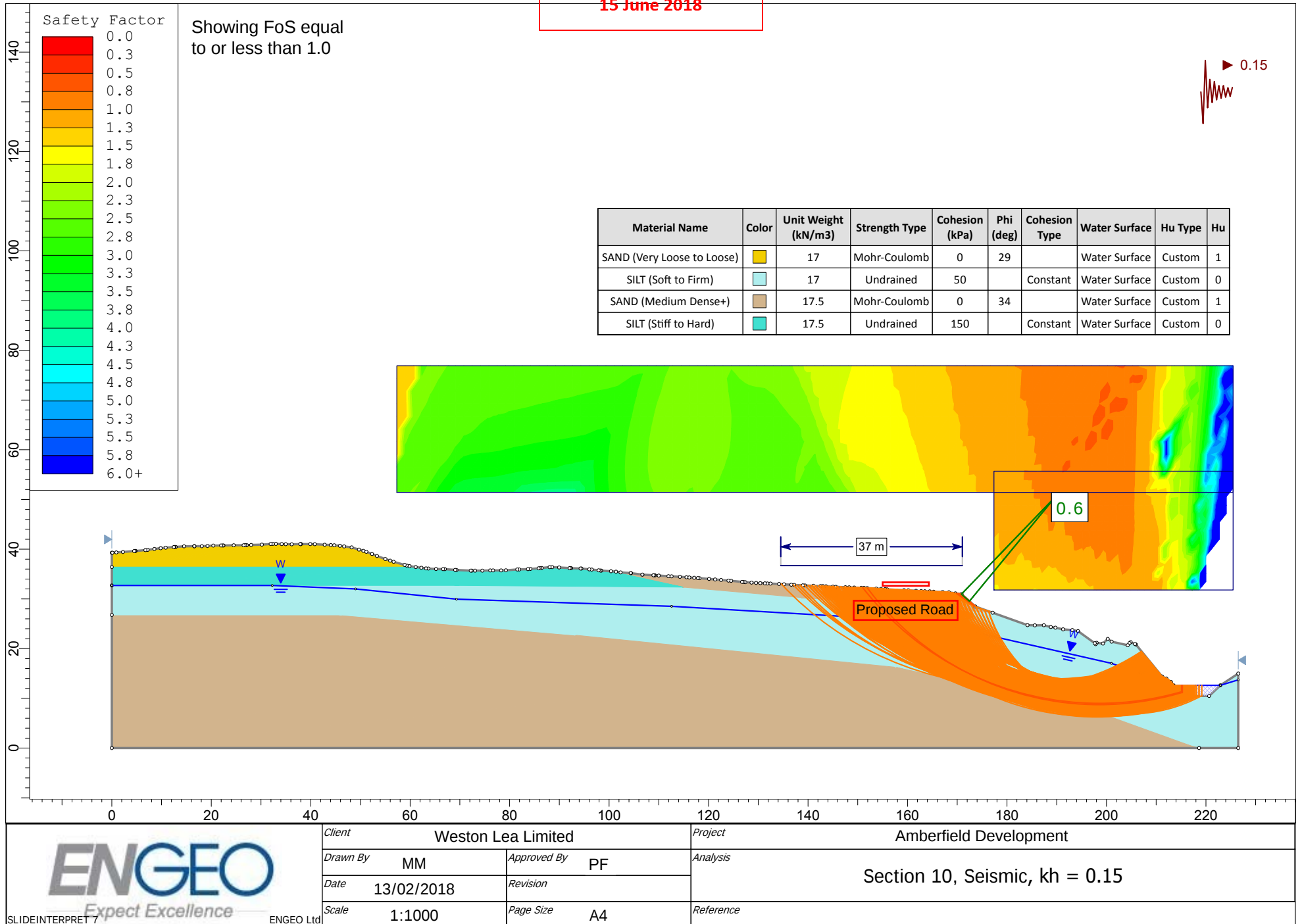


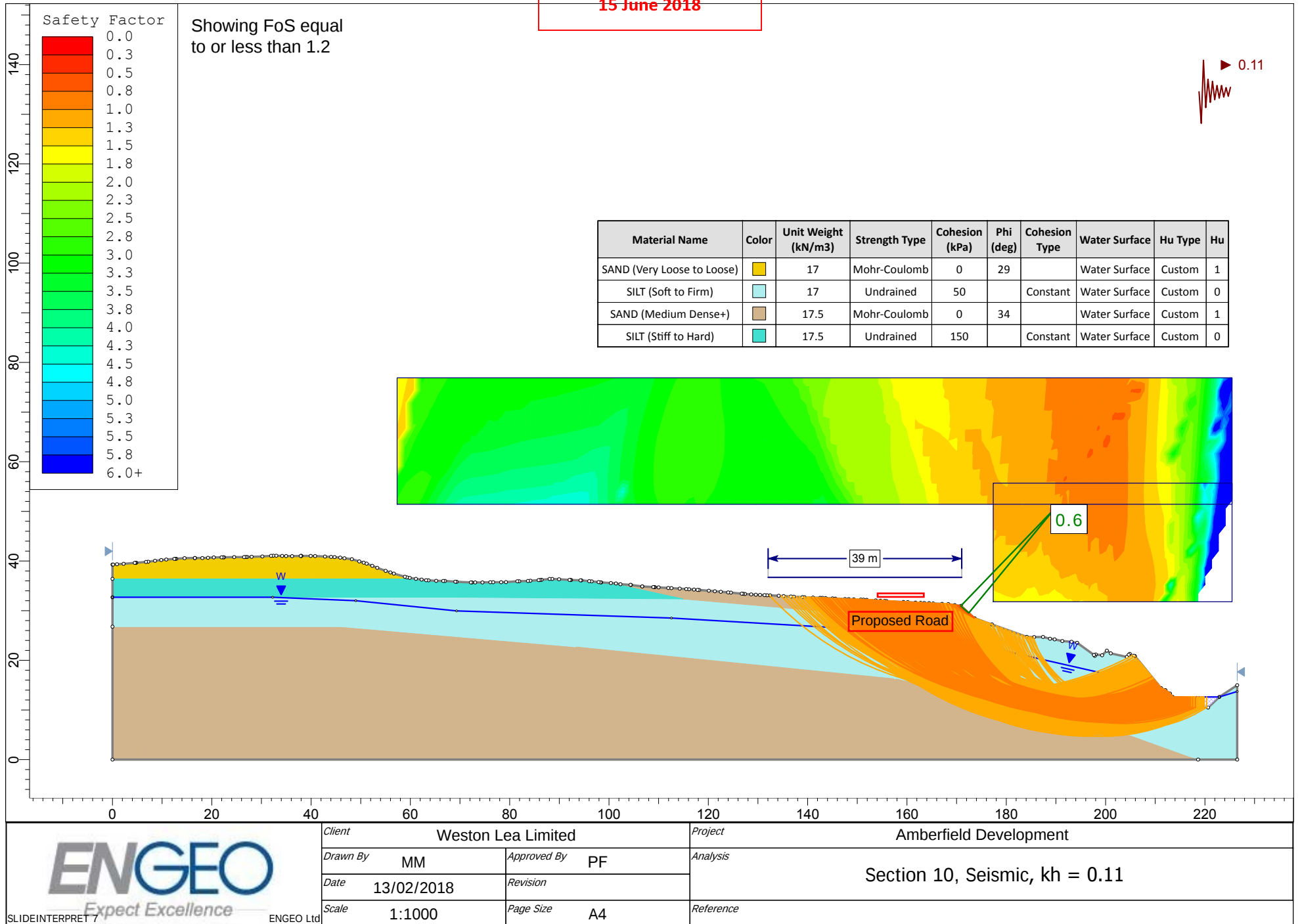
