31 July 2024 Document Ref: AKS2023-0062 | Rev 0

Austino Property Group
C/- Harrison Grierson
PO Box 5760, Victoria St West
Auckland 1142

Attention: Claire Covington

Dear Claire

RE: PROPOSED PRIVATE PLAN CHANGE – RFI RESPONSES
100 HOBSONVILLE ROAD, HOBSONVILLE

Appended to this cover letter are CMW's Geotechnical responses to specific items raised by Auckland Council following the submission of CMW Geotechnical Assessment Report, reference AKS2023-0062AB Rev 0, dated 30 November 2023, in support of a proposed private plan change (PPC).

For and on behalf of CMW Geosciences

Prepared by:

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Distribution: 1 electronic copy to Austino Property Group via email
Original held at CMW Geosciences

Appendix A: Table 1 RFI Responses

Appendix B: Geomorphological Map

Appendix C: CPT Test Location Plan

Appendix D: Liquefaction Analyses Results

Appendix E: Geohazards Assessment & Mitigation Risk Register

APPENDIX A

RFI Responses

Table 1: RFIs and responses

No.	Geotechnical Requests by Auckland Council	Responses by CMW
G1	Please provide copies of the Geotechnical Investigation Report and Geotechnical Completion Report (prepared by Geotek Solutions Ltd) that are referenced in Section 3.2 of the Geotechnical Assessment Report.	PDF copy of the GIR and GCR have been included in the covering email.
G2	It is understood that hand auger boreholes were undertaken on site by Geotek in 2019. Could you please confirm the source of this information and reference to the reporting? Please clarify the purpose of these hand auger boreholes (e.g. was the intention to support the proposed private plan change or were the hand auger boreholes undertaken for some other development)	The historic hand augers were provided to us by our client Austino Property Group who we understand engaged Geotek to undertake the drilling of a spread of hand augers to provide an initial understanding of ground conditions. We understand that apart from a covering email with brief factual interpretation which has not been sourced, there was no formal geotechnical reporting undertaken and there were no development proposals at that time.
G3	Please confirm if the site walkover and geomorphological mapping have been undertaken by an engineering geologist. If so, please provide supporting information. If not, please carry out these exercises and provide the required information.	We can confirm that a site walkover was undertaken by an experienced Geologist and there were no additional geomorphological features identified when compared with the aerial photographs. The observations made on site in conjunction with the previous desktop study are presented on the appended geomorphological map in Appendix B.
G4	Please provide a geomorphological map for the site.	See response G3 above.
G5	Please re-assess the liquefaction vulnerability and update Section 5 accordingly	6 CPT tests were undertaken in the locations identified on the site plan attached in Appendix C to assess site-specific liquefaction susceptibility The methodology of assessment and results are presented in Appendix D which confirms that the risk of Liquefaction Potential is low as well as the Probability of Liquefaction is also low. These results are in keeping with the assessment in the GAR.
G6	Please provide natural hazard risk assessment (including risk categorisation) for the site.	The Geohazards Assessment & Mitigation table in section 5 of the GAR has been updated to include Risk Ratings as attached in Appendix E. There are no changes to the Assessment Outcomes nor Mitigation measures.
I1	Please confirm or clarify the following points in relation to mitigation methods: a) Whether geotechnical mitigation works (e.g. counterfeit drains) would need to occur on the neighbouring land to support this PPC and/or would more efficient mitigations be available if the neighbours land could be assessed; and b) What extent of geotechnical mitigation works would be required to ensure stable residential sites or road can be developed along the western boundary of Block 2? If there has been any investigation done to determine whether stormwater devices could be located anywhere along the western boundary of the PCA, or if there are limitations on device and outlet location.	a) At this early stage, we do not consider it a necessity to undertake construction of subsoils drains and/or earthworks across the current property boundary. Whilst there may be some efficiencies in landform design by having such access, there are several alternative options that can be explored which we describe in brief below. b) Where the risk of slope instability by way of soil creep is confirmed in the future, we consider that mitigation options could comprise a combination of the following measures to resist the loss of lateral, downslope soil support: i) Keyways (or shallow shear keys) along the toe of fill embankments; ii) Retaining walls with increased cantilever embedment; and iii) In extreme instances, in-ground palisade wall retaining structures could be adopted. The requirement as well as design for such measures will be driven by future development proposals at RC stage. c) As highlighted in our Geohazards Assessment, stormwater discharge via on-site soakage is not considered feasible on account of the very low permeability clays as well as the increased risk of slope instability. Stormwater should be discharged to the existing drainage features via a reticulation network.
I2	Please confirm whether the proposed road connections, as indicated in Precinct Plan 2 (Hobsonville Grove Precinct), are feasible from a geotechnical perspective.	The suggested road connections in Precinct Plan 2 are generally considered to be feasible from a geotechnical perspective albeit challenging given the crossing of gully drainage features which will require structures such as bridges and/or culverts.

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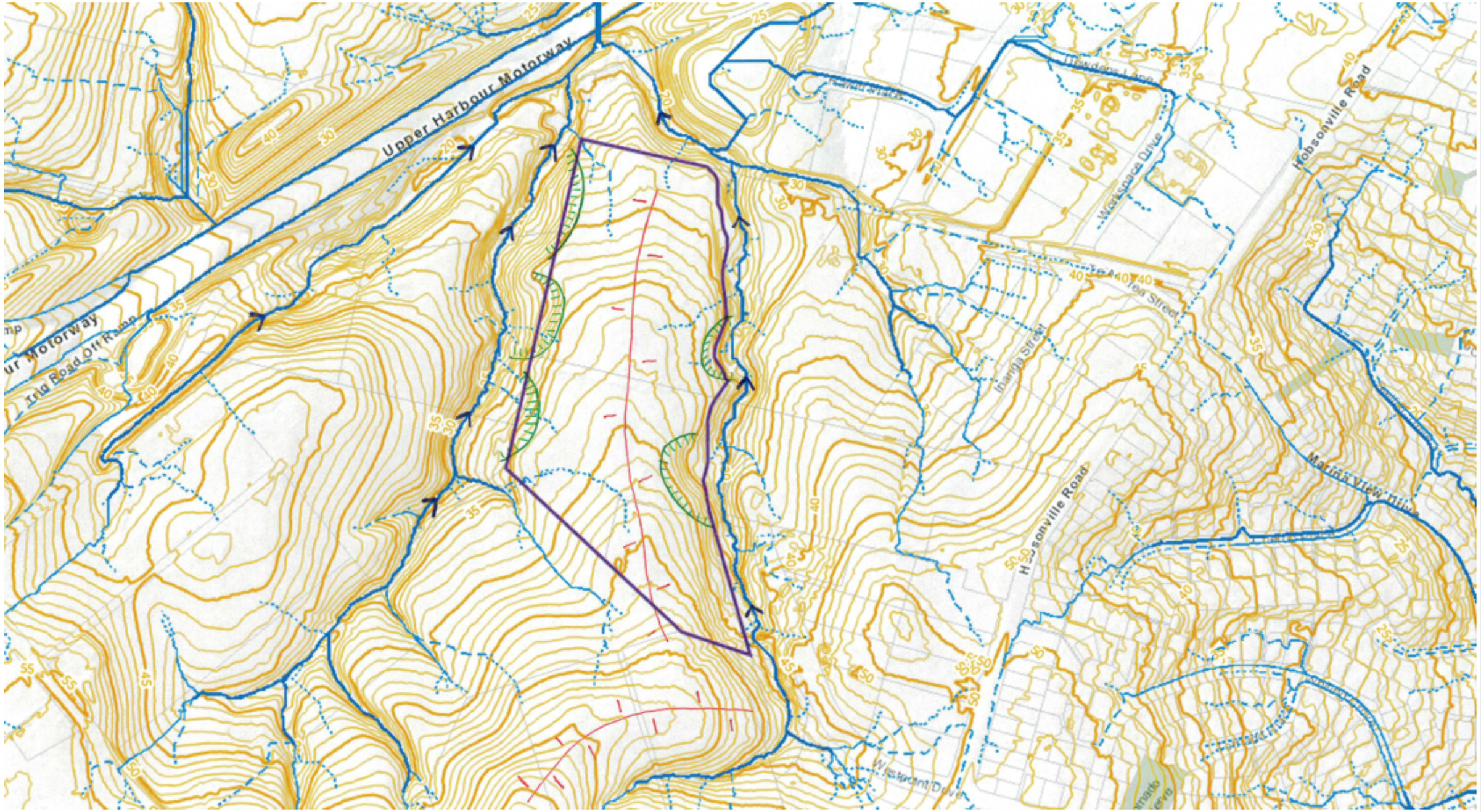
APPENDIX B
Geomorphological Map



LEGEND:

Overland Flow Path - 3ha to 100ha
Ridge Line
Property Boundary
Soil creep headscarp

NOTES:

1. Base plan adapted from AC Geo Maps
2. Arrows on flow paths indicate flow direction

CMW Geosciences

CLIENT: AUSTINO PROPERTY GROUP		DRAWN: FK	PROJECT: AKS2023-0062
PROJECT: 100 HOBSONVILLE ROAD, HOBSONVILLE		CHECKED: EC	DRAWING: 01
		REVISION: Rev 1	SCALE:
TITLE: GEOMORPHOLOGICAL PLAN		DATE: 30/07/2024	SHEET: A3 L

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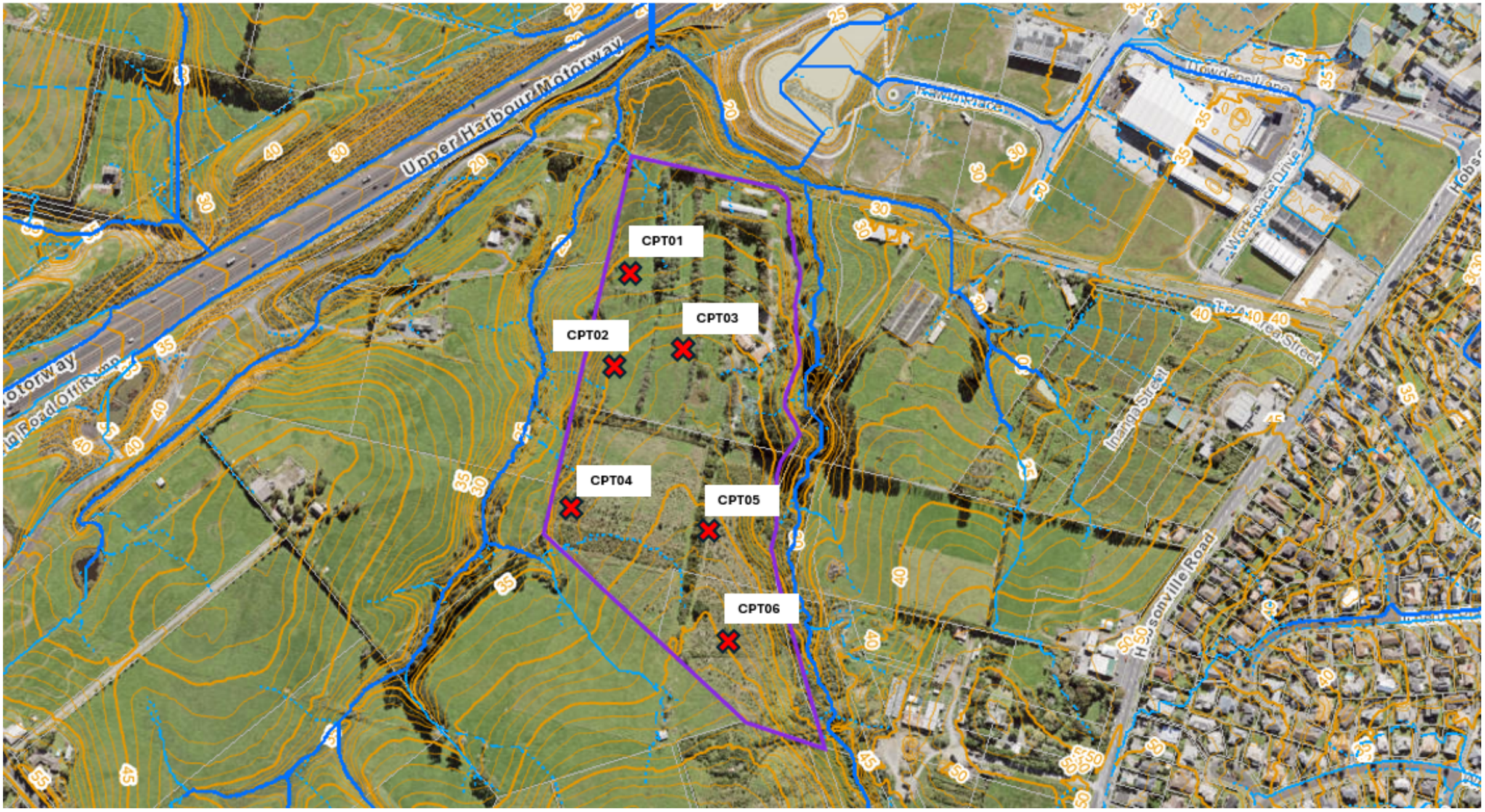
APPENDIX C
CPT Test Location



LEGEND:

CPT Locations ✖

NOTES:

1. Base plan adapted from AC Geo Maps

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CLIENT: AUSTINO PROPERTY GROUP		DRAWN: FK	PROJECT: AKS2023-0062
PROJECT: 100 HOBSONVILLE ROAD, HOBSONVILLE		CHECKED: EC	DRAWING: 02
		REVISION: Rev 1	SCALE:
TITLE: CPT TEST LOCATION PLAN		DATE: 30/07/2024	SHEET: A3 L

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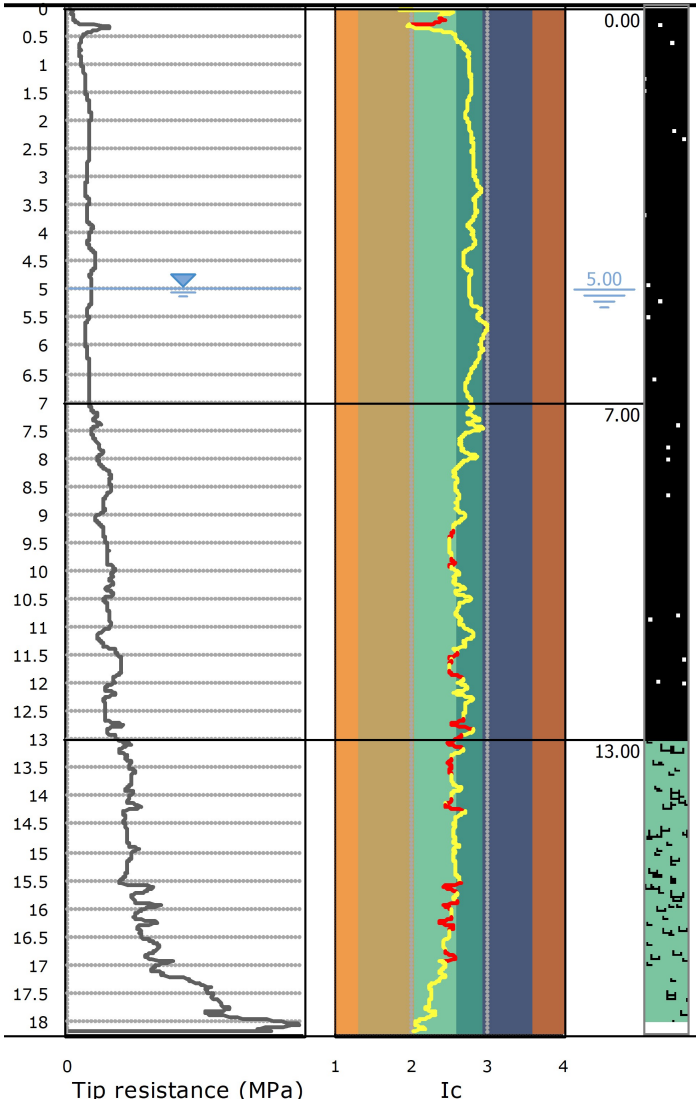
APPENDIX D
Liquefaction Analyses Results

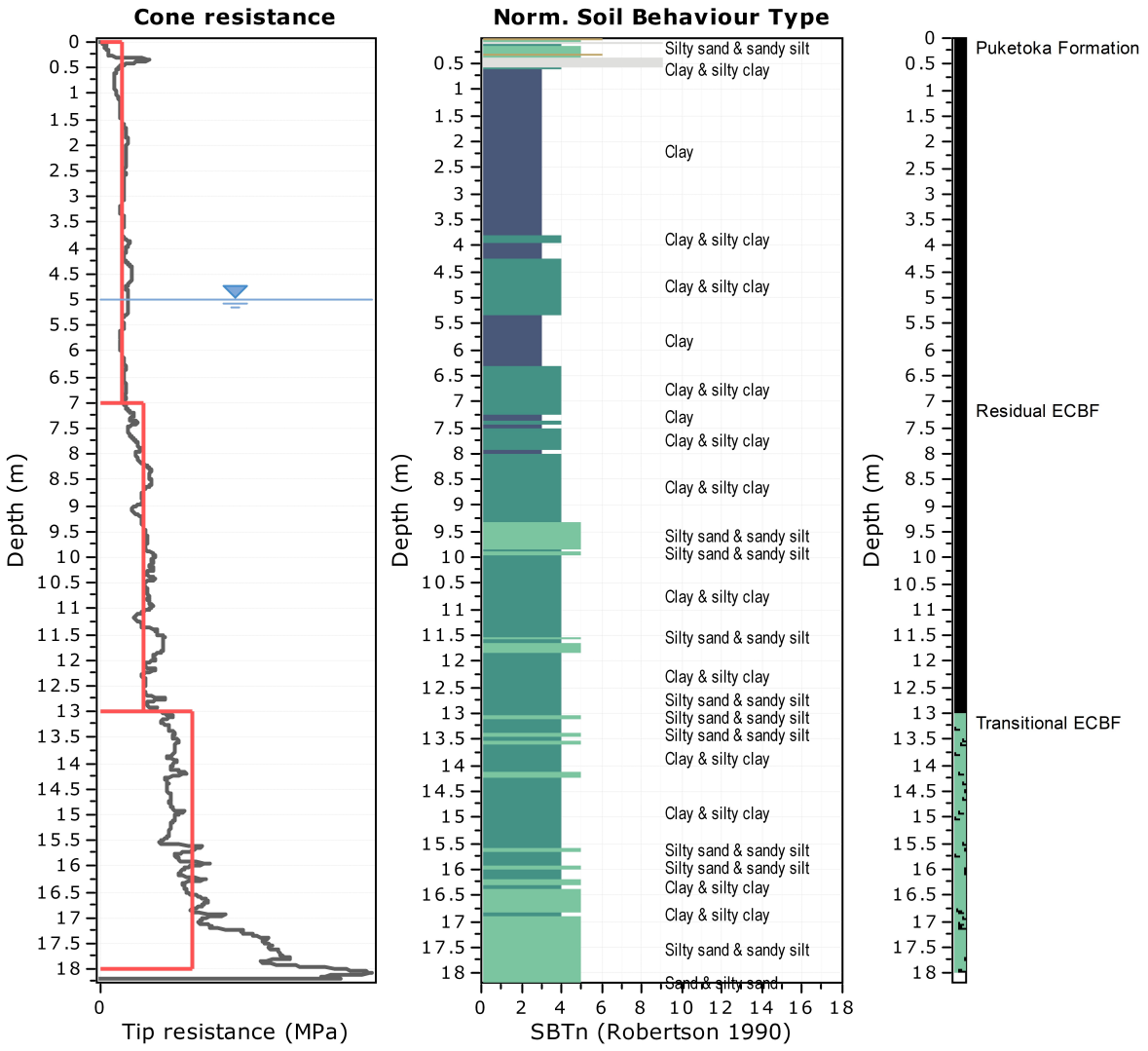
GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

CPT: CPT01
Total depth: 18.18 m, Date: 29/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location: 100 Hobsonville Road



Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
Puketoka Formation	1.3	-	6.0	-	-	-	10.2	36.1	88.2	1.7	8.0	17.6
Residual ECBF	2.6	7.37E-8	10.5	-	-	-	19.0	59.1	184.9	1.4	6.3	17.8
Transitional ECBF	5.5	2.58E-7	20.3	107.5	35.9	36.6	41.8	110.4	-	-	-	19.0



Tabular results

.:: Layer No: 1 ::.

