

APPENDIX G

Soakage Testing Reports



CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-01 Falling Head Permeability Test**

DESIGNER: **OP**

CHECKED: **NK**

REVISION: **0**

DATE: **5/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

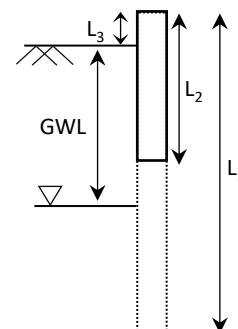
Length L_1 : **2.15** m
 Diameter: **100** mm
 Non-Perm L_2 : **0** m
 Above Gnd L_3 : **0** m

Ground Conditions

GWL: **3.00** m BGL (Blank = Bottom of hole)

Permeability Anisotropy
 m : **1** $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: **3.00** m BGL



Hydraulic Conductivity (k)

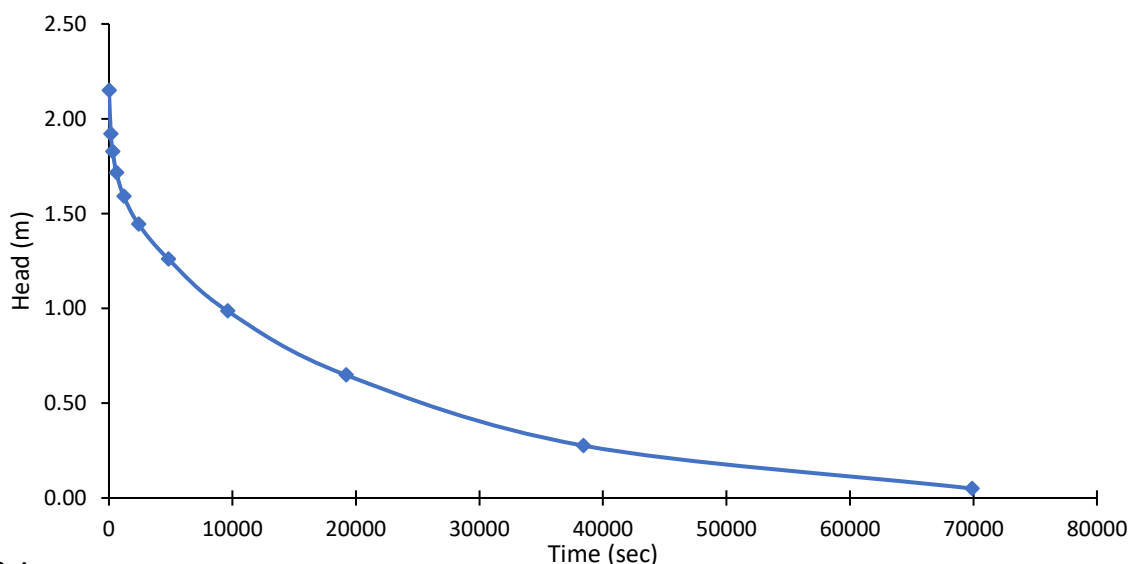
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 3.71\text{E-}06 \text{ ms}^{-1} = 0.32 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 4.93\text{E-}07 \text{ ms}^{-1} = 0.04 \text{ m/day}$$



STRATIGRAPHIC LOG

Clay

EOH @ 2.15m

Data

Time (sec)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	2.150	2.035	1.71E-06	1.60E-05
150	0.230	1.920	1.874	7.99E-07	6.99E-06
300	0.323	1.828	1.772	5.27E-07	4.43E-06
600	0.434	1.716	1.654	3.34E-07	2.67E-06
1200	0.559	1.591	1.517	2.28E-07	1.70E-06
2400	0.706	1.444	1.352	1.72E-07	1.19E-06
4800	0.889	1.261	1.123	1.77E-07	1.07E-06
9600	1.164	0.986	0.817	1.87E-07	9.18E-07
19200	1.502	0.648	0.462	2.68E-07	9.62E-07
38400	1.874	0.276	0.163	5.26E-07	1.19E-06
69891	2.100	0.050			

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.



CLIENT:	Te Kowhai East LP	DESIGNER:	NK
PROJECT:	Te Kowhai East Industrial Development	CHECKED:	AS
		REVISION:	0
TITLE:	SO25-02 Falling Head Permeability Test	DATE:	6/11/2025
		PROJECT:	HAM2025-0116

Specifications - Open-Ended Tube

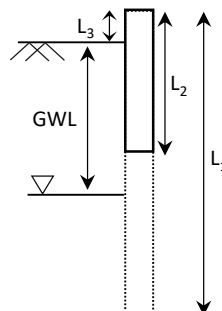
Length L_1 : 2 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

Ground Conditions

GWL: m BGL (Blank = Bottom of hole)

Permeability Anisotropy
 $m = \sqrt{k_h/k_v}$
 m : 1

Bottom of Test Hole: 2.00 m BGL



Hydraulic Conductivity (k)

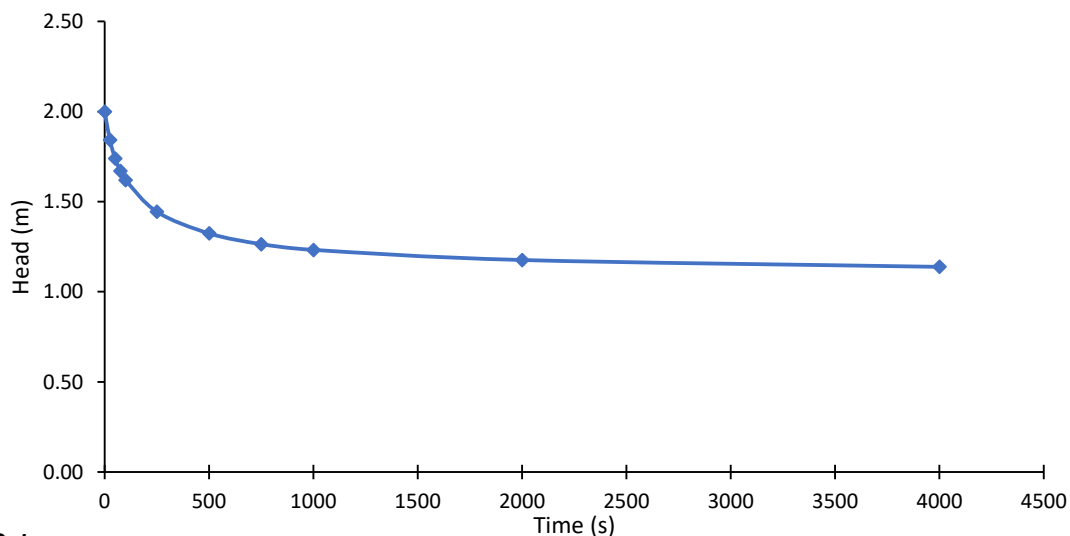
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 1.89\text{E-}05 \text{ ms}^{-1} = 1.63 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 2.11\text{E-}06 \text{ ms}^{-1} = 0.18 \text{ m/day}$$



STRATIGRAPHIC LOG

Clay

EOH @ 2m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	2.000				
25	0.158	1.842	1.921		6.53E-06	6.31E-05
50	0.260	1.740	1.791		4.74E-06	4.34E-05
75	0.329	1.671	1.705		3.50E-06	3.09E-05
100	0.380	1.620	1.645		2.71E-06	2.33E-05
250	0.556	1.444	1.532		1.79E-06	1.46E-05
500	0.676	1.324	1.384		8.70E-07	6.57E-06
750	0.736	1.264	1.294		4.84E-07	3.48E-06
1000	0.768	1.232	1.248		2.76E-07	1.93E-06
2000	0.824	1.176	1.204		1.29E-07	8.80E-07
4000	0.862	1.138	1.157		4.68E-08	3.10E-07

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.



CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-03 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : **1.3 m**
 Diameter: **90 mm**
 Non-Perm L_2 : **0 m**
 Above Gnd L_3 : **0 m**

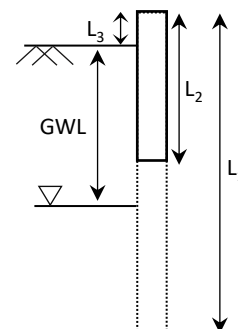
Ground Conditions

GWL: **1.1 m BGL** (Blank = Bottom of hole)

Permeability Anisotropy

m : **1** $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: **1.30 m BGL**



Hydraulic Conductivity (k)

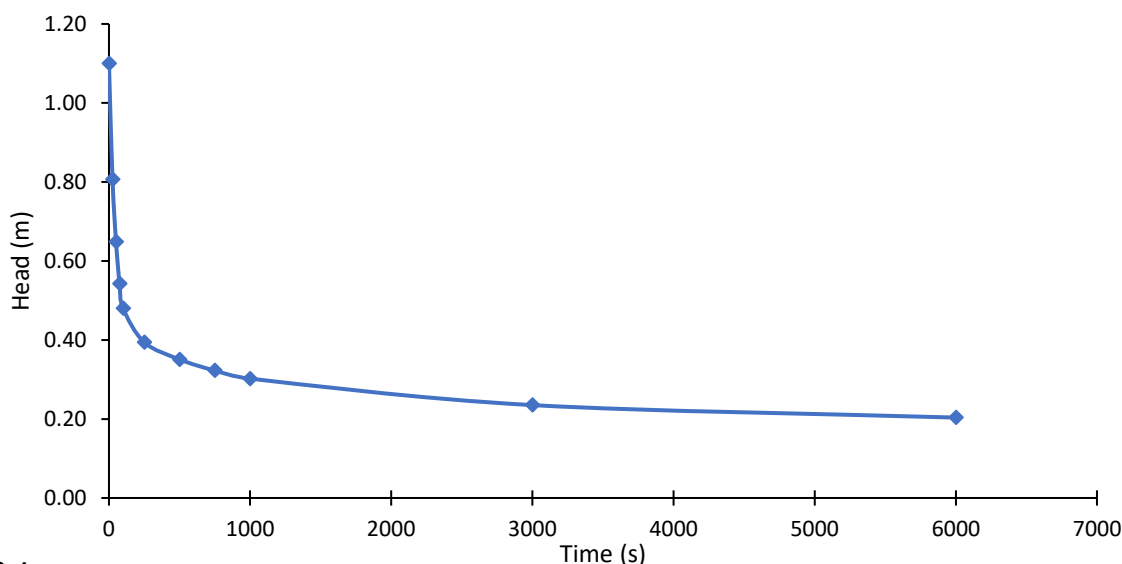
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 6.60\text{E-}05 \text{ ms}^{-1} = 5.70 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 1.21\text{E-}05 \text{ ms}^{-1} = 1.05 \text{ m/day}$$



STRATIGRAPHIC LOG

	Silt
	Sand
	Sandy Silt
EOH @ 1.3m	

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	1.100	1.153	3.53E-05	2.35E-04
25	0.293	0.807	0.928	2.88E-05	1.62E-04
50	0.451	0.649	0.796	2.62E-05	1.31E-04
75	0.558	0.542	0.711	1.93E-05	8.81E-05
100	0.620	0.480	0.637	5.54E-06	2.34E-05
250	0.706	0.394	0.572	2.11E-06	8.17E-06
500	0.749	0.351	0.537	1.57E-06	5.79E-06
750	0.778	0.323	0.512	1.26E-06	4.47E-06
1000	0.798	0.302	0.469	6.37E-07	2.12E-06
3000	0.865	0.235	0.419	2.61E-07	7.82E-07
6000	0.897	0.204			

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.



CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-04 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : **1.3 m**
 Diameter: **90 mm**
 Non-Perm L_2 : **0 m**
 Above Gnd L_3 : **0 m**

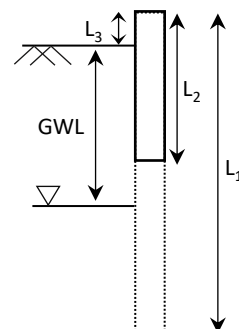
Ground Conditions

GWL: **1.2 m BGL** (Blank = Bottom of hole)

Permeability Anisotropy

m : **1** $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: **1.30 m BGL**



Hydraulic Conductivity (k)

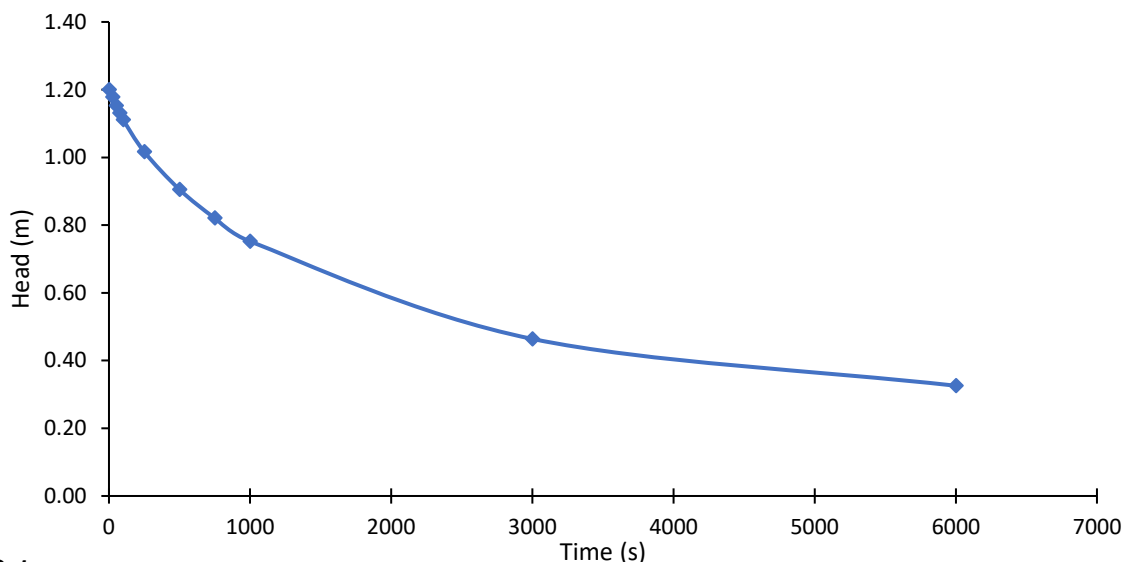
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 9.80\text{E-}06 \text{ ms}^{-1} = 0.85 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 1.53\text{E-}06 \text{ ms}^{-1} = 0.13 \text{ m/day}$$



STRATIGRAPHIC LOG

	Sandy Silt
	Sand
	Sandy Silt
EOH @ 1.3m	

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	1.200			
25	0.022	1.178	1.289	1.95E-06	1.39E-05
50	0.047	1.153	1.265	2.34E-06	1.65E-05
75	0.069	1.131	1.242	2.06E-06	1.43E-05
100	0.089	1.111	1.221	1.90E-06	1.30E-05
250	0.184	1.017	1.164	1.68E-06	1.12E-05
500	0.295	0.905	1.061	1.40E-06	8.69E-06
750	0.379	0.821	0.963	1.26E-06	7.28E-06
1000	0.448	0.752	0.886	1.19E-06	6.47E-06
3000	0.736	0.464	0.708	9.54E-07	4.55E-06
6000	0.874	0.326	0.495	5.81E-07	2.11E-06

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.



CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-02 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : 0.9 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

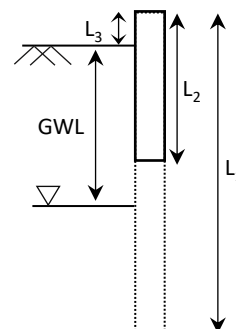
Ground Conditions

GWL: 0.9 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m : 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 0.90 m BGL



Hydraulic Conductivity (k)

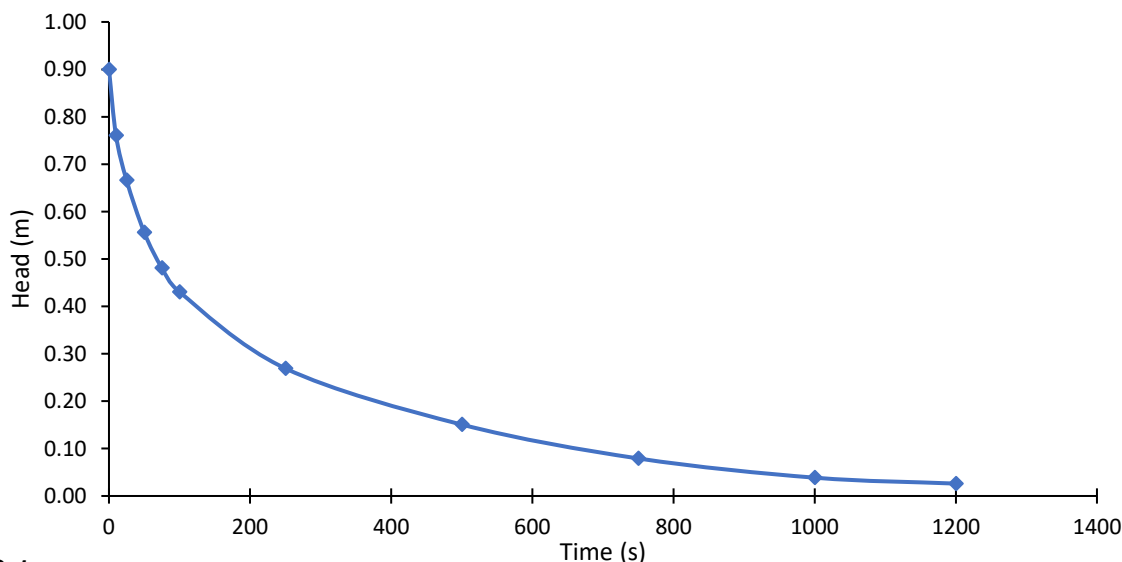
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 9.74\text{E-}05 \text{ ms}^{-1} = 8.42 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 2.89\text{E-}05 \text{ ms}^{-1} = 2.50 \text{ m/day}$$



STRATIGRAPHIC LOG

Sandy Silt

Sand

EOH @ 0.9m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	0.900	0.830	6.00E-05	3.14E-04
10	0.140	0.760	0.713	3.48E-05	1.63E-04
25	0.234	0.666	0.611	3.13E-05	1.32E-04
50	0.344	0.556	0.518	2.77E-05	1.04E-04
75	0.419	0.481	0.456	2.30E-05	7.92E-05
100	0.470	0.430	0.350	1.87E-05	5.59E-05
250	0.631	0.269	0.210	1.77E-05	3.89E-05
500	0.749	0.151	0.115	2.41E-05	3.76E-05
750	0.821	0.079	0.059	3.04E-05	3.30E-05
1000	0.861	0.039	0.032	2.16E-05	1.61E-05
1200	0.874	0.026			

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.

CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-06 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : **1 m**
 Diameter: **90 mm**
 Non-Perm L_2 : **0 m**
 Above Gnd L_3 : **0 m**

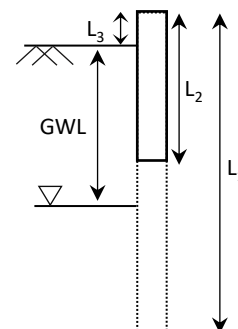
Ground Conditions

GWL: **0.8 m BGL** (Blank = Bottom of hole)

Permeability Anisotropy

m : **1** $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: **1.00 m BGL**



Hydraulic Conductivity (k)

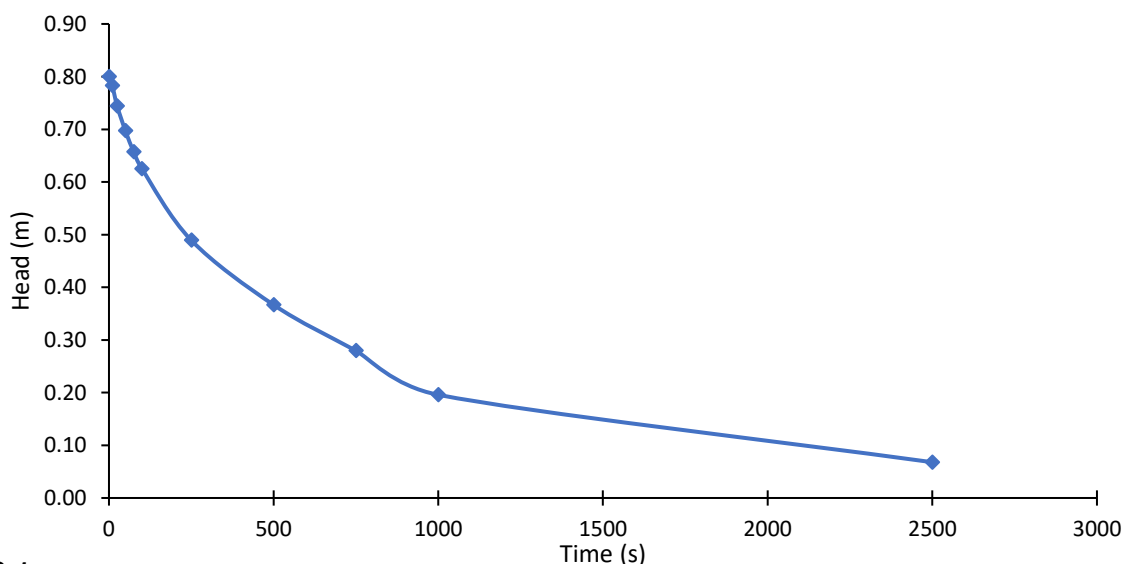
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 3.35E-05 \text{ ms}^{-1} = 2.89 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 6.97E-06 \text{ ms}^{-1} = 0.60 \text{ m/day}$$



STRATIGRAPHIC LOG

Silt

Sand

EOH @ 1m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	0.800	0.991	6.79E-06	3.97E-05
10	0.017	0.783	0.963	1.10E-05	6.32E-05
25	0.056	0.744	0.920	8.64E-06	4.78E-05
50	0.103	0.697	0.877	8.07E-06	4.31E-05
75	0.143	0.657	0.841	7.07E-06	3.66E-05
100	0.175	0.625	0.757	6.18E-06	2.98E-05
250	0.311	0.489	0.628	4.91E-06	2.07E-05
500	0.433	0.367	0.523	5.16E-06	1.88E-05
750	0.520	0.280	0.438	7.52E-06	2.38E-05
1000	0.604	0.196	0.332	4.34E-06	1.15E-05
2500	0.732	0.068			

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.



CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-07 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : 0.9 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

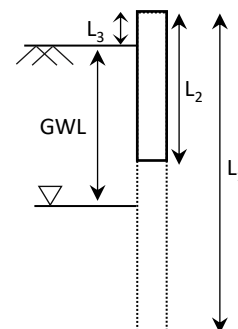
Ground Conditions

GWL: 0.45 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m : 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 0.90 m BGL



Hydraulic Conductivity (k)

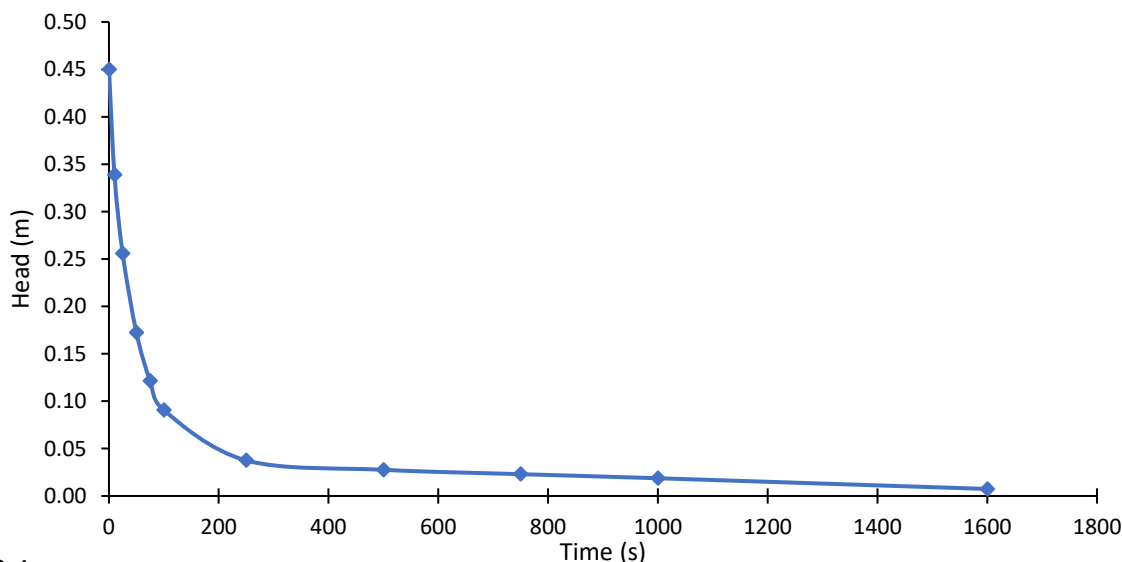
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 1.56\text{E-}04 \text{ ms}^{-1} = 13.47 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 4.02\text{E-}05 \text{ ms}^{-1} = 3.47 \text{ m/day}$$



STRATIGRAPHIC LOG

Fill
Sand
EOH @ 0.9m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	0.450	0.844	9.99E-05	5.04E-04
10	0.111	0.339	0.747	7.16E-05	3.22E-04
25	0.194	0.256	0.664	6.49E-05	2.60E-04
50	0.278	0.172	0.597	6.17E-05	2.13E-04
75	0.329	0.121	0.556	5.38E-05	1.62E-04
100	0.359	0.091	0.514	2.83E-05	7.13E-05
250	0.413	0.038	0.483	6.13E-06	1.01E-05
500	0.422	0.028	0.475	3.68E-06	5.14E-06
750	0.427	0.023	0.471	4.20E-06	5.13E-06
1000	0.431	0.019	0.463	7.91E-06	6.91E-06
1600	0.443	0.007			

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.



CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-08 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : 1.2 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

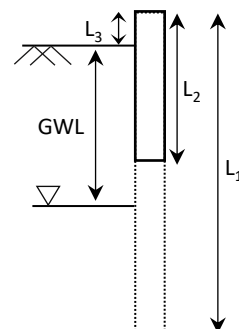
Ground Conditions

GWL: 1 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m : 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.20 m BGL



Hydraulic Conductivity (k)

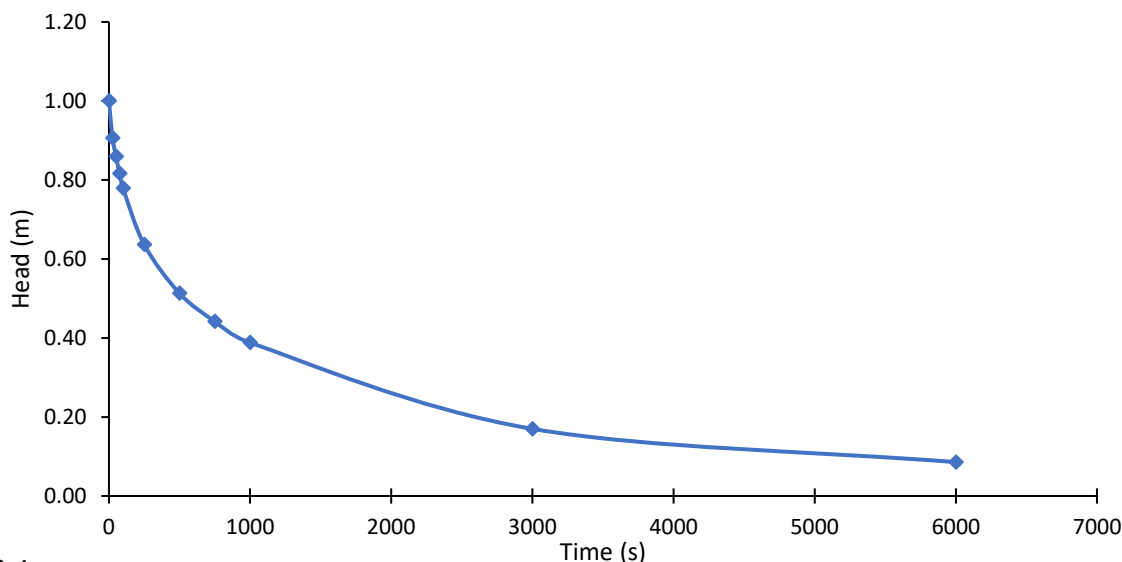
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 2.57\text{E-}05 \text{ ms}^{-1} = 2.22 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 4.56\text{E-}06 \text{ ms}^{-1} = 0.39 \text{ m/day}$$



STRATIGRAPHIC LOG

Silt

Sand

EOH @ 1.2m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	1.000	1.153	1.12E-05	7.33E-05
25	0.093	0.907	1.083	6.34E-06	3.96E-05
50	0.140	0.860	1.038	6.36E-06	3.85E-05
75	0.184	0.816	0.998	5.81E-06	3.42E-05
100	0.221	0.779	0.908	4.54E-06	2.50E-05
250	0.364	0.636	0.775	3.21E-06	1.57E-05
500	0.487	0.513	0.677	2.42E-06	1.07E-05
750	0.558	0.442	0.615	2.24E-06	9.16E-06
1000	0.612	0.388	0.479	2.07E-06	7.59E-06
3000	0.830	0.170	0.328	1.41E-06	3.46E-06
6000	0.914	0.086			

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.

CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-09 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : **1 m**
 Diameter: **90 mm**
 Non-Perm L_2 : **0 m**
 Above Gnd L_3 : **0 m**

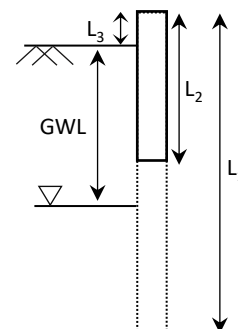
Ground Conditions

GWL: **1 m BGL** (Blank = Bottom of hole)

Permeability Anisotropy

m : **1** $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: **1.00 m BGL**



Hydraulic Conductivity (k)

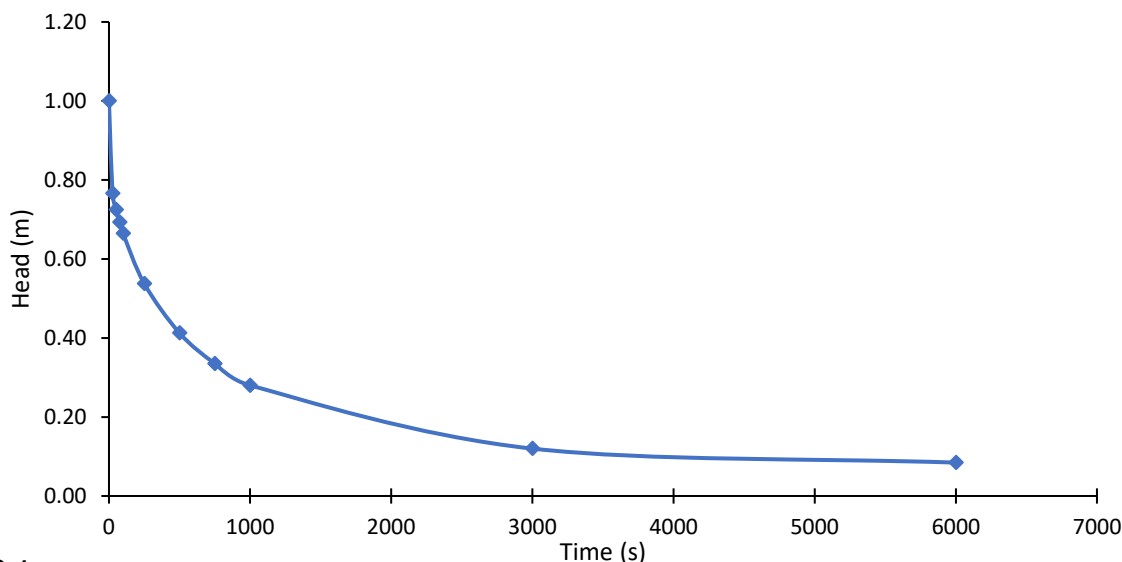
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 3.86E-05 \text{ ms}^{-1} = 3.33 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 8.40E-06 \text{ ms}^{-1} = 0.73 \text{ m/day}$$



STRATIGRAPHIC LOG

Silt

Sand

EOH @ 1m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)		Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	1.000				
25	0.234	0.766	0.883		3.63E-05	2.00E-04
50	0.276	0.724	0.745		8.61E-06	4.16E-05
75	0.307	0.693	0.709		6.95E-06	3.24E-05
100	0.335	0.665	0.679		6.78E-06	3.07E-05
250	0.462	0.538	0.601		6.19E-06	2.59E-05
500	0.588	0.412	0.475		5.35E-06	1.91E-05
750	0.665	0.335	0.374		4.79E-06	1.45E-05
1000	0.720	0.280	0.308		4.60E-06	1.23E-05
3000	0.880	0.120	0.200		3.30E-06	7.37E-06
6000	0.916	0.085	0.102		1.13E-06	1.60E-06

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.

CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-10 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : **1.8 m**
 Diameter: **90 mm**
 Non-Perm L_2 : **0 m**
 Above Gnd L_3 : **0 m**

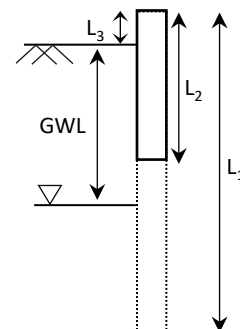
Ground Conditions

GWL: **1.8 m BGL** (Blank = Bottom of hole)

Permeability Anisotropy

m : **1** $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: **1.80 m BGL**



Hydraulic Conductivity (k)

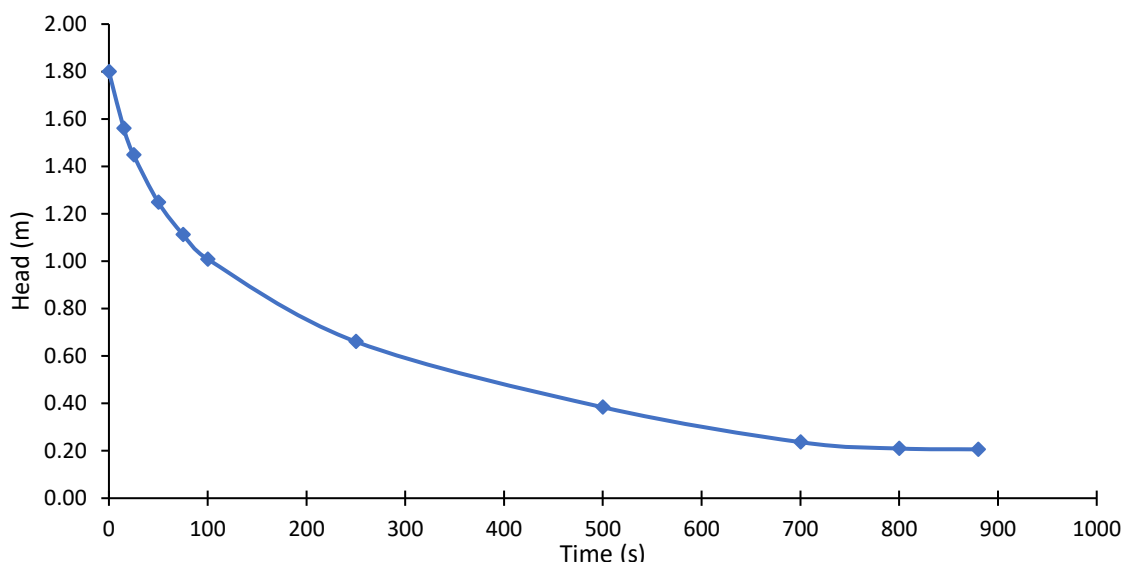
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 7.57\text{E-}05 \text{ ms}^{-1} = 6.54 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 1.25\text{E-}05 \text{ ms}^{-1} = 1.08 \text{ m/day}$$



STRATIGRAPHIC LOG

Fill
Sand
EOH @ 1.8m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	1.800	1.680	2.08E-05	1.82E-04
15	0.240	1.560	1.504	1.76E-05	1.42E-04
25	0.352	1.448	1.348	1.52E-05	1.13E-04
50	0.552	1.248	1.180	1.30E-05	8.72E-05
75	0.688	1.112	1.060	1.18E-05	7.35E-05
100	0.792	1.008	0.834	1.00E-05	5.38E-05
250	1.140	0.660	0.522	1.04E-05	4.08E-05
500	1.416	0.384	0.310	1.54E-05	4.26E-05
700	1.564	0.237	0.223	8.95E-06	1.96E-05
800	1.590	0.210	0.208	1.66E-06	3.48E-06
880	1.594	0.206			

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.



CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-11 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : 0.9 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

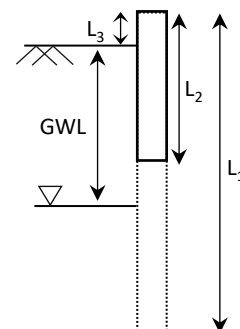
Ground Conditions

GWL: 0.5 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m : 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 0.90 m BGL



Hydraulic Conductivity (k)

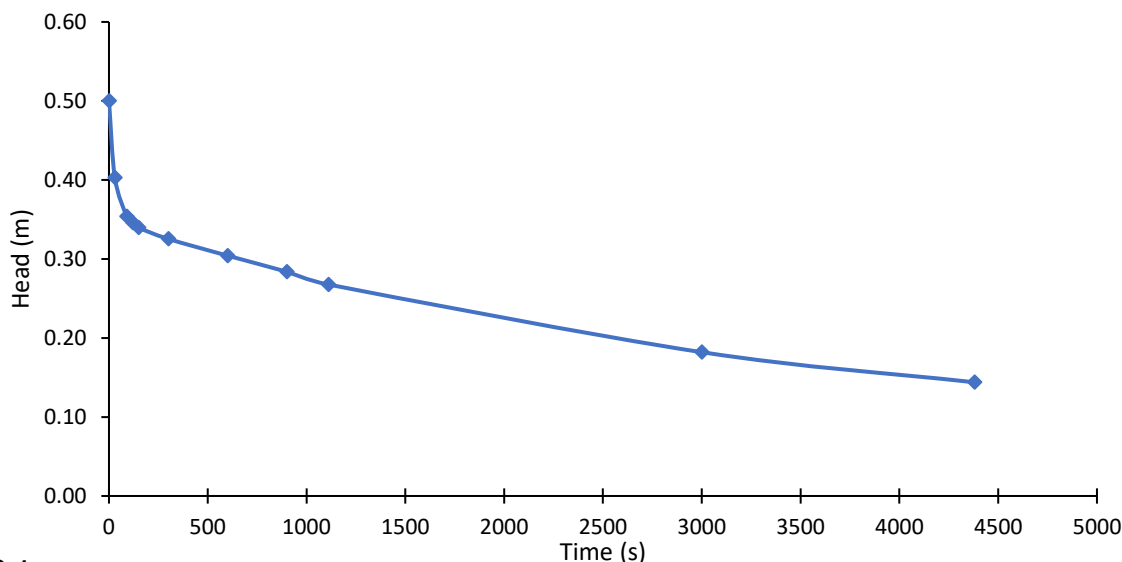
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 2.14\text{E-}05 \text{ ms}^{-1} = 1.85 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 4.42\text{E-}06 \text{ ms}^{-1} = 0.38 \text{ m/day}$$



STRATIGRAPHIC LOG

Silt

EOH @ 0.9m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	0.500	0.851	2.52E-05	1.29E-04
30	0.097	0.403	0.778	7.99E-06	3.77E-05
90	0.146	0.354	0.750	2.97E-06	1.35E-05
120	0.154	0.346	0.743	2.27E-06	1.03E-05
150	0.160	0.340	0.732	1.10E-06	4.90E-06
300	0.175	0.325	0.715	8.81E-07	3.84E-06
600	0.196	0.304	0.694	9.25E-07	3.92E-06
900	0.216	0.284	0.676	1.13E-06	4.67E-06
1110	0.232	0.268	0.625	8.72E-07	3.39E-06
3000	0.318	0.182	0.563	7.75E-07	2.62E-06
4380	0.356	0.144			

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.

CLIENT: **Te Kowhai East LP**

PROJECT: **Te Kowhai East Industrial Development**

TITLE: **SO25-12 Falling Head Permeability Test**

DESIGNER: **NK**

CHECKED: **AS**

REVISION: **0**

DATE: **6/11/2025**

PROJECT: **HAM2025-0116**

Specifications - Open-Ended Tube

Length L_1 : 1.2 m
Diameter: 90 mm
Non-Perm L_2 : 0 m
Above Gnd L_3 : 0 m

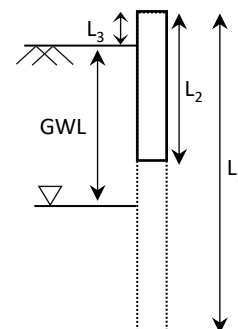
Ground Conditions

GWL: 1 m BGL (Blank = Bottom of hole)

Permeability Anisotropy

m : 1 $m = \sqrt{k_h/k_v}$

Bottom of Test Hole: 1.20 m BGL



Hydraulic Conductivity (k)

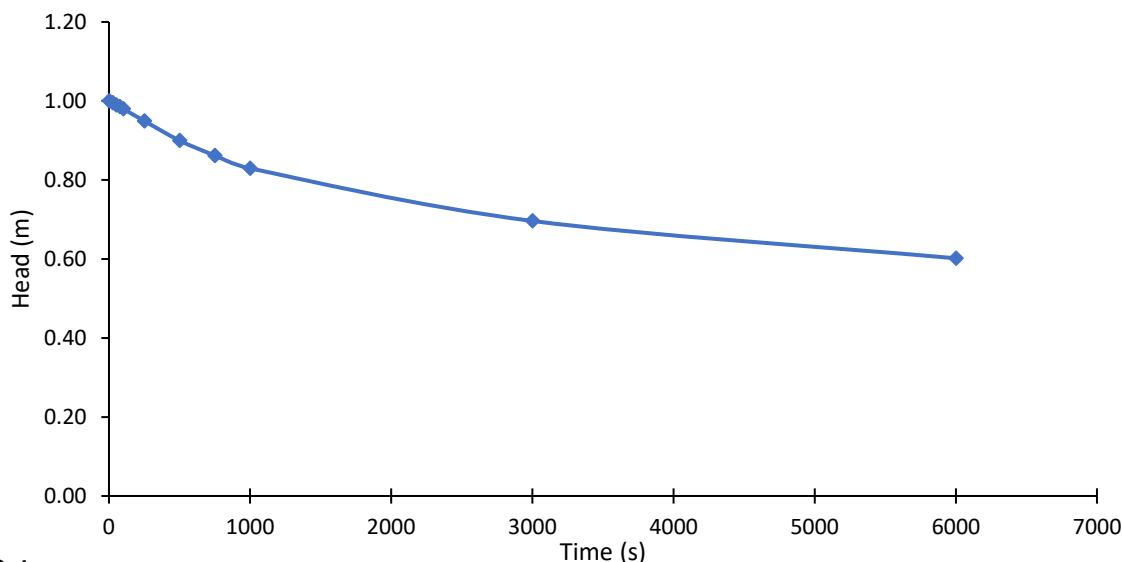
Note: CMW considers the CIRIA 113 value the most appropriate method for most purposes, but also provides the analysis method as outlined by Hvorslev if desired.

CIRIA 113: Somerville (1986), Control of groundwater for temporary works, CIRIA Report 113, Appendix 4

$$k = \left(\log \frac{h_1}{h_2} - \log \frac{2h_1 + d}{2h_2 + d} \right) \cdot \frac{(h_1 + h_2)}{2(t_2 - t_1)} = 3.14E-06 \text{ ms}^{-1} = 0.27 \text{ m/day}$$

Hvorslev: Hvorslev (1951) Time Lag and Soil Permeability in Ground-Water Observations, Fig 18, p49

$$k = \frac{d^2 \ln \left(\frac{mL}{d} + \sqrt{\left(\frac{mL}{d} \right)^2 + 1} \right)}{8L(t_2 - t_1)} \ln \frac{H_1}{H_2} = 4.88E-07 \text{ ms}^{-1} = 0.04 \text{ m/day}$$



STRATIGRAPHIC LOG

Silt

Sand

EOH @ 1.2m

Data

Time (s)	Tape Avg (m)	Head (m)	Perm. Length (m)	Hvorslev 'k' Case G (ms ⁻¹)	CIRIA 113 'k' (ms ⁻¹)
0	0.000	1.000			
25	0.005	0.995	1.198	5.23E-07	3.52E-06
50	0.010	0.990	1.192	6.40E-07	4.30E-06
75	0.015	0.985	1.188	4.75E-07	3.18E-06
100	0.020	0.980	1.183	5.81E-07	3.88E-06
250	0.051	0.949	1.165	6.04E-07	3.99E-06
500	0.100	0.900	1.125	6.22E-07	4.00E-06
750	0.138	0.862	1.081	5.11E-07	3.19E-06
1000	0.171	0.829	1.046	4.70E-07	2.86E-06
3000	0.304	0.696	0.963	2.82E-07	1.62E-06
6000	0.398	0.602	0.849	1.71E-07	8.92E-07

The hydraulic conductivity values above are calculated as an average across the whole data set. Any designer using these values may consider the raw data and other calculation methods, and must satisfy themselves as to their suitability.

APPENDIX H

Geohazard Assessment Table

NATURAL HAZARDS RISK ASSESSMENT FOR LANDUSE CHANGE

PROPOSED INDUSTRIAL DEVELOPMENT, TE KOWHAI EAST, WAIKATO

1 CONTEXT

This appendix to CMW report reference HAM2025-0116AF Rev0 sets out the criteria for and presents the results of an assessment of the geotechnical-related natural hazards associated with this proposed subdivision development.

Section 106 of the Resource Management Act (RMA) requires an assessment of the risk from natural hazards to be carried out when considering the granting of a subdivision consent. S106 RMA specifically states that the assessment must consider the combined effect of the natural hazard likelihood and material damage to land, other land, or structures (consequence).

Section 2 of the RMA defines natural hazards as any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.

The National Policy Statement for Natural Hazards 2025 (NPS-NH) provides direction under the Resource Management Act 1991 for assessing the risk associated with natural hazards for subdivision, use and development.

2 BASIS OF ASSESSMENT

2.1 Risk Classification

The occurrence of natural hazards and their potential impacts on the proposed subdivision development is assessed in terms of risk significance, which is based on likelihood and consequence factors. A risk matrix is used to assess the likelihood and consequence factors, the form of which used by CMW for this project is presented in Table B1 which is derived from Appendix 1 of the NPS-NH.

Table B1: Risk Matrix

	Almost certain Up to 10 10% or more	Very Likely 10-20 10% to 5%	Likely 20 – 50 5% to 2%	Possible 50 – 100 2% to 1%	Unlikely 100 – 500 1% to 0.2%	Rare 500 – 5000 0.2% to 0.02%	Very rare >5000 <0.02%
ARI (Years) AEP							
Catastrophic	Very High	Very High	Very High	High	Medium	Medium	Medium
Major	Very High	Very High	High	High	Medium	Medium	Medium
Moderate	High	High	High	Medium	Medium	Low	Low
Minor	Medium	Medium	Medium	Medium	Low	Low	Low
Negligible	Low	Low	Low	Low	Low	Low	Low

2.2 Likelihood

With respect to assessing the likelihood or chance of the risk occurring, the qualitative definitions used by CMW for this project are provided in Table B2 for each likelihood classification, which is derived from Appendix 1 of the NPS-NH.

Table B2: Likelihood Classification (extract from NPS-NH)

Likelihood Level	Annual Exceedance Probability (AEP)	Average Recurrence Interval (ARI) or 'Return Period'
Almost Certain	10% or more	Up to and including 10 years
Very Likely	10% to 15%	Over 10 and up to and including 20 years
Likely	5% to 2%	Over 20 and up to and including 50 years
Possible	2% to 1%	Over 50 and up to and including 100 years
Unlikely	1% to 0.2%	Over 100 and up to and including 500 years
Rare	0.2% to 0.02%	Over 500 and up to and including 1000 years
Very Rare	Less than 0.02%	More than 500 years

2.3 Consequence

In terms of determining the consequence or severity of the natural hazard occurring, the qualitative definitions used by CMW for this project are provided in Table B3 for each consequence classification, which is derived from Appendix 1 of the NPS-NH.

Table B3: Consequence Table (extract from NPS-NH)

Consequence Level	Damage to Property	Potential for Injury or Fatalities
Catastrophic	Severe damage to land and building(s), potential for collapse or total destruction of structures. Building(s) need to be demolished, rebuilt or relocated.	High threat to life safety, with probable fatalities and/or critical injuries.
Major	Major damage to land and building(s), including structural damage. Loss of use and substantial repair required.	Unsafe for people, with potential for many injuries, or critical injuries and/or fatalities.
Moderate	Some damage to land and non-structural damage to building(s). Limited loss of use, repairs required.	Unsafe for people, with potential for injuries, although expected to be minor.
Minor	Minor damage to land and building(s). No loss of use, minimal repairs required.	Isolated minor injuries possible.
Negligible	No loss of use, no building repairs required.	No injuries.

2.4 Proportionate Management of Natural Hazard Risk

It is recognised that the natural hazard risk assessment provided herein is qualitative and, due to the wide range of possible geohazards that could occur, is somewhat subjective. Decision-makers must consider the scale and detail of information necessary to assess the risk by having regard to the anticipated level of risk.

Other methods are available to quantitatively assess an acceptable level of geotechnical related natural hazard risk, such as defining an acceptable factor of safety with respect to slope stability or acceptable differential ground settlements with respect to recommended building code limits.

When managing natural hazard risk associated with subdivision, use and development, decision-makers must apply mitigation measures, including location and design, for the purposes of ensuring that:

- (a) very high natural hazard risk is avoided;
- (b) high or medium natural hazard risk is avoided or mitigated proportionate to the level of risk; and
- (c) any creation of, or increase in, significant natural hazard risk on other sites is avoided or mitigated proportionate to the level of natural hazard risk.

3 RISK ASSESSMENT

The natural hazards relevant to this proposed subdivision development and adjacent, potentially affected land have been assessed with respect to the criteria outlined above.

Assessment is based on proposed post development ground conditions with and without any geotechnical controls. The latent risk was first assessed with the site in its proposed developed state to consider the risks to the development and surrounding land, including assessment of land modifications from the pre-existing natural state, without any implemented geotechnical controls. The specific geotechnical mitigation measures and engineering design solutions outlined in the table below and CMW report, where relevant, were then considered to determine the natural hazard residual risk remaining after the proposed controls have been implemented.

Results of this assessment are presented in Table C1 below.

Table C1: Natural Hazard Risk Assessment Results								
NPHS Hazard	Description	Proposed Site Latent Risk of Damage to Land / Structures			Comments and Geotechnical Control	Proposed Site Residual Risk of Damage to Land / Structures OR Acceleration/ Worsening of Hazard with Geotechnical Controls Implemented		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Earthquake	Fault Rupture	Rare	Major	Medium	Approximately 35km from the Kerepehi Fault. Recurrence interval of 2,000 to 3,500 years, no control required.	Rare	Major	Medium
	Liquefaction Subsidence	Rare	Major	Medium	Shallow groundwater table, high risk of surface manifestation of liquefaction. Engineering design required for foundations to withstand seismic induced settlements.	Rare	Minor	Low
	Lateral Spread	Rare	Major	Medium	Shallow groundwater table and liquifiable layers. Lateral movement expected during ULS event neighbouring swales and wetlands. Structures to be designed to withstand lateral movement or engineered remediation required for swale/wetlands.	Rare	Minor	Low
Volcanic Activity	Ash & Pyroclastic Falls	Very Rare	Moderate	Low	No geotechnical controls warranted	Very Rare	Moderate	Low

Table C1: Natural Hazard Risk Assessment Results

NPHS Hazard	Description	Proposed Site Latent Risk of Damage to Land / Structures			Comments and Geotechnical Control	Proposed Site Residual Risk of Damage to Land / Structures OR Acceleration/ Worsening of Hazard with Geotechnical Controls Implemented		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
	Lava flows & Lahars	Very Rare	Moderate	Low	No geotechnical controls warranted	Very Rare	Moderate	Low
Geothermal Activity	Formation of geysers, hot springs, fumaroles, mud pools	Very Rare	Moderate	Low	Low risk due to distance from closest known geothermal area	Very Rare	Moderate	Low
Erosion	Cut and Fill Batters	Almost Certain	Minor	Medium	Slope batters to be designed by geotechnical engineer. Appropriate revegetation / planting of batters to reduce surface erosion risk.	Possible	Minor	Medium
Landslip	Global Slope Instability	Possible	Moderate	Medium	Slope stability assessment for northern cut batter and fill embankment. Engineering design to satisfy required slope factors of safety	Unlikely	Minor	Medium
	Soil Creep	Possible	Minor	Medium	Slope batters to be designed by geotechnical engineer.	Rare	Minor	Low
	Bearing Capacity Failure	Possible	Major	High	Bearing Capacity to be assessed by Geotechnical Engineer and foundations designed to suit.	Unlikely	Major	Low
	Cut & Fill Batter Instability	Possible	Major	High	Slope batters to be designed by geotechnical engineer.	Rare	Moderate	Low
Subsidence	Soft soils leading to foundation subsidence	Rare	Moderate	Low	Isolated low strength soils expected. Undercut and remove any surficial soft soils, existing fill and replace with	Very Rare	Moderate	Low

Table C1: Natural Hazard Risk Assessment Results

NPHS Hazard	Description	Proposed Site Latent Risk of Damage to Land / Structures			Comments and Geotechnical Control	Proposed Site Residual Risk of Damage to Land / Structures OR Acceleration/ Worsening of Hazard with Geotechnical Controls Implemented		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
					engineered fill during earthworks. Geotechnical engineer to observe building preparation works during construction.			
	Sinkholes	Rare	Moderate	Low	Not encountered during investigation. Geologically low risk.	Very Rare	Moderate	Low
	Effects of Dewatering	Possible	Moderate	Medium	Dewatering likely required to construct swales and wetlands. Assessment of dewatering effects should be undertaken as part on detailed design. Develop monitoring plan including possible mitigation measures as required depending on assessment results.	Unlikely	Moderate	Medium
Sedimentation	Rockfall, Debris Inundation	Very Rare	Negligible	Low	Most of site is near level. Northern cut slope/retaining and fill embankment is to be engineer designed.	Very Rare	Negligible	Low
Coastal Erosion & Coastal Inundation	Erosion and Inundation	Very Rare	Negligible	Low	Site is >50km away from coast.	Very Rare	Negligible	Low
Tsunami	Tsunami	Very Rare	Negligible	Low	Site is >50km away from coast.	Very Rare	Negligible	Low
Flooding	Inundation	Rare	Minor	Low	Engineered stormwater disposal design for concentrated flows from roads and roof areas.	Rare	Minor	Low

Notes:

- Assessments include the impact of the proposed subdivision works on adjacent properties.
- The following reference(s) contain information on the hazards contained in this assessment and the non-geotechnical hazards that have not been included:
 - **Waikato**
<https://waikatoregion.maps.arcgis.com/apps/MapSeries/index.html?appid=f2b48398f93146e8a5cf0aa3fddce92c>

APPENDIX I

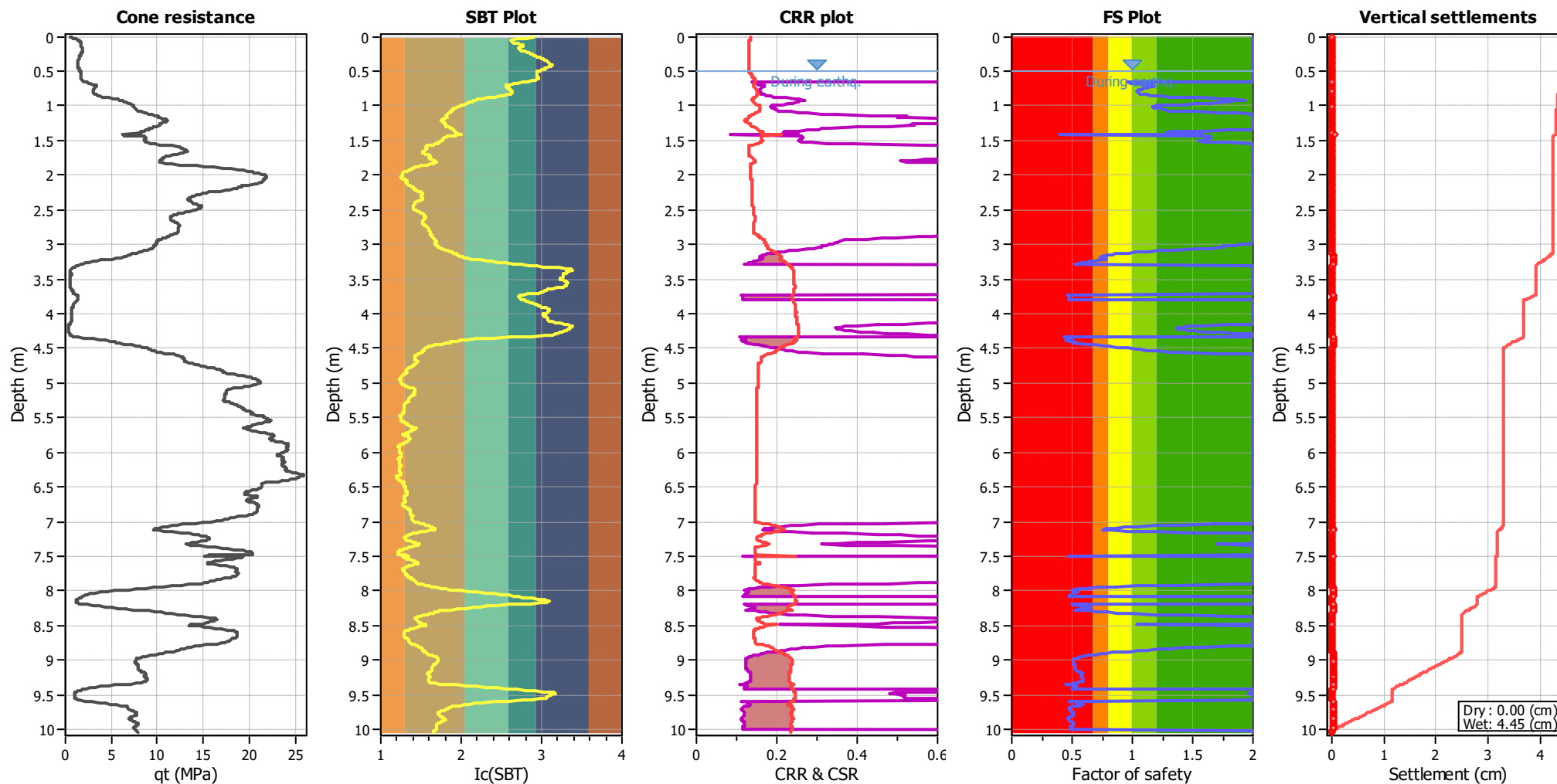
Liquefaction Assessment

Project:

Location:

CPT: CPT25-01

Total depth: 10.04 m



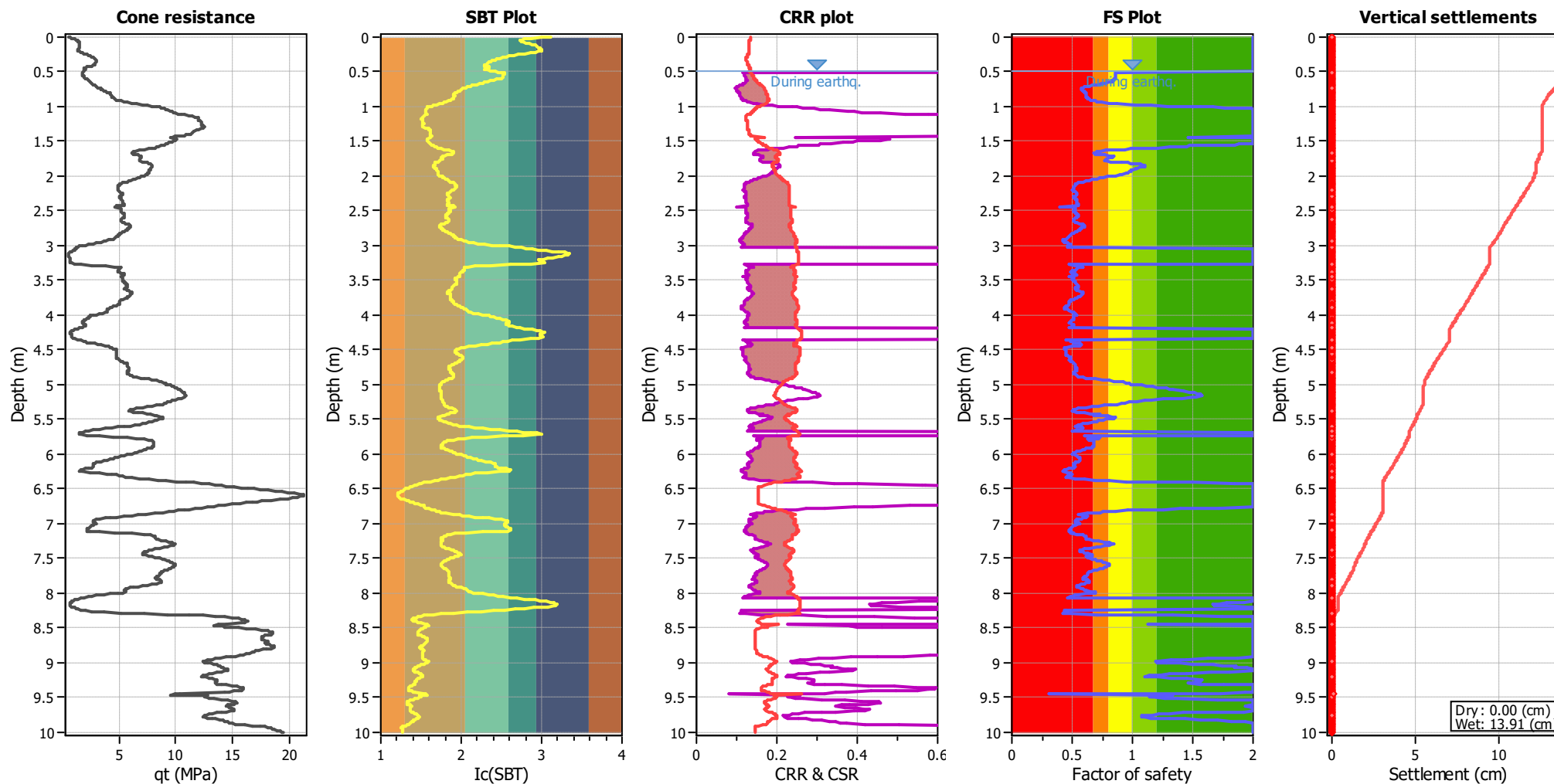
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-02

Total depth: 10.01 m



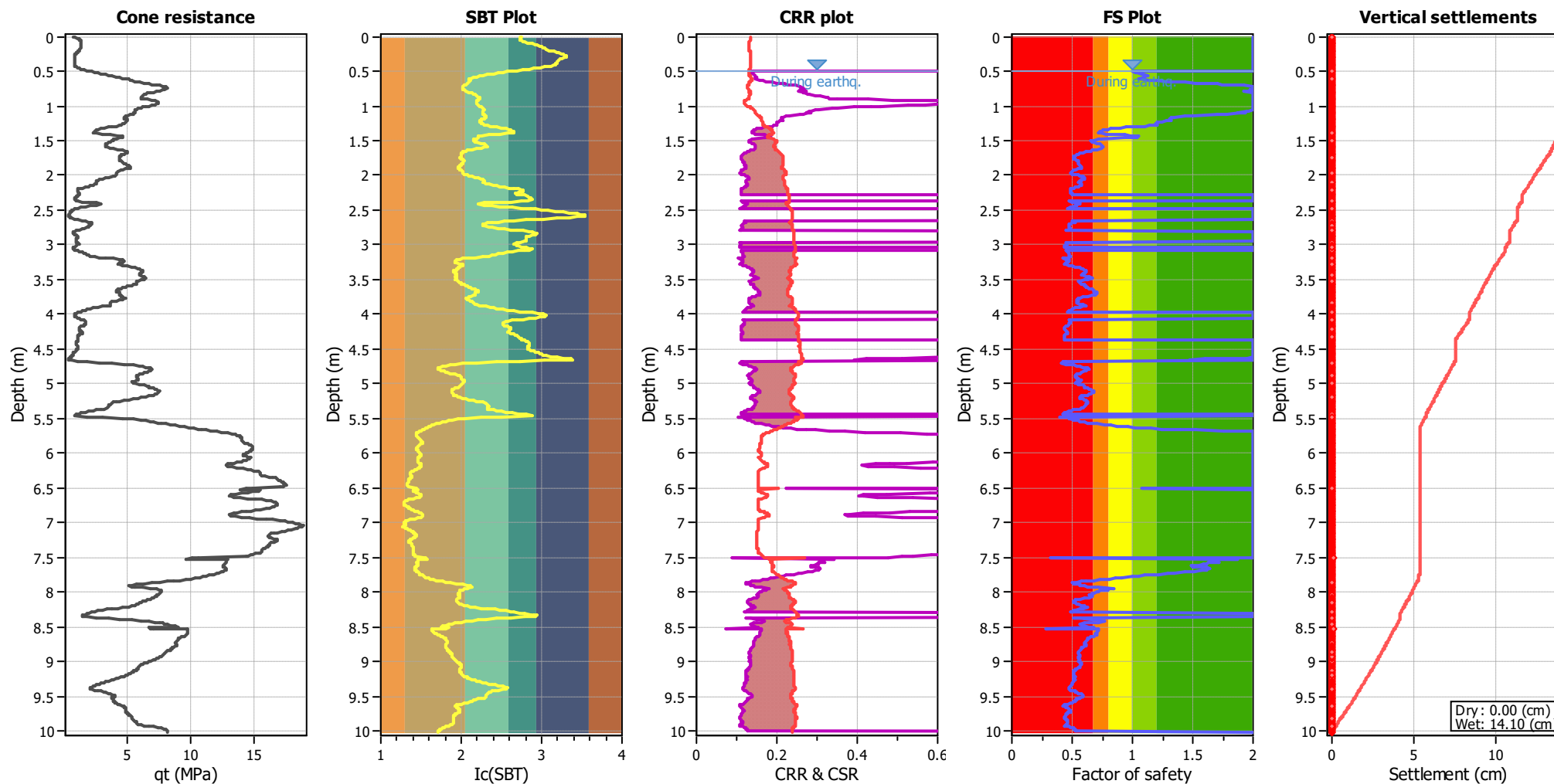
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-03

Total depth: 10.02 m



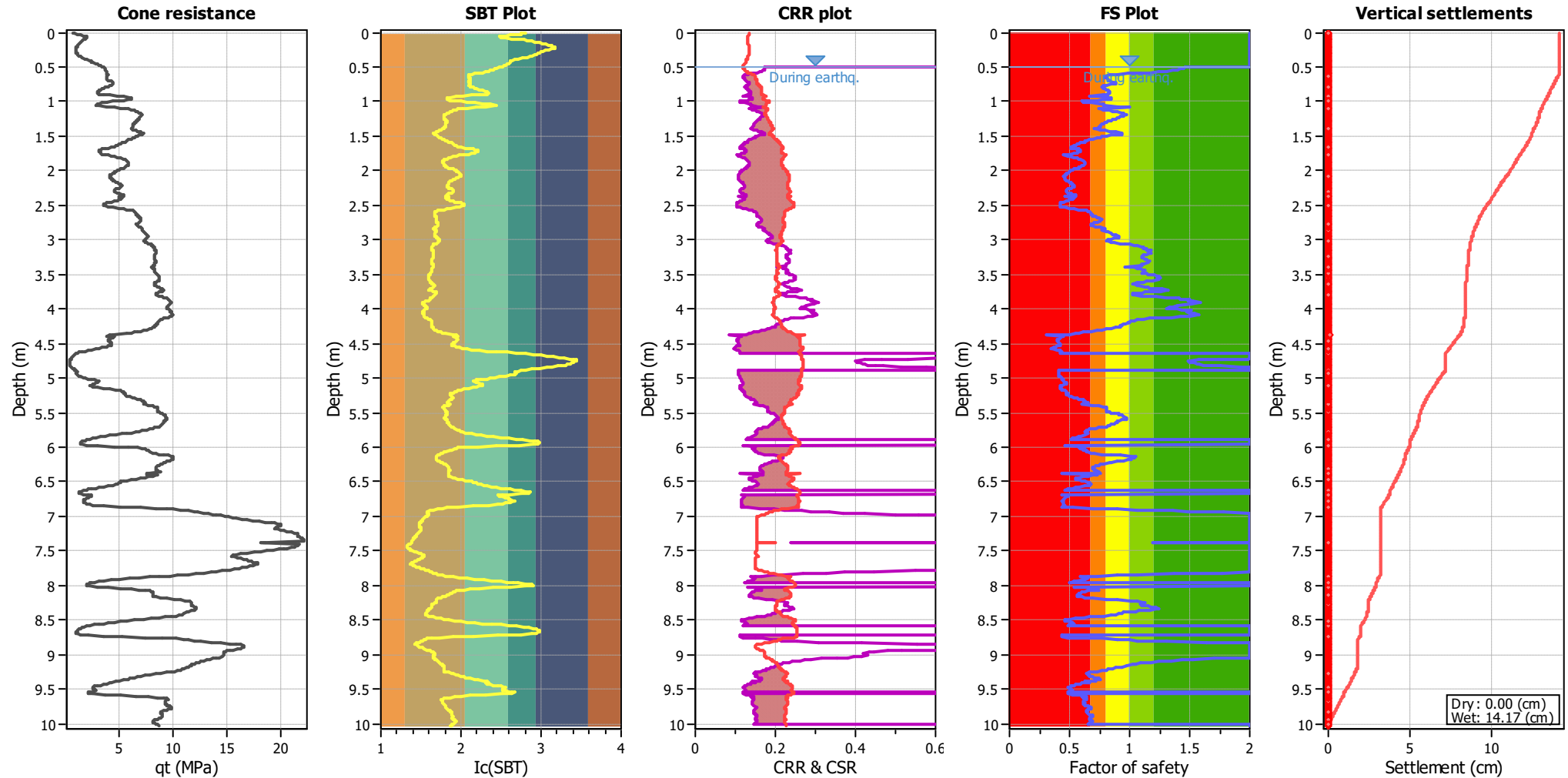
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT25-04

Total depth: 10.03 m



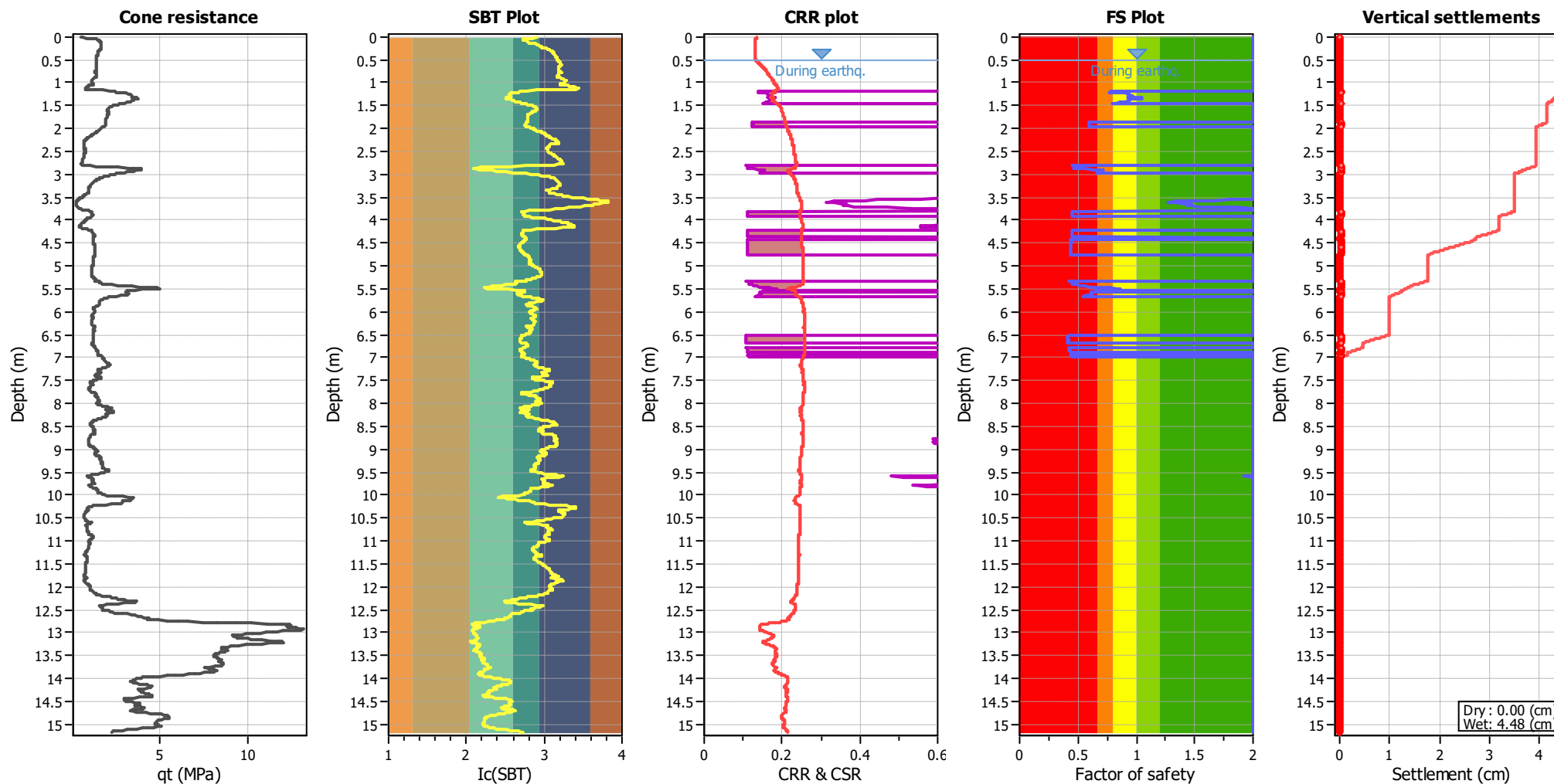
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT25-18

Total depth: 15.18 m



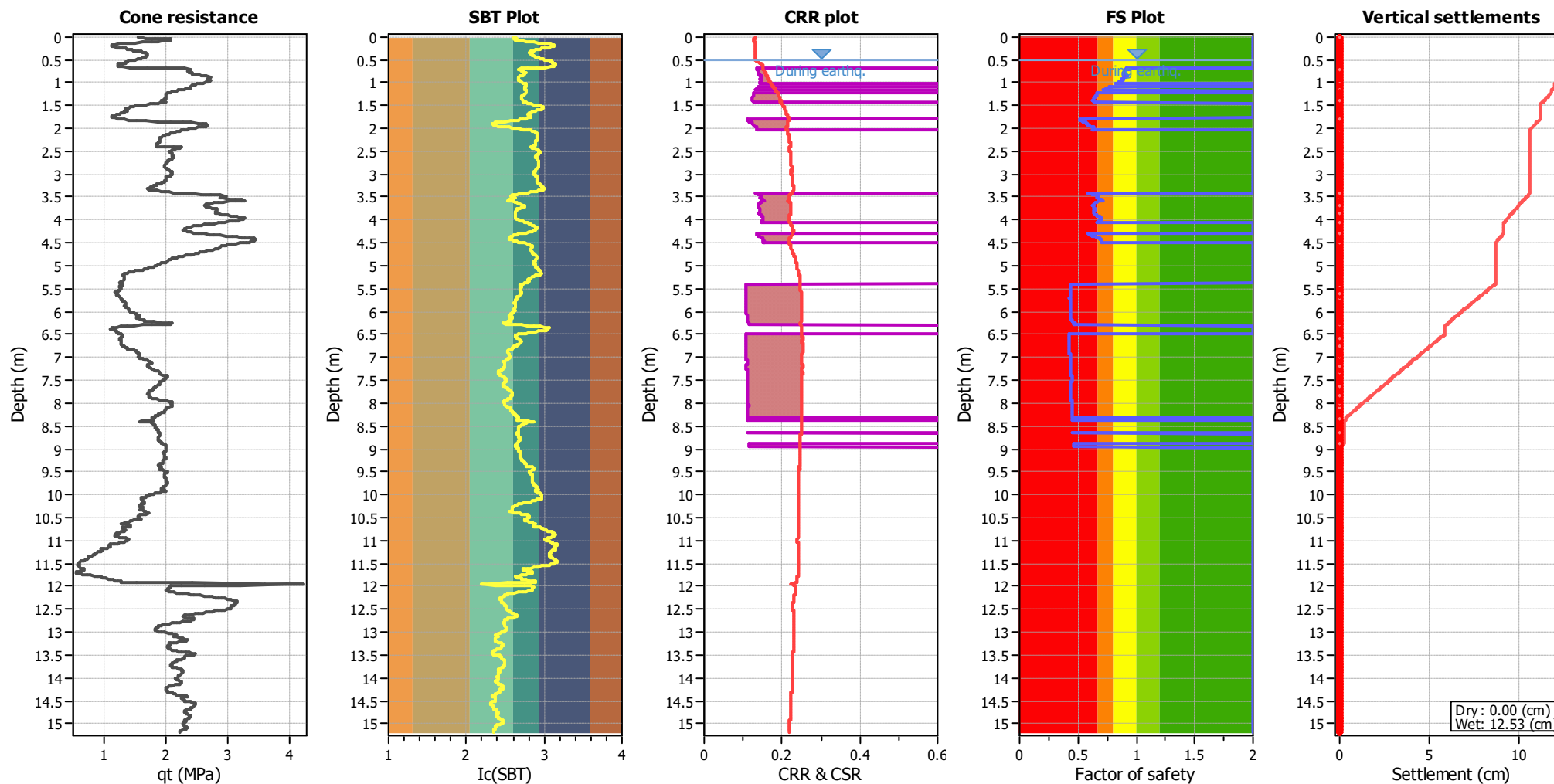
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-19

Total depth: 15.19 m



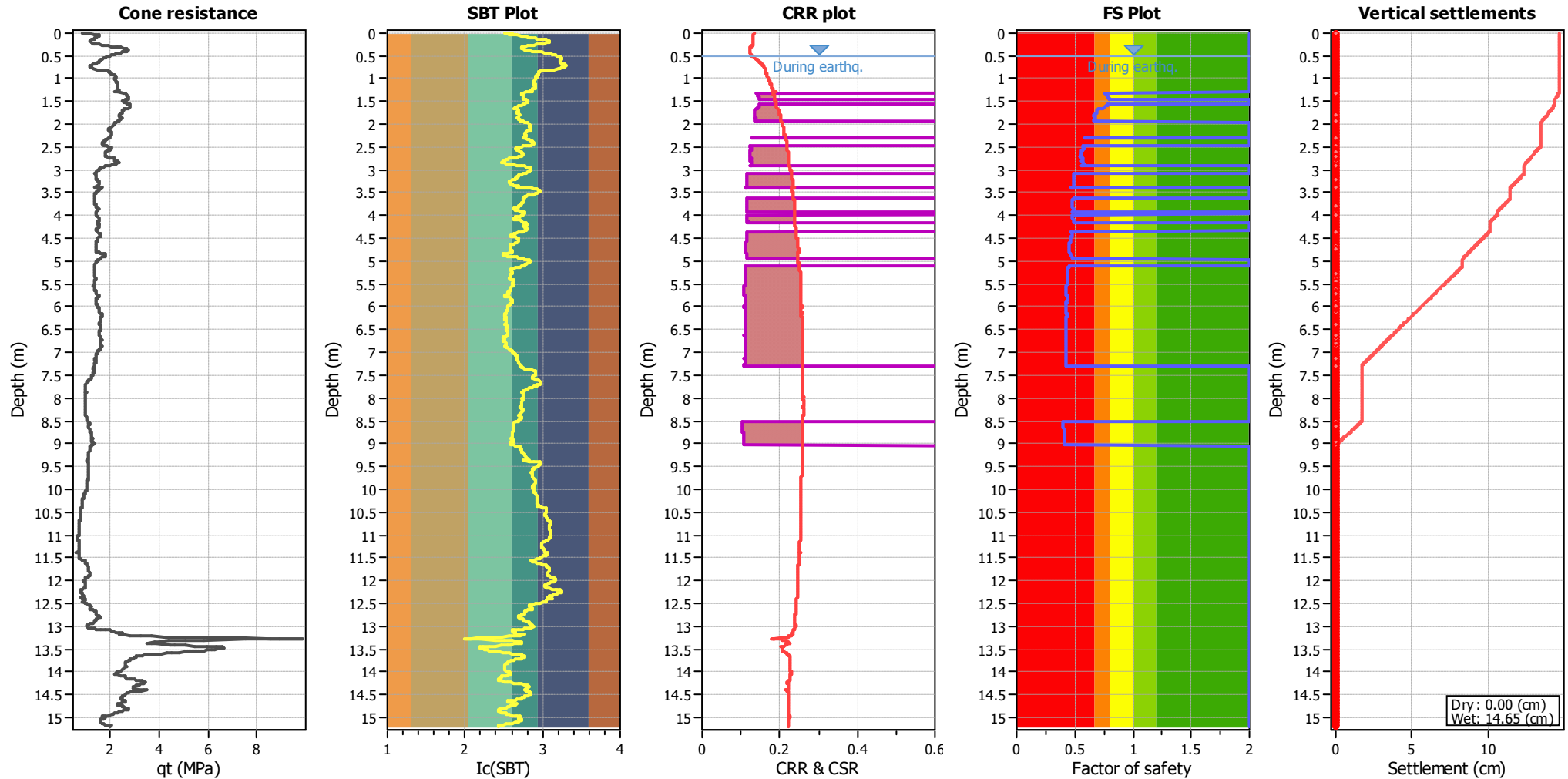
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-20

Total depth: 15.20 m



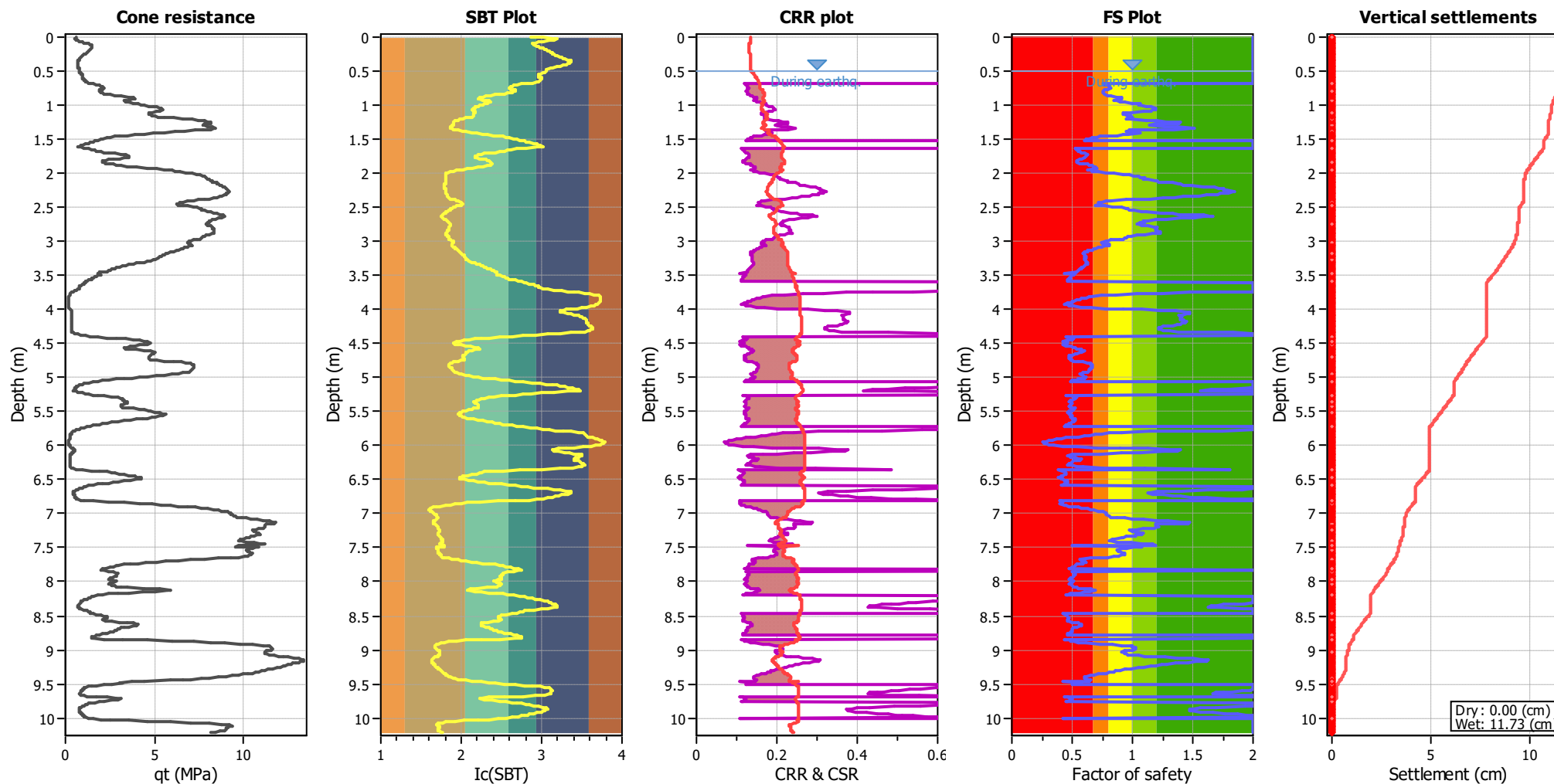
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-21