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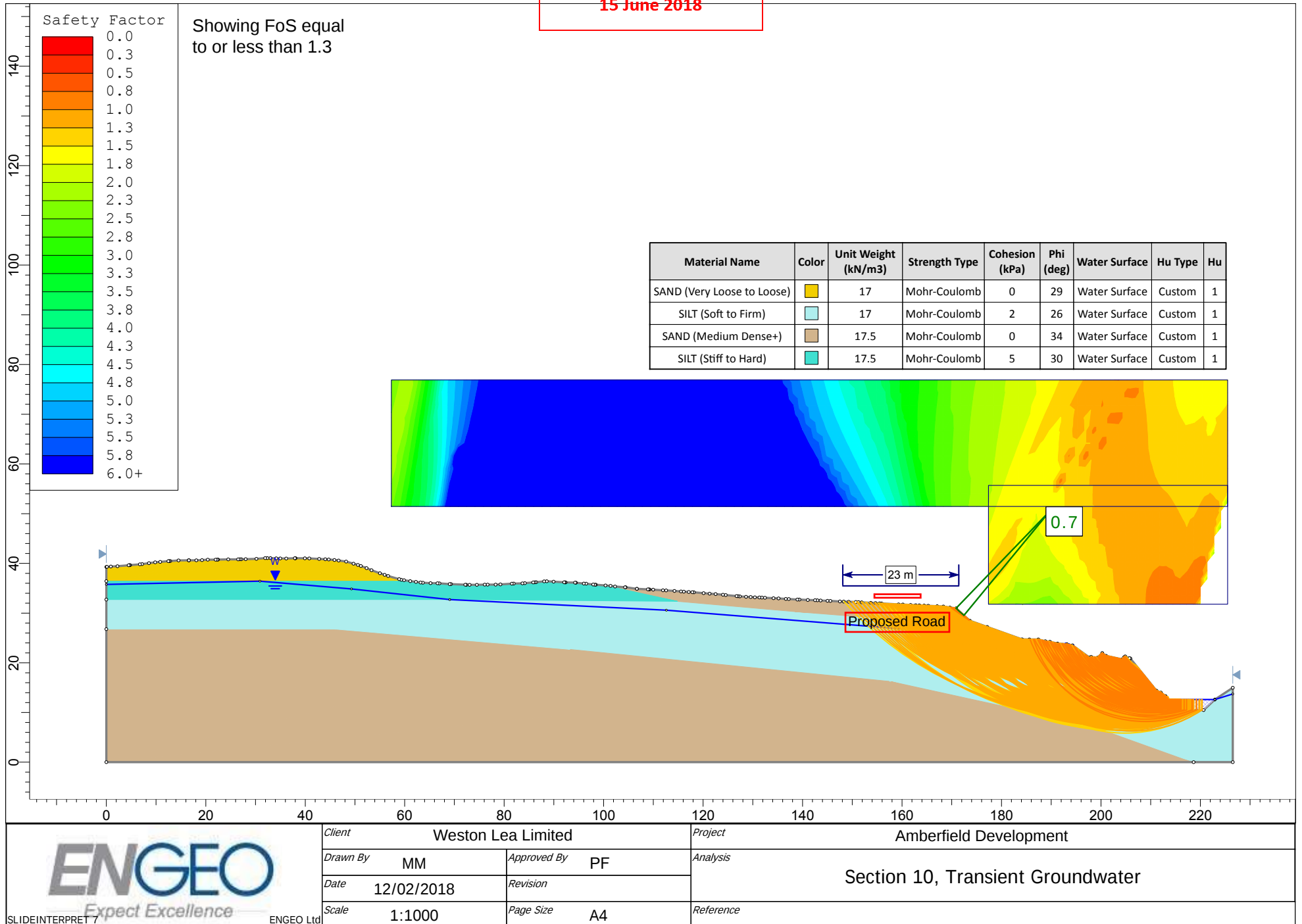