Code: Puketoka **Start depth:** 0.00 (m), **End depth:** 7.00 (m)

Description: Puketoka Formation

Basic results

Total cone resistance: 1.33 ±0.31 MPa
Sleeve friction: 0.00 ±61.36 kPa
Ic: 0.00 ±2.78
σ_v': 46.35 ±34.49 kPa
SBT_n: 0
SBTn description: N/A
Schneider zone: Zone 1a
Schneider desc.: Silts and low Ir clays

Estimation results

Permeability: 0.00E+00 ±1.35E-06 m/s
N_{60}: 6.01 ±1.32 blows
Es: 0.00 ±0.00 MPa
Dr (%): 0.00 ±0.00
φ (degrees): 0.00 ±0.00 °
Unit weight: 17.62 ±0.66 kN/m³

Constrained Mod.: 10.17 ±2.42 MPa
Go: 36.10 ±8.61 MPa
Su: 88.20 ±21.48 kPa
Su ratio: 1.73 ±1.35
O.C.R.: 7.97 ±6.21

.:: Layer No: 2 ::.

Code: Residual ECBF **Start depth:** 7.00 (m), **End depth:** 13.00 (m)

Description: Residual ECBF

Basic results	Estimation results	
Total cone resistance: 2.55 ±0.50 MPa	Permeability: 7.37E-08 ±5.77E-08 m/s	Constrained Mod.: 19.05 ±3.85 MPa
Sleeve friction: 47.18 ±13.72 kPa	N_{60}: 10.51 ±1.72 blows	Go: 59.13 ±9.95 MPa
Ic: 2.66 ±0.10	Es: 0.00 ±0.00 MPa	Su: 184.93 ±38.81 kPa
σ_v': 124.58 ±13.59 kPa	Dr (%): 0.00 ±0.00	Su ratio: 1.37 ±0.24
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 6.31 ±1.11
SBTn description: Clay & silty clay	Unit weight: 17.78 ±0.39 kN/m³	
Schneider zone: Zone 1b		
Schneider desc.: Clays		

.:: Layer No: 3 ::.

Code: Transitional ECBF **Start depth:** 13.00 (m), **End depth:** 18.00 (m)

Description: Transitional ECBF

Basic results	Estimation results	
Total cone resistance: 5.52 ±2.55 MPa	Permeability: 2.58E-07 ±5.66E-07 m/s	Constrained Mod.: 41.84 ±20.26 MPa
Sleeve friction: 101.90 ±43.63 kPa	N_{60}: 20.30 ±6.77 blows	Go: 110.43 ±30.66 MPa
Ic: 2.48 ±0.13	Es: 107.47 ±19.06 MPa	Su: 0.00 ±0.00 kPa
σ_v': 175.28 ±12.80 kPa	Dr (%): 35.94 ±5.45	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 36.55 ±0.76 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 18.96 ±0.53 kN/m³	
Schneider zone: Zone 1a		
Schneider desc.: Silts and low Ir clays		

Summary table of mean values

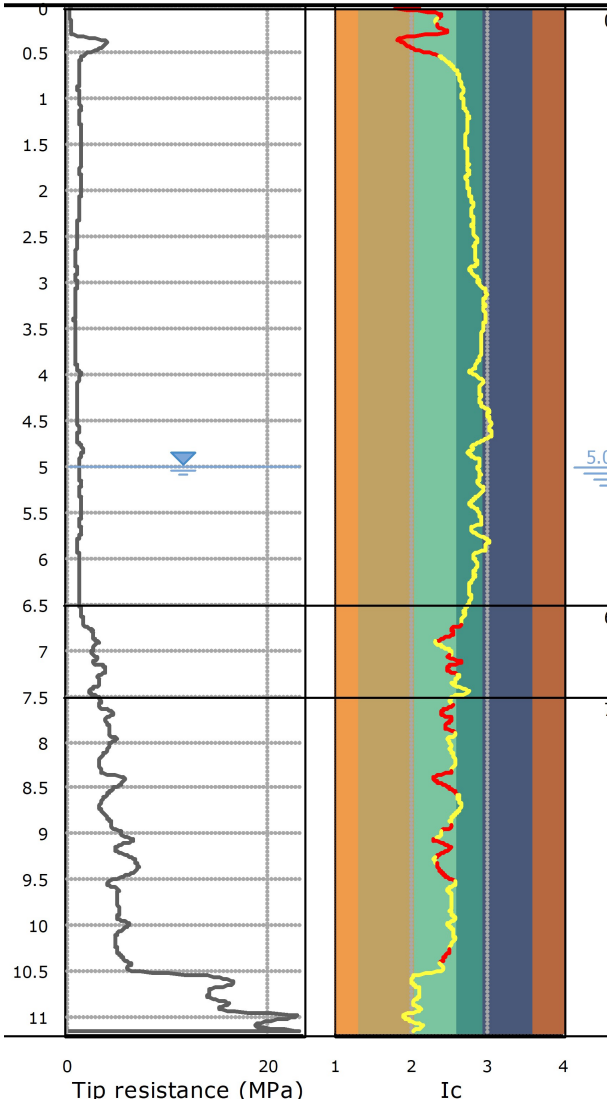
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00 7.00	7.00	0.00E+00 (±1.35E-06)	6.0 (±1.3)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	10.2 (±2.4)	36.1 (±8.6)	88.2 (±21.5)	1.7 (±1.3)	8.0 (±6.2)	17.6 (±0.7)
7.00 13.00	6.00	7.37E-08 (±5.77E-08)	10.5 (±1.7)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±3.9)	59.1 (±9.9)	184.9 (±38.8)	1.4 (±0.2)	6.3 (±1.1)	17.8 (±0.4)
13.00 18.00	5.00	2.58E-07 (±5.66E-07)	20.3 (±6.8)	107.5 (±19.1)	35.9 (±5.5)	36.6 (±0.8)	41.8 (±20.3)	110.4 (±30.7)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	19.0 (±0.5)

Depth values presented in this table are measured from free ground surface

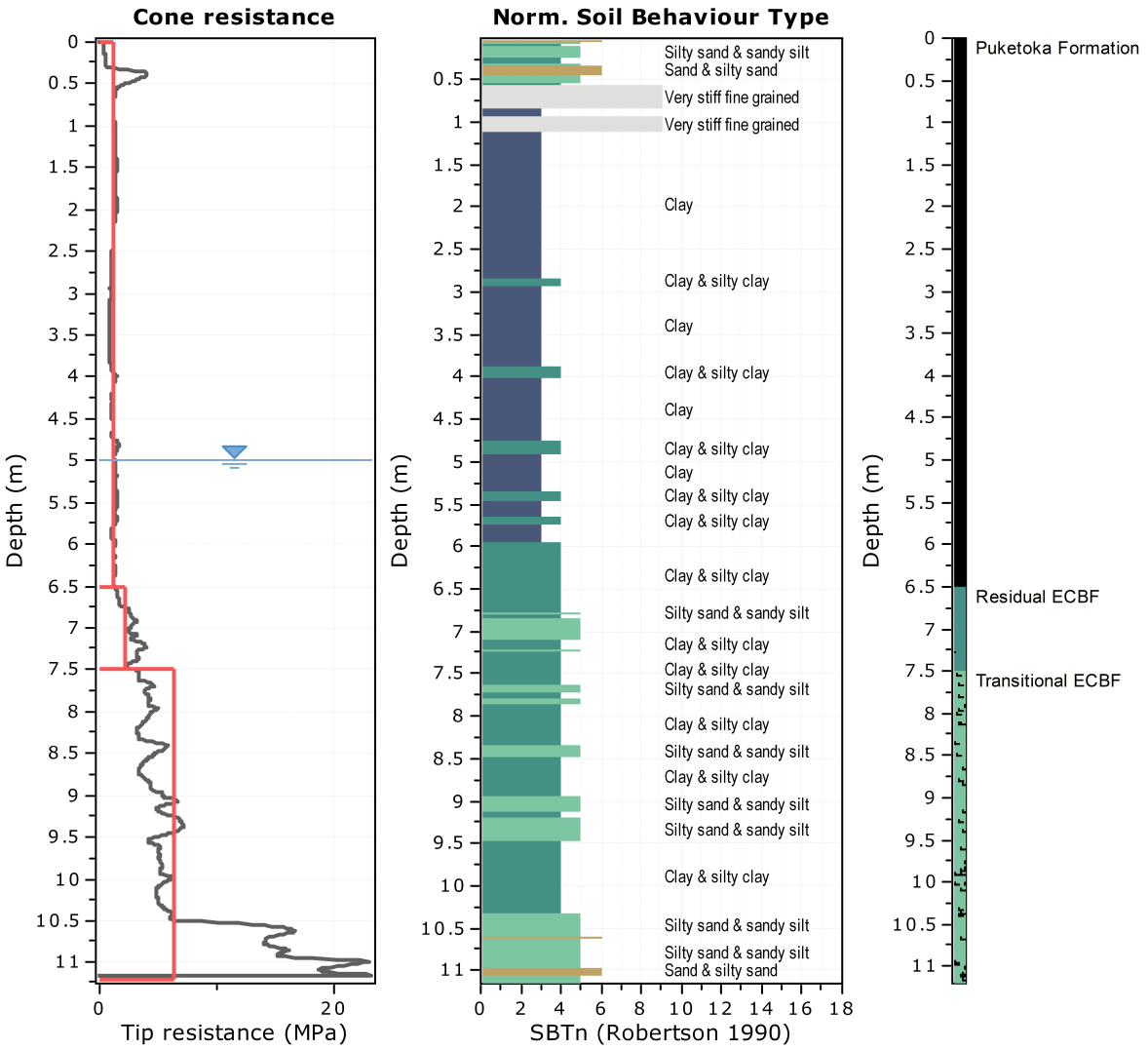
GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

CPT: CPT02
Total depth: 11.15 m, Date: 29/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location: 100 Hobsonville Road



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Puketoka Formation	1.1	2.23E-8	5.3	-	-	-	8.7	32.4	75.6	1.4	6.7	17.3
6.50	Residual ECBF	2.2	9.89E-8	8.7	-	-	-	16.3	47.1	153.0	1.3	6.2	17.4
7.50	Transitional ECBF	6.3	4.52E-7	22.2	133.9	53.7	39.9	49.1	120.3	-	-	-	19.5



Tabular results

.:: Layer No: 1 ::.

Code: Puketoka **Start depth:** 0.00 (m), **End depth:** 6.50 (m)

Description: Puketoka Formation

Basic results

Total cone resistance: 1.15 ±0.22 MPa
Sleeve friction: 0.00 ±54.16 kPa
Ic: 0.00 ±2.83
σ_v': 49.29 ±29.34 kPa
SBT_n: 0
SBTn description: N/A
Schneider zone: N/A
Schneider desc.: N/A

Estimation results

Permeability: 2.23E-08 ±7.80E-08 m/s
N_{60}: 5.28 ±0.98 blows
Es: 0.00 ±0.00 MPa
Dr (%): 0.00 ±0.00
φ (degrees): 0.00 ±0.00 °
Unit weight: 17.32 ±0.68 kN/m³

Constrained Mod.: 8.66 ±1.81 MPa
Go: 32.36 ±6.59 MPa
Su: 75.57 ±14.59 kPa
Su ratio: 1.44 ±1.33
O.C.R.: 6.66 ±6.13

.:: Layer No: 2 ::.

Code: Residual ECBF **Start depth:** 6.50 (m), **End depth:** 7.50 (m)

Description: Residual ECBF

Basic results	Estimation results	
Total cone resistance: 2.17 ±0.69 MPa	Permeability: 9.89E-08 ±1.57E-07 m/s	Constrained Mod.: 16.35 ±5.51 MPa
Sleeve friction: 35.65 ±25.34 kPa	N_{60}: 8.74 ±2.52 blows	Go: 47.06 ±15.23 MPa
Ic: 2.61 ±0.11	Es: 0.00 ±0.00 MPa	Su: 153.03 ±48.25 kPa
σ_v': 101.15 ±2.77 kPa	Dr (%): 0.00 ±0.00	Su ratio: 1.35 ±0.48
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 6.23 ±2.23
SBTn description: Clay & silty clay	Unit weight: 17.40 ±0.77 kN/m³	
Schneider zone: Zone 1b		
Schneider desc.: Clays		

.:: Layer No: 3 ::.

Code: Transitional ECBF **Start depth:** 7.50 (m), **End depth:** 11.20 (m)

Description: Transitional ECBF

Basic results	Estimation results	
Total cone resistance: 6.32 ±5.78 MPa	Permeability: 4.52E-07 ±3.21E-06 m/s	Constrained Mod.: 49.08 ±46.15 MPa
Sleeve friction: 156.50 ±116.66 kPa	N_{60}: 22.15 ±13.83 blows	Go: 120.35 ±59.66 MPa
Ic: 2.39 ±0.22	Es: 133.94 ±37.68 MPa	Su: 0.00 ±0.00 kPa
σ_v': 124.06 ±10.20 kPa	Dr (%): 53.68 ±11.41	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 39.89 ±1.68 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.51 ±0.84 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

Summary table of mean values

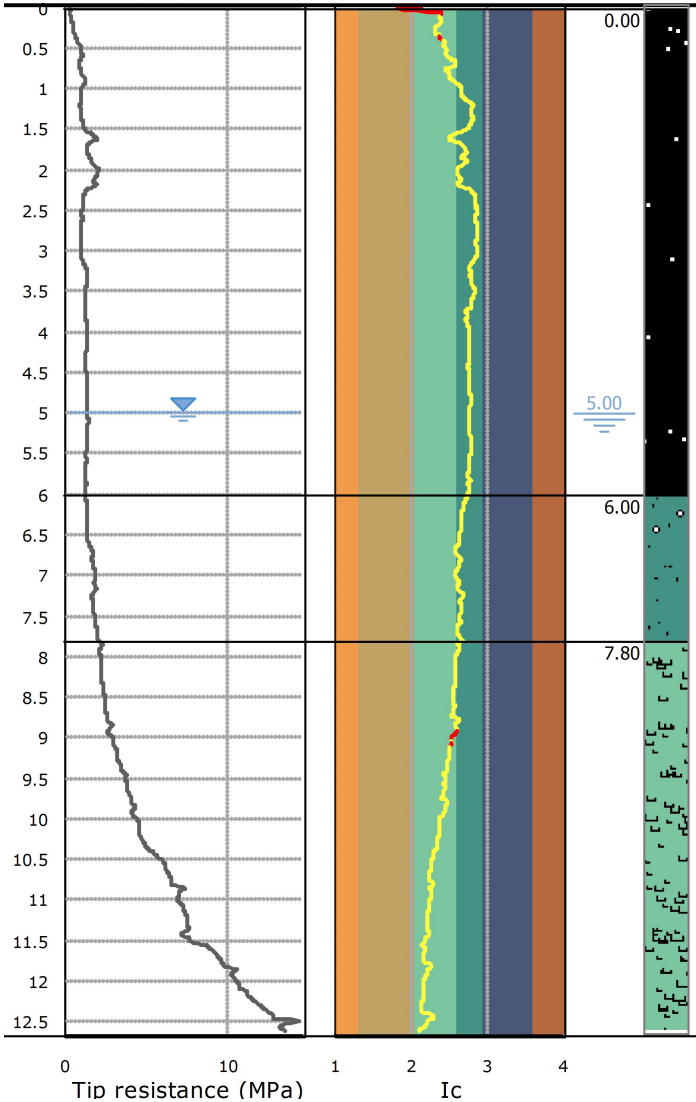
From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	6.50	2.23E-08	5.3	0.0	0.0	0.0	8.7	32.4	75.6	1.4	6.7	17.3
6.50		(±7.80E-08)	(±1.0)	(±0.0)	(±0.0)	(±0.0)	(±1.8)	(±6.6)	(±14.6)	(±1.3)	(±6.1)	(±0.7)
6.50	1.00	9.89E-08	8.7	0.0	0.0	0.0	16.3	47.1	153.0	1.3	6.2	17.4
7.50		(±1.57E-07)	(±2.5)	(±0.0)	(±0.0)	(±0.0)	(±5.5)	(±15.2)	(±48.2)	(±0.5)	(±2.2)	(±0.8)
7.50	3.70	4.52E-07	22.2	133.9	53.7	39.9	49.1	120.3	0.0	0.0	0.0	19.5
11.20		(±3.21E-06)	(±13.8)	(±37.7)	(±11.4)	(±1.7)	(±46.2)	(±59.7)	(±0.0)	(±0.0)	(±0.0)	(±0.8)