Total depth: 10.21 m



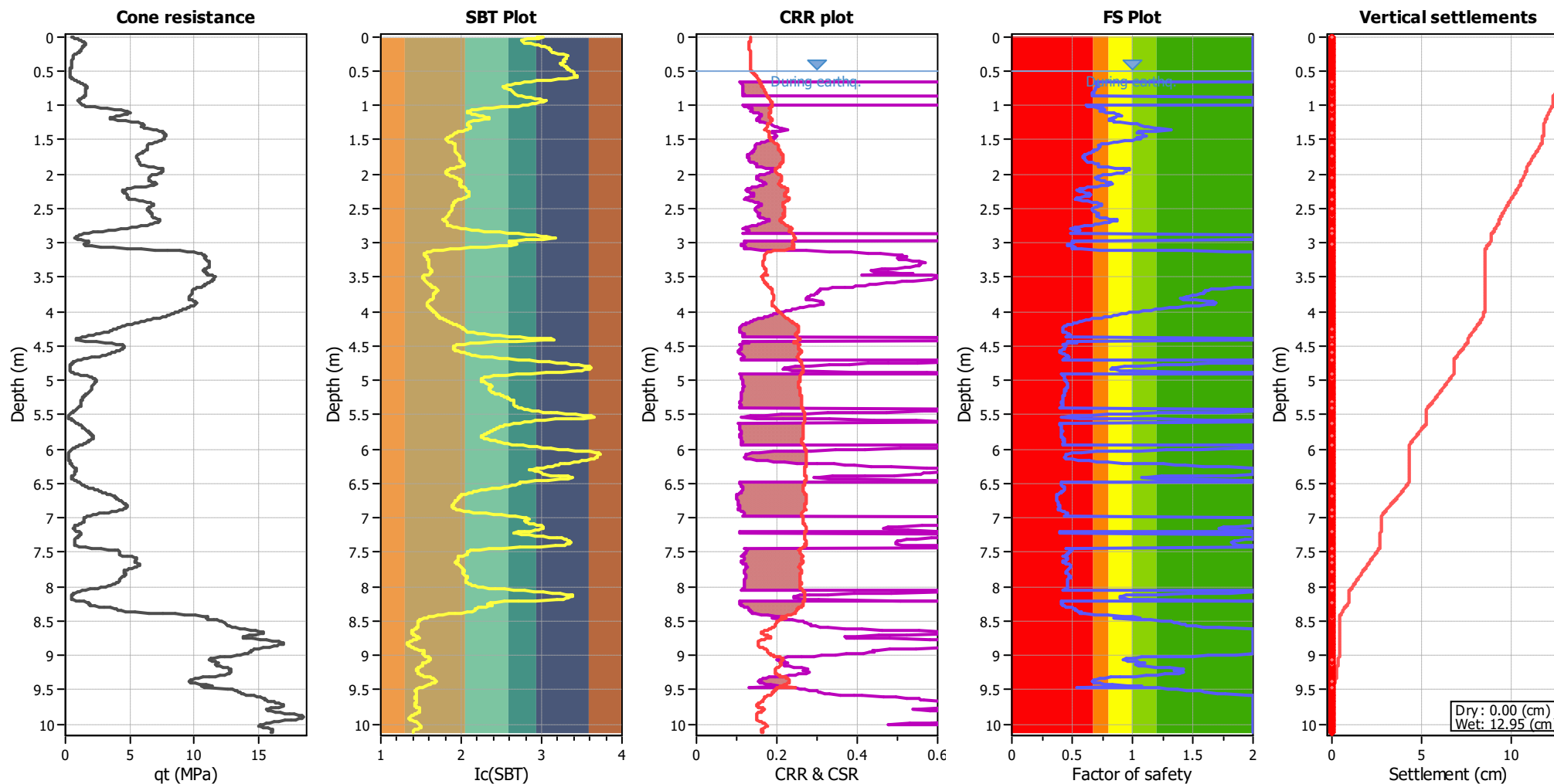
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-08

Total depth: 10.12 m



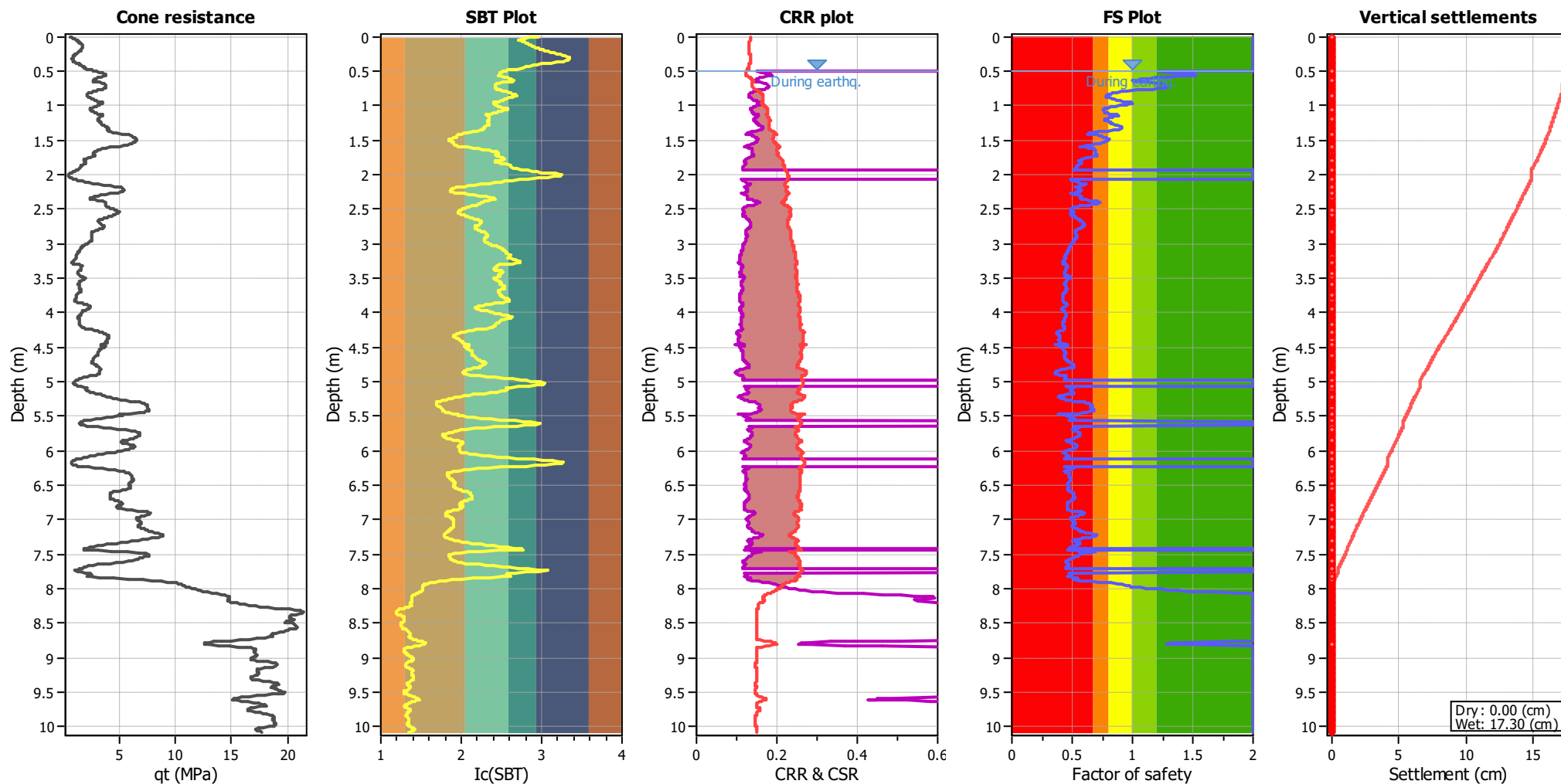
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-09

Total depth: 10.08 m



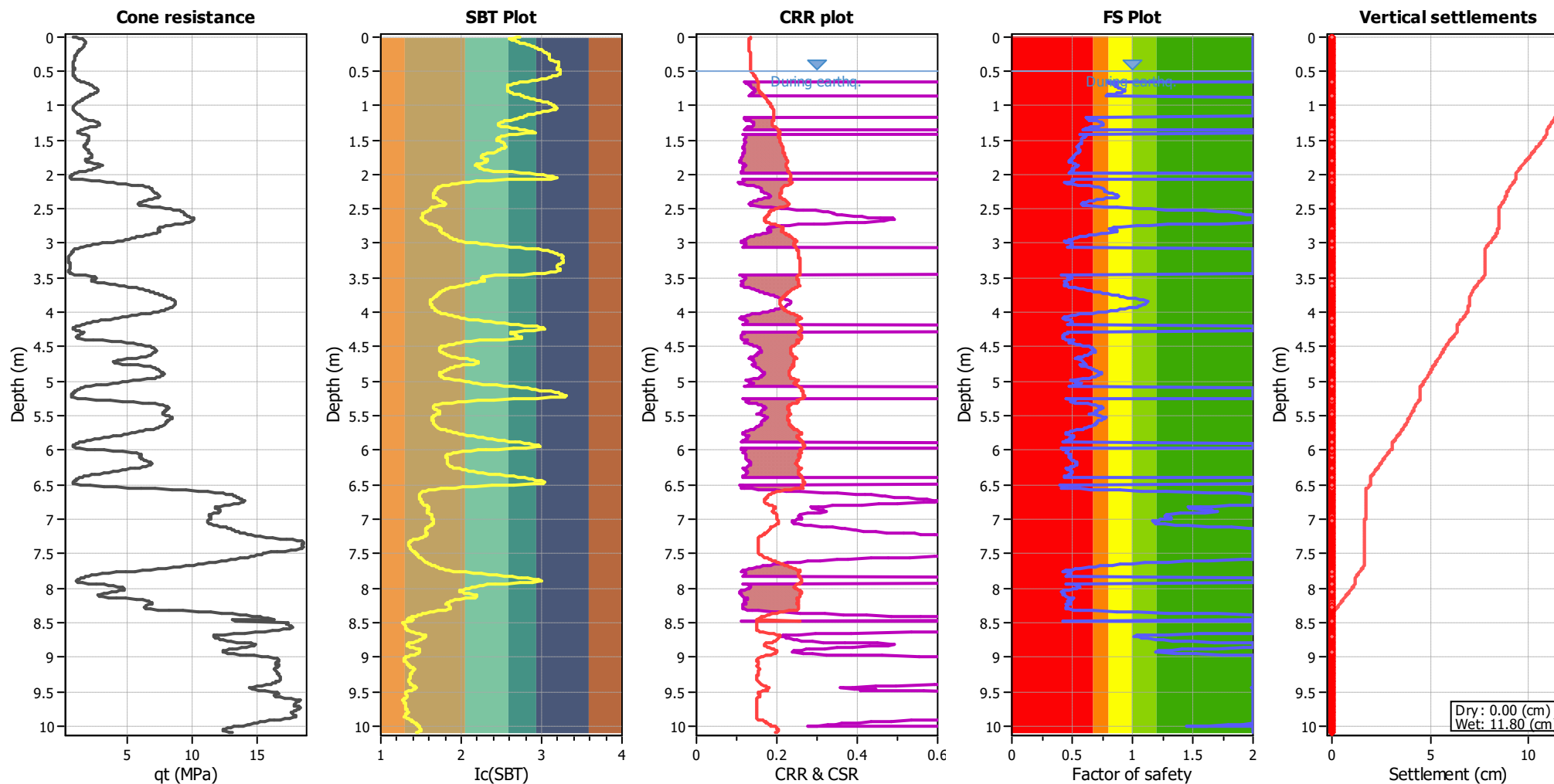
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-10

Total depth: 10.09 m



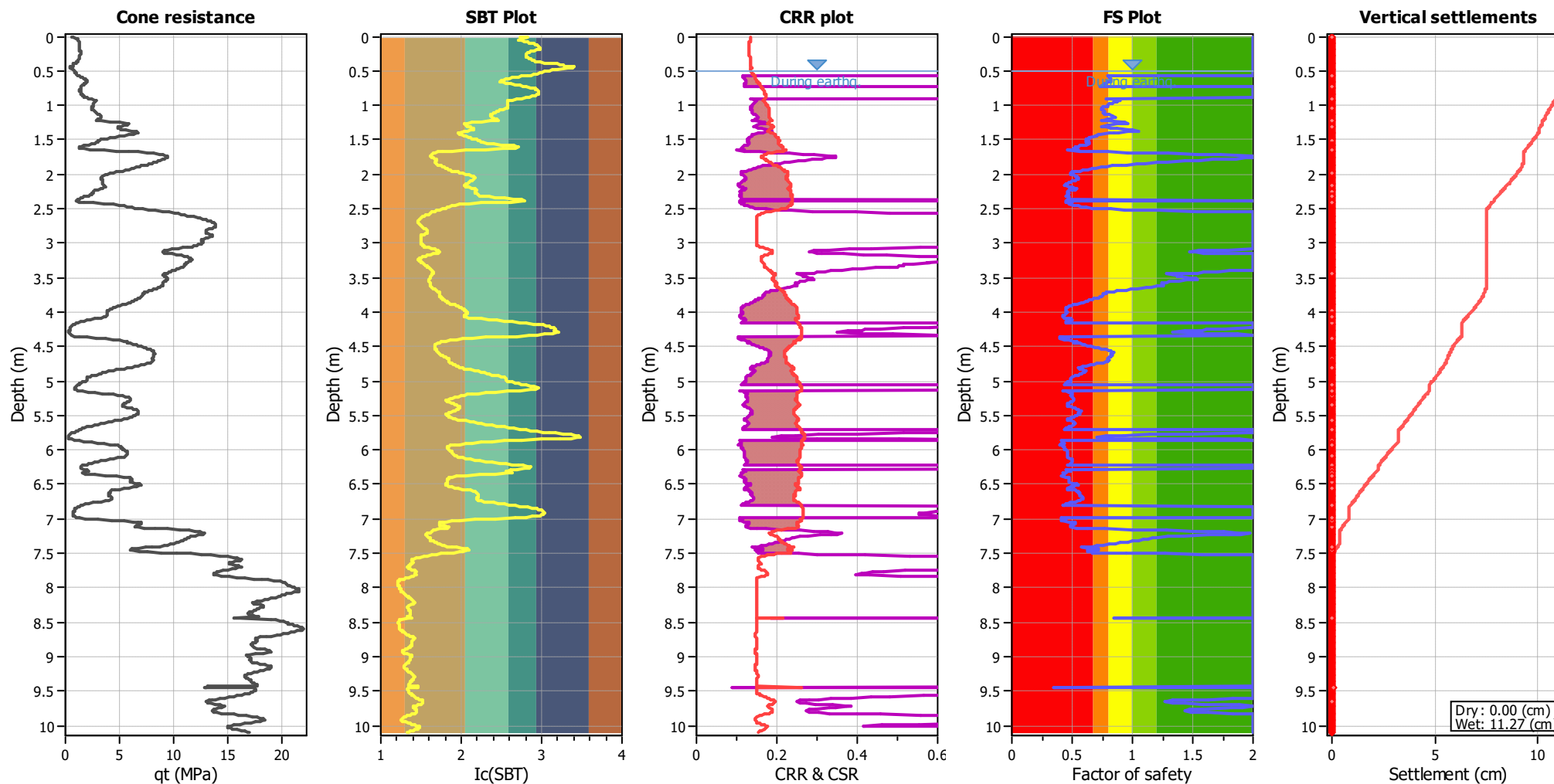
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-11

Total depth: 10.10 m



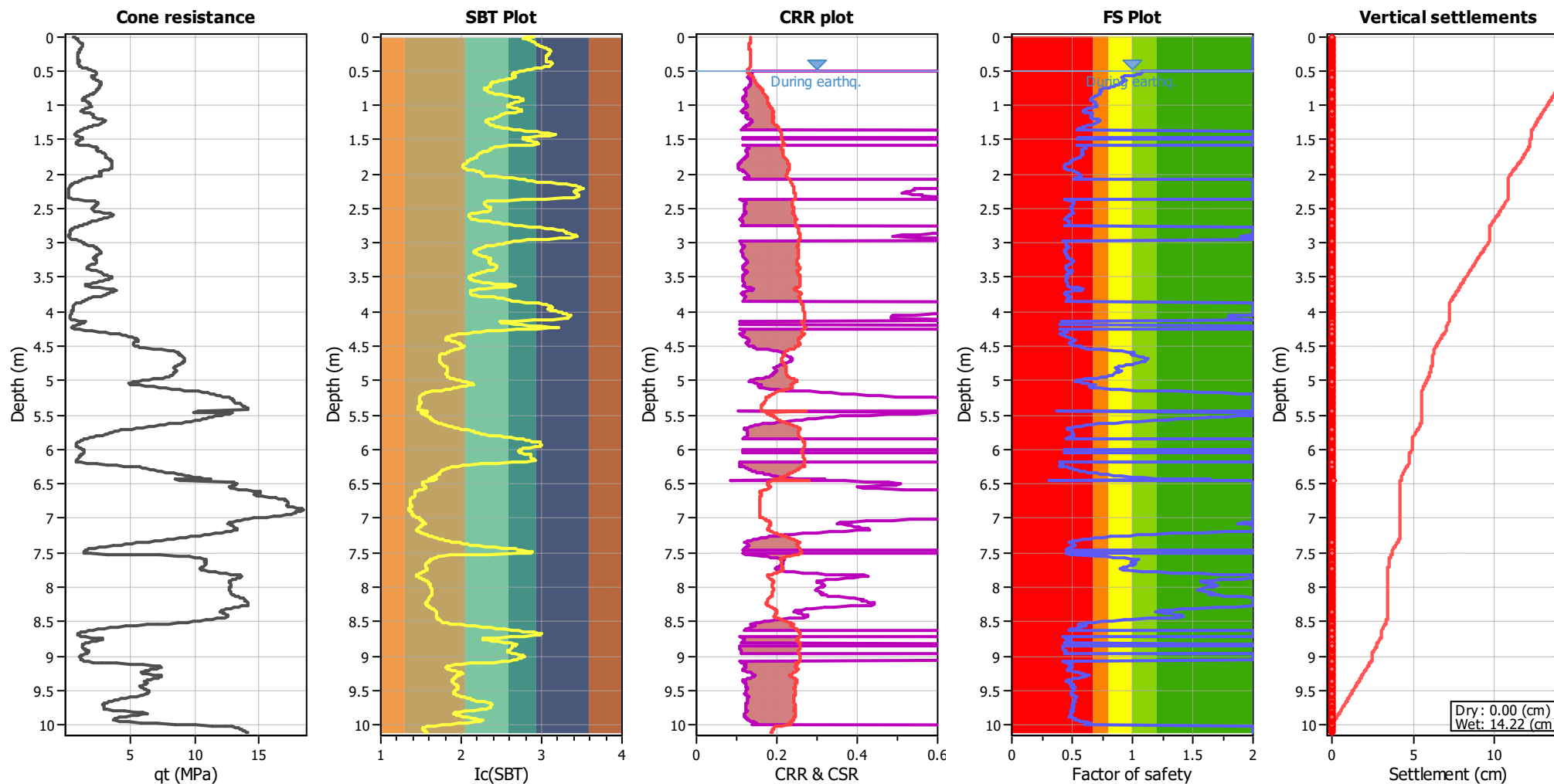
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-12

Total depth: 10.11 m



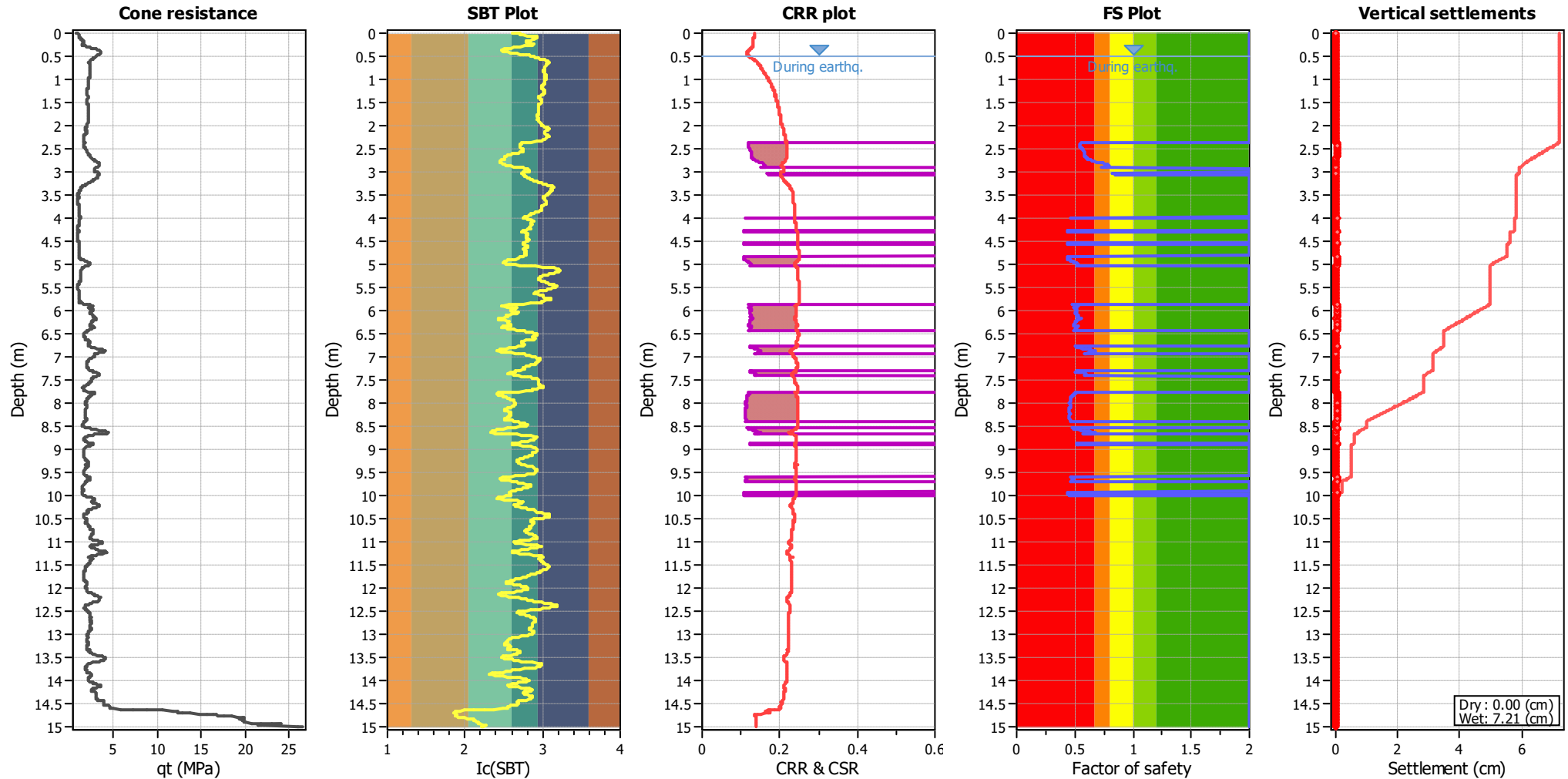
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT25-14

Total depth: 14.99 m



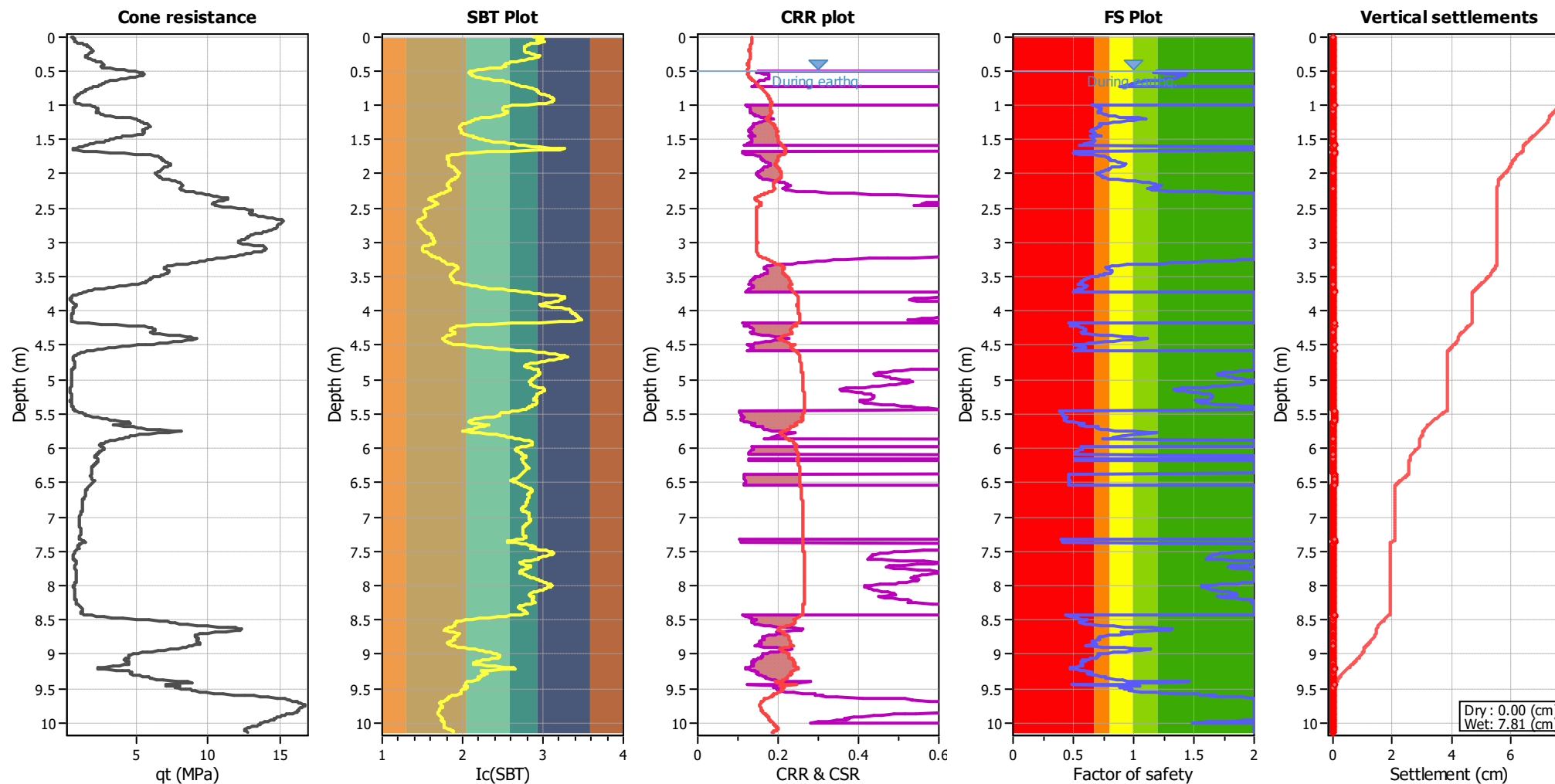
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-15

Total depth: 10.14 m



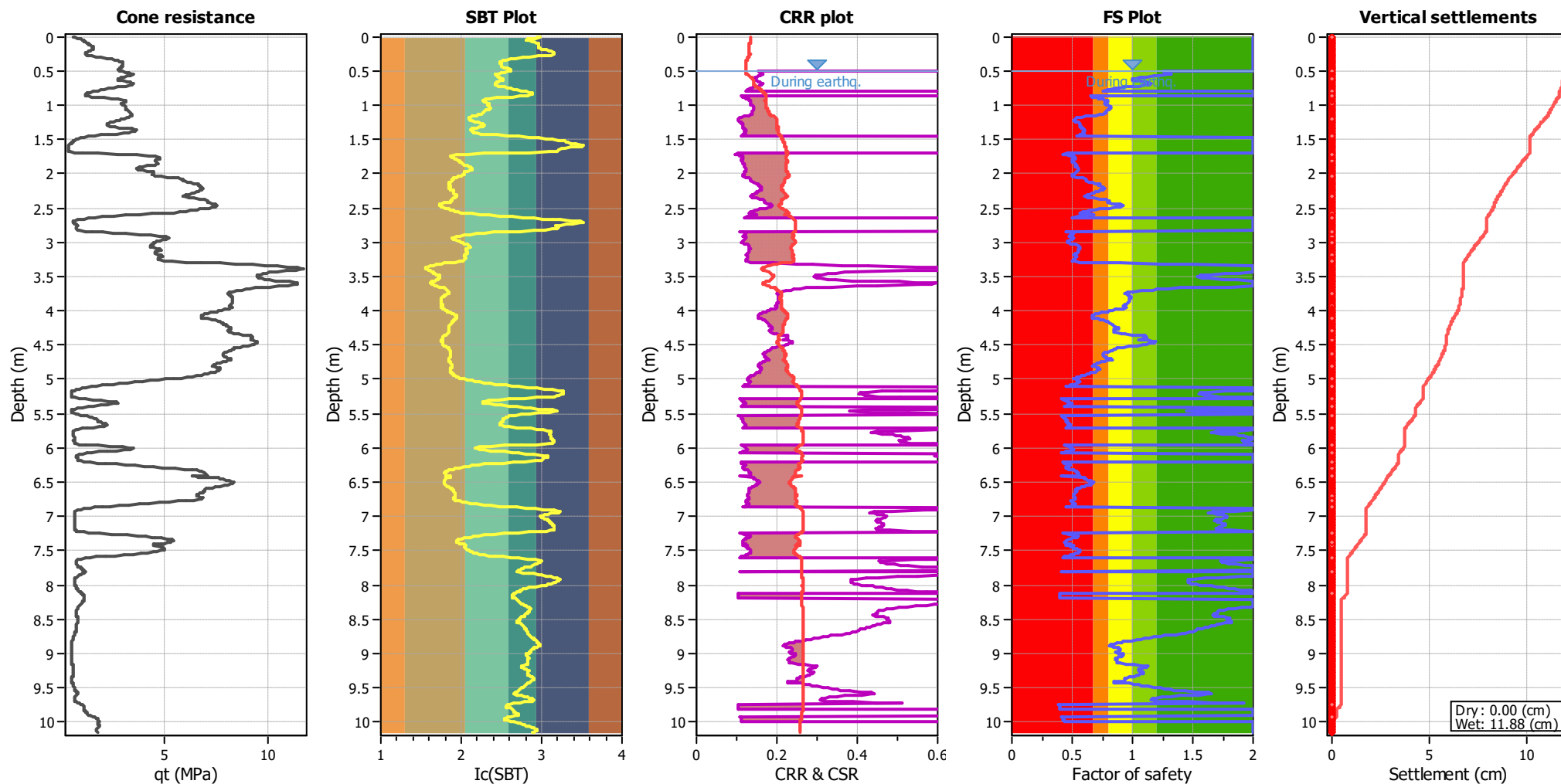
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-16

Total depth: 10.15 m



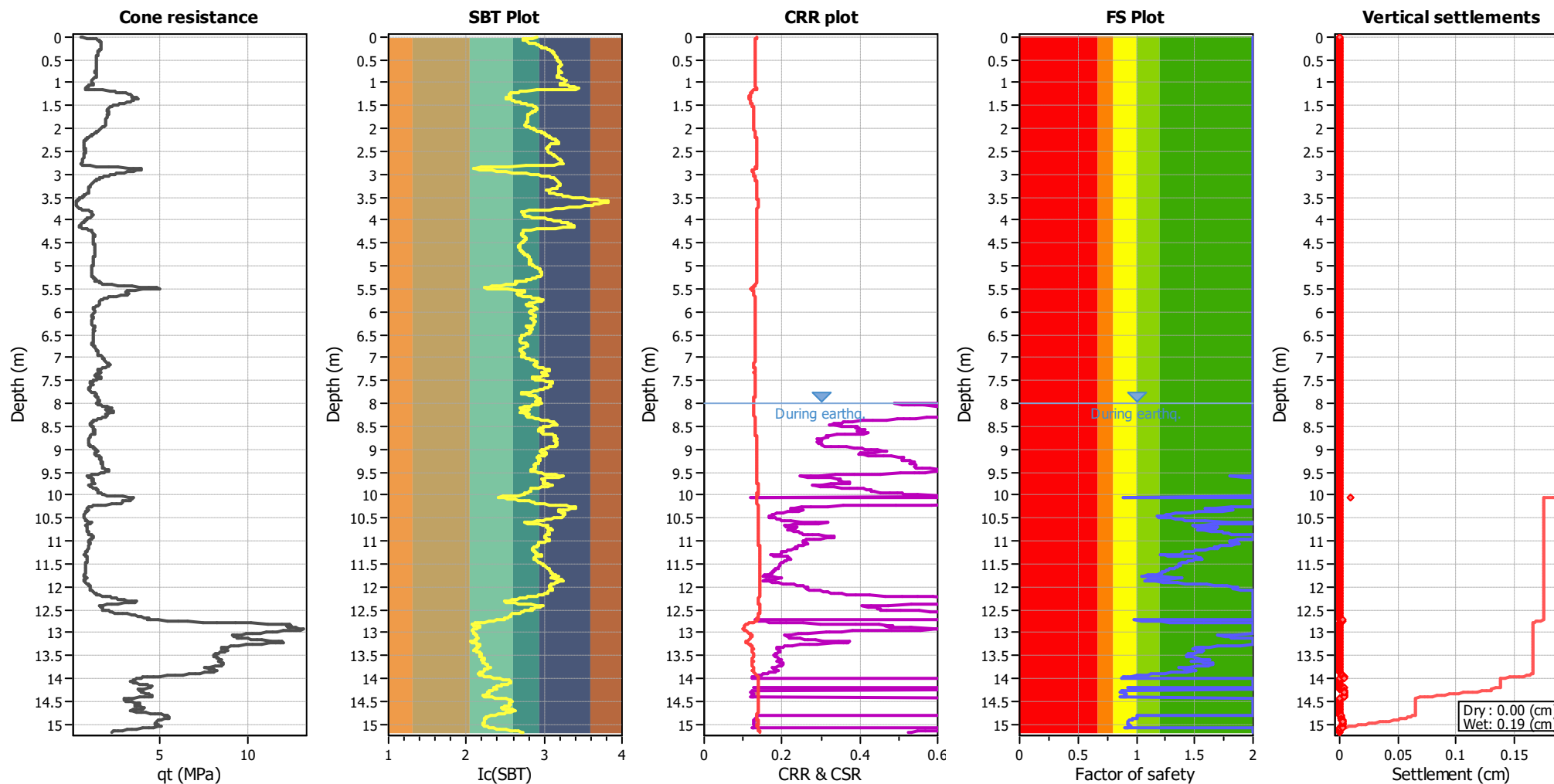
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-18

Total depth: 15.18 m



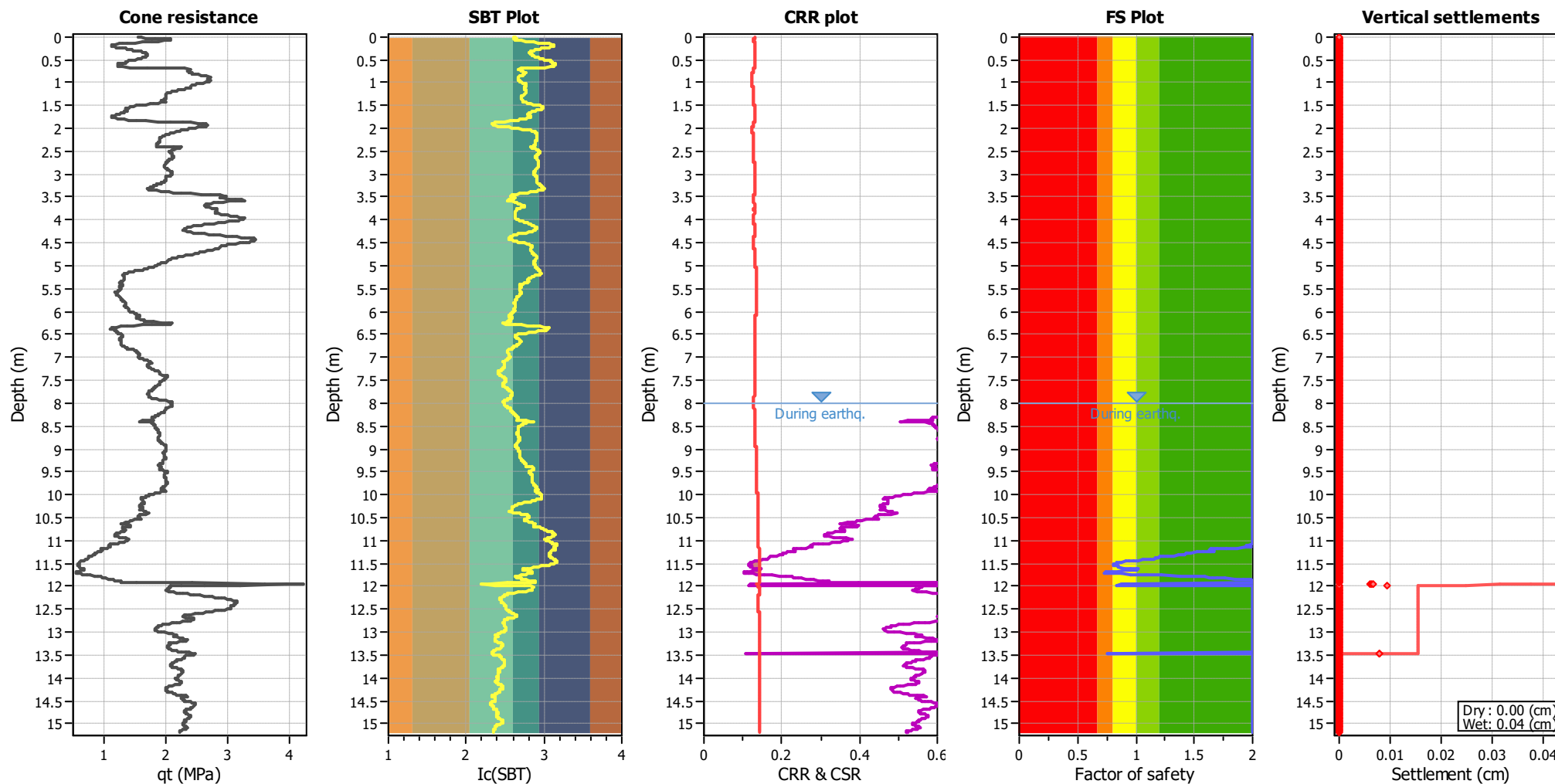
Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-19

Total depth: 15.19 m



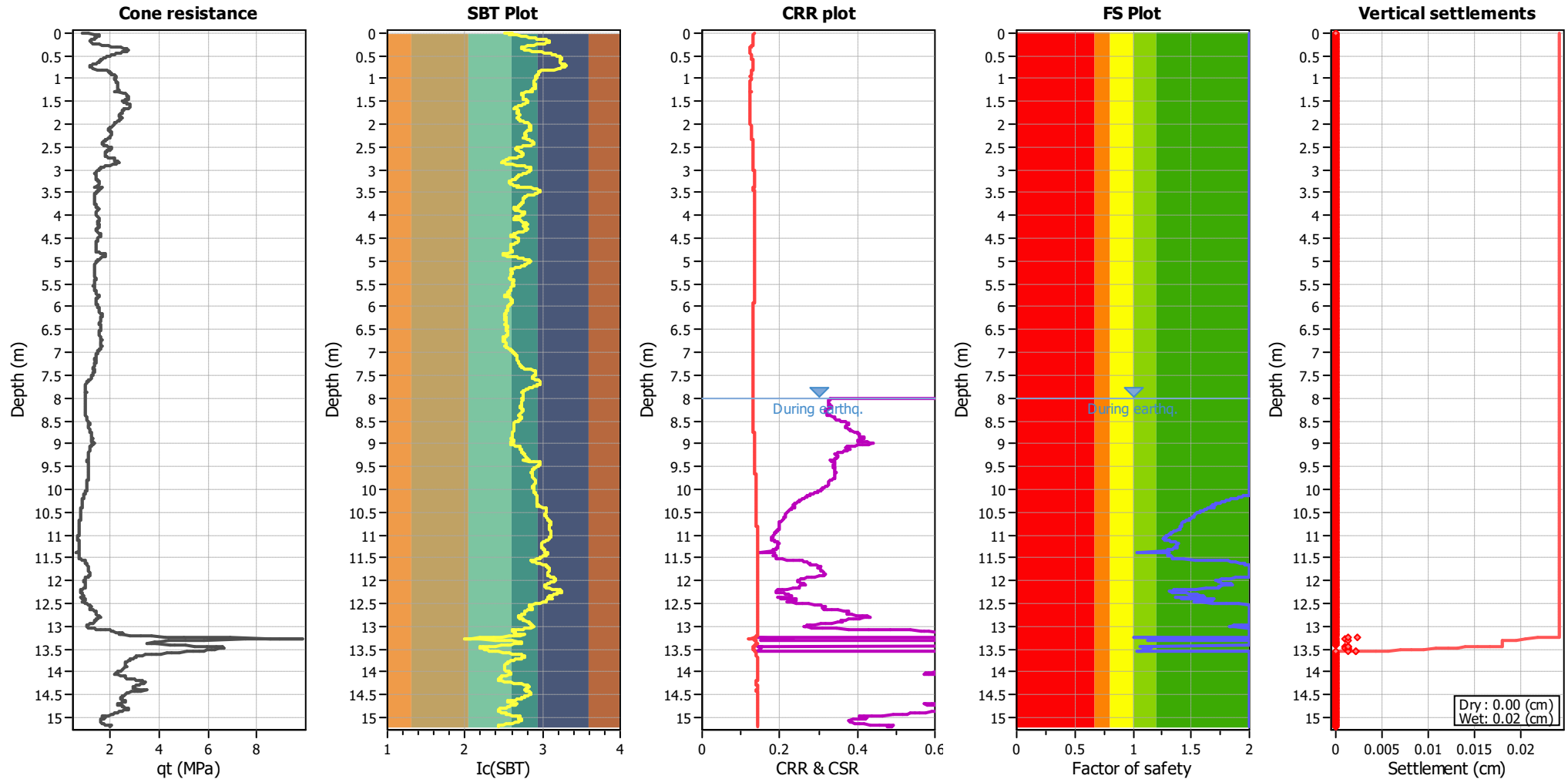
Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-20

Total depth: 15.20 m



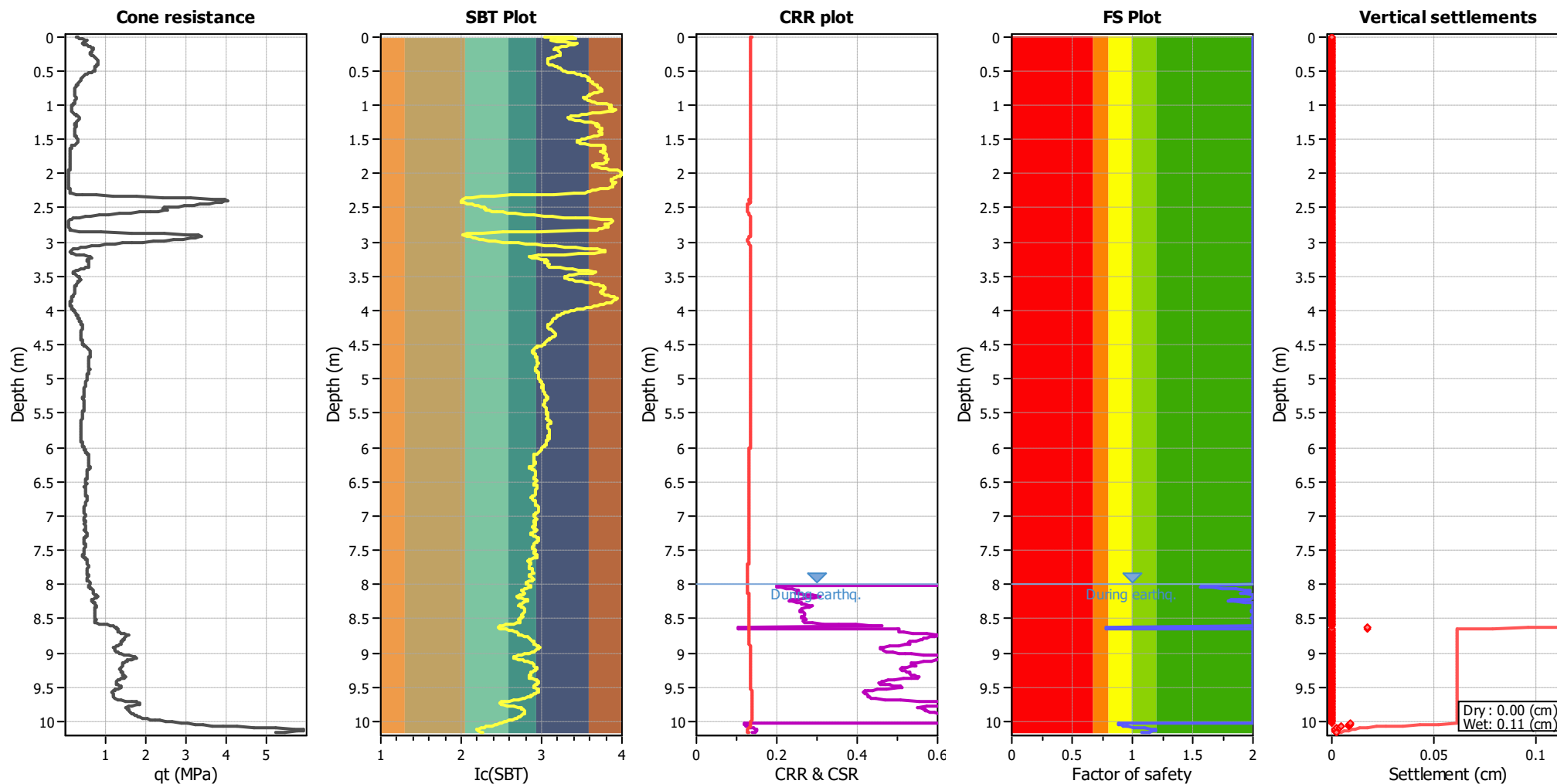
Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-17

Total depth: 10.16 m



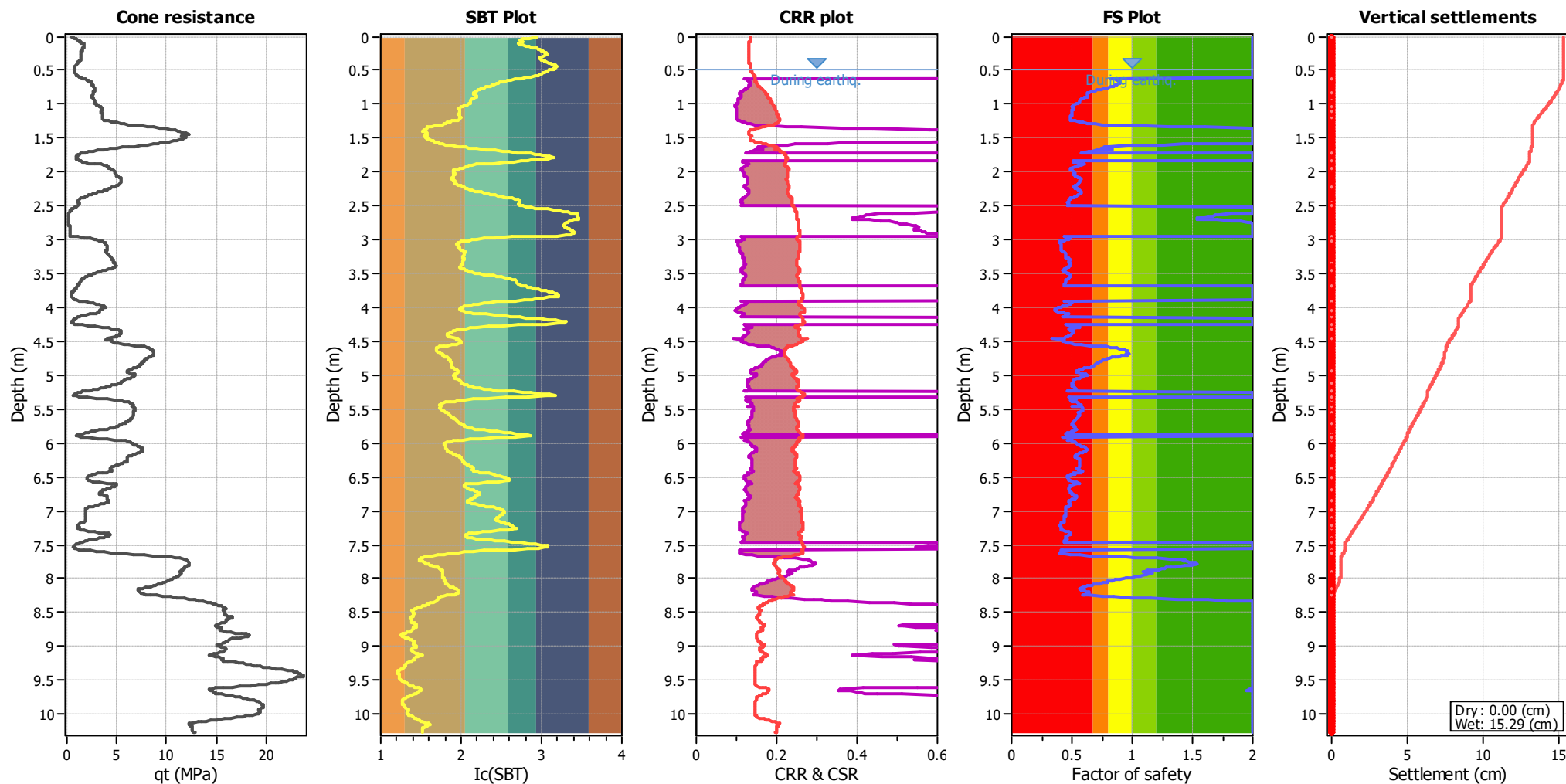
Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-27

Total depth: 10.27 m



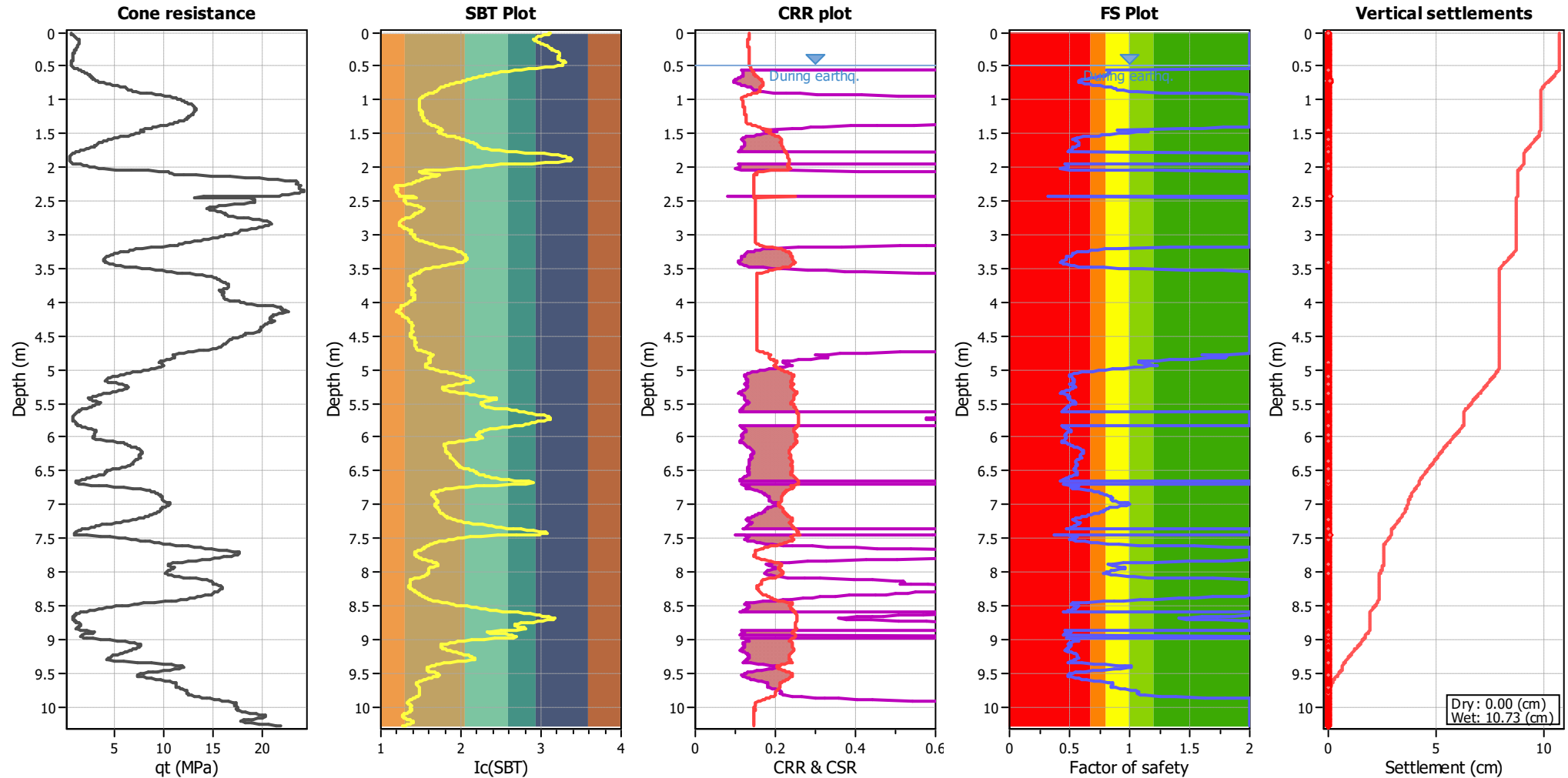
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT25-28

Total depth: 10.28 m



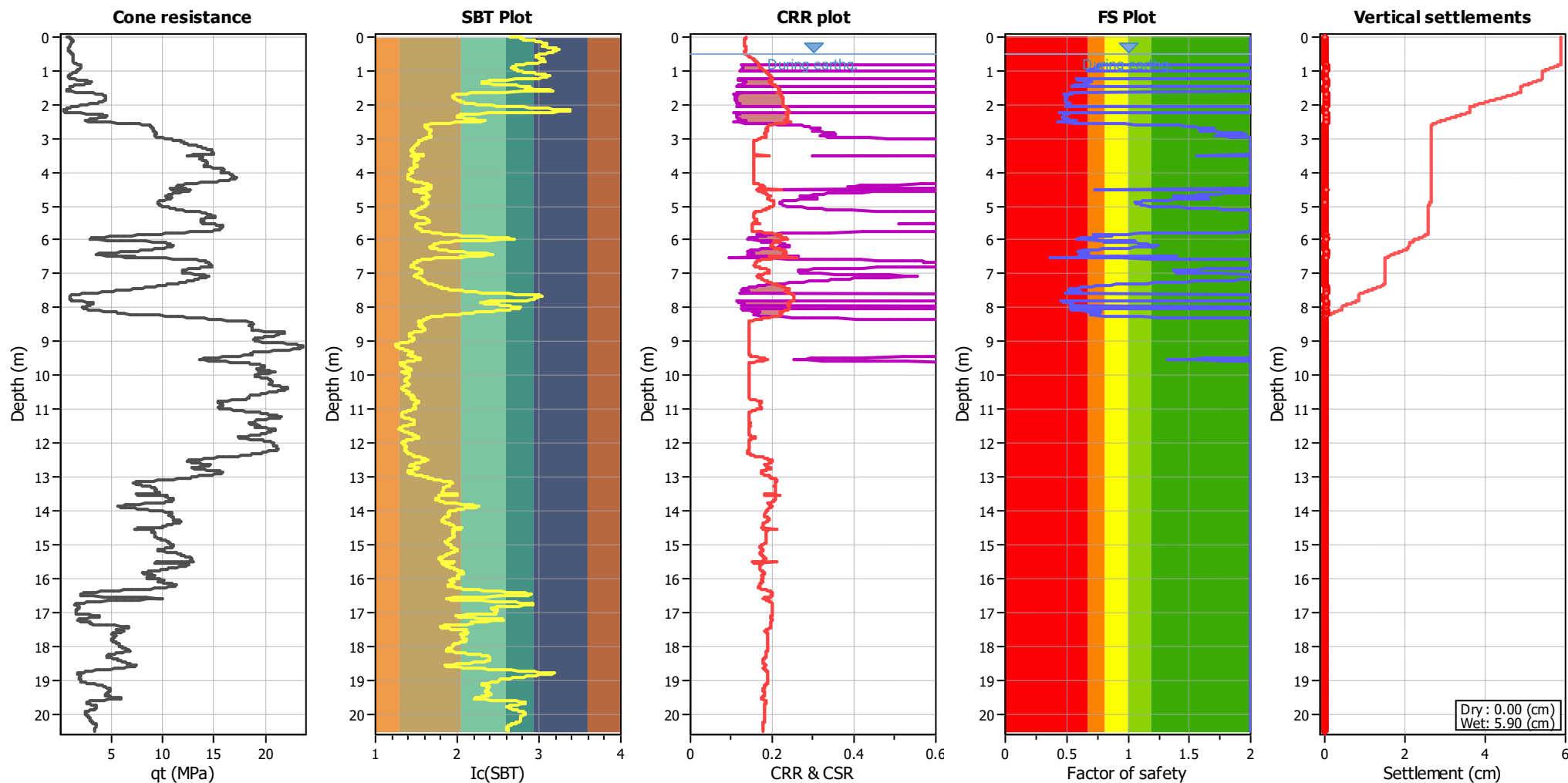
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: SCPT25-01

Total depth: 20.51 m



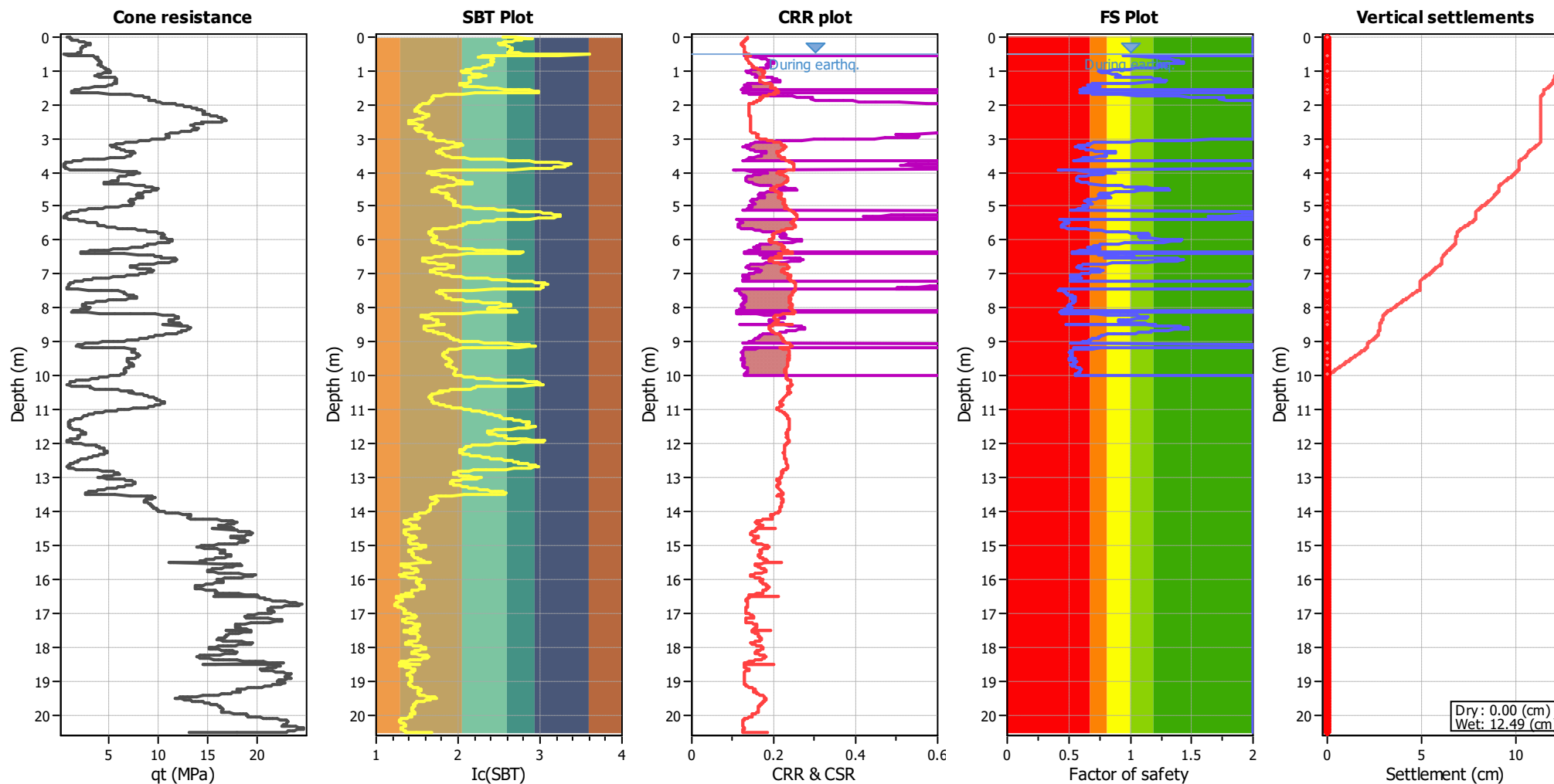
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: SCPT25-02

Total depth: 20.52 m



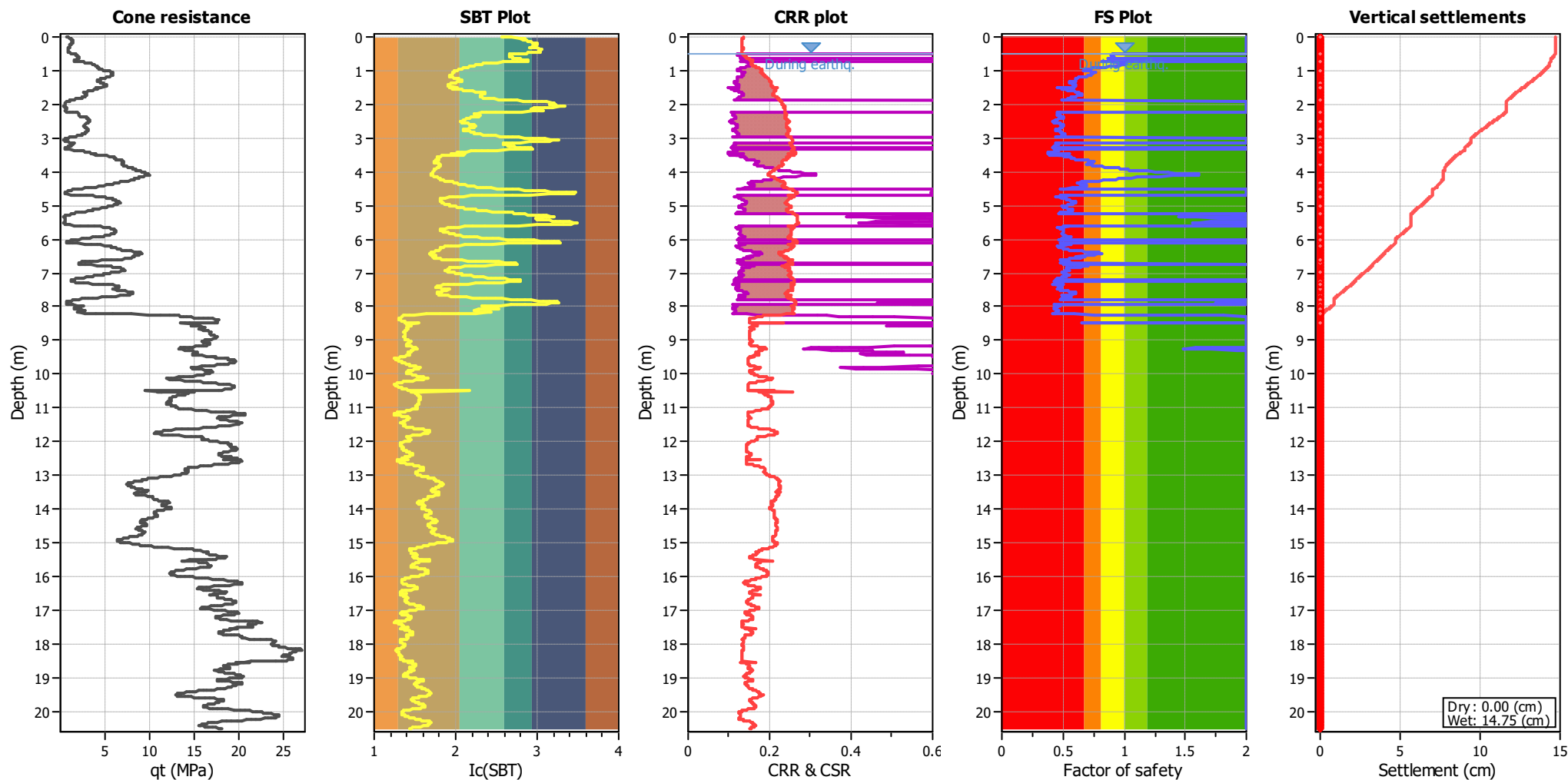
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: SCPT25-03

Total depth: 20.50 m



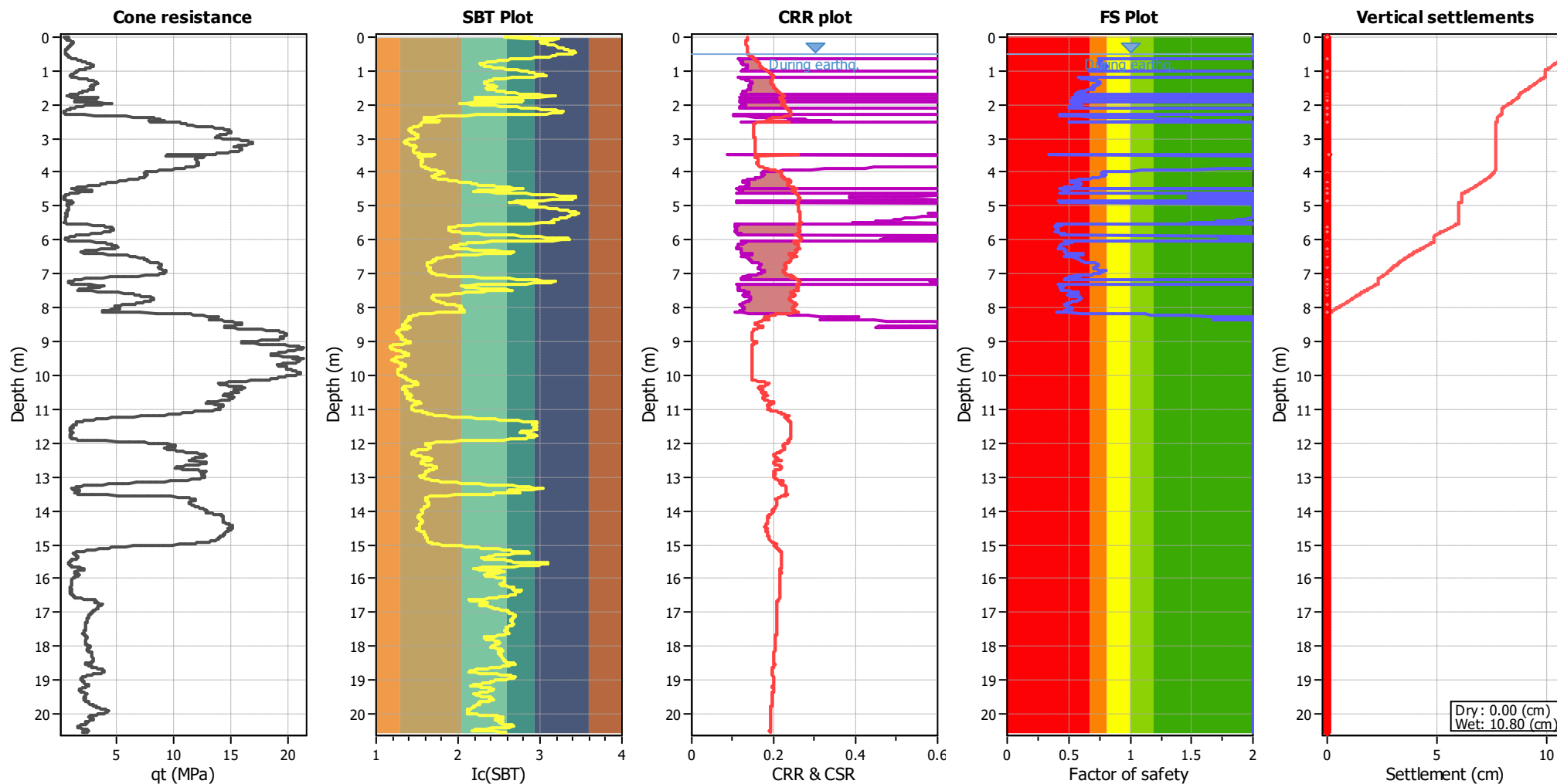
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: SCPT25-04

Total depth: 20.54 m



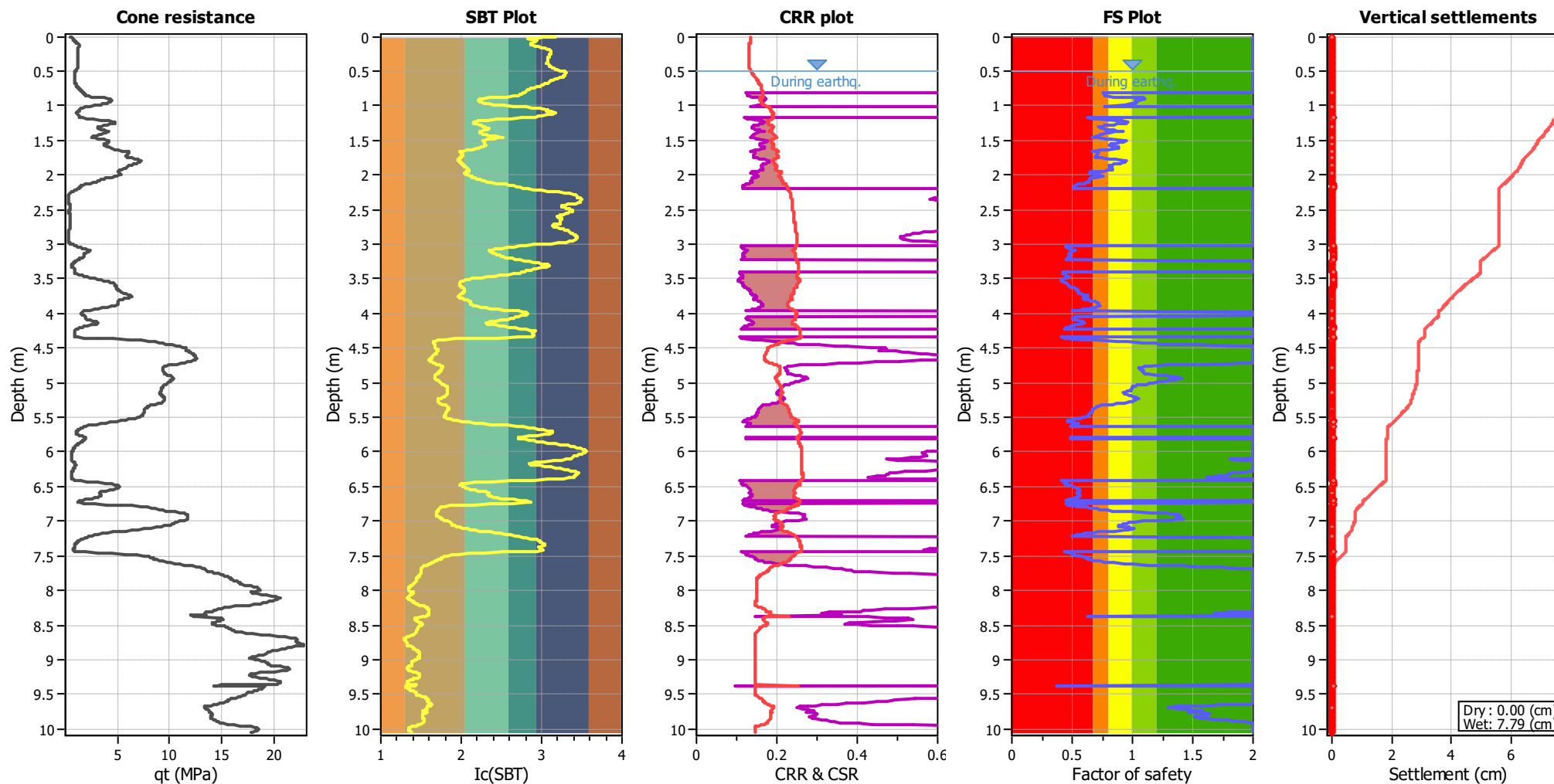
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-05

Total depth: 10.05 m



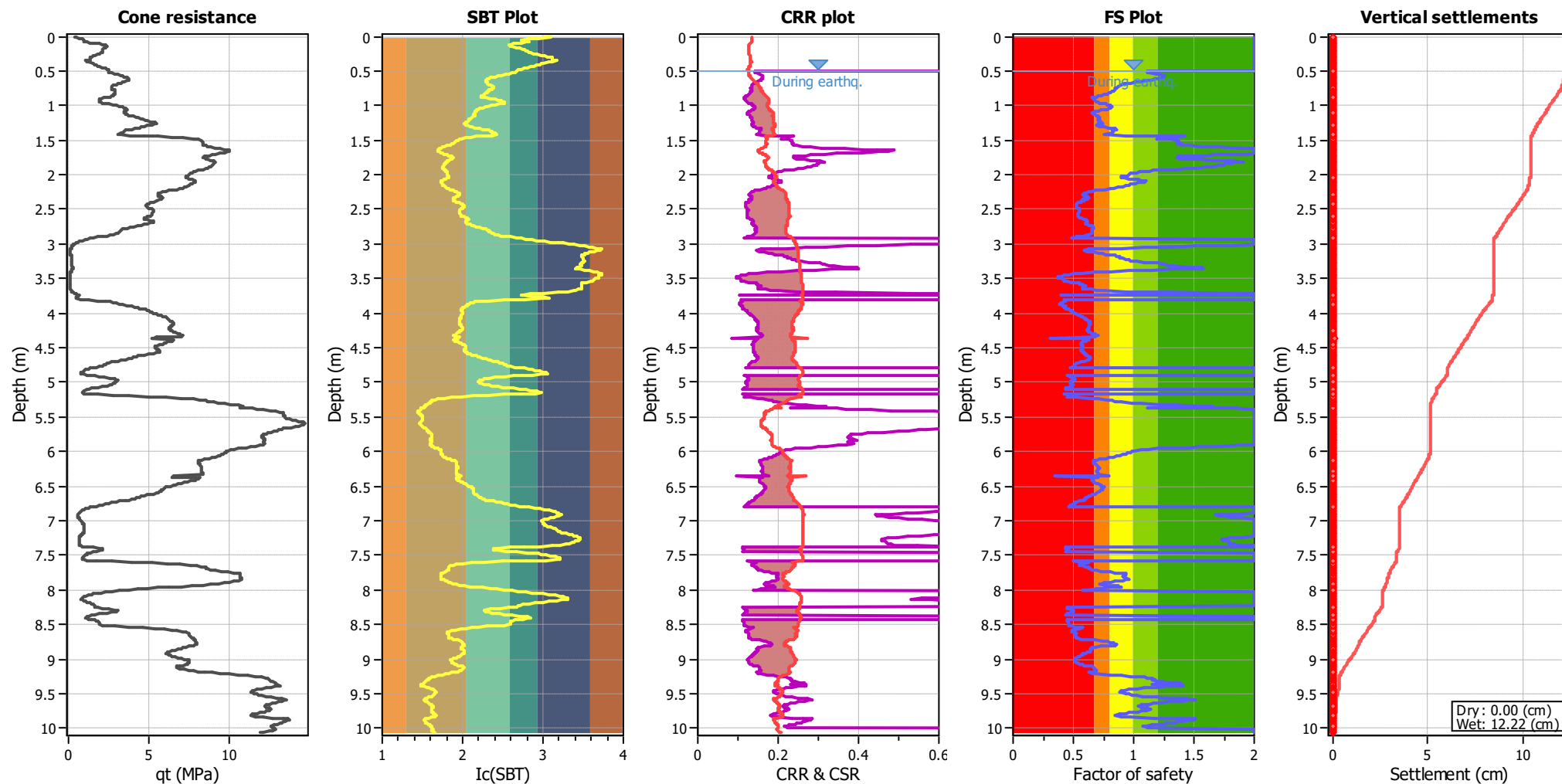
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-06

Total depth: 10.06 m



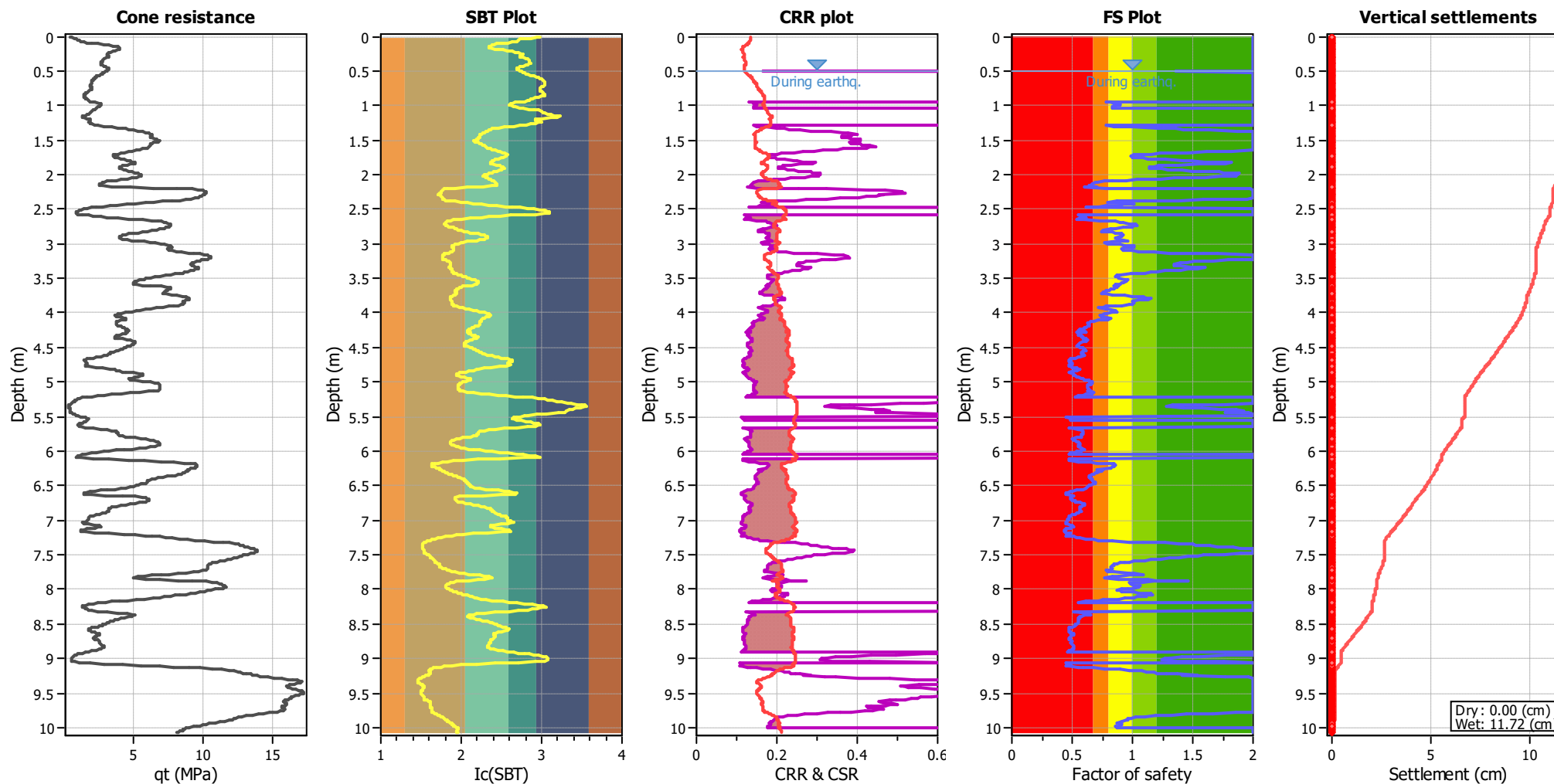
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Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT25-07