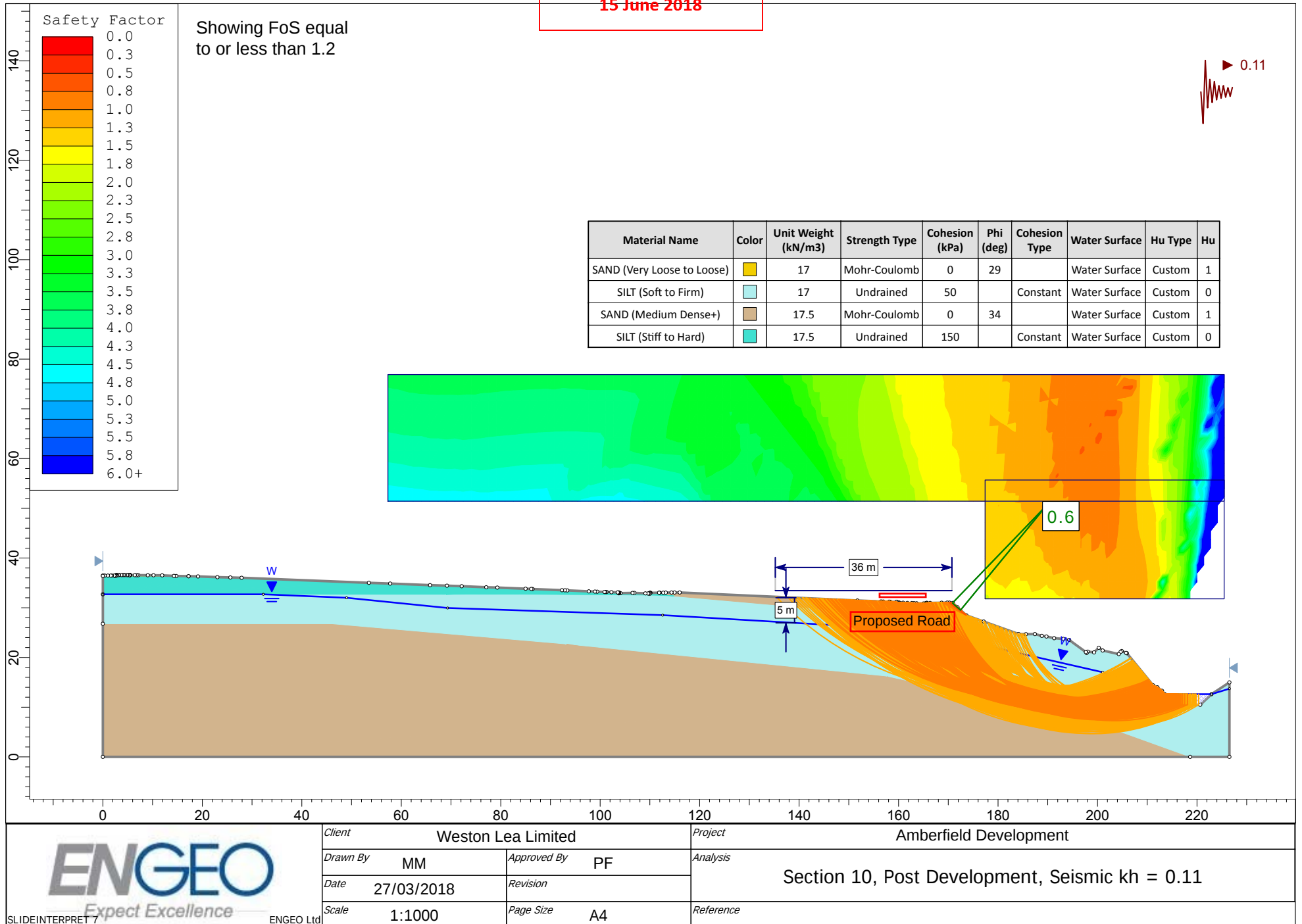


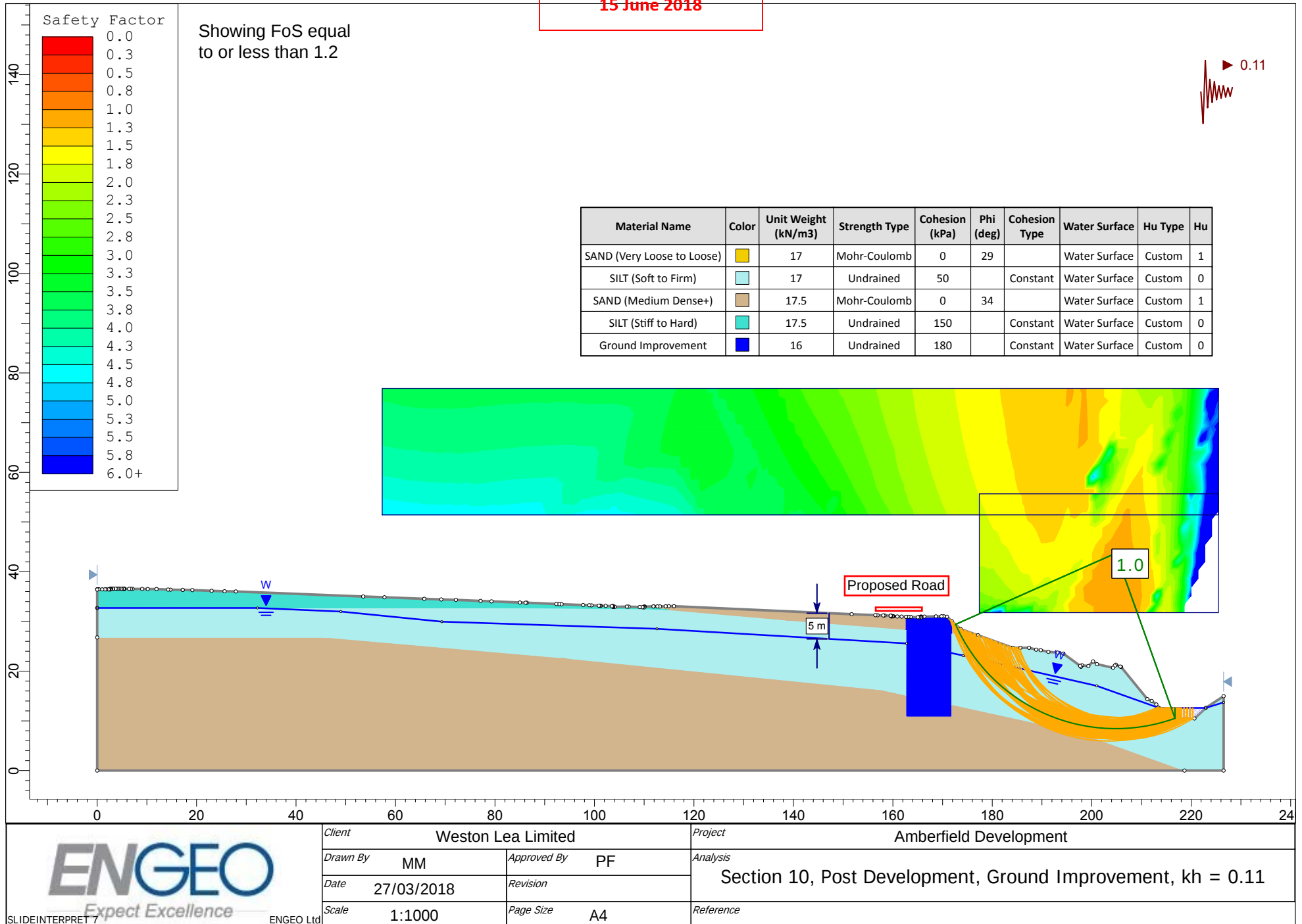
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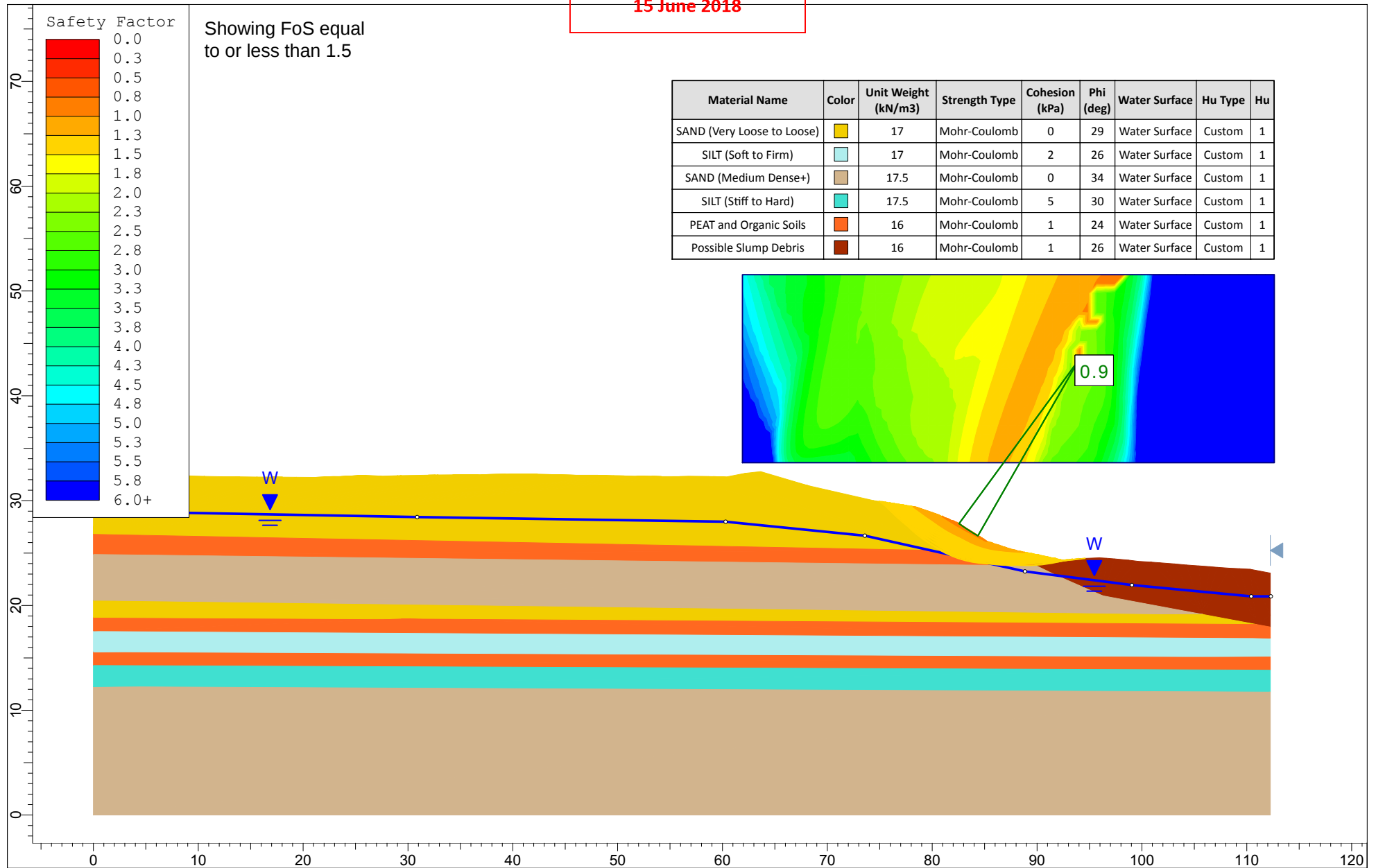