Depth values presented in this table are measured from free ground surface

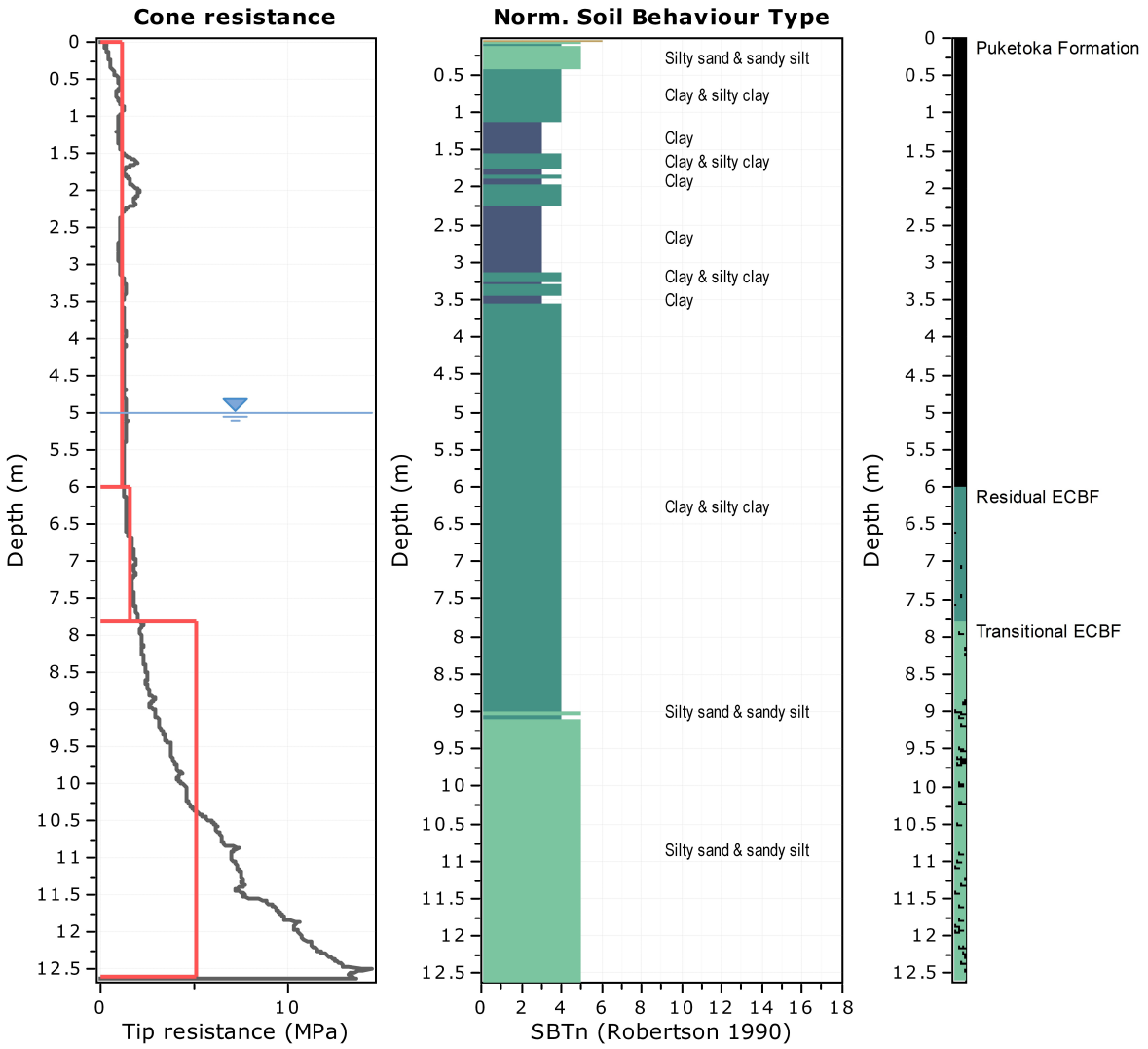
GeoLogismiki
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

CPT: CPT03
Total depth: 12.62 m, Date: 29/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location: 100 Hobsonville Road



Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
Puketoka Formation	1.2	4.76E-8	5.1	-	-	-	8.8	28.4	82.5	1.6	7.6	17.1
Residual ECBF	1.6	8.39E-8	6.6	-	-	-	11.8	33.1	133.0	1.1	4.9	16.5
Transitional ECBF	5.0	5.93E-7	17.2	81.9	38.3	36.7	38.7	86.4	-	-	-	18.7



Tabular results

.:: Layer No: 1 ::.

Code: Puketoka **Start depth:** 0.00 (m), **End depth:** 6.00 (m)

Description: Puketoka Formation

Basic results

Total cone resistance: 1.15 ±0.28 MPa
Sleeve friction: 0.00 ±44.47 kPa
Ic: 0.00 ±2.72
σ_v': 40.38 ±30.29 kPa
SBT_n: 0
SBTn description: N/A
Schneider zone: N/A
Schneider desc.: N/A

Estimation results

Permeability: 4.76E-08 ±1.41E-07 m/s
N_{60}: 5.07 ±1.26 blows
Es: 0.00 ±0.00 MPa
Dr (%): 0.00 ±0.00
φ (degrees): 0.00 ±0.00 °
Unit weight: 17.13 ±0.66 kN/m³

Constrained Mod.: 8.80 ±2.19 MPa
Go: 28.38 ±7.90 MPa
Su: 82.45 ±17.89 kPa
Su ratio: 1.65 ±1.12
O.C.R.: 7.62 ±5.15

.:: Layer No: 2 ::.

Code: Residual ECBF **Start depth:** 6.00 (m), **End depth:** 7.80 (m)

Description: Residual ECBF

Basic results	Estimation results	
Total cone resistance: 1.59 ±0.22 MPa	Permeability: 8.39E-08 ±2.09E-08 m/s	Constrained Mod.: 11.78 ±1.72 MPa
Sleeve friction: 17.83 ±4.79 kPa	N_{60}: 6.55 ±0.78 blows	Go: 33.12 ±4.71 MPa
Ic: 2.64 ±0.04	Es: 0.00 ±0.00 MPa	Su: 132.99 ±16.41 kPa
σ_v': 98.36 ±3.50 kPa	Dr (%): 0.00 ±0.00	Su ratio: 1.07 ±0.13
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 4.93 ±0.58
SBTn description: Clay & silty clay	Unit weight: 16.48 ±0.36 kN/m³	
Schneider zone: Zone 1b		
Schneider desc.: Clays		

.:: Layer No: 3 ::.

Code: Transitional ECBF **Start depth:** 7.80 (m), **End depth:** 12.60 (m)

Description: Transitional ECBF

Basic results	Estimation results	
Total cone resistance: 5.03 ±3.44 MPa	Permeability: 5.93E-07 ±9.54E-07 m/s	Constrained Mod.: 38.72 ±27.36 MPa
Sleeve friction: 80.99 ±83.35 kPa	N_{60}: 17.23 ±9.45 blows	Go: 86.41 ±46.73 MPa
Ic: 2.36 ±0.16	Es: 81.88 ±28.93 MPa	Su: 0.00 ±0.00 kPa
σ_v': 124.24 ±12.29 kPa	Dr (%): 38.25 ±7.66	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 36.69 ±1.45 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 18.66 ±1.02 kN/m³	
Schneider zone: Zone 1b		
Schneider desc.: Clays		

Summary table of mean values

From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00 6.00	6.00	4.76E-08 (±1.41E-07)	5.1 (±1.3)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	8.8 (±2.2)	28.4 (±7.9)	82.5 (±17.9)	1.6 (±1.1)	7.6 (±5.2)	17.1 (±0.7)
6.00 7.80	1.80	8.39E-08 (±2.09E-08)	6.6 (±0.8)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	11.8 (±1.7)	33.1 (±4.7)	133.0 (±16.4)	1.1 (±0.1)	4.9 (±0.6)	16.5 (±0.4)
7.80 12.60	4.80	5.93E-07 (±9.54E-07)	17.2 (±9.5)	81.9 (±28.9)	38.3 (±7.7)	36.7 (±1.4)	38.7 (±27.4)	86.4 (±46.7)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	18.7 (±1.0)

Depth values presented in this table are measured from free ground surface

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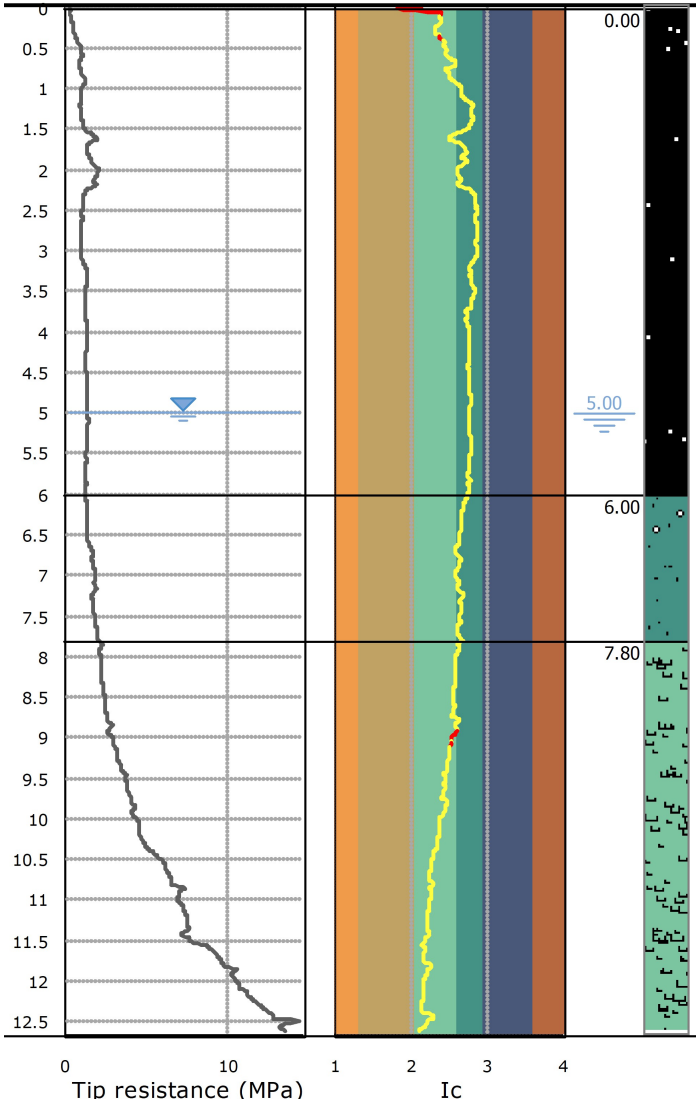
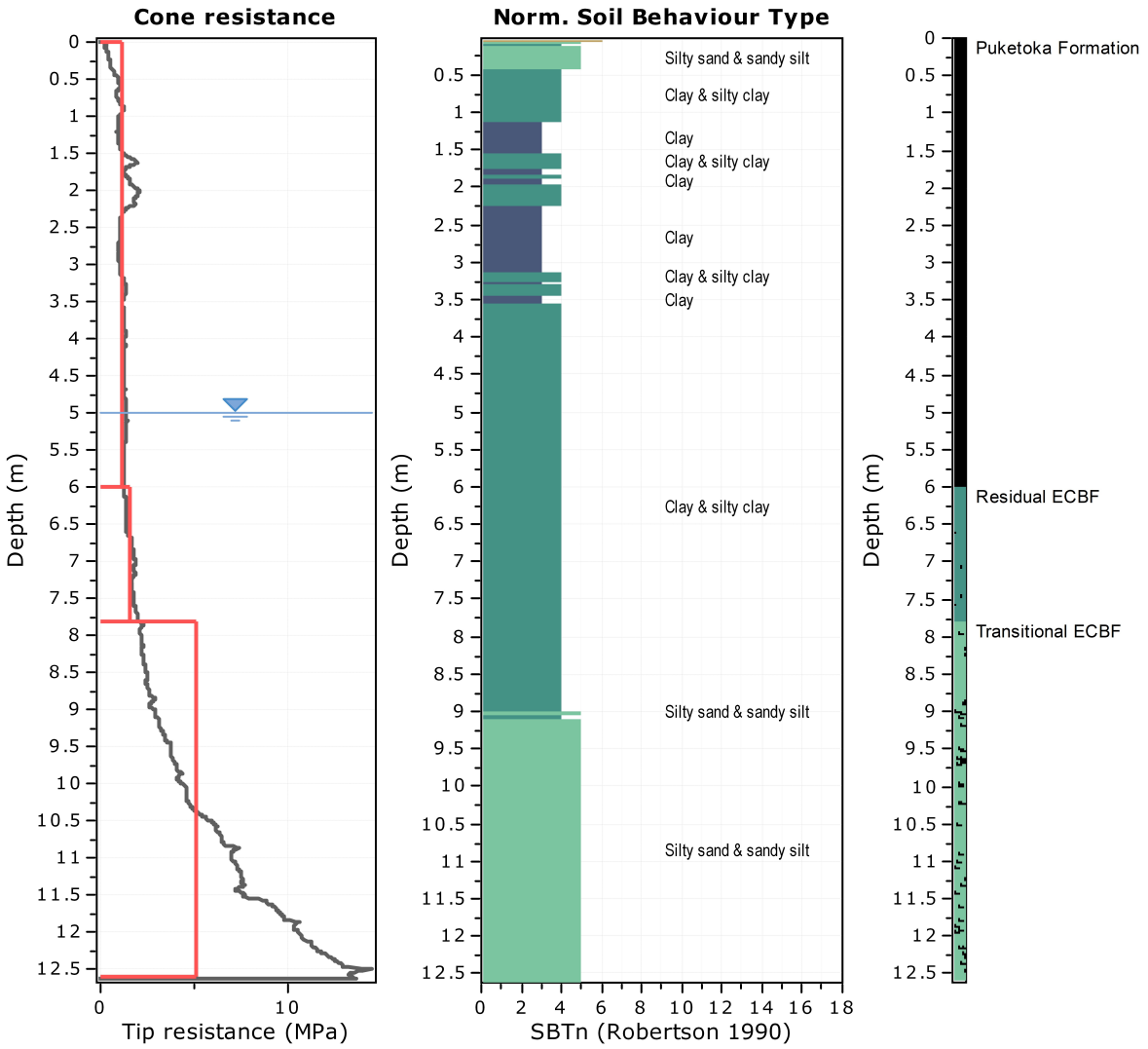
Merarhias 56
http://www.geologismiki.gr

CPT: CPT03
Total depth: 12.62 m, Date: 29/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location: 100 Hobsonville Road



Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
Puketoka Formation	1.2	4.76E-8	5.1	-	-	-	8.8	28.4	82.5	1.6	7.6	17.1
Residual ECBF	1.6	8.39E-8	6.6	-	-	-	11.8	33.1	133.0	1.1	4.9	16.5
Transitional ECBF	5.0	5.93E-7	17.2	81.9	38.3	36.7	38.7	86.4	-	-	-	18.7



Tabular results

.:: Layer No: 1 ::.

Code: Puketoka **Start depth:** 0.00 (m), **End depth:** 6.00 (m)

Description: Puketoka Formation

Basic results

Total cone resistance: 1.15 ±0.28 MPa
Sleeve friction: 0.00 ±44.47 kPa
Ic: 0.00 ±2.72
σ_v': 40.38 ±30.29 kPa
SBT_n: 0
SBTn description: N/A
Schneider zone: N/A
Schneider desc.: N/A

Estimation results

Permeability: 4.76E-08 ±1.41E-07 m/s
N_{60}: 5.07 ±1.26 blows
Es: 0.00 ±0.00 MPa
Dr (%): 0.00 ±0.00
φ (degrees): 0.00 ±0.00 °
Unit weight: 17.13 ±0.66 kN/m³

Constrained Mod.: 8.80 ±2.19 MPa
Go: 28.38 ±7.90 MPa
Su: 82.45 ±17.89 kPa
Su ratio: 1.65 ±1.12
O.C.R.: 7.62 ±5.15

.:: Layer No: 2 ::.

Code: Residual ECBF **Start depth:** 6.00 (m), **End depth:** 7.80 (m)

Description: Residual ECBF

Basic results	Estimation results	
Total cone resistance: 1.59 ±0.22 MPa	Permeability: 8.39E-08 ±2.09E-08 m/s	Constrained Mod.: 11.78 ±1.72 MPa
Sleeve friction: 17.83 ±4.79 kPa	N_{60}: 6.55 ±0.78 blows	Go: 33.12 ±4.71 MPa
Ic: 2.64 ±0.04	Es: 0.00 ±0.00 MPa	Su: 132.99 ±16.41 kPa
σ_v': 98.36 ±3.50 kPa	Dr (%): 0.00 ±0.00	Su ratio: 1.07 ±0.13
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 4.93 ±0.58
SBTn description: Clay & silty clay	Unit weight: 16.48 ±0.36 kN/m³	
Schneider zone: Zone 1b		
Schneider desc.: Clays		

.:: Layer No: 3 ::.