Total depth: 10.07 m



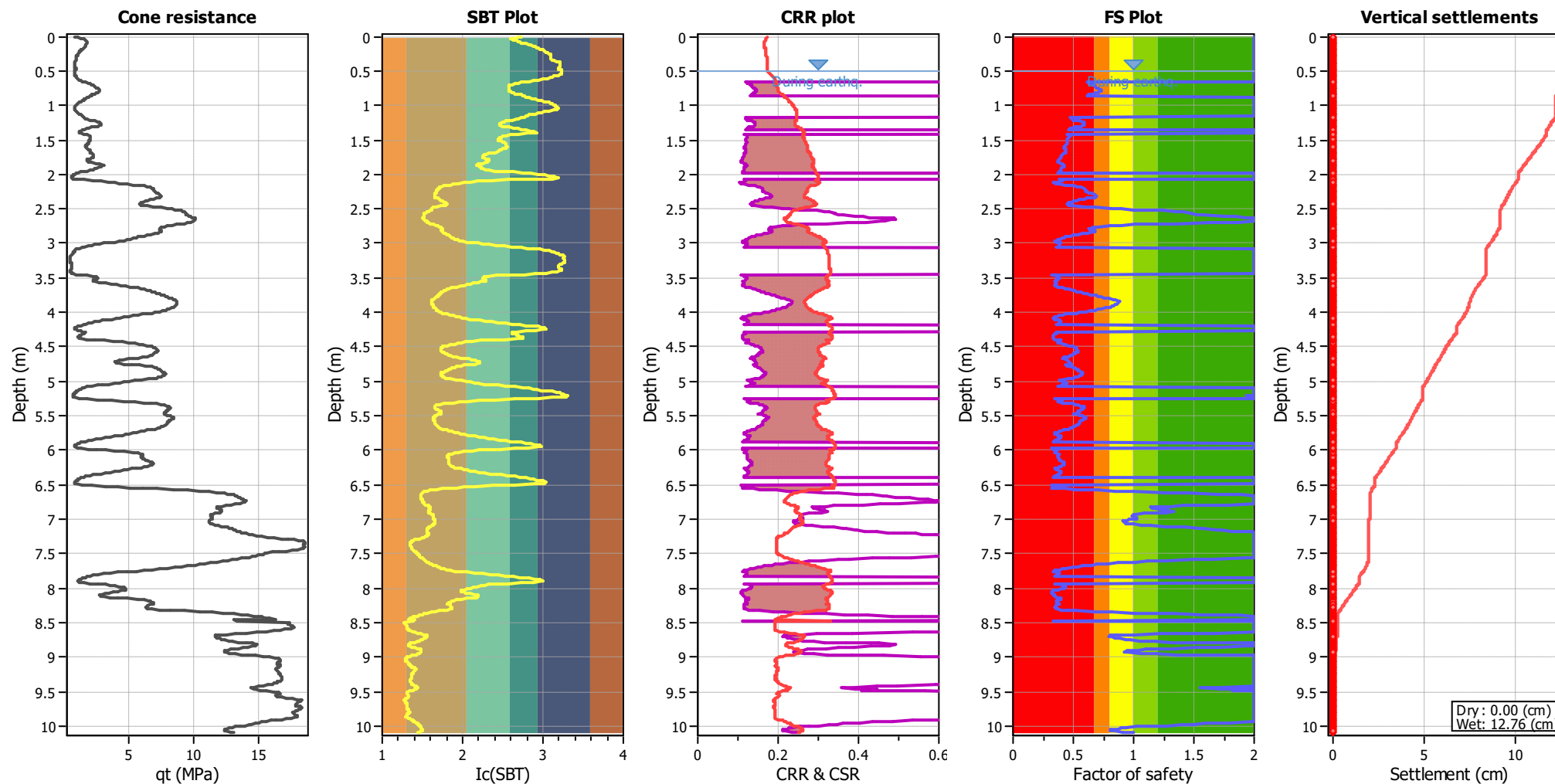
Analysis method:	B&I (2014)	G.W.T. (in-situ):	0.50 m	Use fill:	No	Clay like behavior	
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	10.00 m
Peak ground acceleration:	0.25	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT25-10

Total depth: 10.09 m



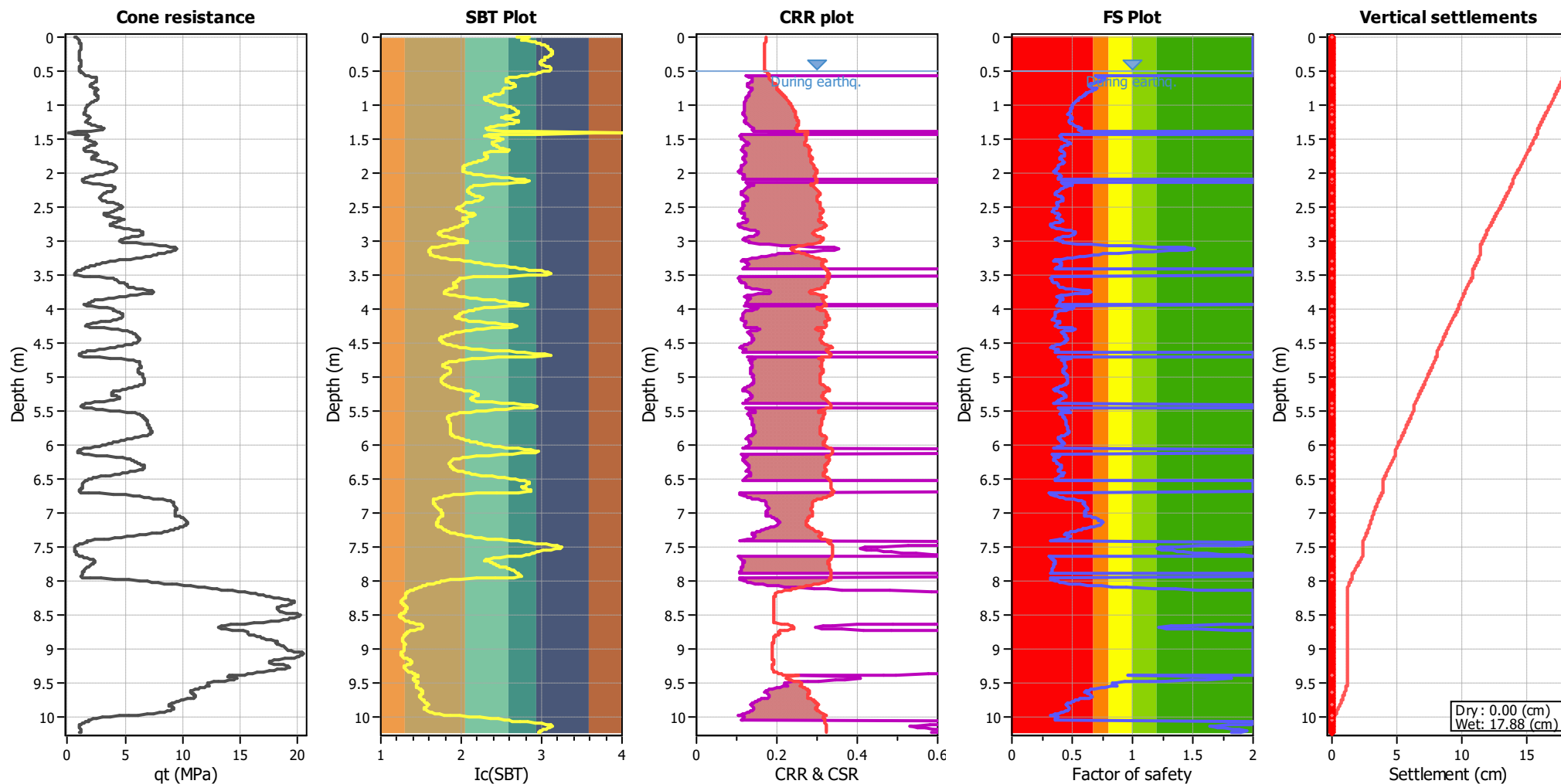
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Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT25-23

Total depth: 10.23 m



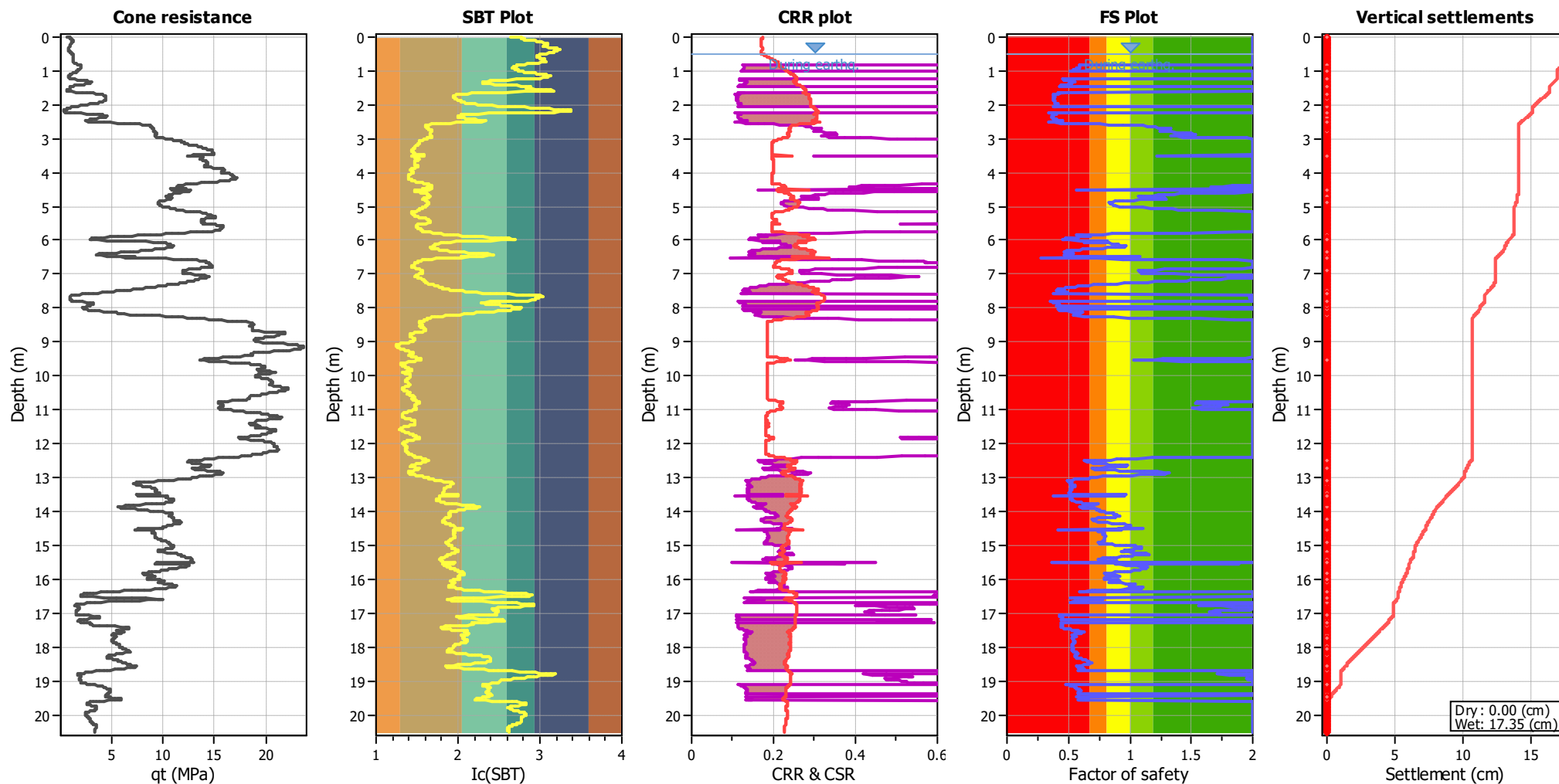
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Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: SCPT25-01

Total depth: 20.51 m



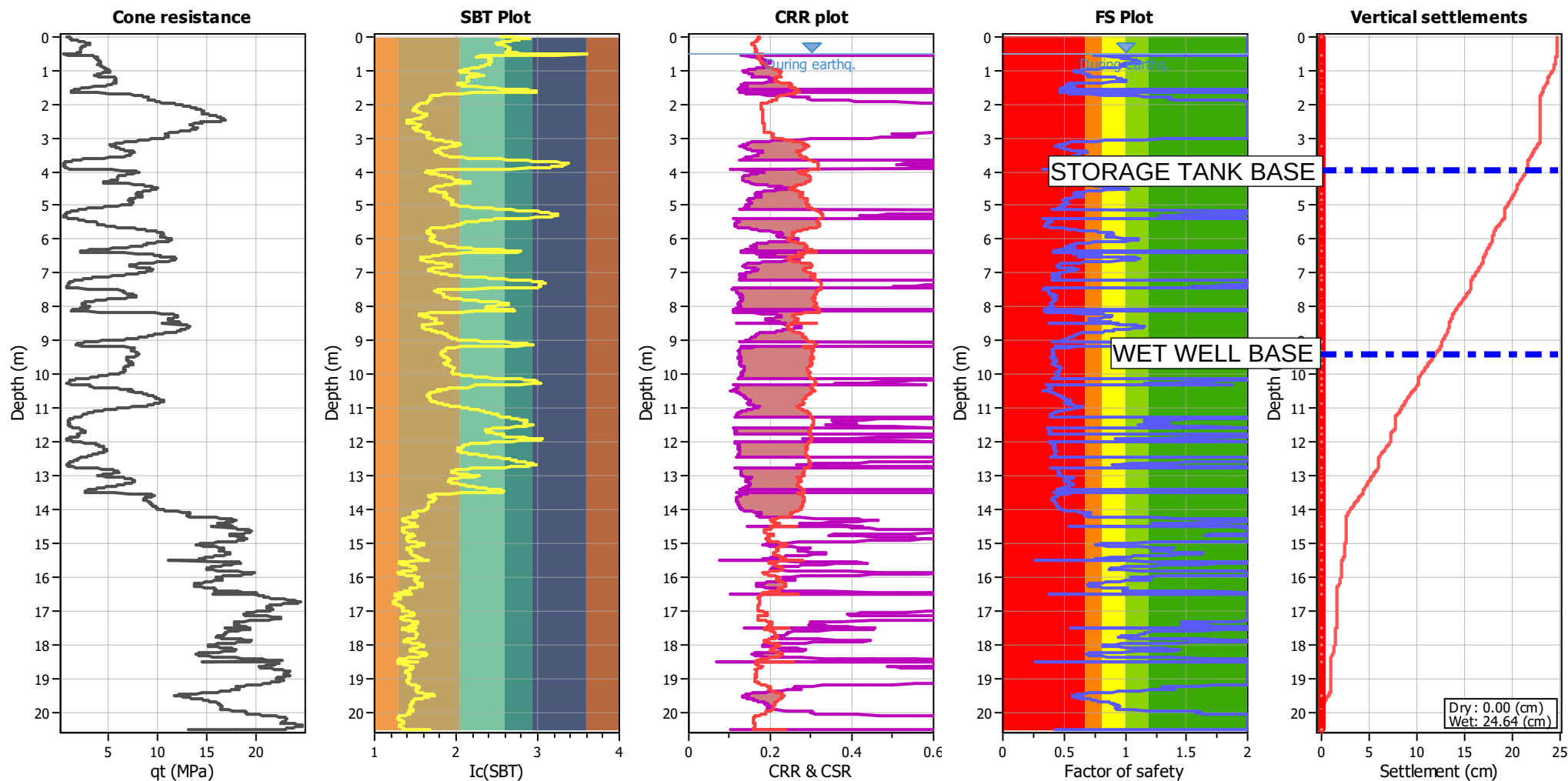
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Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: SCPT25-02

Total depth: 20.52 m



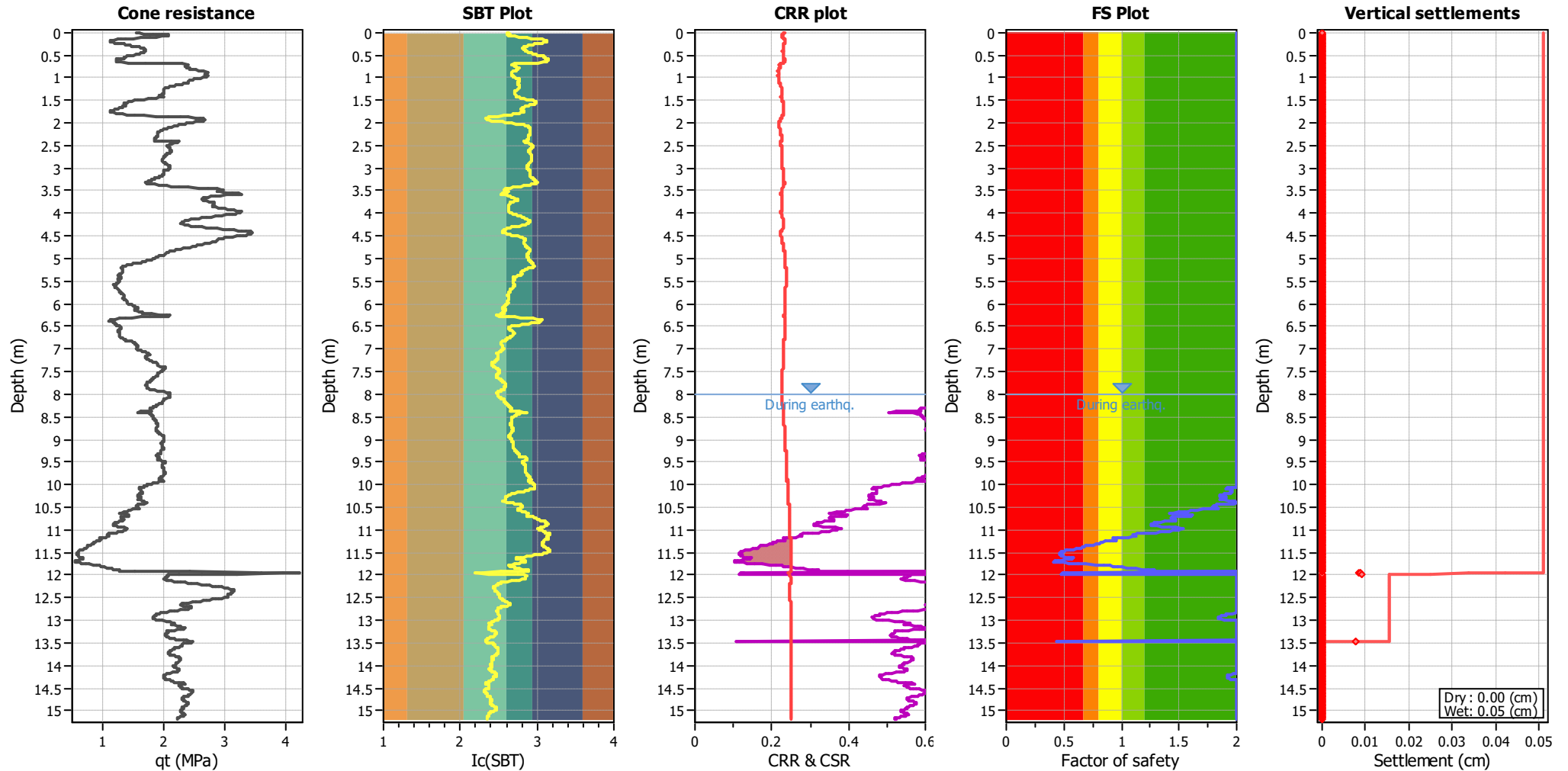
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Fines correction method:	B&I (2014)	G.W.T. (earthq.):	0.50 m	Fill height:	N/A	applied:	.
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.32	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:	Method based

Project:

Location:

CPT: CPT25-19

Total depth: 15.19 m



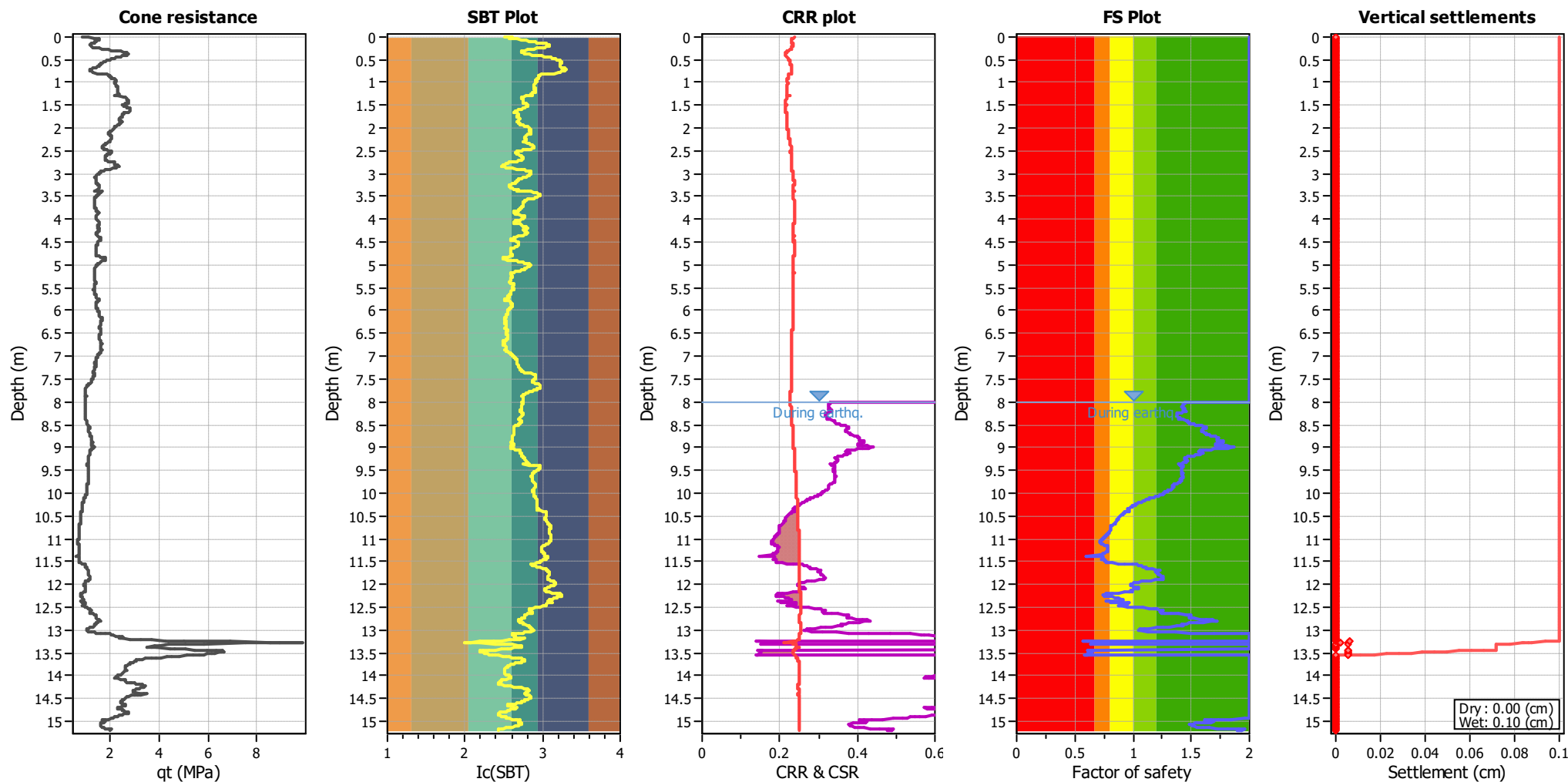
Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

Project:

Location:

CPT: CPT25-20

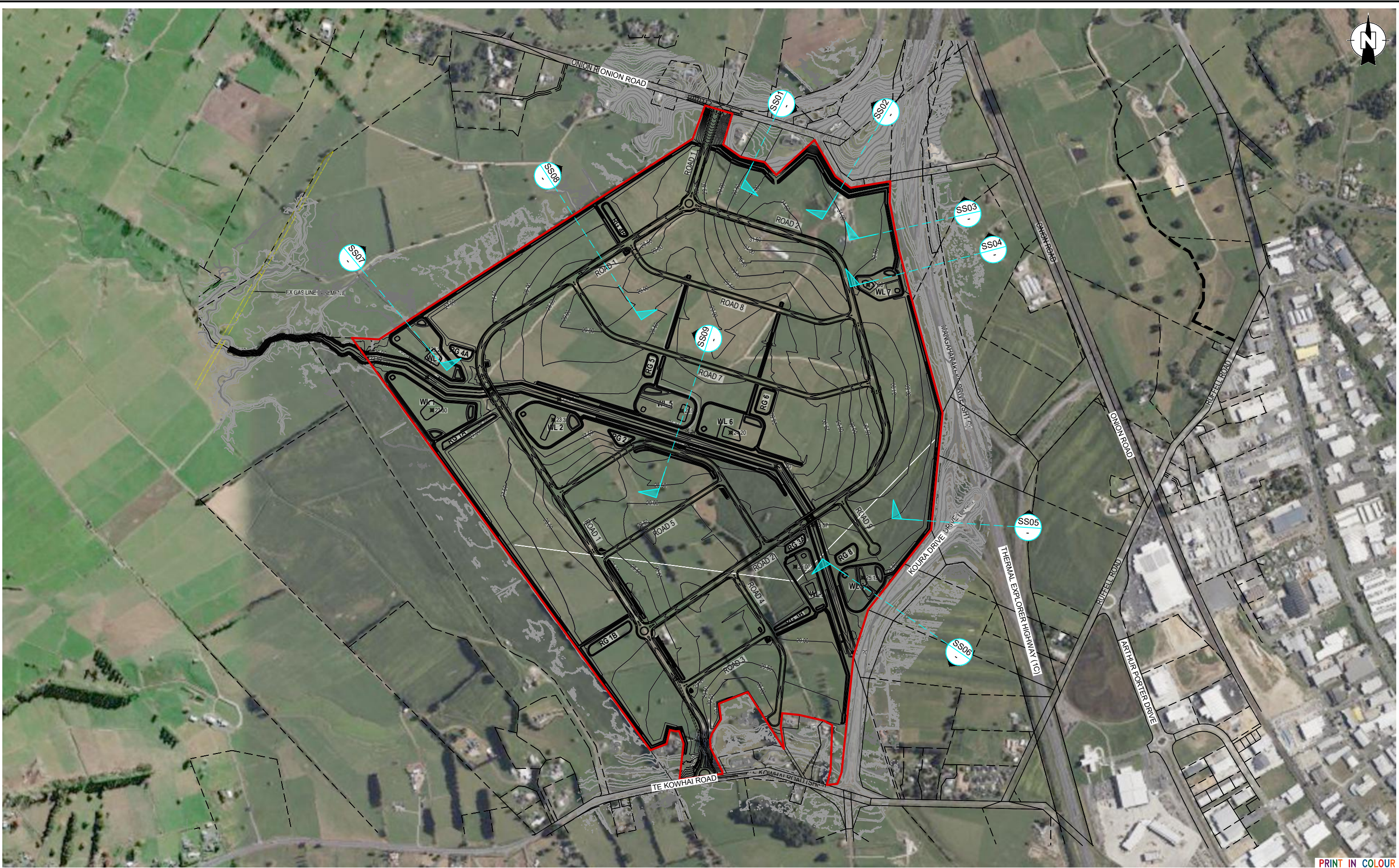
Total depth: 15.20 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	8.00 m	Use fill:	No	Clay like behavior
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	8.00 m	Fill height:	N/A	applied:
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:
Earthquake magnitude M_w :	5.90	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:
Peak ground acceleration:	0.44	Unit weight calculation:	Based on SBT	K_0 applied:	Yes	MSF method:
						Method based

APPENDIX J

Slope Stability Assessment



LEGEND:

- SITE BOUNDARY
- PR CONTOUR (MAJOR)
- PR CONTOUR (MINOR)

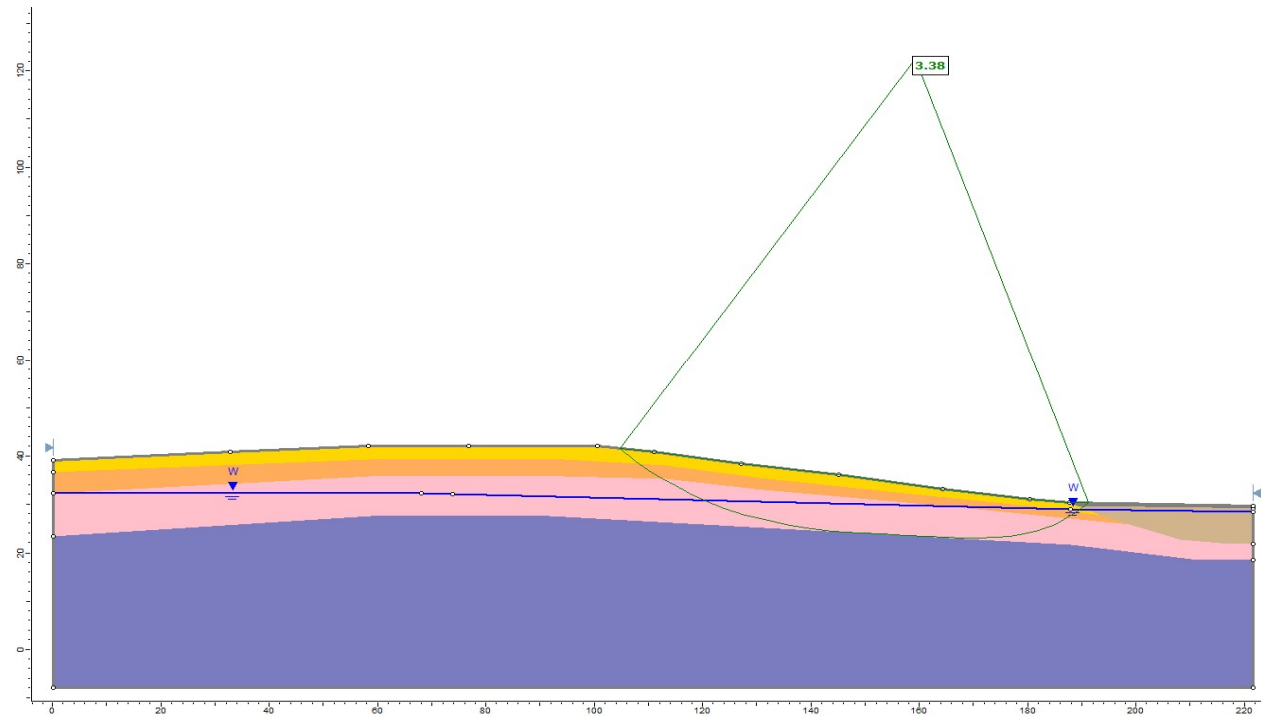
NOTES:

1. AERIAL IMAGE COURTESY OF LINZ - HAMILTON 0.05m URBAN AERIAL PHOTOS (2024-2025).
2. SITE LAYOUT ADAPTED FROM MAVEN DRAWING, PROJECT NO. 180010, DRAWING NUMBER C205, REVA.
3. CRS: NZGD2000 / NZTM. VERTICAL DATUM IN TERMS OF NZVD2016.
4. TEST LOCATIONS ARE INDICATIVE ONLY.

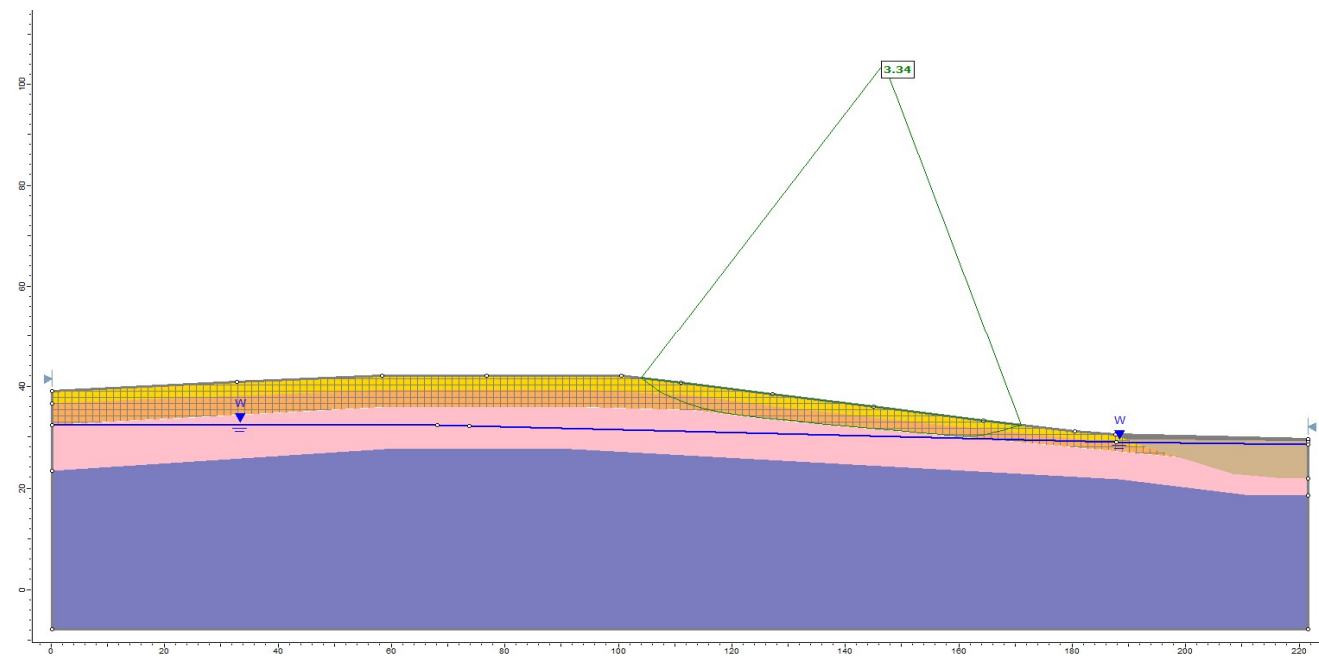


CLIENT: TE KOWHAI EAST GENERAL PARTNER LIMITED	DRAWN: DB	PROJECT: HAM2025-0116
PROJECT: TE KOWHAI EAST INDUSTRIAL DEVELOPMENT	CHECKED: AS	DRAWING: 05
TITLE: SLOPE STABILITY PLAN	REVISION: 0	SCALE: 1:10 000
	DATE: 10.08.2026	SHEET: A3 L

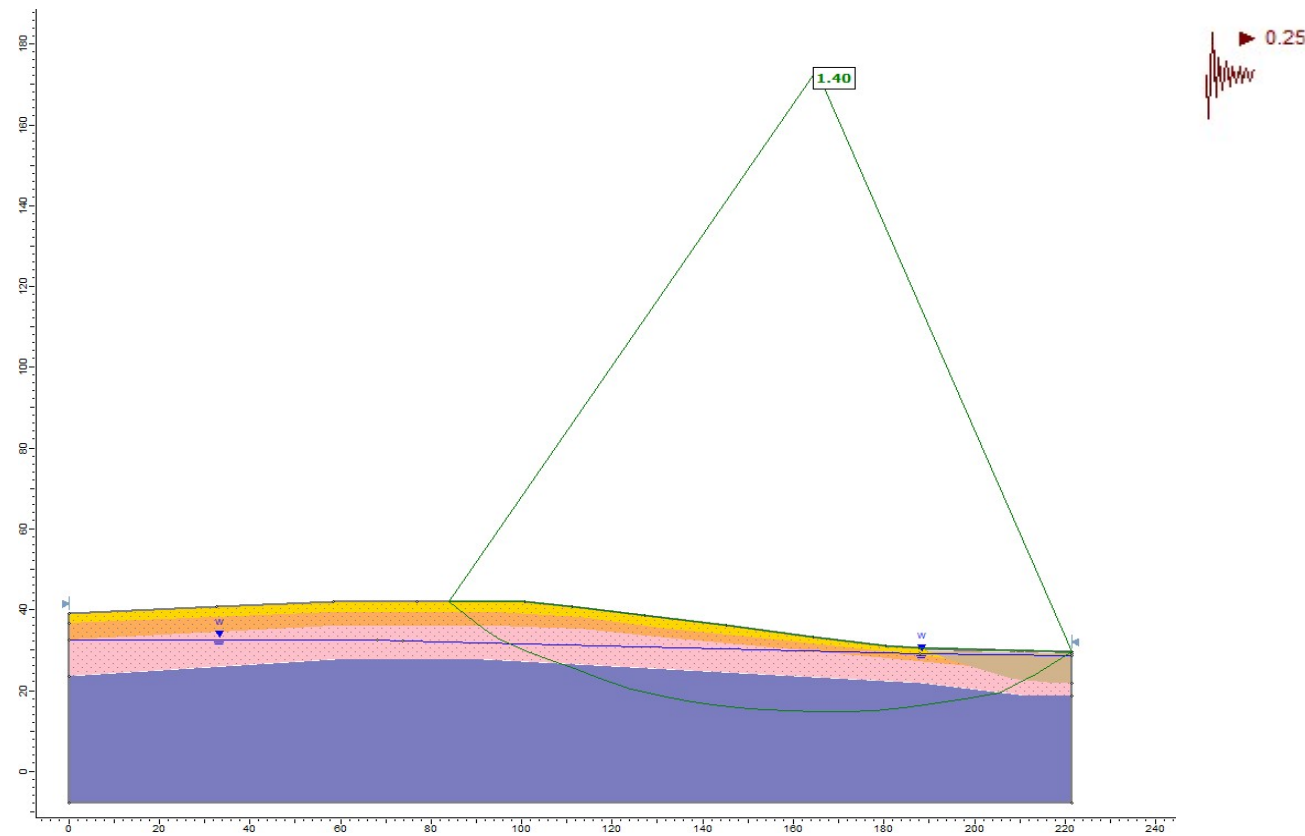
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

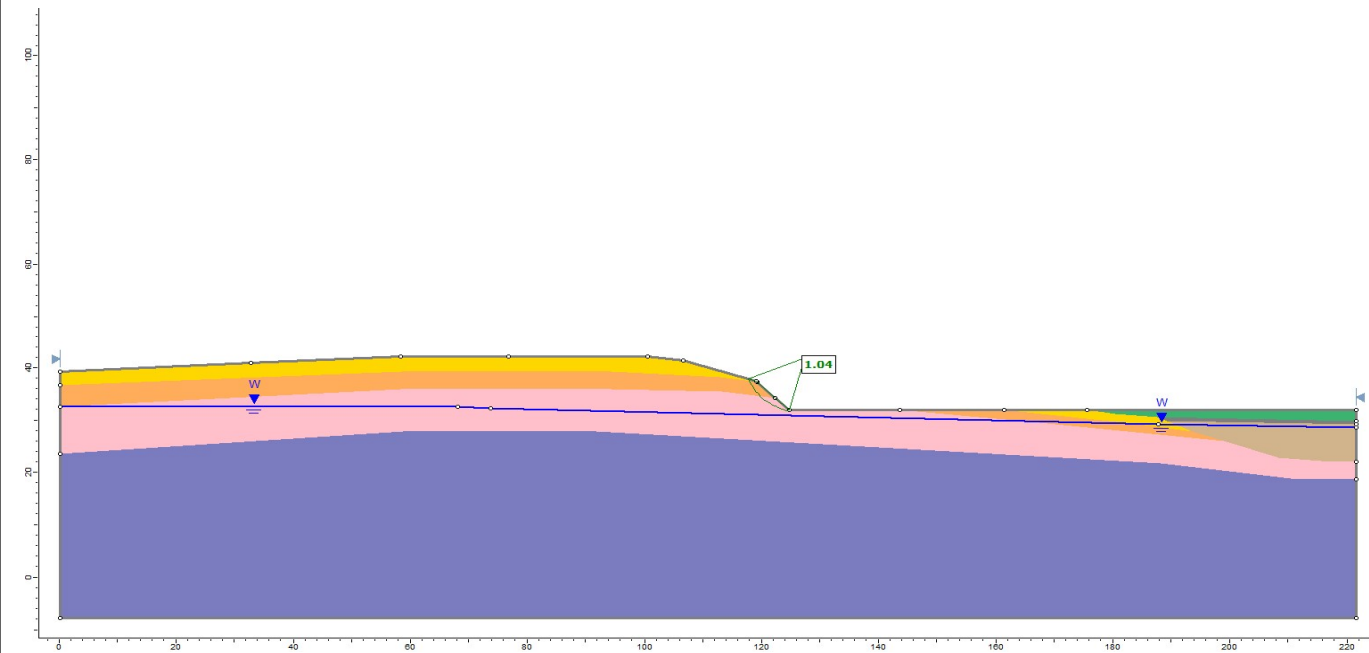
SEISMIC

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated

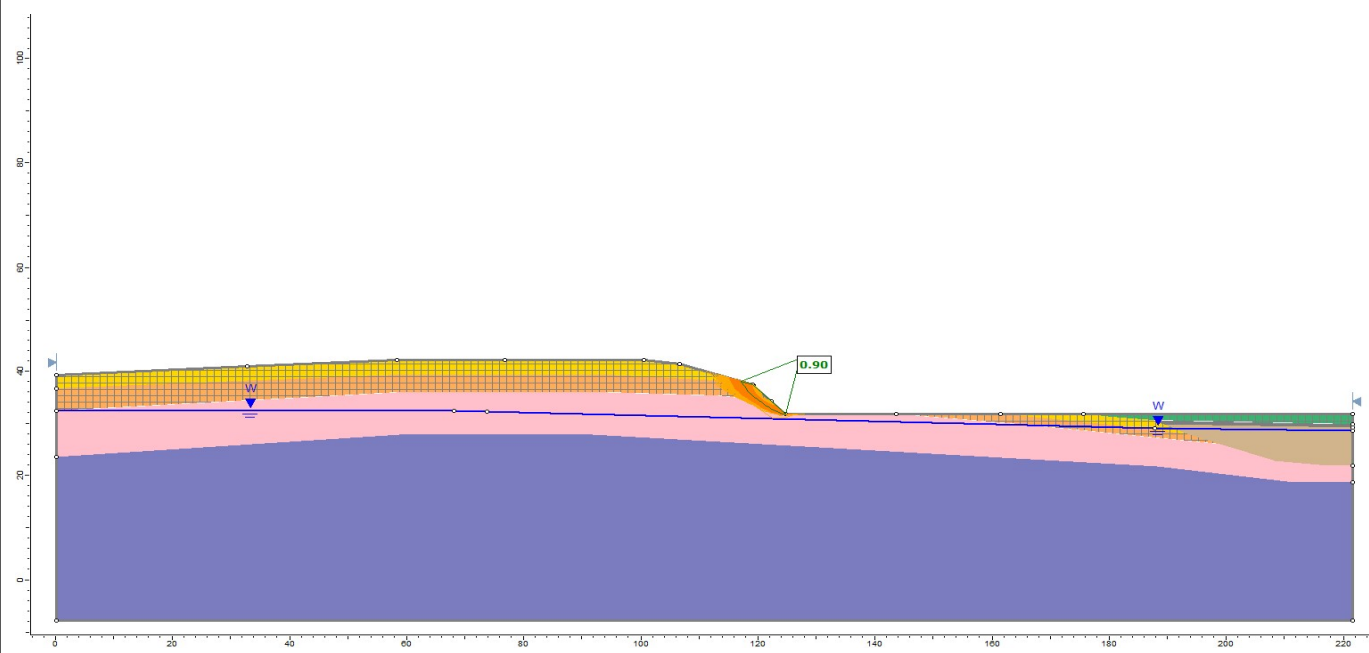
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Ru Value
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	None		0.3
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	None		0.3

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	50	0	Constant	Water Table	Automatically Calculated

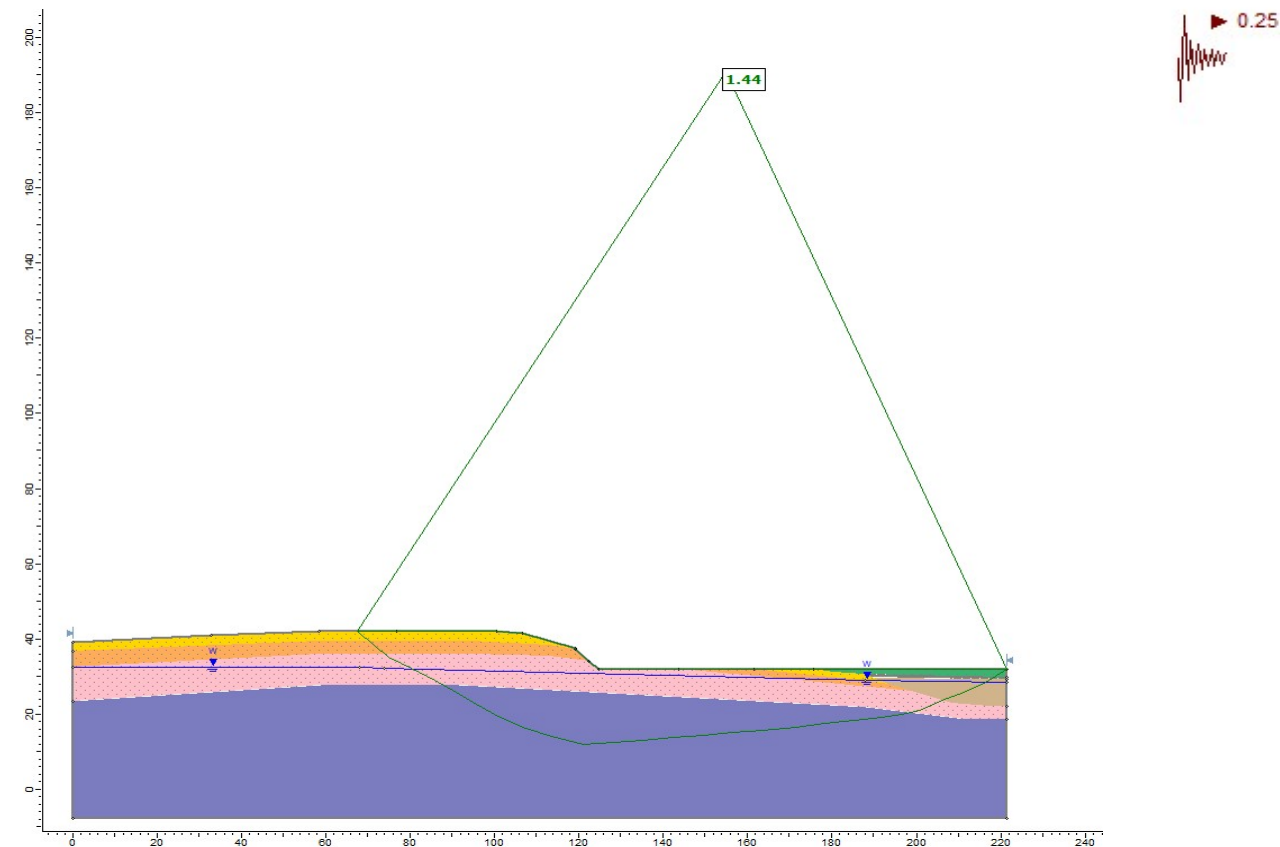
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Ru Value
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	None		0.3
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	None		0.3
Very stiff to hard CLAY (Engineered Fill) - Ru		18	Mohr-Coulomb	5	28	None		0.3

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Custom	0
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Custom	0
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	80	0	Constant	Water Table	Custom	0
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant	Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained		18	Undrained	120	0	Constant	Water Table	Automatically Calculated	

PREVAILING

ELEVATED
GROUNDWATER

SEISMIC



Project
Te Kowhai Industrial Development

Title
Section 1 - Proposed

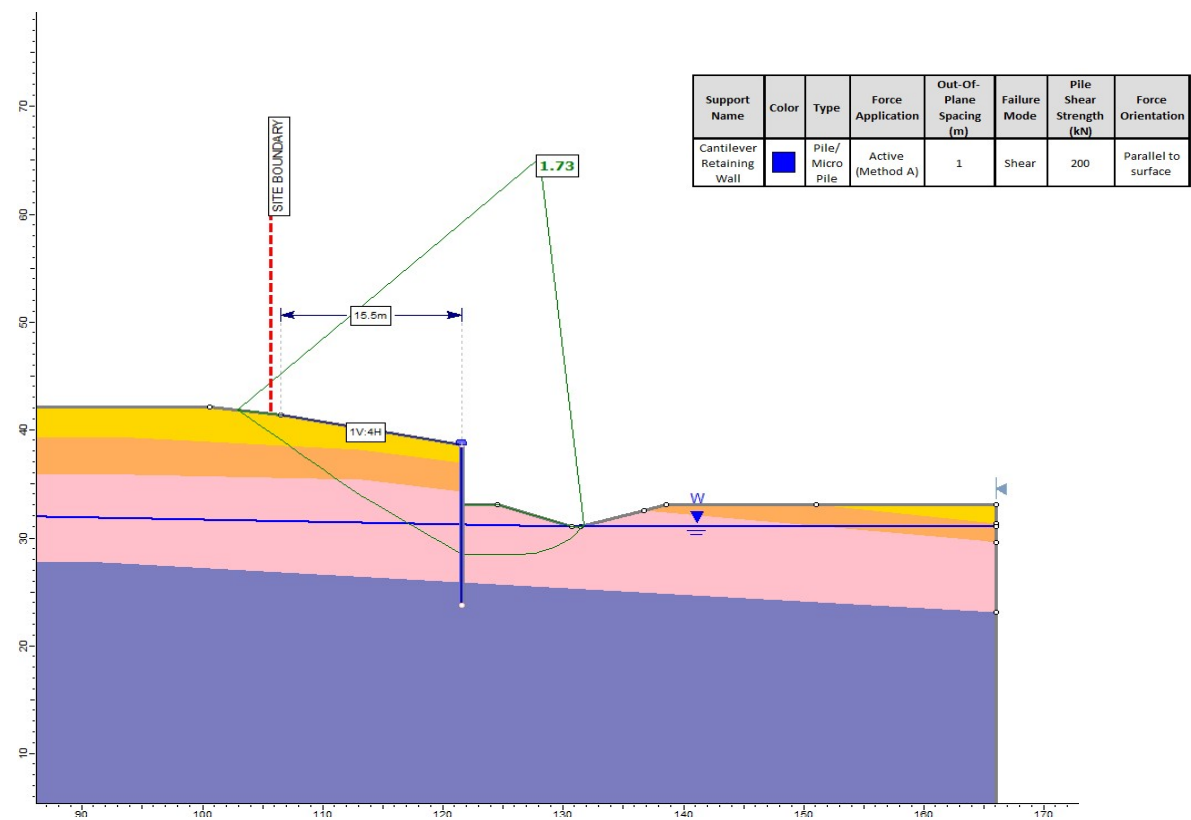
Analysis
Cuckoo

Date
10/08/2026

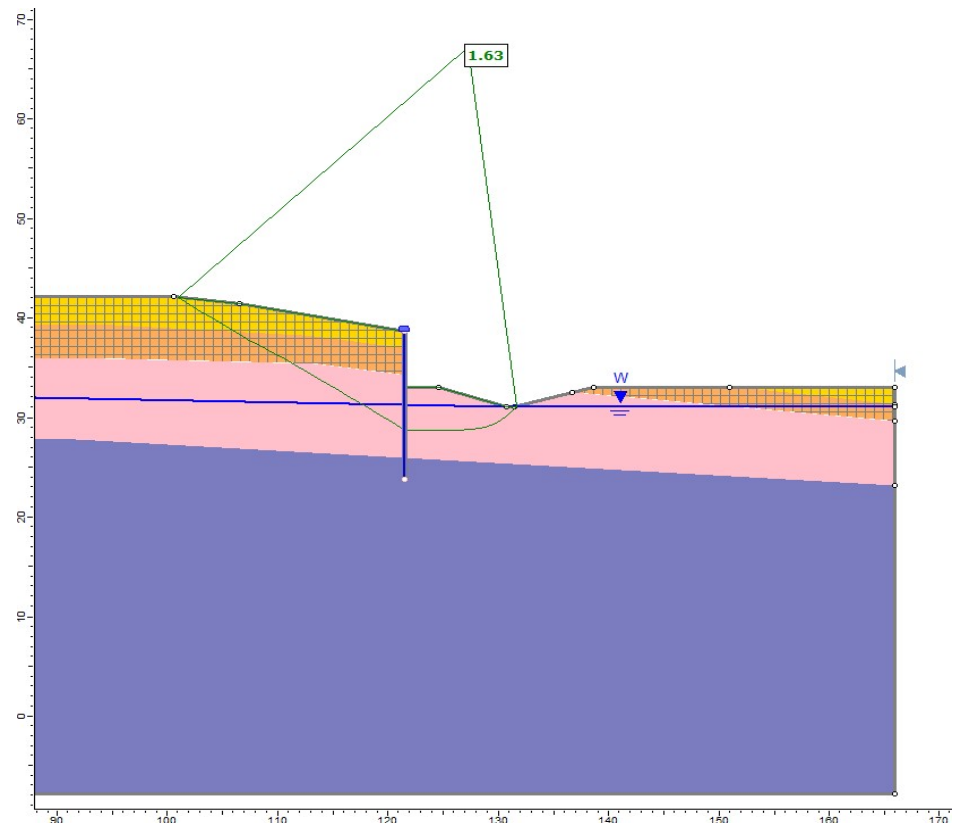
Project No.
HAM2025-0116

Drawing
STAB 02

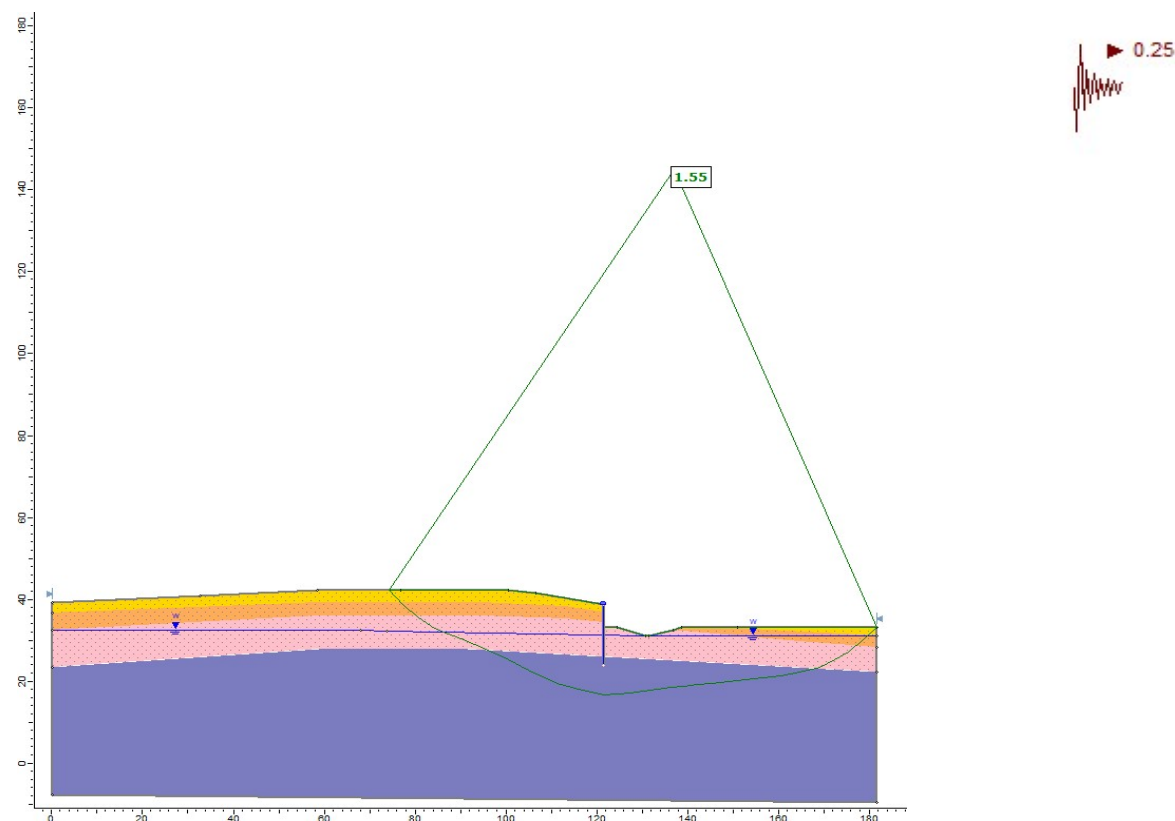
Proposed Profile with Remediation - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile with Remediation - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3.



Proposed Profile with Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



PREVAILING

ELEVATED
GROUNDWATER

SEISMIC

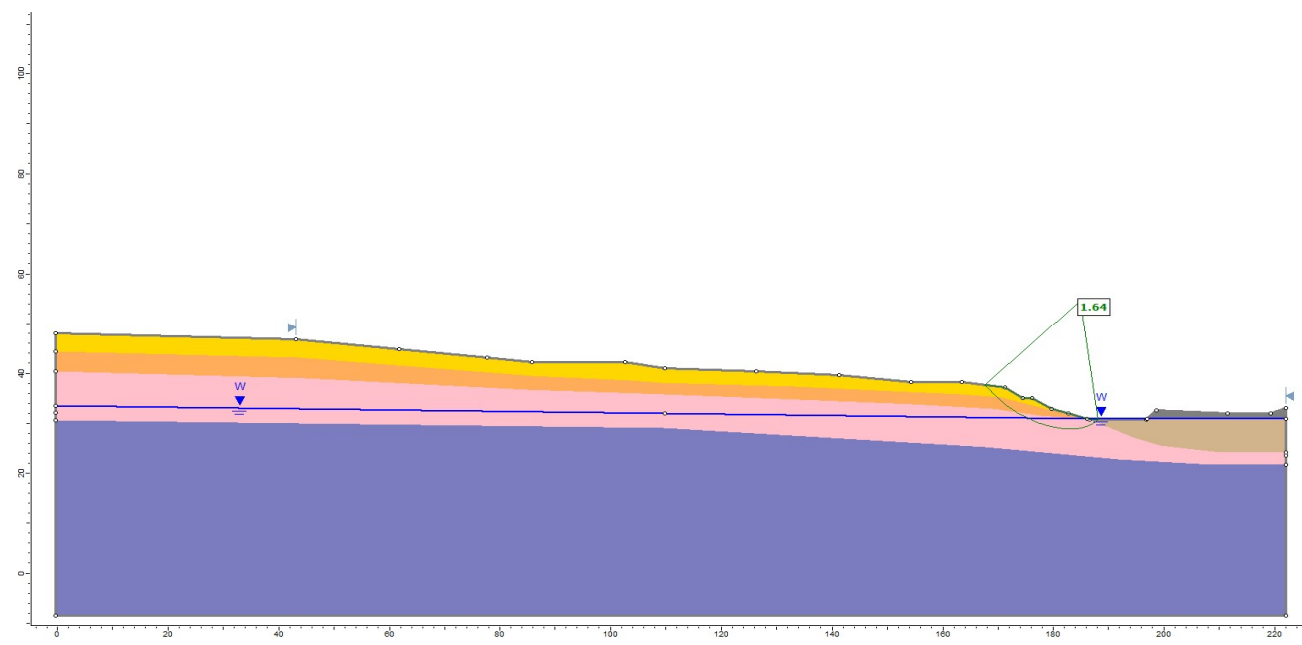
Parameters

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Stiff to very stiff CLAY (Hamilton Ashes)	Yellow	16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes)	Orange	16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation)	Pink	16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	Light Blue	17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)	Dark Blue	16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	Light Green	16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)	Dark Green	18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated

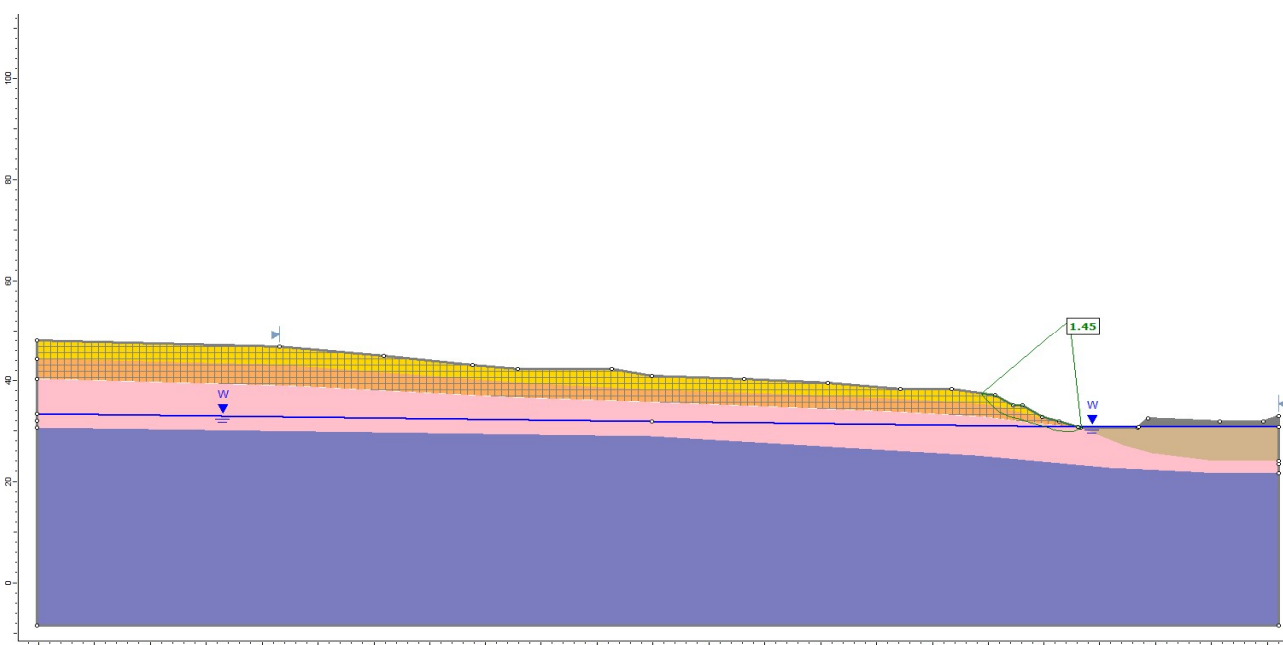
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Ru Value
Stiff CLAY/SILT (Puketoka Formation)	Pink	16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	Light Blue	17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)	Dark Blue	16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	Light Green	16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3	Yellow	16	Mohr-Coulomb	4	28	None		0.3
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3	Orange	16	Mohr-Coulomb	5	28	None		0.3
Very stiff to hard CLAY (Engineered Fill) - Ru	Dark Green	18	Mohr-Coulomb	5	28	None		0.3

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	Light Blue	17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	Light Green	16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained	Yellow	16	Undrained	80	0	Constant	Water Table	Custom	0
Very stiff to hard CLAY (Kuroa Ashes) - Undrained	Orange	16	Undrained	100	0	Constant	Water Table	Custom	0
Stiff CLAY/SILT (Puketoka Formation) - Undrained	Pink	16	Undrained	80	0	Constant	Water Table	Custom	0
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained	Dark Blue	16	Undrained	40	0	Constant	Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained	Dark Green	18	Undrained	120	0	Constant	Water Table	Automatically Calculated	

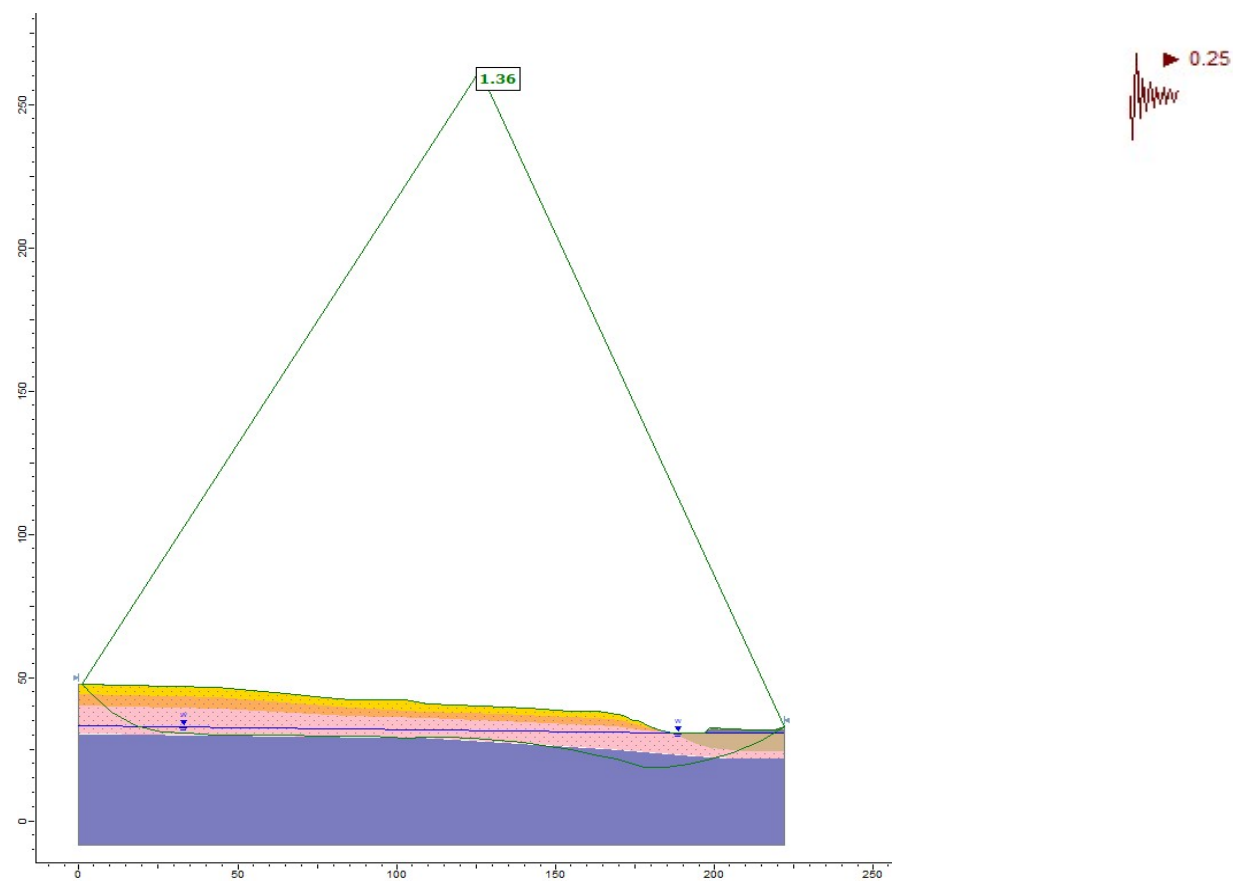
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



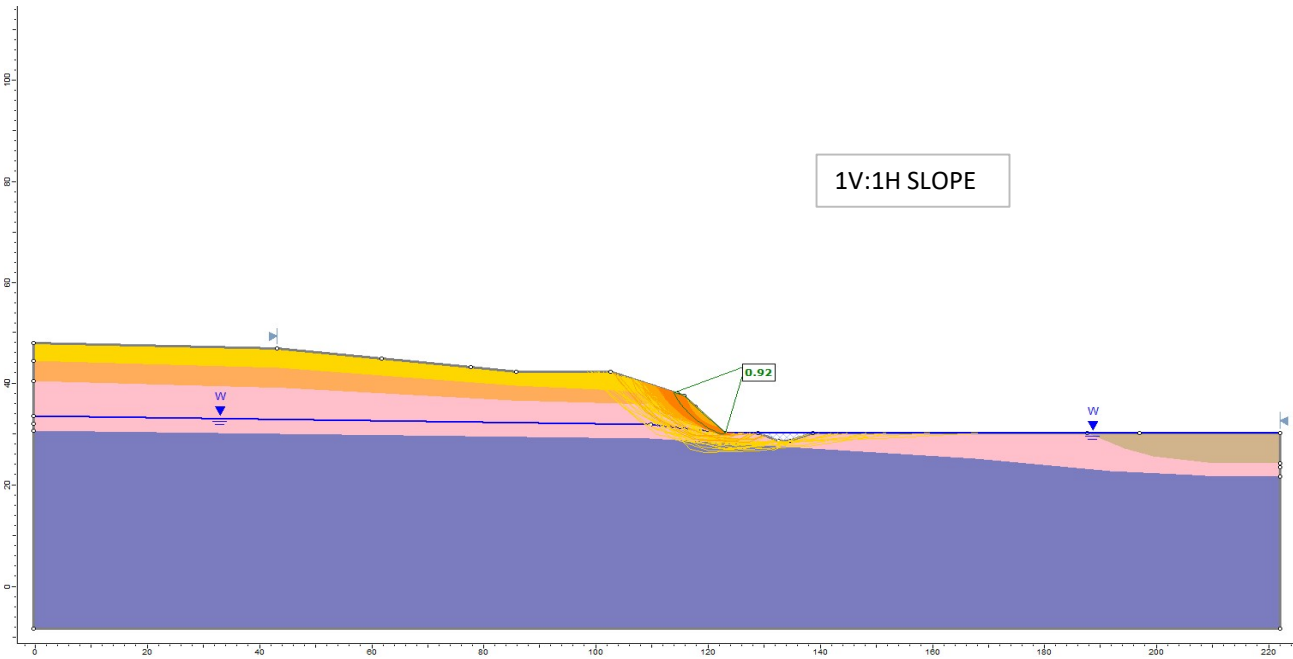
Parameters

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated

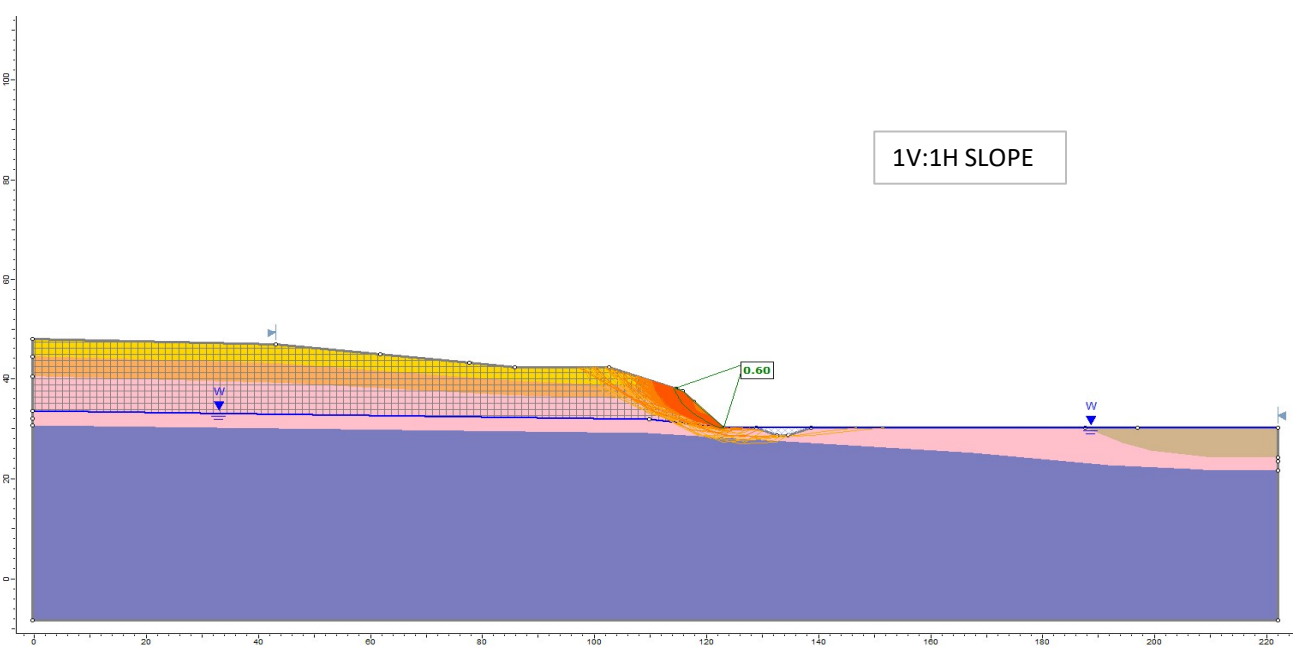
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Ru Value
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	None		0.3
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	None		0.3

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	50	0	Constant	Water Table	Automatically Calculated

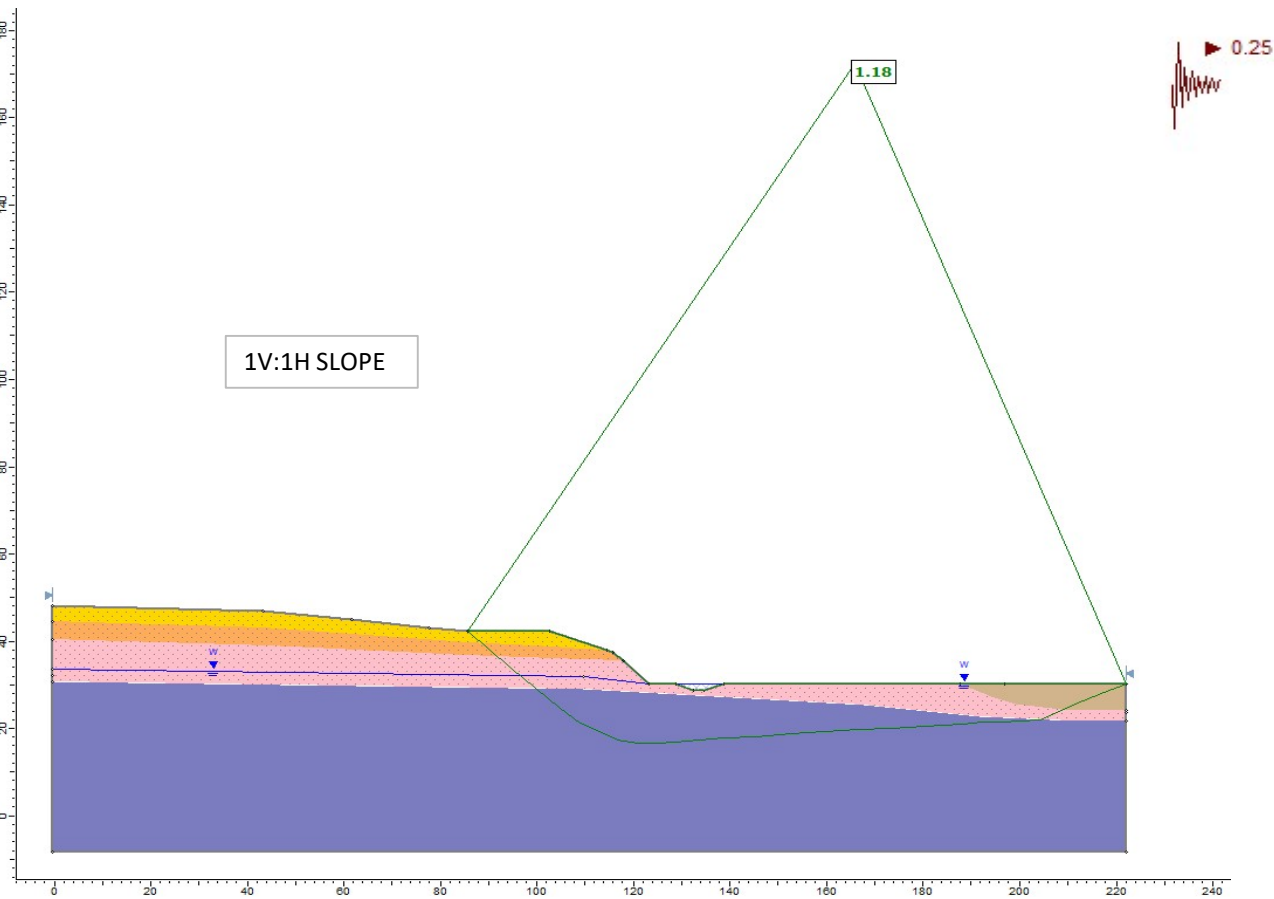
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Ru Value
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	None		0.3
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	None		0.3

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	50	0	Constant	Water Table	Automatically Calculated



Project
Te Kowhai Industrial Development

Title
Section 02 - Proposed

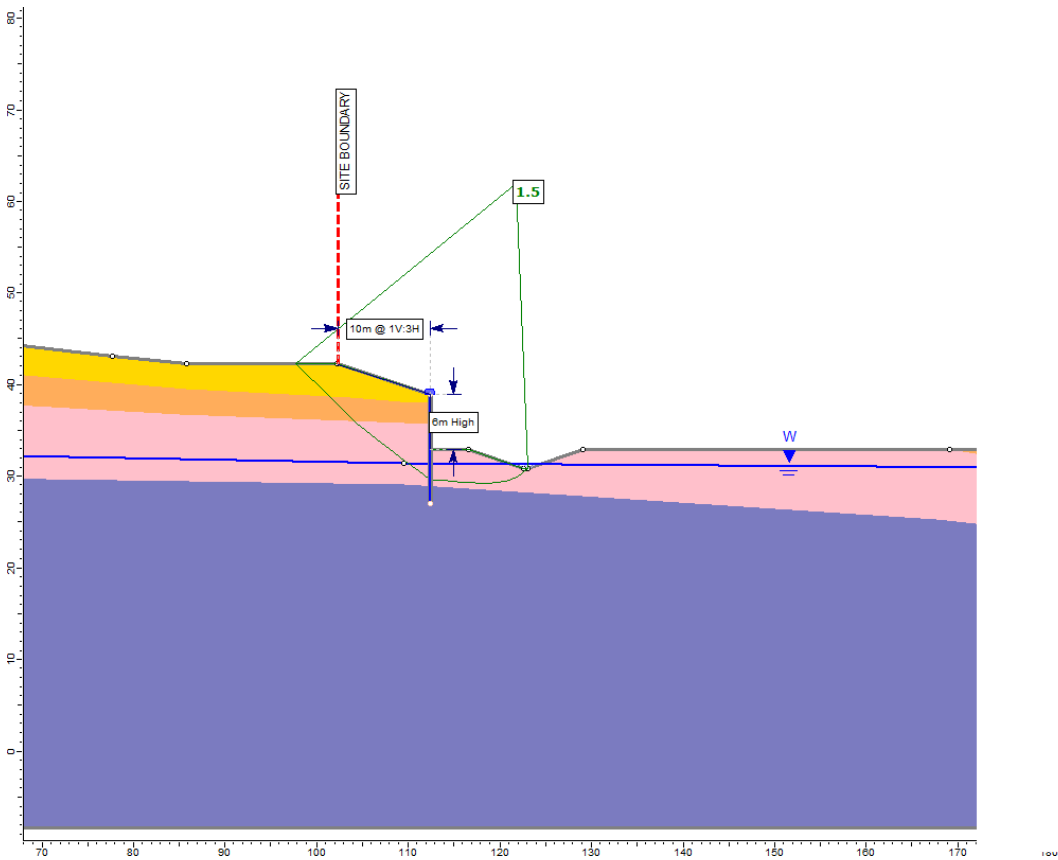
Analysis
Cuckoo

Date
10/08/2026

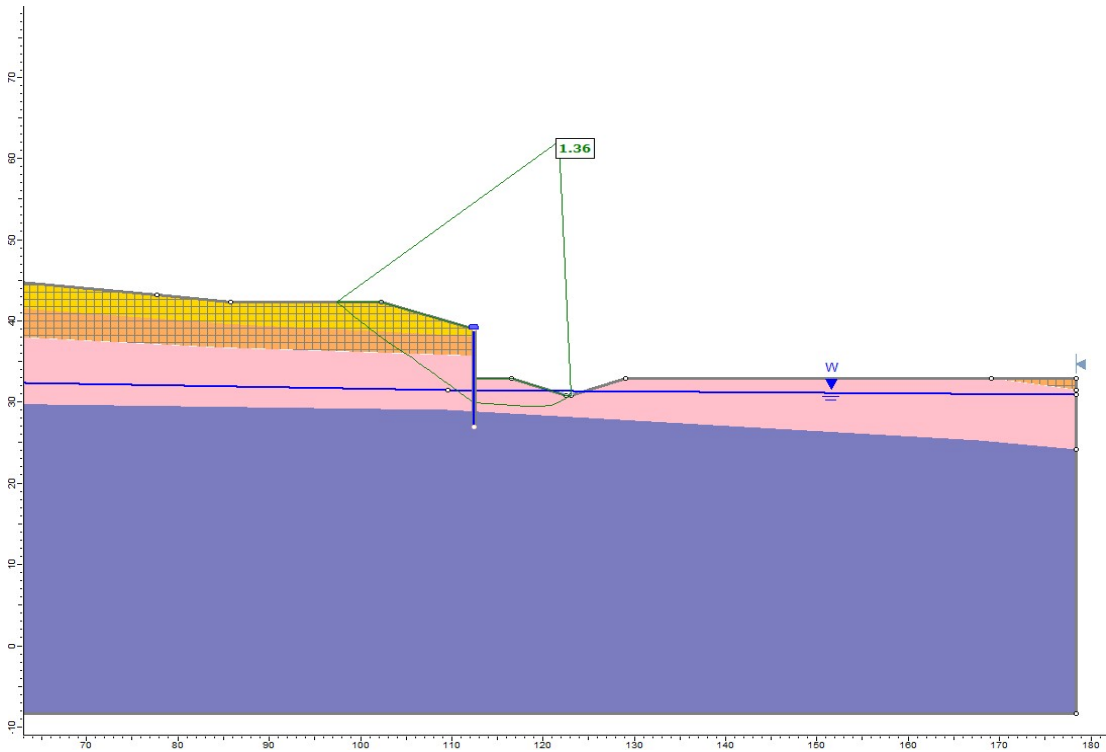
Project No.
HAM2025-0116

Drawing
STAB 02

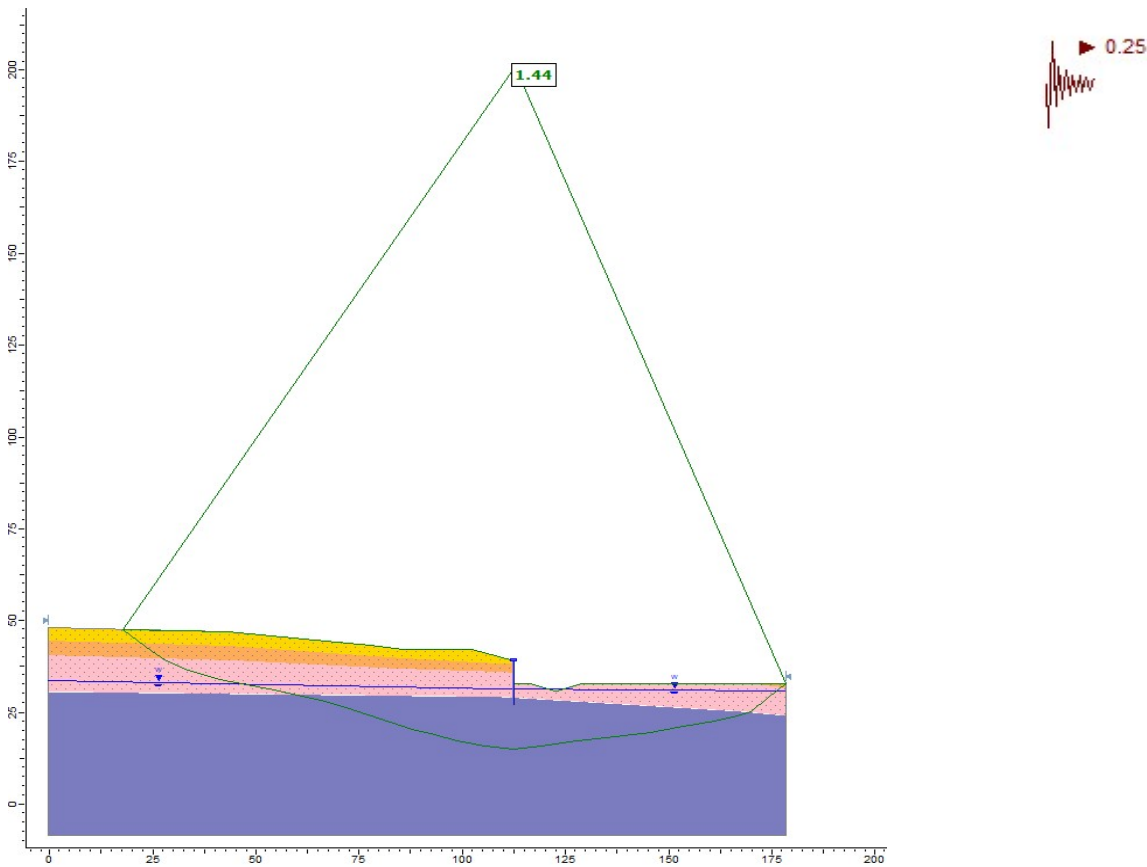
Proposed Profile with Remediation - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile with Remediation - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3.