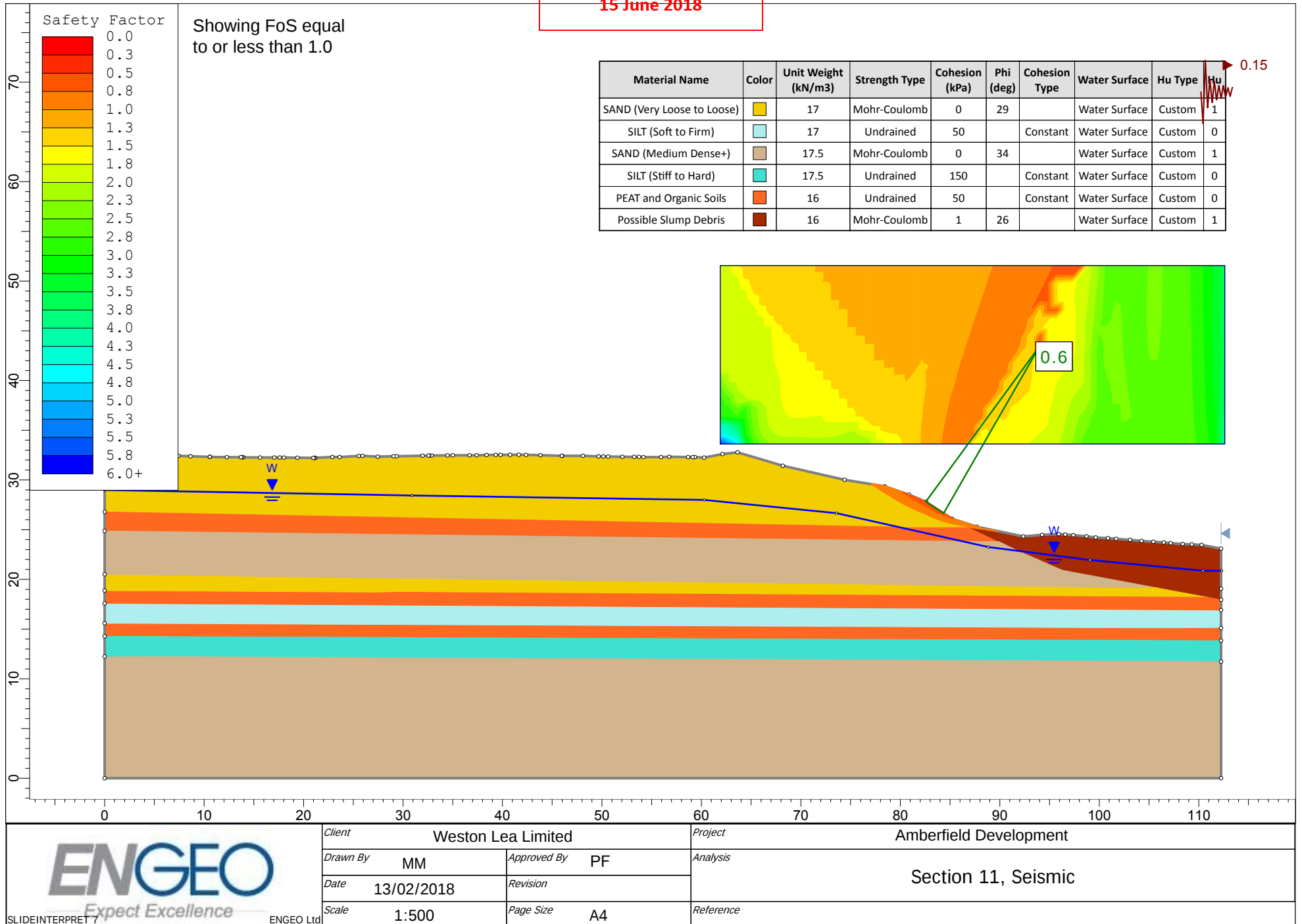


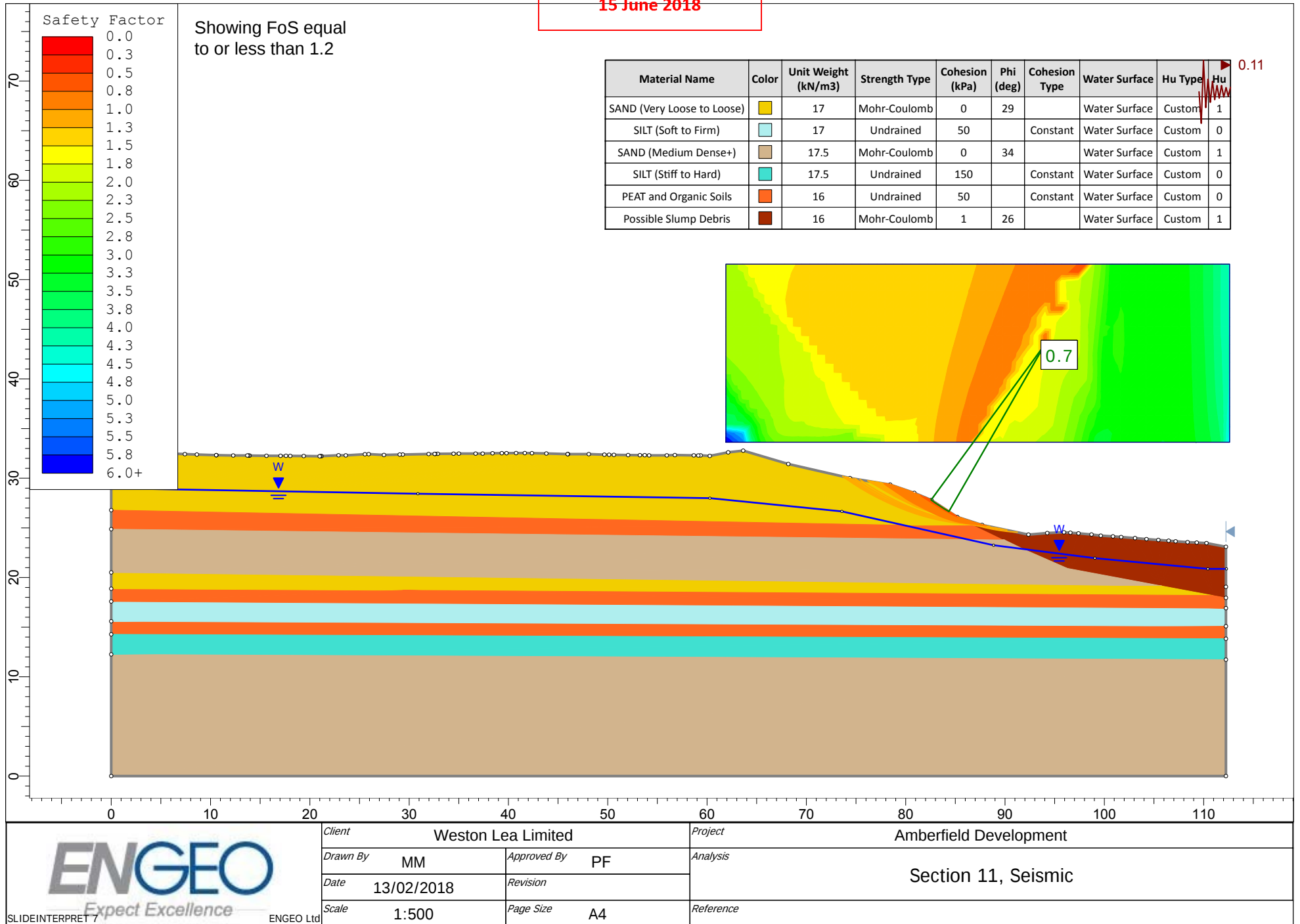


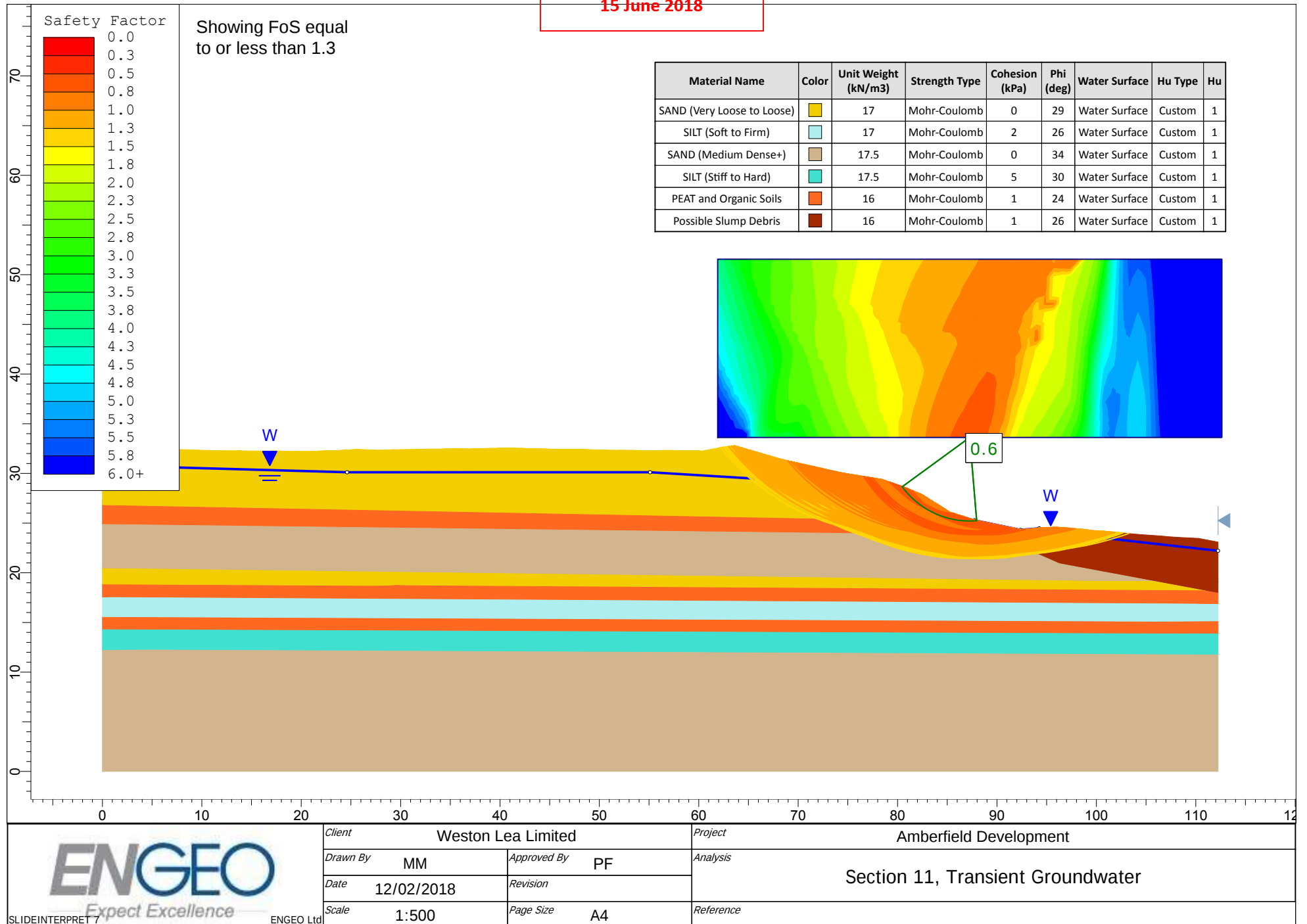




	Client Weston Lea Limited		Project Amberfield Development	
	Drawn By MM	Approved By PF	Analysis Section 11, Normal Groundwater	
	Date 12/02/2018	Revision		
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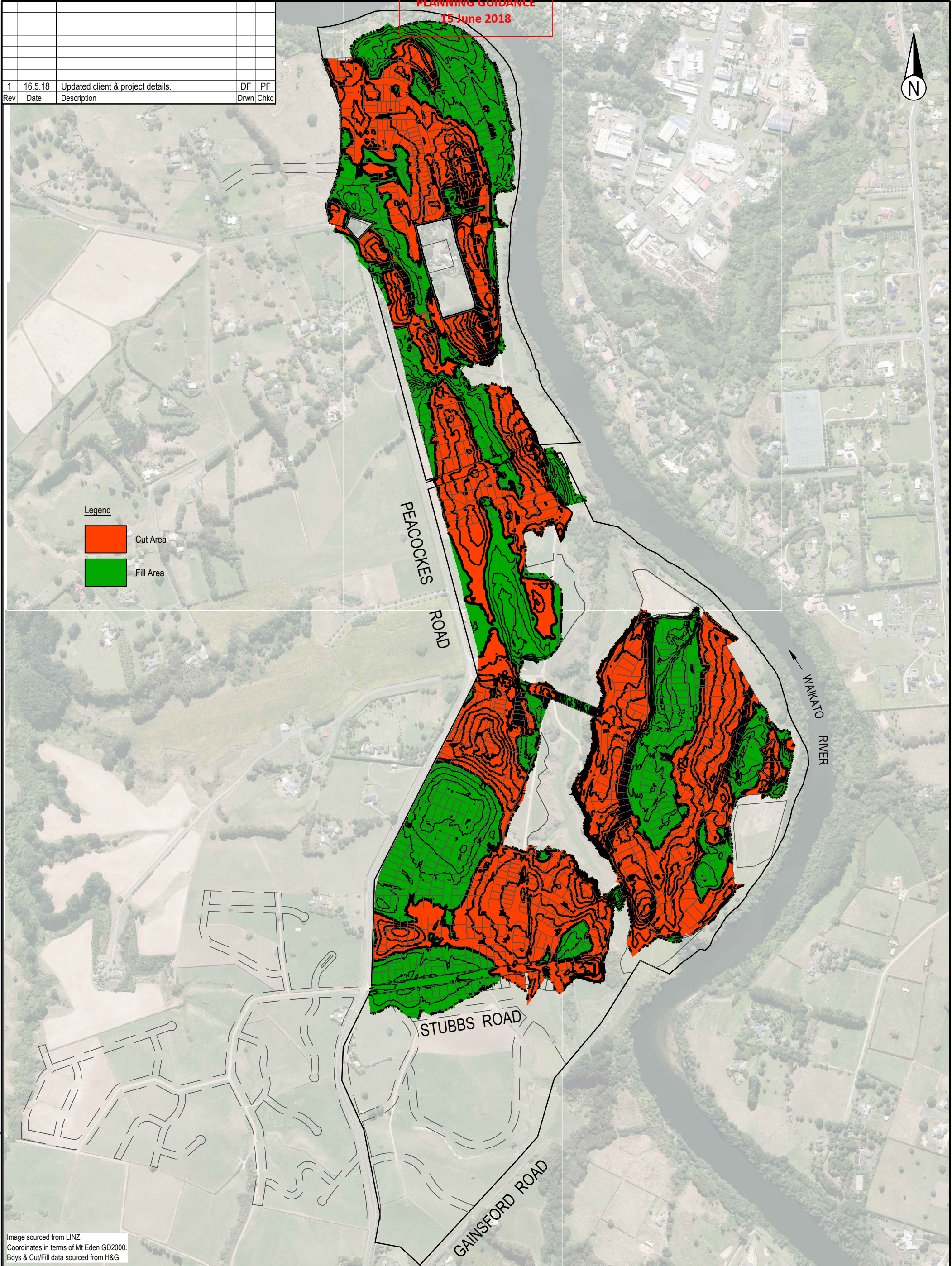




APPENDIX 8:
Geological Sections

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1	16.5.18	Updated client & project details.	DF	PF	
Rev	Date	Description	Drwn	Chkd	



Legend

Cut Area

Fill Area

Image sourced from LINZ.
Coordinates in terms of Mt Eden GD2000.
Bdys & Cut/Fill data sourced from H&G.



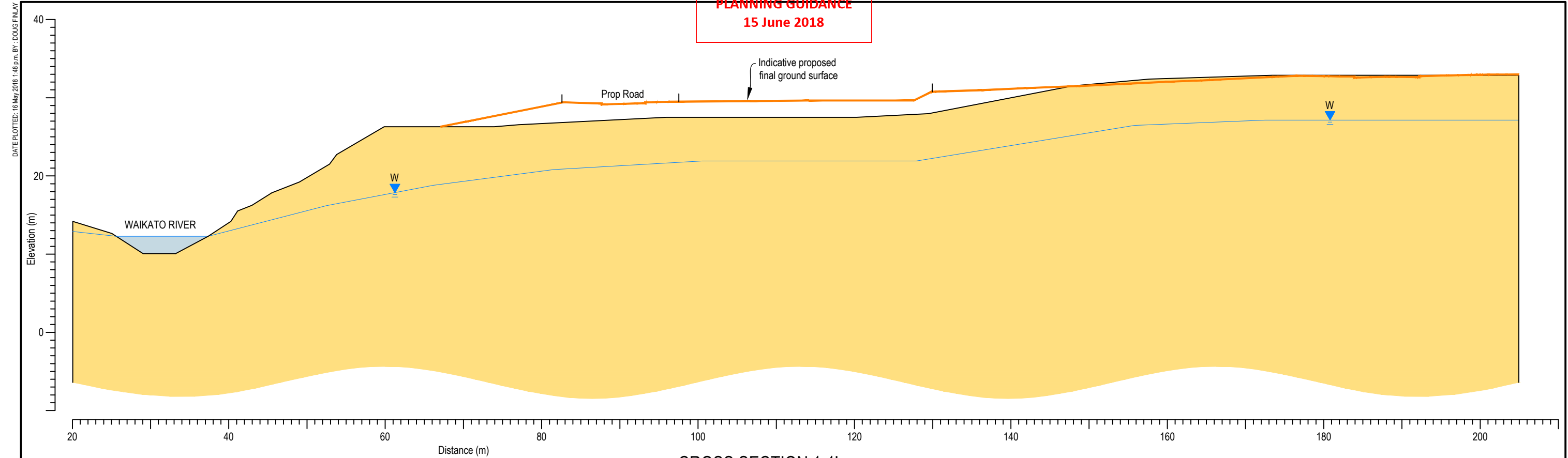
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CUT TO FILL PLAN