Code: Transitional ECBF **Start depth:** 7.80 (m), **End depth:** 12.60 (m)

Description: Transitional ECBF

Basic results	Estimation results	
Total cone resistance: 5.03 ±3.44 MPa	Permeability: 5.93E-07 ±9.54E-07 m/s	Constrained Mod.: 38.72 ±27.36 MPa
Sleeve friction: 80.99 ±83.35 kPa	N_{60}: 17.23 ±9.45 blows	Go: 86.41 ±46.73 MPa
Ic: 2.36 ±0.16	Es: 81.88 ±28.93 MPa	Su: 0.00 ±0.00 kPa
σ_v': 124.24 ±12.29 kPa	Dr (%): 38.25 ±7.66	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 36.69 ±1.45 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 18.66 ±1.02 kN/m³	
Schneider zone: Zone 1b		
Schneider desc.: Clays		

Summary table of mean values

From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00 6.00	6.00	4.76E-08 (±1.41E-07)	5.1 (±1.3)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	8.8 (±2.2)	28.4 (±7.9)	82.5 (±17.9)	1.6 (±1.1)	7.6 (±5.2)	17.1 (±0.7)
6.00 7.80	1.80	8.39E-08 (±2.09E-08)	6.6 (±0.8)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	11.8 (±1.7)	33.1 (±4.7)	133.0 (±16.4)	1.1 (±0.1)	4.9 (±0.6)	16.5 (±0.4)
7.80 12.60	4.80	5.93E-07 (±9.54E-07)	17.2 (±9.5)	81.9 (±28.9)	38.3 (±7.7)	36.7 (±1.4)	38.7 (±27.4)	86.4 (±46.7)	0.0 (±0.0)	0.0 (±0.0)	0.0 (±0.0)	18.7 (±1.0)

Depth values presented in this table are measured from free ground surface

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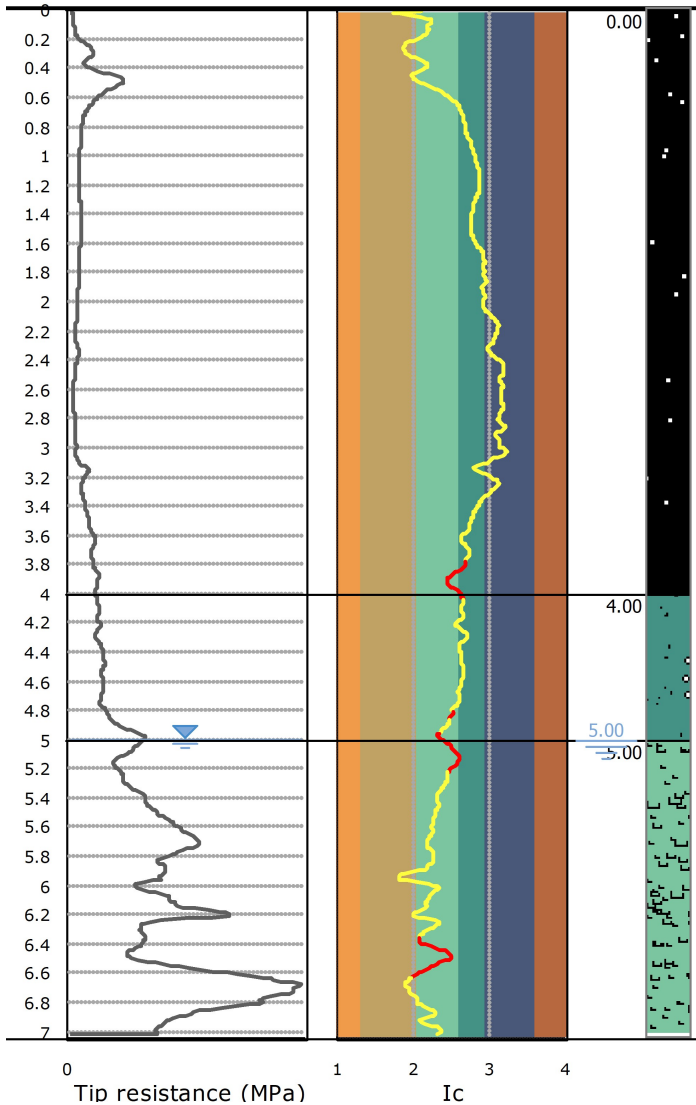
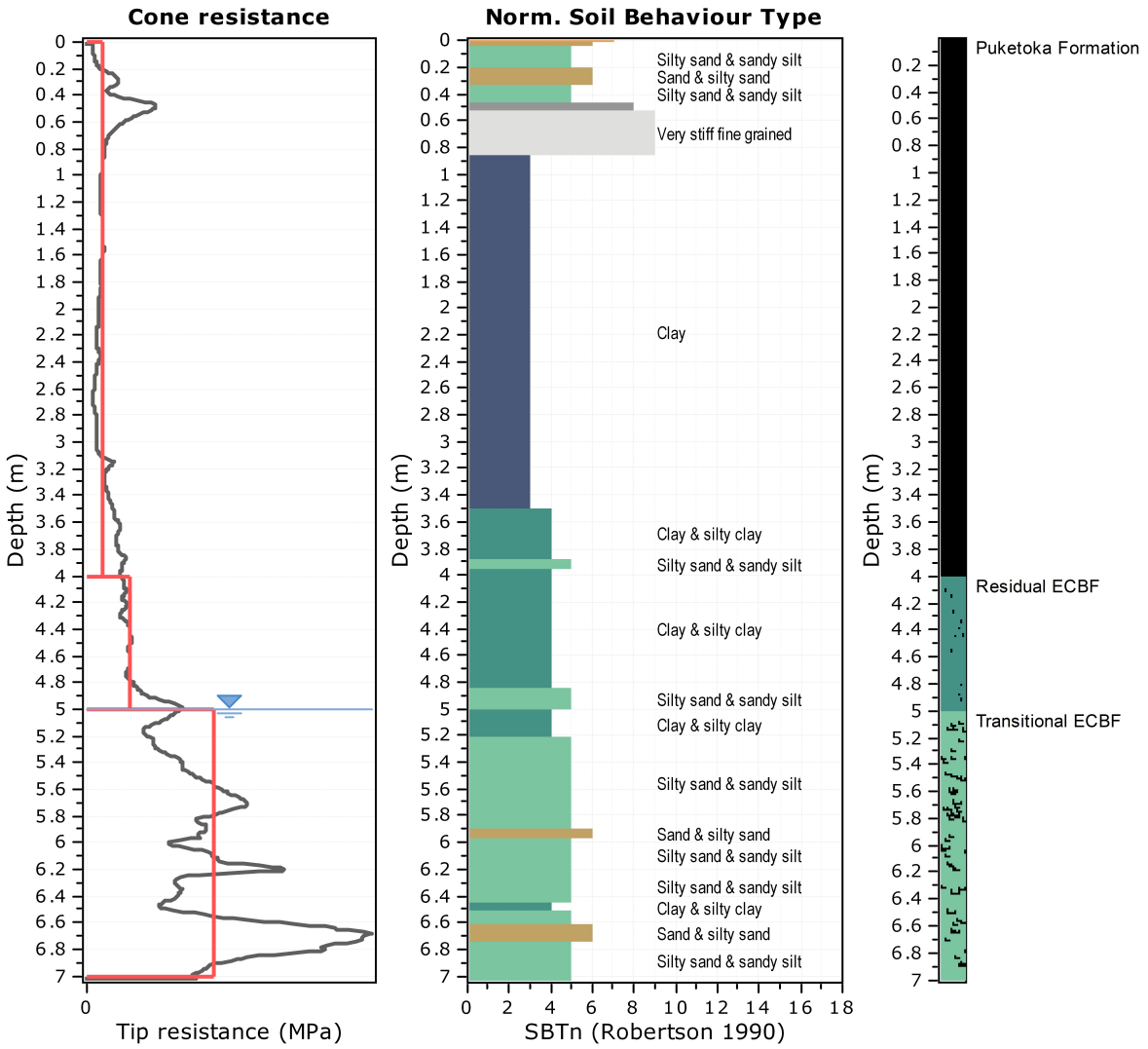
CPT: CPT04
Total depth: 7.02 m, Date: 29/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location: 100 Hobsonville Road



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Puketoka Formation	1.0	2.97E-8	4.6	-	-	-	7.7	27.6	57.4	1.8	8.5	17.5
4.00	Residual ECBF	2.8	1.07E-7	11.1	-	-	-	21.7	65.6	181.4	2.3	10.5	18.5
5.00	Transitional ECBF	8.3	1.93E-6	25.5	94.7	48.6	39.0	65.6	125.1	-	-	-	19.7



Tabular results

.:: Layer No: 1 ::.

Code: Puketoka **Start depth:** 0.00 (m), **End depth:** 4.00 (m)

Description: Puketoka Formation

Basic results

Total cone resistance: 1.00 ±0.74 MPa
Sleeve friction: 0.00 ±71.31 kPa
Ic: 0.00 ±2.81
σ_v': 24.20 ±21.27 kPa
SBT_n: 0
SBT description: N/A
Schneider zone: N/A
Schneider desc.: N/A

Estimation results

Permeability: 2.97E-08 ±4.09E-06 m/s
N_{60}: 4.56 ±2.15 blows
Es: 0.00 ±0.00 MPa
Dr (%): 0.00 ±0.00
φ (degrees): 0.00 ±0.00 °
Unit weight: 17.54 ±0.93 kN/m³

Constrained Mod.: 7.69 ±5.97 MPa
Go: 27.57 ±12.57 MPa
Su: 57.38 ±35.12 kPa
Su ratio: 1.83 ±2.14
O.C.R.: 8.46 ±9.87

.:: Layer No: 2 ::.

Code: Residual ECBF **Start depth:** 4.00 (m), **End depth:** 5.00 (m)

Description: Residual ECBF

Basic results	Estimation results	
Total cone resistance: 2.79 ±0.67 MPa	Permeability: 1.07E-07 ±1.25E-07 m/s	Constrained Mod.: 21.69 ±5.33 MPa
Sleeve friction: 87.99 ±16.06 kPa	N_{60}: 11.12 ±1.95 blows	Go: 65.62 ±8.96 MPa
Ic: 2.60 ±0.08	Es: 0.00 ±0.00 MPa	Su: 181.40 ±16.63 kPa
σ_v': 79.08 ±4.68 kPa	Dr (%): 0.00 ±0.00	Su ratio: 2.28 ±0.15
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 10.53 ±0.67
SBTn description: Clay & silty clay	Unit weight: 18.53 ±0.25 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

.:: Layer No: 3 ::.

Code: Transitional ECBF **Start depth:** 5.00 (m), **End depth:** 7.00 (m)

Description: Transitional ECBF

Basic results	Estimation results	
Total cone resistance: 8.32 ±3.60 MPa	Permeability: 1.93E-06 ±5.34E-06 m/s	Constrained Mod.: 65.64 ±28.75 MPa
Sleeve friction: 169.94 ±91.42 kPa	N_{60}: 25.48 ±8.67 blows	Go: 125.10 ±40.48 MPa
Ic: 2.19 ±0.15	Es: 94.69 ±26.86 MPa	Su: 0.00 ±0.00 kPa
σ_v': 98.87 ±5.13 kPa	Dr (%): 48.57 ±8.84	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 39.01 ±1.72 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 19.71 ±0.74 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

Summary table of mean values

From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	4.00	2.97E-08	4.6	0.0	0.0	0.0	7.7	27.6	57.4	1.8	8.5	17.5
4.00		(±4.09E-06)	(±2.1)	(±0.0)	(±0.0)	(±0.0)	(±6.0)	(±12.6)	(±35.1)	(±2.1)	(±9.9)	(±0.9)
4.00	1.00	1.07E-07	11.1	0.0	0.0	0.0	21.7	65.6	181.4	2.3	10.5	18.5
5.00		(±1.25E-07)	(±1.9)	(±0.0)	(±0.0)	(±0.0)	(±5.3)	(±9.0)	(±16.6)	(±0.1)	(±0.7)	(±0.2)
5.00	2.00	1.93E-06	25.5	94.7	48.6	39.0	65.6	125.1	0.0	0.0	0.0	19.7
7.00		(±5.34E-06)	(±8.7)	(±26.9)	(±8.8)	(±1.7)	(±28.7)	(±40.5)	(±0.0)	(±0.0)	(±0.0)	(±0.7)

Depth values presented in this table are measured from free ground surface

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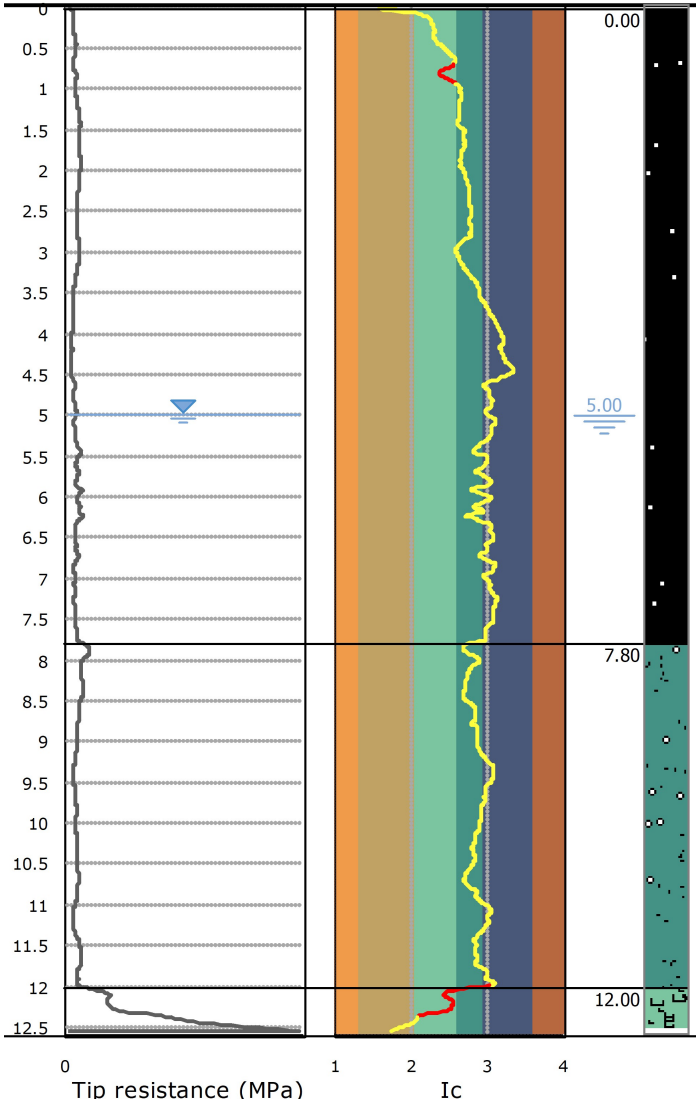
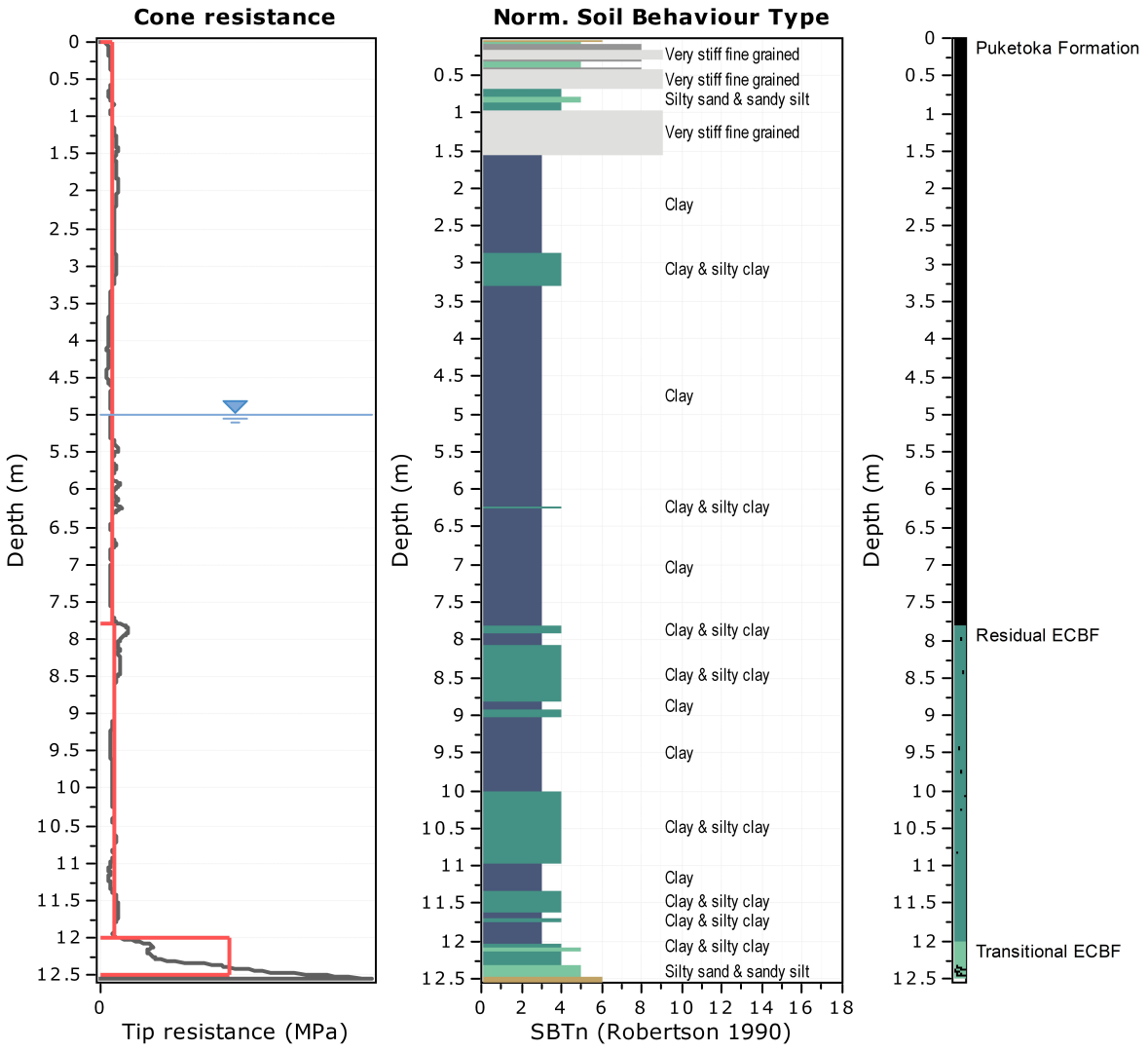
CPT: CPT05
Total depth: 12.55 m, Date: 29/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location: 100 Hobsonville Road



Depth (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Puketoka Formation	1.5	-	7.2	-	-	-	11.6	47.1	93.8	1.7	7.7	18.2
7.80	Residual ECBF	1.8	1.64E-8	8.6	-	-	-	12.8	51.5	122.2	0.9	4.1	17.4
12.00	Transitional ECBF	17.1	3.72E-6	49.3	189.3	66.3	41.7	134.4	241.5	-	-	-	20.9



Tabular results

.:: Layer No: 1 ::.

Code: Puketoka **Start depth:** 0.00 (m), **End depth:** 7.80 (m)

Description: Puketoka Formation

Basic results

Total cone resistance: 1.53 ±0.40 MPa
Sleeve friction: 0.00 ±88.54 kPa
Ic: 0.00 ±2.87
σ_v': 51.73 ±37.67 kPa
SBT_n: 0
SBTn description: N/A
Schneider zone: Zone 3
Schneider desc.: Transitional soils

Estimation results

Permeability: 0.00E+00 ±6.38E-06 m/s
N_{60}: 7.22 ±1.65 blows
Es: 0.00 ±0.00 MPa
Dr (%): 0.00 ±0.00
φ (degrees): 0.00 ±0.00 °
Unit weight: 18.15 ±0.56 kN/m³

Constrained Mod.: 11.60 ±3.30 MPa
Go: 47.06 ±12.44 MPa
Su: 93.79 ±26.92 kPa
Su ratio: 1.67 ±1.95
O.C.R.: 7.73 ±9.00

.:: Layer No: 2 ::.