Proposed Profile with Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



PREVAILING

ELEVATED
GROUNDWATER

SEISMIC

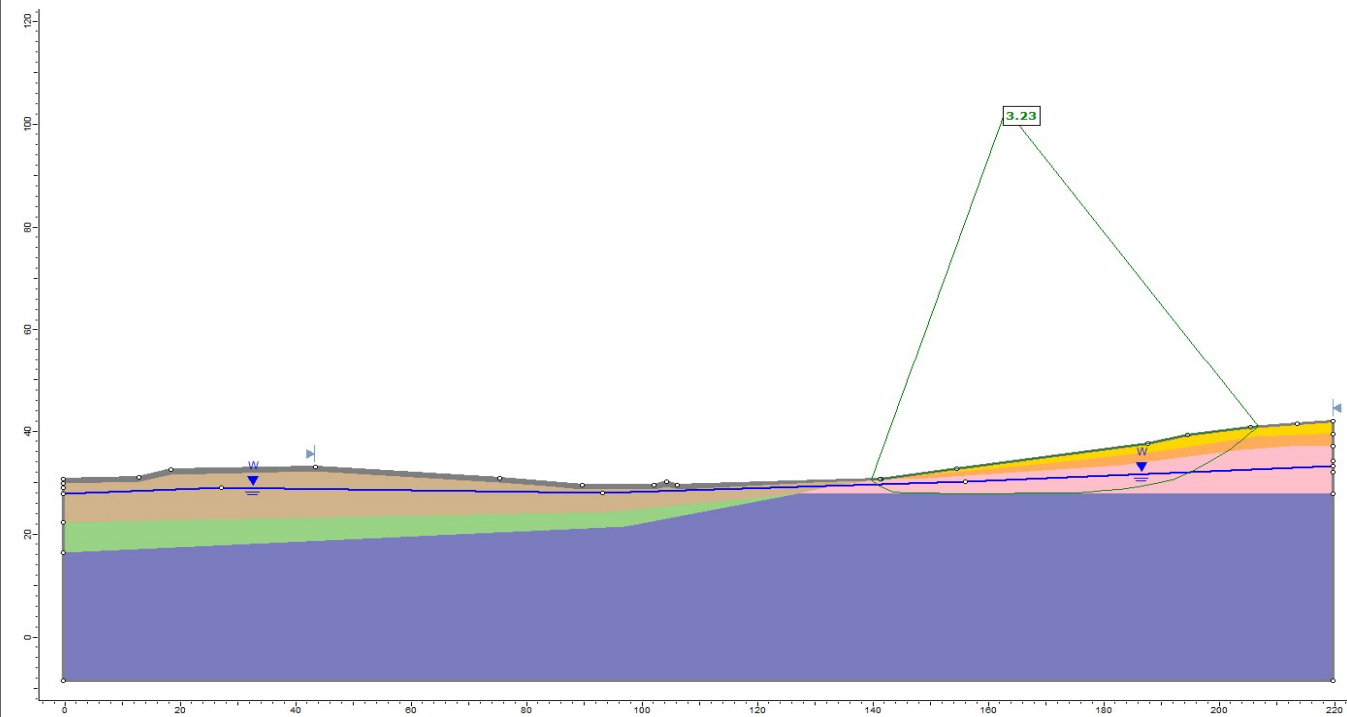
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Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated

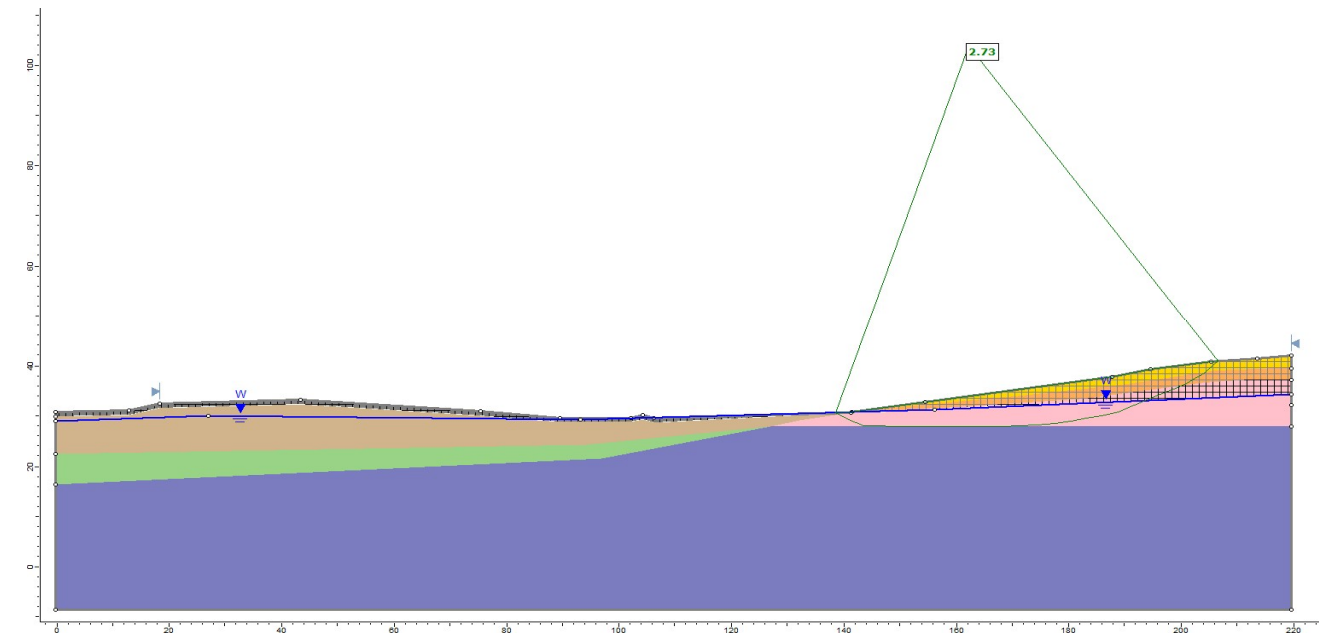
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Ru Value
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	None		0.3
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	None		0.3

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	50	0	Constant	Water Table	Automatically Calculated

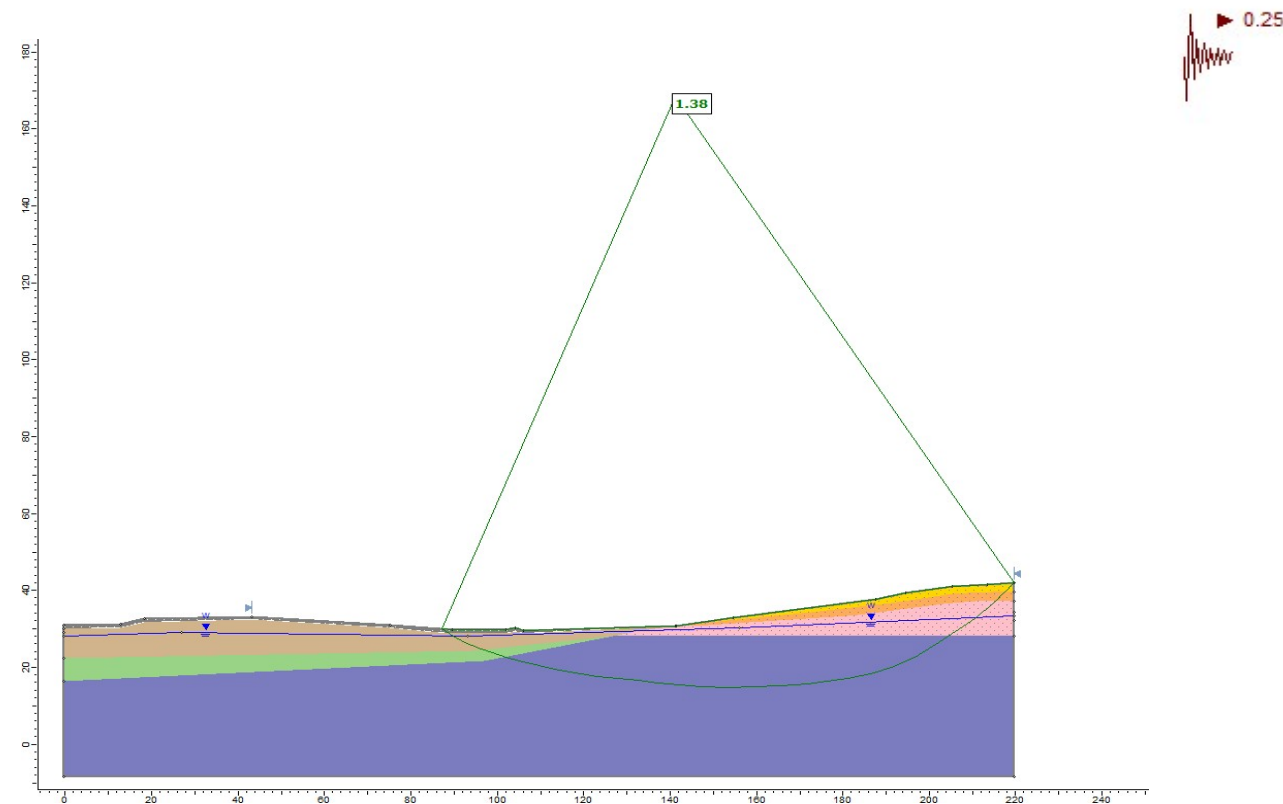
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

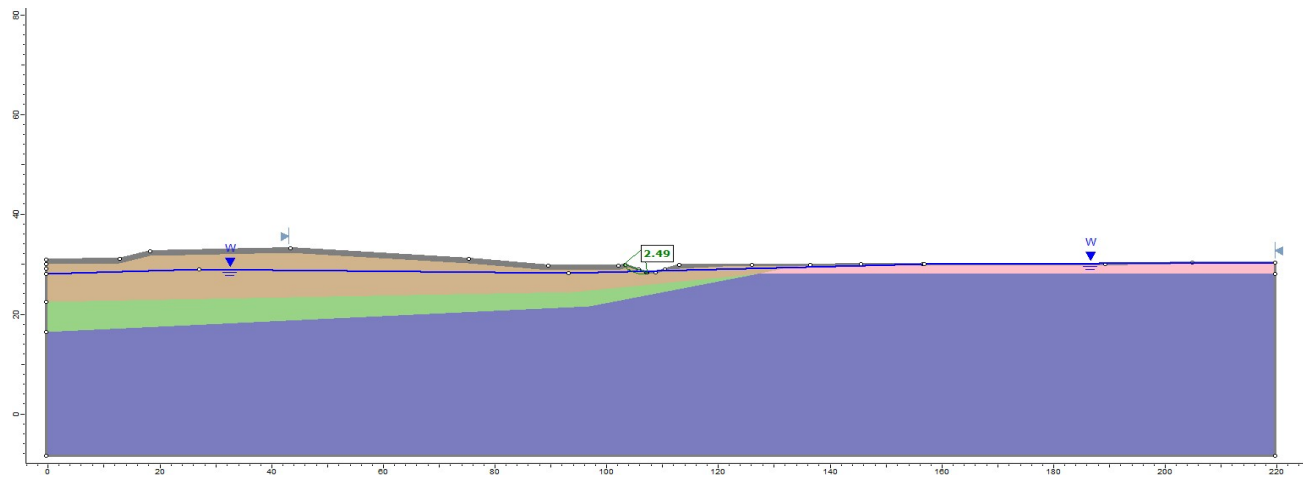
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated

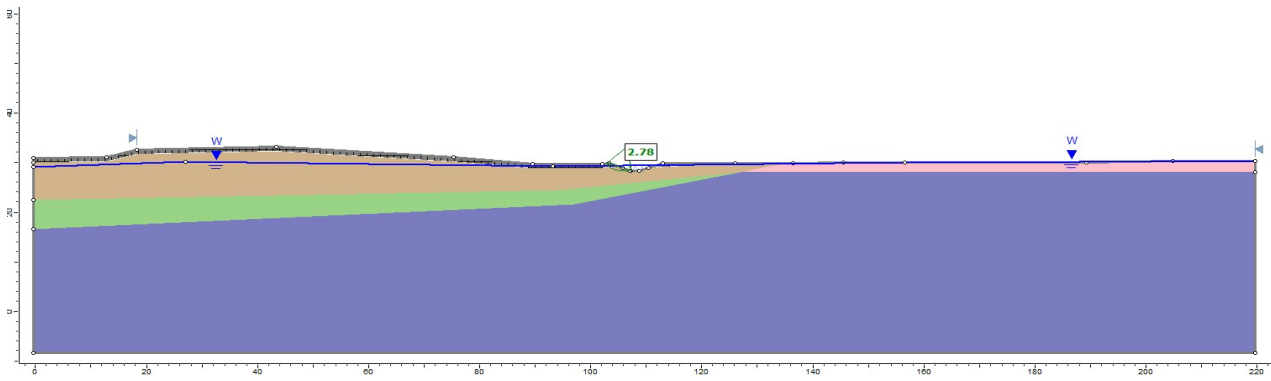
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Ru Value
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	None		0.3
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	None		0.3

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	50	0	Constant	Water Table	Automatically Calculated

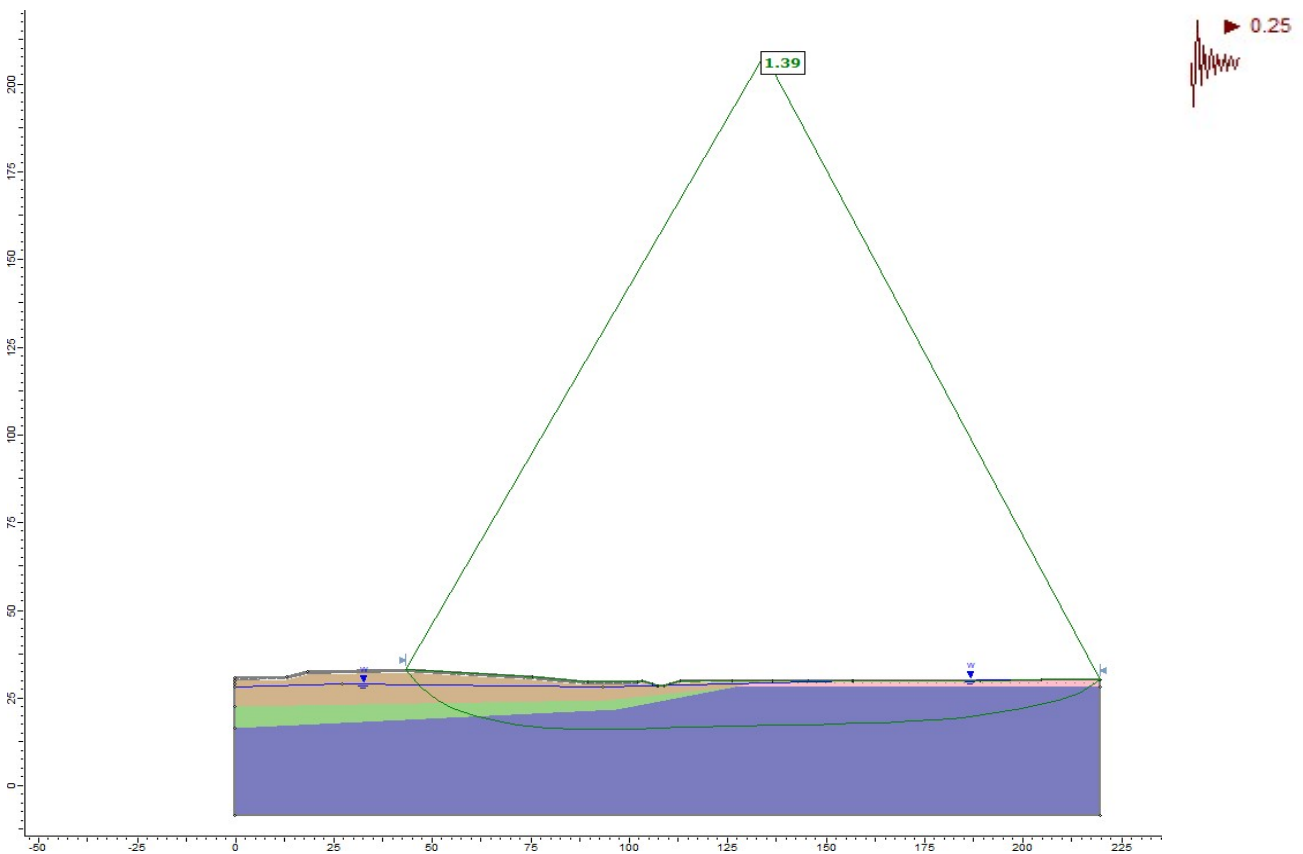
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



PREVAILING

ELEVATED
GROUNDWATER

SEISMIC

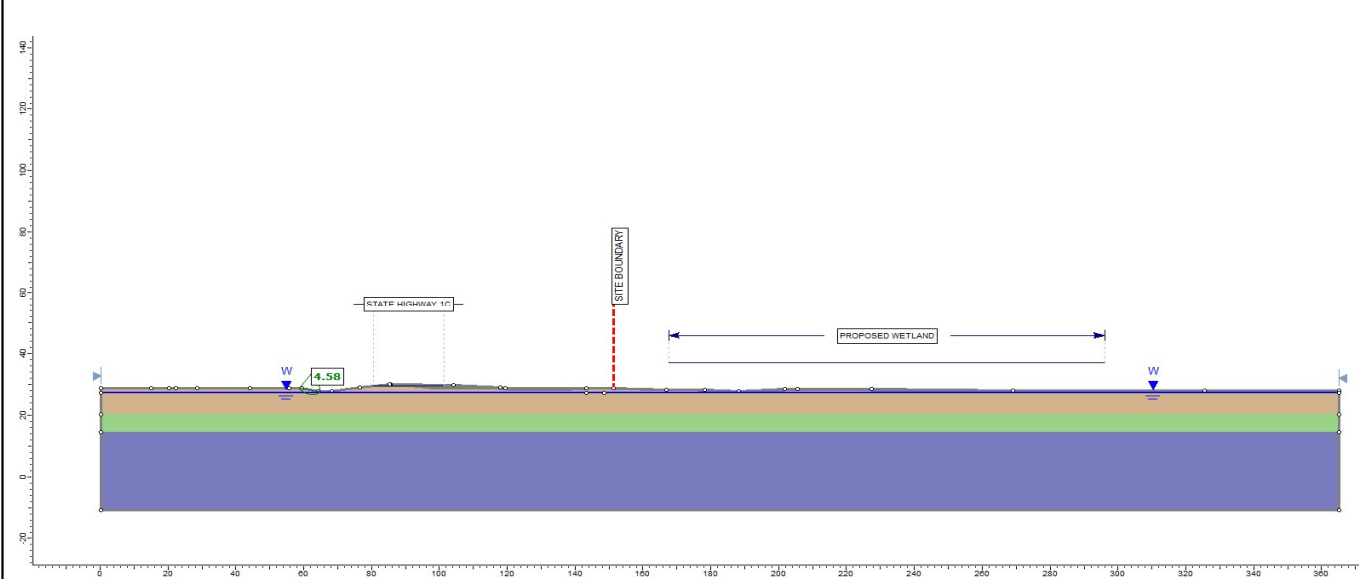
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Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated

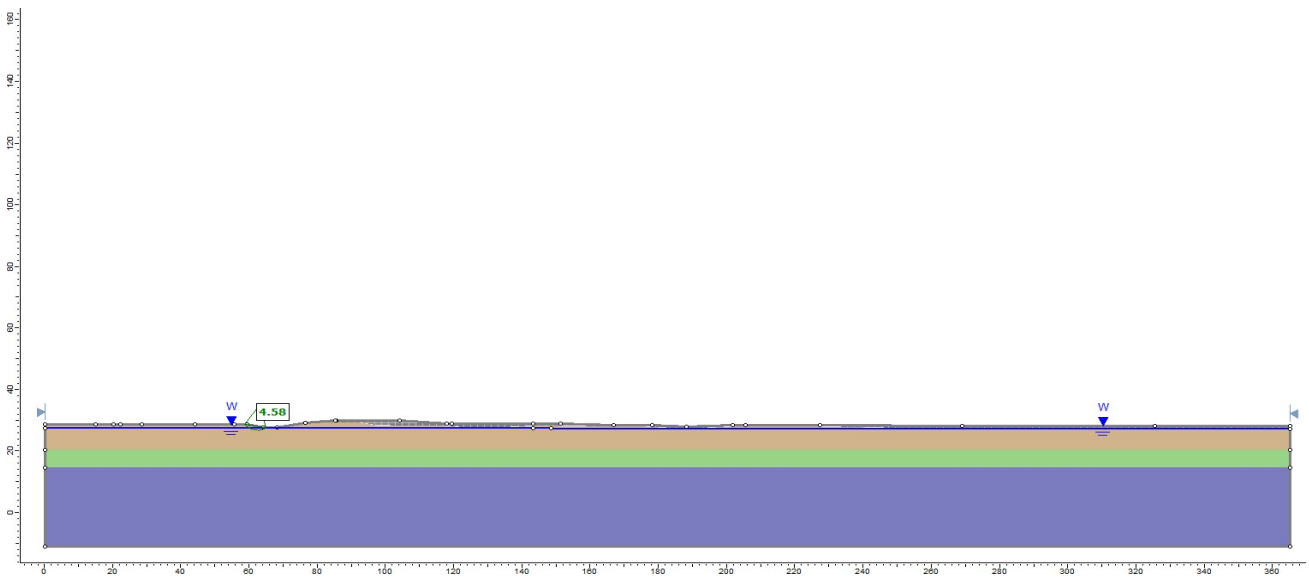
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Ru Value
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	None		0.3
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	None		0.3

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Automatically Calculated
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Automatically Calculated
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	50	0	Constant	Water Table	Automatically Calculated

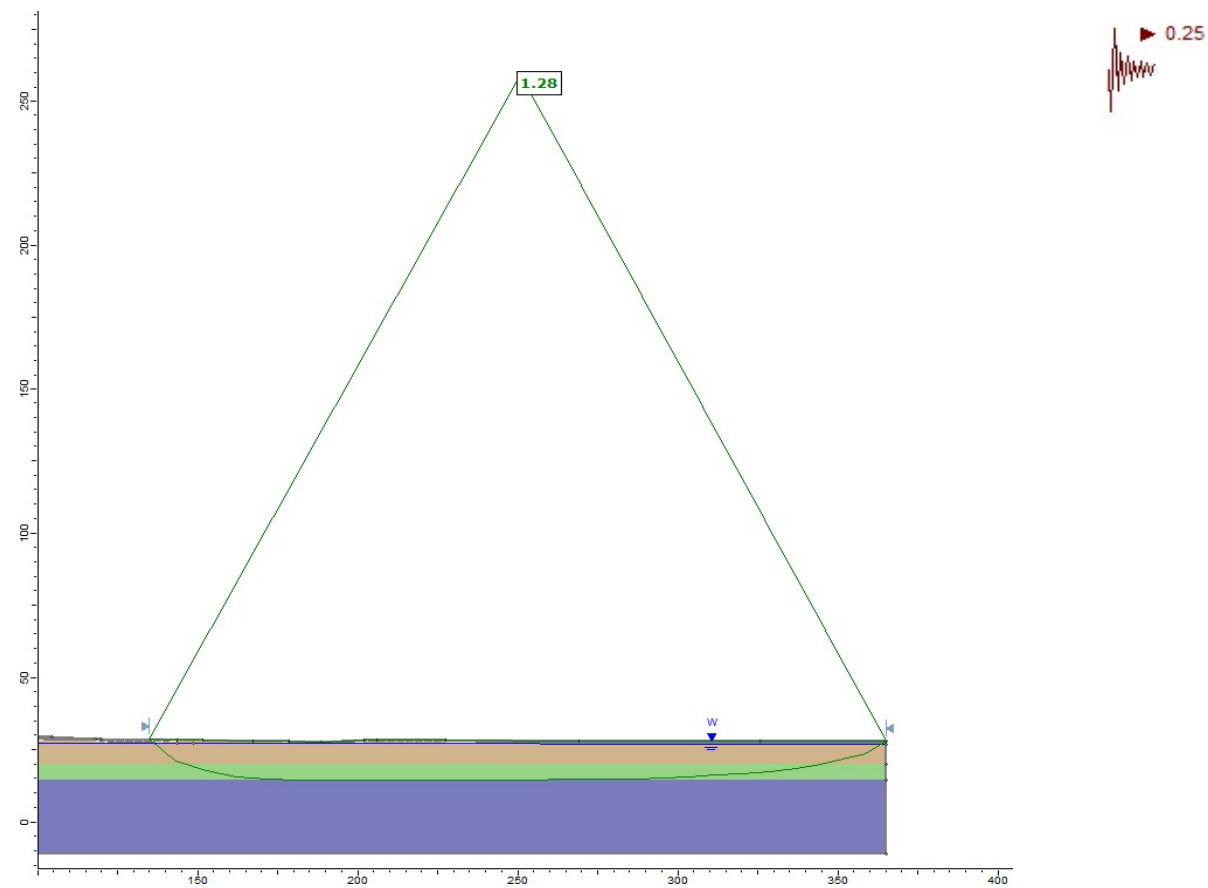
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

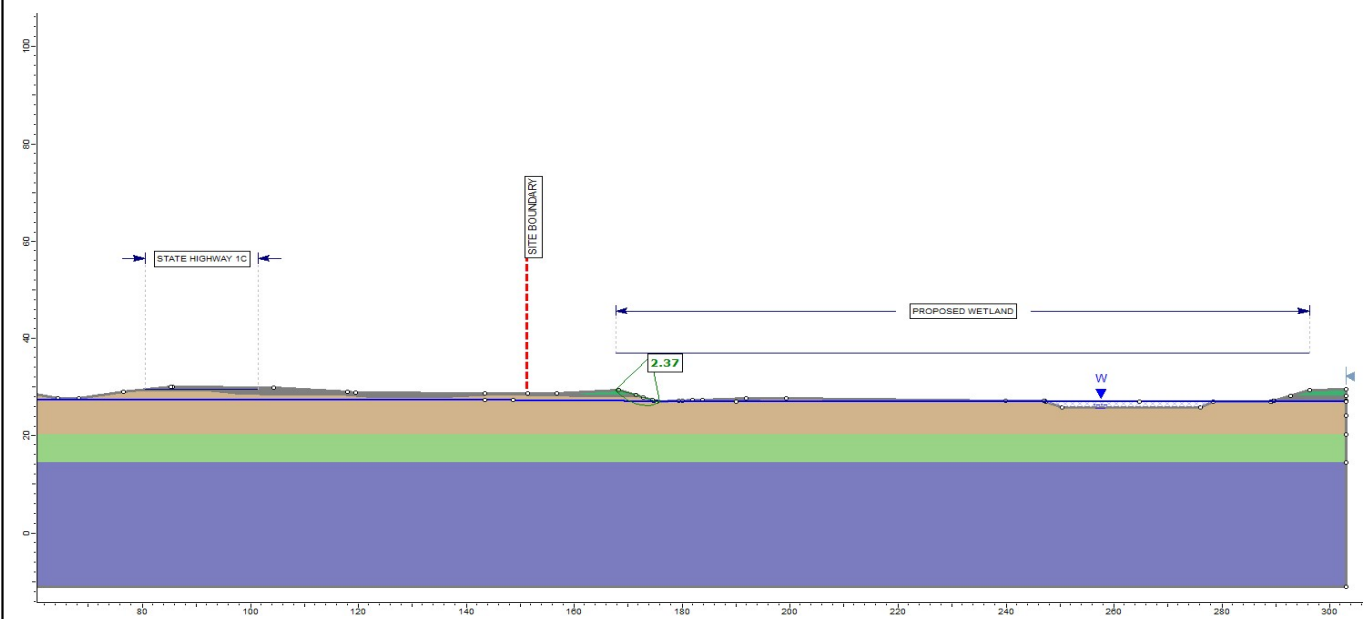
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1

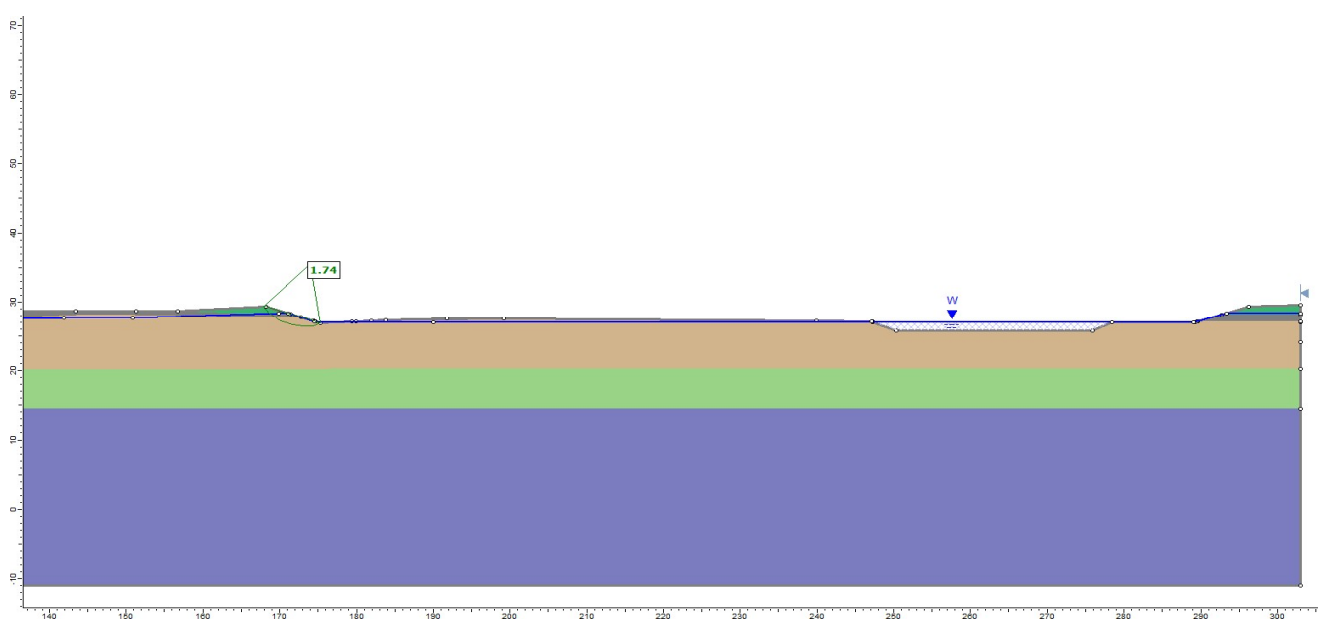
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated		
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28	None			0.3
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1	

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)-Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)-Liq.		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				Water Table	Custom	1

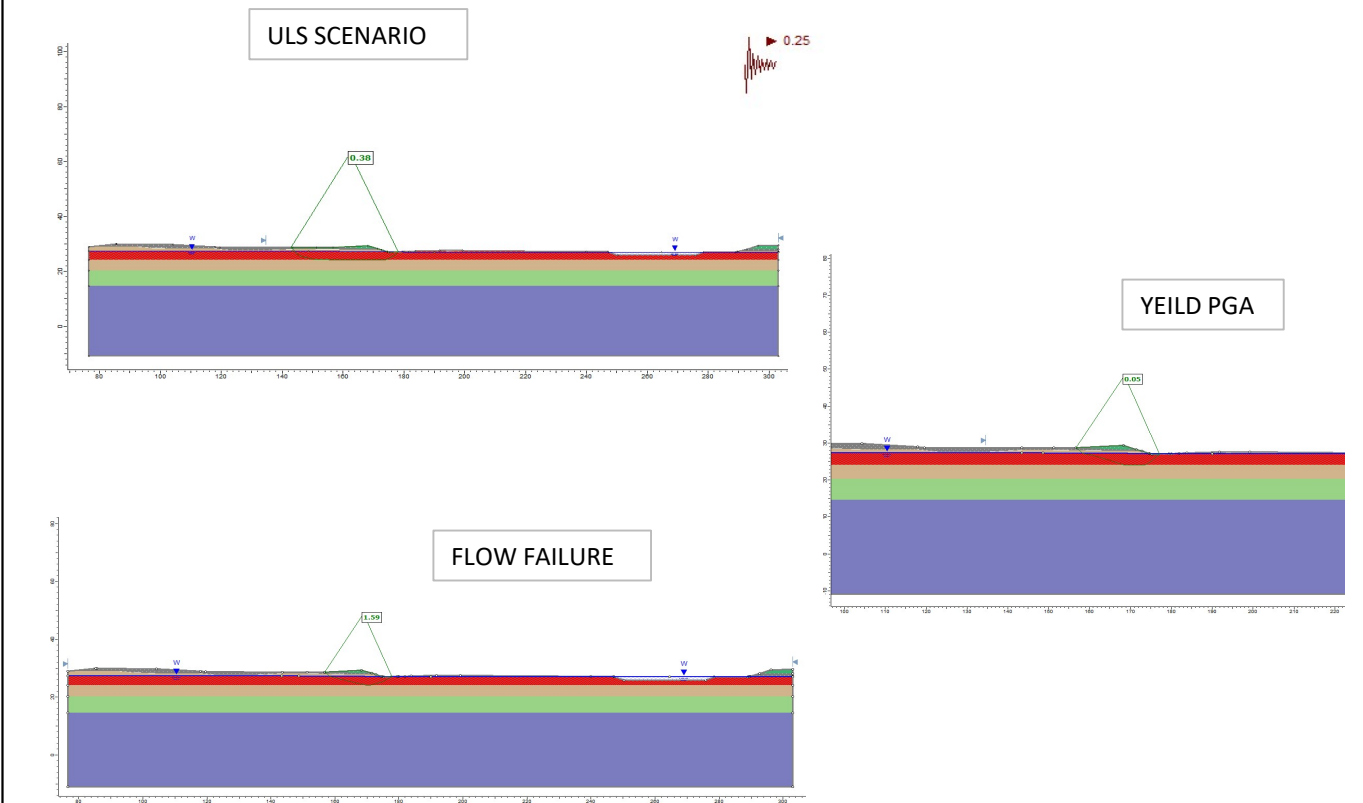
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Automatically Calculated

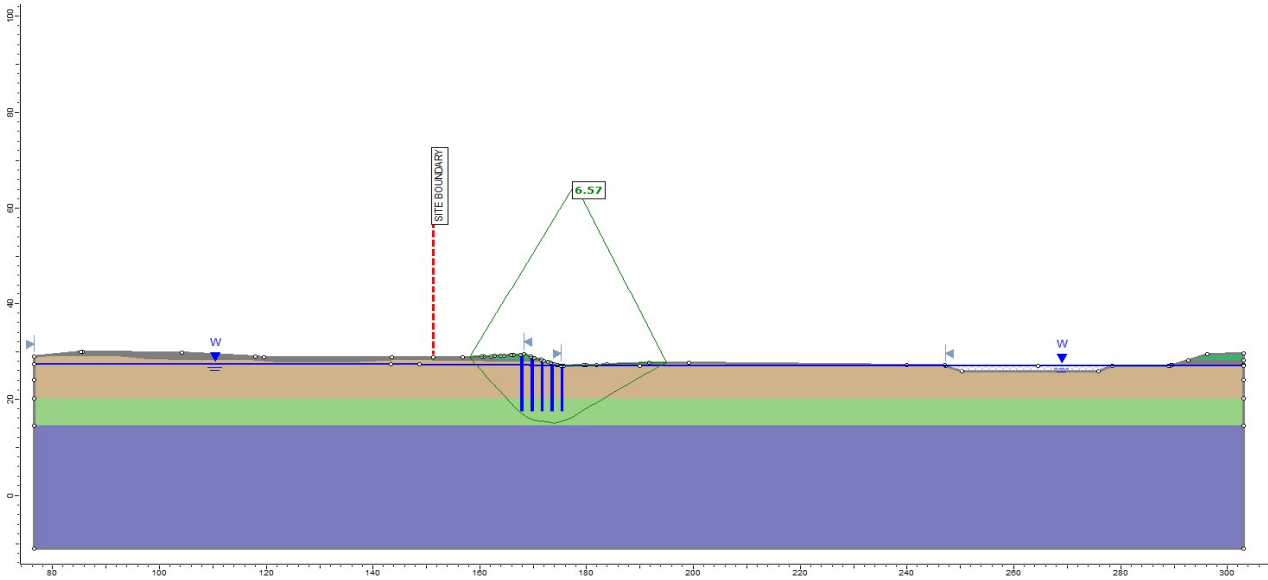
ELEVATED GROUNDWATER

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Automatically Calculated

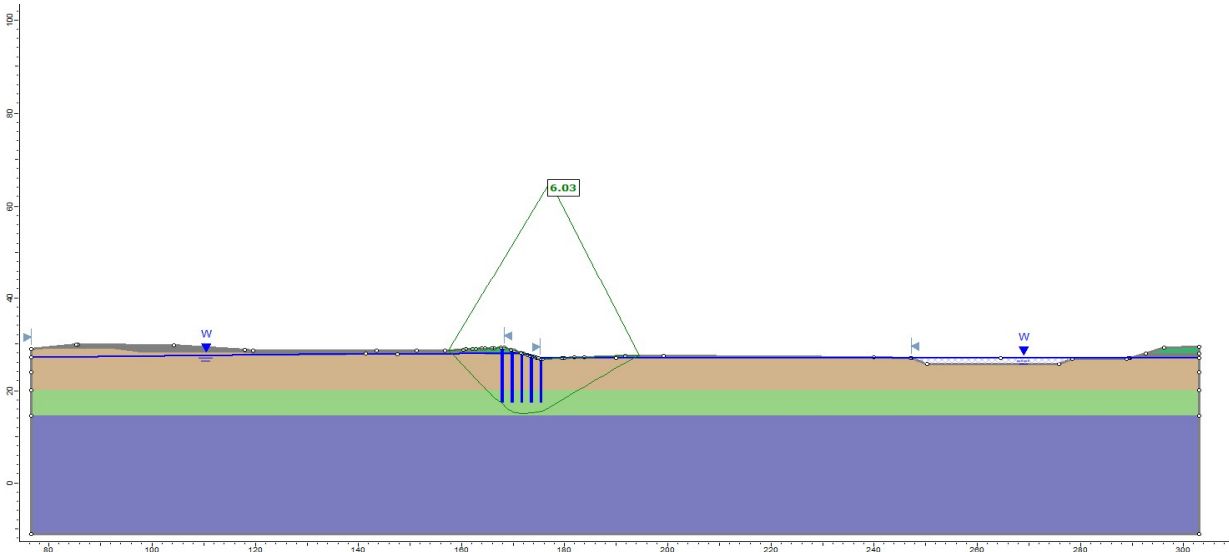
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained		18	Undrained	120	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liq.		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				Water Table	Custom	1

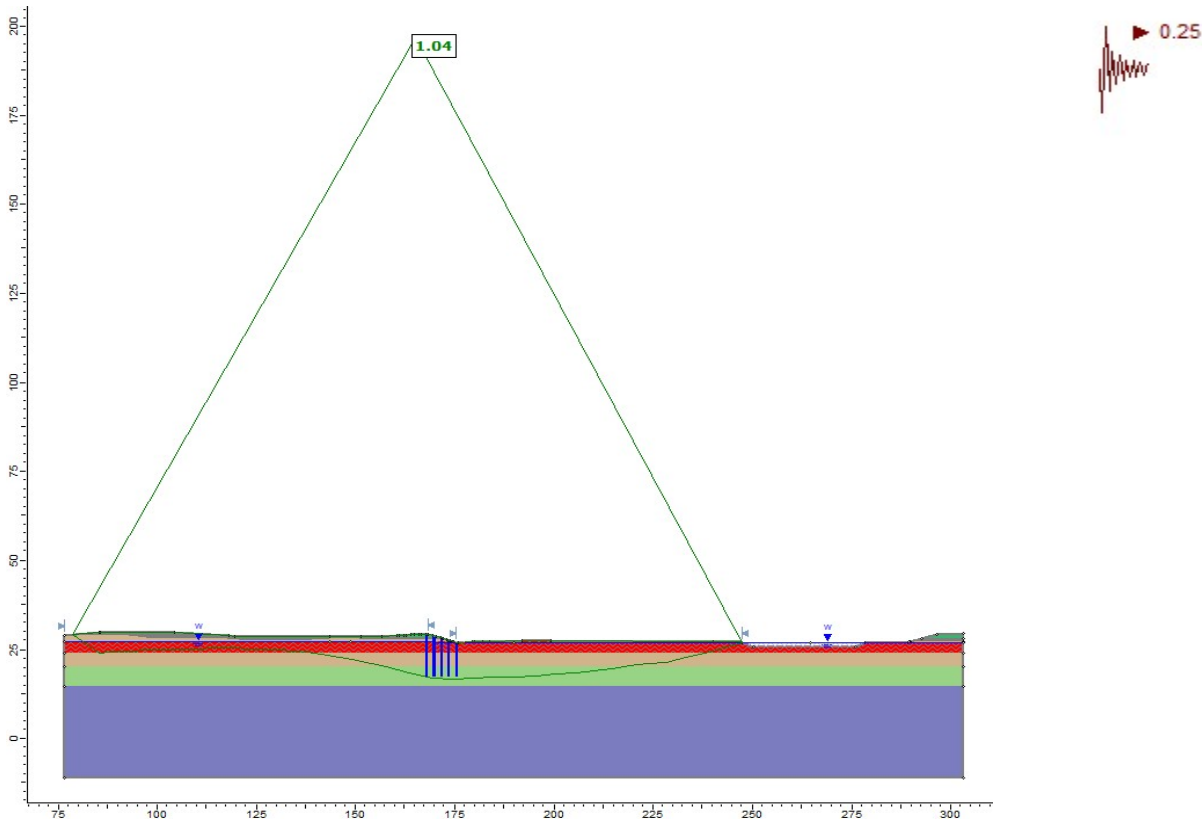
Proposed Profile with Remediation - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile with Remediation - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3.



Proposed Profile with Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



PREVAILING

ELEVATED
GROUNDWATER

SEISMIC

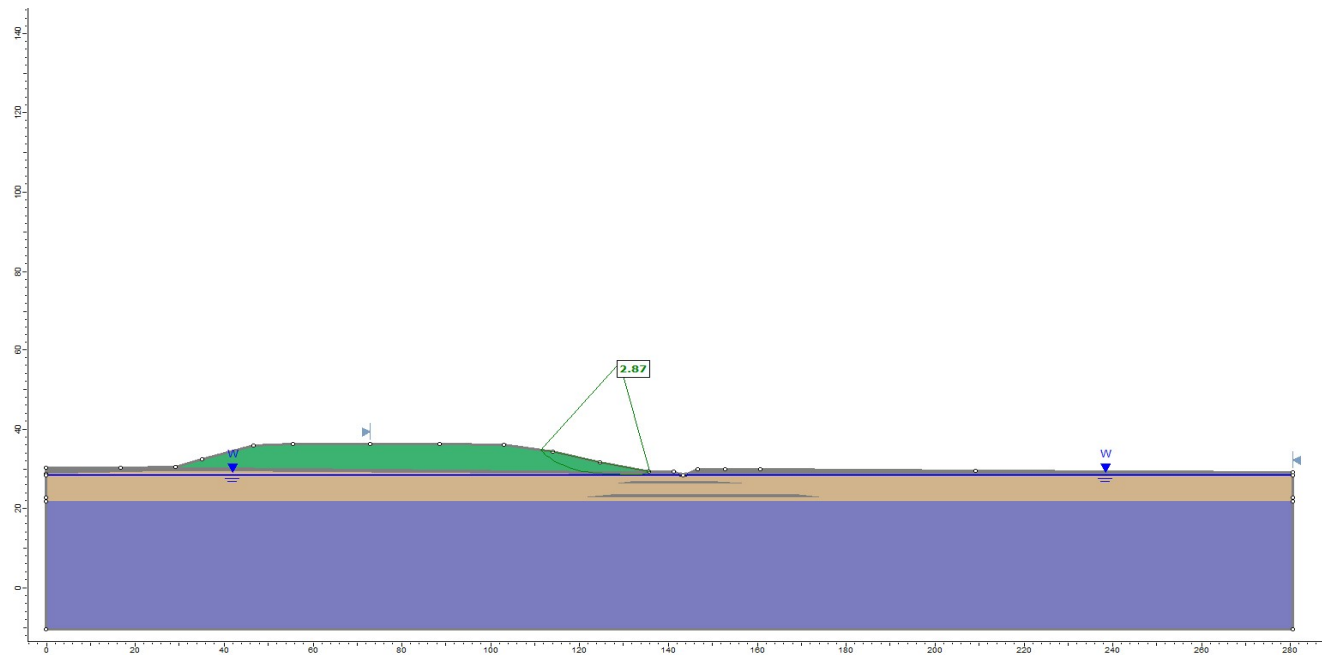
Parameters

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		None			0
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28		None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		None			0
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35		None			0
CFA Piles		20	Undrained	10000	0	Constant	Water Table	Custom	1	

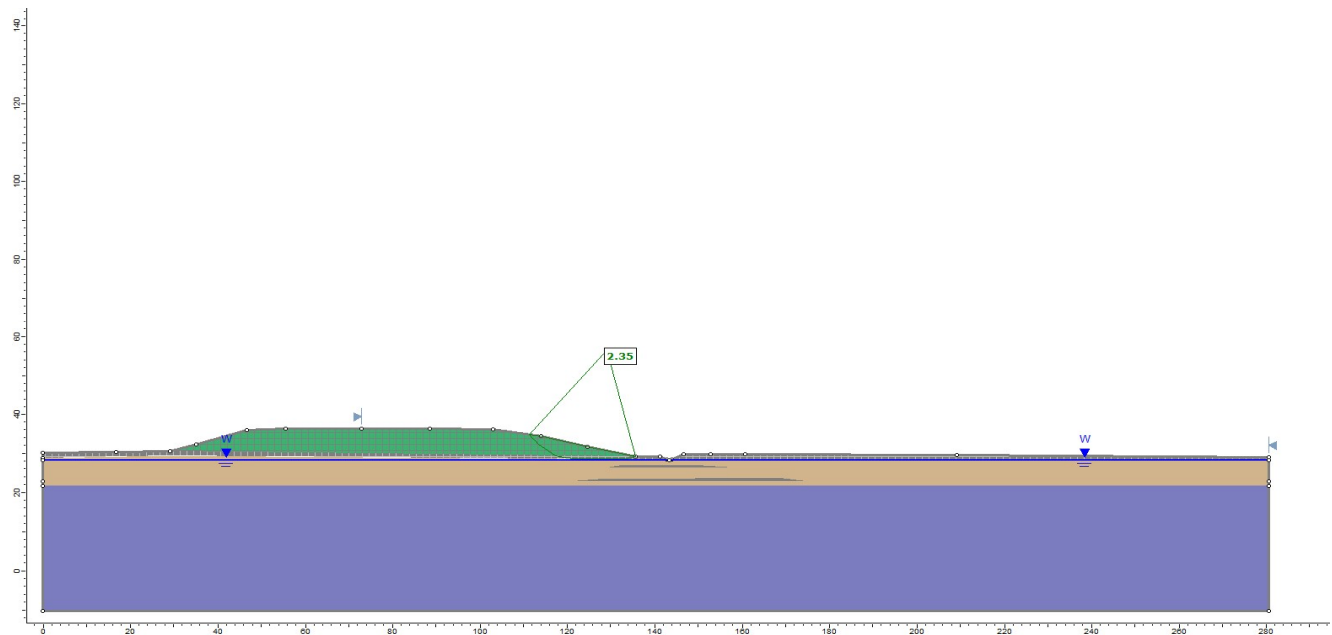
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		None			0
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28		None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		None			0
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35		None			0
CFA Piles		20	Undrained	10000	0	Constant	Water Table	Custom	1	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				None			0
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Lq		16	Vertical Stress Ratio				0.07	5	None			0
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				None			0
CFA Piles		20	Undrained	10000	0	Constant			Water Table	Custom	1	

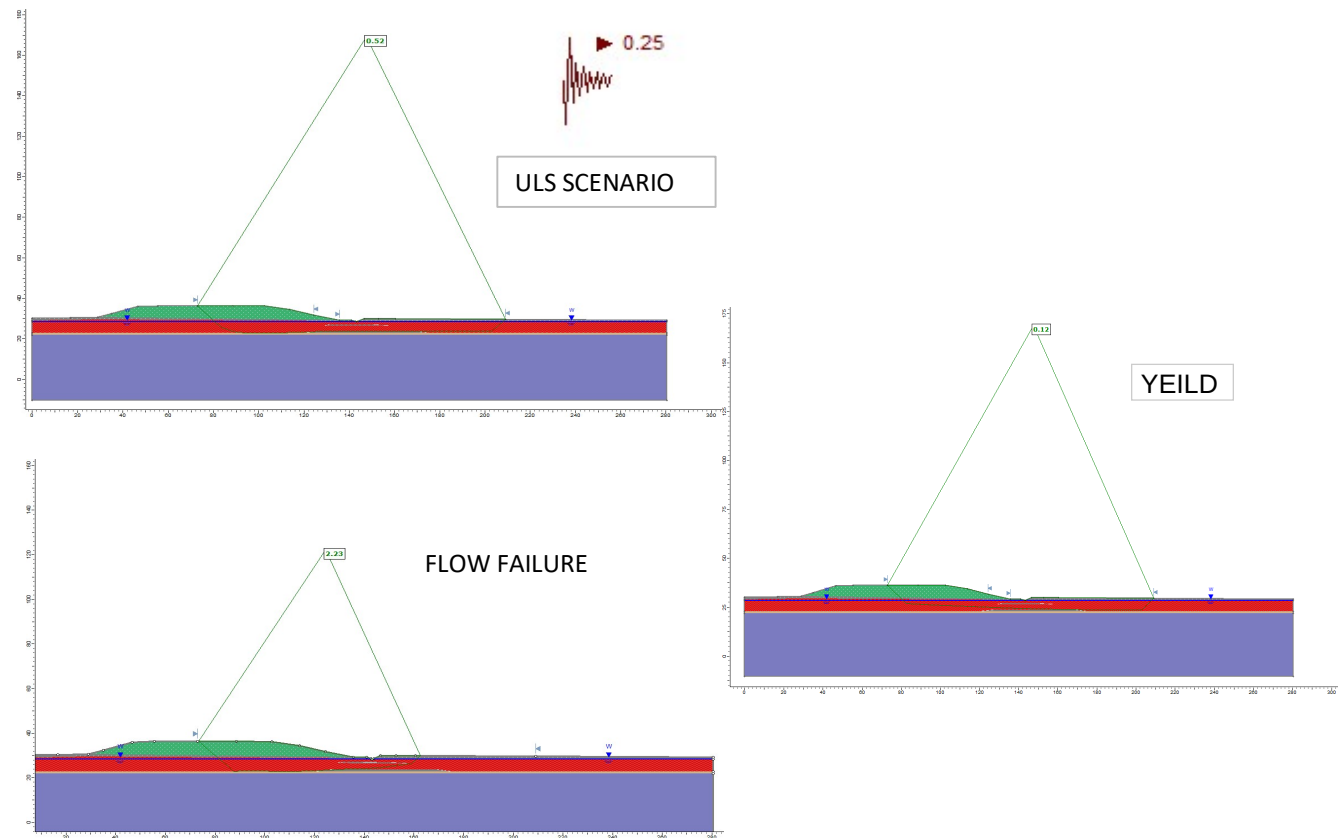
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - Seismic Events. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

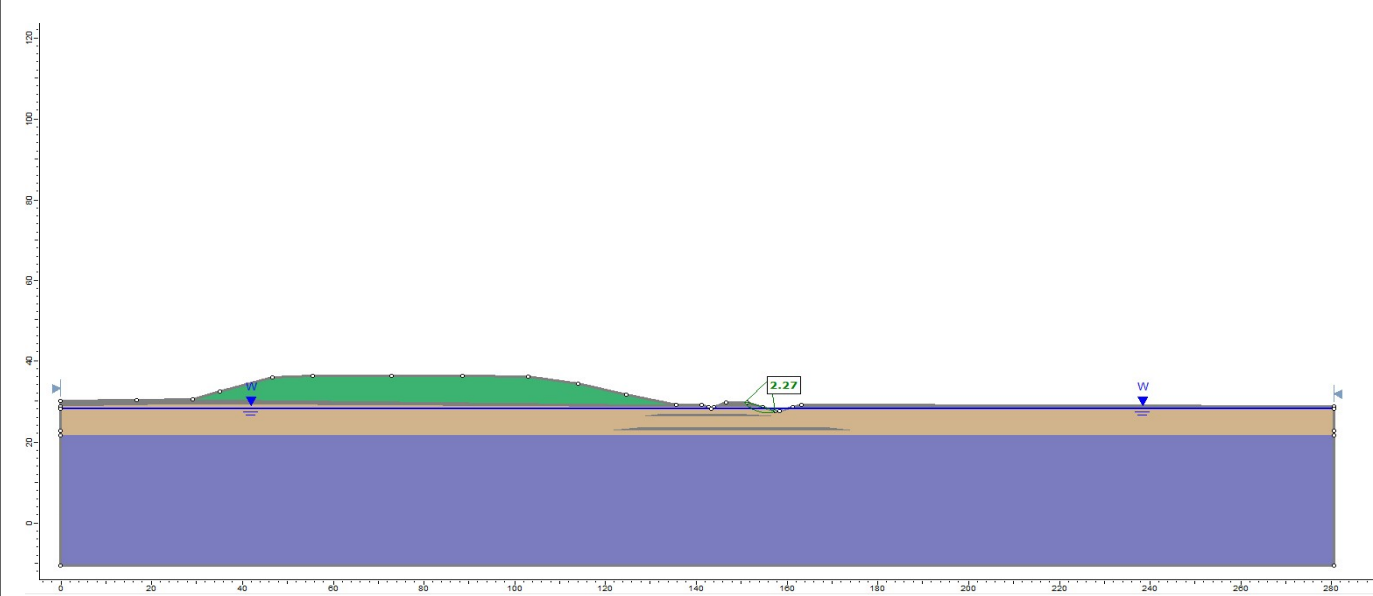
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Automatically Calculated

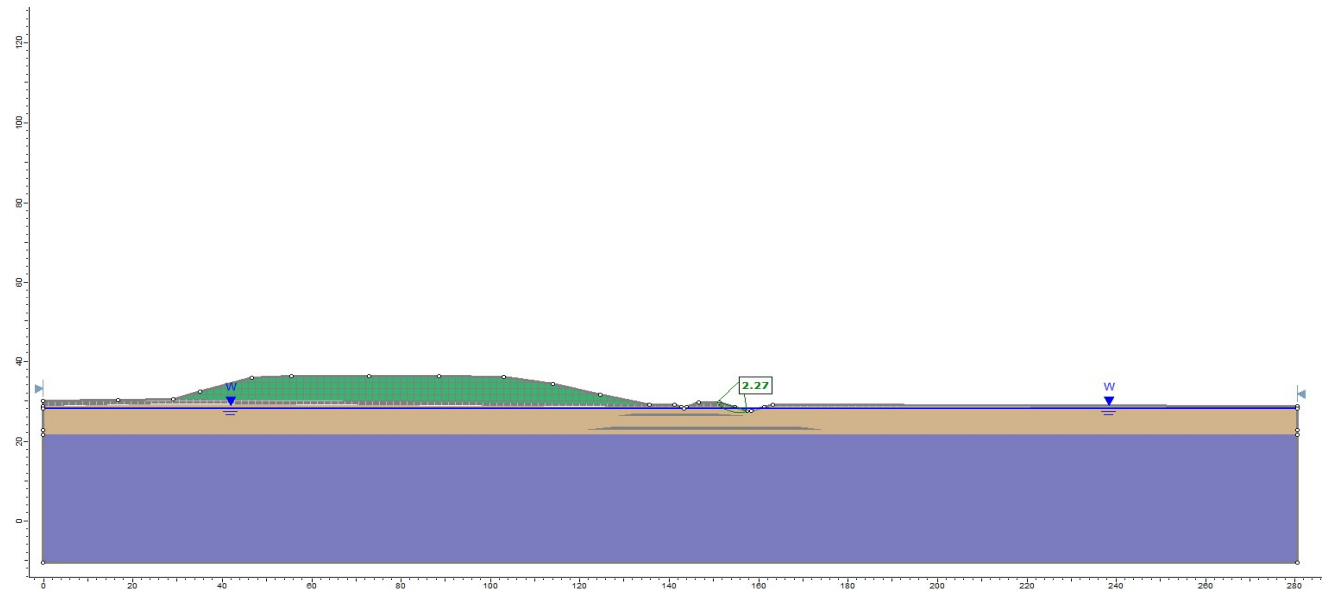
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Automatically Calculated

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained		18	Undrained	120	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liquefaction		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				Water Table	Custom	1

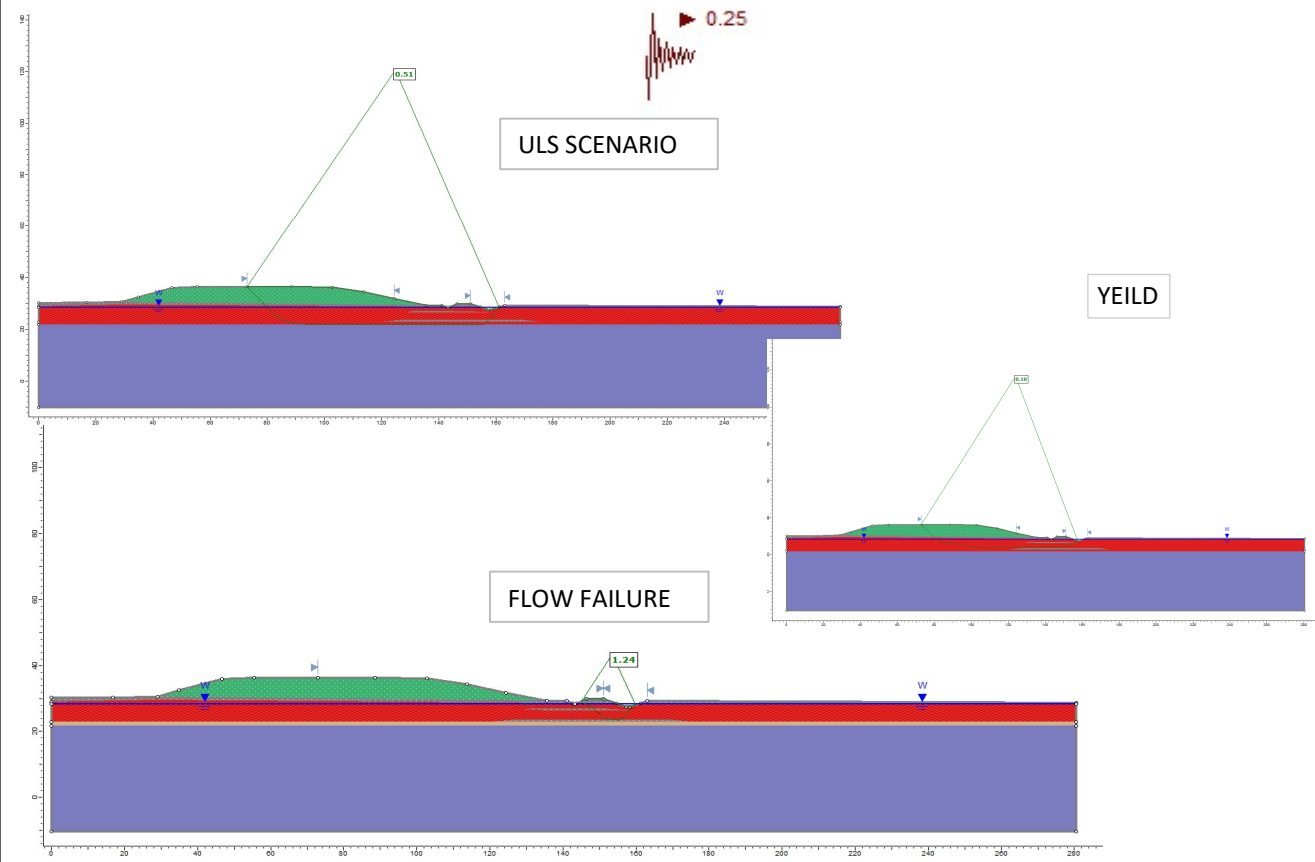
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	HuType
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Automatically Calculated

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	HuType
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Automatically Calculated

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained		18	Undrained	120	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liquefaction		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				Water Table	Custom	1



Project
Te Kowhai Industrial Development

Title
Section 05 - Proposed

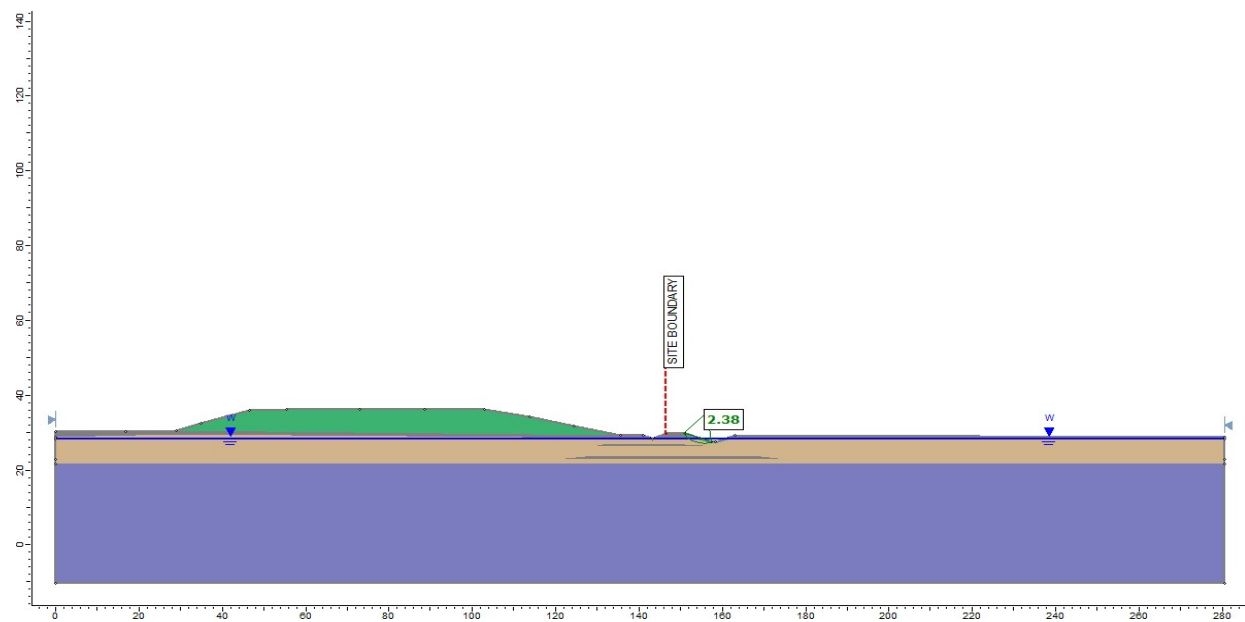
Analysis
Cuckoo

Date
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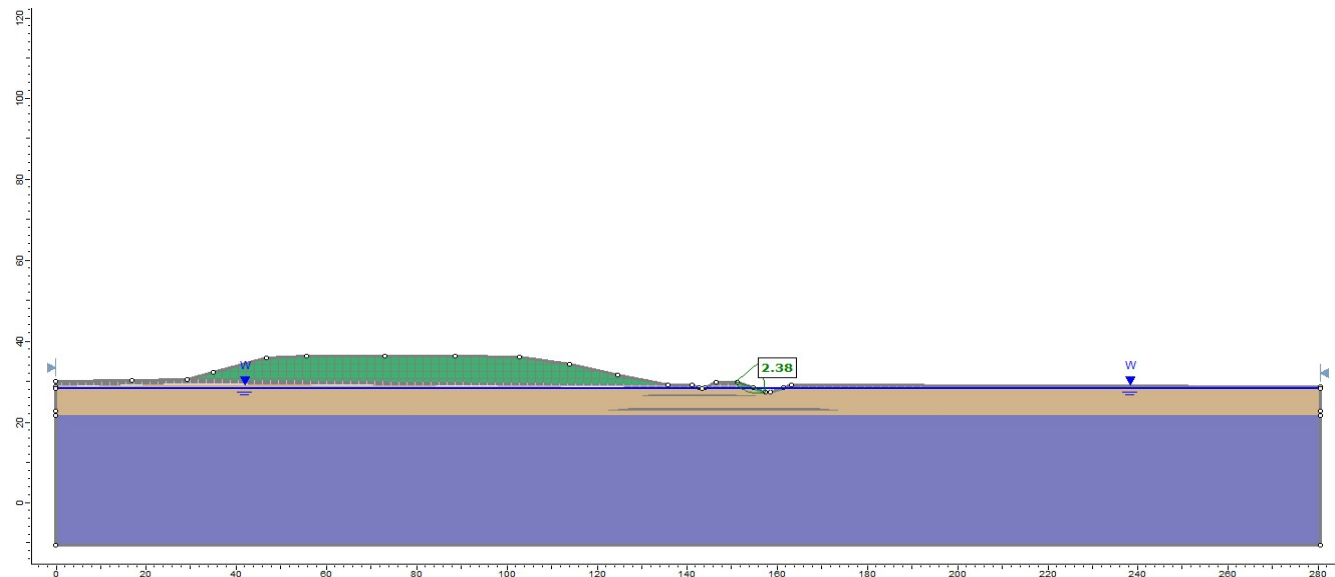
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HAM2025-0116

Drawing
STAB 02

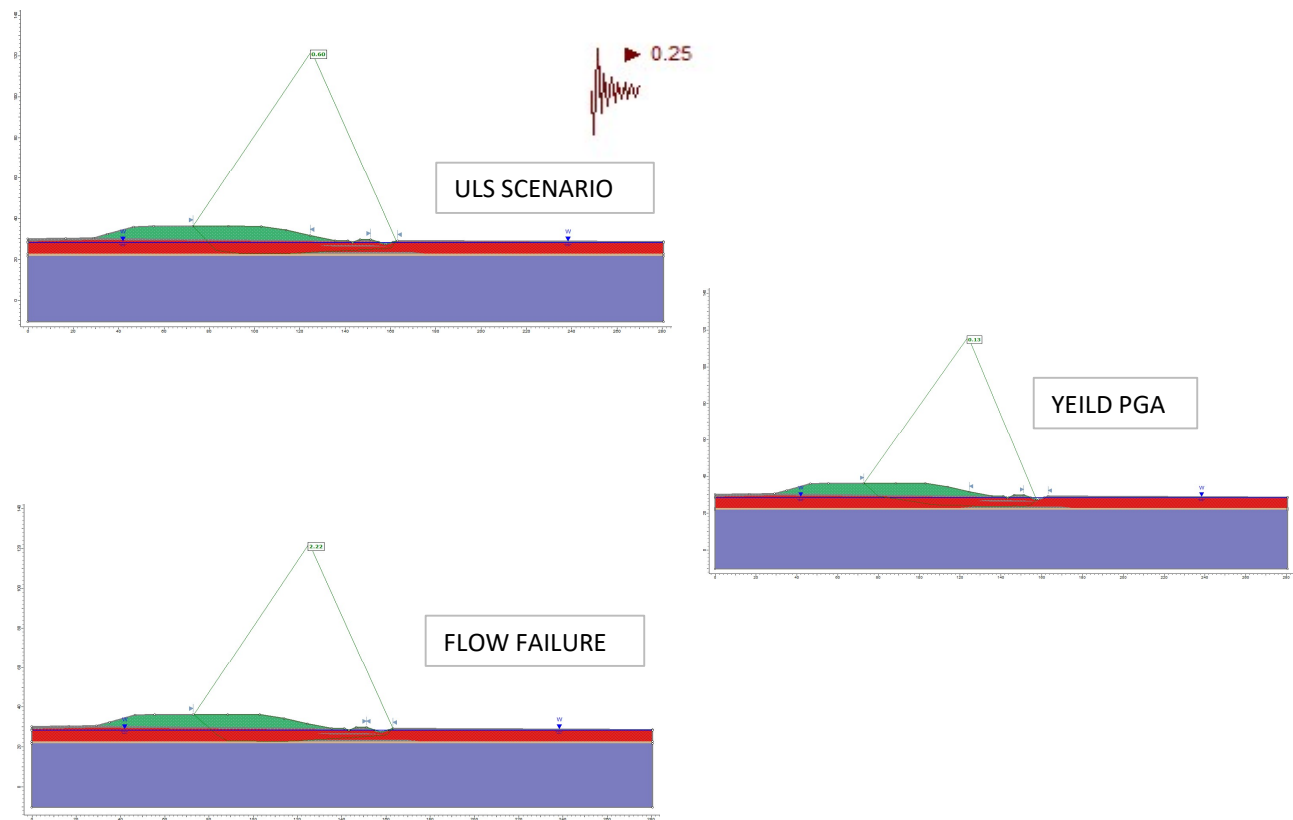
Proposed Profile with Remediation - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile with Remediation - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3.



Proposed Profile with Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	HuType
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Automatically Calculated

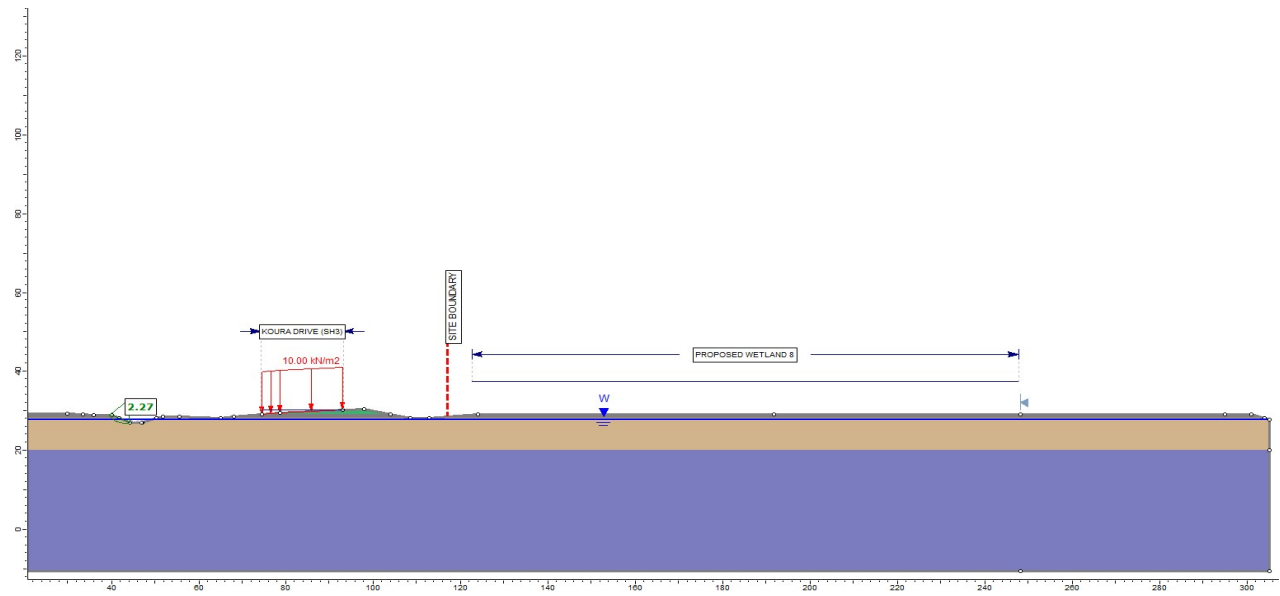
ELEVATED
GROUNDWATER

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	HuType
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Automatically Calculated

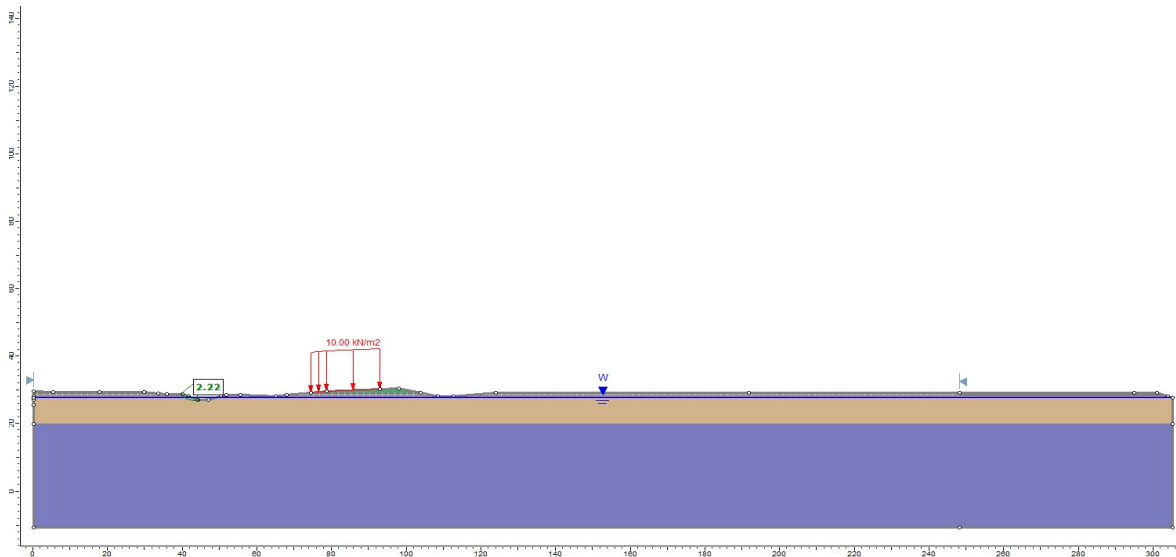
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained		18	Undrained	120	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liq.		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				Water Table	Custom	1

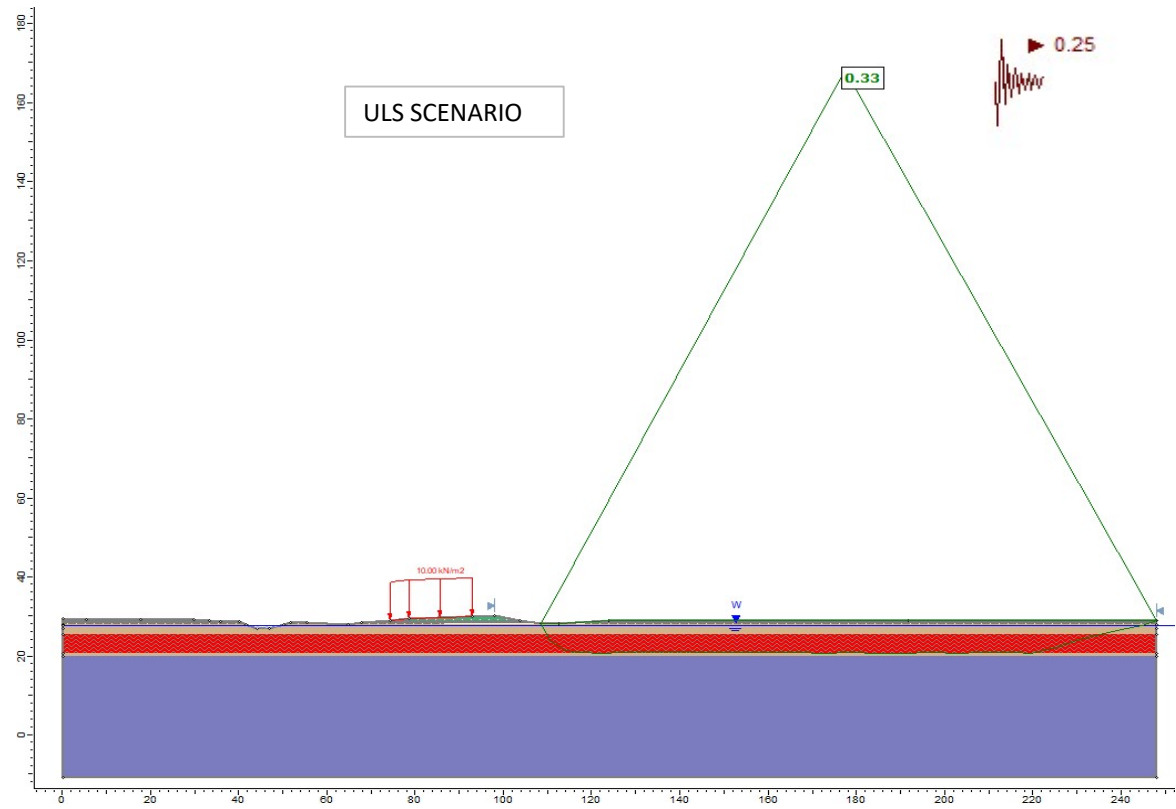
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - Seismic Events. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

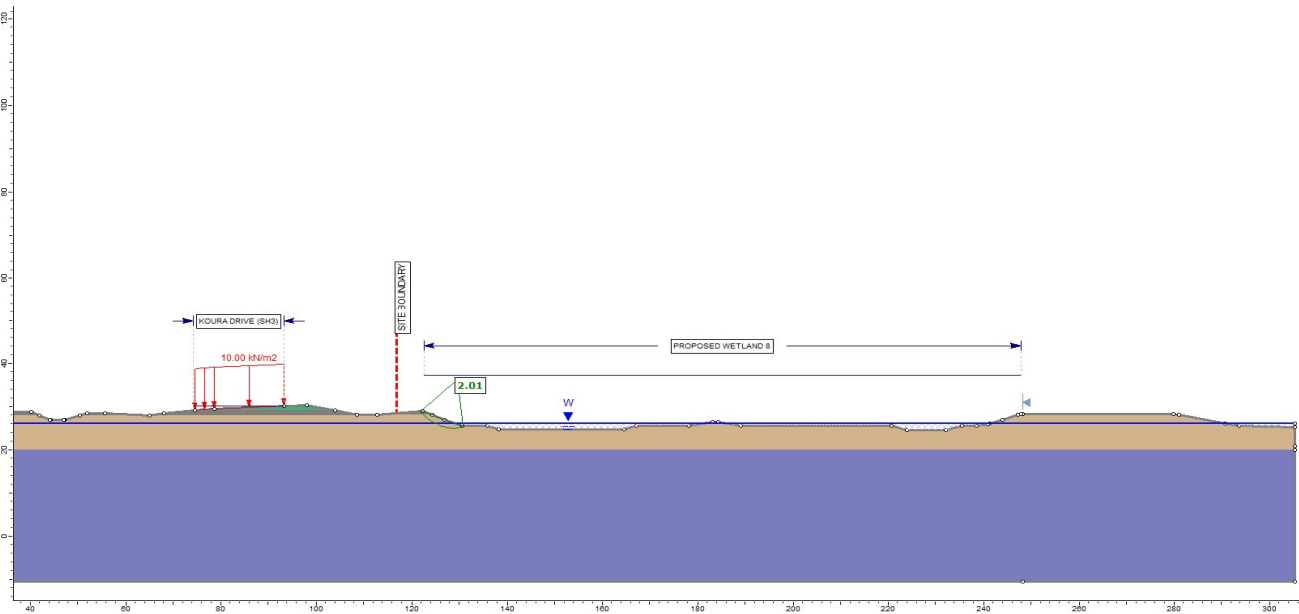
SEISMIC

Material Name	Color	Unit Weight (kN/m³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated

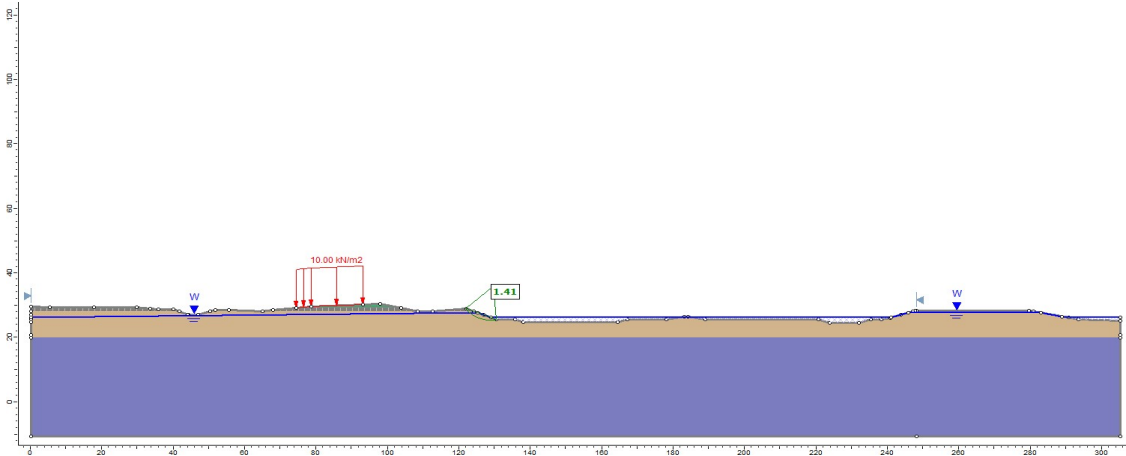
Material Name	Color	Unit Weight (kN/m³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated		
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28	None			0.3
Very stiff to hard CLAY (Engineered Fill) - Ru		18	Mohr-Coulomb	5	28	Water Table	Custom	1	

Material Name	Color	Unit Weight (kN/m³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained		18	Undrained	120	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liq		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1

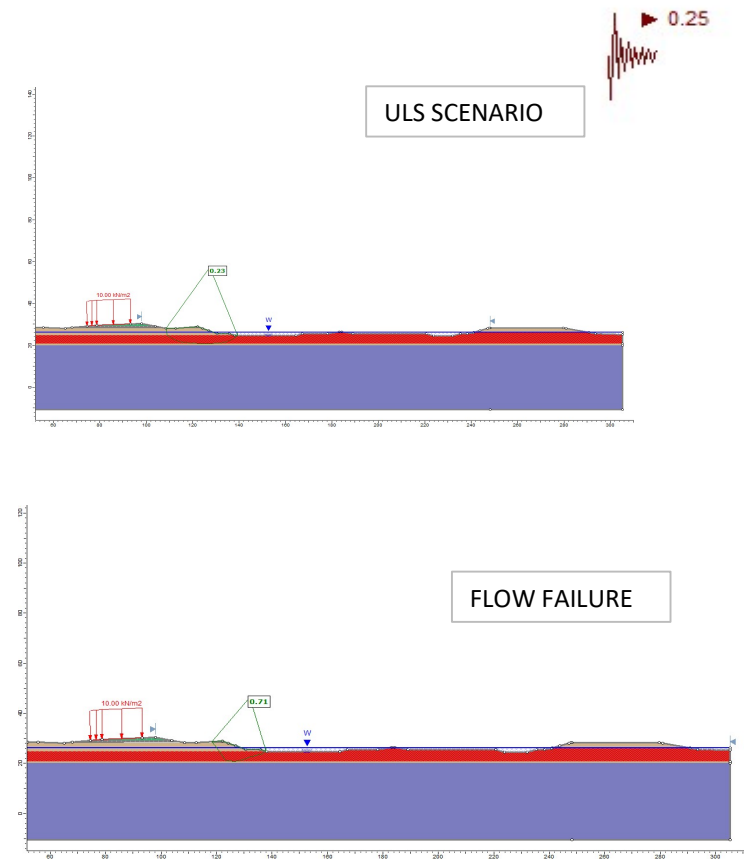
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

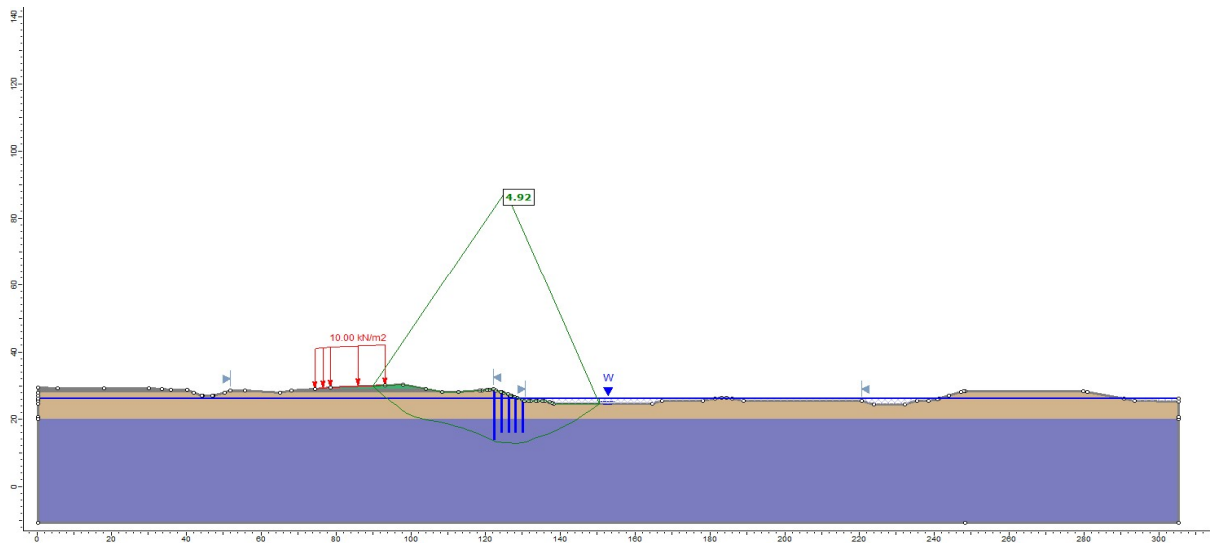
SEISMIC

Material Name	Color	Unit Weight (kN/m³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated