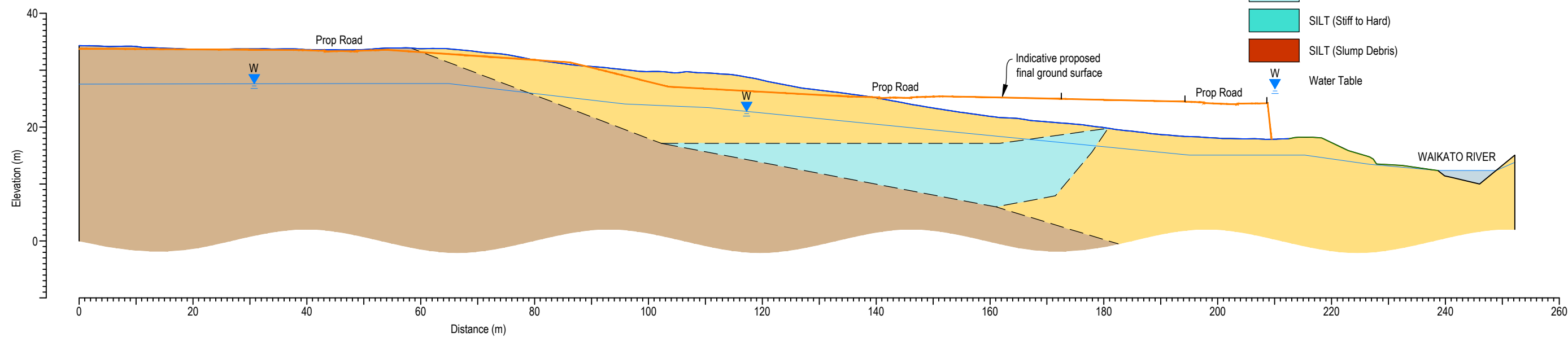
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Project: AMBERFIELD SUBDIVISION HAMILTON	Designed: MM	
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	Checked: -	
Proj No: 14280.000.000	Date: 29.3.18	Size: A3
	Scale: 1:7500	Rev: 1

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CROSS SECTION 1-1'
SCALE 1:500

- Legend
- SAND (Very Loose to Loose)
 - SAND (Medium Dense+)
 - SAND (Slump Debris)
 - SILT (Soft to Firm)
 - SILT (Stiff to Hard)
 - SILT (Slump Debris)



CROSS SECTION 2-2'
SCALE 1:750

XREFs:
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Rev	Date	Description	Drwn	Chkd
3	16.5.18	Updated client & project details.	DF	PF
2	29.3.18	Appendix No. change.	DF	MM
1	26.3.18	Add indicative prop final ground level.	DF	MM



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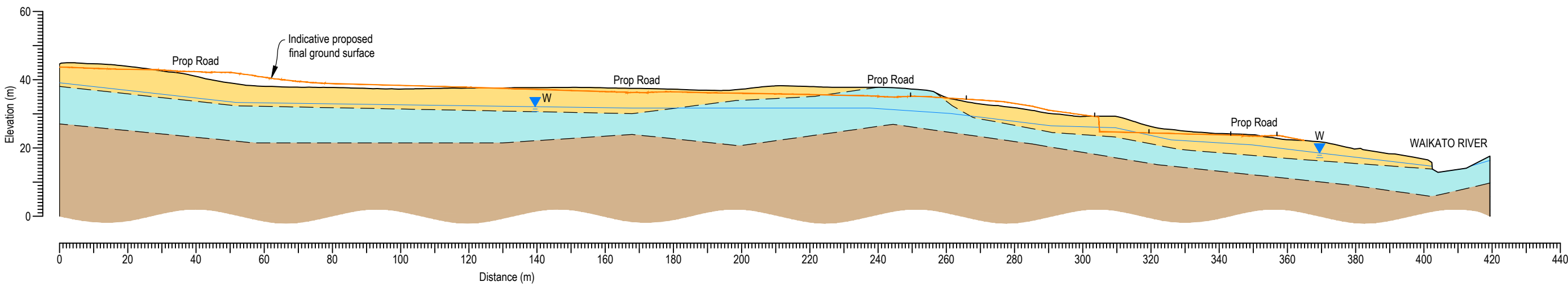
GEOLOGICAL SECTIONS

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	Drawn: DF		
	Checked: -		
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DATE PLOTTED: 16 May 2018 1:50 p.m. BY: DOUG FINLAY

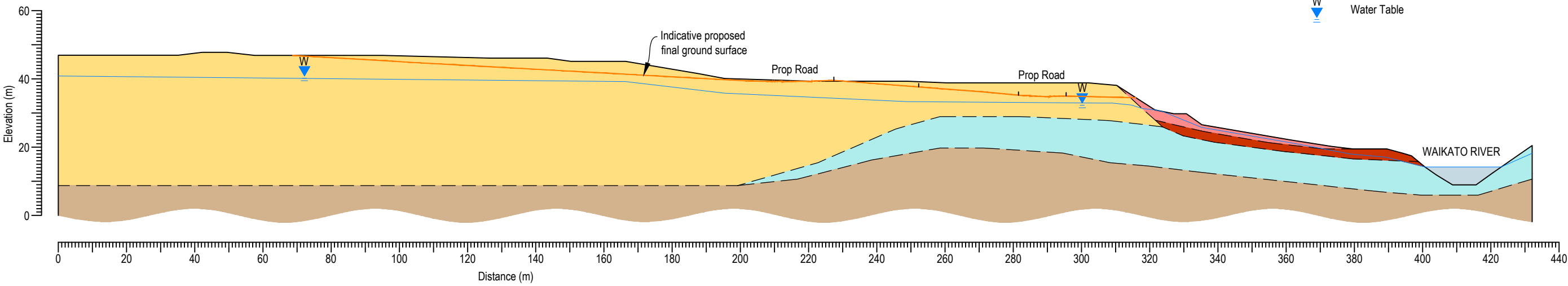
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CROSS SECTION 3-3'
SCALE 1:1250

- Legend
- SAND (Very Loose to Loose)
 - SAND (Medium Dense+)
 - SAND (Slump Debris)
 - SILT (Soft to Firm)
 - SILT (Slump Debris)
 - Water Table



CROSS SECTION 4-4'
SCALE 1:1250

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Rev	Date	Description	Drwn	Chkd
3	16.5.18	Updated client & project details.	DF	PF
2	29.3.18	Appendix No. change.	DF	MM
1	26.3.18	Add indicative prop final ground level.	DF	MM