Code: Residual ECBF **Start depth:** 7.80 (m), **End depth:** 12.00 (m)

Description: Residual ECBF

Basic results	Estimation results	
Total cone resistance: 1.80 ±0.52 MPa	Permeability: 1.64E-08 ±1.67E-08 m/s	Constrained Mod.: 12.76 ±4.33 MPa
Sleeve friction: 39.37 ±28.60 kPa	N_{60}: 8.58 ±1.99 blows	Go: 51.46 ±14.06 MPa
Ic: 2.87 ±0.11	Es: 0.00 ±0.00 MPa	Su: 122.18 ±35.32 kPa
σ_v': 130.05 ±9.04 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.89 ±0.36
SBT_n: 4	φ (degrees): 0.00 ±0.00 °	O.C.R.: 4.10 ±1.64
SBTn description: Clay & silty clay	Unit weight: 17.44 ±0.66 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

.:: Layer No: 3 ::.

Code: Transitional ECBF **Start depth:** 12.00 (m), **End depth:** 12.50 (m)

Description: Transitional ECBF

Basic results	Estimation results	
Total cone resistance: 17.12 ±6.89 MPa	Permeability: 3.72E-06 ±5.00E-06 m/s	Constrained Mod.: 134.38 ±55.39 MPa
Sleeve friction: 386.43 ±123.89 kPa	N_{60}: 49.28 ±15.50 blows	Go: 241.47 ±63.50 MPa
Ic: 2.08 ±0.29	Es: 189.25 ±17.62 MPa	Su: 0.00 ±0.00 kPa
σ_v': 150.16 ±1.37 kPa	Dr (%): 66.31 ±5.99	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 41.74 ±0.94 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 20.93 ±0.84 kN/m³	
Schneider zone: N/A		
Schneider desc.: N/A		

Summary table of mean values

From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	7.80	0.00E+00	7.2	0.0	0.0	0.0	11.6	47.1	93.8	1.7	7.7	18.2
7.80		(±6.38E-06)	(±1.7)	(±0.0)	(±0.0)	(±0.0)	(±3.3)	(±12.4)	(±26.9)	(±1.9)	(±9.0)	(±0.6)
7.80	4.20	1.64E-08	8.6	0.0	0.0	0.0	12.8	51.5	122.2	0.9	4.1	17.4
12.00		(±1.67E-08)	(±2.0)	(±0.0)	(±0.0)	(±0.0)	(±4.3)	(±14.1)	(±35.3)	(±0.4)	(±1.6)	(±0.7)
12.00	0.50	3.72E-06	49.3	189.3	66.3	41.7	134.4	241.5	0.0	0.0	0.0	20.9
12.50		(±5.00E-06)	(±15.5)	(±17.6)	(±6.0)	(±0.9)	(±55.4)	(±63.5)	(±0.0)	(±0.0)	(±0.0)	(±0.8)

Depth values presented in this table are measured from free ground surface

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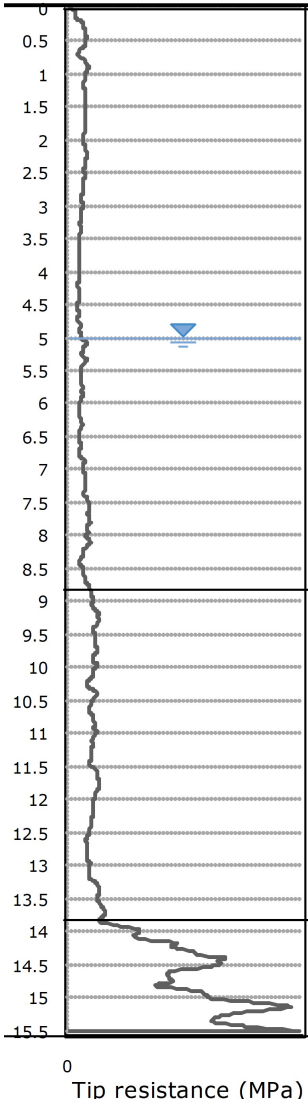
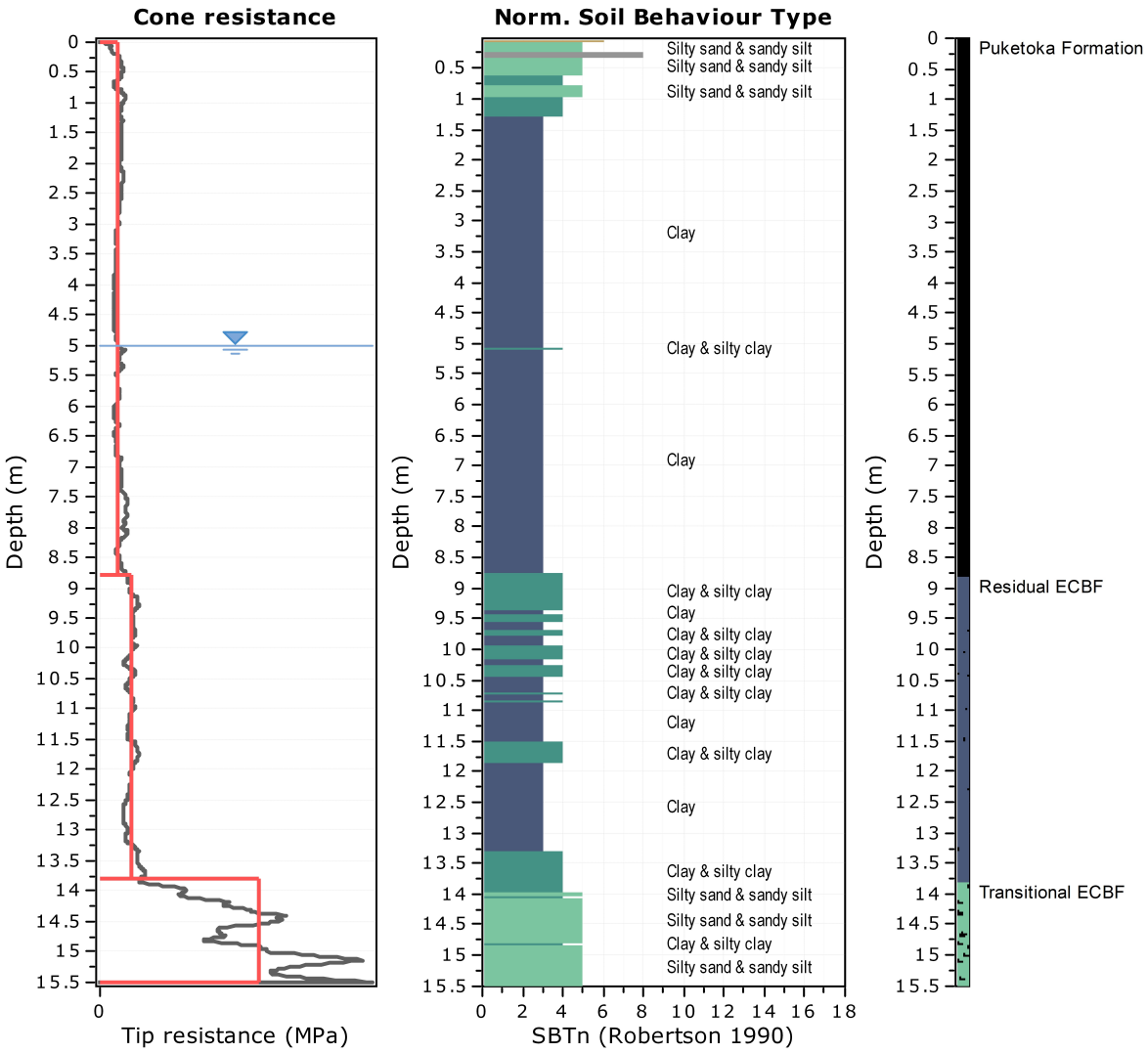
CPT: CPT06
Total depth: 15.51 m, Date: 29/07/2024
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

Project:
Location: 100 Hobsonville Road



Depth (m) Elevation: 0.00 (m)	Description	qt (MPa)	Ksbt (m/s)	N60	Es (MPa)	Dr	Phi (°)	M (MPa)	Go (MPa)	Su (kPa)	Su ratio	OCR	Gamma (kN/m³)
0.00	Puketoka Formation	1.2	-	5.9	-	-	-	8.9	38.7	73.5	1.1	5.2	17.6
8.80	Residual ECBF	2.0	1.47E-8	9.7	-	-	-	14.6	60.9	132.7	1.0	4.4	17.8
13.80	Transitional ECBF	10.3	1.27E-6	32.7	129.6	45.3	38.2	80.0	166.9	-	-	-	20.0



Tabular results

.:: Layer No: 1 ::.

Code: Puketoka **Start depth:** 0.00 (m), **End depth:** 8.80 (m)

Description: Puketoka Formation

Basic results

Total cone resistance: 1.20 ±0.25 MPa
Sleeve friction: 0.00 ±62.46 kPa
Ic: 0.00 ±2.94
σ_v': 57.76 ±36.94 kPa
SBT_n: 0
SBT description: N/A
Schneider zone: Zone 3
Schneider desc.: Transitional soils

Estimation results

Permeability: 0.00E+00 ±3.84E-06 m/s
N_{60}: 5.87 ±1.22 blows
Es: 0.00 ±0.00 MPa
Dr (%): 0.00 ±0.00
φ (degrees): 0.00 ±0.00 °
Unit weight: 17.62 ±0.57 kN/m³
Constrained Mod.: 8.92 ±1.99 MPa
Go: 38.66 ±9.17 MPa
Su: 73.46 ±16.45 kPa
Su ratio: 1.12 ±0.91
O.C.R.: 5.17 ±4.21

.:: Layer No: 2 ::.

Code: Residual ECBF **Start depth:** 8.80 (m), **End depth:** 13.80 (m)

Description: Residual ECBF

Basic results	Estimation results	
Total cone resistance: 2.03 ±0.31 MPa	Permeability: 1.47E-08 ±9.70E-09 m/s	Constrained Mod.: 14.61 ±2.50 MPa
Sleeve friction: 53.55 ±10.15 kPa	N_{60}: 9.72 ±1.15 blows	Go: 60.92 ±6.94 MPa
Ic: 2.89 ±0.09	Es: 0.00 ±0.00 MPa	Su: 132.66 ±24.08 kPa
σ_v': 137.16 ±11.62 kPa	Dr (%): 0.00 ±0.00	Su ratio: 0.95 ±0.19
SBT_n: 3	φ (degrees): 0.00 ±0.00 °	O.C.R.: 4.40 ±0.86
SBTn description: Clay	Unit weight: 17.84 ±0.26 kN/m³	
Schneider zone: Zone 1a		
Schneider desc.: Silts and low Ir clays		

.:: Layer No: 3 ::.

Code: Transitional ECBF **Start depth:** 13.80 (m), **End depth:** 15.50 (m)

Description: Transitional ECBF

Basic results	Estimation results	
Total cone resistance: 10.28 ±3.17 MPa	Permeability: 1.27E-06 ±9.36E-07 m/s	Constrained Mod.: 79.96 ±25.39 MPa
Sleeve friction: 204.66 ±76.85 kPa	N_{60}: 32.67 ±8.29 blows	Go: 166.87 ±39.56 MPa
Ic: 2.25 ±0.14	Es: 129.55 ±21.08 MPa	Su: 0.00 ±0.00 kPa
σ_v': 167.42 ±4.60 kPa	Dr (%): 45.29 ±5.15	Su ratio: 0.00 ±0.00
SBT_n: 5	φ (degrees): 38.18 ±0.95 °	O.C.R.: 0.00 ±0.00
SBTn description: Silty sand & sandy silt	Unit weight: 20.00 ±0.62 kN/m³	
Schneider zone: Zone 1a		
Schneider desc.: Silts and low Ir clays		

Summary table of mean values

From depth To depth (m)	Thickness (m)	Permeability (m/s)	SPT_{N60} (blows/30cm)	E_s (MPa)	D_r (%)	Friction angle	Constrained modulus, M (MPa)	Shear modulus, G_O (MPa)	Undrained strength, S_U (kPa)	Undrained strength ratio	OCR	Unit weight (kN/m³)
0.00	8.80	0.00E+00	5.9	0.0	0.0	0.0	8.9	38.7	73.5	1.1	5.2	17.6
8.80		(±3.84E-06)	(±1.2)	(±0.0)	(±0.0)	(±0.0)	(±2.0)	(±9.2)	(±16.5)	(±0.9)	(±4.2)	(±0.6)
8.80	5.00	1.47E-08	9.7	0.0	0.0	0.0	14.6	60.9	132.7	1.0	4.4	17.8
13.80		(±9.70E-09)	(±1.1)	(±0.0)	(±0.0)	(±0.0)	(±2.5)	(±6.9)	(±24.1)	(±0.2)	(±0.9)	(±0.3)
13.80	1.70	1.27E-06	32.7	129.6	45.3	38.2	80.0	166.9	0.0	0.0	0.0	20.0
15.50		(±9.36E-07)	(±8.3)	(±21.1)	(±5.1)	(±0.9)	(±25.4)	(±39.6)	(±0.0)	(±0.0)	(±0.0)	(±0.6)

Depth values presented in this table are measured from free ground surface

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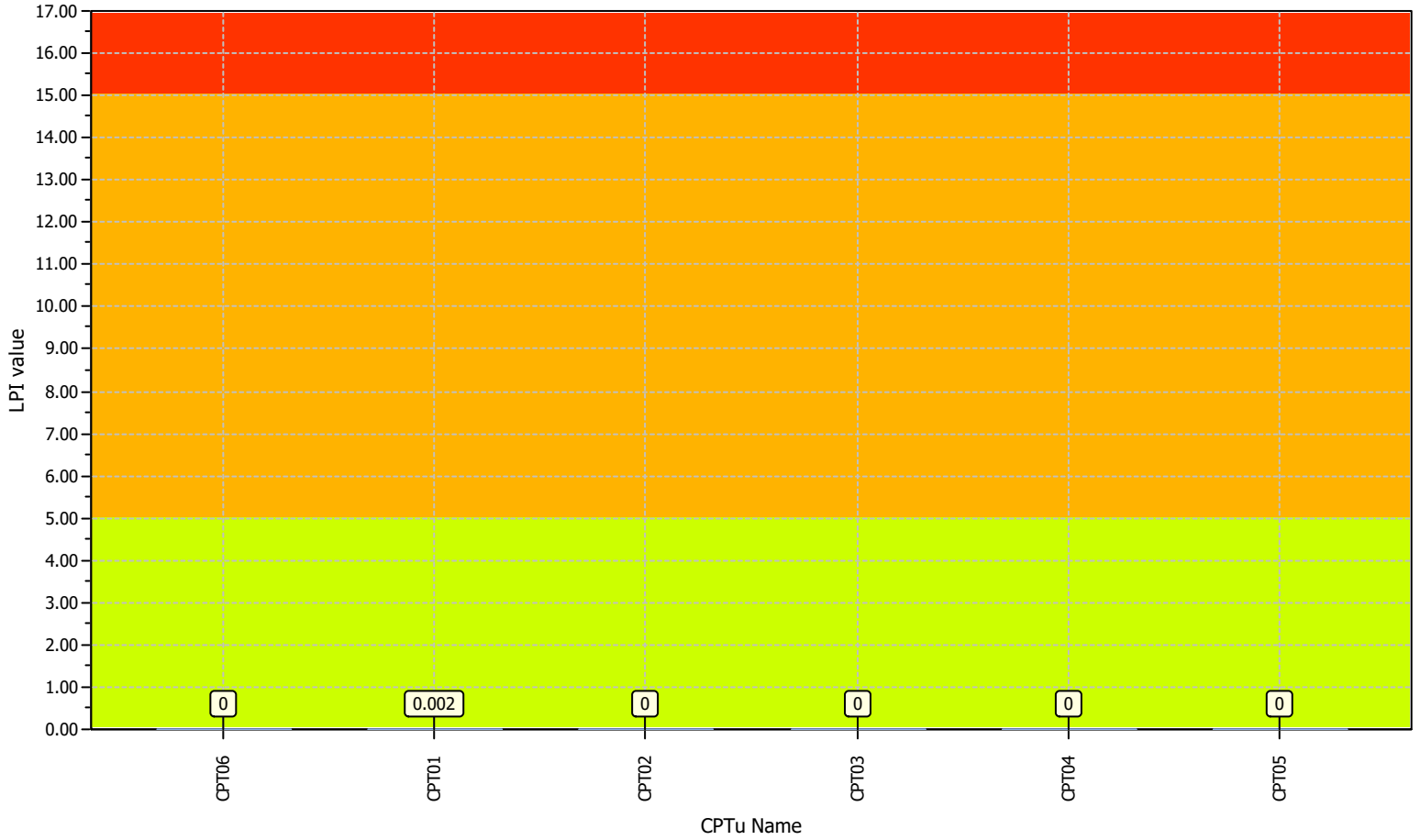
Project title :