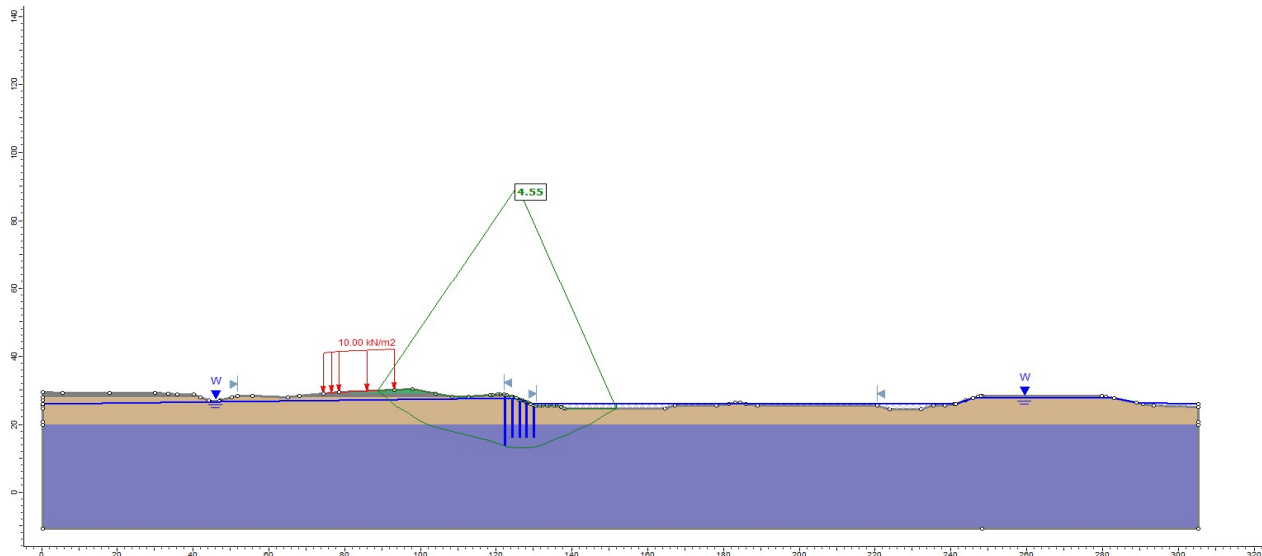
Material Name	Color	Unit Weight (kN/m³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated		
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28	None			0.3
Very stiff to hard CLAY (Engineered Fill) - Ru		18	Mohr-Coulomb	5	28	Water Table	Custom	1	

Material Name	Color	Unit Weight (kN/m³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained		18	Undrained	120	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liq		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1

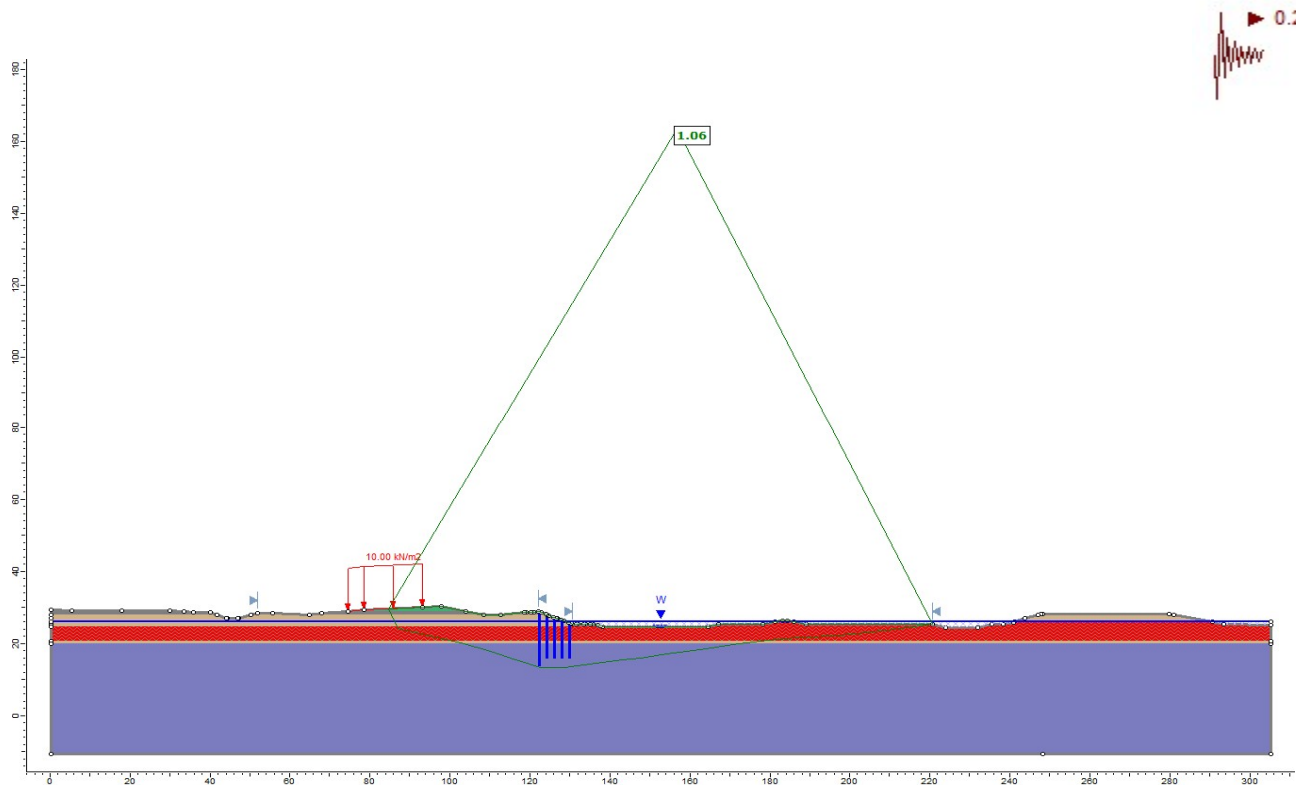
Proposed Profile with Shear Key Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



Proposed Profile with DSM Piling Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



Proposed Profile with Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



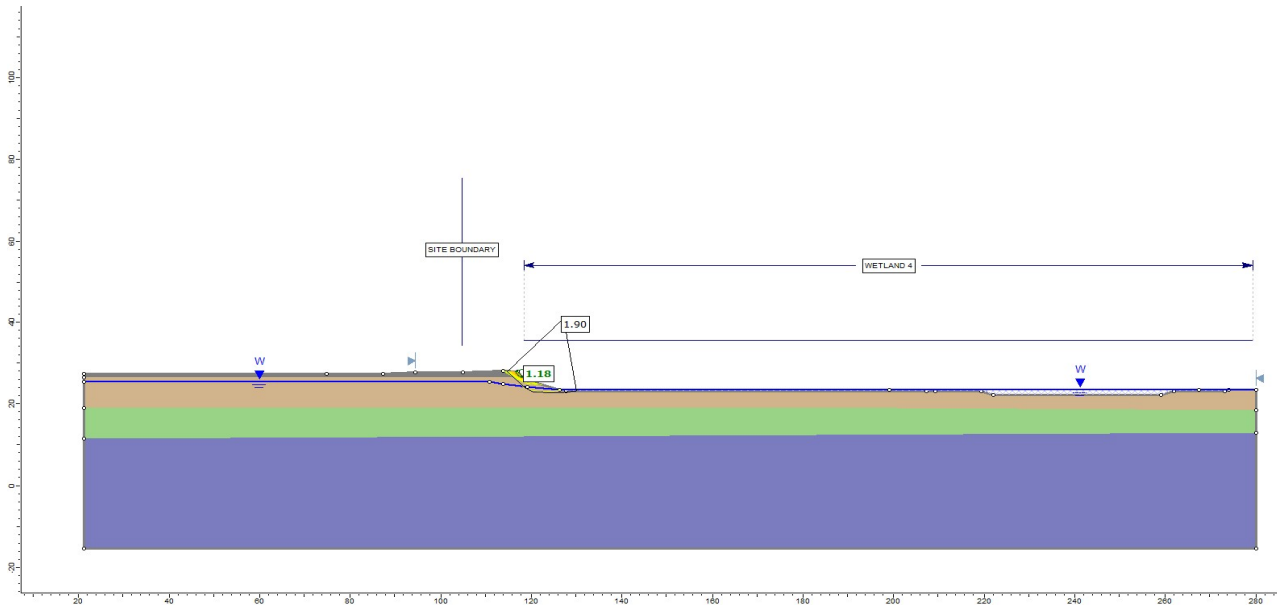
PREVAILING & ELEVATED
GROUNDWATER CASE

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Igimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		None			0
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28		None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		None			0
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35		None			0
CFA Piles		20	Undrained	10000	0	Constant	Water Table	Custom	1	

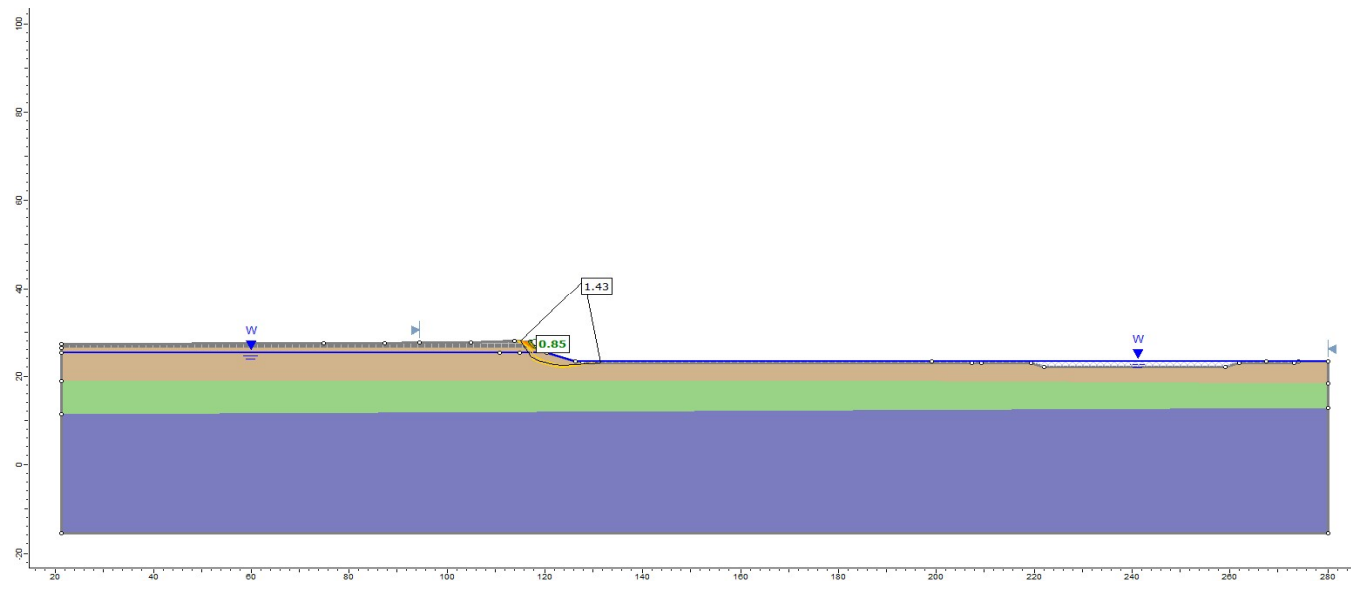
SEISMIC

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Igimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				None			0
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Lig.		16	Vertical Stress Ratio				0.07	5	None			0
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				None			0
CFA Piles		20	Undrained	10000	0	Constant			Water Table	Custom	1	

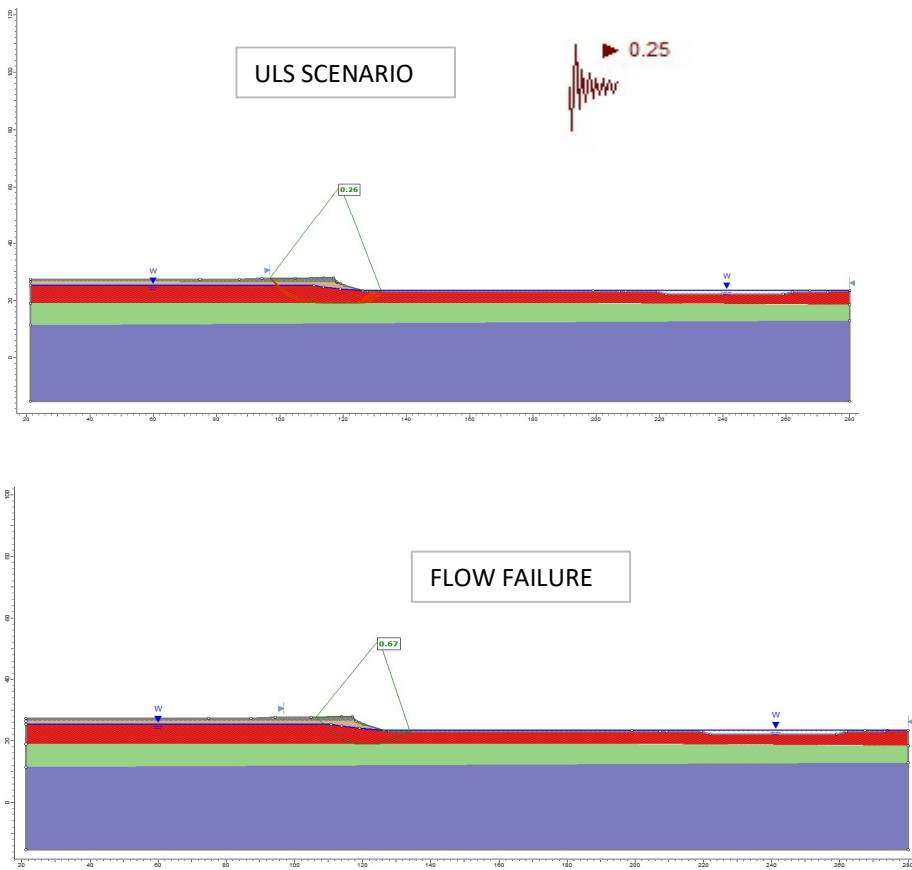
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1

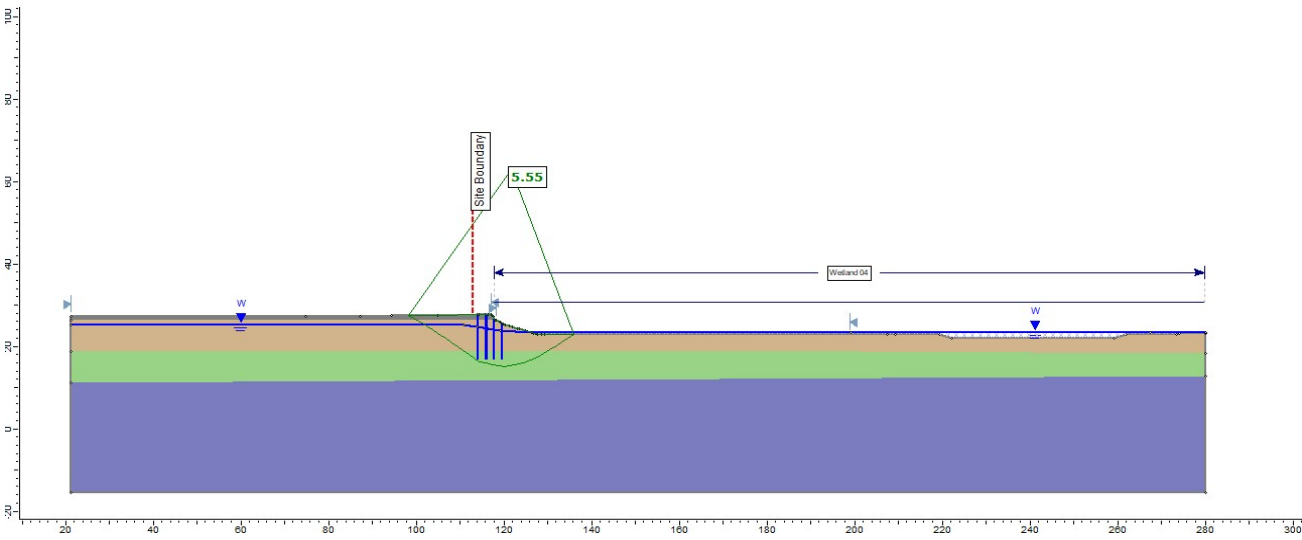
ELEVATED GROUNDWATER

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated		
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28	None			0.3
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1	

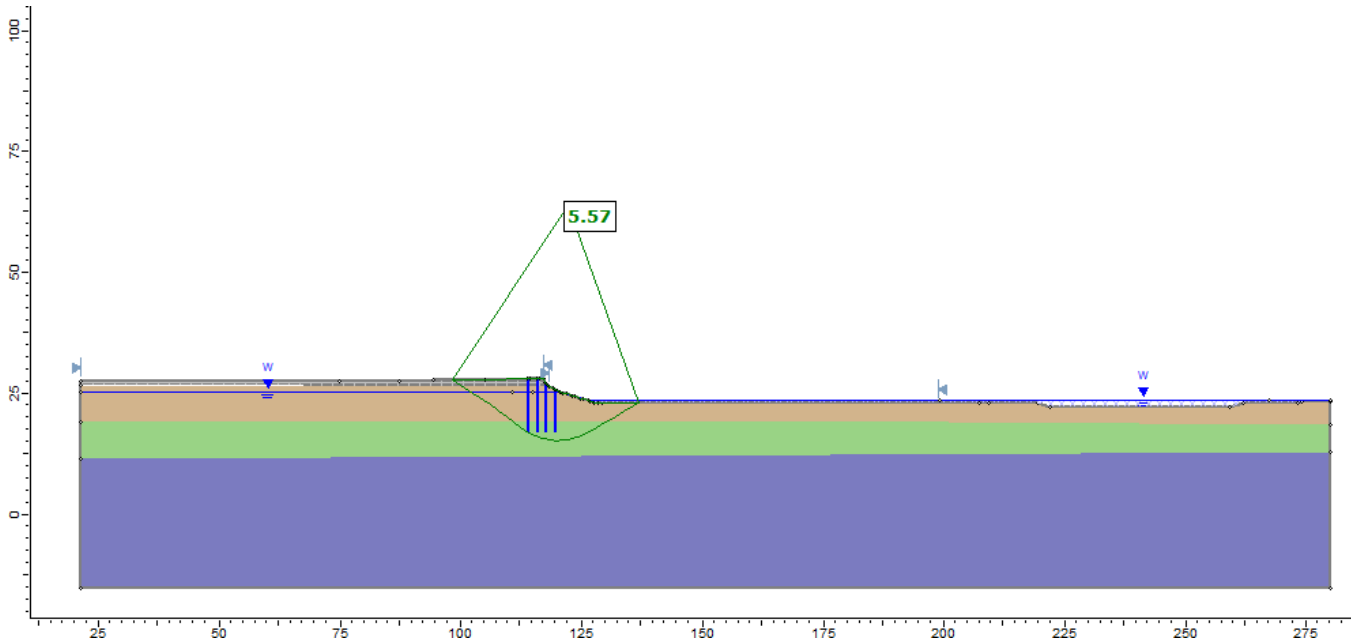
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36			Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28			Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34			Water Table	Automatically Calculated	
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28			Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liq		16	Vertical Stress Ratio		0.07		5	Water Table	Custom	1
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35			Water Table	Custom	1

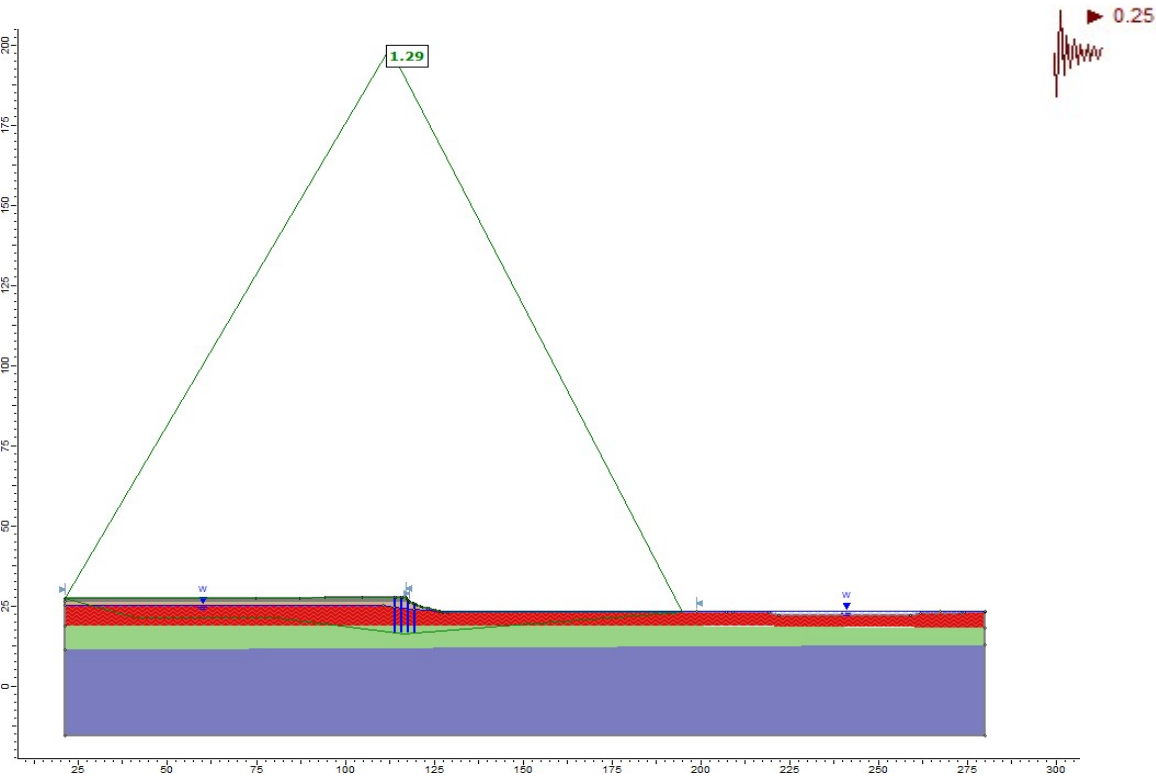
Proposed Profile with Remediation - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile with Remediation - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3.



Proposed Profile with Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

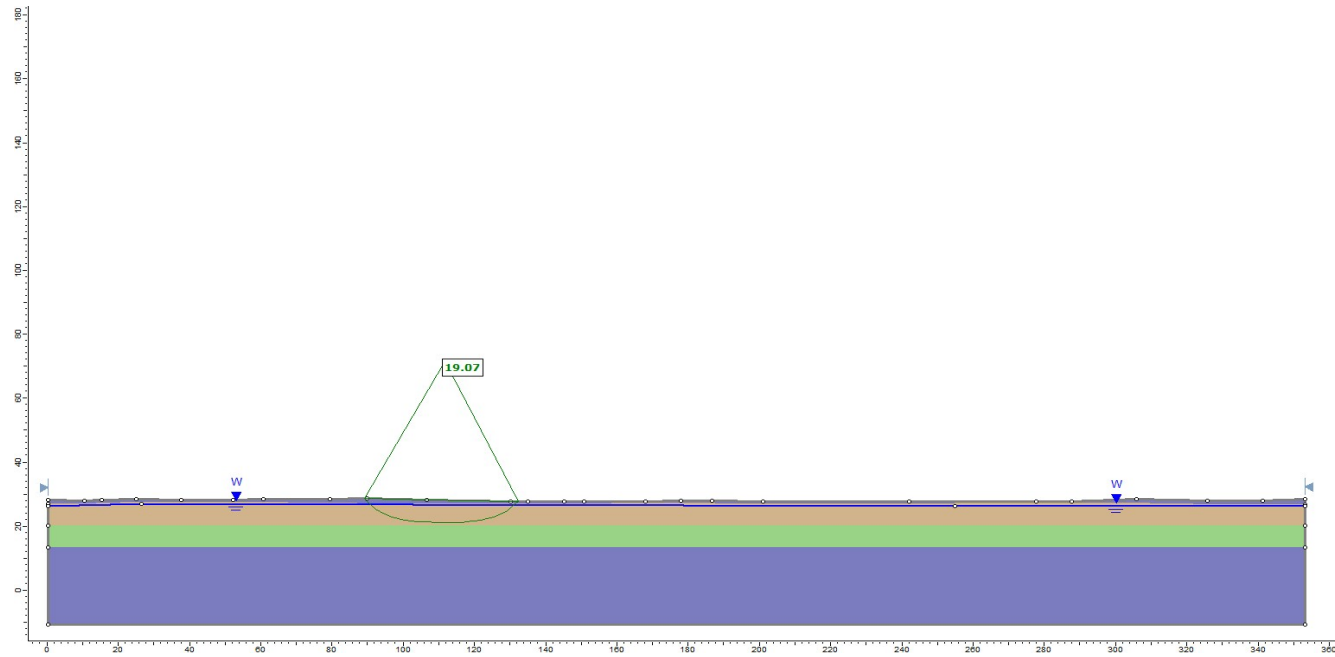
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu Value	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		None			0
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28		None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		None			0
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35		None			0
CFA Piles		20	Undrained	10000	0	Constant	Water Table	Custom	1	

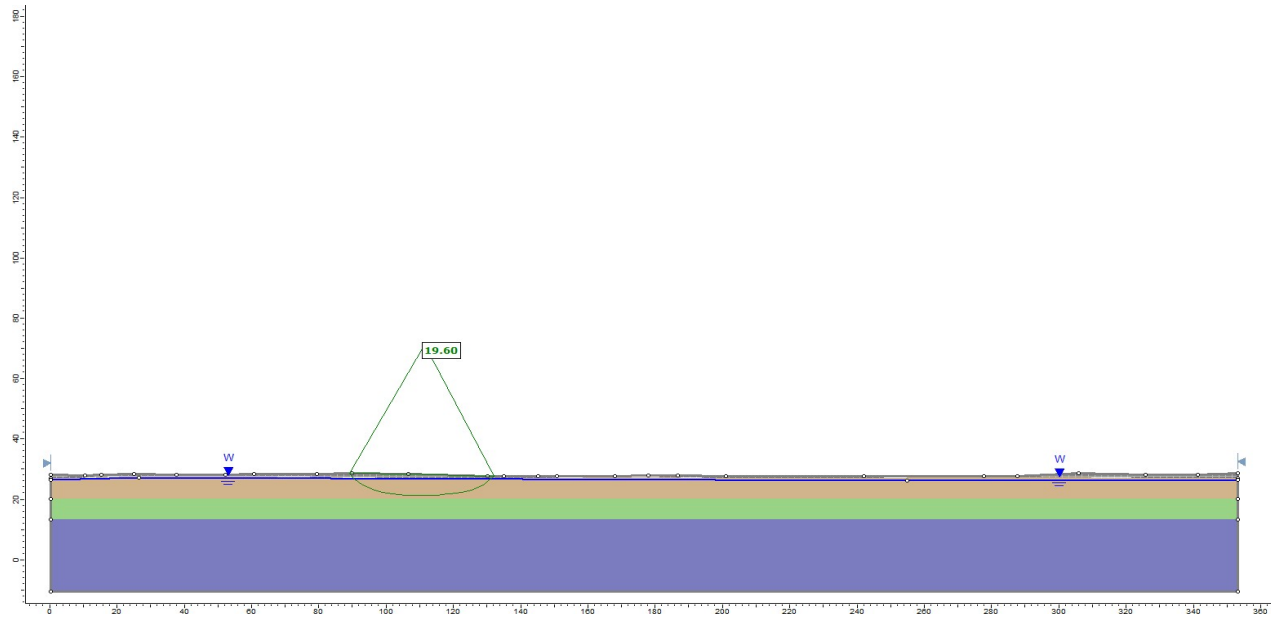
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		None	0
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28		None	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		None	0
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28		None	0.3
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35		None	0
CFA Piles		20	Undrained	10000	0	Constant	None	0

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu Value	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				None			0
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				None			0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liq.		16	Vertical Stress Ratio				0.07	5	None			0
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				None			0
CFA Piles		20	Undrained	10000	0	Constant			Water Table	Custom	1	

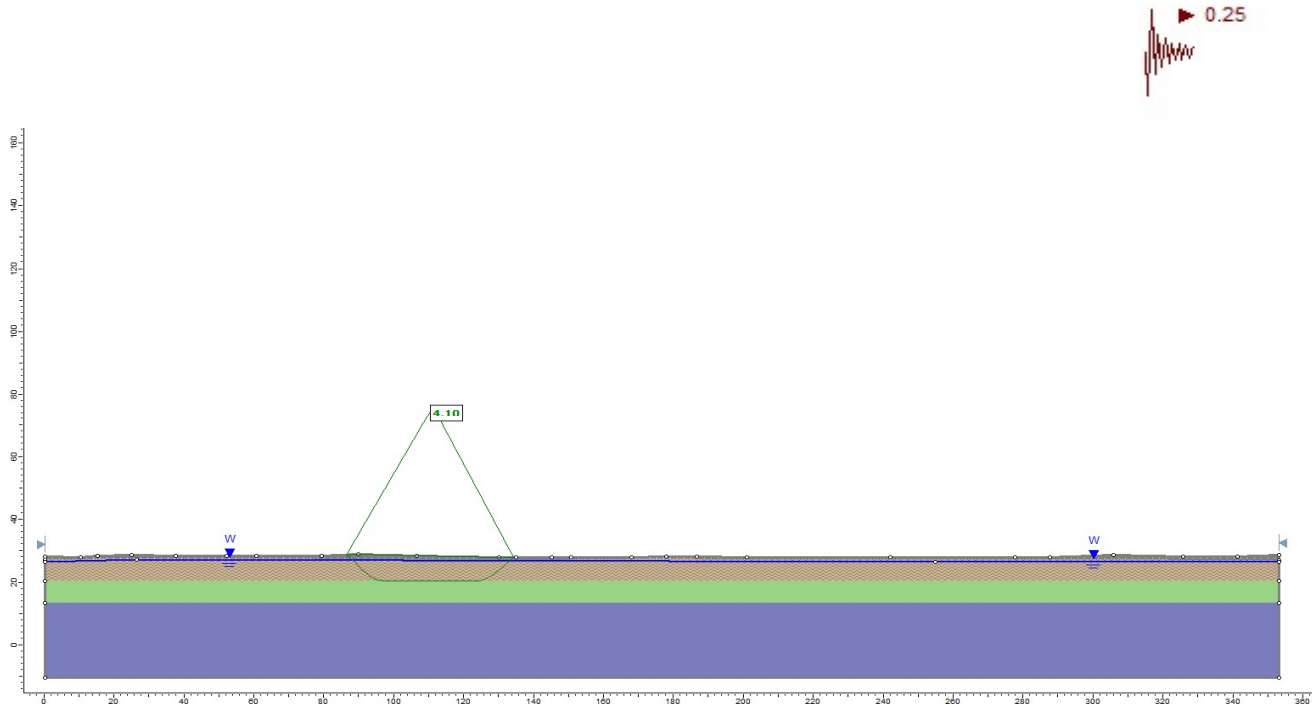
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - Seismic Events. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1

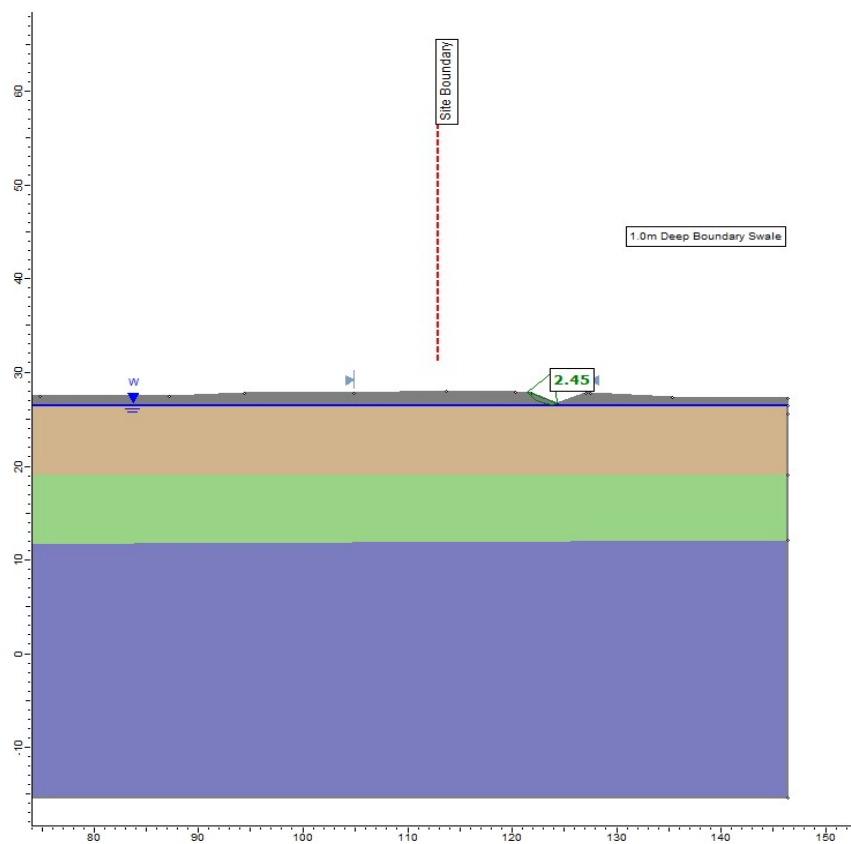
ELEVATED GROUNDWATER

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated		
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28	None			0.3
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1	

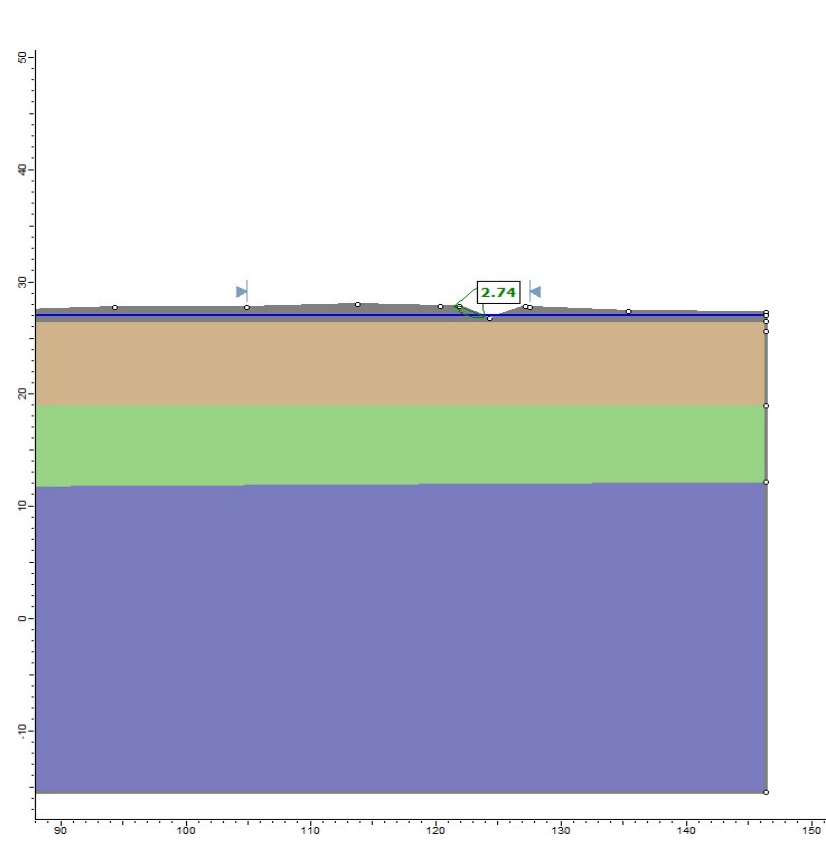
SEISMIC

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liq.		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				Water Table	Custom	1

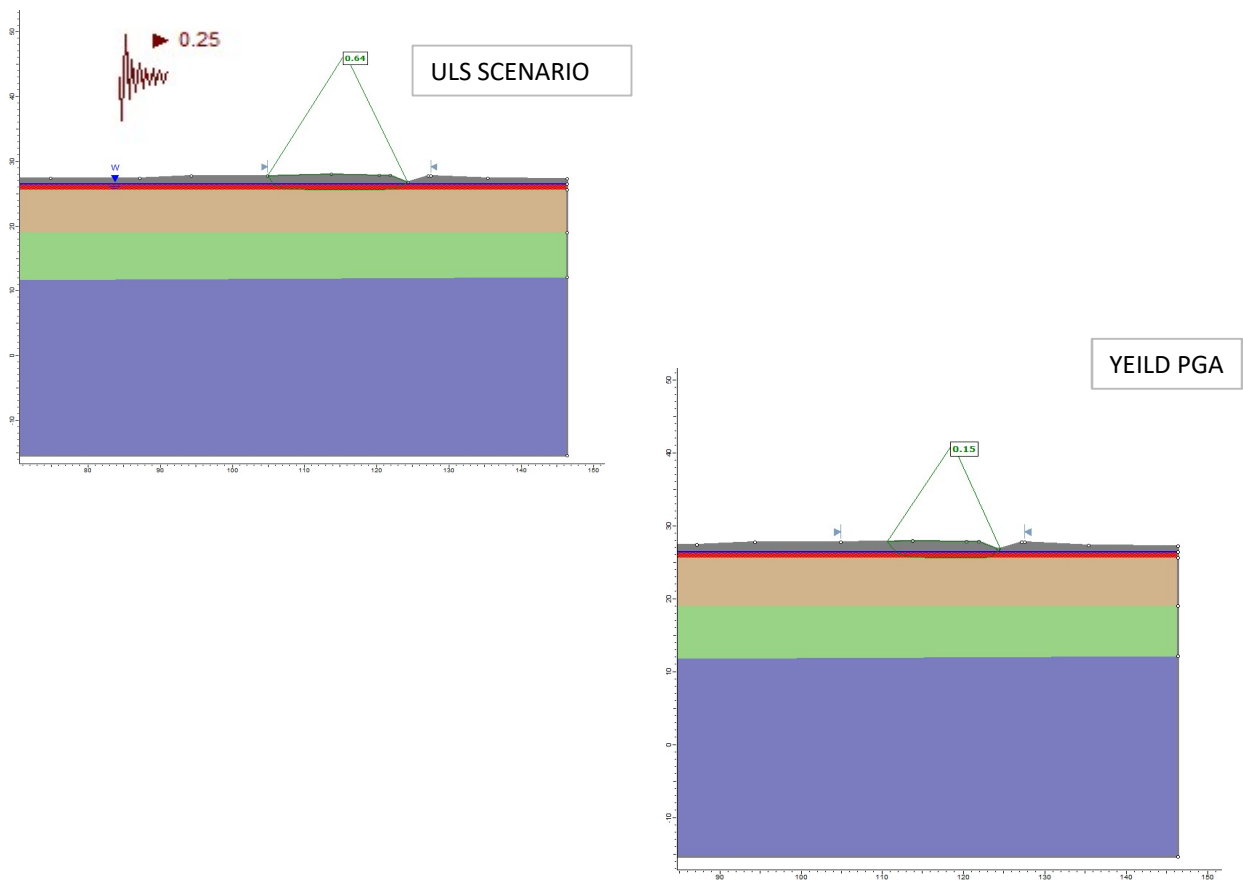
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - Seismic Events. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

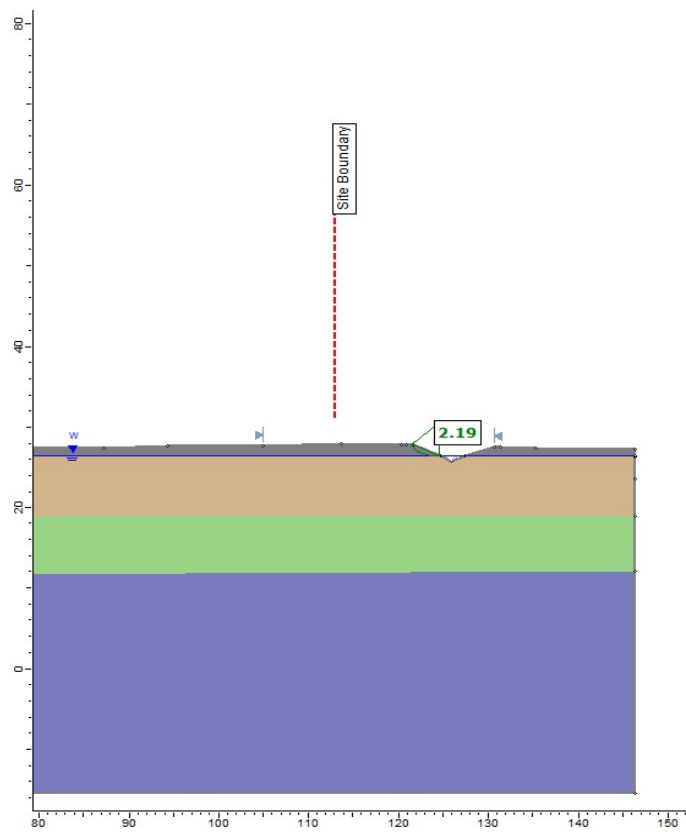
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1

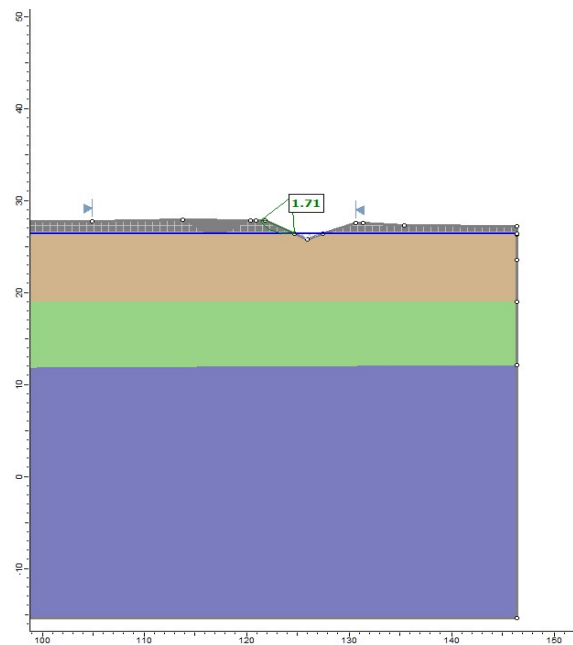
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated		
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28	None			0.3
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1	

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36			None	0
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28			None	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34			None	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liq.		16	Vertical Stress Ratio		0.07	5		None	0
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35			None	0

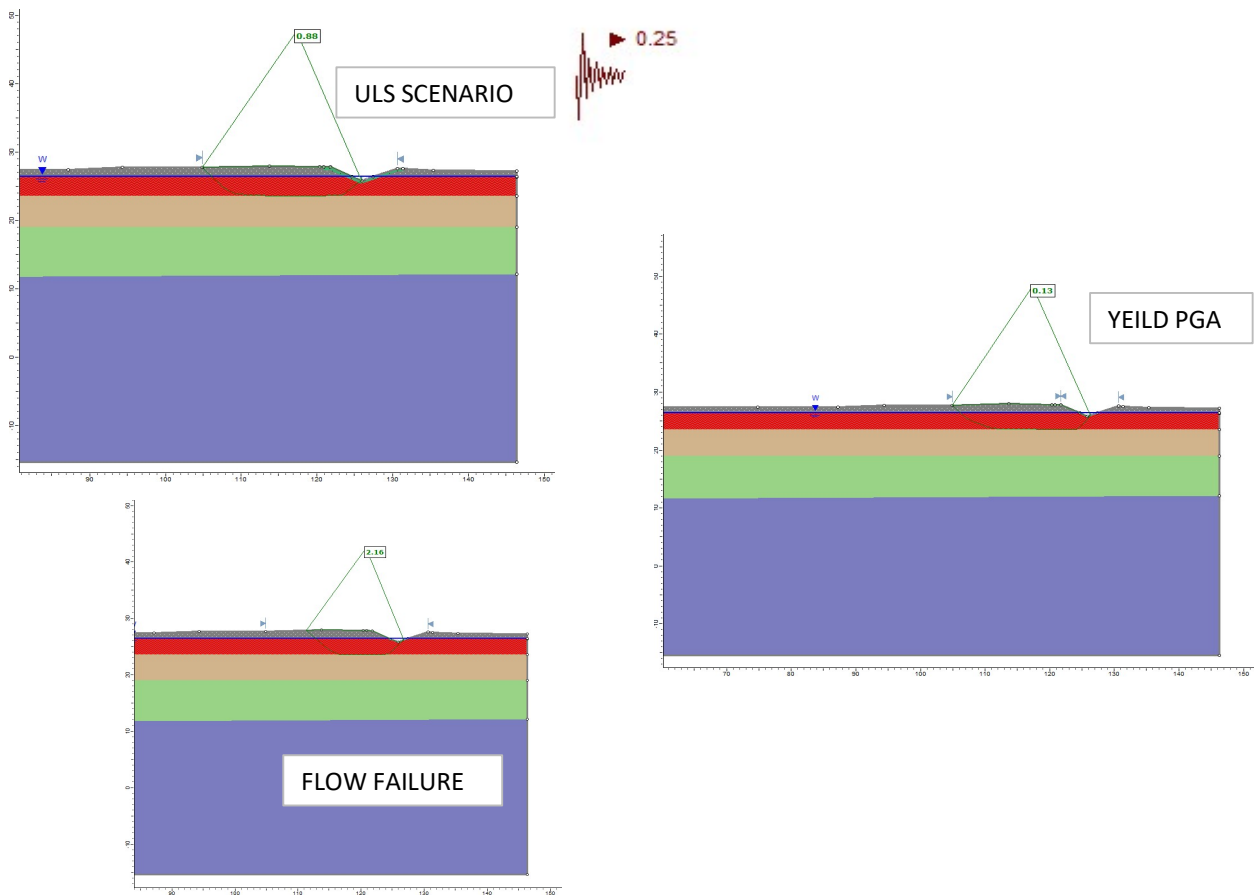
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

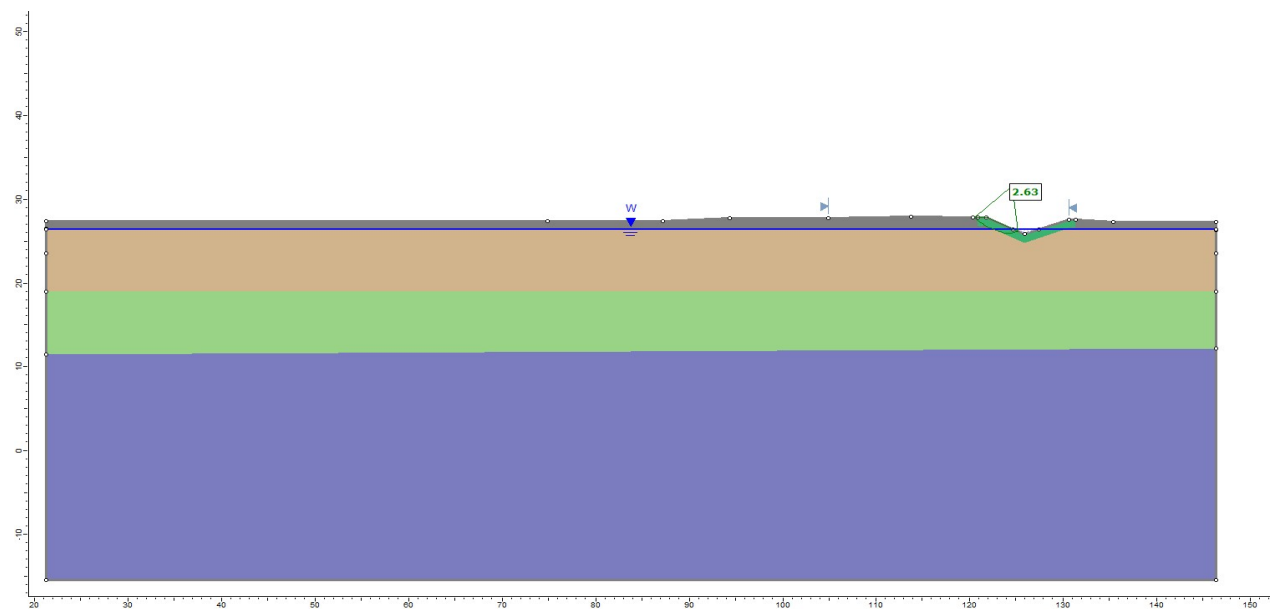
SEISMIC

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Igimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated

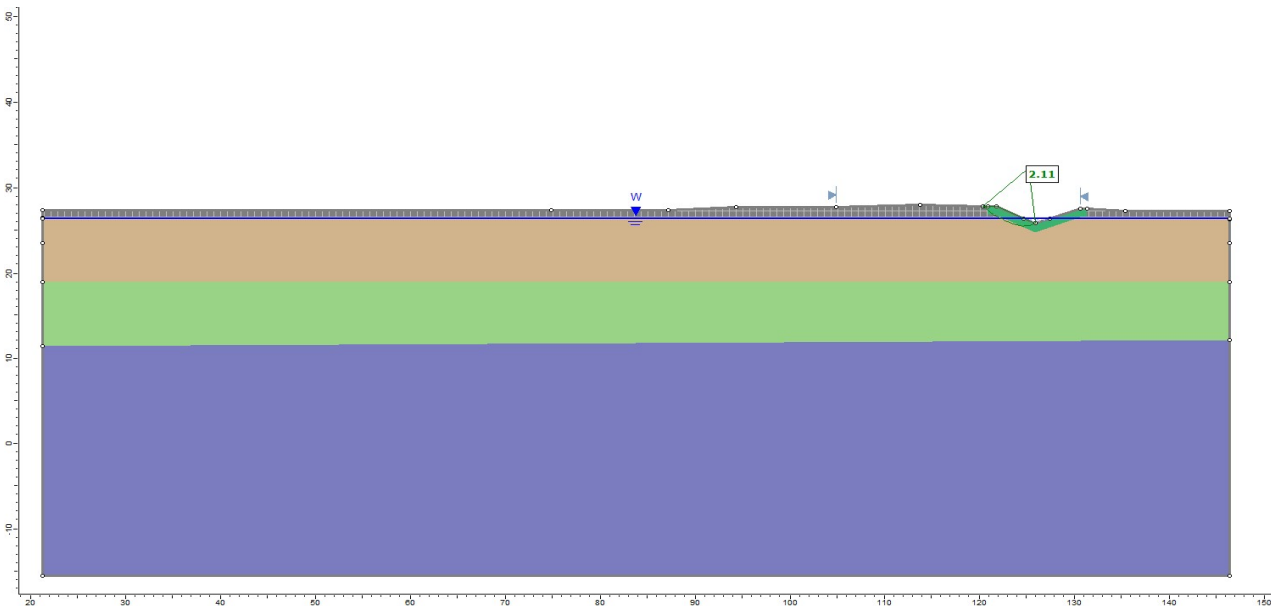
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Igimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated		
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28	None			0.3
Very stiff to hard CLAY (Engineered Fill) - Ru		18	Mohr-Coulomb	5	28	Water Table	Custom	1	

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Igimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained		18	Undrained	120	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Liq		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1

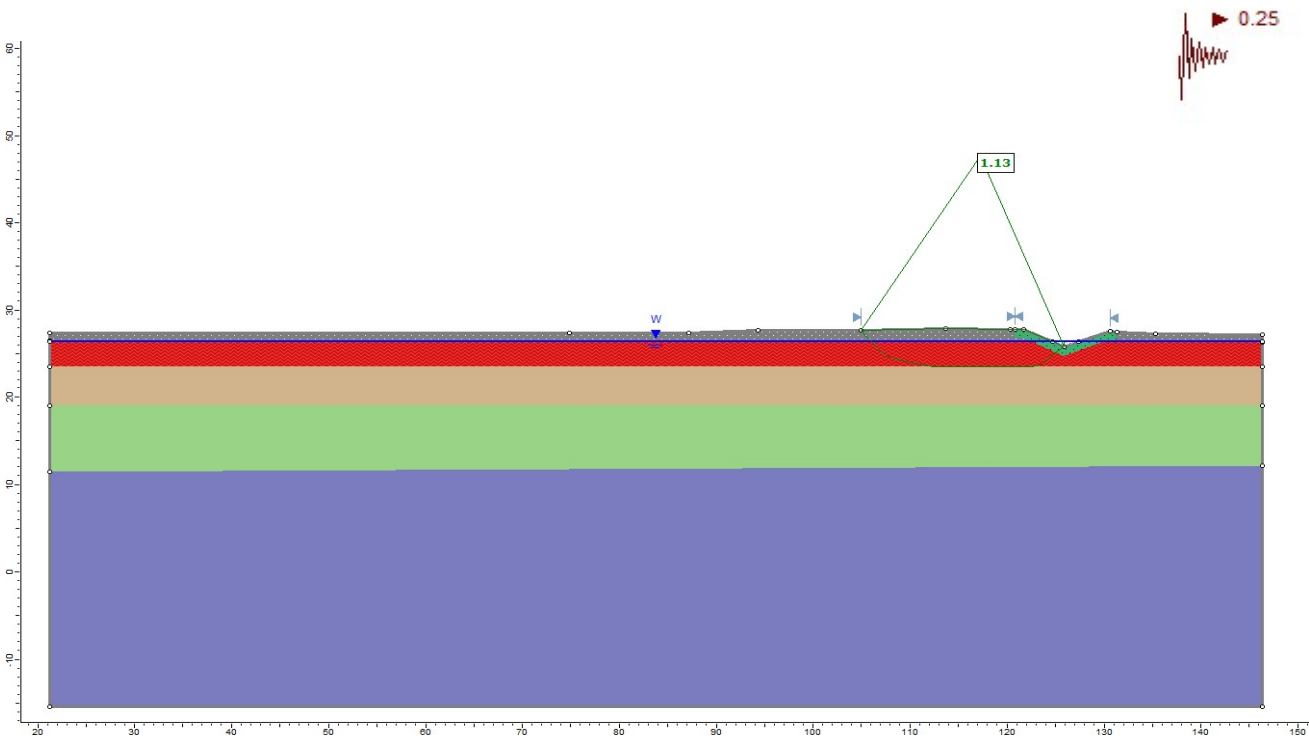
Proposed Profile with Remediation - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile with Remediation - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3.



Proposed Profile with Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



PREVAILING

ELEVATED
GROUNDWATER

SEISMIC

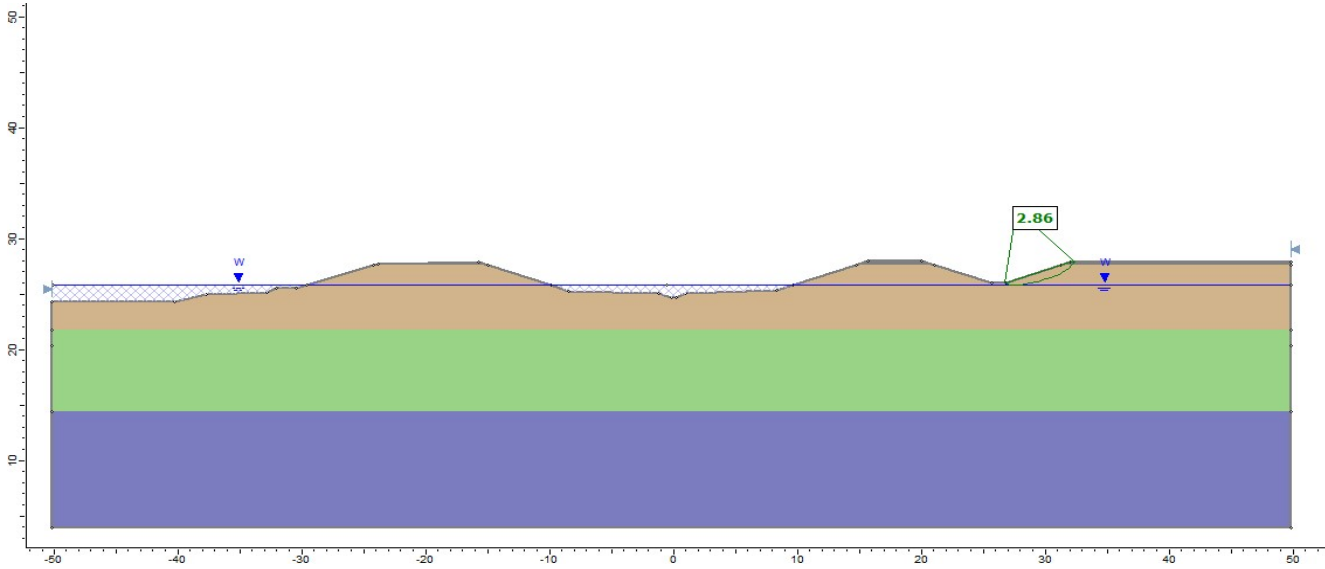
Parameters

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated
Very stiff to hard CLAY (Engineered Fill)		18	Mohr-Coulomb	5	28	Water Table	Automatically Calculated

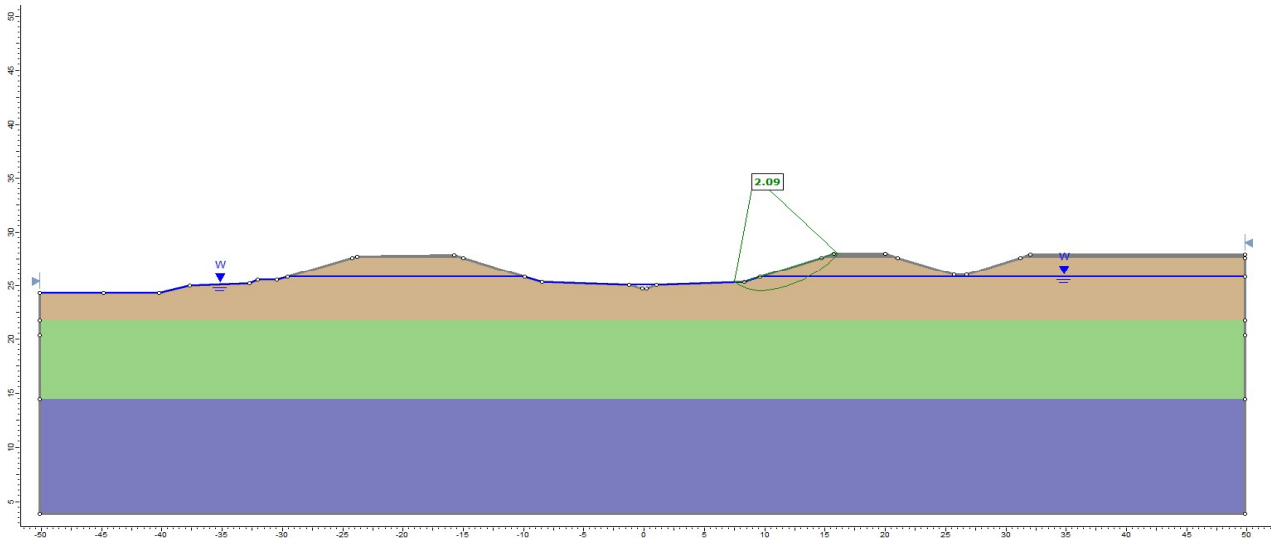
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated		
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28	None			0.3
Very stiff to hard CLAY (Engineered Fill) - Ru		18	Mohr-Coulomb	5	28	Water Table	Custom	1	

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28				Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Very stiff to hard CLAY (Engineered Fill) - Undrained		18	Undrained	120	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Lig.		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1

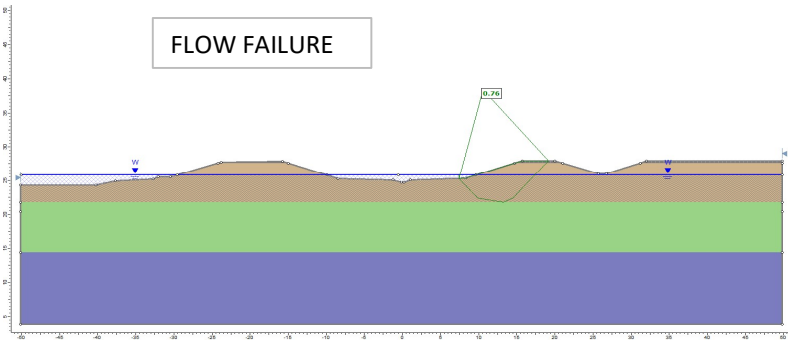
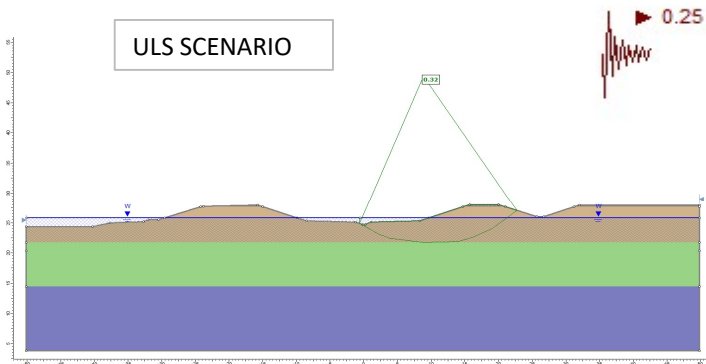
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1

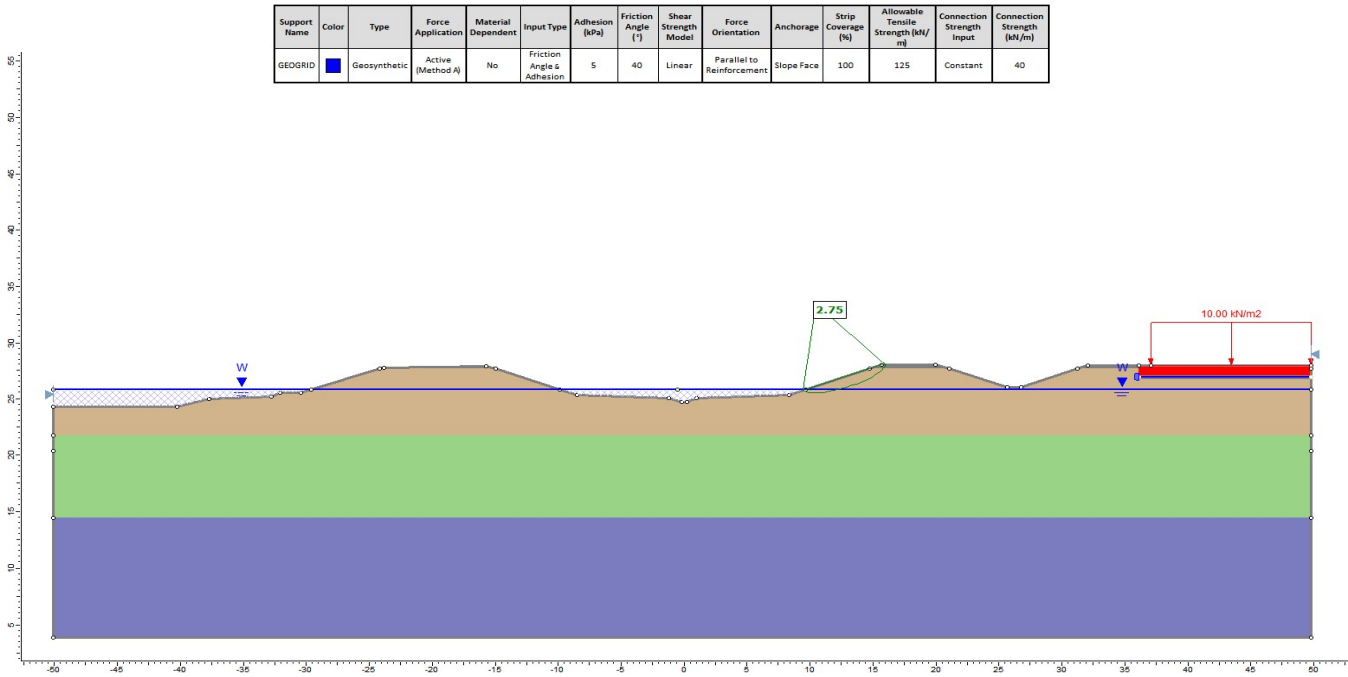
ELEVATED GROUNDWATER

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation)		16	Mohr-Coulomb	2	28	Water Table	Automatically Calculated		
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated		
Firm to stiff CLAY/SILT (Hinuera Formation) - Ru		16	Mohr-Coulomb	2	28	None			0.3
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35	Water Table	Custom	1	

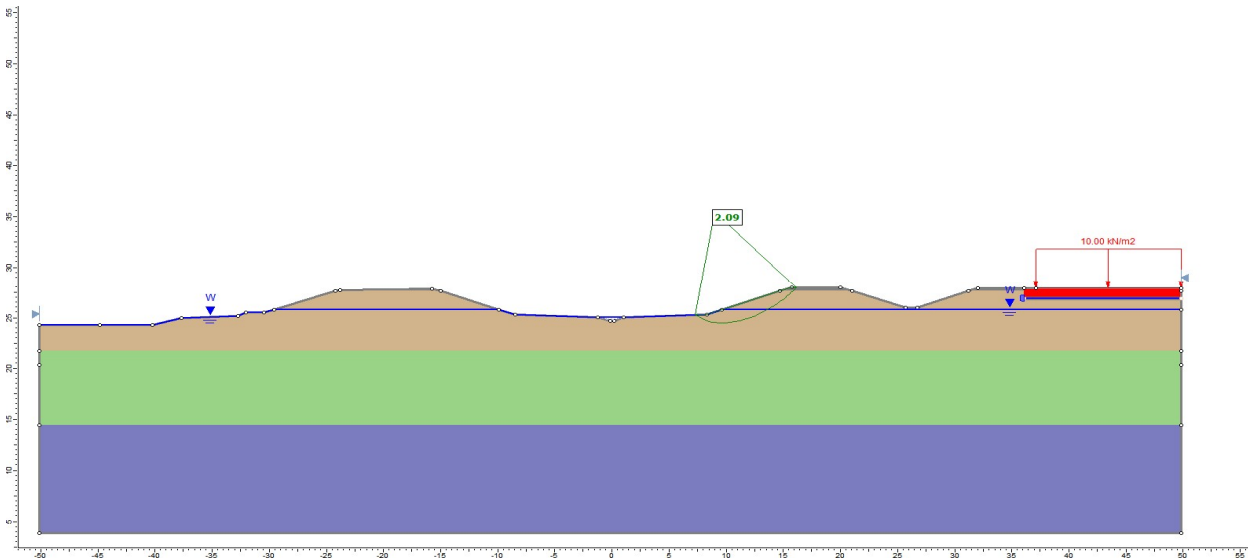
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36				Water Table	Automatically Calculated	
Firm to stiff CLAY/SILT (Hinuera Formation)-Undrained		16	Undrained	40	0	Constant			Water Table	Custom	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)-Liq.		16	Vertical Stress Ratio				0.07	5	Water Table	Custom	1
Dense SAND (Hinuera Formation)		16	Mohr-Coulomb	0	35				Water Table	Custom	1

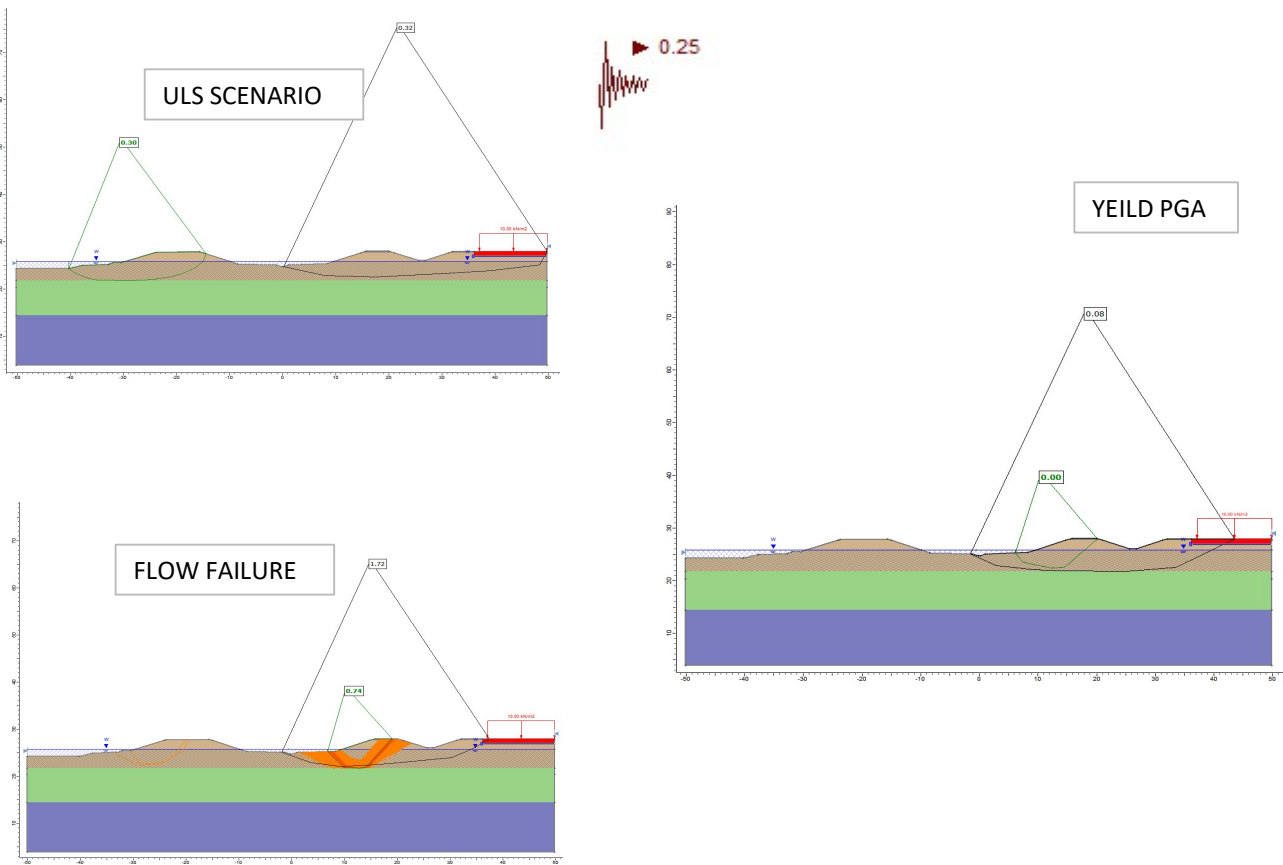
Proposed Profile with Remediation - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile with Remediation - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3.



Proposed Profile with Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	Blue	17	Mohr-Coulomb	0	36	None	0
Firm to stiff CLAY/SILT (Hinuera Formation)	Grey	16	Mohr-Coulomb	2	28	None	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	Brown	16	Mohr-Coulomb	2	34	None	0
Very stiff to hard CLAY (Engineered Fill)	Green	18	Mohr-Coulomb	5	28	None	0
Dense SAND (Hinuera Formation)	Light Green	16	Mohr-Coulomb	0	35	None	0

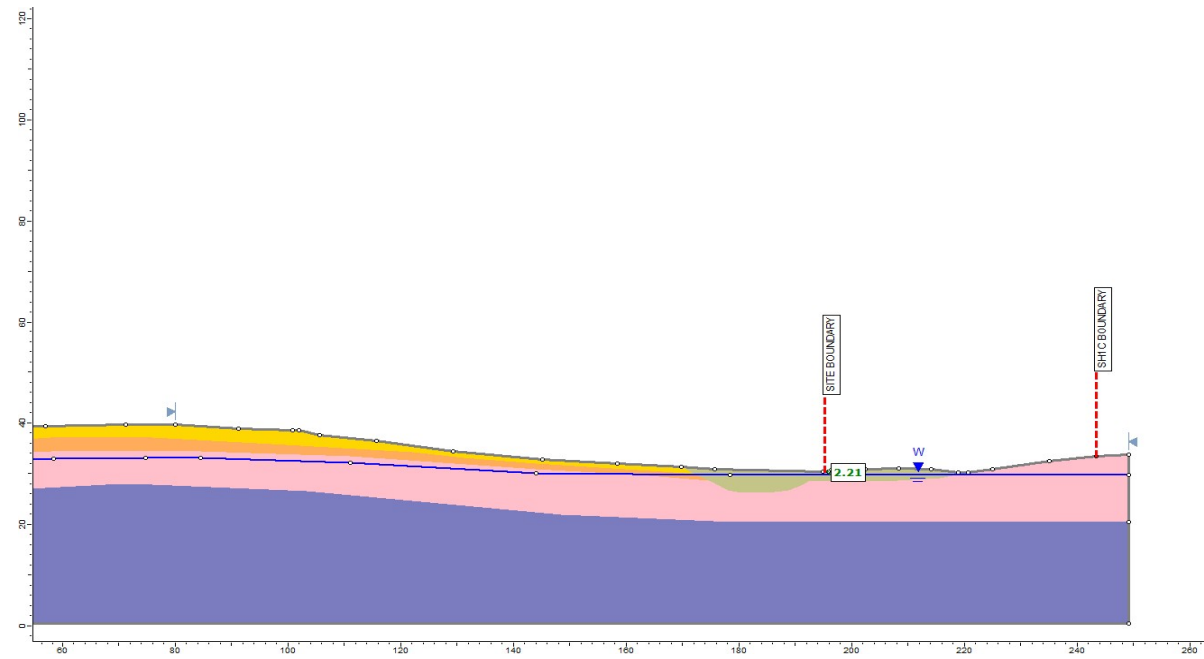
ELEVATED GROUNDWATER

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	Blue	17	Mohr-Coulomb	0	36	None	0
Firm to stiff CLAY/SILT (Hinuera Formation)	Grey	16	Mohr-Coulomb	2	28	None	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	Brown	16	Mohr-Coulomb	2	34	None	0
Very stiff to hard CLAY (Engineered Fill)	Green	18	Mohr-Coulomb	5	28	None	0
Dense SAND (Hinuera Formation)	Light Green	16	Mohr-Coulomb	0	35	None	0

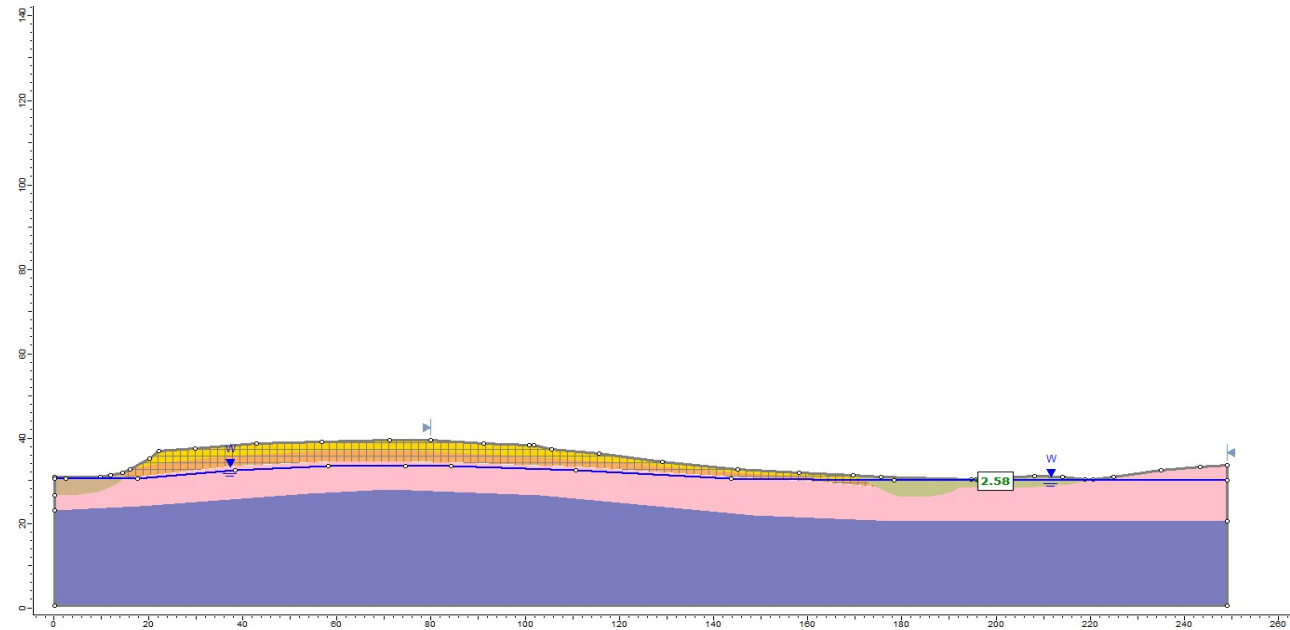
SEISMIC

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Vertical Stress Ratio	Minimum Shear Strength (kPa)	Water Surface	Ru Value
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	Blue	17	Mohr-Coulomb	0	36				None	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	Brown	16	Mohr-Coulomb	2	34				None	0
Firm to stiff CLAY/SILT (Hinuera Formation) - Undrained	Grey	16	Undrained	40	0	Constant			None	0
Very stiff to hard CLAY (Engineered Fill) - Undrained	Green	18	Undrained	120	0	Constant			None	0
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation) - Lig.	Brown	16	Vertical Stress Ratio				0.07	5	None	0
Dense SAND (Hinuera Formation)	Light Green	16	Mohr-Coulomb	0	35				None	0

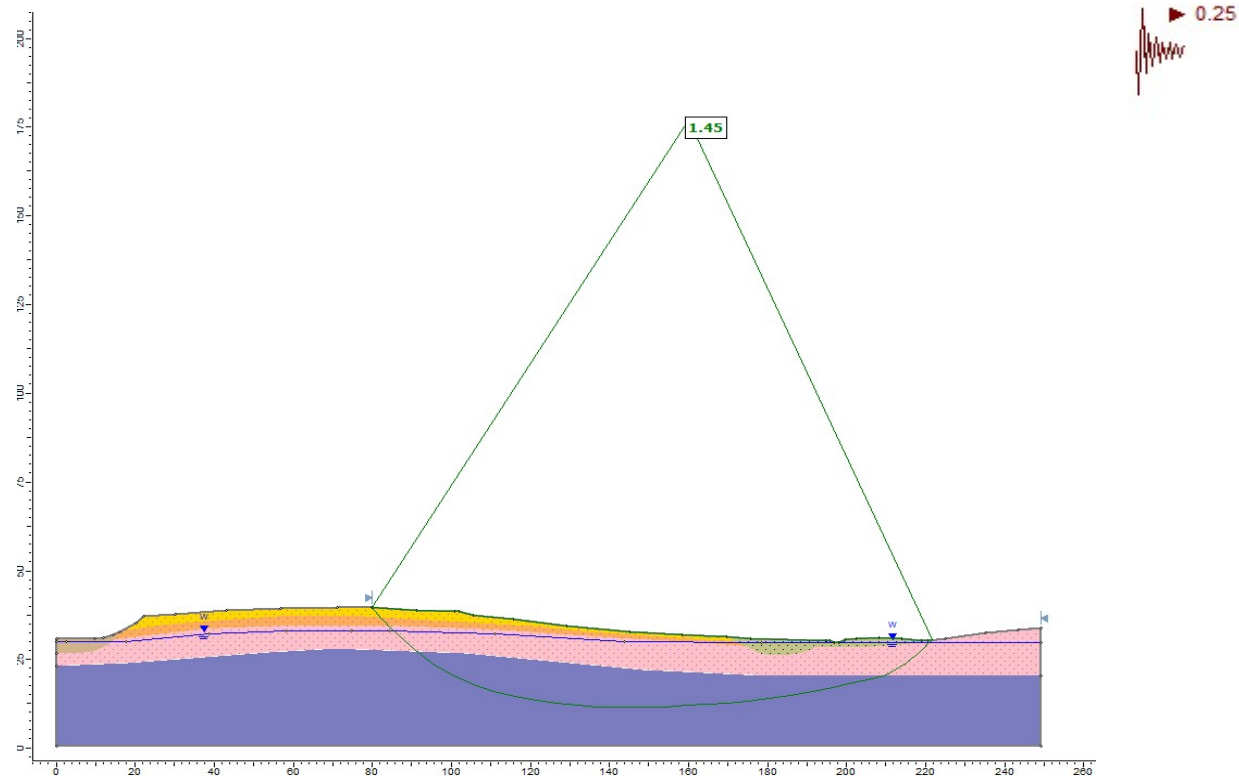
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



PREVAILING

ELEVATED
GROUNDWATER

SEISMIC

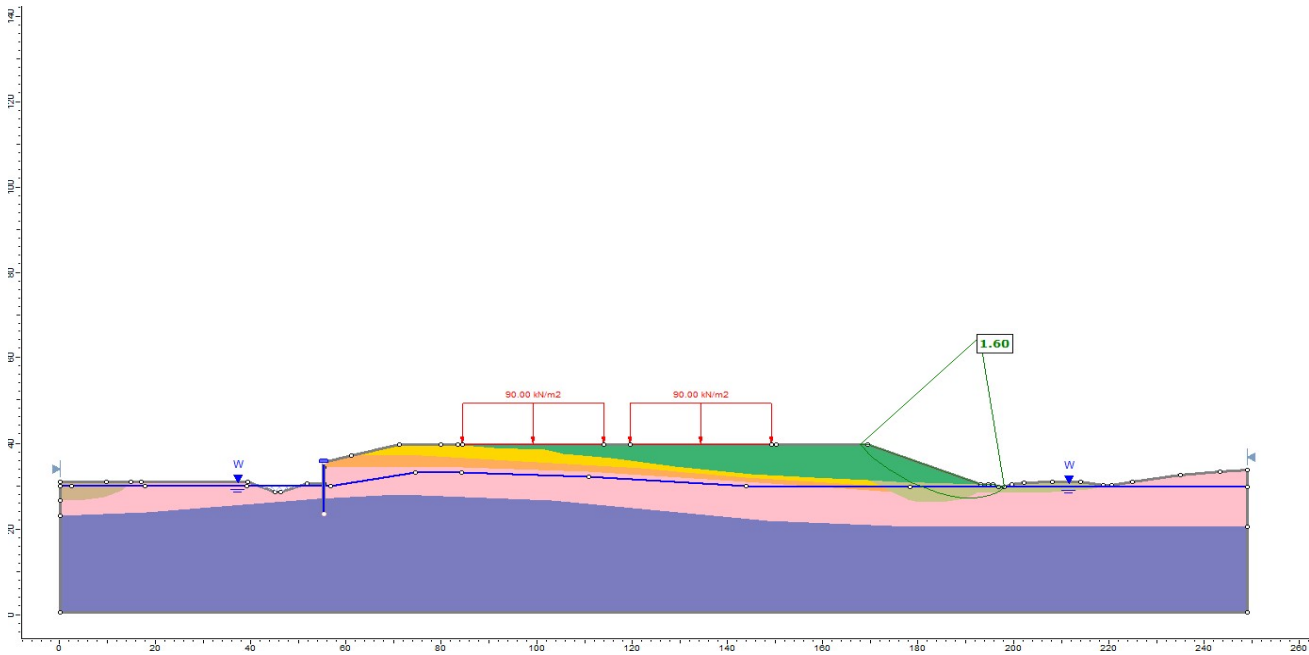
Parameters

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated	
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated	
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Firm SILT (Piako Subgroup)		16	Mohr-Coulomb	1	28	Water Table	Custom	1

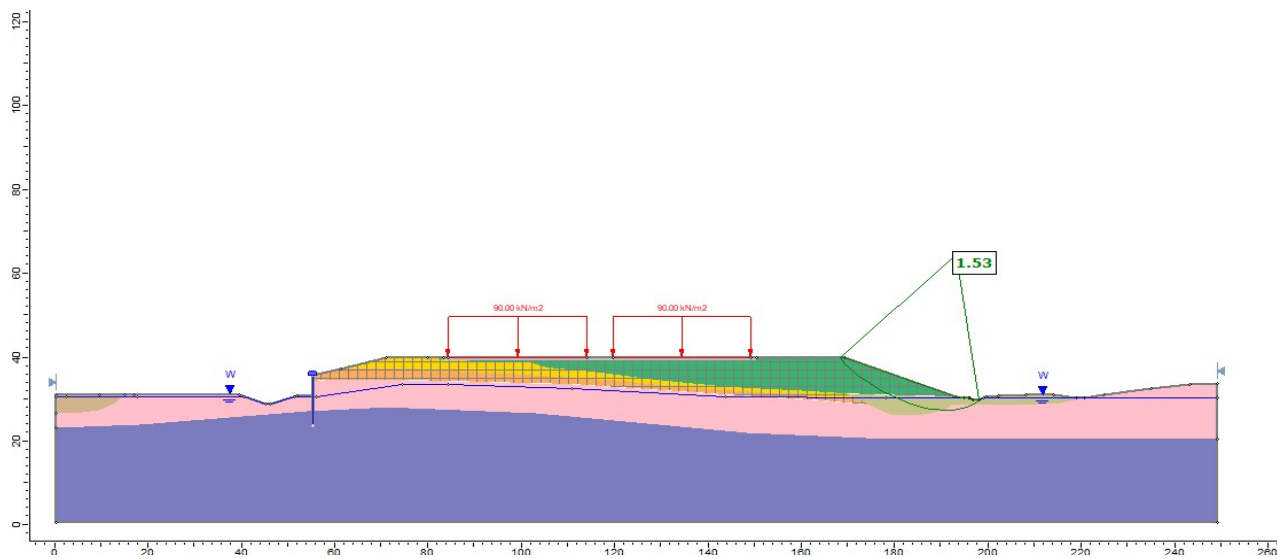
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	Water Table	Custom	1
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	Water Table	Custom	1
Firm SILT (Piako Subgroup)		16	Mohr-Coulomb	1	28	Water Table	Custom	1

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Custom	0
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Custom	0
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	80	0	Constant	Water Table	Custom	0
Firm SILT (Piako Subgroup) - Undrained		16	Undrained	30	0	Constant	Water Table	Custom	1

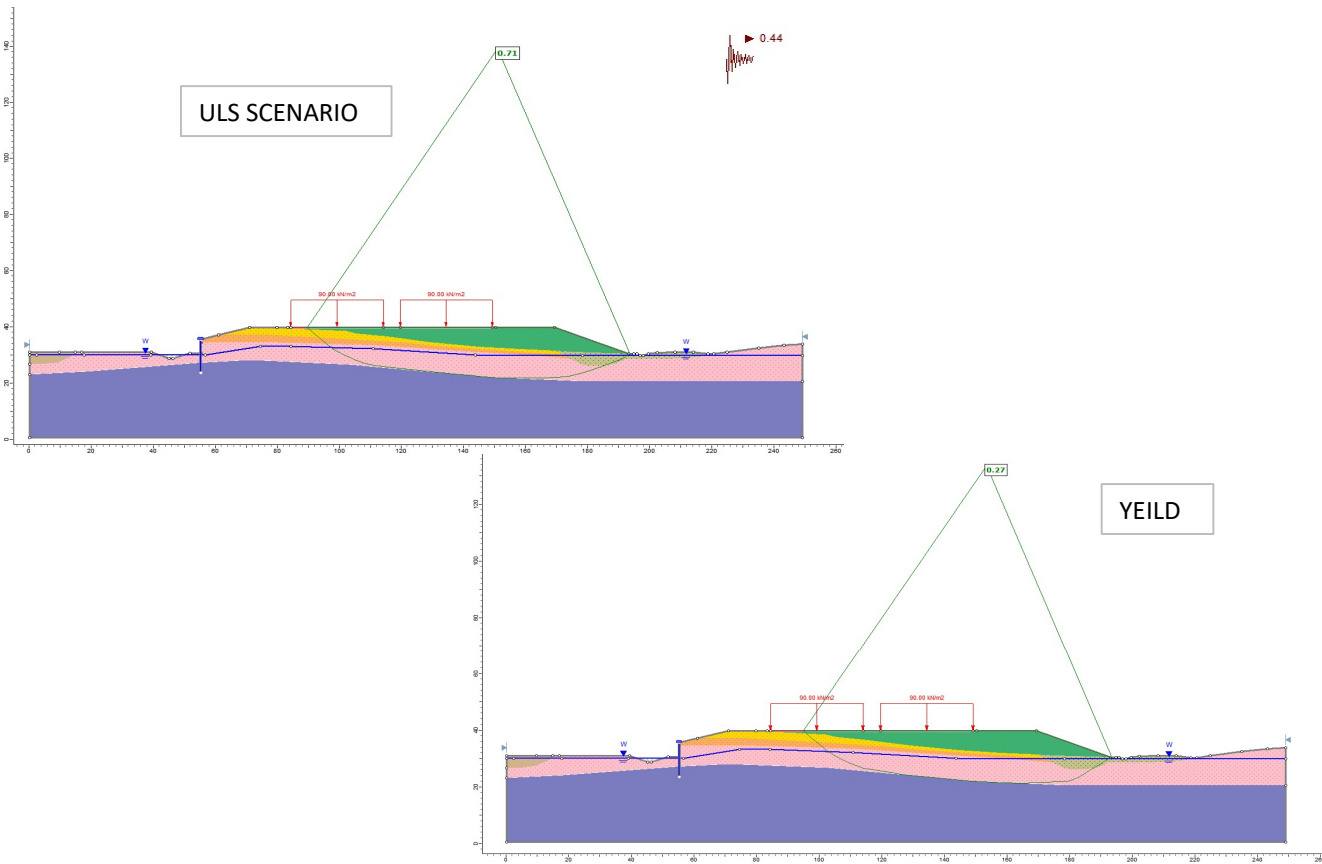
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff to very stiff CLAY (Hamilton Ashes)	Yellow	16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated	
Very stiff to hard CLAY (Kuroa Ashes)	Orange	16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated	
Stiff CLAY/SILT (Puketoka Formation)	Pink	16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	Blue	17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	Brown	16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Firm SILT (Piako Subgroup)	Green	16	Mohr-Coulomb	1	28	Water Table	Custom	1

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff CLAY/SILT (Puketoka Formation)	Pink	16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	Blue	17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	Brown	16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3	Yellow	16	Mohr-Coulomb	4	28	Water Table	Custom	1
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3	Orange	16	Mohr-Coulomb	5	28	Water Table	Custom	1
Firm SILT (Piako Subgroup)	Green	16	Mohr-Coulomb	1	28	Water Table	Custom	1

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	Blue	17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	Brown	16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained	Yellow	16	Undrained	80	0	Constant	Water Table	Custom	0
Very stiff to hard CLAY (Kuroa Ashes) - Undrained	Orange	16	Undrained	100	0	Constant	Water Table	Custom	0
Stiff CLAY/SILT (Puketoka Formation) - Undrained	Pink	16	Undrained	80	0	Constant	Water Table	Custom	0
Firm SILT (Piako Subgroup) - Undrained	Green	16	Undrained	30	0	Constant	Water Table	Custom	1



Project
Te Kowhai Industrial Development

Title
Section 10 - Proposed - L to R

Analysis

Cuckoo

Date

10/08/2026

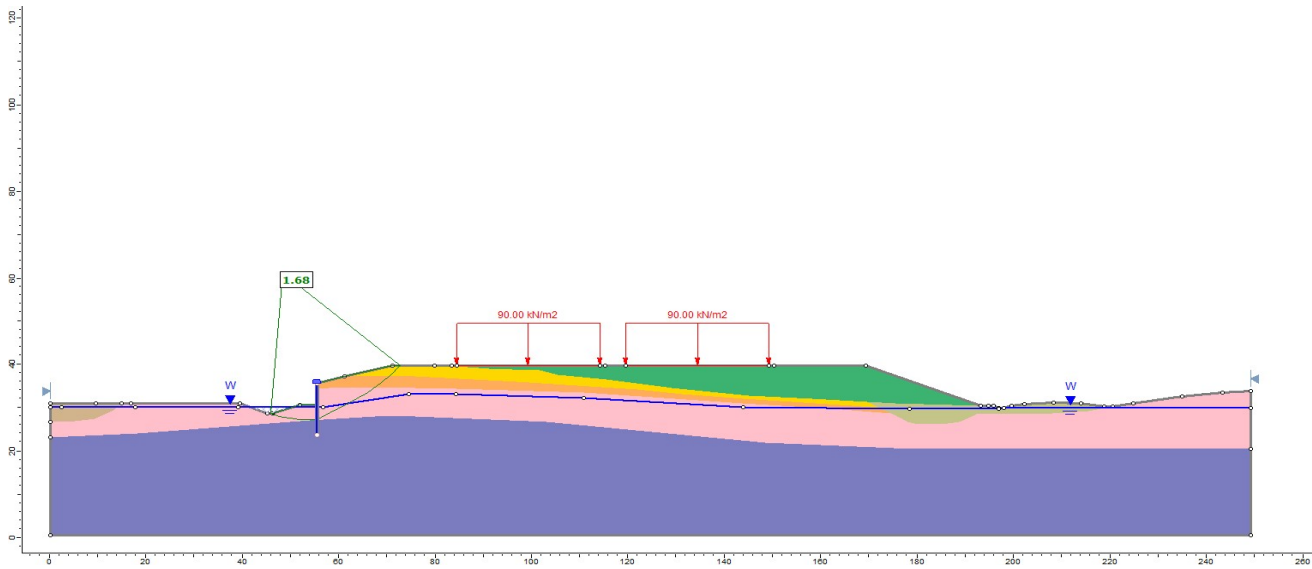
Project No.