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Client: WESTON LEA LIMITED		Appendix No:	
Project: AMBERFIELD SUBDIVISION HAMILTON	Designed: MM	8B Sheet 2 Size: A3	
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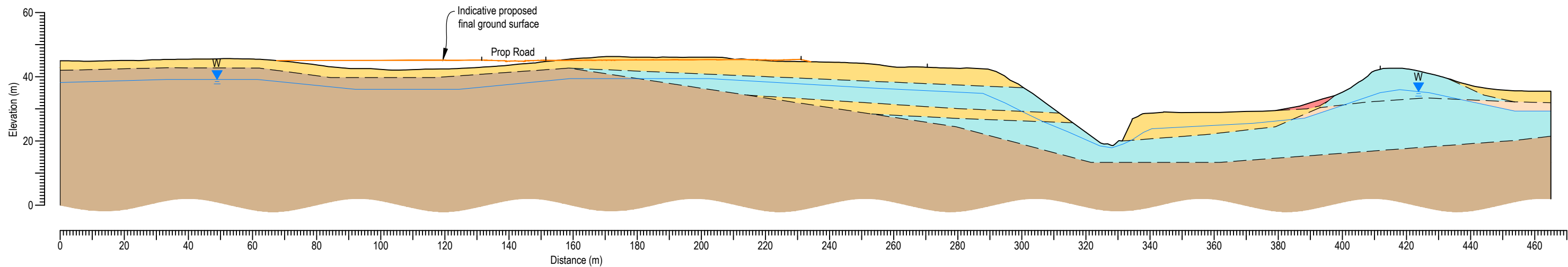
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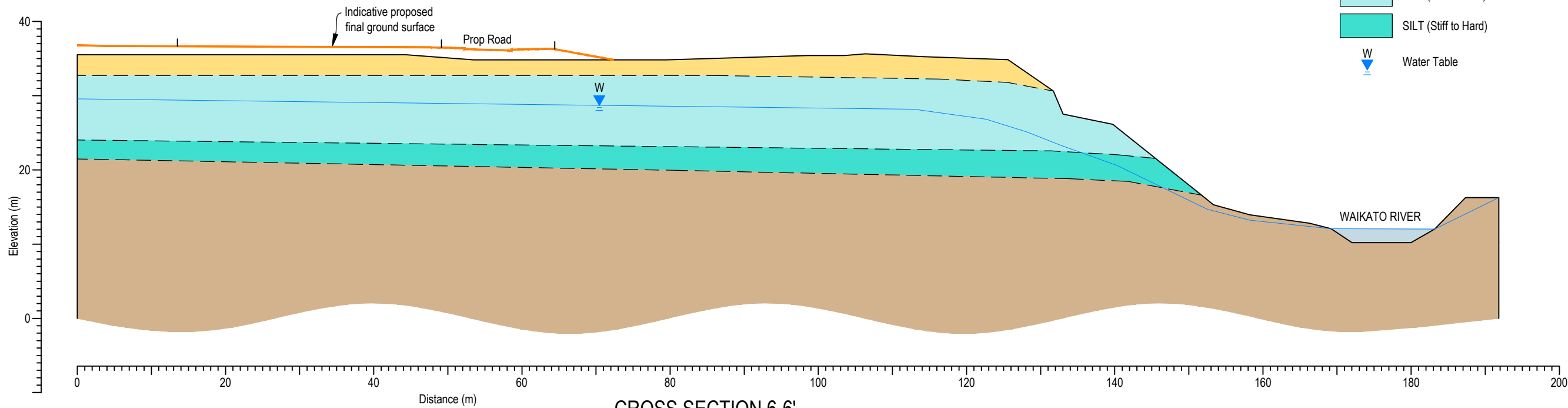
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CROSS SECTION 5-5'
SCALE 1:1250

- Legend
- SAND (Very Loose to Loose)
 - SAND (Medium Dense+)
 - SAND (Slump Debris)
 - SILT (Soft to Firm)
 - SILT (Stiff to Hard)
 - W Water Table



CROSS SECTION 6-6'
SCALE 1:600

Rev	Date	Description	Drwn	Chkd
3	16.5.18	Updated client & project details.	DF	PF
2	29.3.18	Appendix No. change.	DF	MM
1	26.3.18	Add indicative prop final ground level.	DF	MM



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GEOLOGICAL SECTIONS

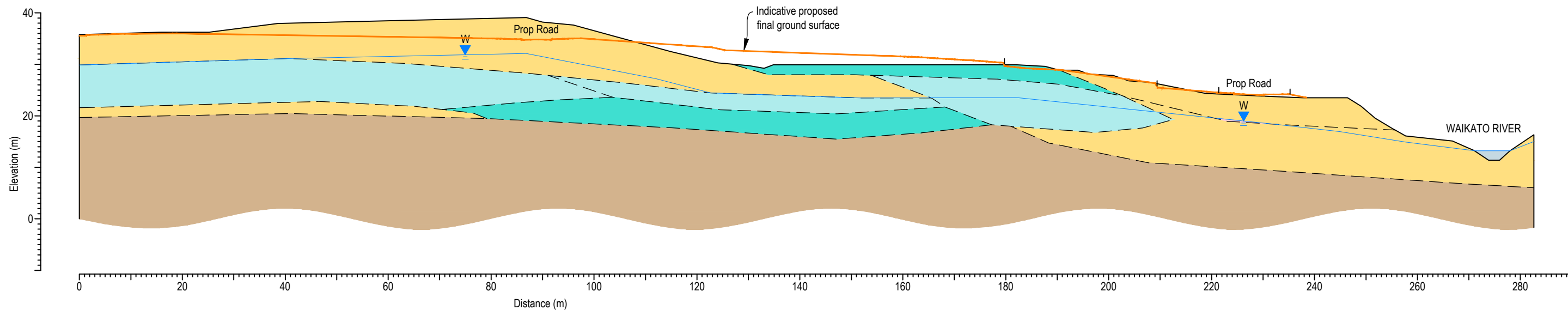
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DATE PLOTTED: 16 May 2018 1:53 p.m. BY: DOUG FINLAY

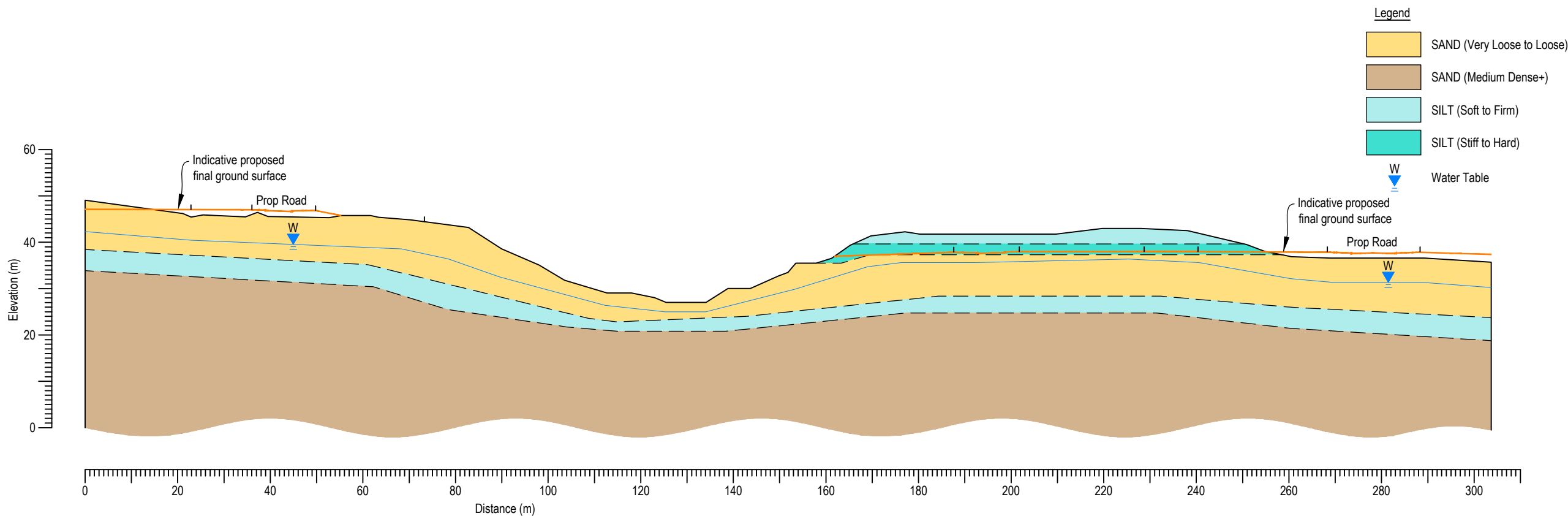
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CROSS SECTION 7-7'

SCALE 1:800



CROSS SECTION 8-8'

SCALE 1:1000

Legend

- SAND (Very Loose to Loose)
- SAND (Medium Dense+)
- SILT (Soft to Firm)
- SILT (Stiff to Hard)

W Water Table

Rev	Date	Description	Drwn	Chkd
3	16.5.18	Updated client & project details.	DF	PF
2	29.3.18	Appendix No. change.	DF	MM
1	26.3.18	Add indicative prop final ground level.	DF	MM