Location : 100 Hobsonville Road

Overall Liquefaction Potential Index report



LPI color scheme

- Very high risk
- High risk
- Low risk

Basic statistics

Total CPT number: 6
100% low risk
0% high risk
0% very high risk

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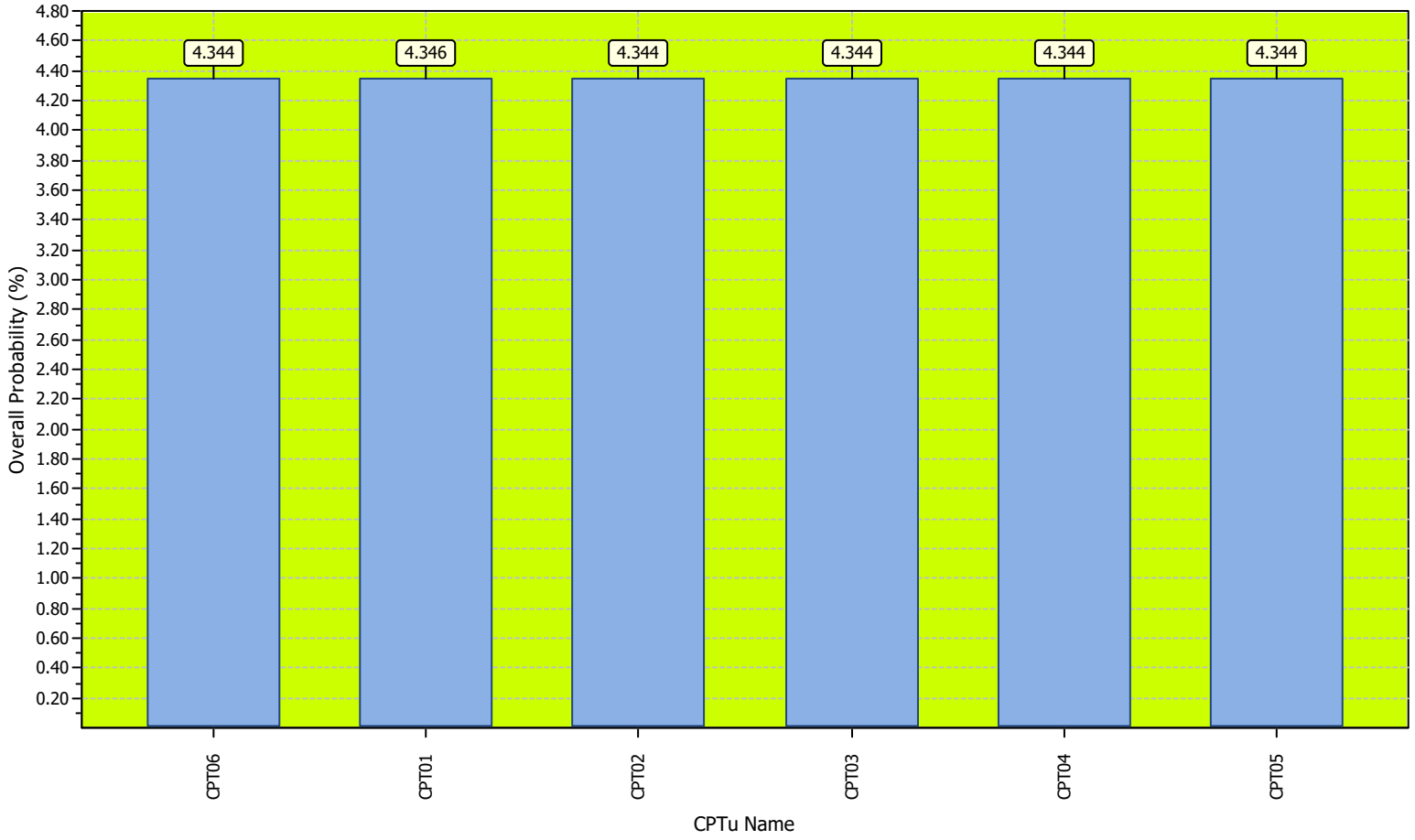
Project title :

Location : 100 Hobsonville Road

Overall Probability for Liquefaction report



Probability color scheme

- Very High Probability
- High Probability
- Low Probability

Basic statistics

Total CPT number: 6
100% low probability
0% high probability
0% very high probability

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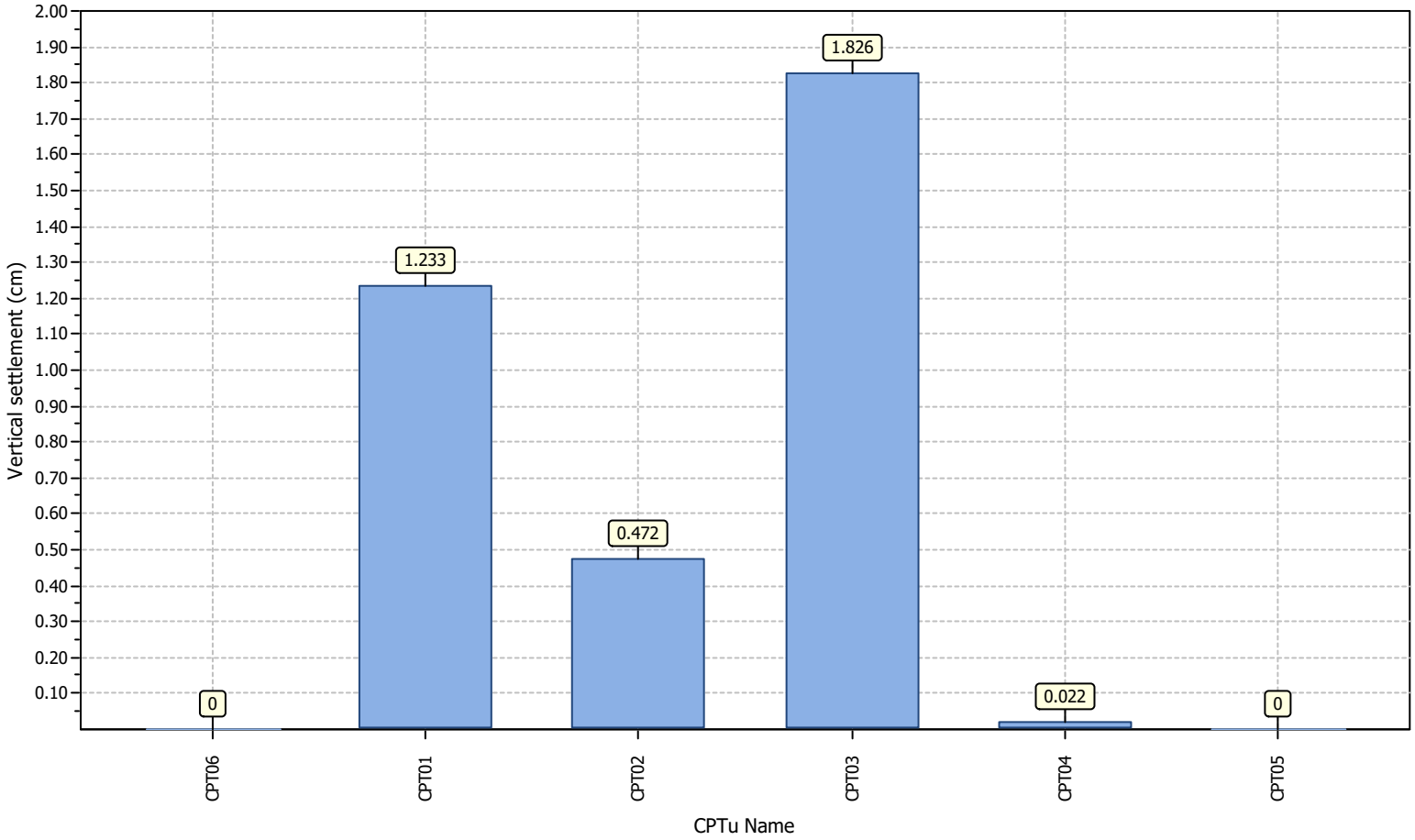
Project title :

Location : 100 Hobsonville Road

Overall vertical settlements report



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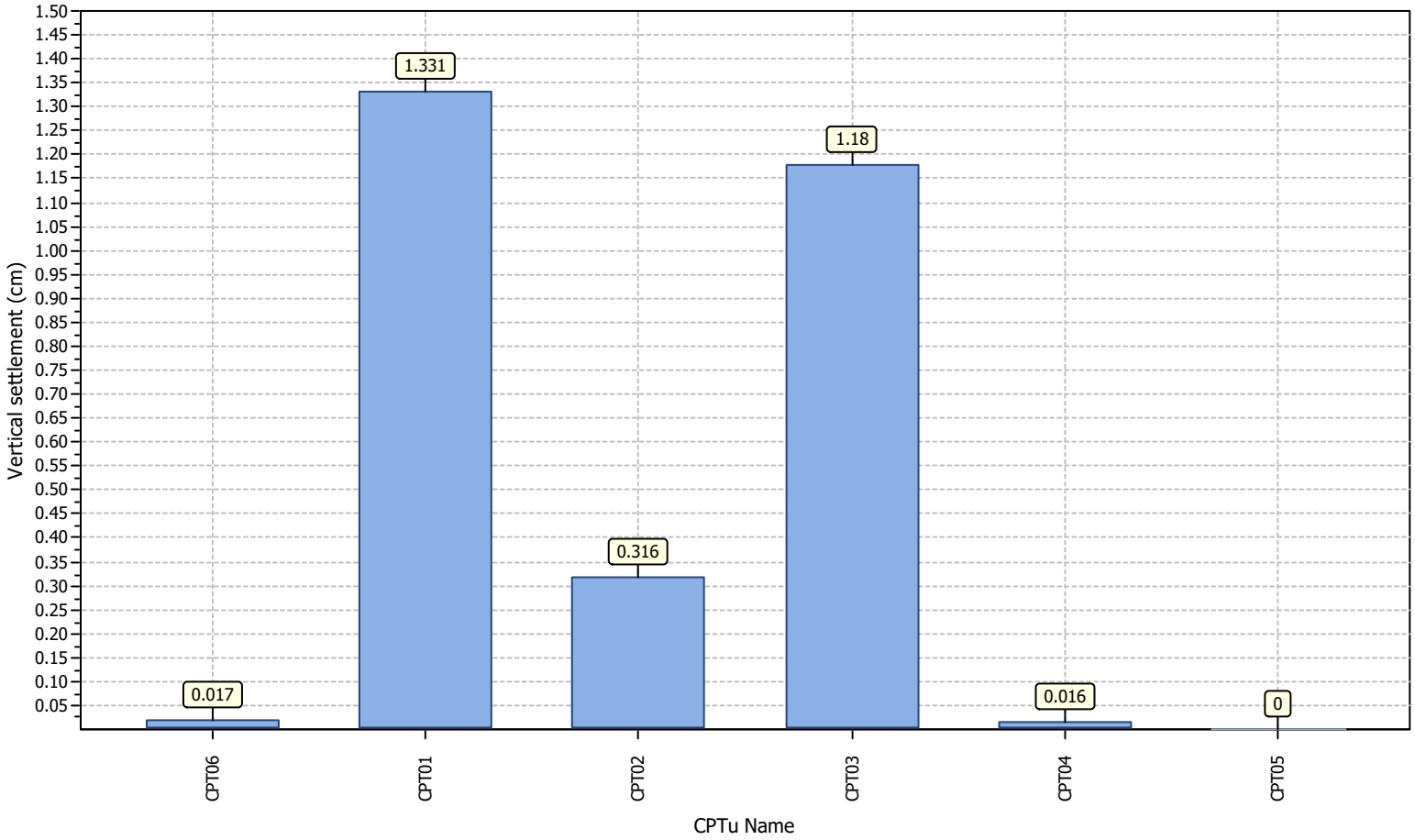
Project title :

Location : 100 Hobsonville Road

Overall vertical settlements report



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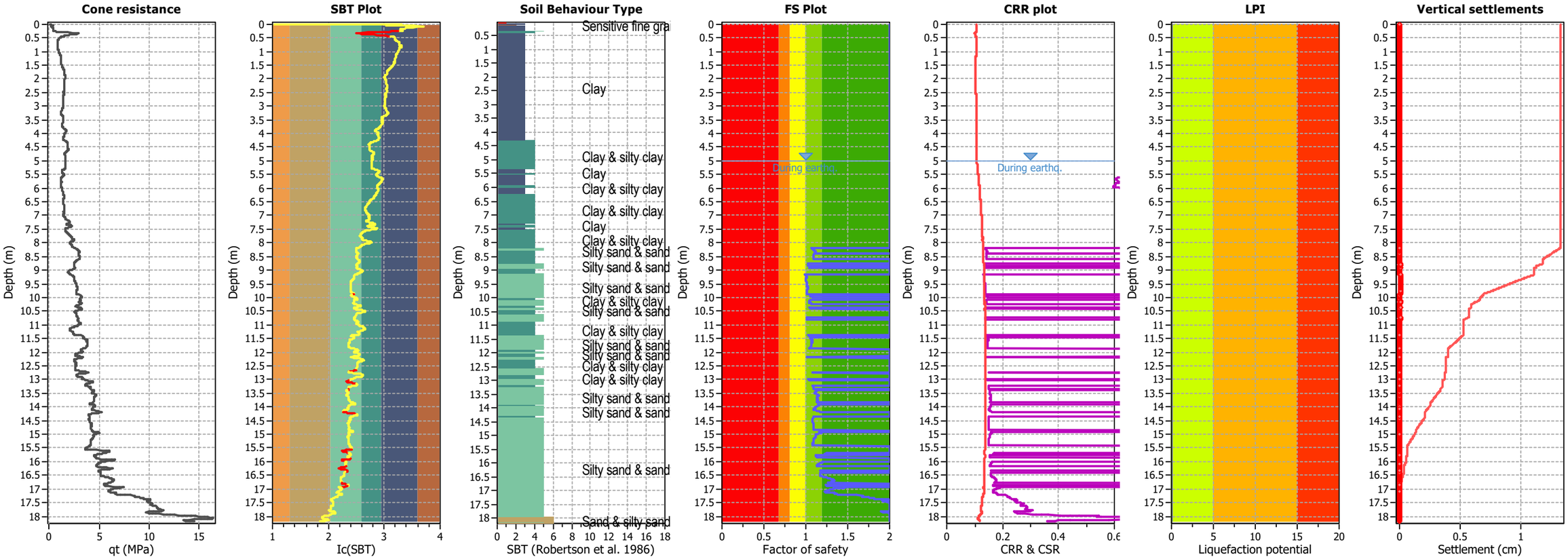
Project:
Location: 100 Hobsonville Road

CPT: CPT01
Total depth: 18.18 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_o applied:	Yes		

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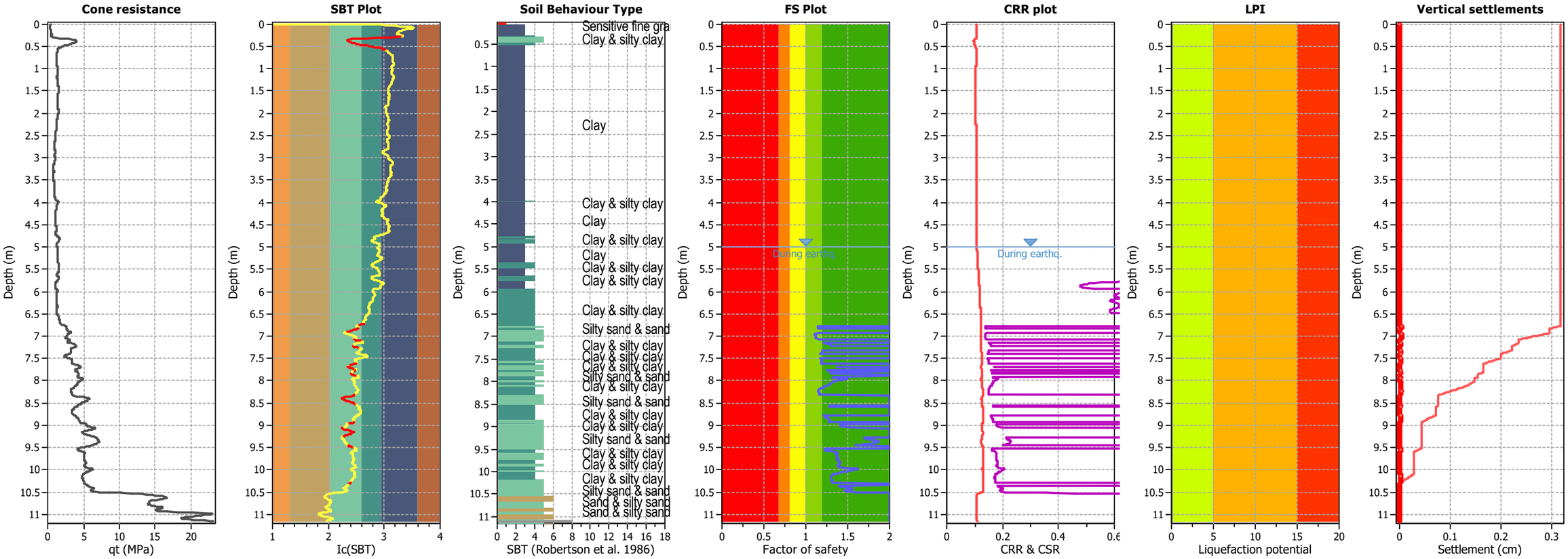
Project:
Location: 100 Hobsonville Road

CPT: CPT02
Total depth: 11.15 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_o applied:	Yes		

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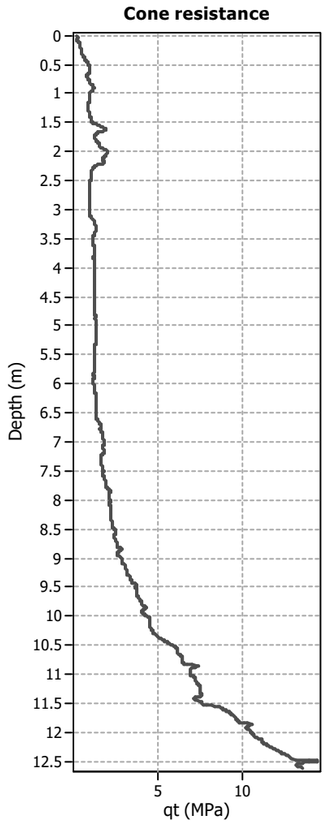
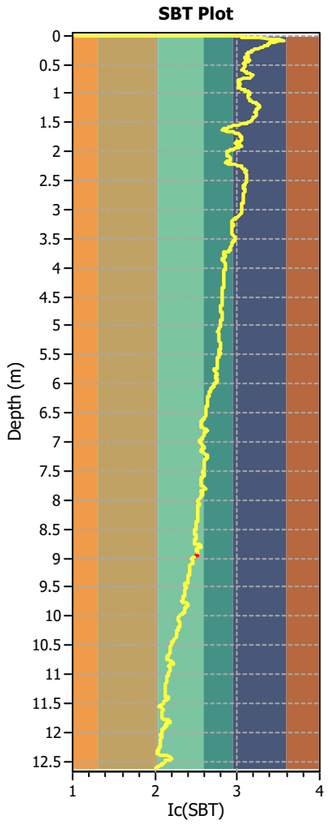
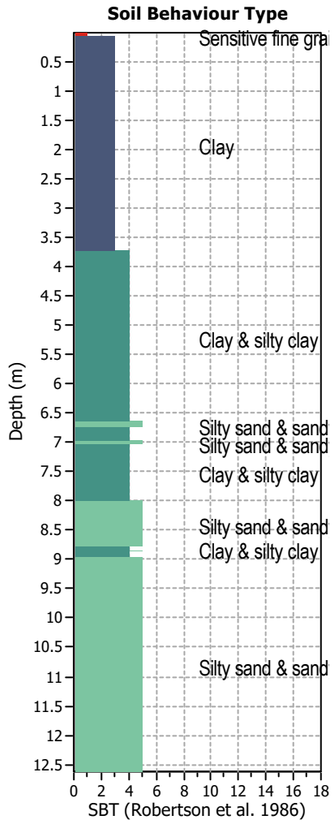
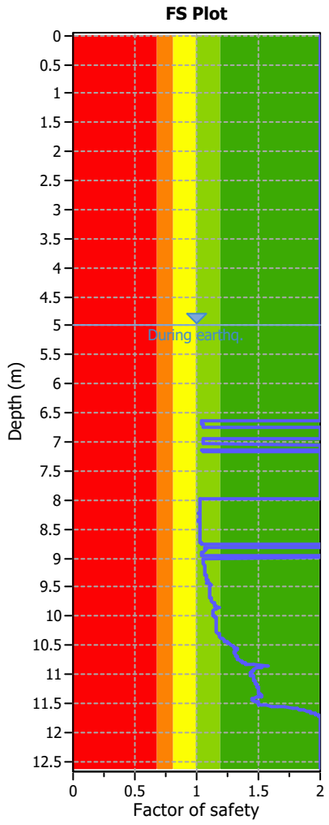
Project:
Location: 100 Hobsonville Road