HAM2025-0116

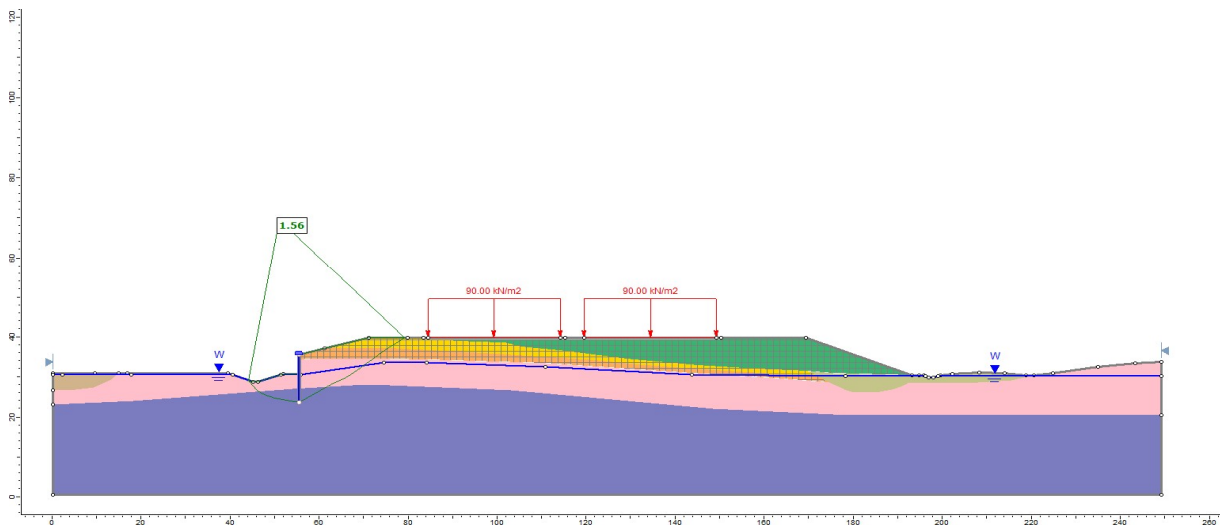
Drawing

STAB 02

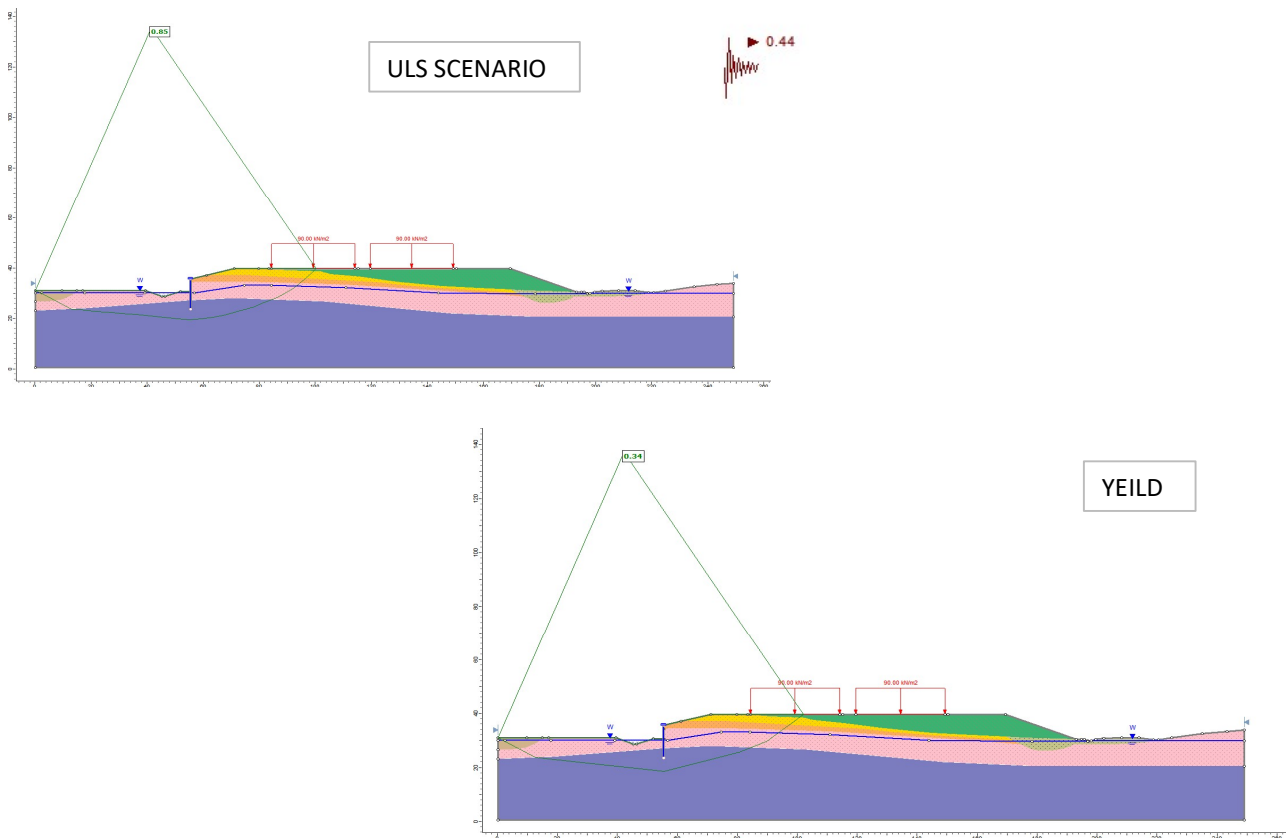
Proposed Profile with Remediation - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile with Remediation - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3.



Proposed Profile with Remediation - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

PREVAILING

ELEVATED
GROUNDWATER

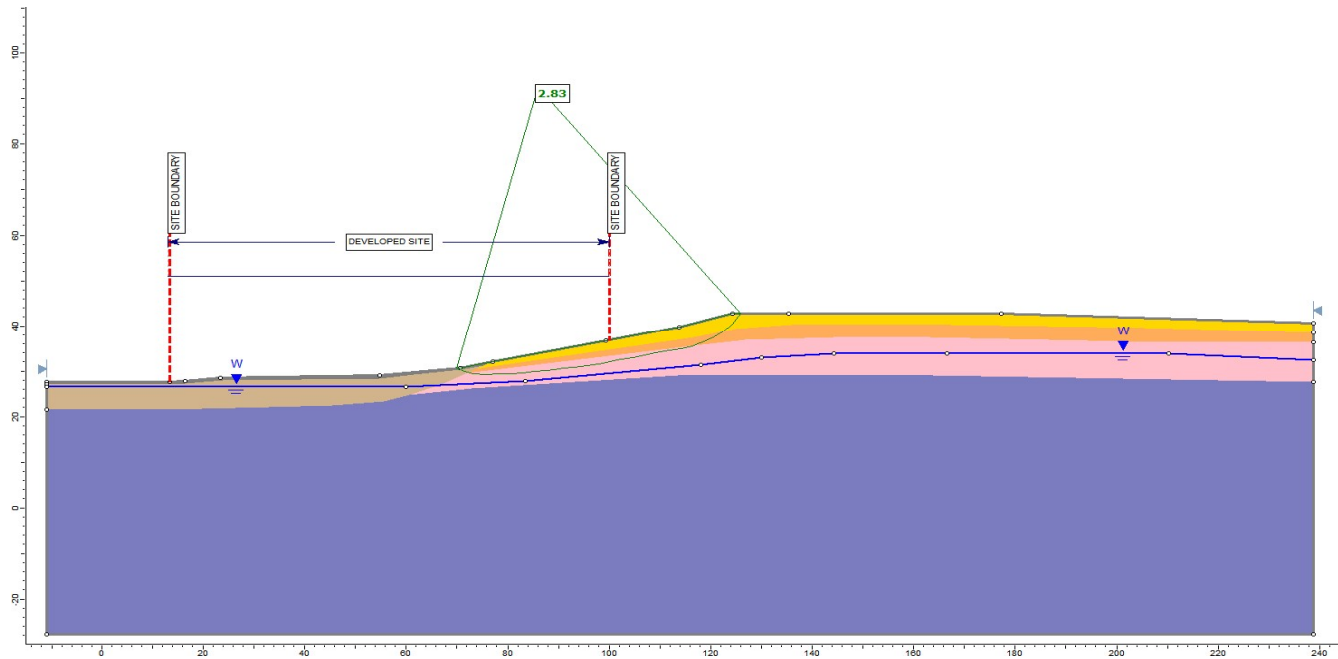
SEISMIC

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff to very stiff CLAY (Hamilton Ashes)	 	16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated	
Very stiff to hard CLAY (Kuroa Ashes)	 	16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated	
Stiff CLAY/SILT (Puketoka Formation)	 	16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	 	17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	 	16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Firm SILT (Piako Subgroup)	 	16	Mohr-Coulomb	1	28	Water Table	Custom	1

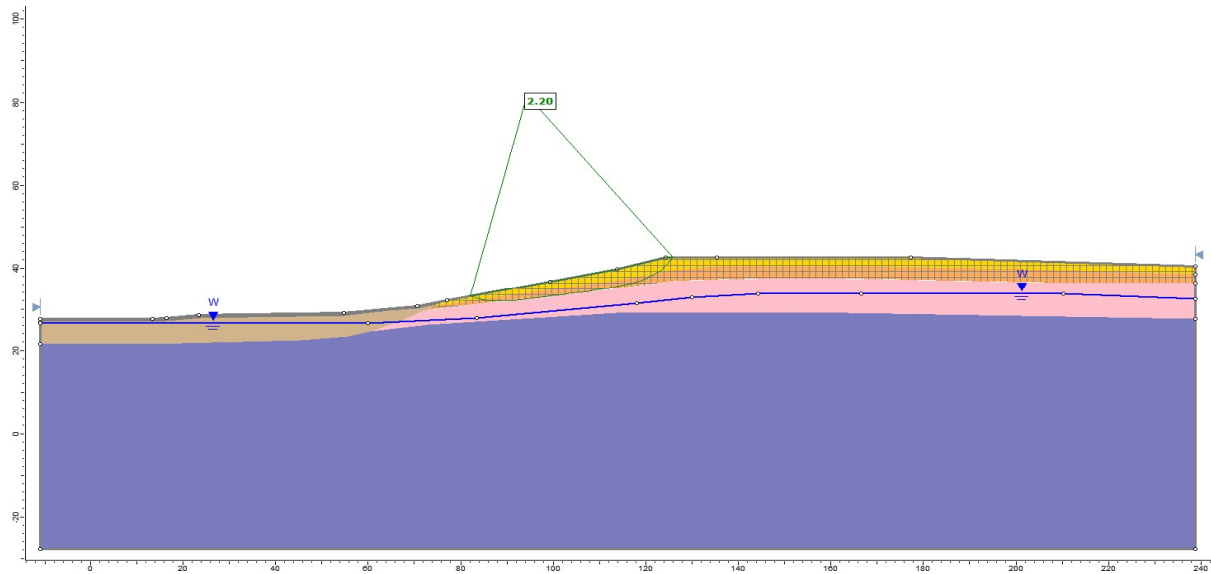
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff CLAY/SILT (Puketoka Formation)	 	16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	 	17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	 	16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3	 	16	Mohr-Coulomb	4	28	Water Table	Custom	1
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3	 	16	Mohr-Coulomb	5	28	Water Table	Custom	1
Firm SILT (Piako Subgroup)	 	16	Mohr-Coulomb	1	28	Water Table	Custom	1

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)	 	17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)	 	16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained	 	16	Undrained	80	0	Constant	Water Table	Custom	0
Very stiff to hard CLAY (Kuroa Ashes) - Undrained	 	16	Undrained	100	0	Constant	Water Table	Custom	0
Stiff CLAY/SILT (Puketoka Formation) - Undrained	 	16	Undrained	80	0	Constant	Water Table	Custom	0
Firm SILT (Piako Subgroup) - Undrained	 	16	Undrained	30	0	Constant	Water Table	Custom	1

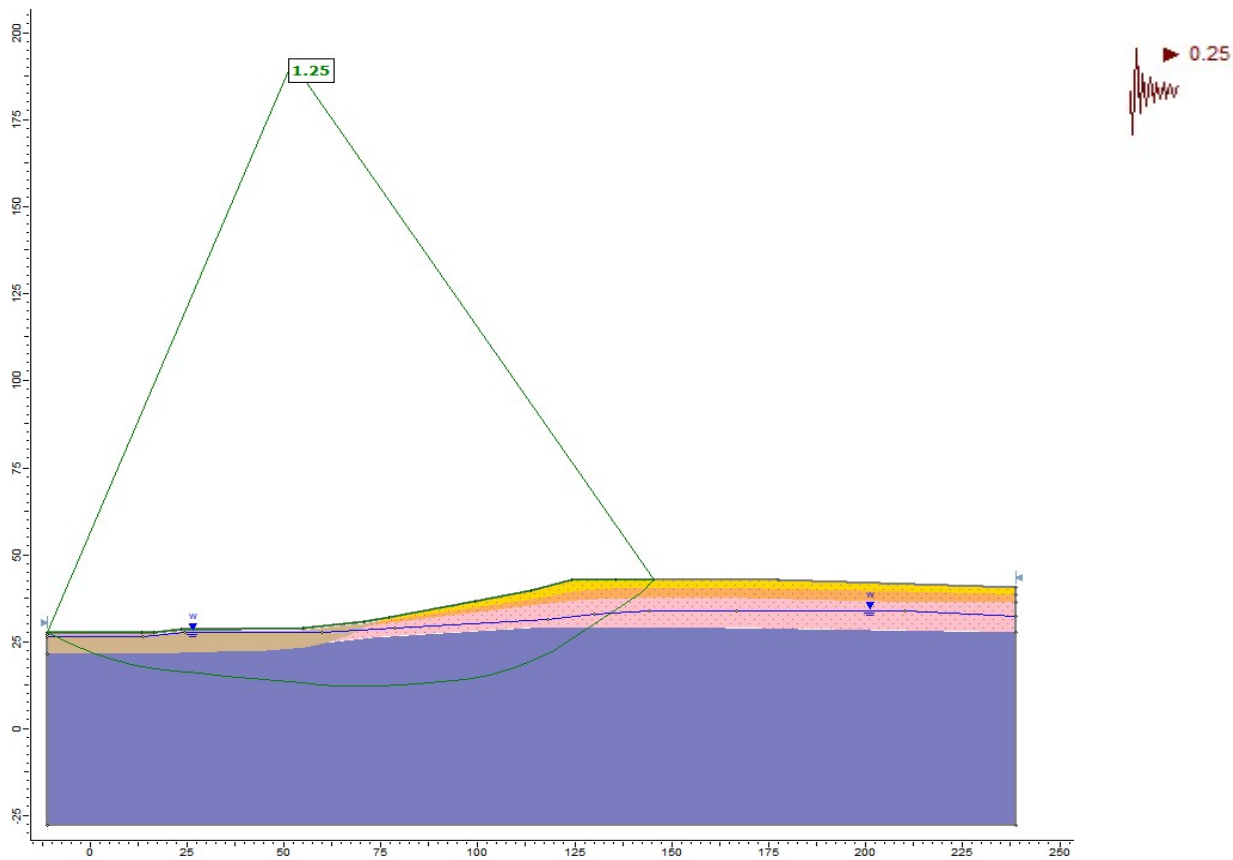
Existing Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Existing Profile - Worst Case Groundwater Conditions. Failures Filtered to FoS≤1.3



Existing Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated	
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated	
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Firm SILT (Piako Subgroup)		16	Mohr-Coulomb	1	28	Water Table	Custom	1

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	Water Table	Custom	1
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	Water Table	Custom	1
Firm SILT (Piako Subgroup)		16	Mohr-Coulomb	1	28	Water Table	Custom	1

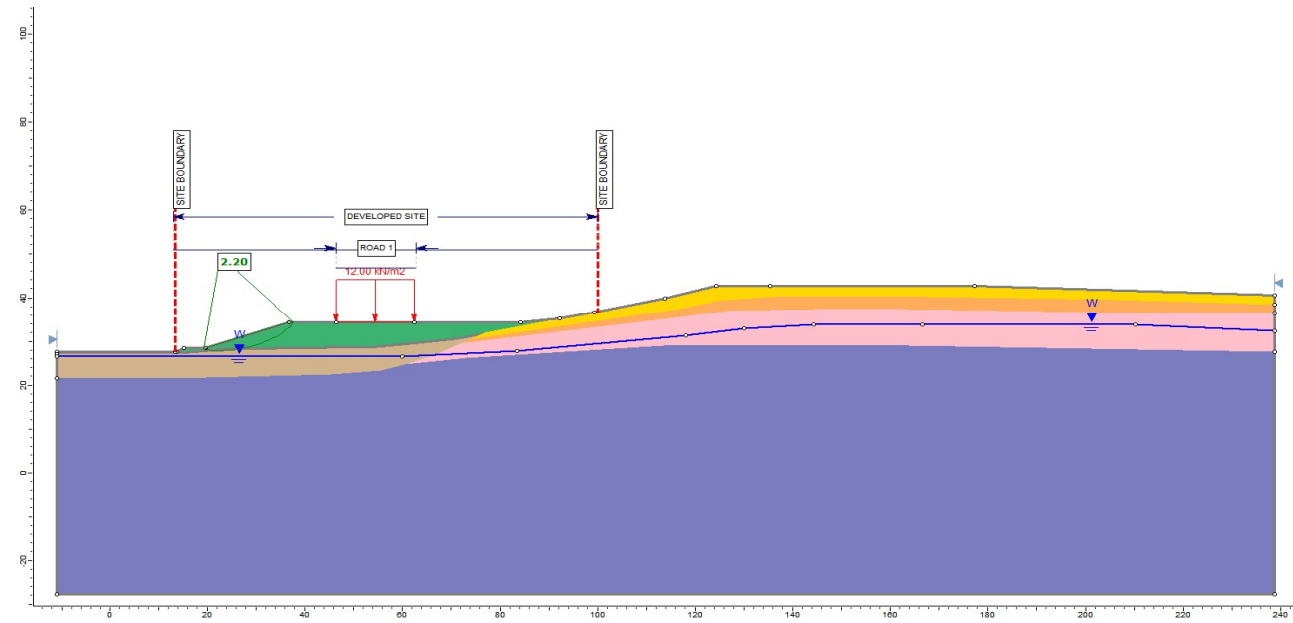
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Custom	0
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Custom	0
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	80	0	Constant	Water Table	Custom	0
Firm SILT (Piako Subgroup) - Undrained		16	Undrained	30	0	Constant	Water Table	Custom	1

PREVAILING

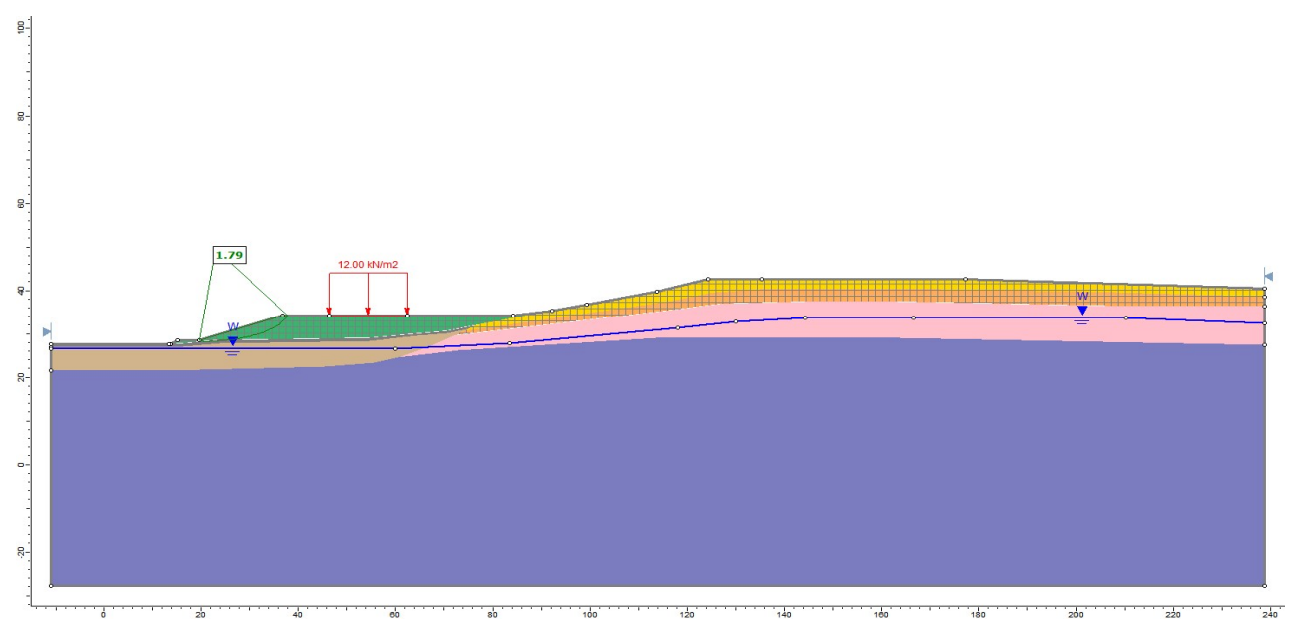
ELEVATED
GROUNDWATER

SEISMIC

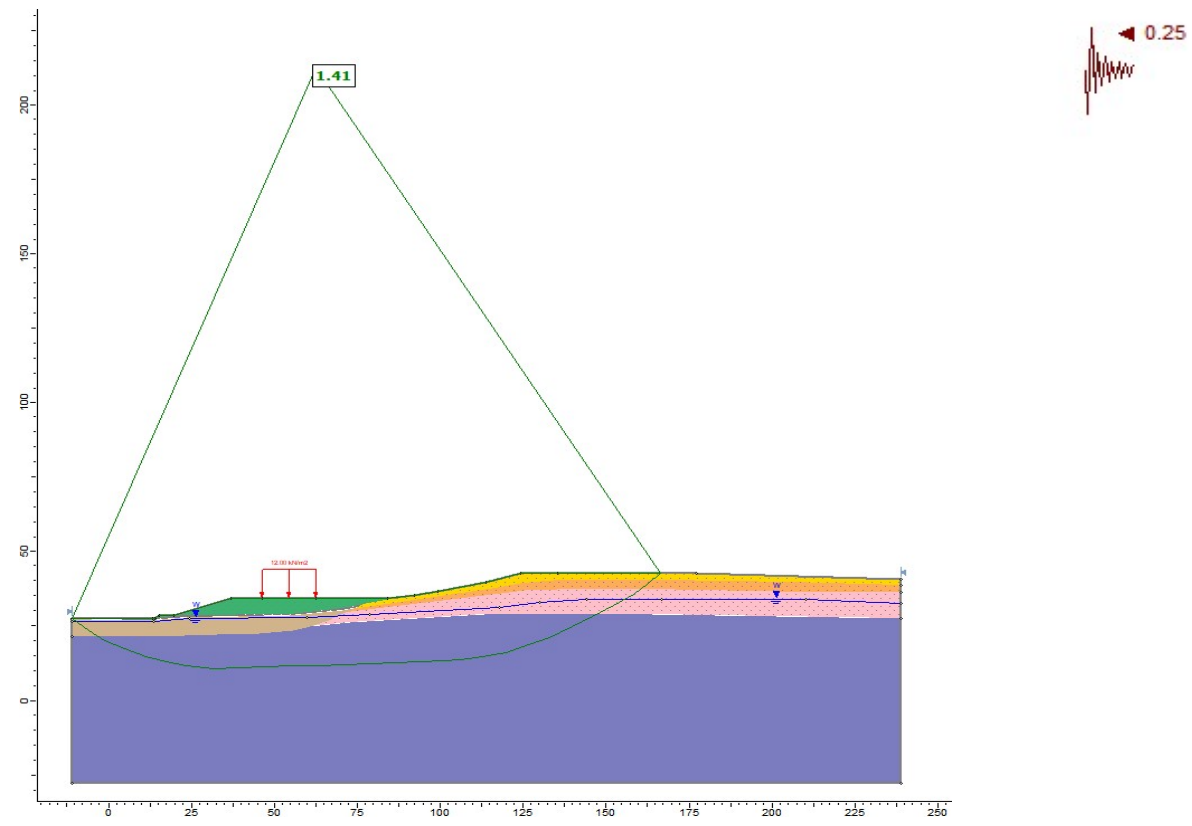
Proposed Profile - Normal Groundwater Conditions. Failures Filtered to FoS≤1.5



Proposed Profile - Worst Credible Groundwater Conditions. Failures Filtered to FoS≤1.3



Proposed Profile - ULS Seismic Event. Failures Filtered to FoS≤1.0



Parameters

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff to very stiff CLAY (Hamilton Ashes)		16	Mohr-Coulomb	4	28	Water Table	Automatically Calculated	
Very stiff to hard CLAY (Kuroa Ashes)		16	Mohr-Coulomb	5	28	Water Table	Automatically Calculated	
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Firm SILT (Piako Subgroup)		16	Mohr-Coulomb	1	28	Water Table	Custom	1

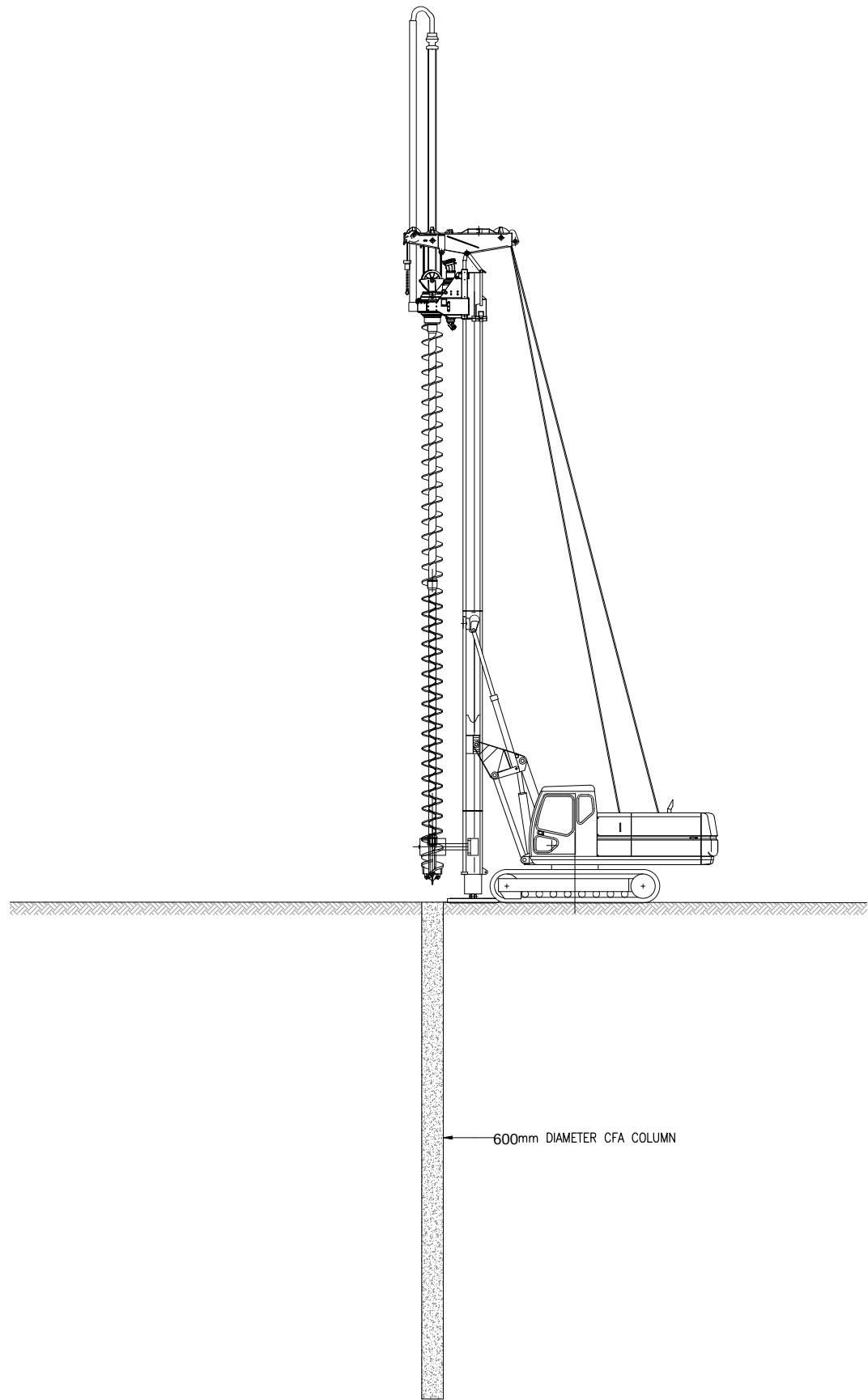
Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Water Surface	Hu Type	Hu
Stiff CLAY/SILT (Puketoka Formation)		16	Mohr-Coulomb	3	28	Water Table	Automatically Calculated	
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36	Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34	Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Ru=0.3		16	Mohr-Coulomb	4	28	Water Table	Custom	1
Very stiff to hard CLAY (Kuroa Ashes) - Ru=0.3		16	Mohr-Coulomb	5	28	Water Table	Custom	1
Firm SILT (Piako Subgroup)		16	Mohr-Coulomb	1	28	Water Table	Custom	1

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (°)	Cohesion Type	Water Surface	Hu Type	Hu
Dense to very dense SAND (Non-welded Ignimbrite - Walton Subgroup)		17	Mohr-Coulomb	0	36		Water Table	Automatically Calculated	
Loose to medium dense SAND with interbedded stiff silts (Hinuera Formation)		16	Mohr-Coulomb	2	34		Water Table	Automatically Calculated	
Stiff to very stiff CLAY (Hamilton Ashes) - Undrained		16	Undrained	80	0	Constant	Water Table	Custom	0
Very stiff to hard CLAY (Kuroa Ashes) - Undrained		16	Undrained	100	0	Constant	Water Table	Custom	0
Stiff CLAY/SILT (Puketoka Formation) - Undrained		16	Undrained	80	0	Constant	Water Table	Custom	0
Firm SILT (Piako Subgroup) - Undrained		16	Undrained	30	0	Constant	Water Table	Custom	1

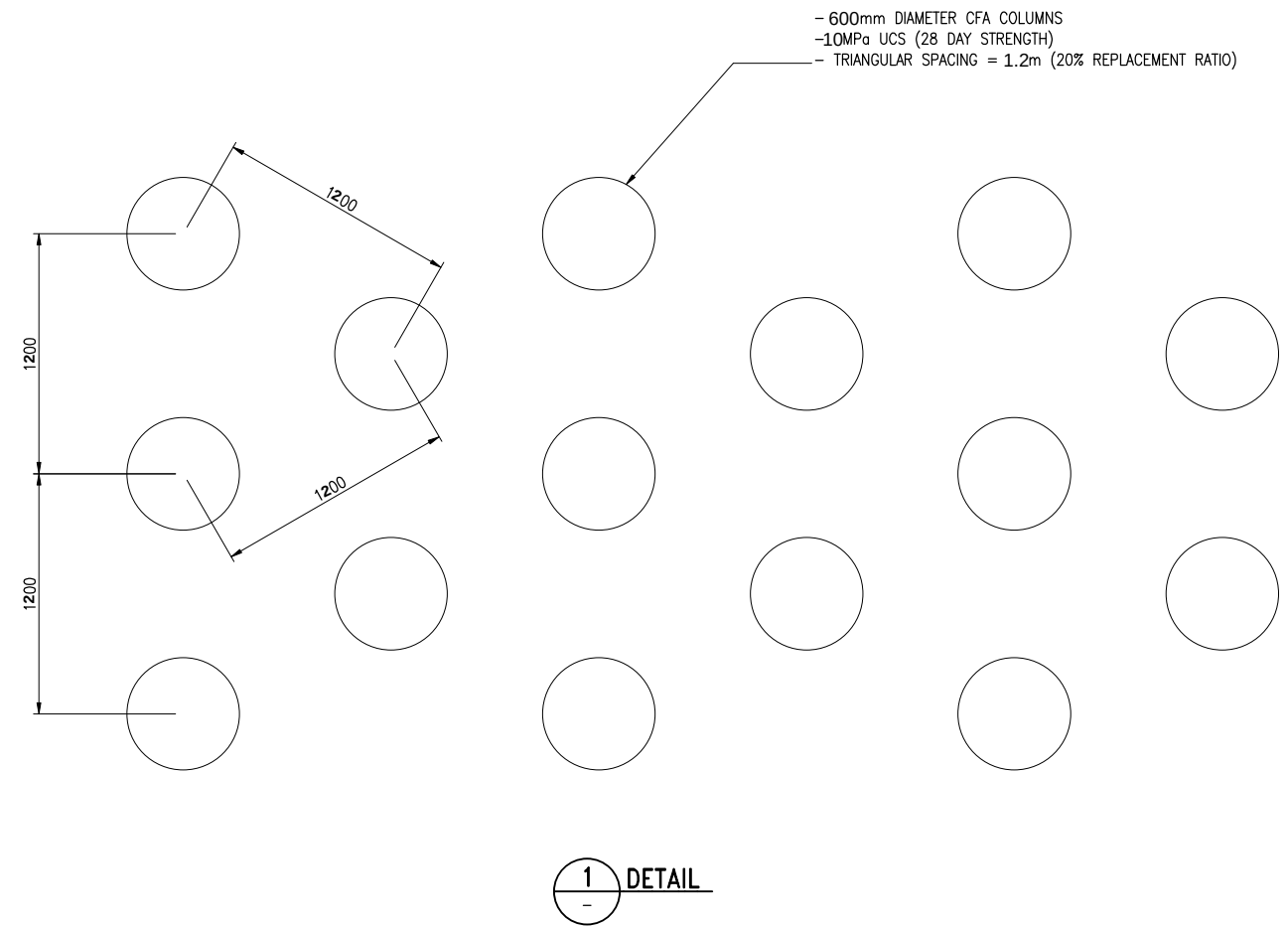
PREVAILING

ELEVATED
GROUNDWATER

SEISMIC



INDICATIVE ONLY



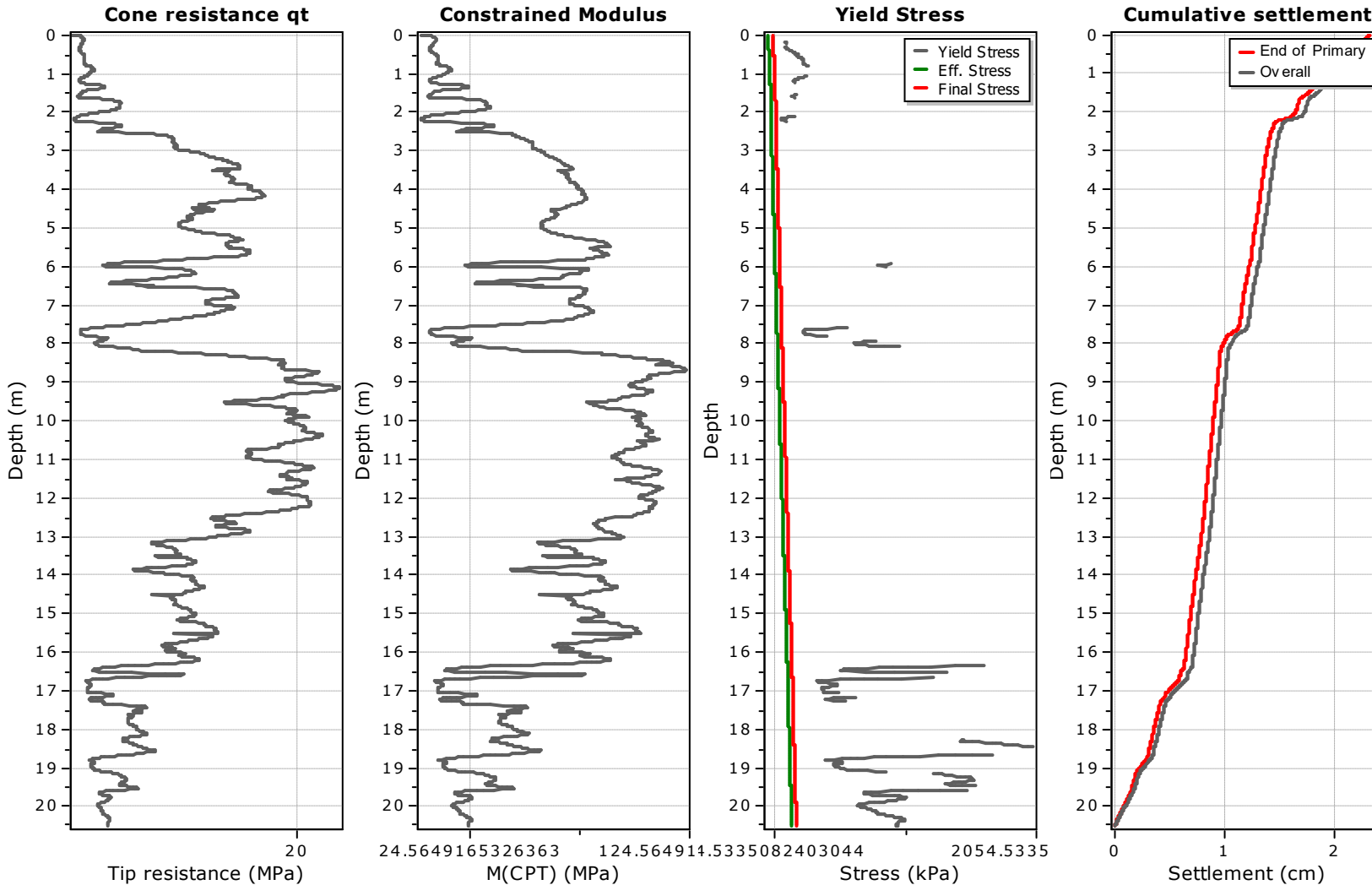
 Great People Practical Solutions	CLIENT: TE KOWHAI EAST LIMITED PARTNERSHIP	DRAWN: AS	PROJECT: HAM2025-0116
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		REVISION: 0	SCALE: -
	TITLE: CFA PILE PRELIMINARY DETAIL	DATE: 26/08/2026	SHEET: A3L

APPENDIX K

Load Induced Settlement Assessment

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 36.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

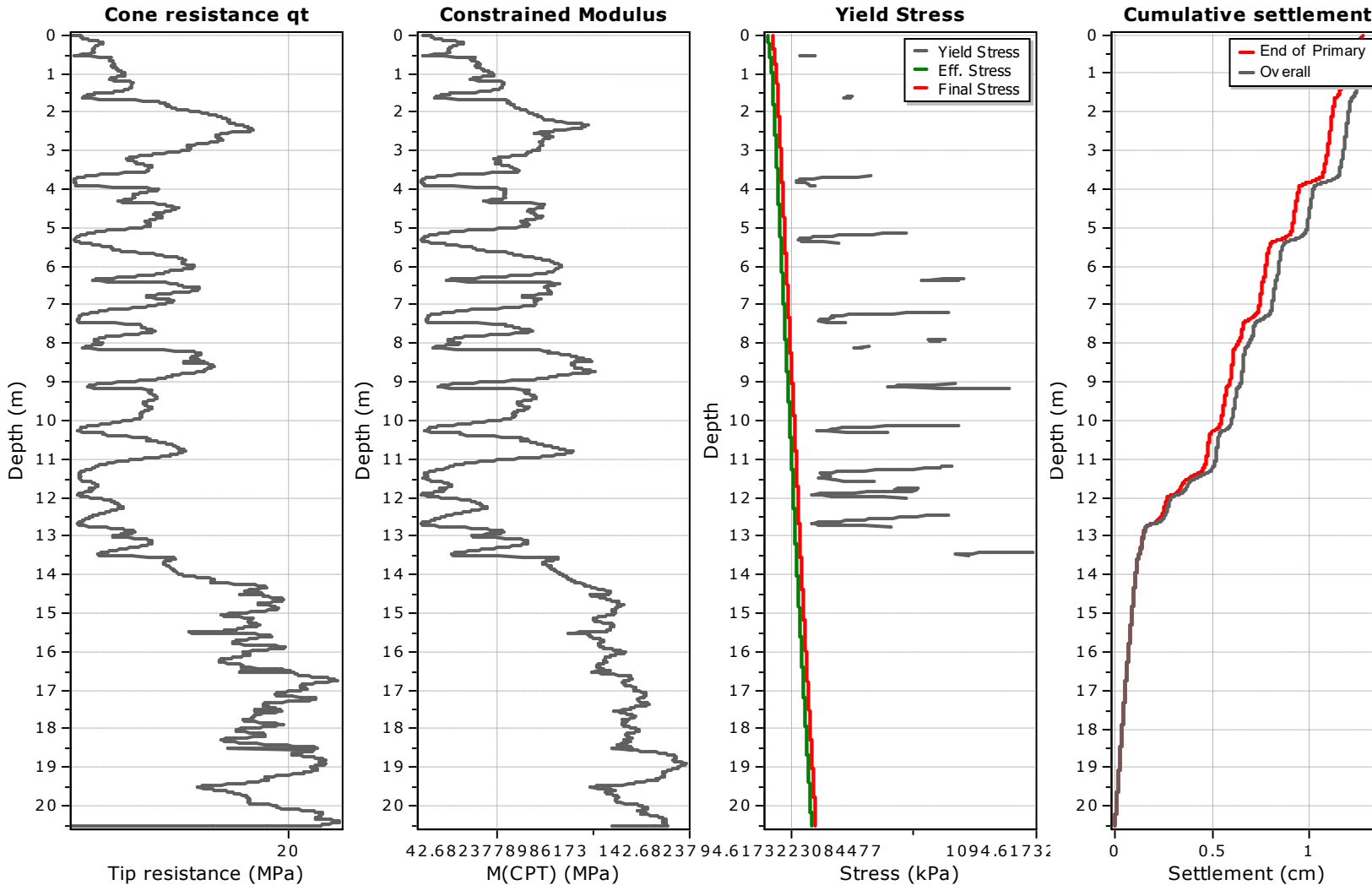
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 18.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

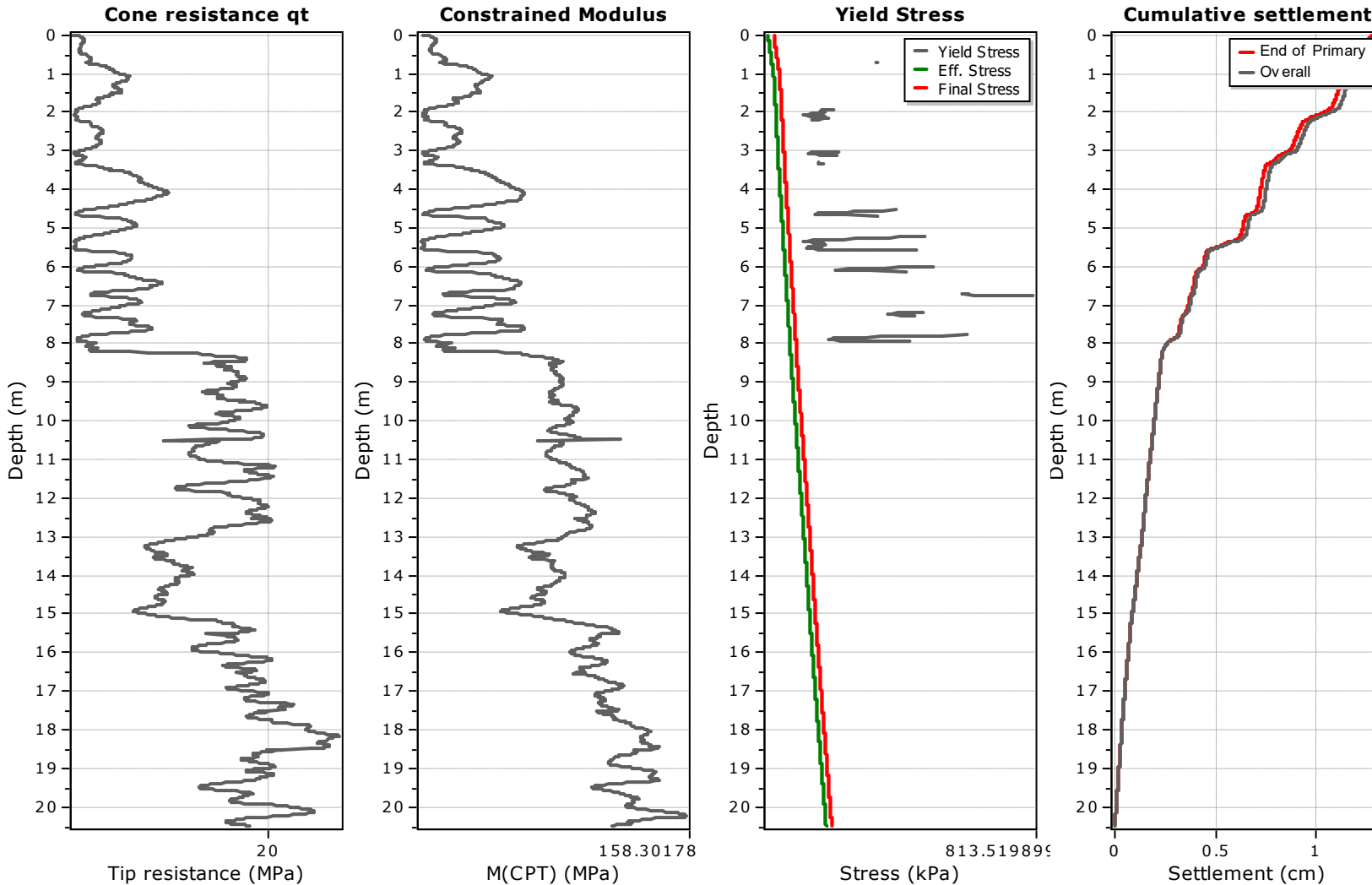
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
 Footing width: 100.00 (m)
 L/B: 1.0
 Footing pressure: 18.00 (kPa)
 Embedment depth: 0.00 (m)
 Footing is rigid: No
 Remove excavation load: No
 Apply 20% rule: No
 Calculate secondary settlements: Yes
 Time period for primary consolidation: 6 months
 Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

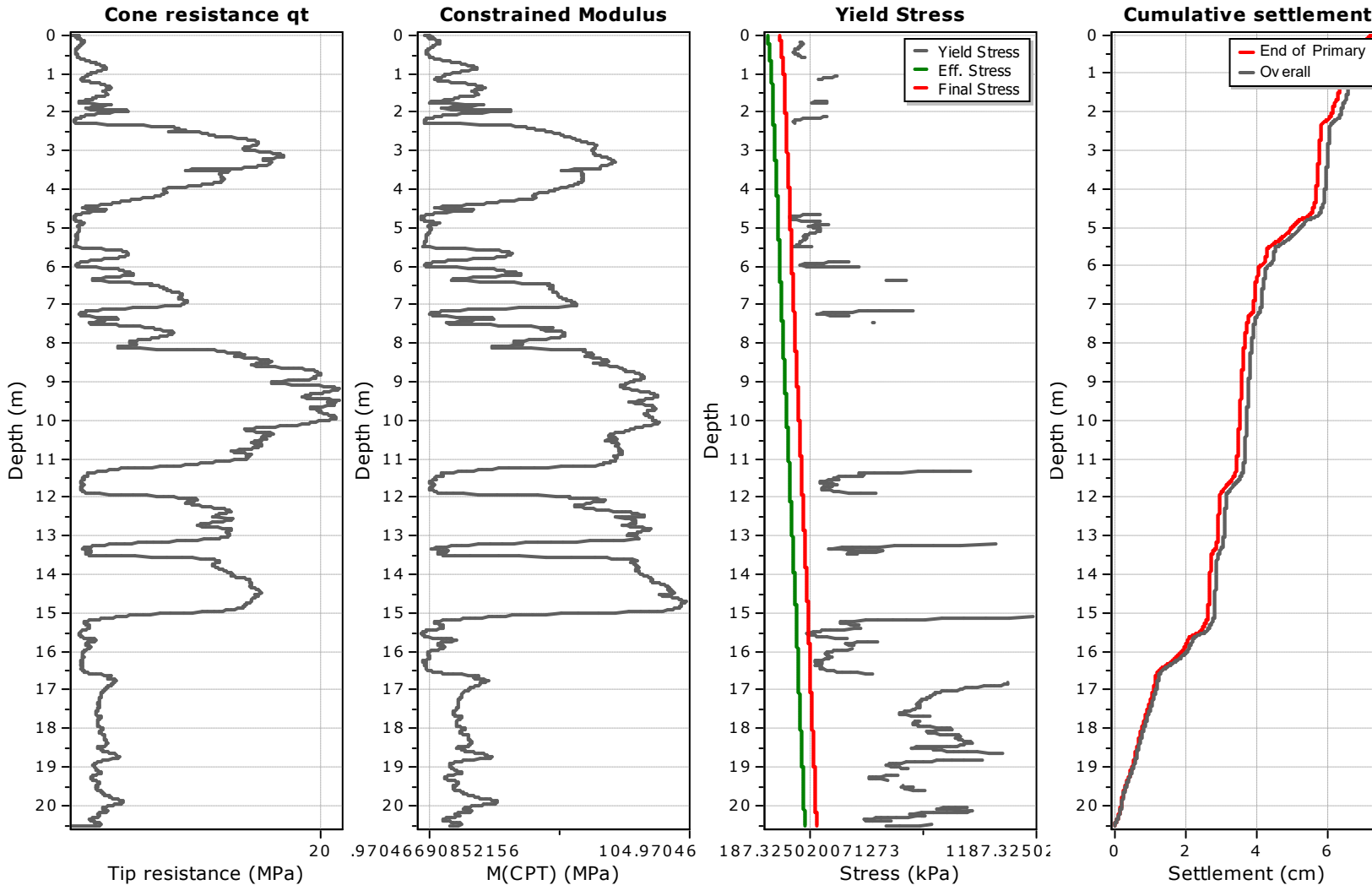
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 54.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

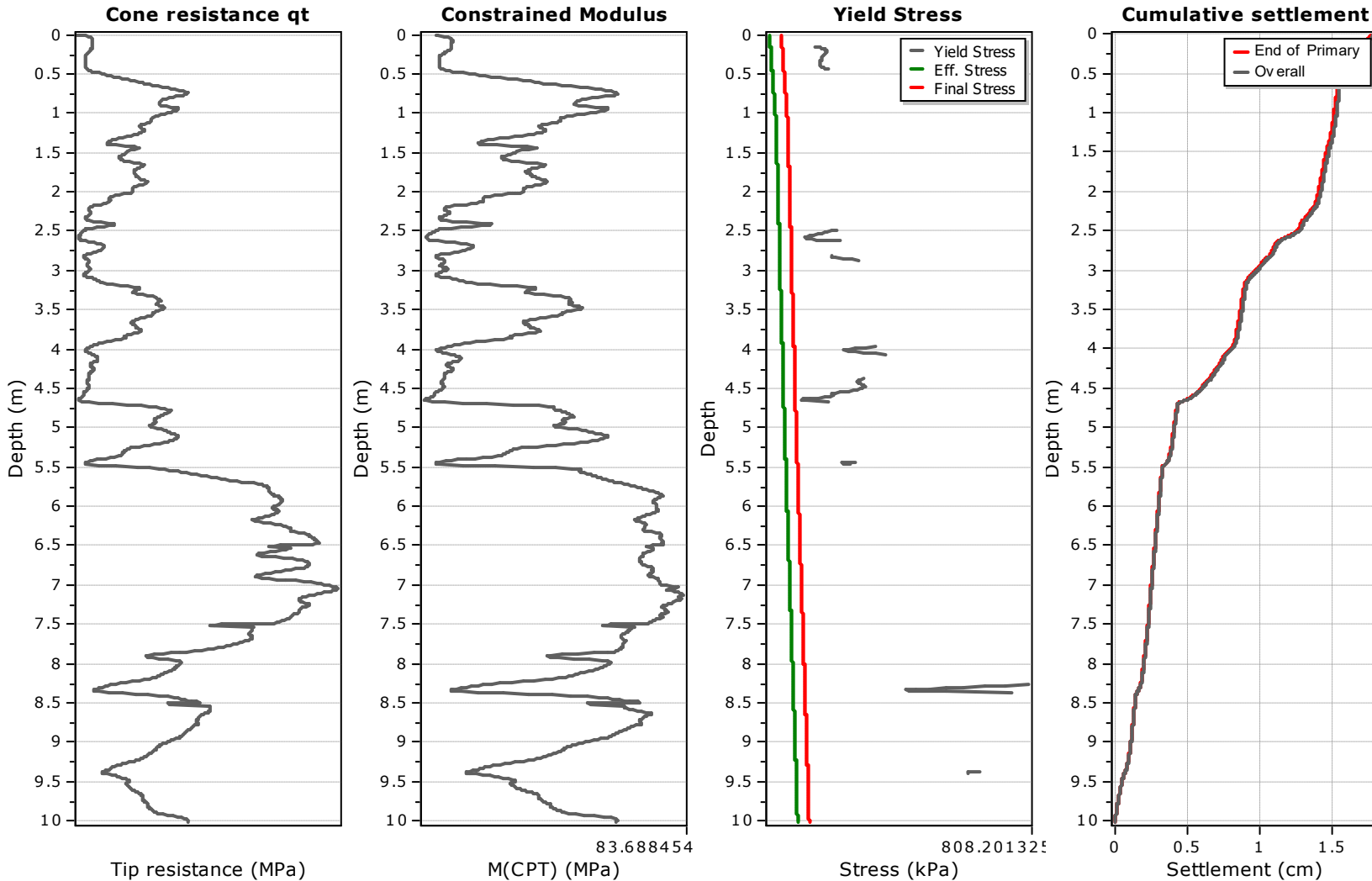
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
 Footing width: 100.00 (m)
 L/B: 1.0
 Footing pressure: 36.00 (kPa)
 Embedment depth: 0.00 (m)
 Footing is rigid: No
 Remove excavation load: No
 Apply 20% rule: No
 Calculate secondary settlements: Yes
 Time period for primary consolidation: 6 months
 Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

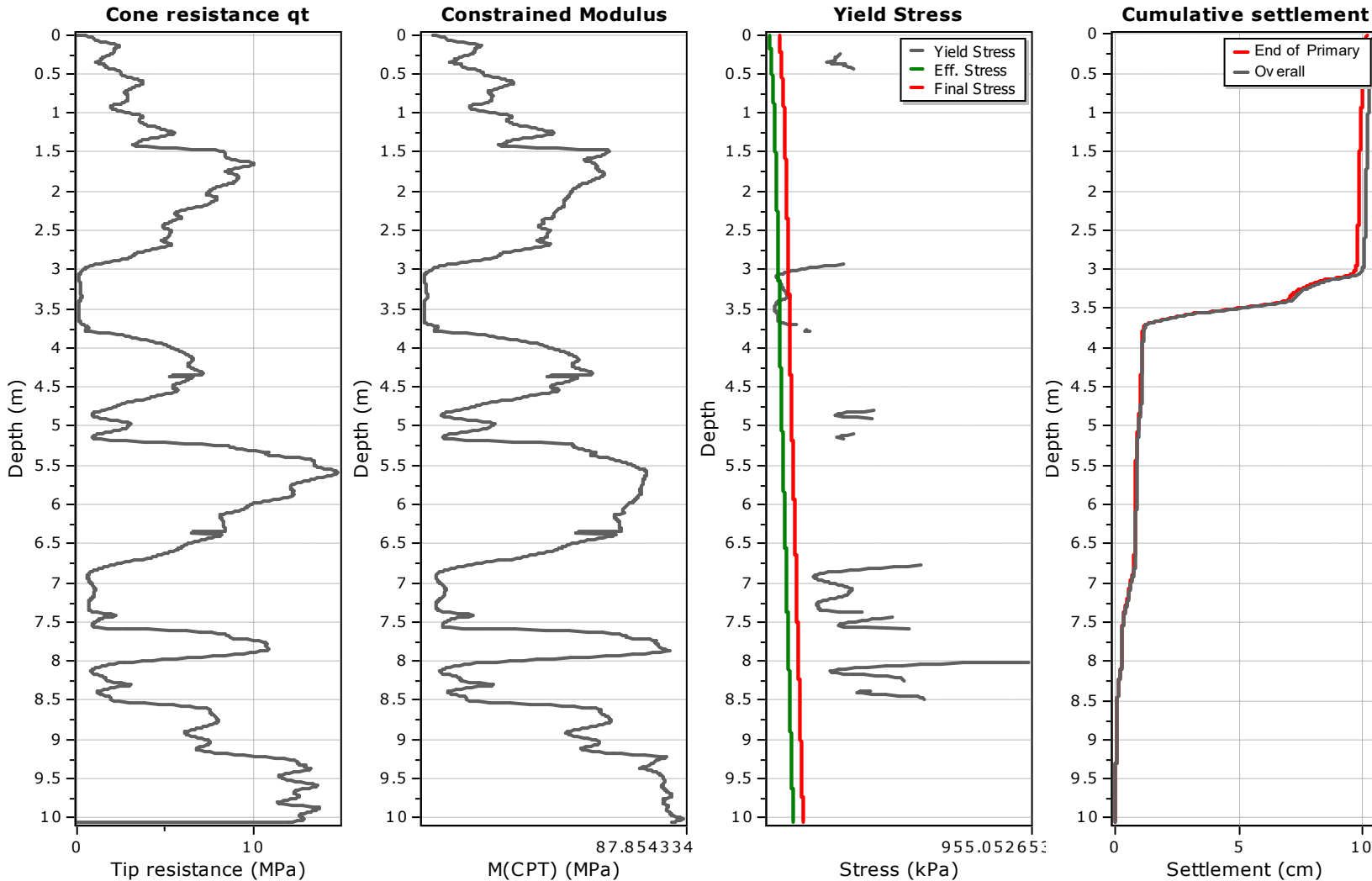
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 36.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

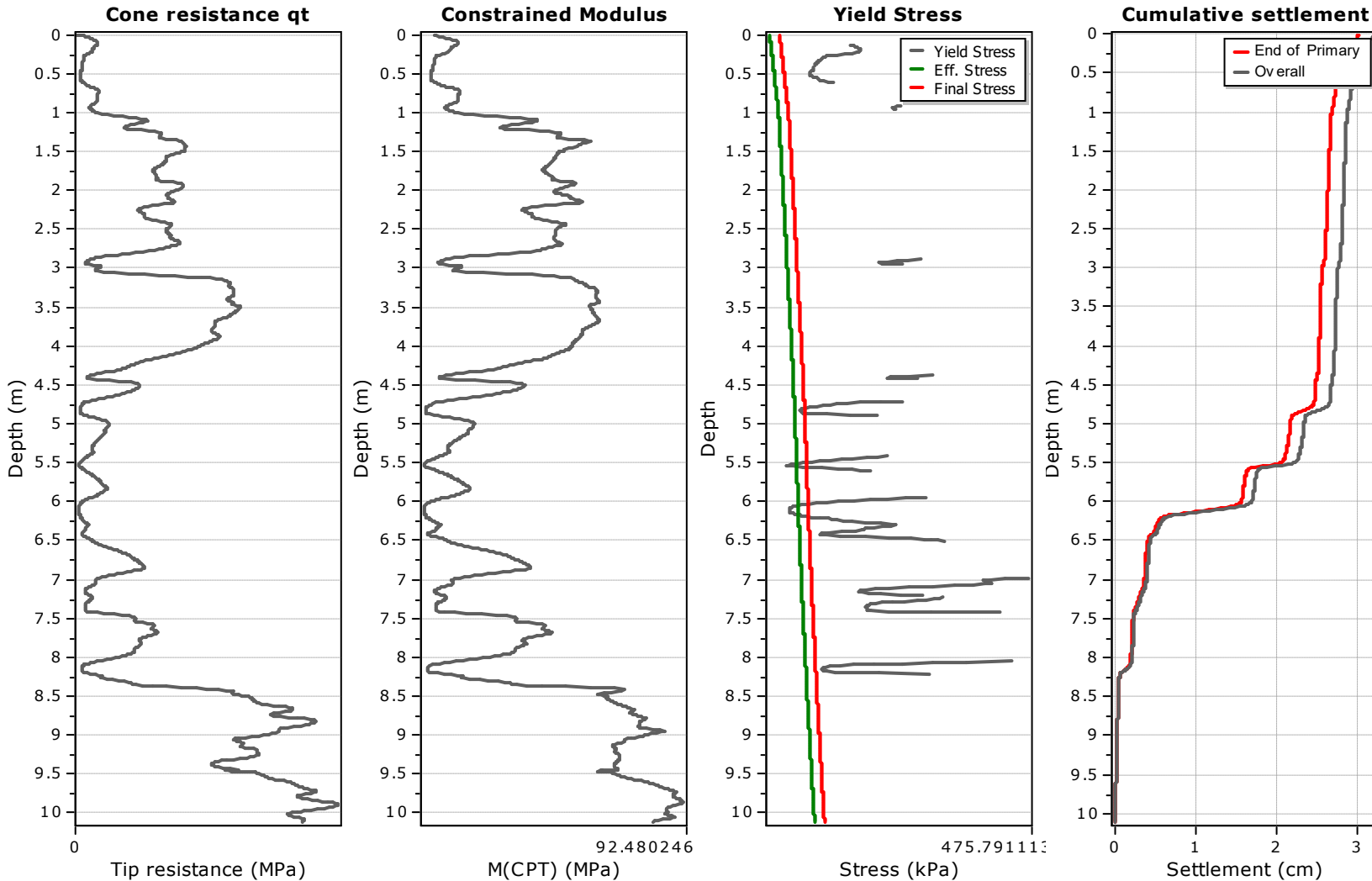
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
 Footing width: 100.00 (m)
 L/B: 1.0
 Footing pressure: 18.00 (kPa)
 Embedment depth: 0.00 (m)
 Footing is rigid: No
 Remove excavation load: No
 Apply 20% rule: No
 Calculate secondary settlements: Yes
 Time period for primary consolidation: 6 months
 Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

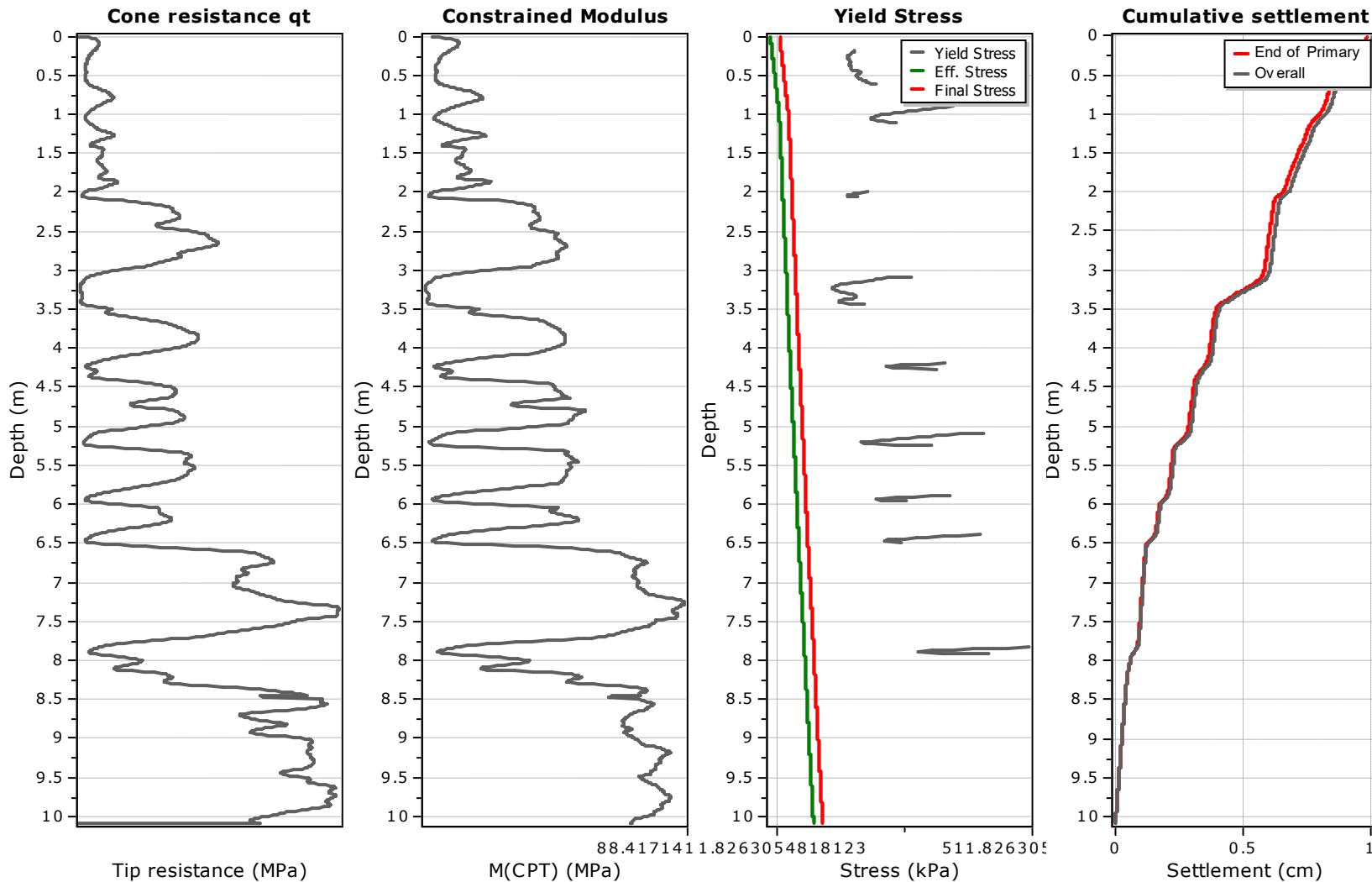
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 18.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

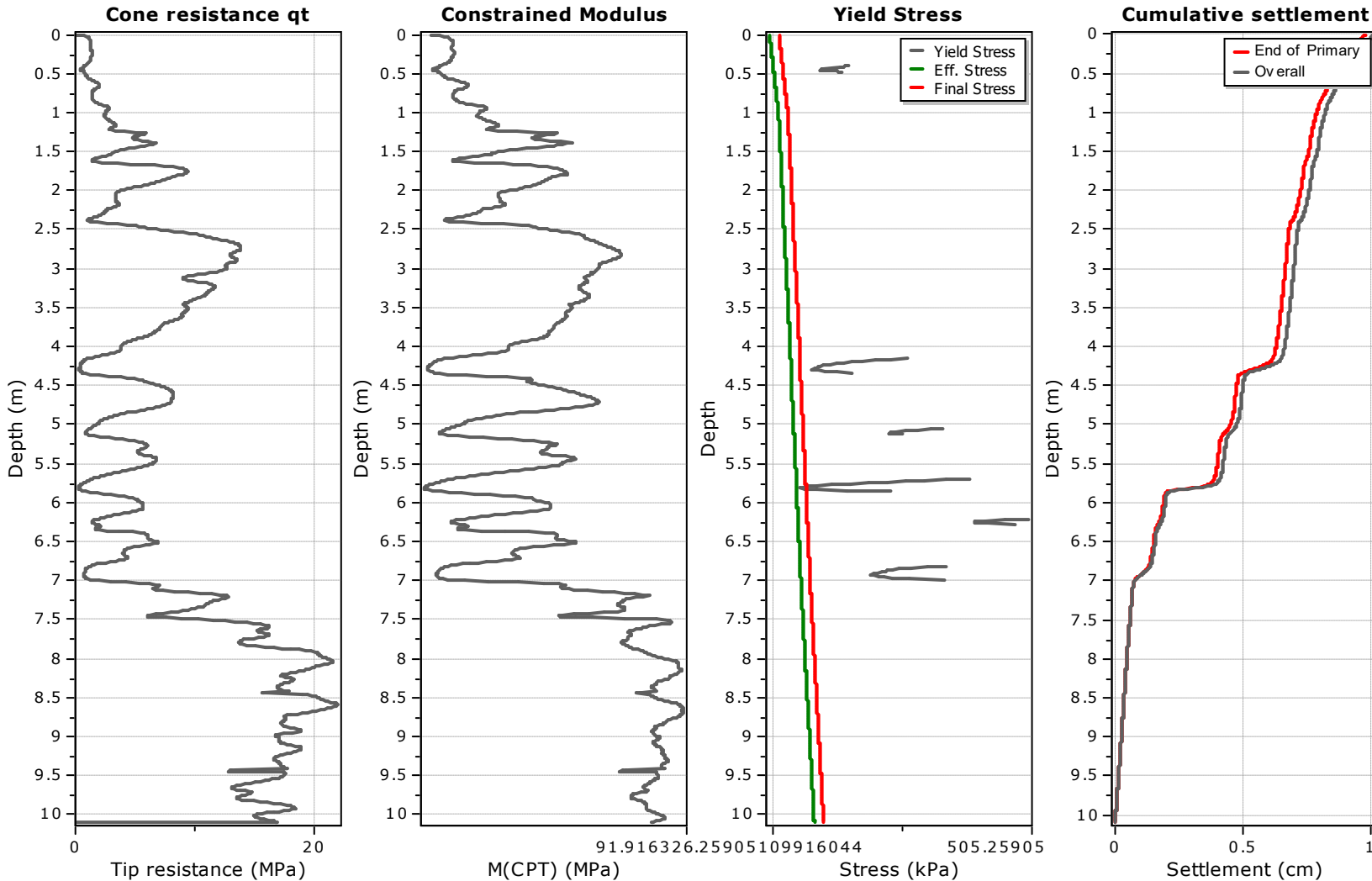
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 18.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

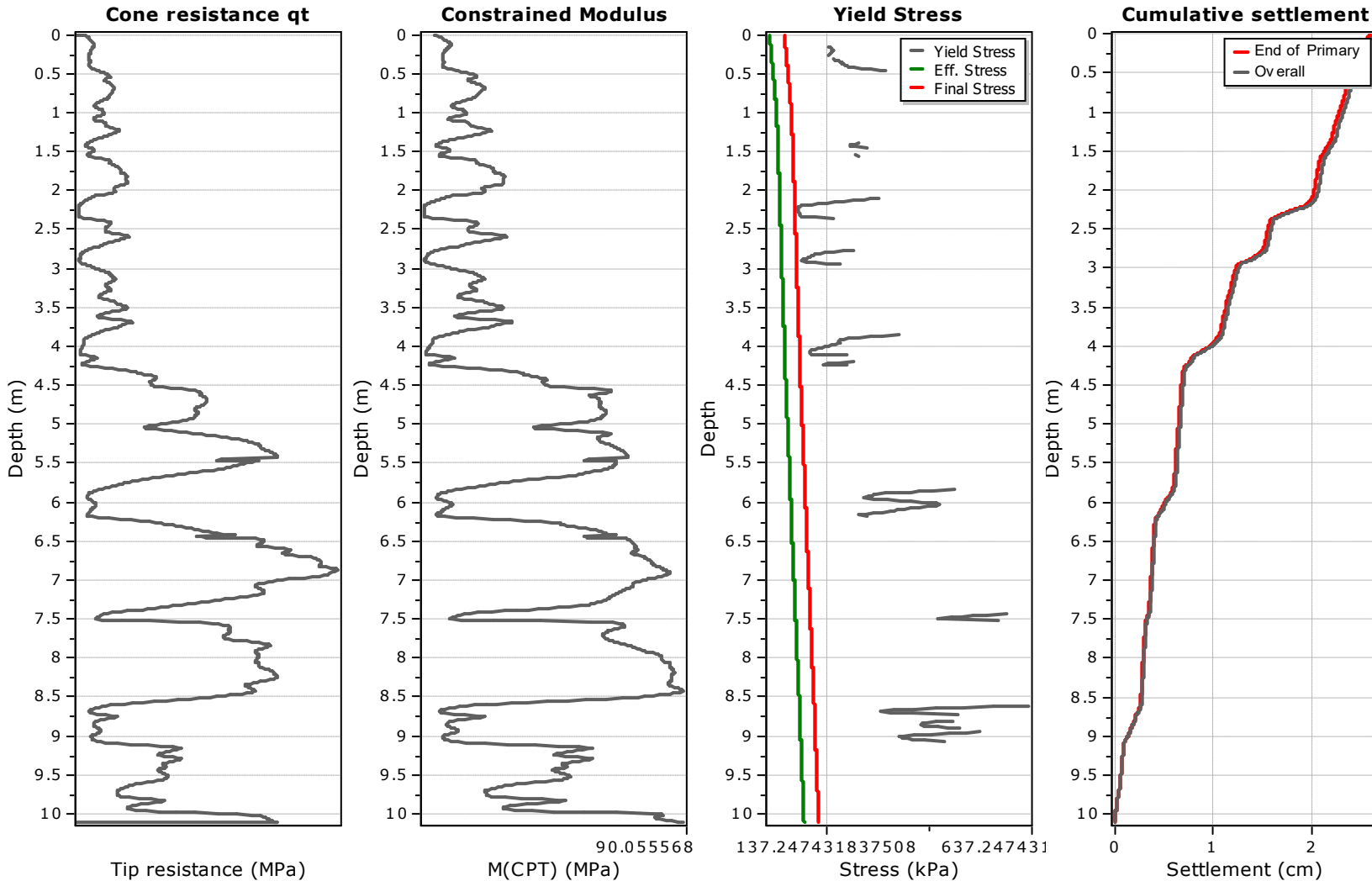
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 100.00 (m)
L/B: 1.0
Footing pressure: 36.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 12 months