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Client: WESTON LEA LIMITED		Appendix No:	
Project: AMBERFIELD SUBDIVISION HAMILTON	Designed: MM	8B Sheet 4 Size: A3	
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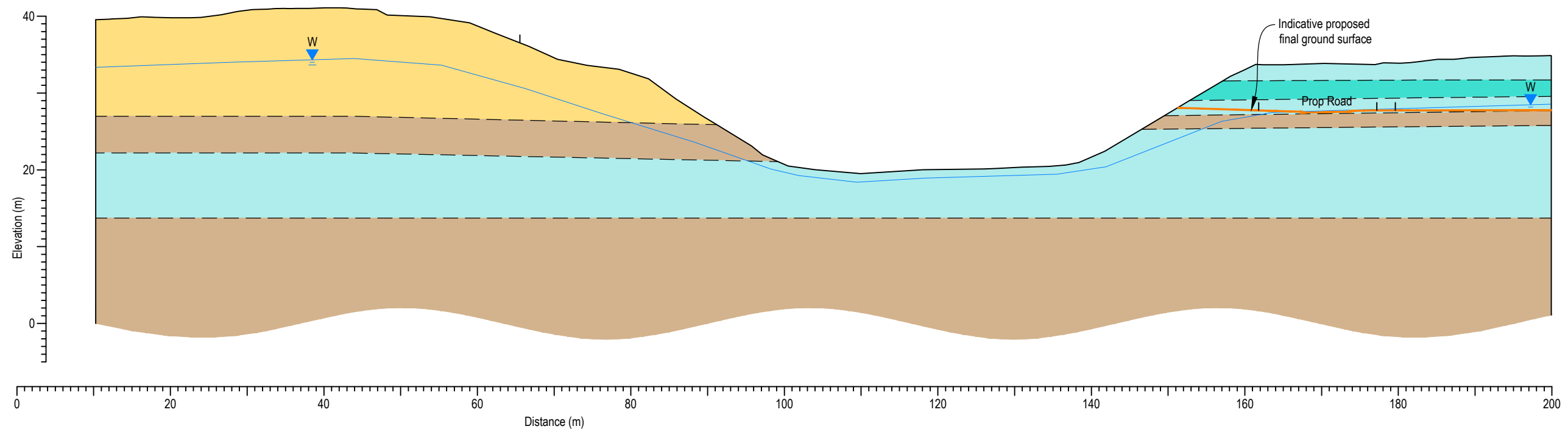
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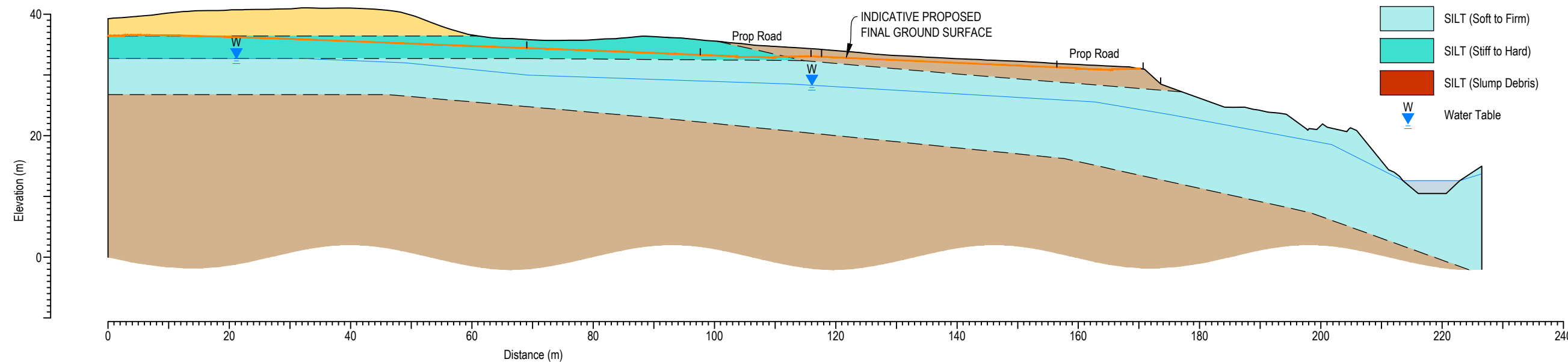
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CROSS SECTION 9-9'
SCALE 1:600

- Legend
- SAND (Very Loose to Loose)
 - SAND (Medium Dense+)
 - SAND (Slump Debris)
 - SILT (Soft to Firm)
 - SILT (Stiff to Hard)
 - SILT (Slump Debris)
 - Water Table



CROSS SECTION 10-10'
SCALE 1:750

Rev	Date	Description	Drwn	Chkd
3	16.5.18	Updated client & project details.	DF	PF
2	29.3.18	Appendix No. change.	DF	MM
1	26.3.18	Add indicative prop final ground level.	DF	MM



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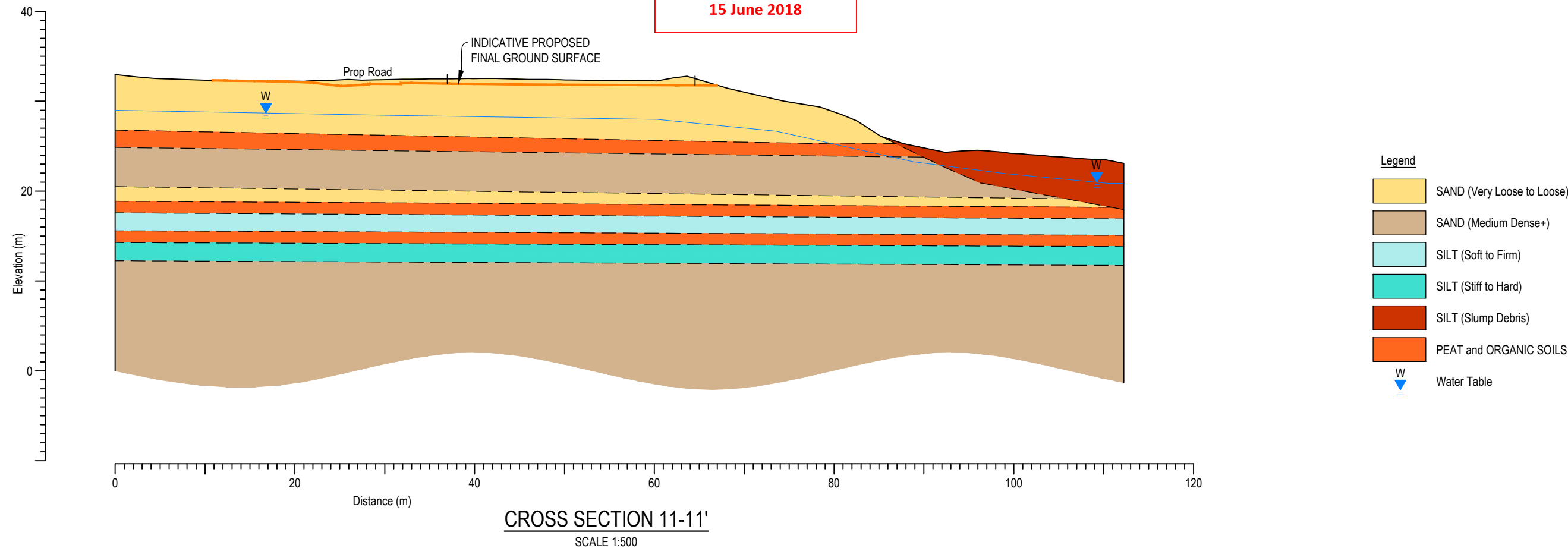
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GEOLOGICAL SECTIONS

Client: WESTON LEA LIMITED		Appendix No: 8B Sheet 5 Size: A3
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3	16.5.18	Updated client & project details.	DF	PF	
2	29.3.18	Appendix No. change.	DF	MM	
1	26.3.18	Add indicative prop final ground level.	DF	MM	
Rev	Date	Description	Drwn	Chkd	



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Client: WESTON LEA LIMITED		Appendix No:	
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1	16.5.18	Updated client & project details.	DF	PF
Rev	Date	Description	Drwn	Chkcd



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TYPICAL COUNTERFORT DRAIN & OUTFALL DETAIL

Client:	WESTON LEA LIMITED
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Project: AMBERFIELD SUBDIVISION
HAMILTON

HAMILTON	Checked: MM
	Date: 29.3.18

Proj No:	14280.000.000
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Scale: AS SHOWN

Appendix:

8C

Size: A3

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