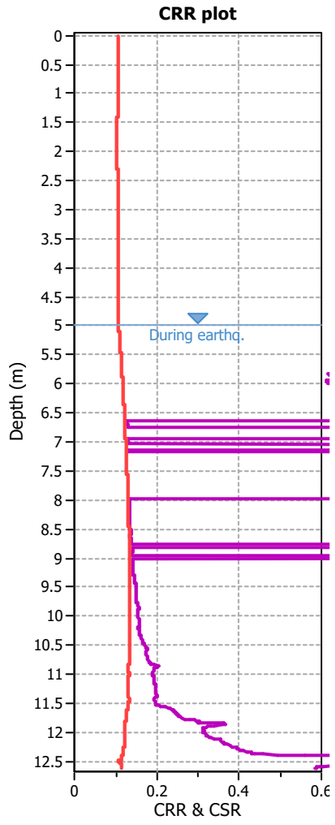
CPT: CPT03
Total depth: 12.62 m

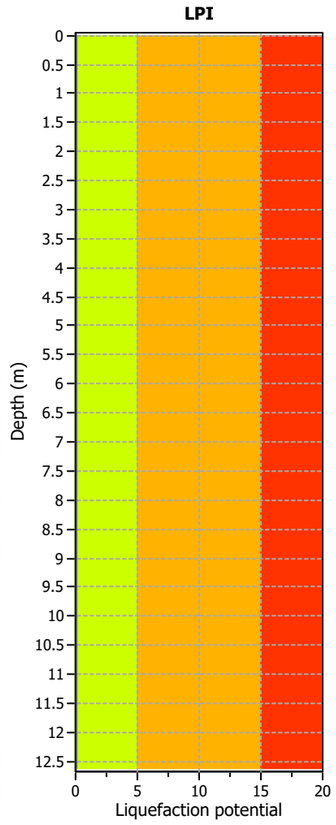


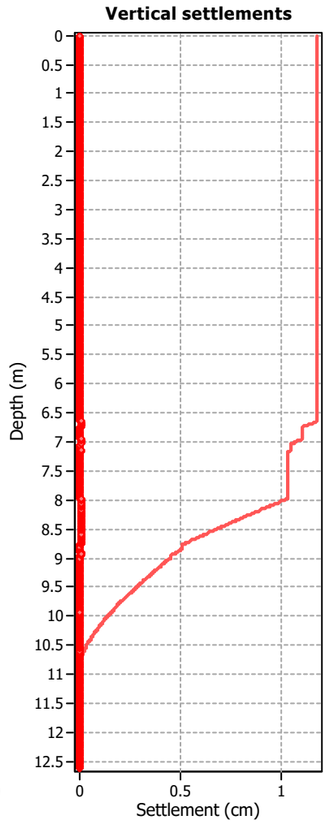












Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_o applied:	Yes		

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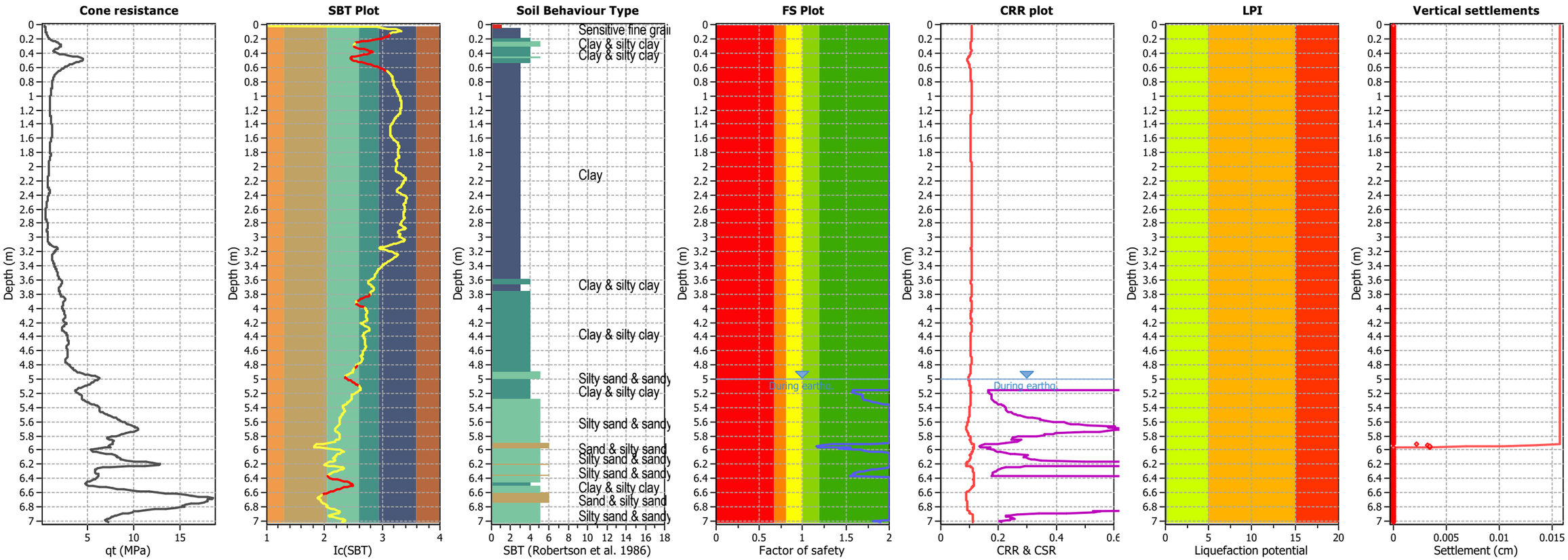
Project:

Location: 100 Hobsonville Road

CPT: CPT04

Total depth: 7.02 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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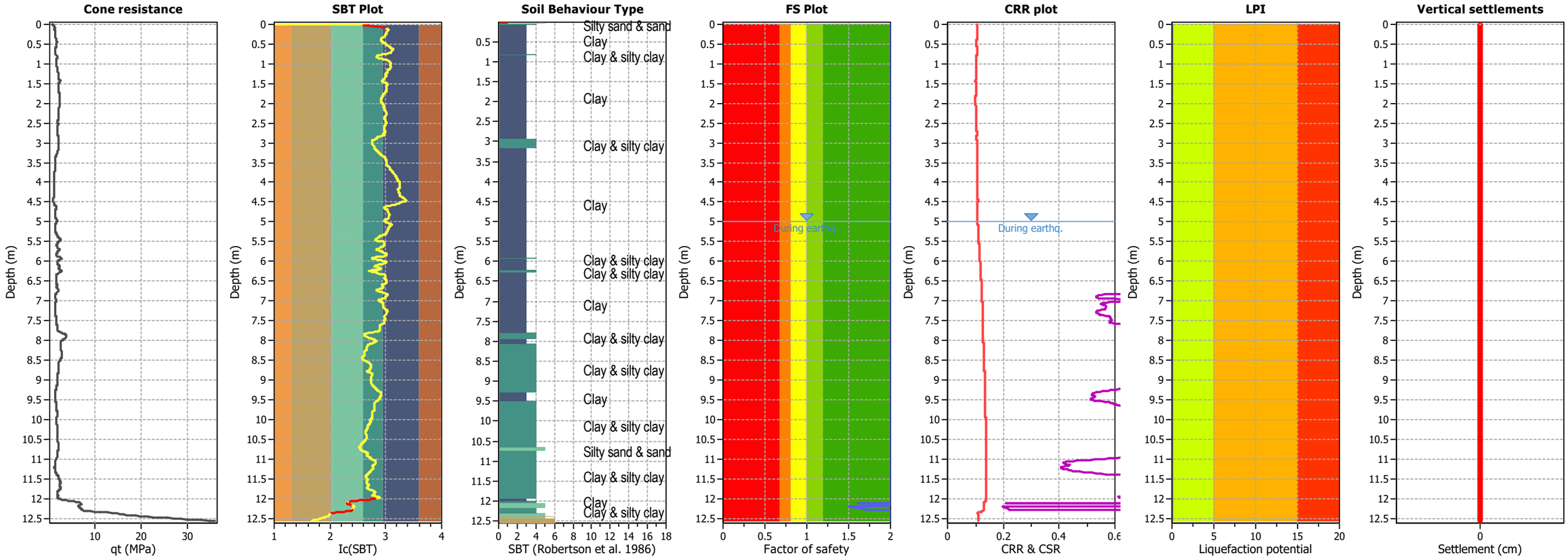
Project:

Location: 100 Hobsonville Road

CPT: CPT05

Total depth: 12.55 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	20.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based

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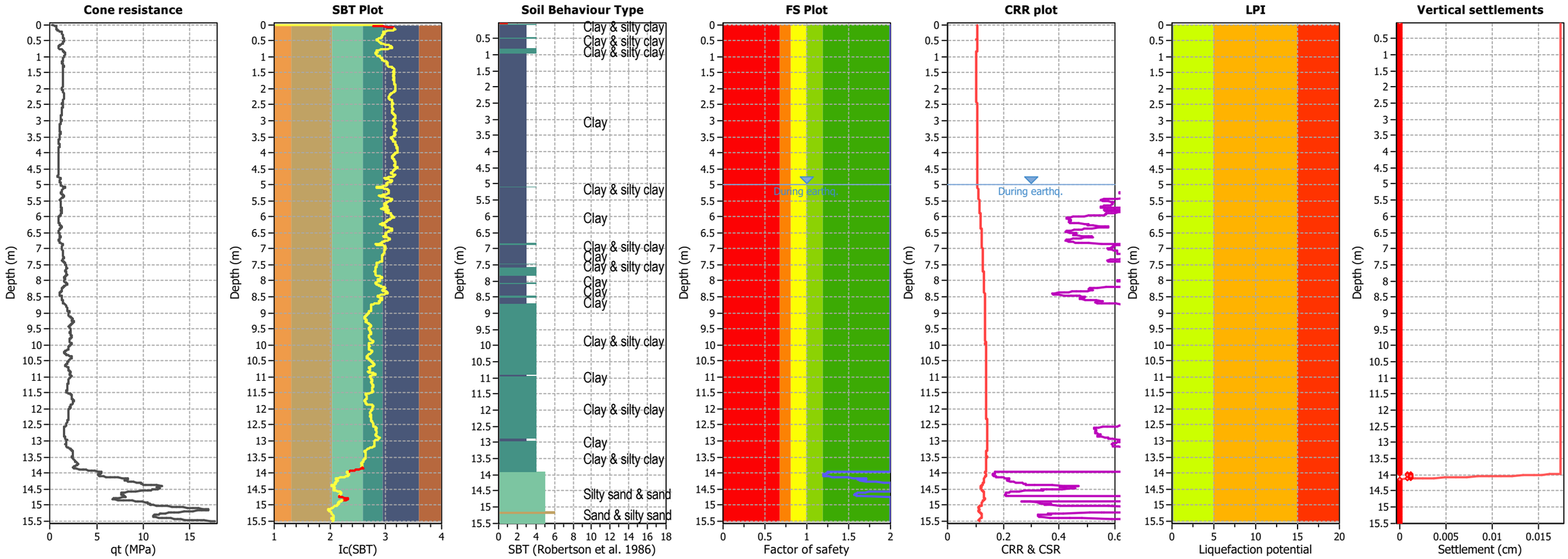
Project:

Location: 100 Hobsonville Road

CPT: CPT06

Total depth: 15.51 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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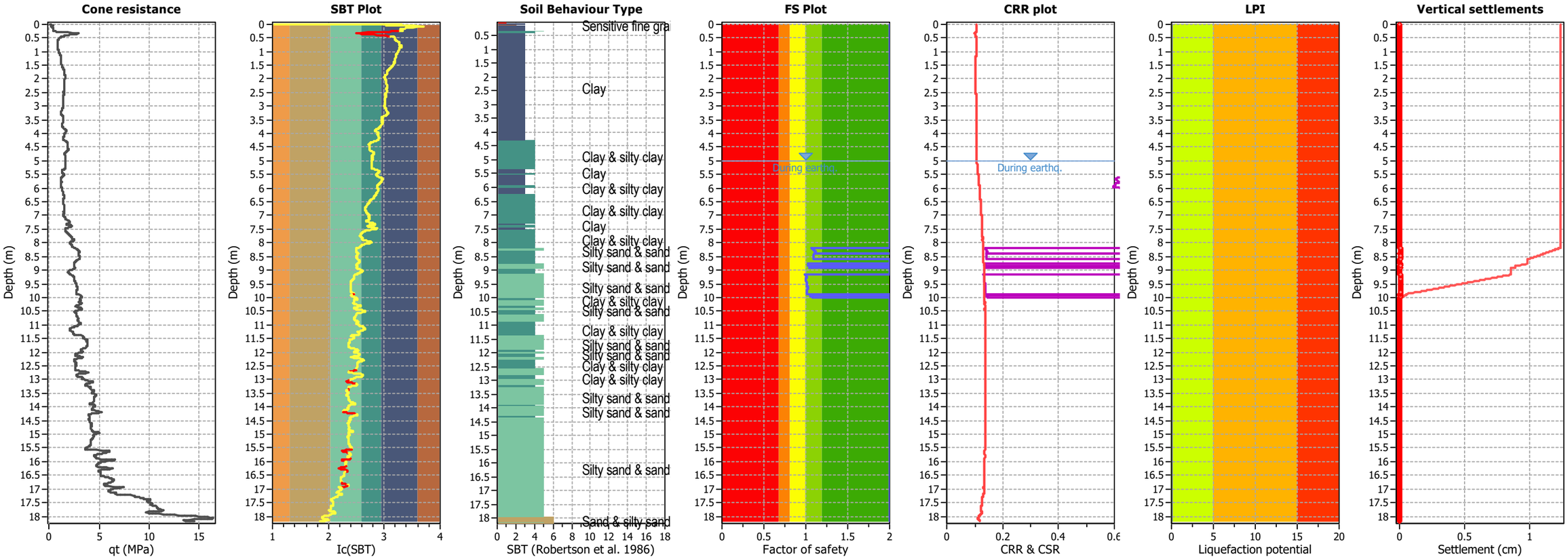
Project:
Location: 100 Hobsonville Road

CPT: CPT01
Total depth: 18.18 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_o applied:	Yes		

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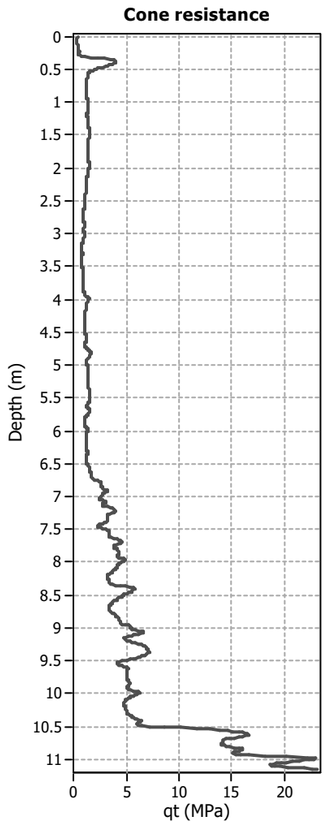
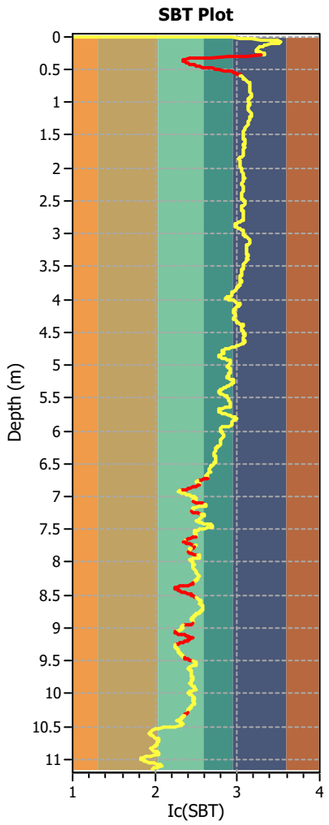
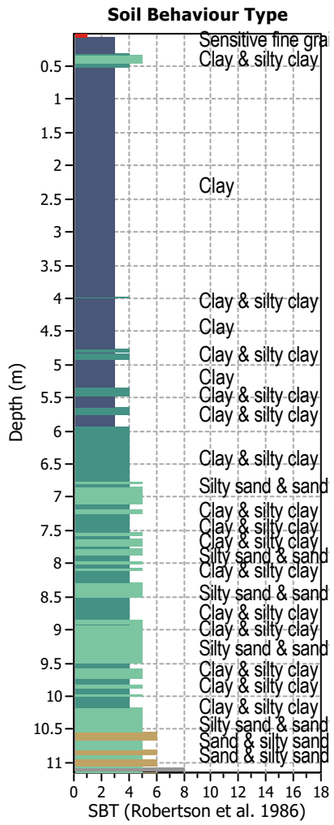
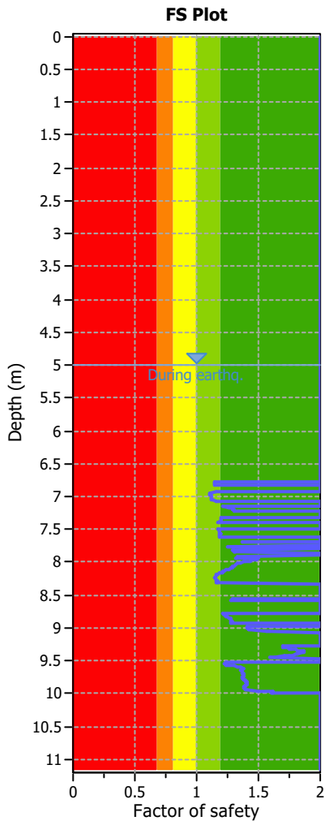
Project:
Location: 100 Hobsonville Road