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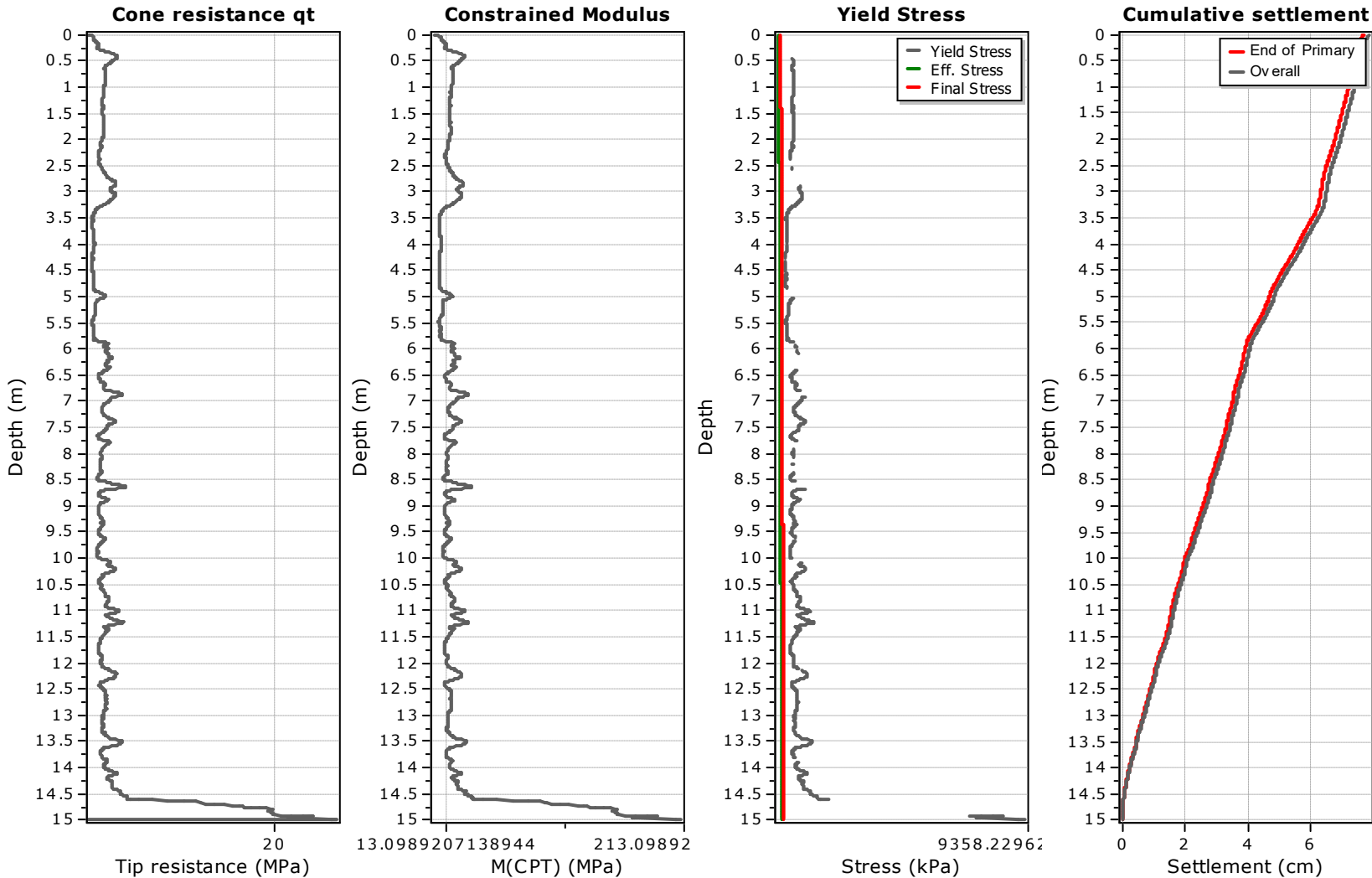
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Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
 Footing width: 100.00 (m)
 L/B: 1.0
 Footing pressure: 72.00 (kPa)
 Embedment depth: 0.00 (m)
 Footing is rigid: No
 Remove excavation load: No
 Apply 20% rule: No
 Calculate secondary settlements: Yes
 Time period for primary consolidation: 6 months
 Time period for second. settlements: 12 months

* Primary settlement calculation is performed according to the following formula:

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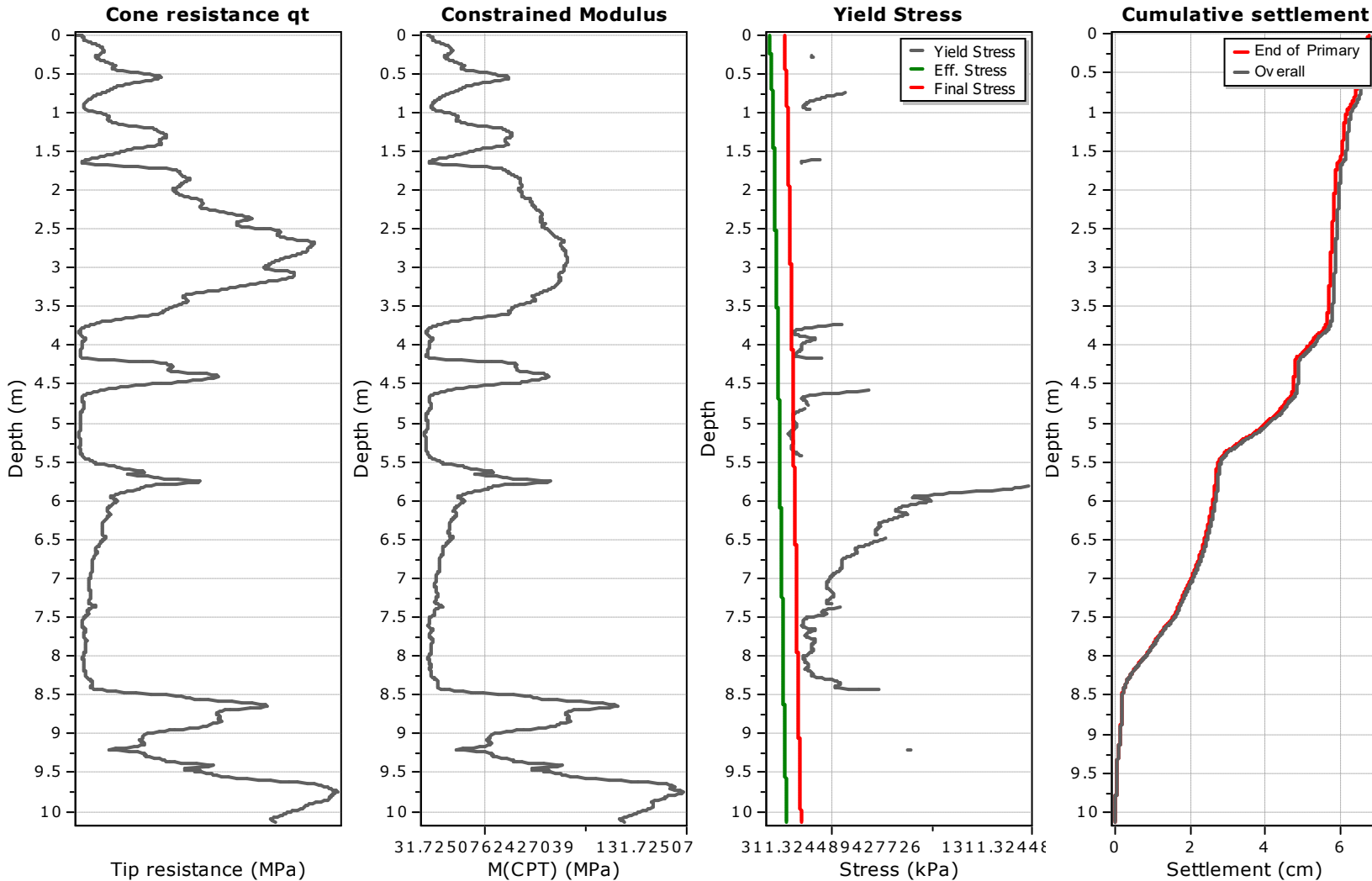
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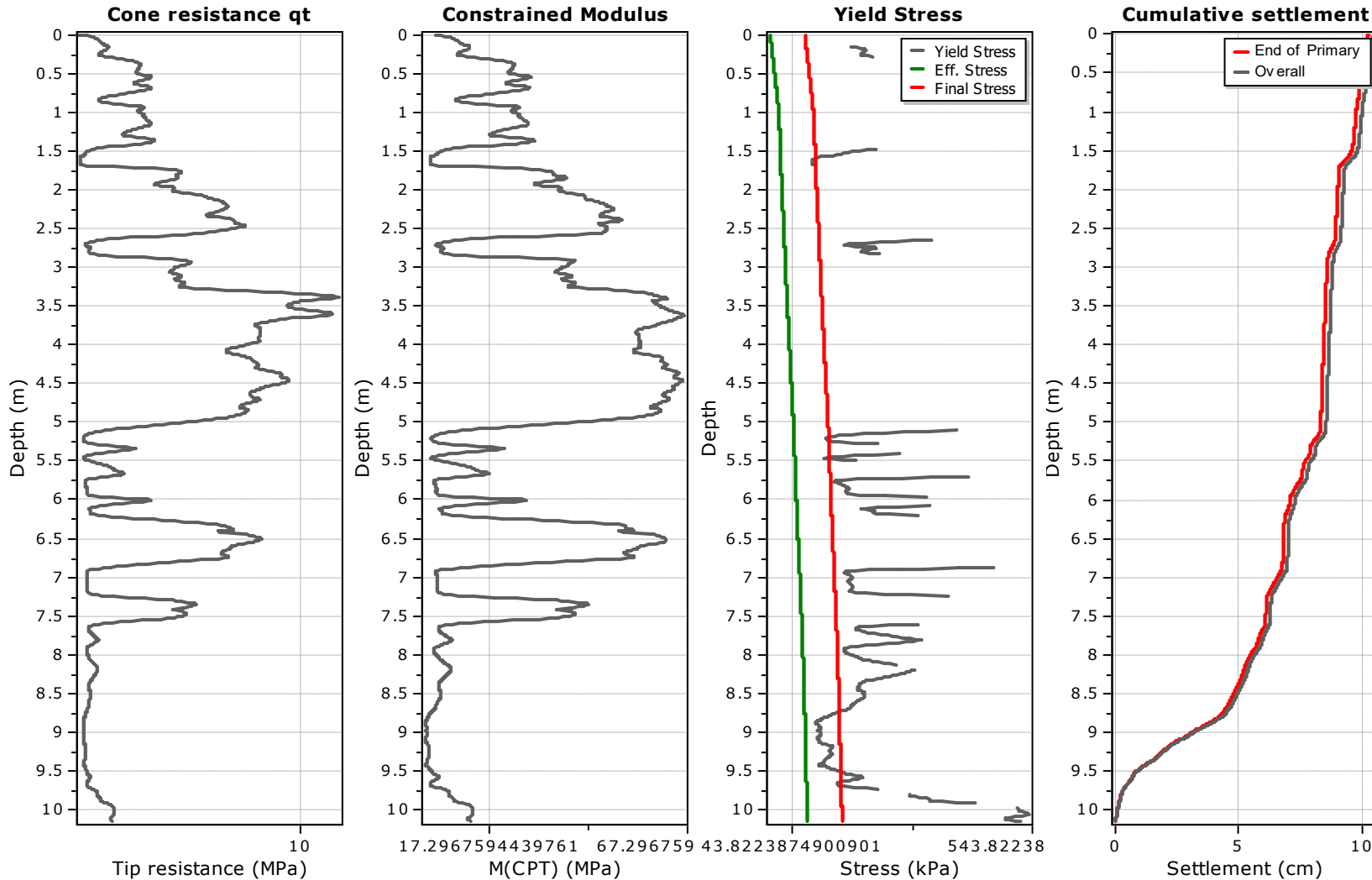
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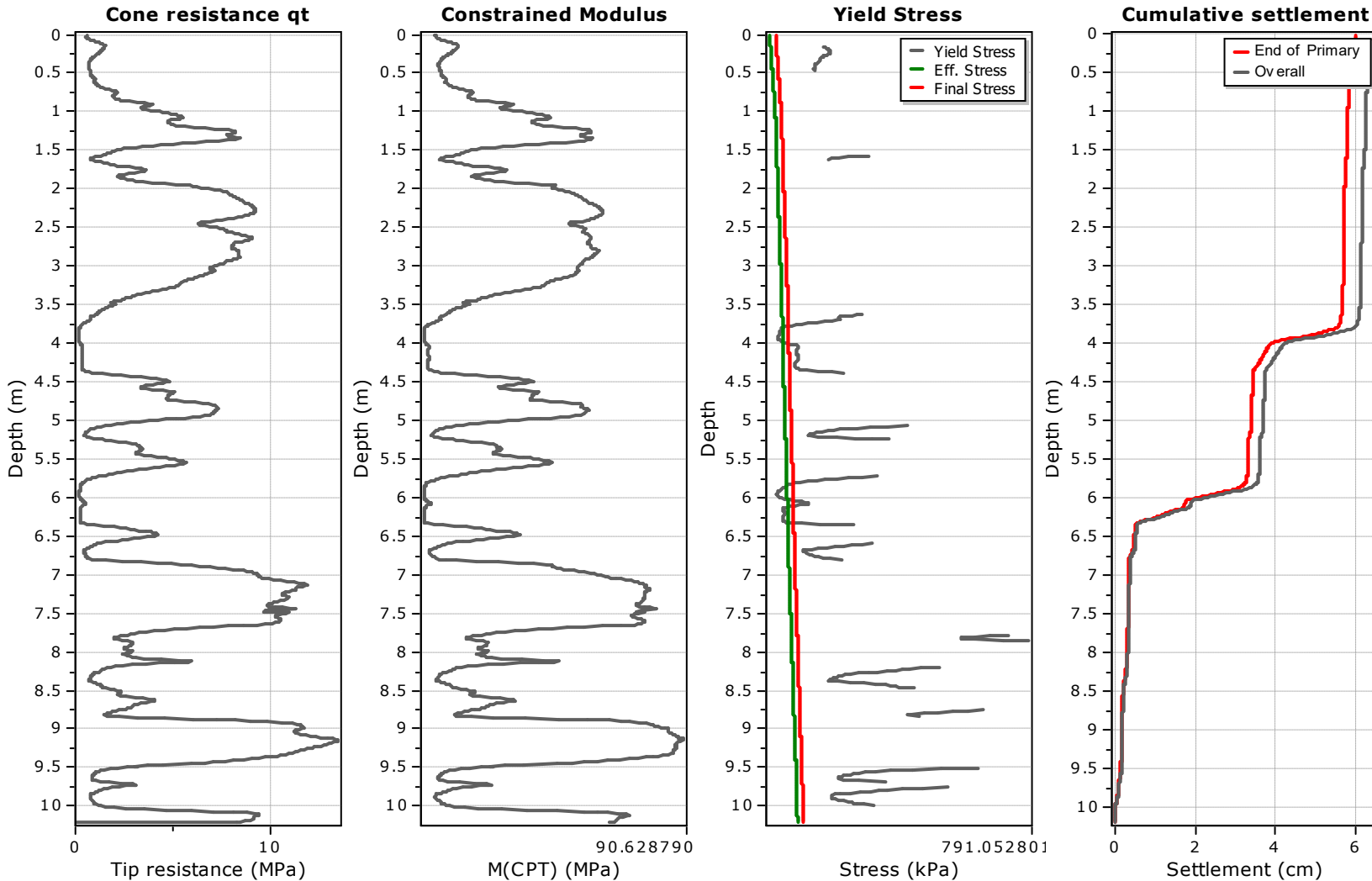
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 Footing width: 100.00 (m)
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 Footing pressure: 18.00 (kPa)
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 Footing is rigid: No
 Remove excavation load: No
 Apply 20% rule: No
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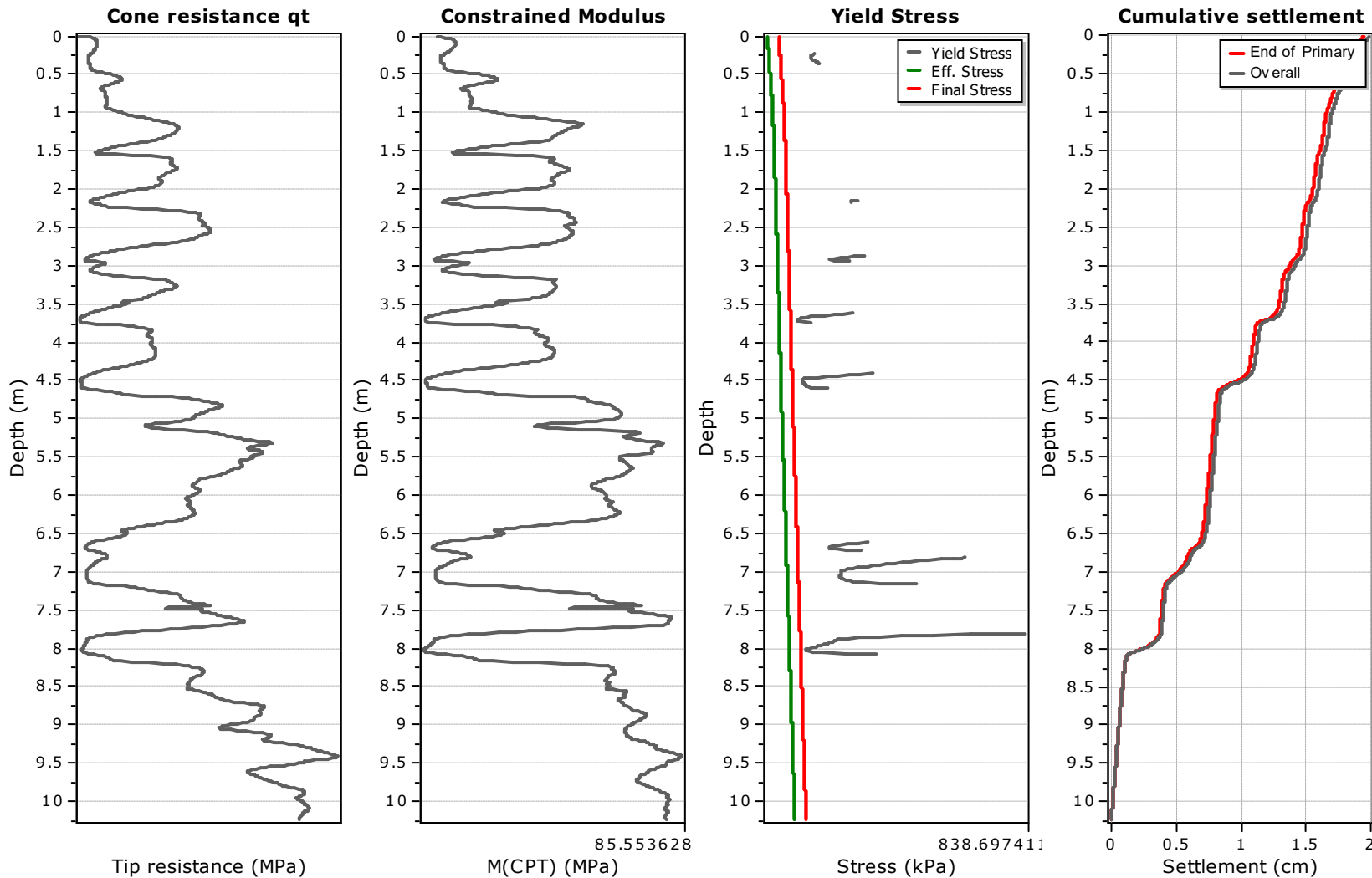
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Calculation properties

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 Footing pressure: 36.00 (kPa)
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 Footing is rigid: No
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 Apply 20% rule: No
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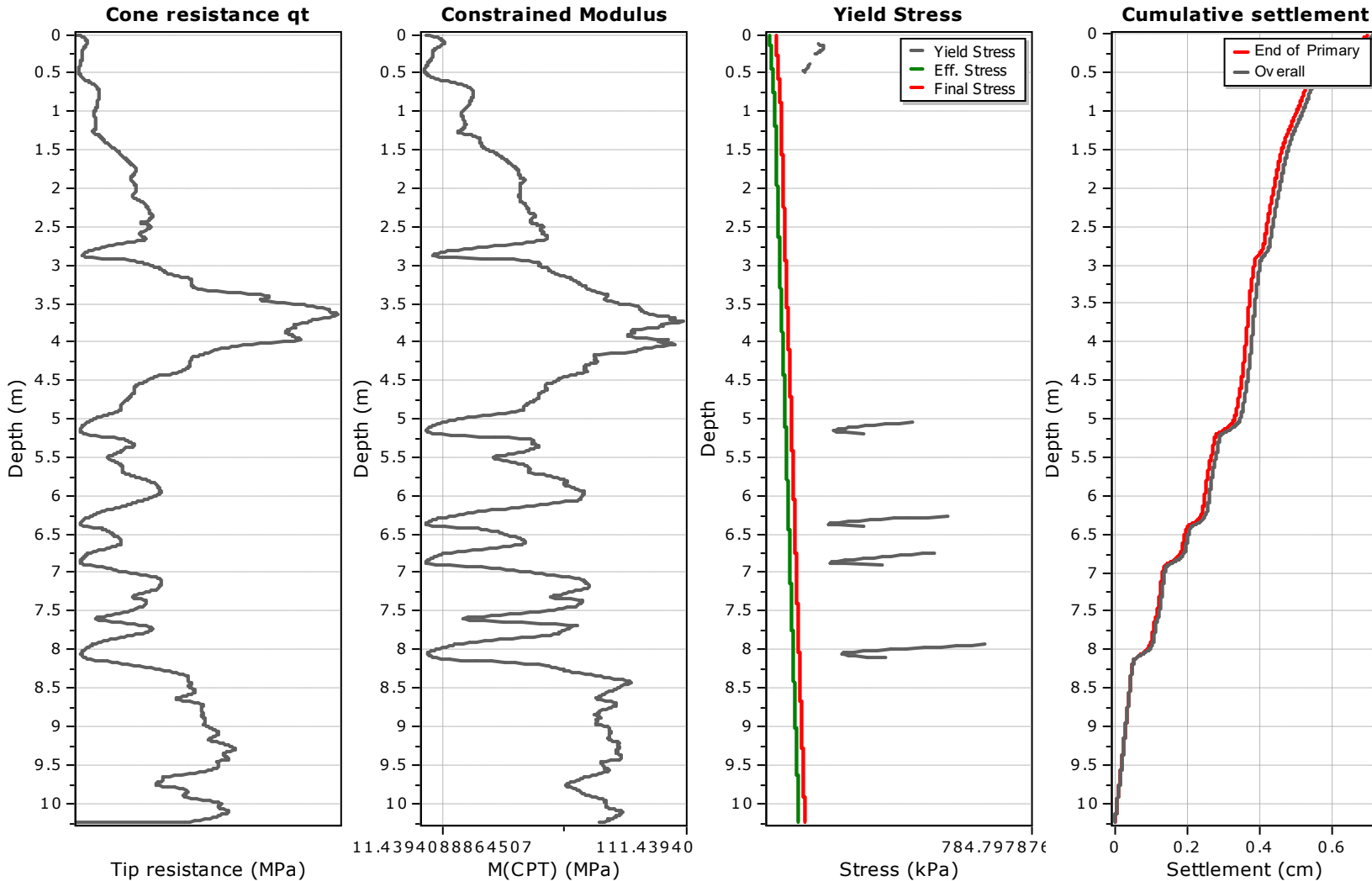
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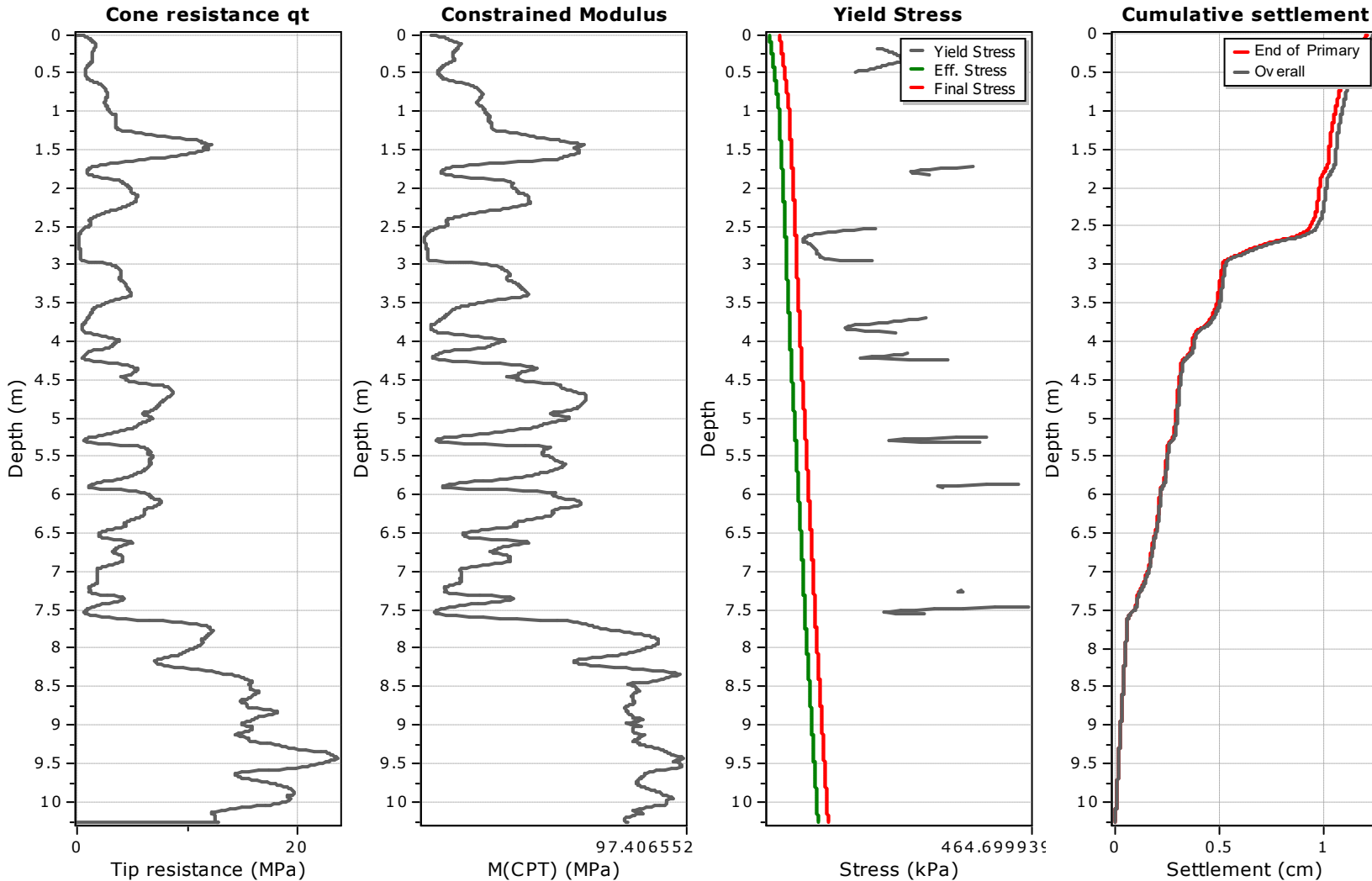
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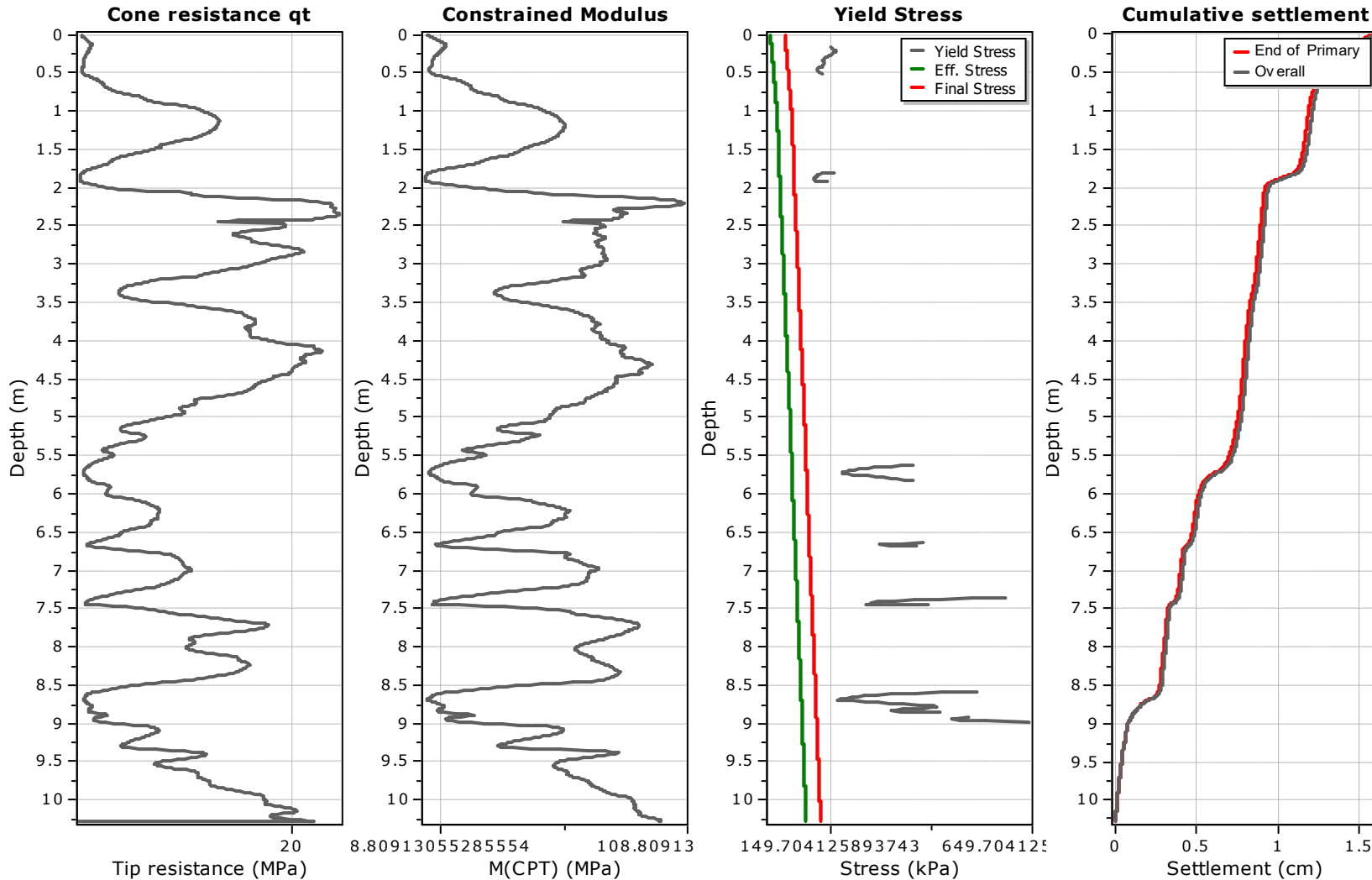
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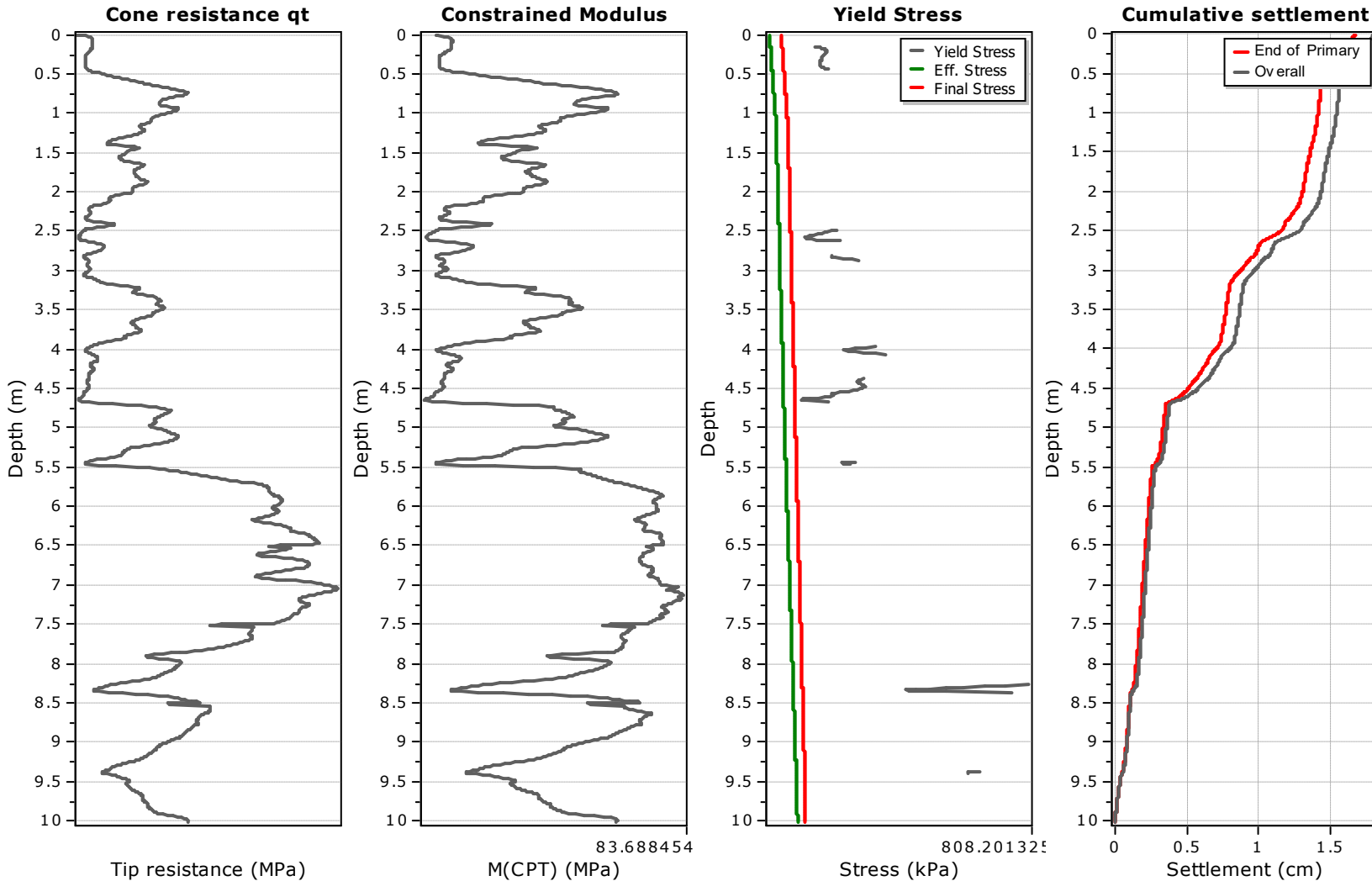
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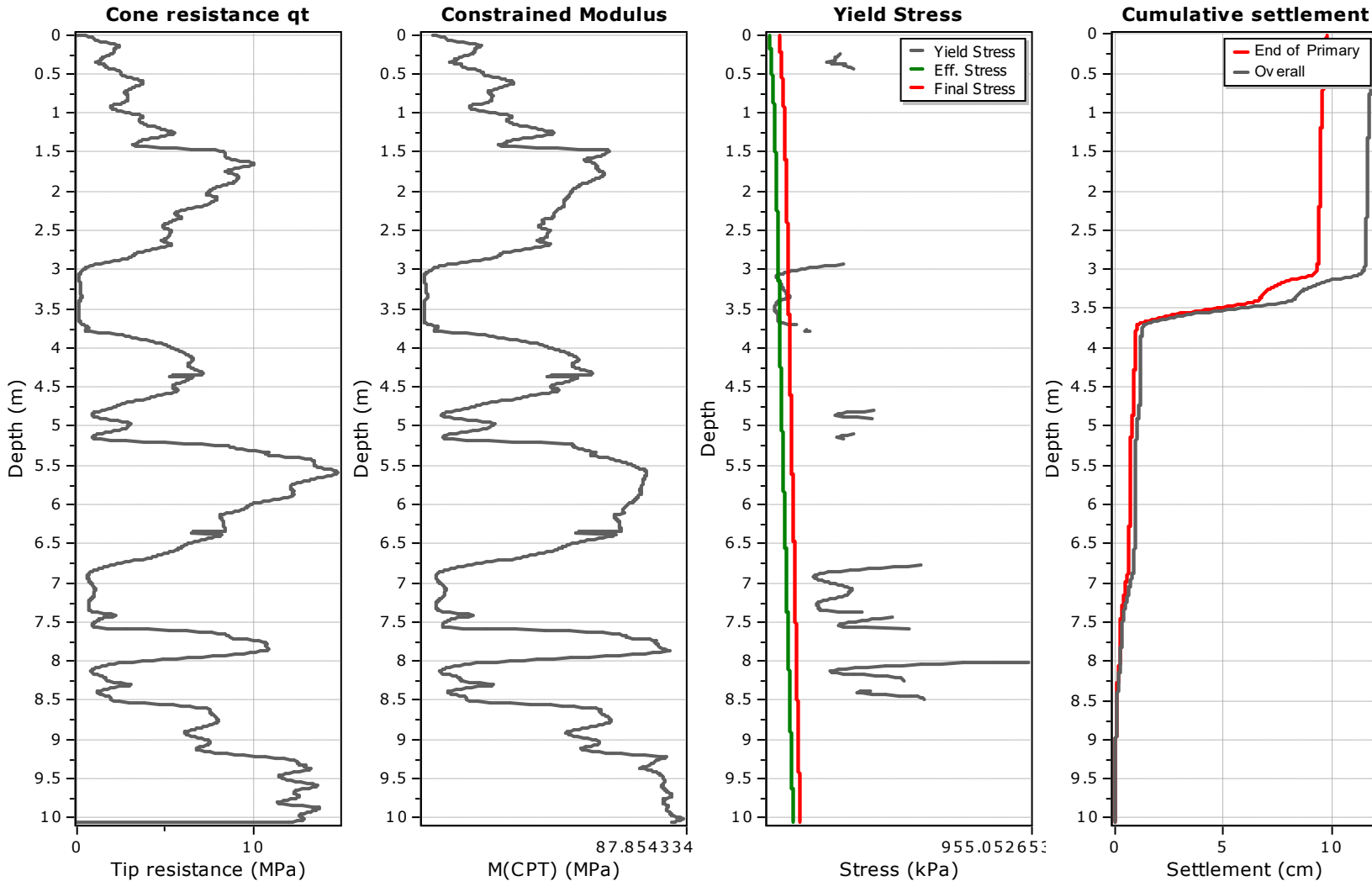
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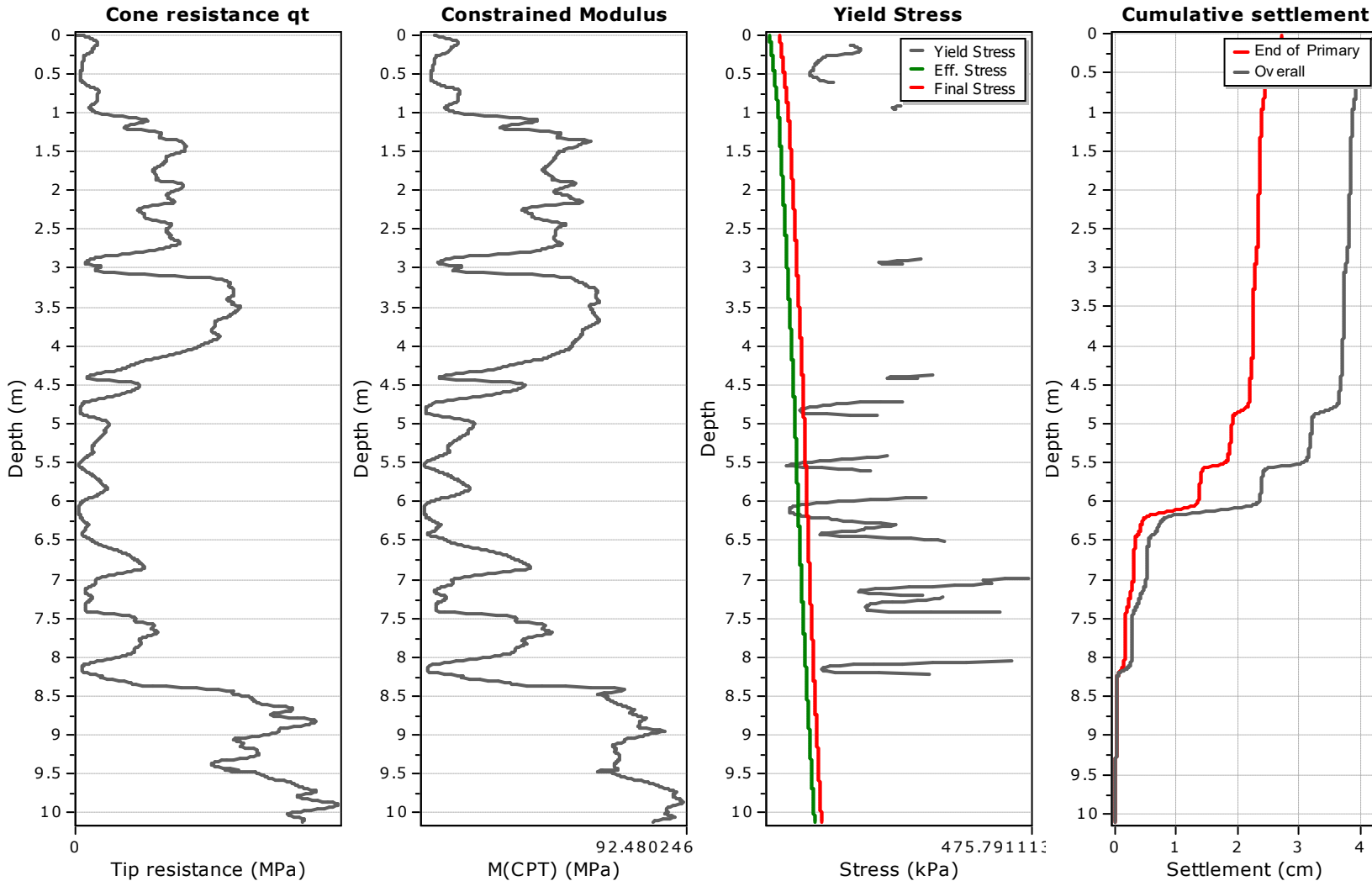
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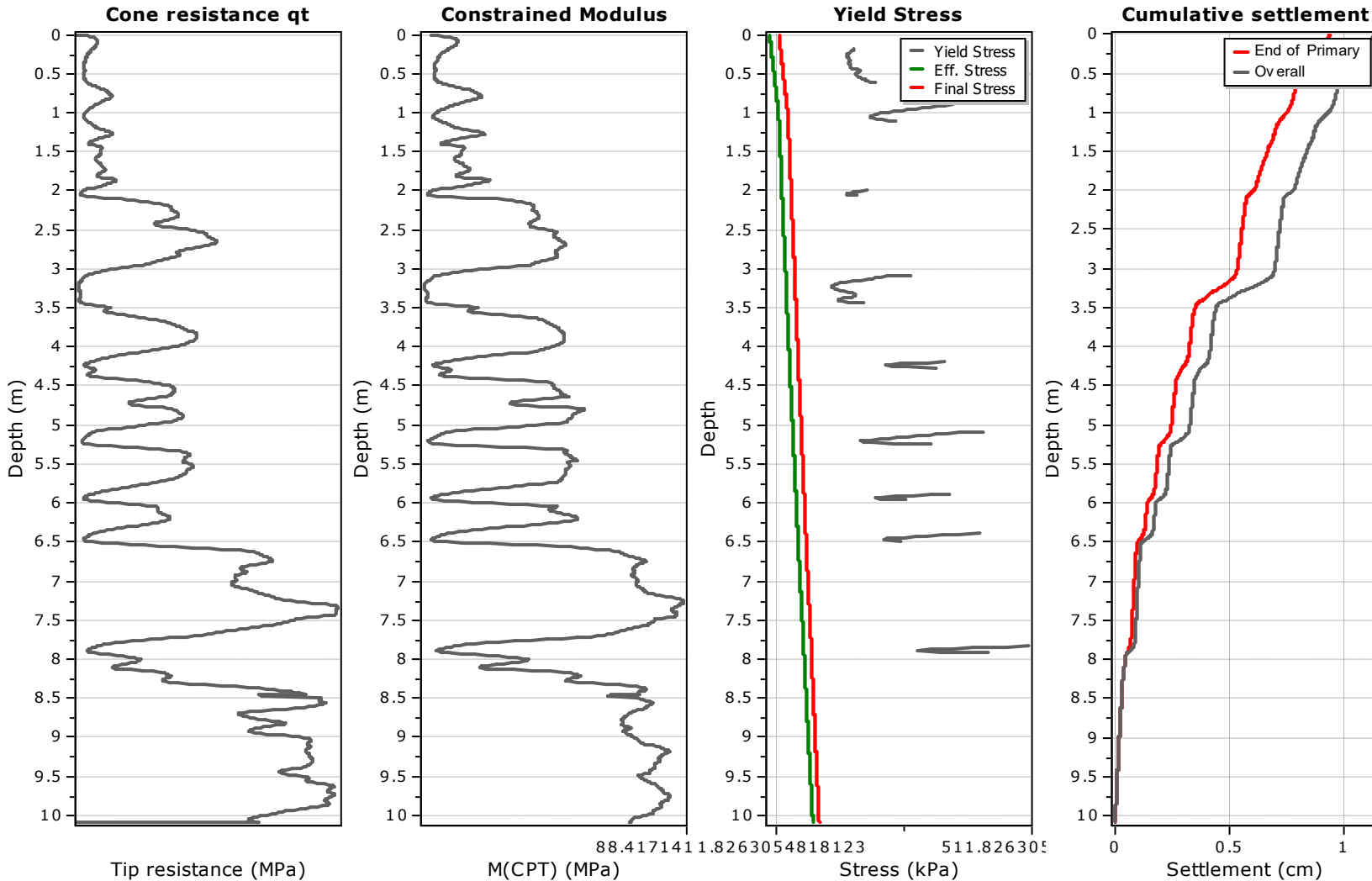
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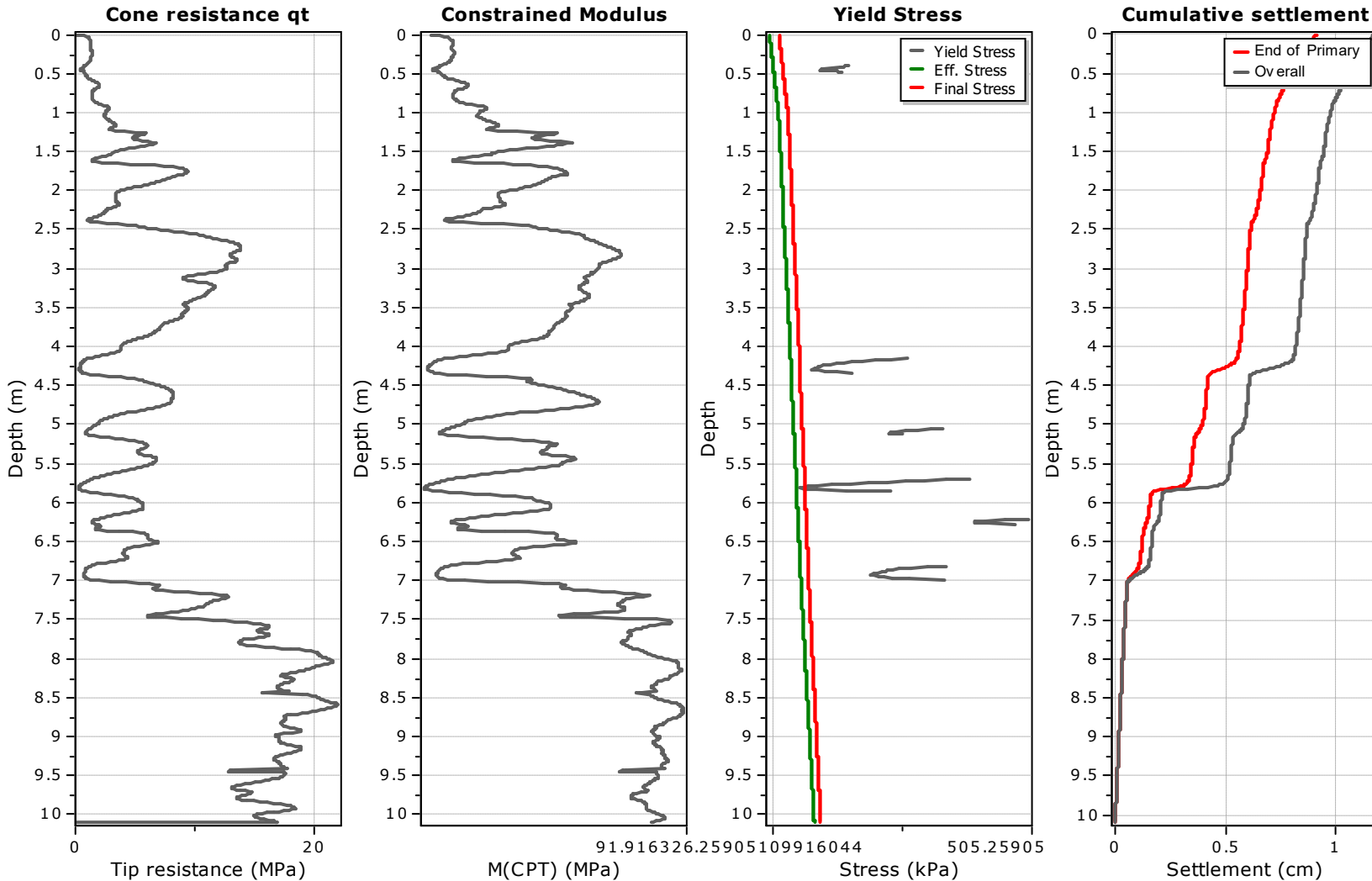
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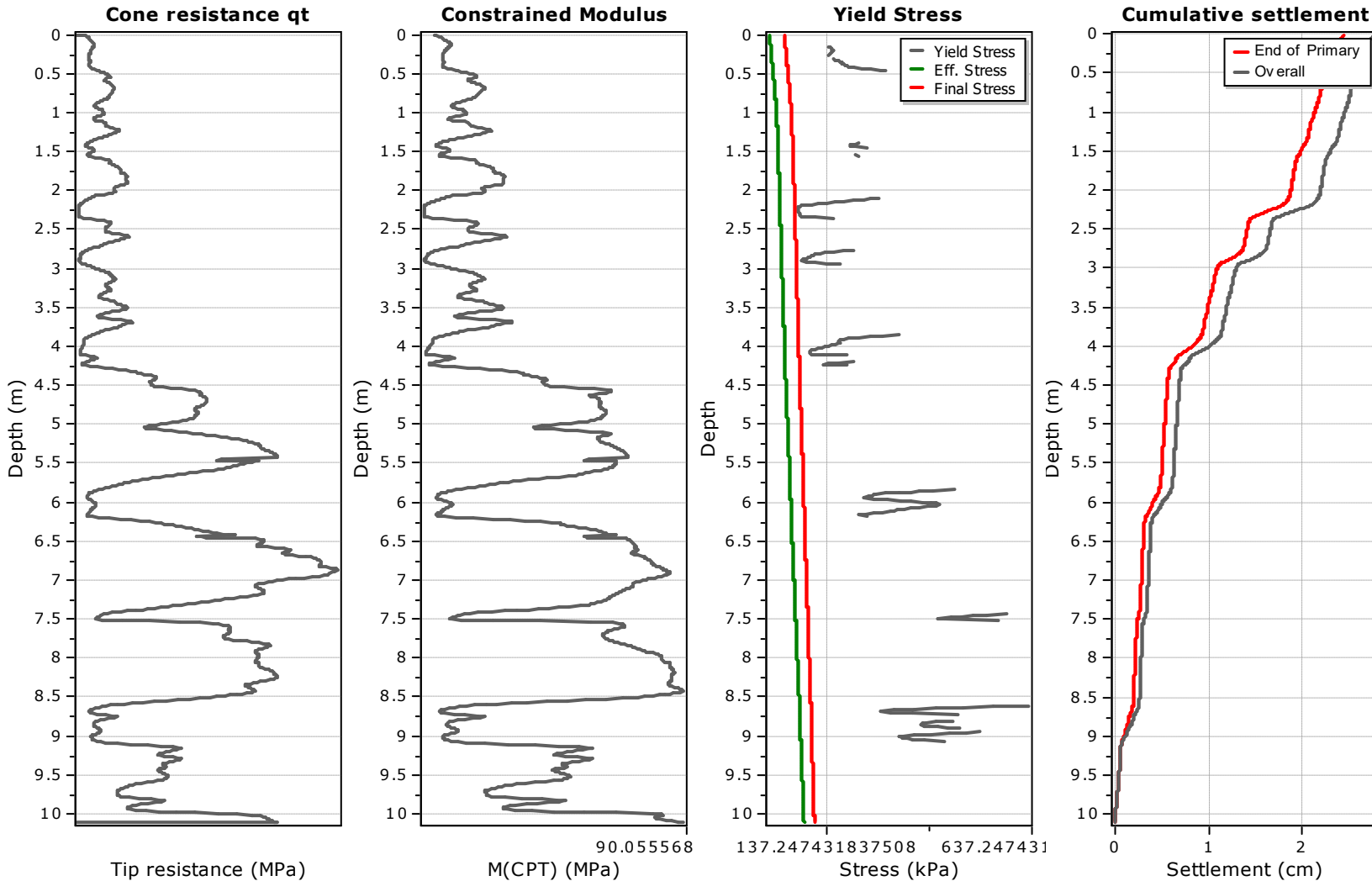
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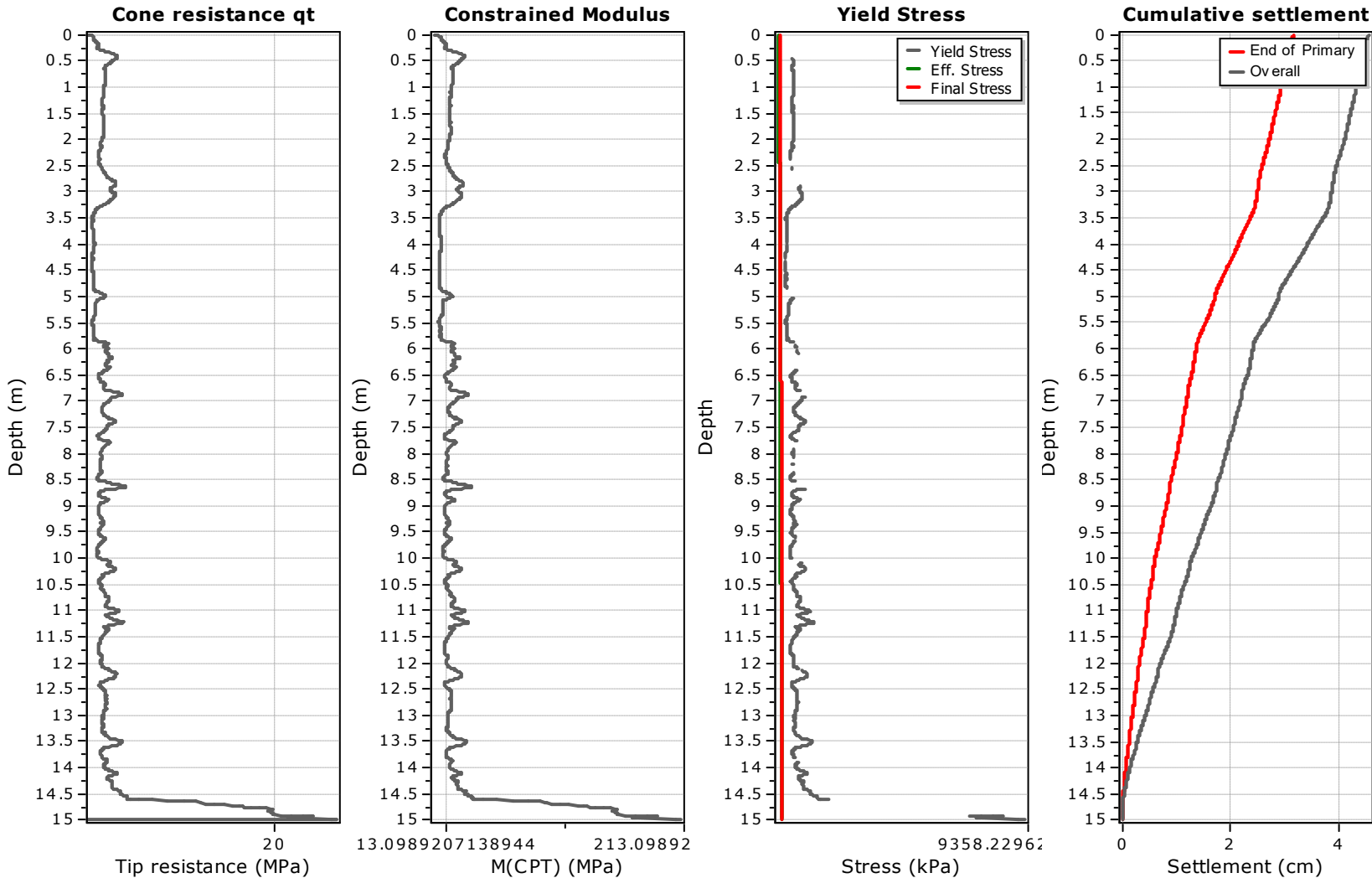
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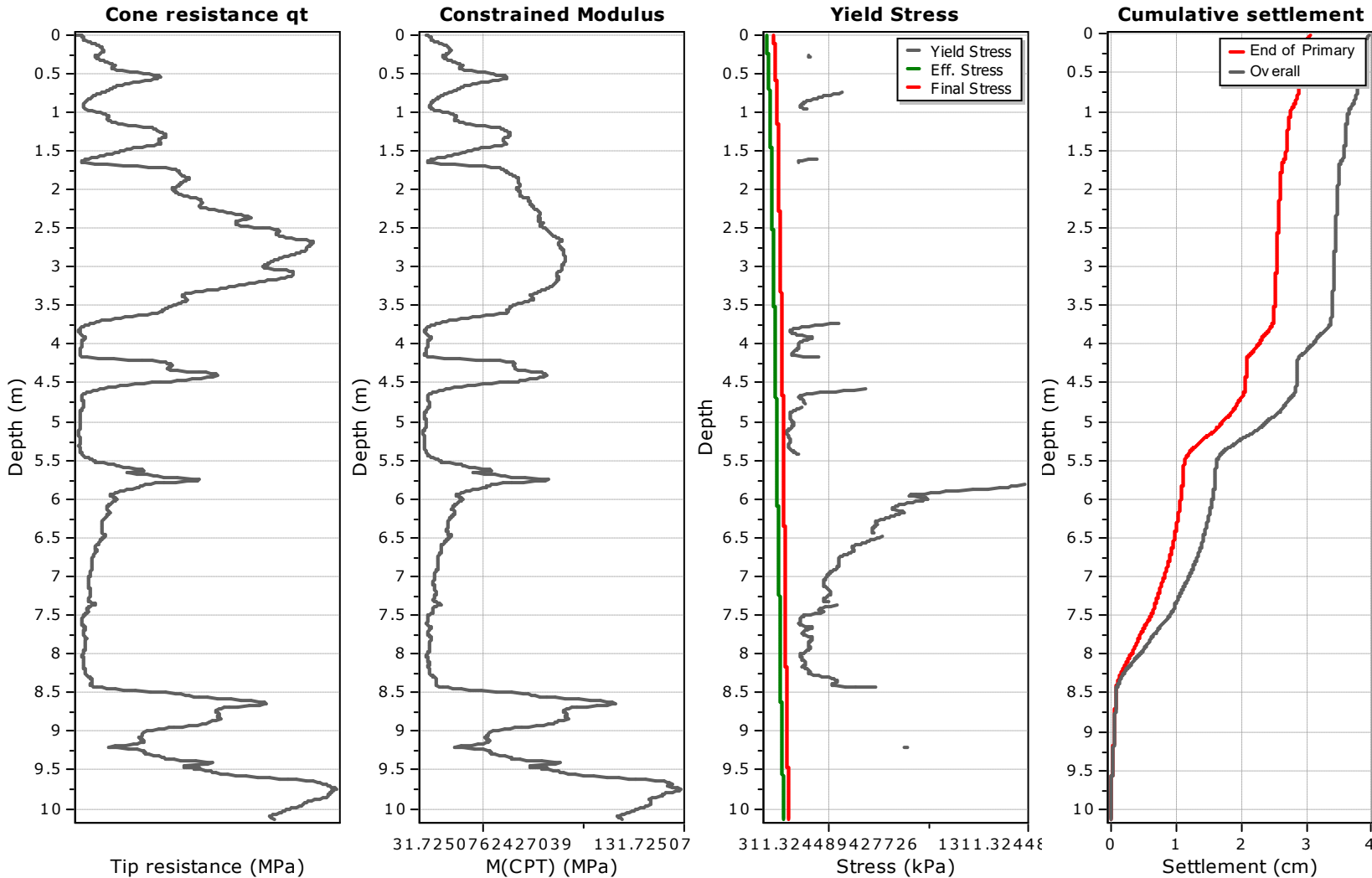
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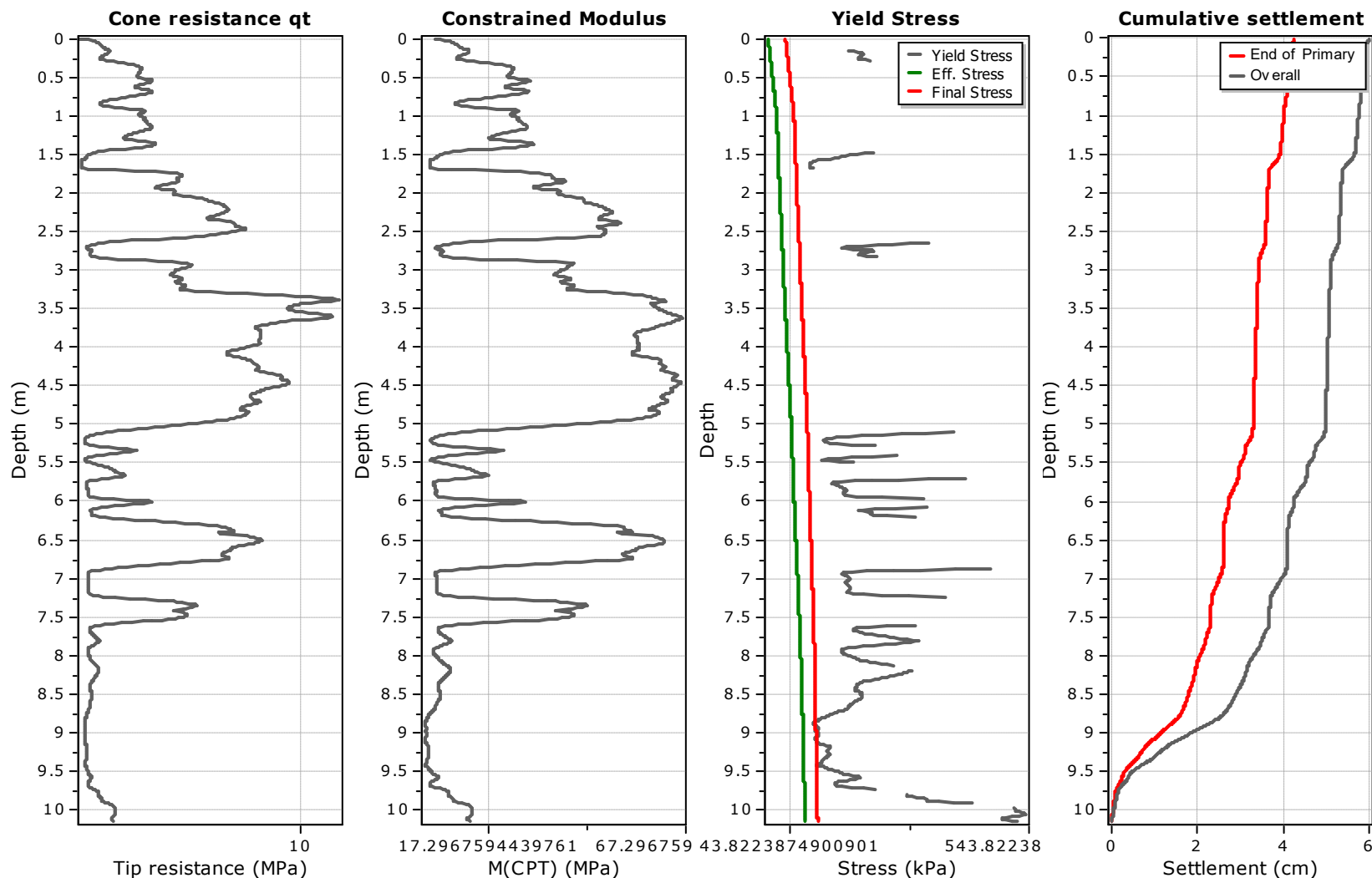
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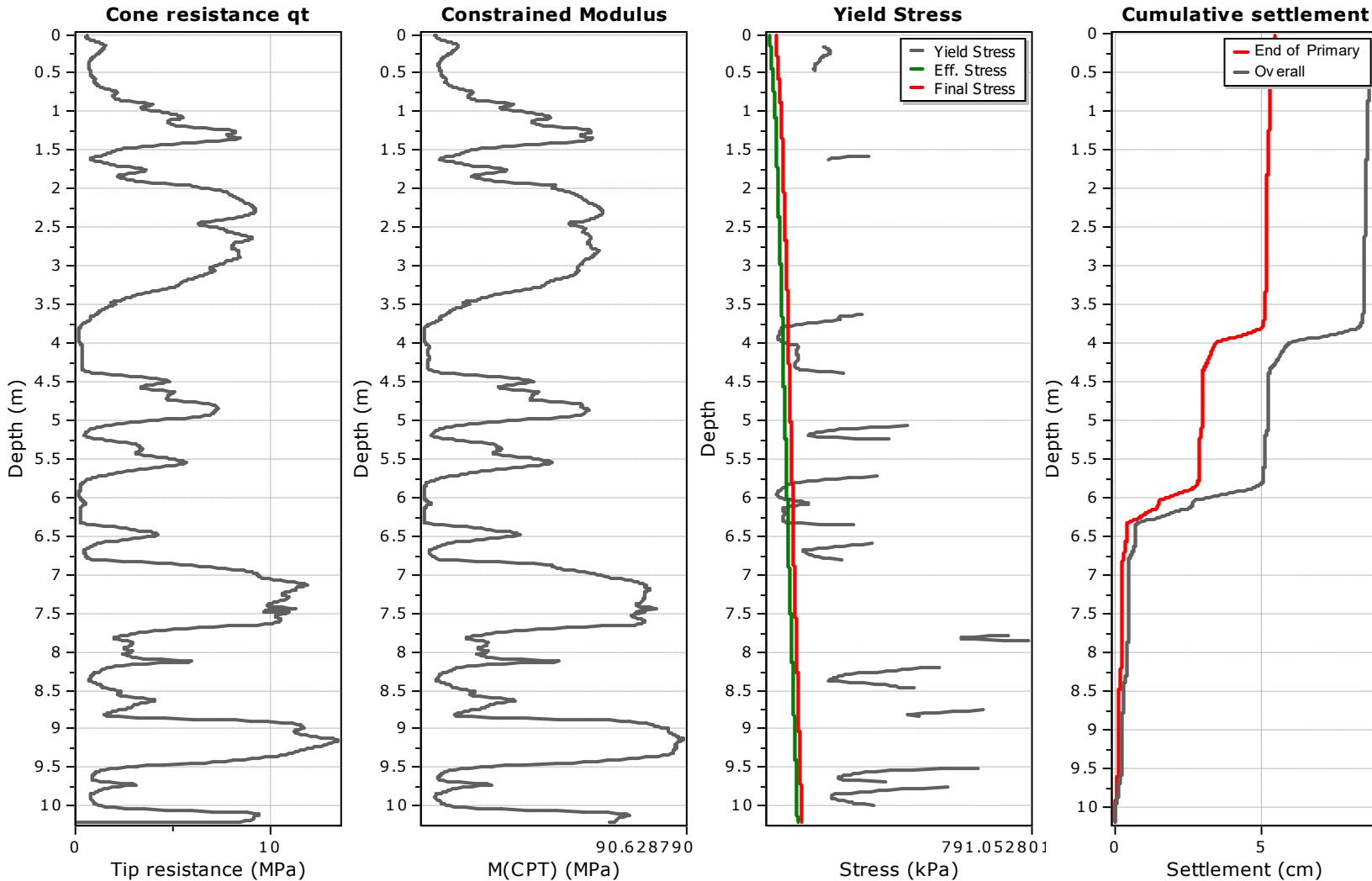
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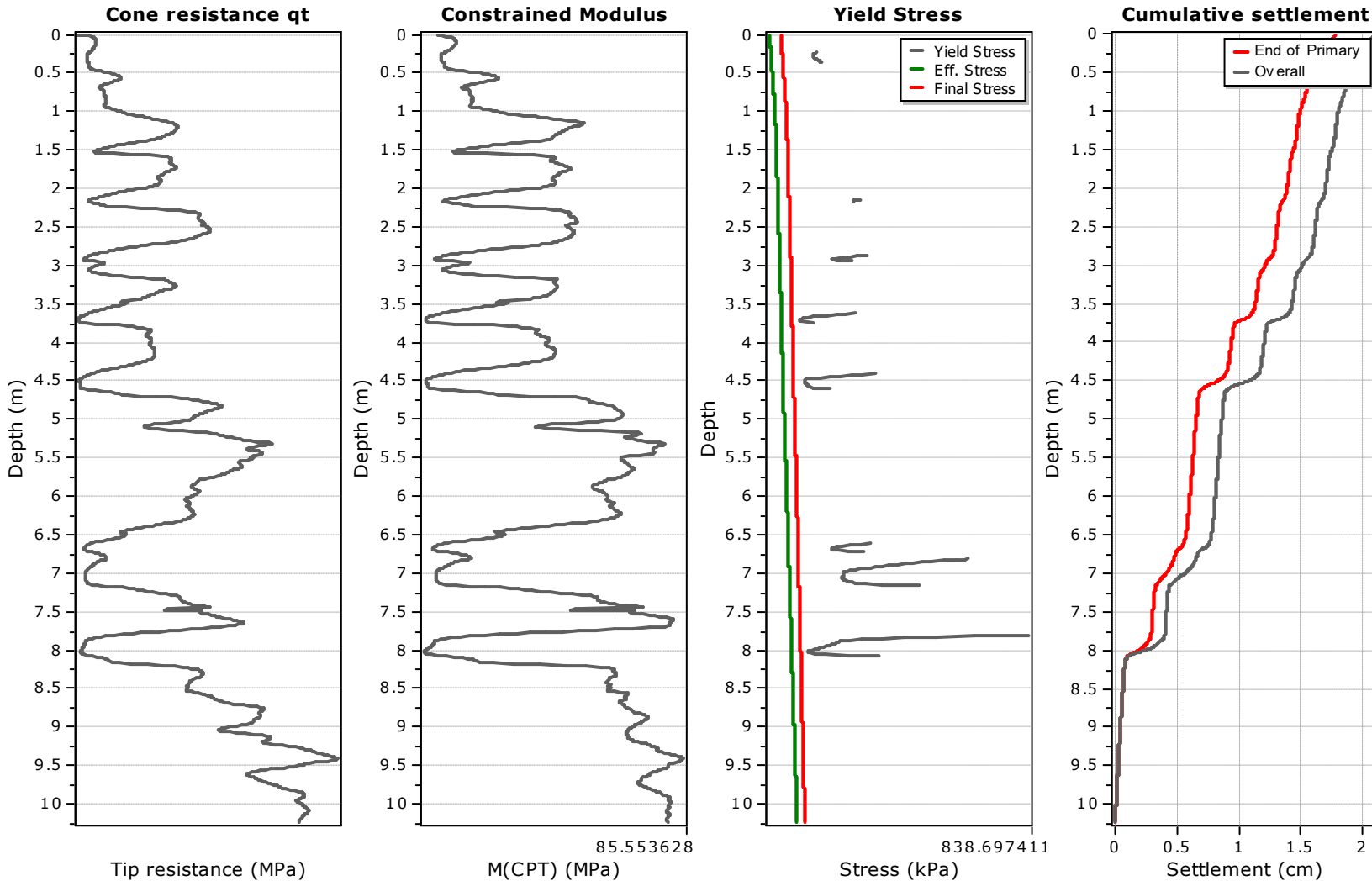
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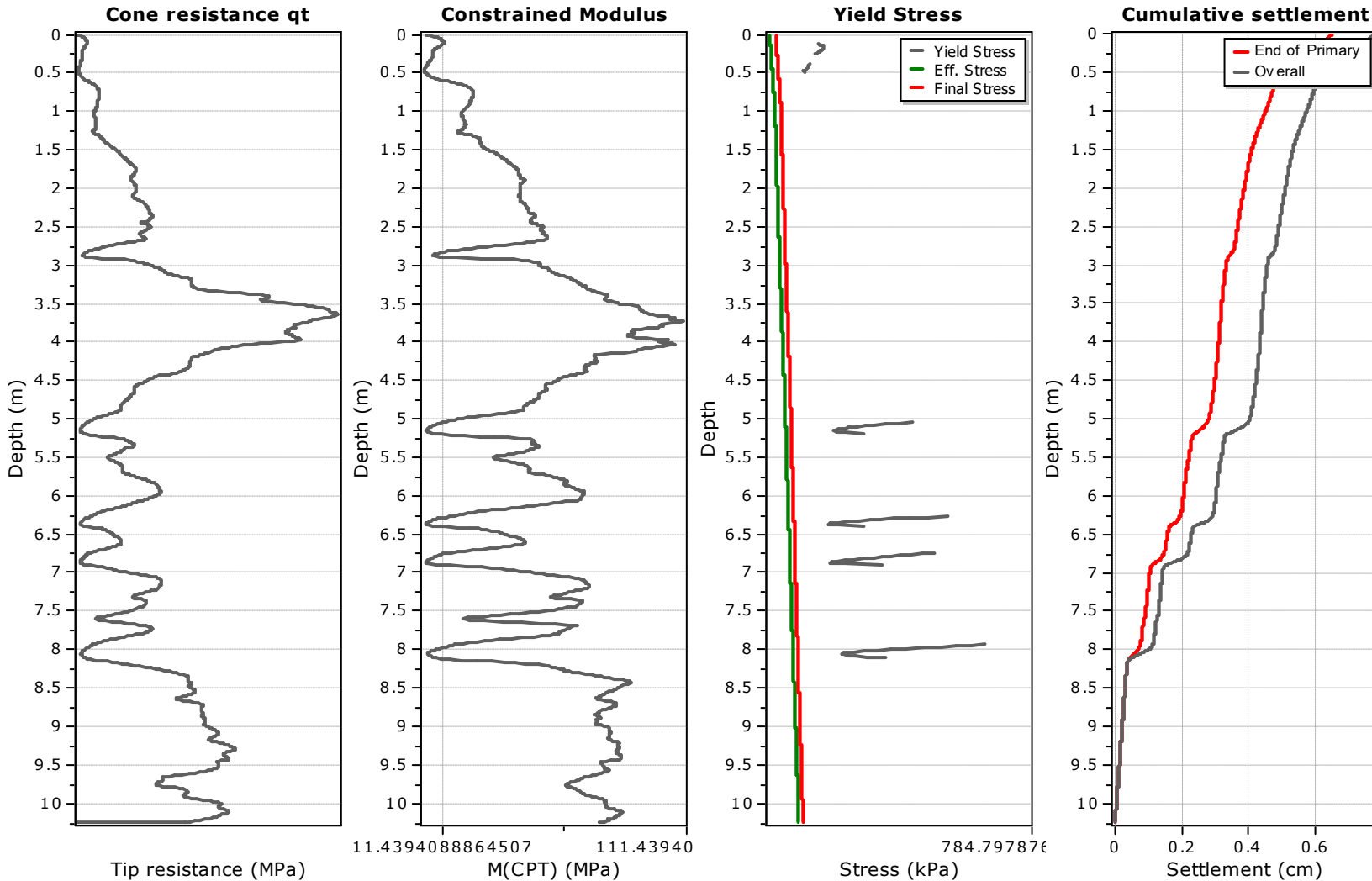
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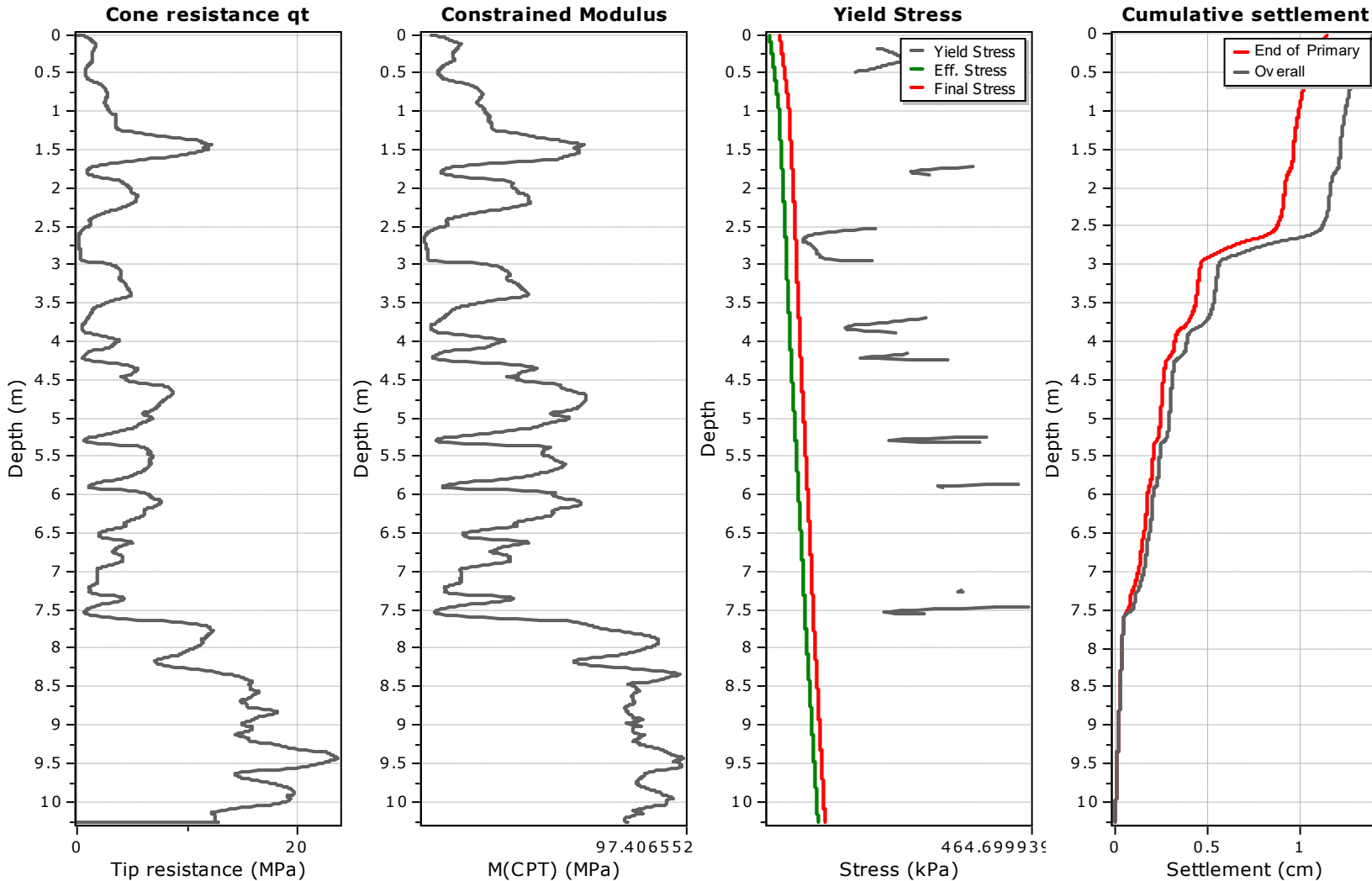
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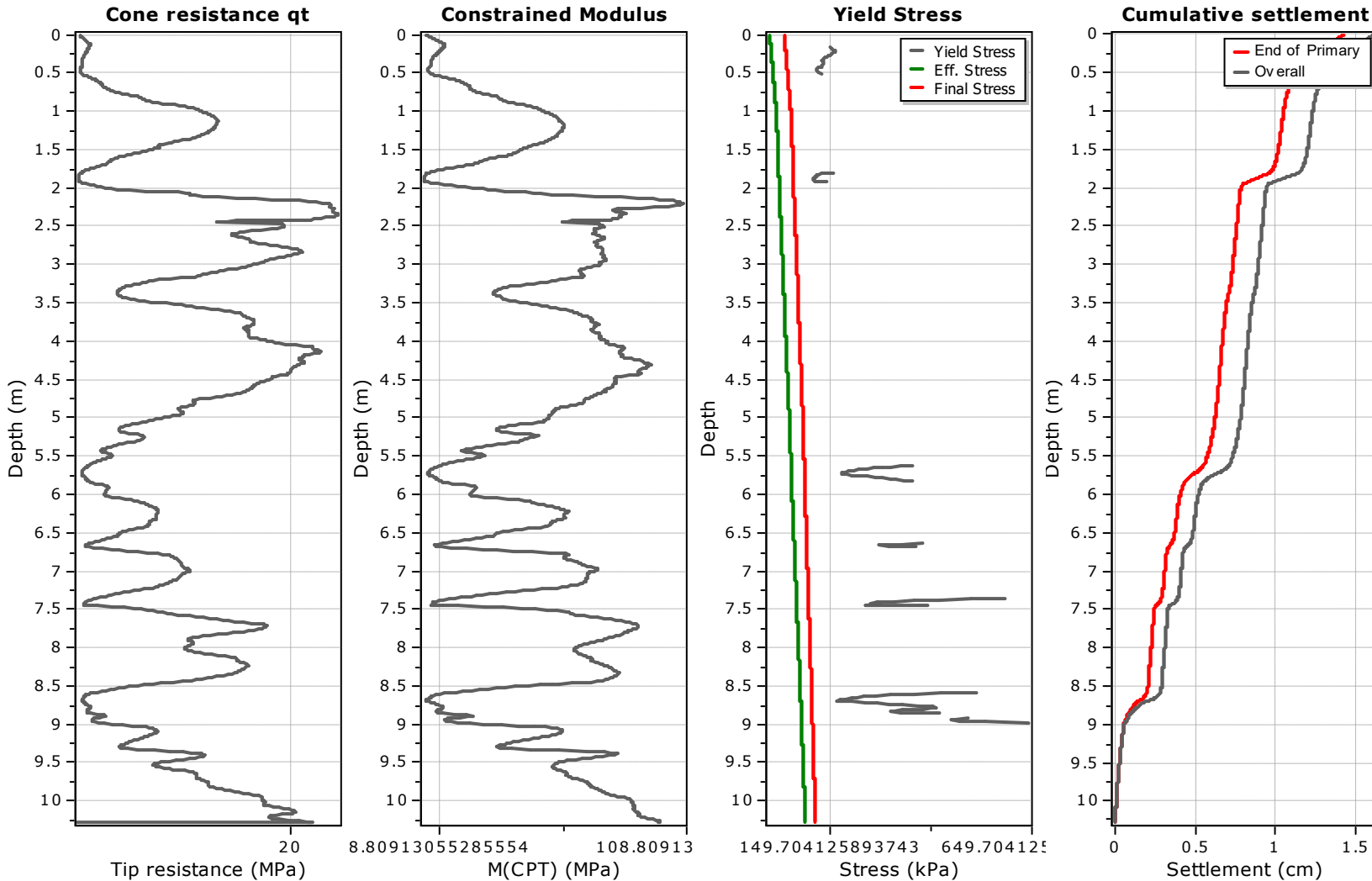
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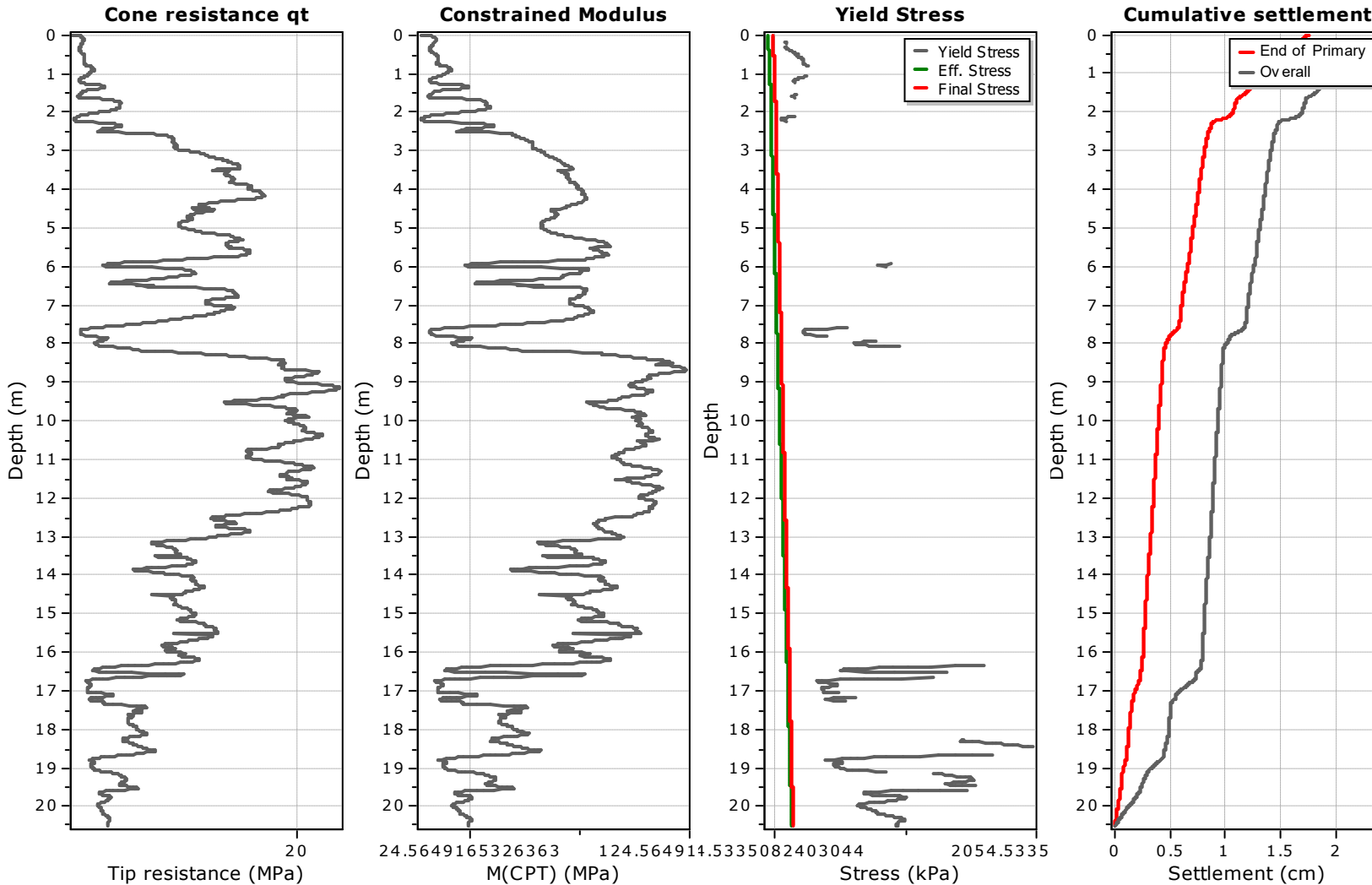
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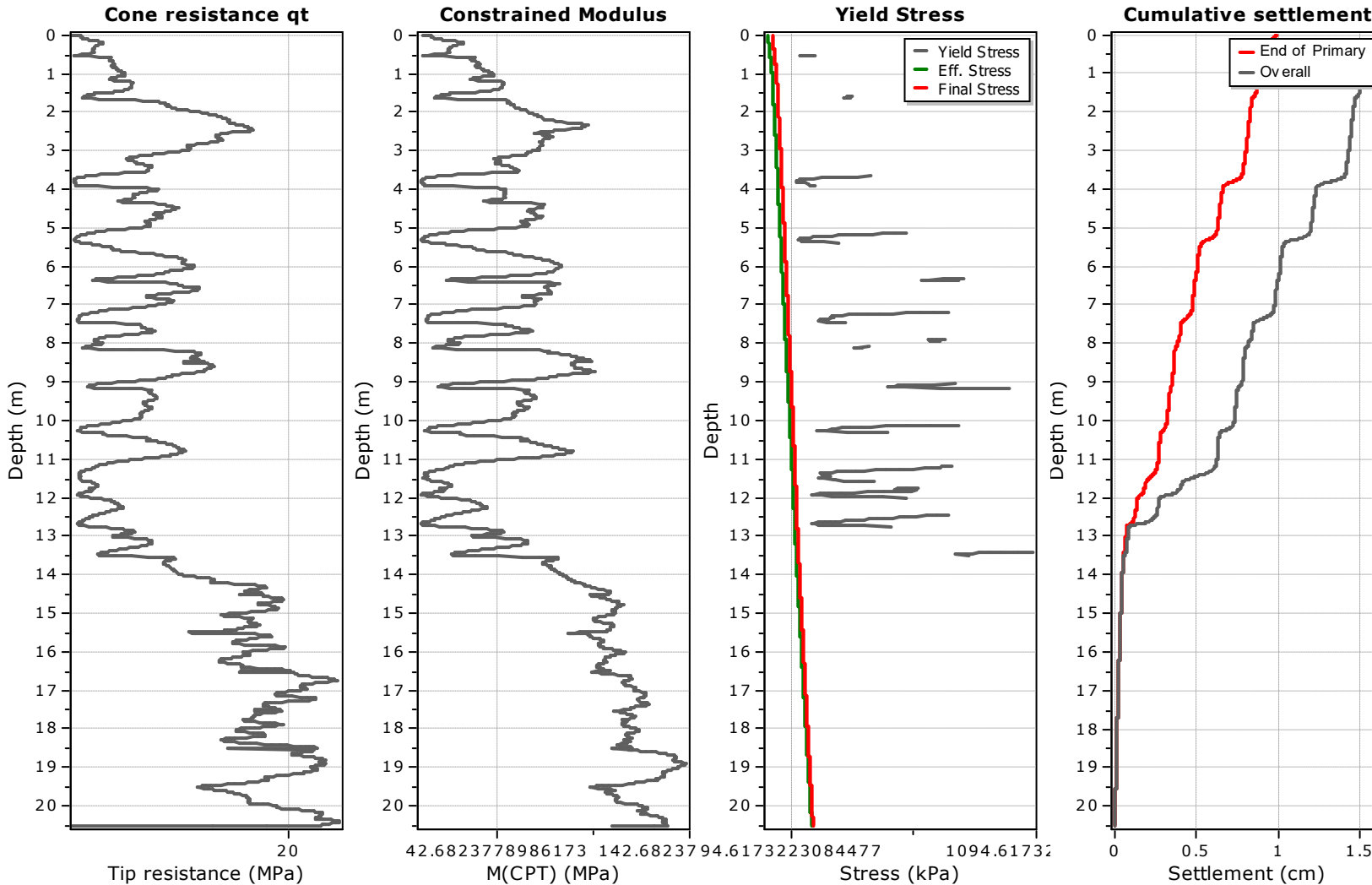
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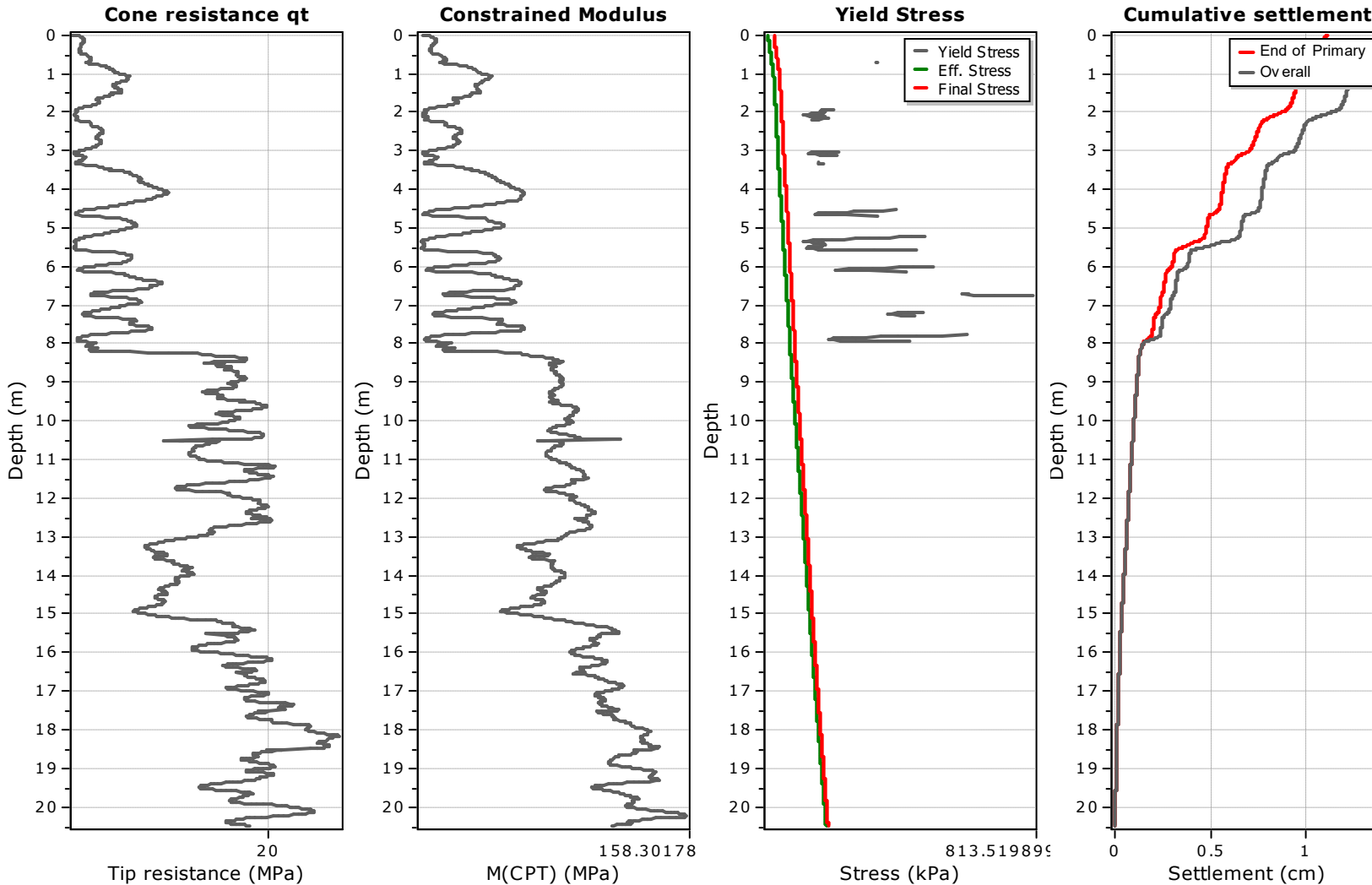
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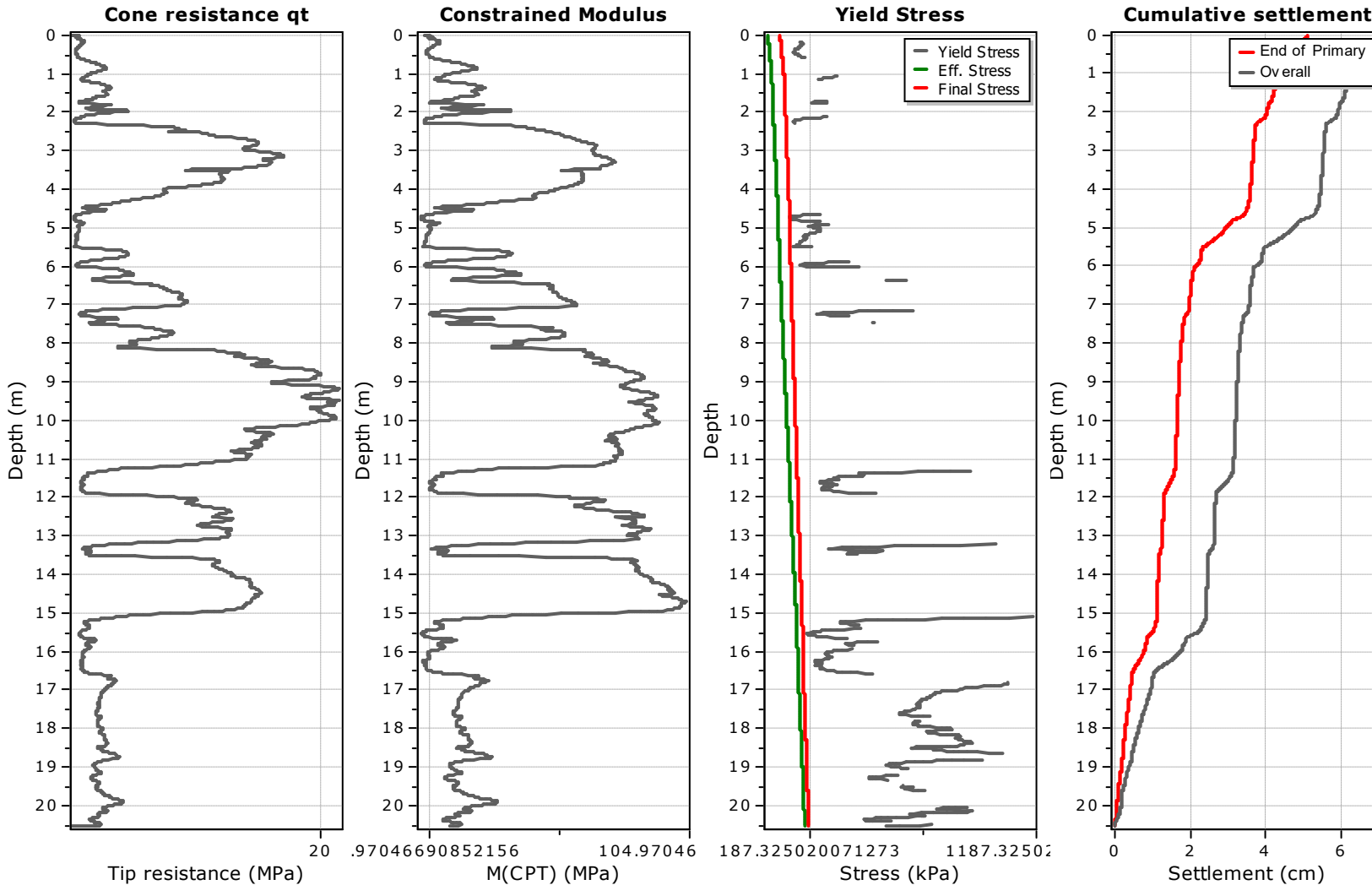
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Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 20.00 (m)
L/B: 1.0
Footing pressure: 54.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 1200 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

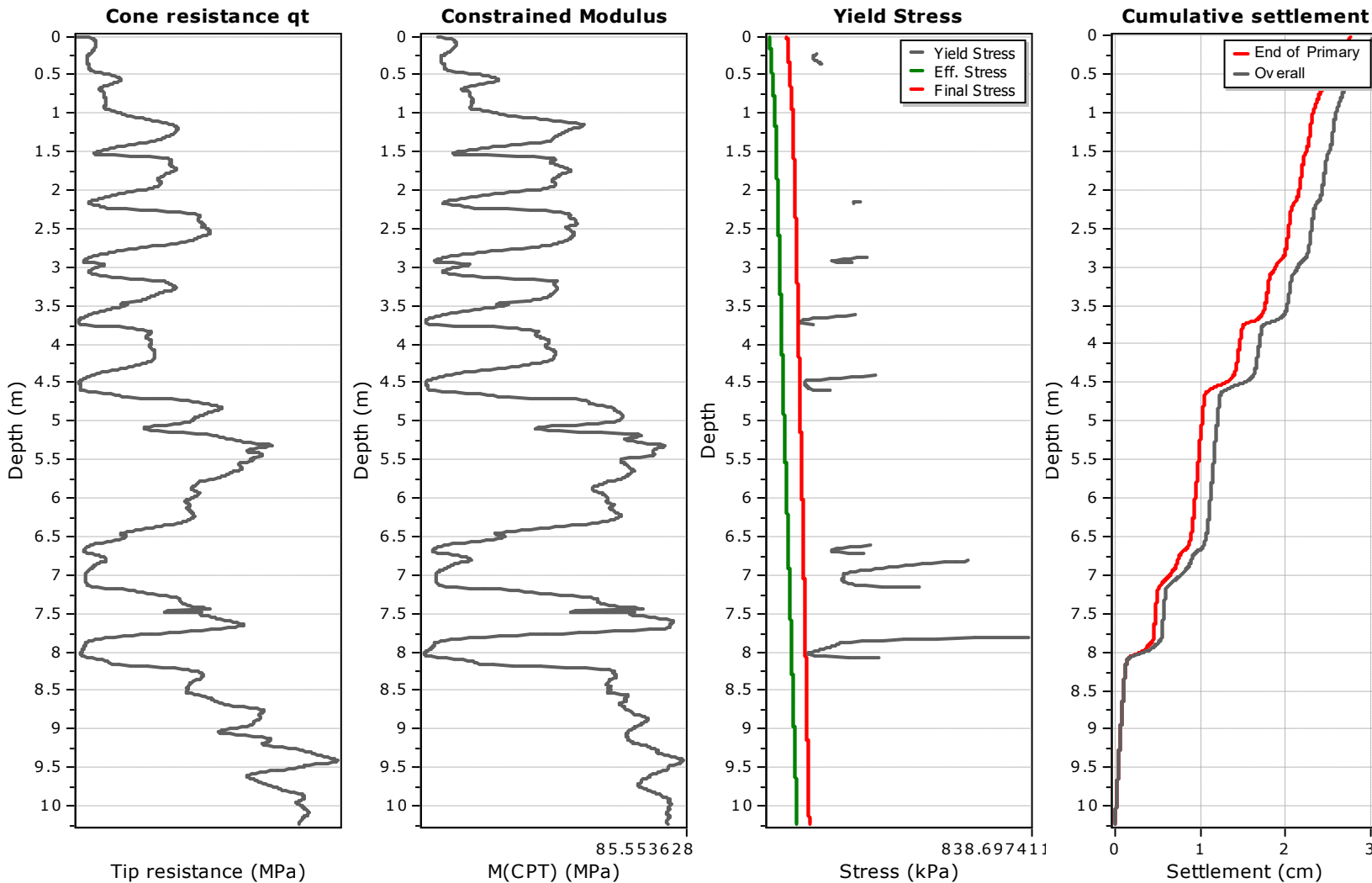
* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
 Footing width: 20.00 (m)
 L/B: 1.0
 Footing pressure: 56.00 (kPa)
 Embedment depth: 0.00 (m)
 Footing is rigid: No
 Remove excavation load: No
 Apply 20% rule: No
 Calculate secondary settlements: Yes
 Time period for primary consolidation: 6 months
 Time period for second. settlements: 600 months

* Primary settlement calculation is performed according to the following formula:

$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

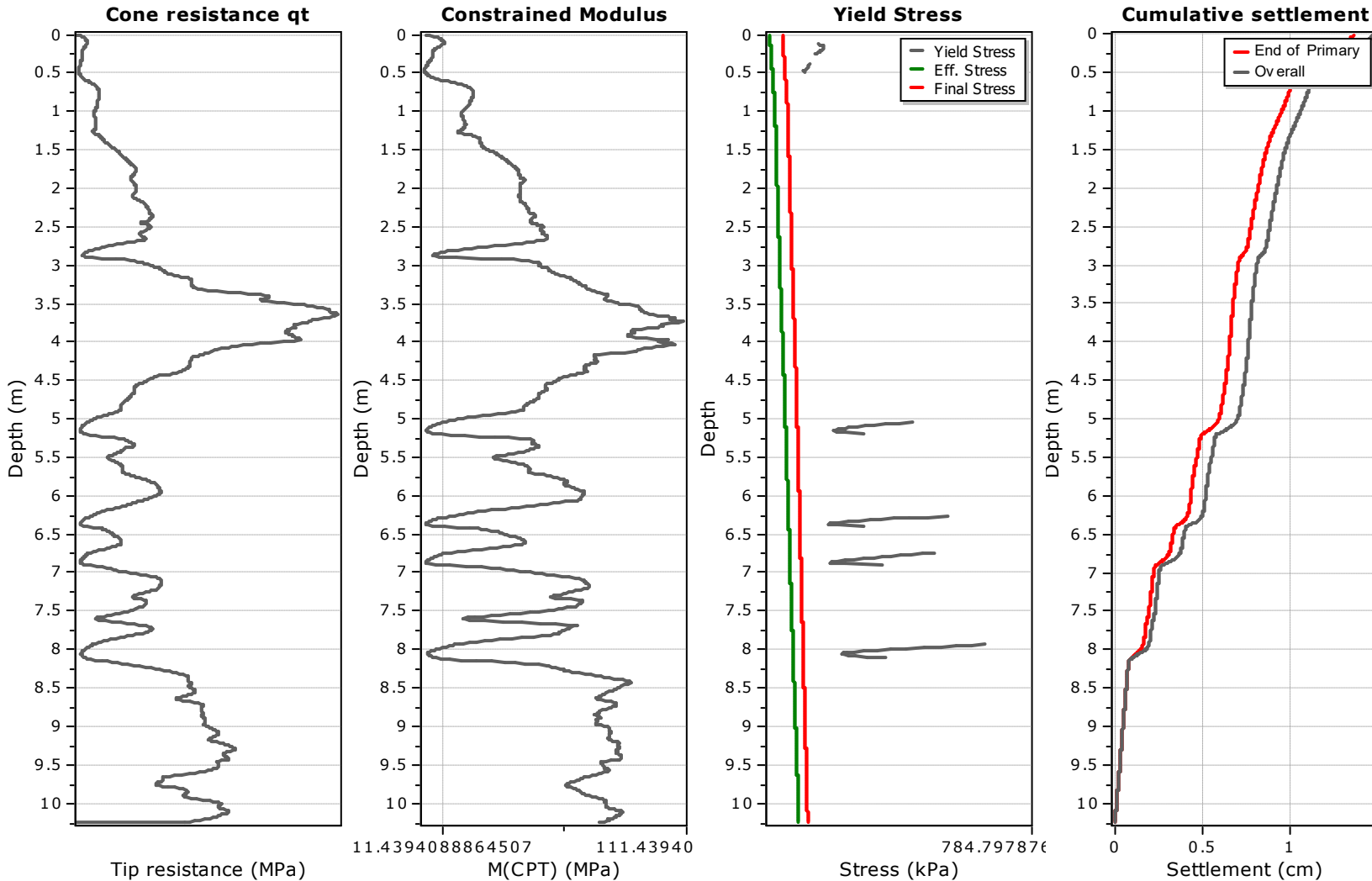
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where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 20.00 (m)
L/B: 1.0
Footing pressure: 38.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

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$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

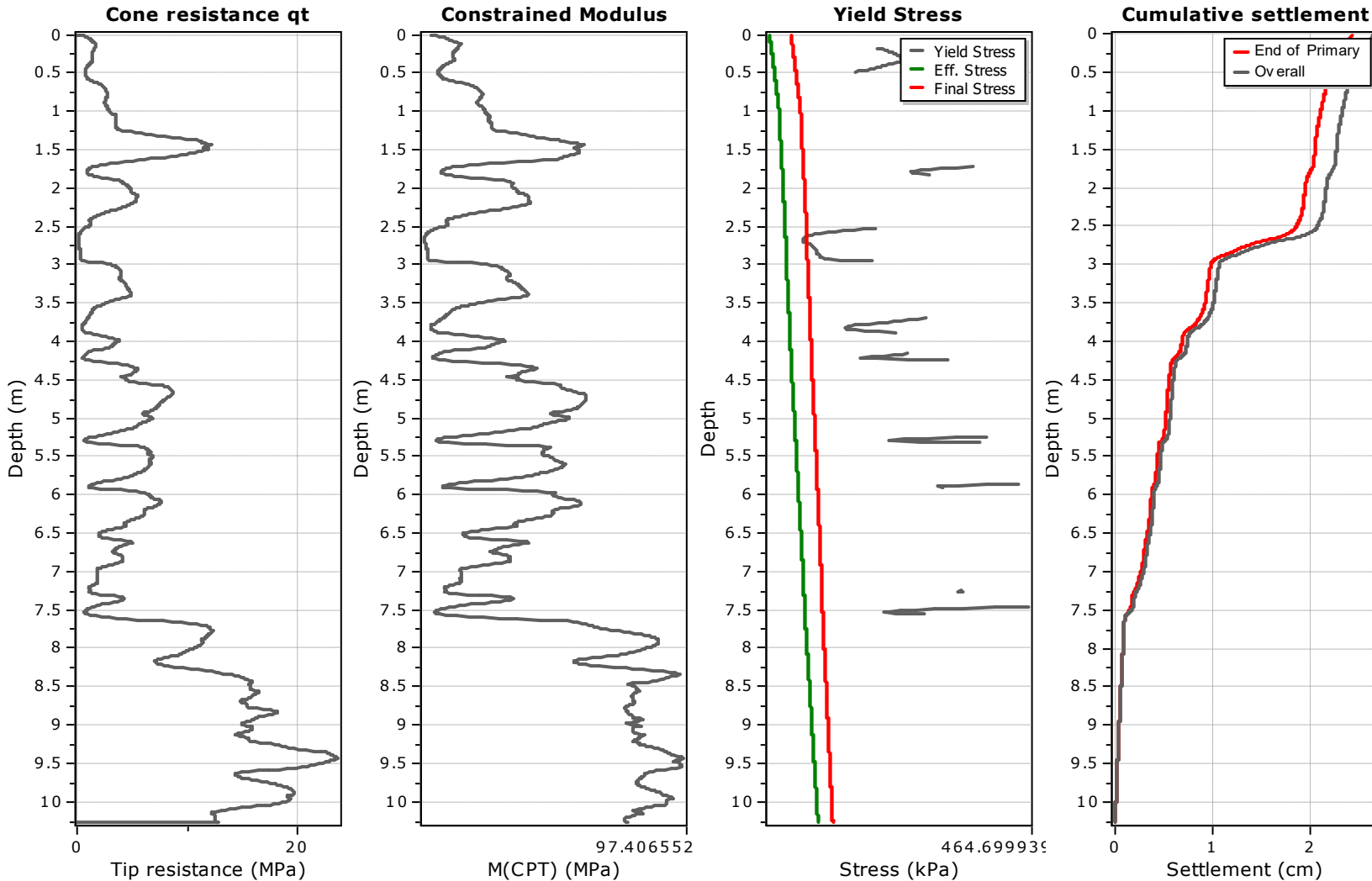
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Settlements calculation according to theory of elasticity*



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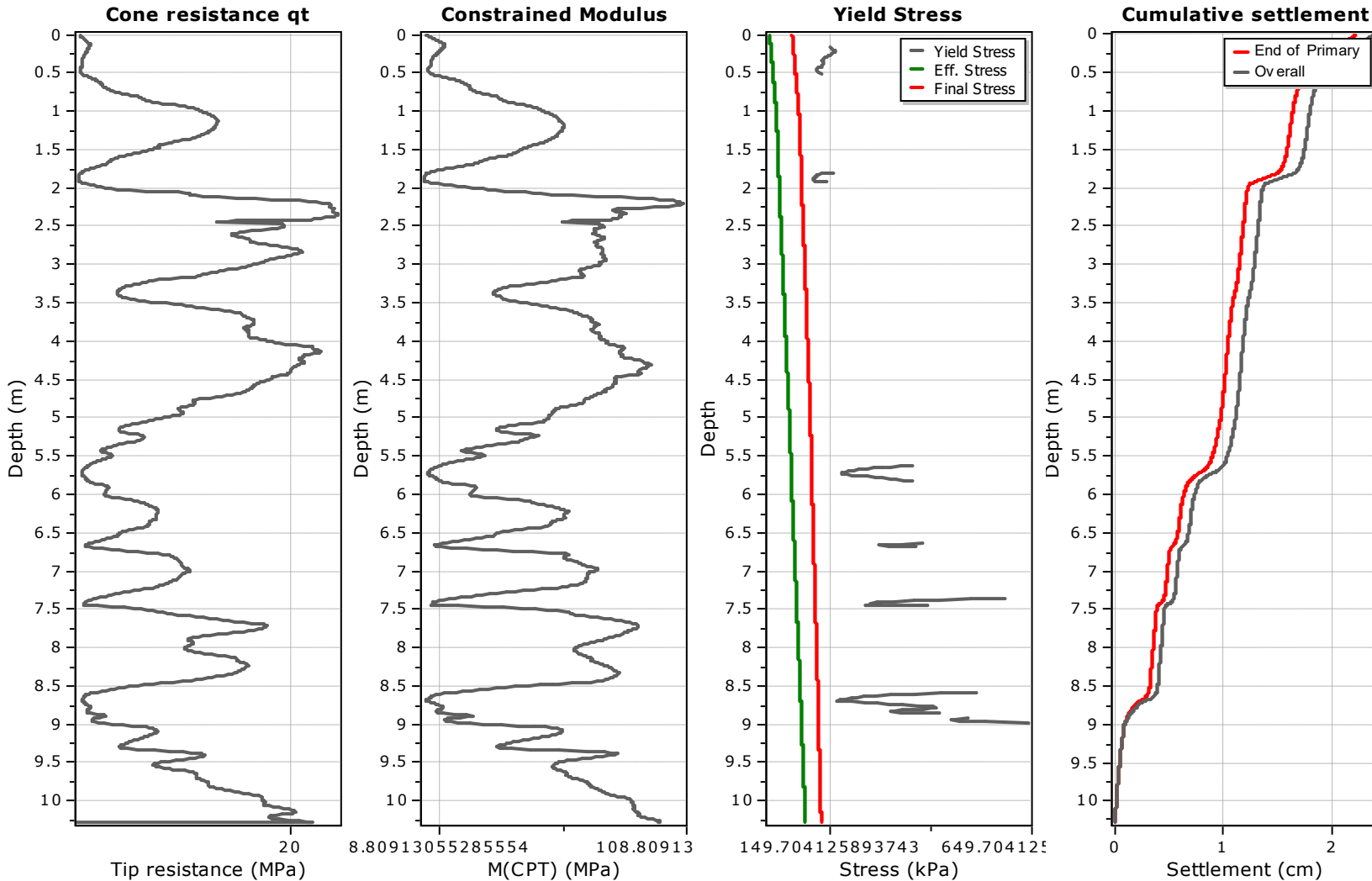
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Settlements calculation according to theory of elasticity*



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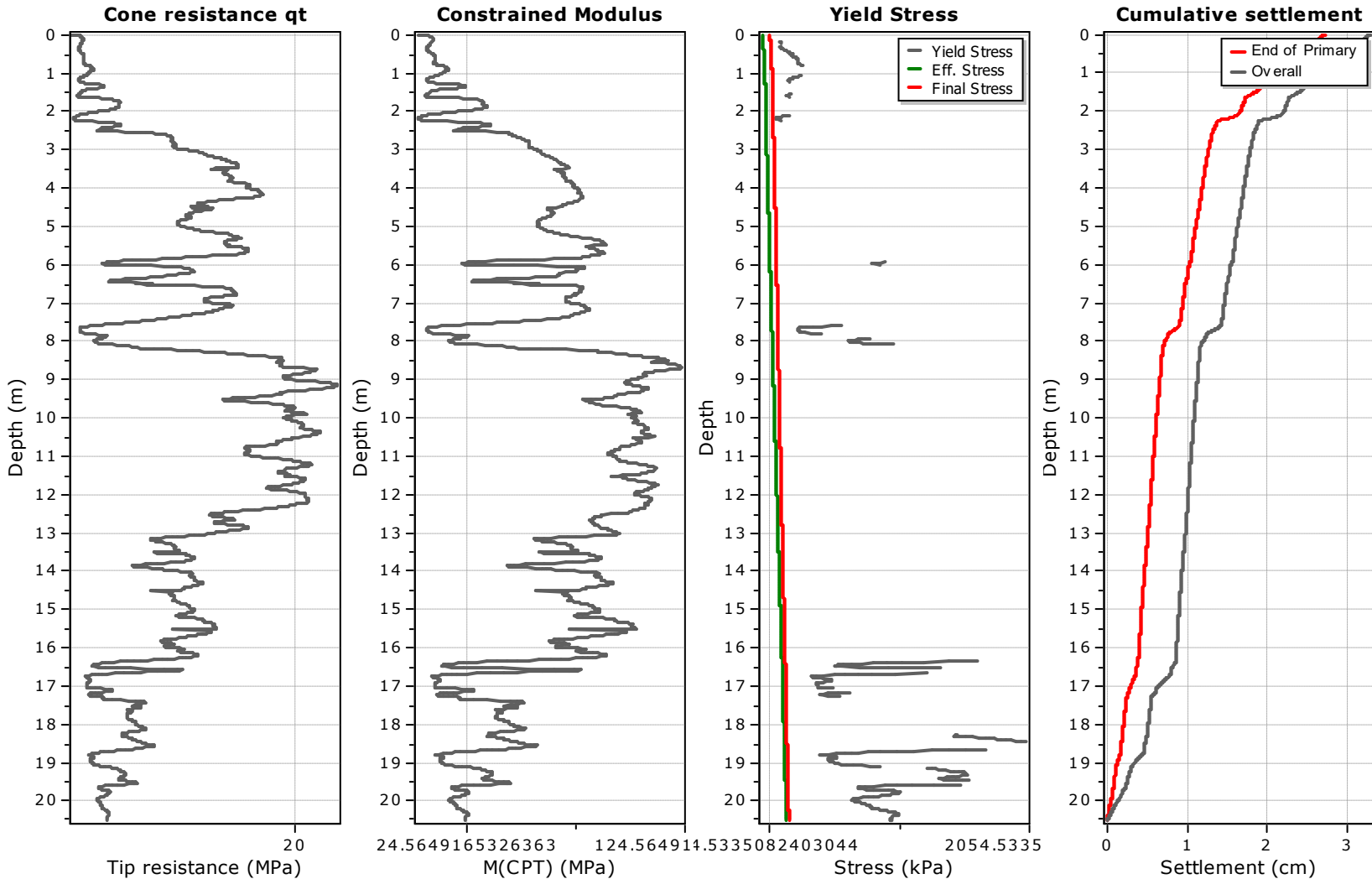
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Location:

Settlements calculation according to theory of elasticity*



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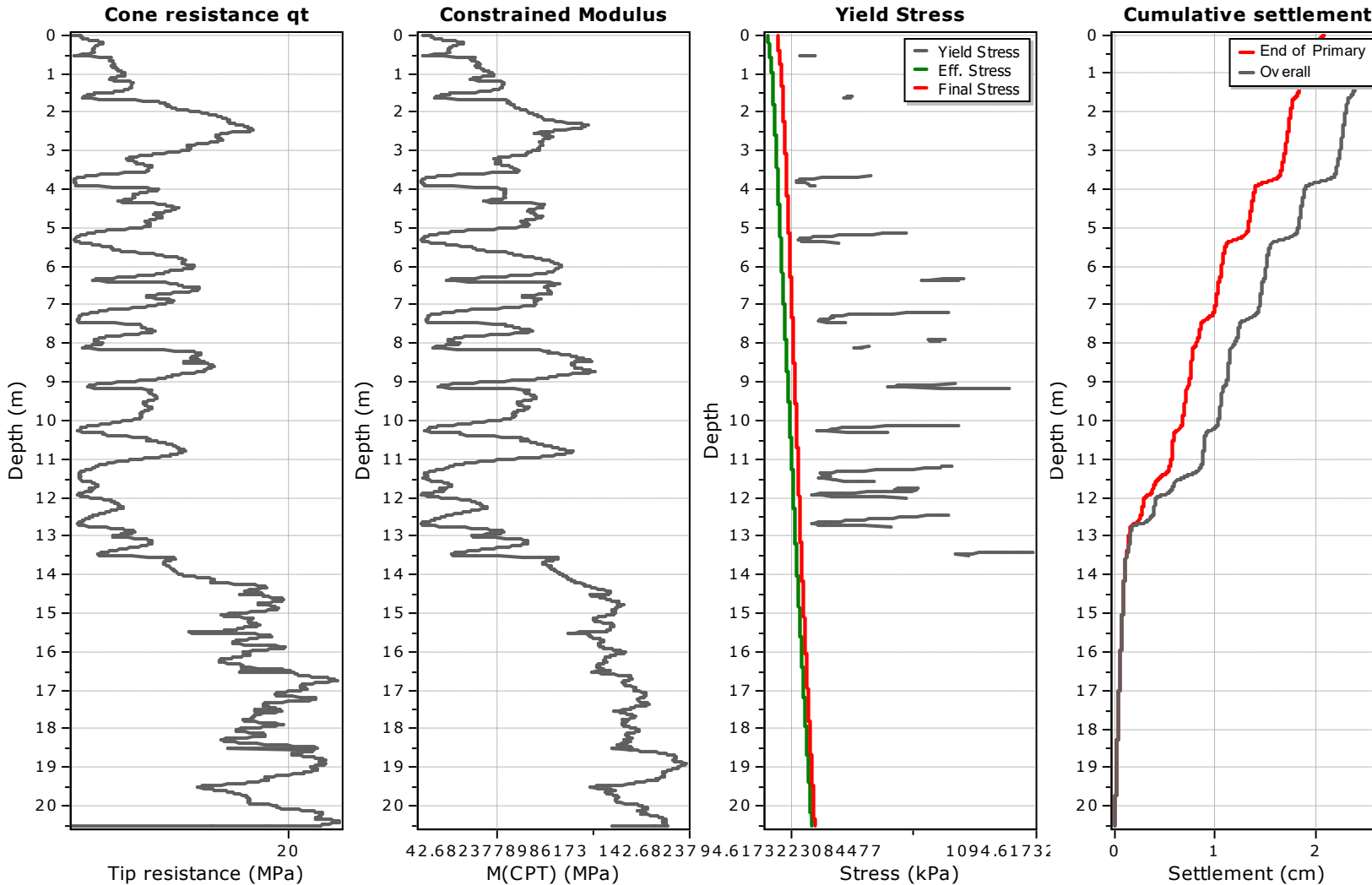
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Location:

Settlements calculation according to theory of elasticity*



Calculation properties

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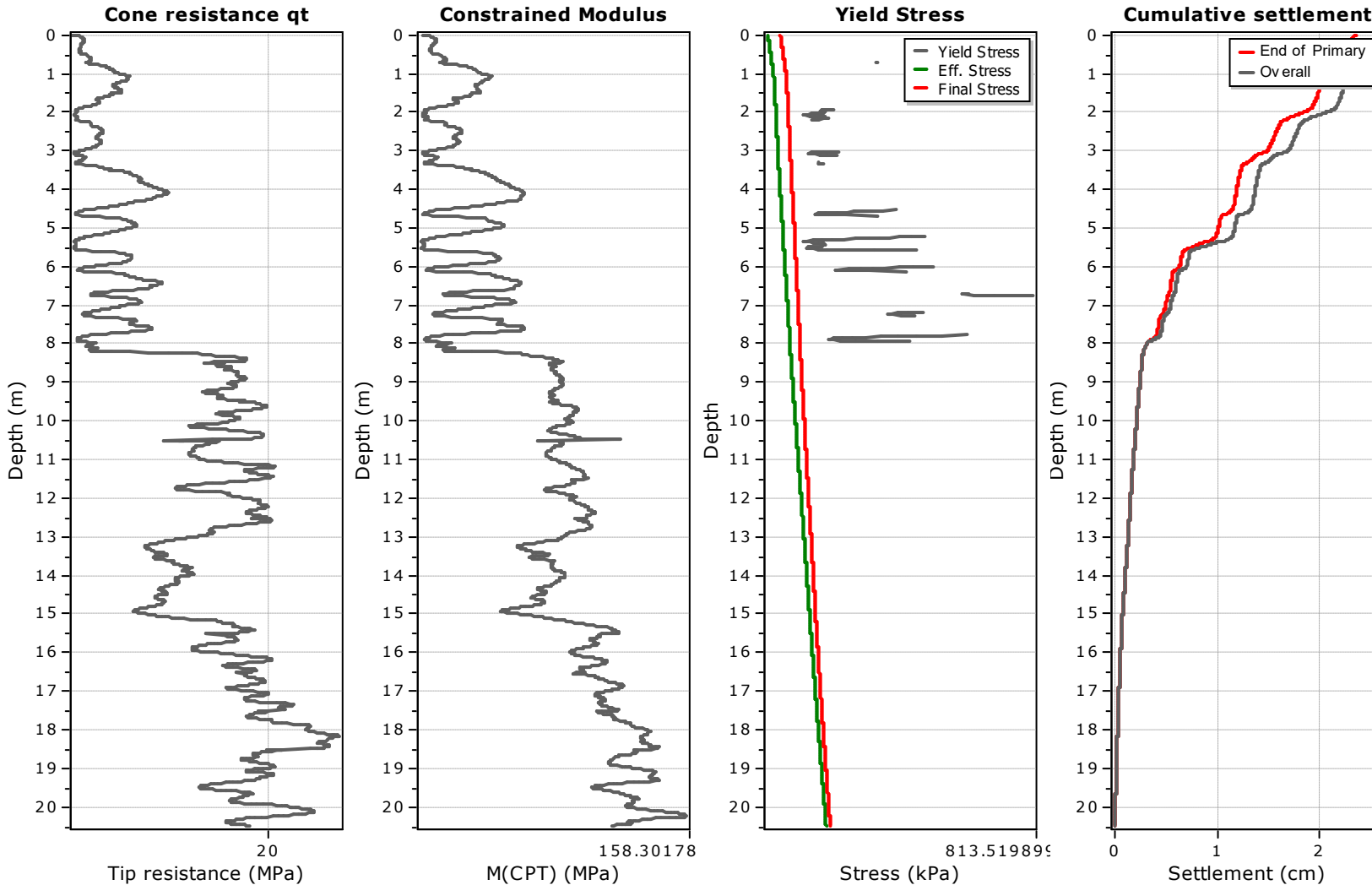
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where t_p is the duration of primary consolidation

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Location:

Settlements calculation according to theory of elasticity*



Calculation properties

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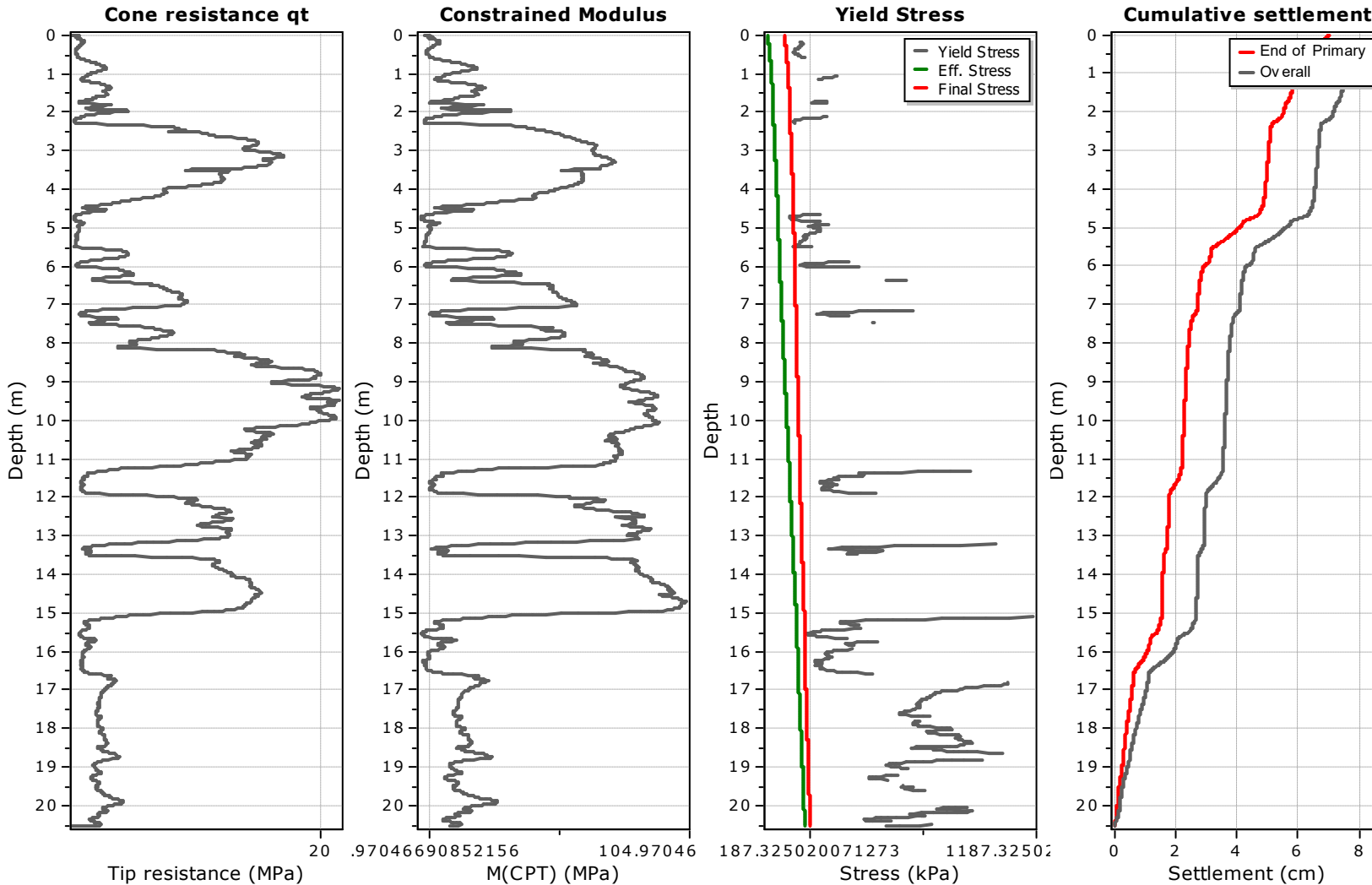
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where t_p is the duration of primary consolidation

Project:
Location:

Settlements calculation according to theory of elasticity*



Calculation properties

Footing type: Rectangular
Footing width: 20.00 (m)
L/B: 1.0
Footing pressure: 74.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: Yes
Time period for primary consolidation: 6 months
Time period for second. settlements: 600 months

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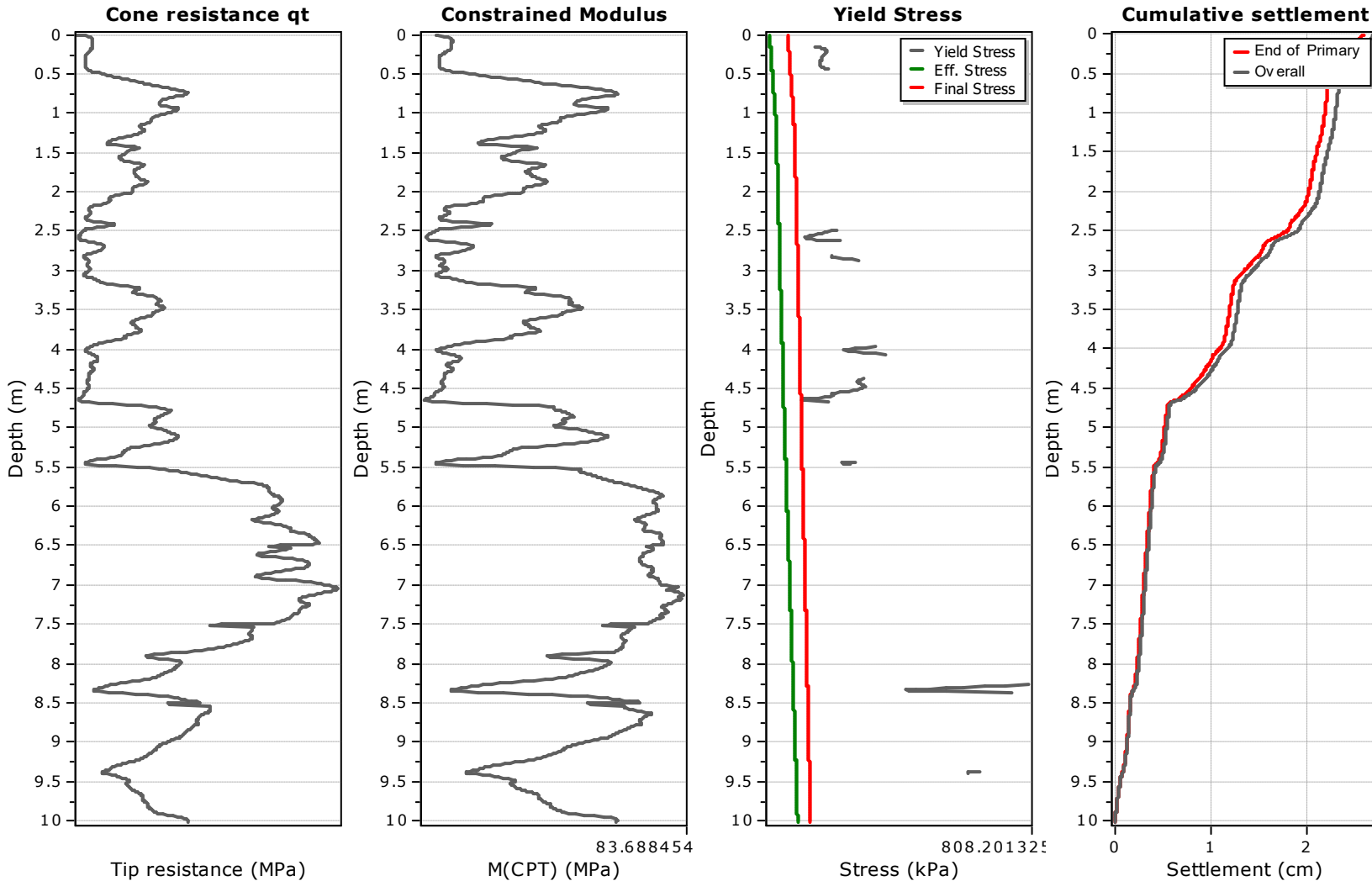
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Settlements calculation according to theory of elasticity*



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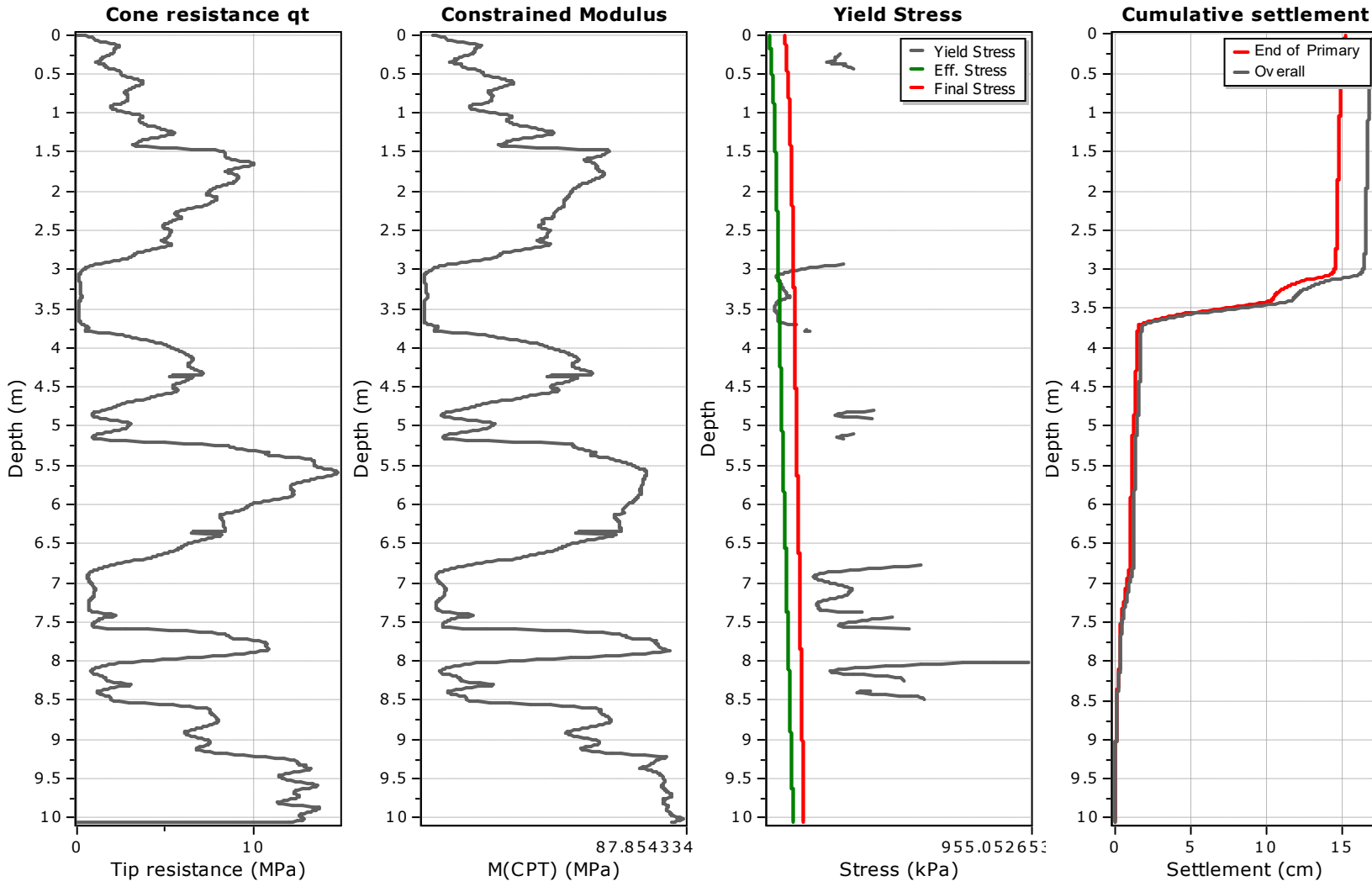
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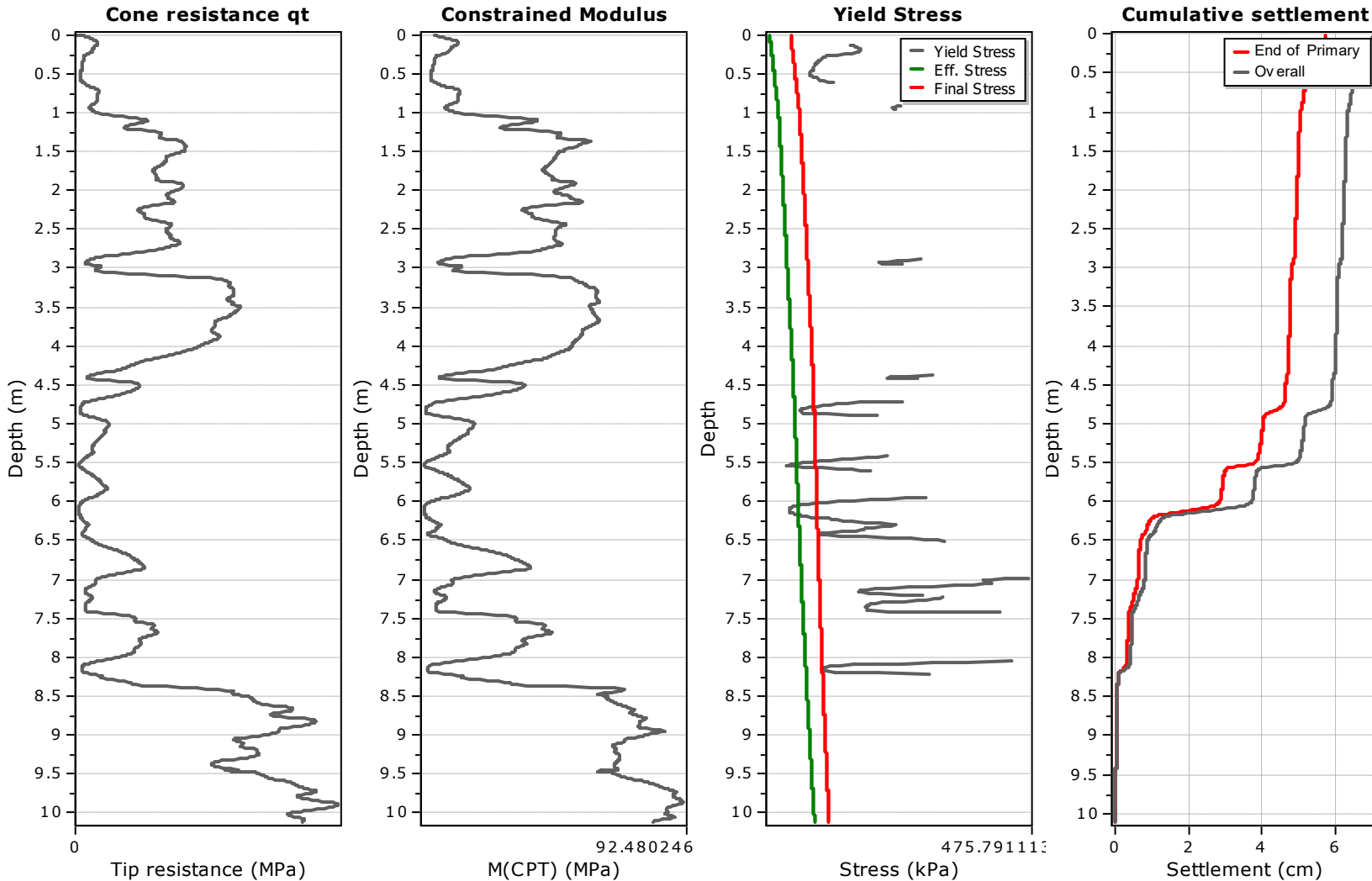
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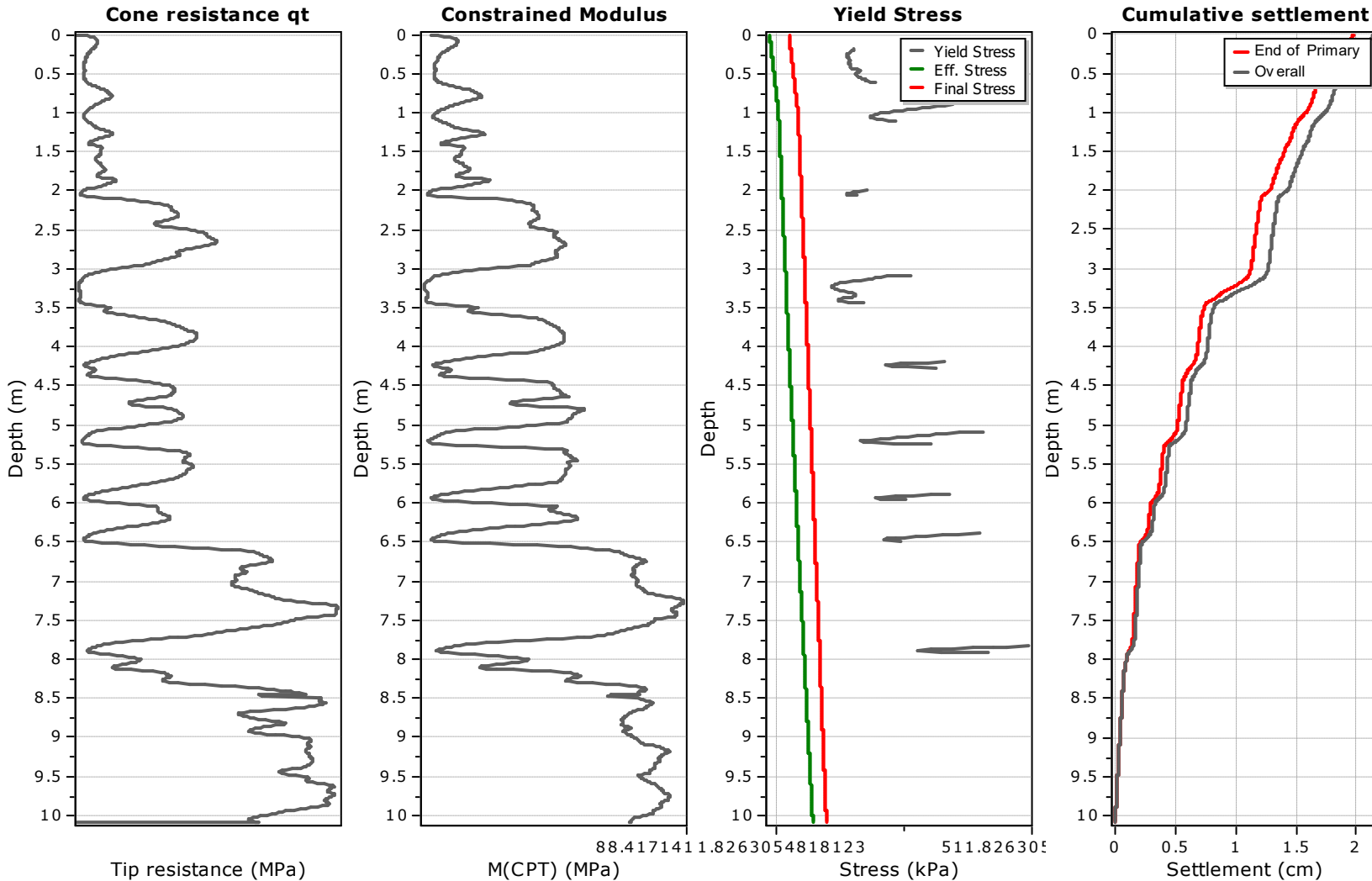
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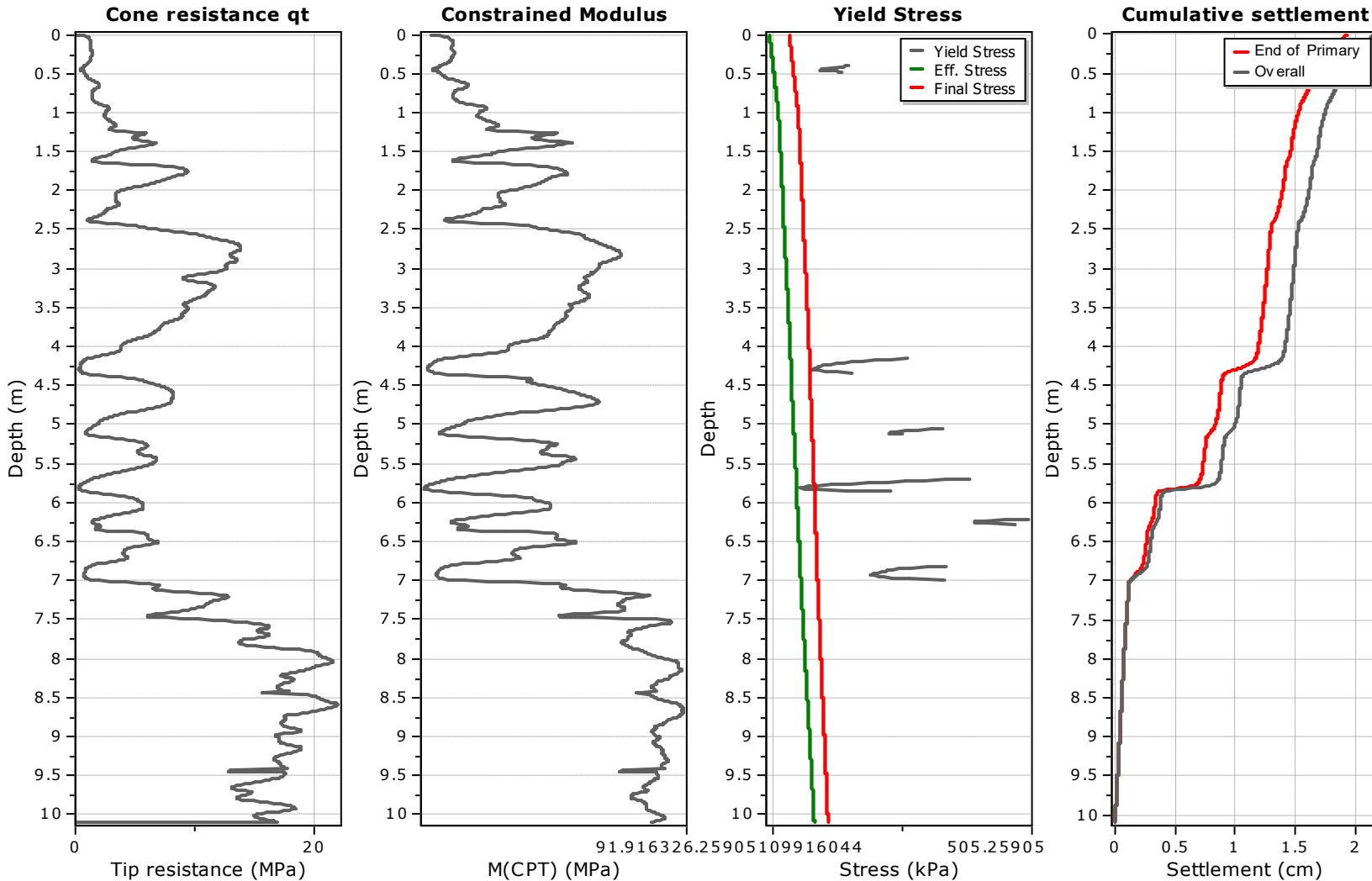
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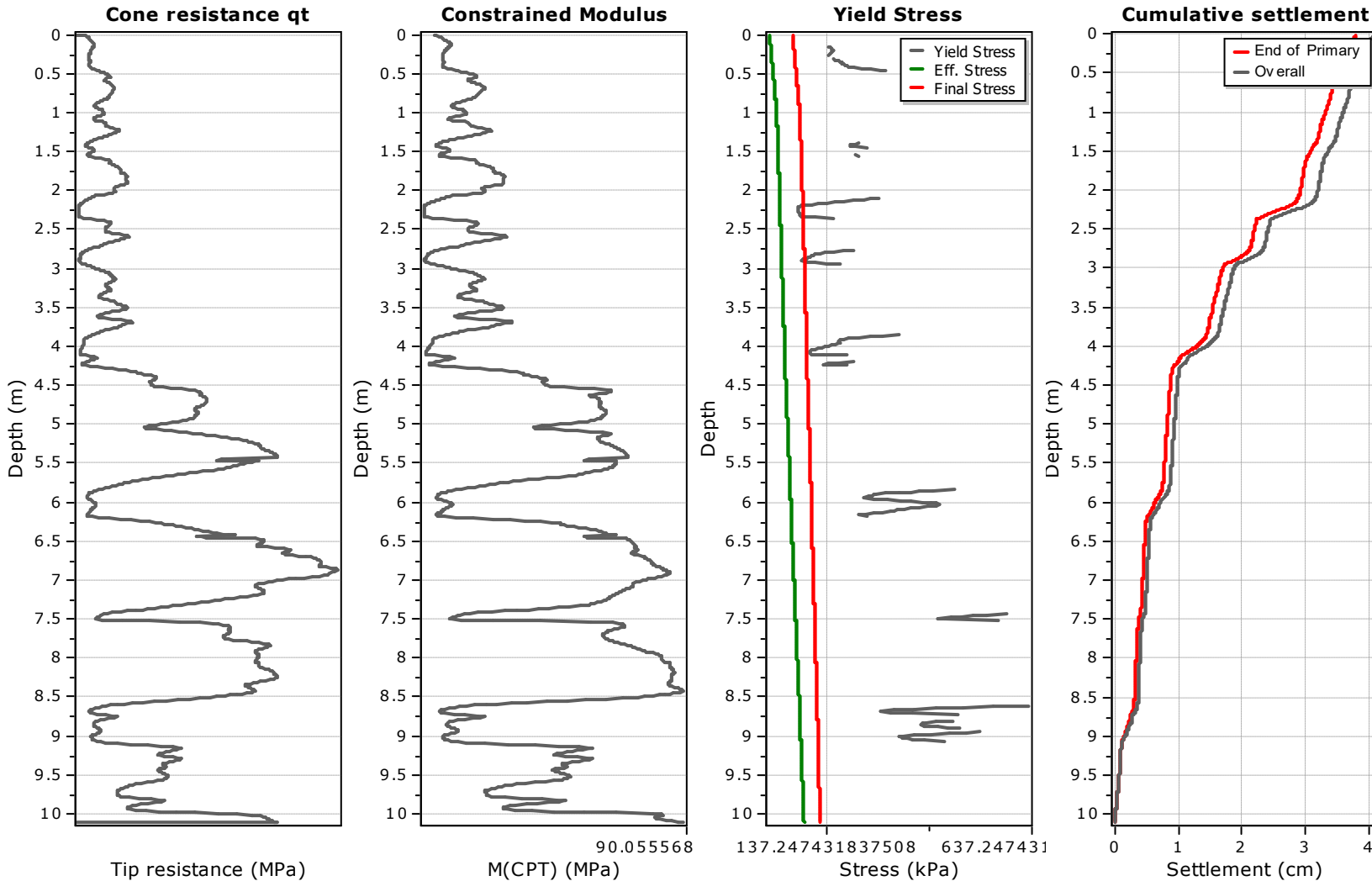
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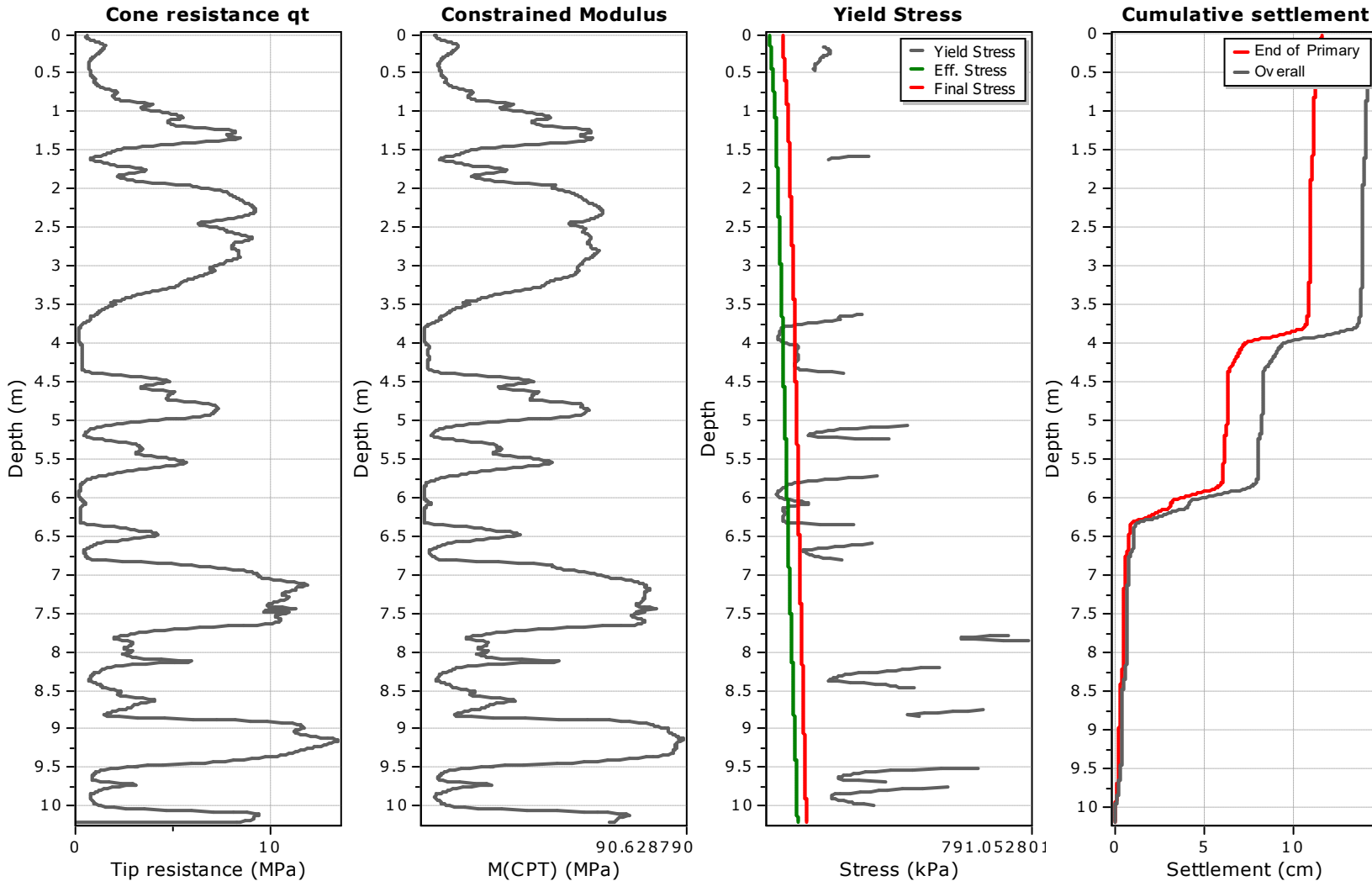
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Location:

Settlements calculation according to theory of elasticity*



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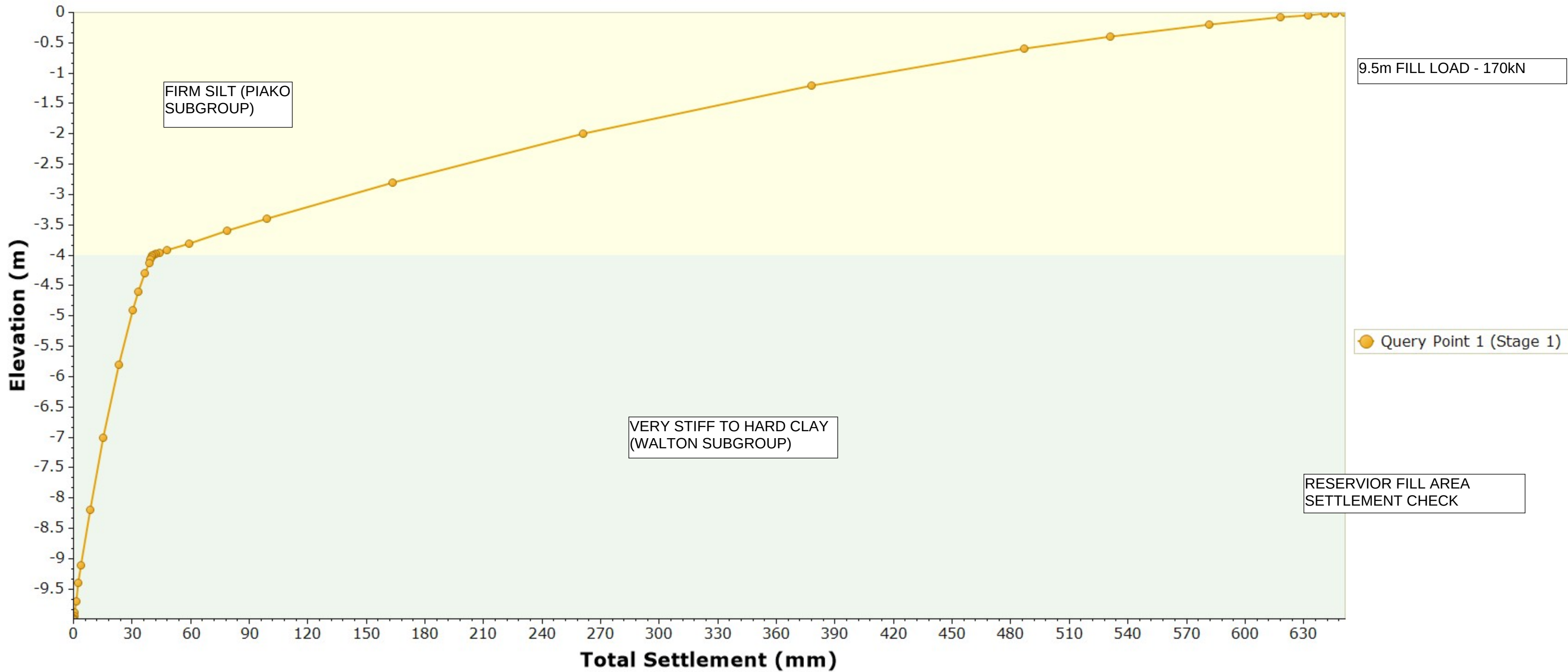
$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

* Secondary (creep) settlement calculation is performed according to the following formula:

$$S = C_\alpha \cdot \Delta z \cdot \log(t/t_p)$$

where t_p is the duration of primary consolidation

Total Settlement vs. Elevation



Reference Stage: None

1.0m Drawdown

$$S = \Delta\sigma_v \times M_v \times H$$

Where:

- S = Settlement
- $\Delta\sigma_v$ = Change in vertical stress
- M_v = Coefficient of volume compressibility
- H = Thickness of the compressible layer

1 GWL change (m)

9.8 Change in Overburden Stress (kPa)

5 H Compressive soil thickness (m)

5 Soil Elastic Modulus (Mpa)

0.2 $M_v \sim 1/E$

S = 9.8 mm

GWL DRAWDOWN INCLUDED
SETTLEMENT CHECK

More accurately, if you consider Poisson's ratio ν :

$$M_v = \frac{1 - 2\nu}{E(1 - \nu)}$$

For saturated soils under 1D compression, $\nu \approx 0.3$, so M_v is slightly less than $1/E$.

$\nu = 0.2$

$M_v = 0.150$

S = 7.4 mm

APPENDIX L

SID Assessment

CMW Safety in Design Risk Assessment									
HAM2025-0116 - Te Kowhai East Industrial Development									
Design Element	Hazard	Description	Assessed Risk			Controls Incorporated in Design	Residual Risk		
			Consequence	Likelihood	Risk Rating		Consequence	Likelihood	Risk Rating
Retaining Walls (If required)	Falling from height	Injury to construction staff while constructing or public once wall is constructed.	4	3	12	Temporary barrier fence to avoid public climbing, permanent fencing to be considered to prevent falls access.	1	3	3
	Striking underground services	Injury to construction staff if live services are struck.	4	2	8	All sites cleared for services prior to construction requiring digging or boring into the ground.	1	2	2
	Moving Machinery	Lifting and swing area of machinery may cause injury to construction staff.	4	3	12	Separate moving machinery from light vehicles and person movements with fencing and/or safe distances from exposed construction staff operations.	1	3	3
	Working at edges of excavations	Injury to construction staff or public by falling into excavations.	4	3	12	Site to be made safe if excavations are to be left open and public can access, excavations to be filled or securely covered on same day of excavation, safe distances from excavations to be maintained and demarked with boundary fence.	1	3	3
	Excavation collapse	Injury to construction staff or persons able to access the excavation after hours.	4	3	12	Staged excavation to be undertaken where able, boundary fence where excavations are under construction or other means of separation for staff or public from potential collapse.	1	3	3
	Retaining wall failure	Exceed specified loading conditions, wall drainage blockage.	4	2	8	Appropriate construction and permanent loading conditions allowed for, design adequate drainage measures, assess impact of blocked drainage on design.	1	2	2
	Falling objects from above	Injury to construction staff or persons under the proposed wall.	4	3	12	Hard hats to be worn at all times as the wall is constructed and where lifting is undertaken, safe distance from any lifting or movements above when being undertaken.	1	3	3
Earthworks	Falling from height	Injury to construction staff while constructing steep temporary or permanent earthworks cut or fill faces.	4	3	12	Temporary barrier fence or other means to be used to ensure persons cannot access to the edge of steep excavations	1	3	3
	Striking underground services	Injury to construction staff if live services are struck.	4	2	8	All sites cleared for services prior to site investigations and earthworks construction	1	2	2
	Moving Machinery	Injury to construction staff.	4	3	12	Separate moving machinery from light vehicles and person movements with fencing and/or safe distances from exposed construction staff operations.	1	3	3
	Working at edges of excavations	Injury to construction staff.	4	3	12	Install safety barriers, exclusion zones, signage as necessary to warn of hazard.	1	3	3
	Trench excavation collapse	Injury to construction staff or persons due to crushing/impact injury.	4	3	12	Follow Worksafe requirements, trench shields or benching of excavations to be used. No staff to enter the trench without appropriate and approved measures already in place.	1	3	3
	Cut / fill batter collapse	Injury to construction staff during construction.	3	2	6	Safe distances and appropriate temporary slope gradients and heights to be assessed prior to construction and monitored during to confirm as appropriate, safe distances and barrier fencing to be used on site where deemed necessary.	1	3	3
	Excessive noise during construction	Damage to hearing of construction staff or persons adjacent to the site.	3	2	6	Comply with appropriate allowances for noise on site, ear protection to be worn where appropriate, setback distances from adjacent sites or notified working hours to avoid conflict with adjacent property inhabitants.	1	2	2
	Machinery rollover	Machinery trafficability over soft, wet or uneven ground.	4	2	8	Appropriate construction of temporary haul roads, implement drainage and geofabrics, appropriate driver training.	1	2	2
	Contaminated Soils	Airborne or in-ground contaminants affecting construction staff.	4	1	4	Perform an environmental assessment of the site prior to construction.	1	1	1
Plant Platform	Moving Machinery	Injury to construction staff.	4	3	12	Separate moving machinery from light vehicles and person movements with fencing and/or safe distances from exposed construction staff operations.	1	3	3
	Plant platform instability	Injury to construction staff or persons due to crushing/impact injury.	4	3	12	Design to incorporate adequate factor of safety, prepare lift management plans to ensure adequate separation between plant and persons.	1	3	3
	Excessive plant settlement	Plant / equipment damage, injury to construction staff or persons due to sudden plant / load movements.	4	3	12	Undertake trial lift with adequate separation of plant and load from persons, monitor settlements during lift.	1	3	3
NOTE: It is the Contractors responsibility to cover construction related risks in a more comprehensive manner (being the competent party in that respect).									

Safety in Design Assessment Framework						
Risk Matrix		Consequence				
		Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Likelihood	Event Will Occur 5	Medium 5	High 10	High 15	Extreme 20	Extreme 25
	Event Almost Certain to Occur 4	Low 4	Medium 8	High 12	Extreme 16	Extreme 20
	Event May Occur 3	Low 3	Medium 6	High 9	High 12	High 15
	Event Not Likely to Occur 2	Low 2	Low 4	Medium 6	Medium 8	High 10
	Event Rarely Occurs 1	Low 1	Low 2	Low 3	Low 4	Medium 5

APPENDIX M

Statement of Professional Opinion

28 August 2026

Document Ref: HAM2025-0116AF | Rev 0

RE: STATEMENT OF PROFESSIONAL OPINION AS TO THE GEOTECHNICAL SUITABILITY OF LAND FOR DEVELOPMENT TE KOWHAI EAST INDUSTRIAL DEVELOPMENT

Development: Te Kowhai East Industrial Development

Owner: Te Kowhai East Limited Partners

Location: Te Kowhai Road, Waikato

I, Kori Lentfer, of CMW Geotechnical NZ Limited (Level 1, Block C/401 Grey Street, Hamilton)

Hereby confirm that:

1. The extent of my preliminary investigations is described in report HAM2025-0116AE Rev0 dated 28 August 2026.
2. In my professional opinion, not to be construed as a guarantee, I considered that the proposed works give due regards to land slope, liquefaction and foundation stability and settlement considerations and that the land is suitable for the proposed development provided the geotechnical constraints outlined within my geotechnical investigation report have been considered.
3. The professional opinion is furnished to the Council and the owner for the purpose along, on the express condition that it will not be relied upon by any other person and does not remove the necessity for further inspection during the course of the works.

For and on behalf of CMW Geosciences

Prepared by:



Kori Lentfer
Principal Engineering Geologist
CMEngNZ, PEngGeol





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