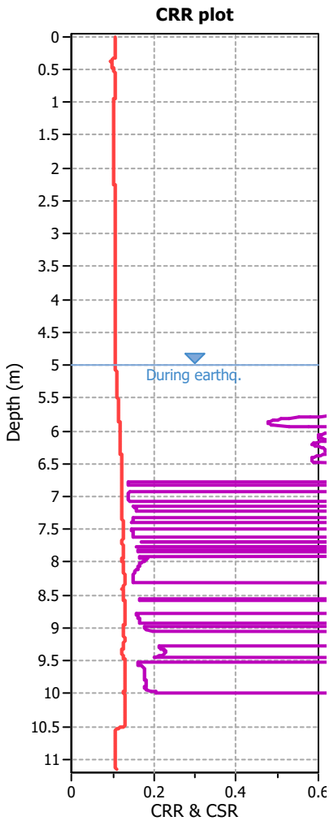
CPT: CPT02
Total depth: 11.15 m

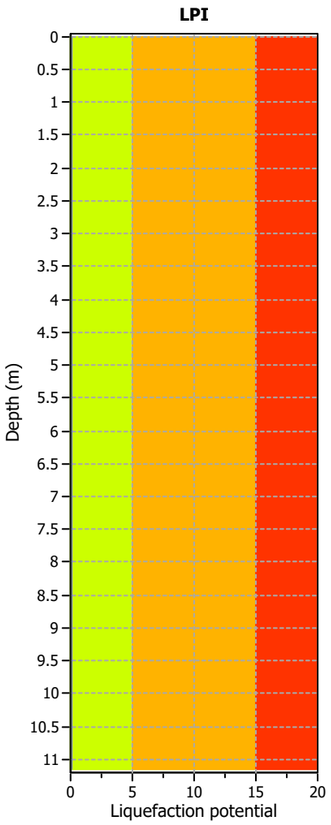


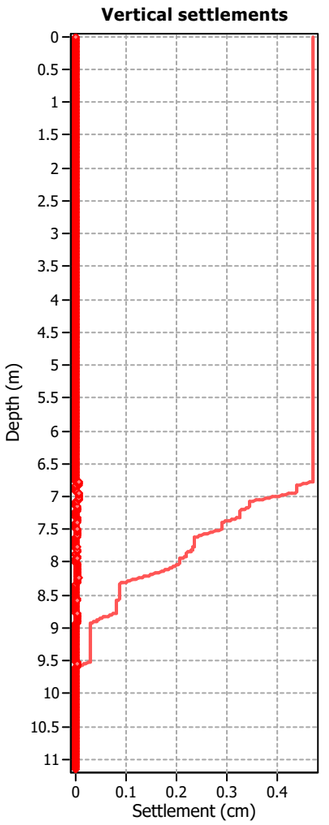












Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_o applied:	Yes		

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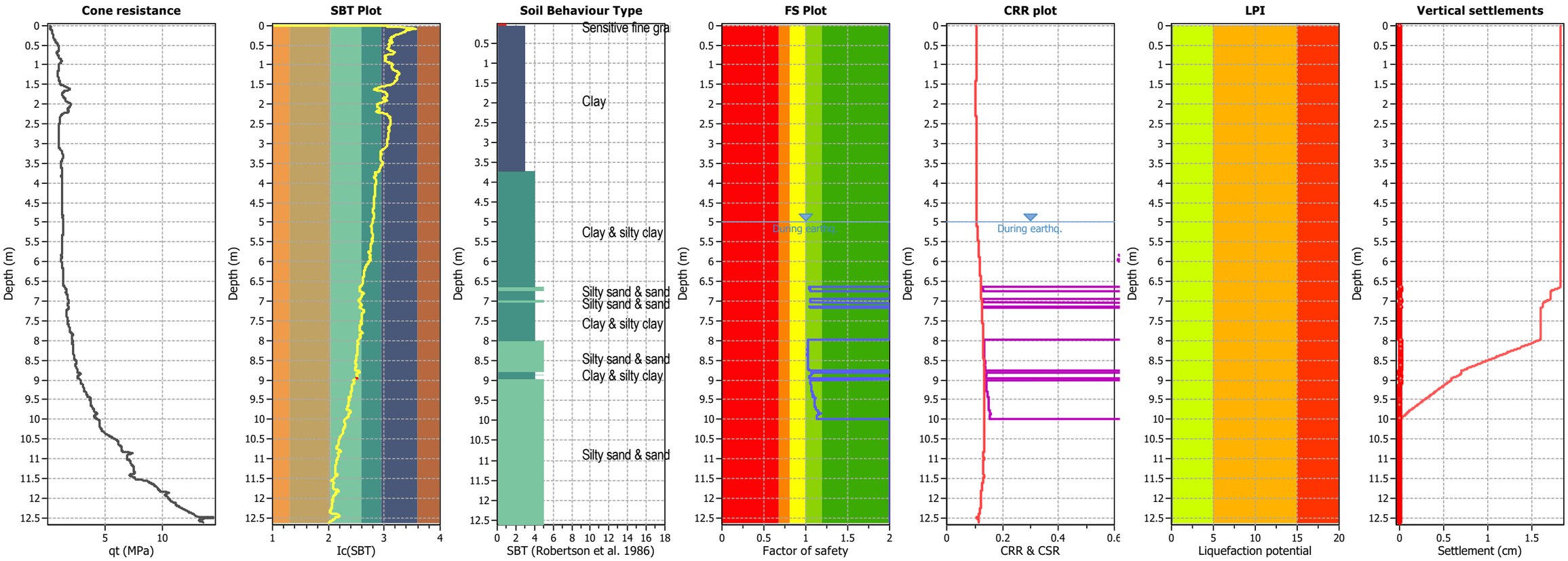
Project:

Location: 100 Hobsonville Road

CPT: CPT03

Total depth: 12.62 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based

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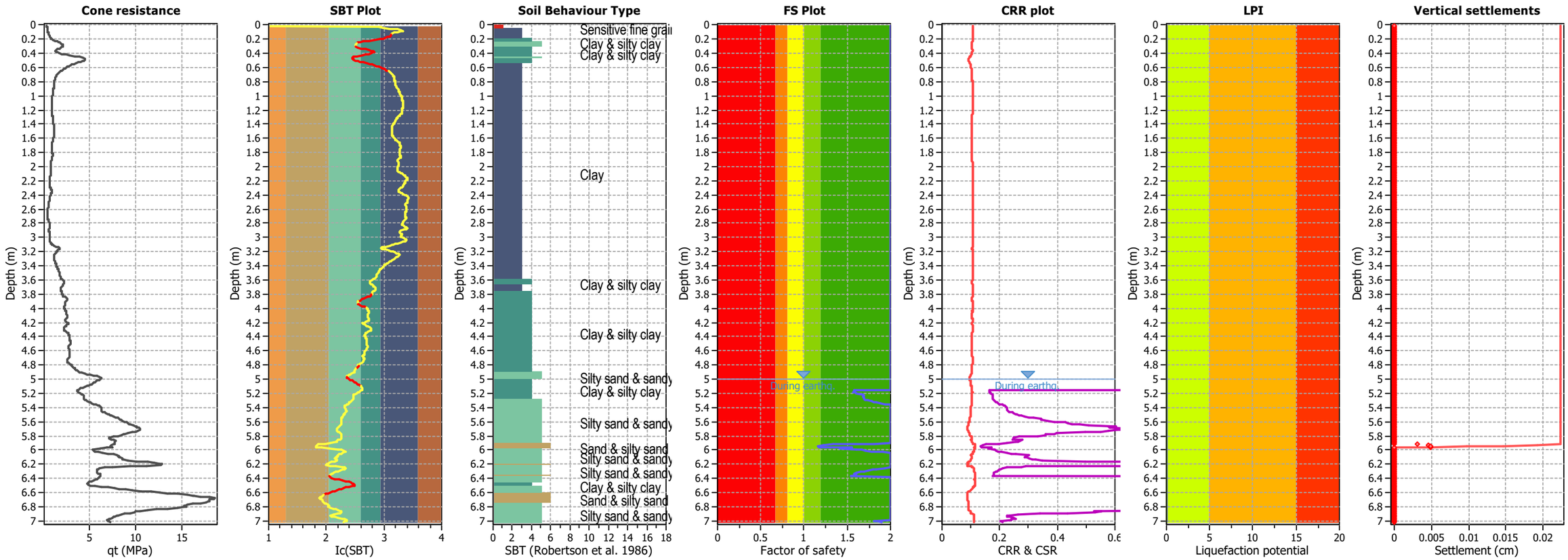
Project:

Location: 100 Hobsonville Road

CPT: CPT04

Total depth: 7.02 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

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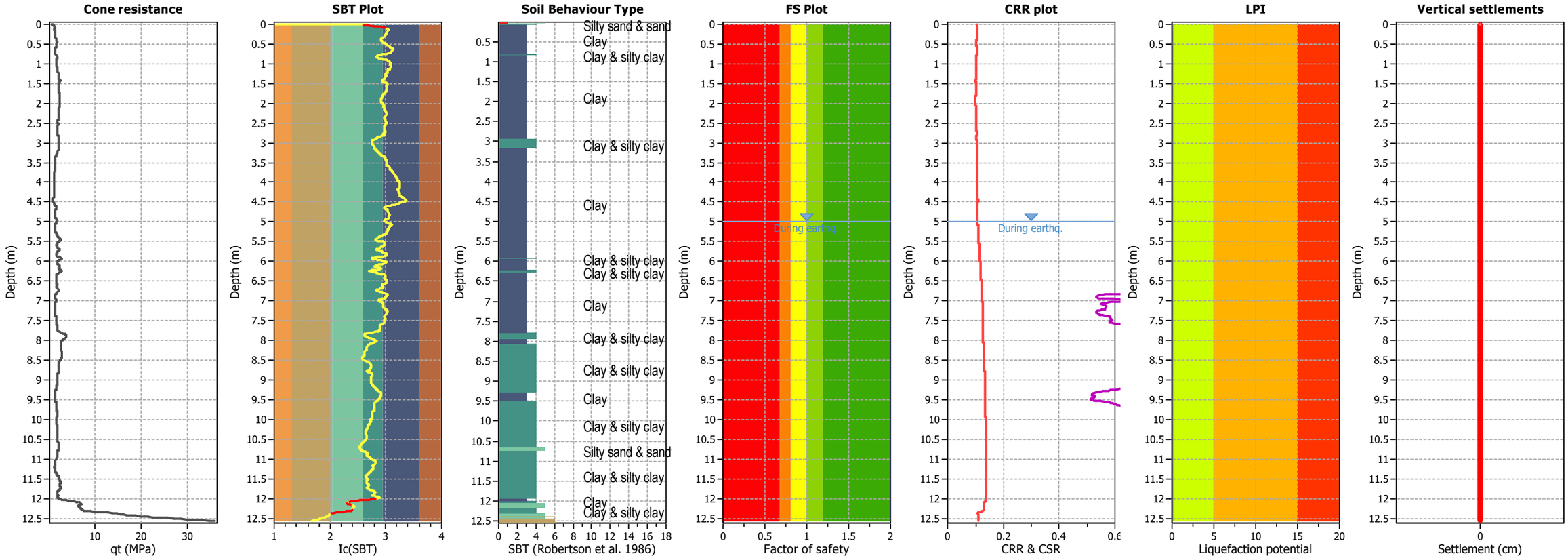
Project:

Location: 100 Hobsonville Road

CPT: CPT05

Total depth: 12.55 m



Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth applied:	Yes
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	Limit depth:	10.00 m
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_o applied:	Yes	MSF method:	Method based

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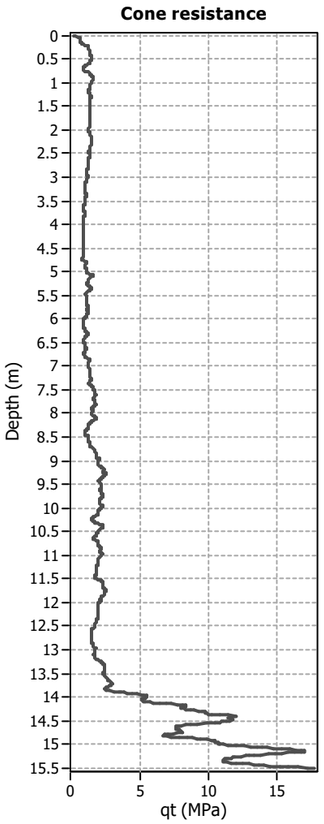
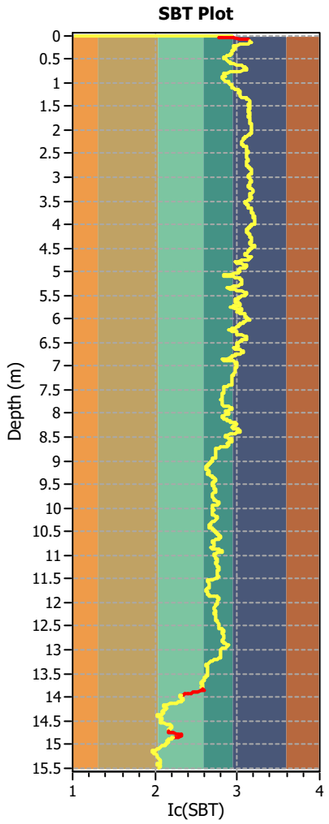
Project:

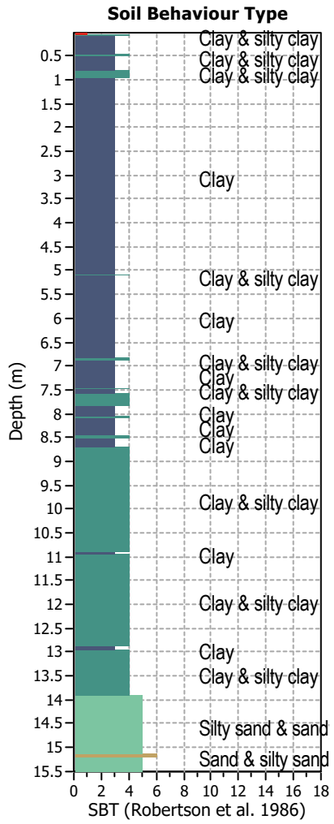
Location: 100 Hobsonville Road

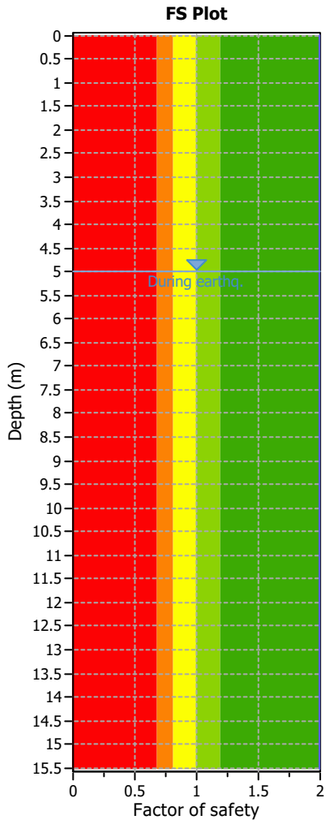
CPT: CPT06

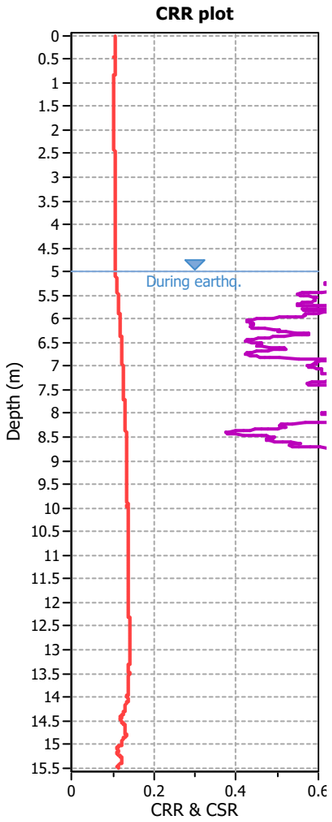
Total depth: 15.51 m

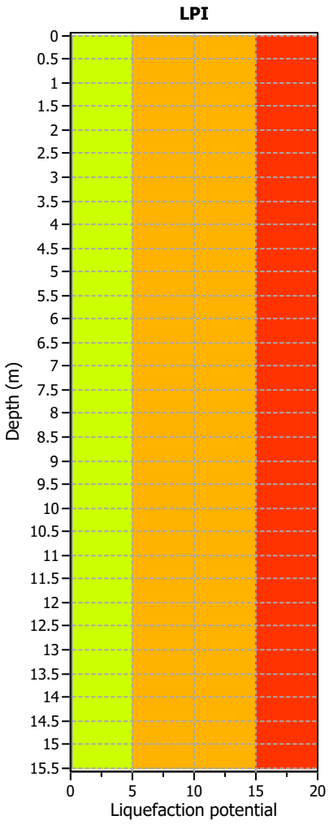


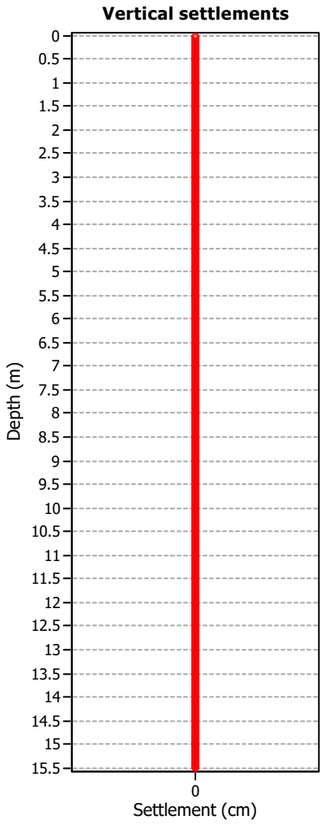












Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.00 m	Use fill:	No	Clay like behavior applied:	.
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.50	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

APPENDIX E

Geohazards Assessment & Mitigation Risk Register

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CLIENT:	Austino Property Group
PROJECT:	GEOTECHNICAL ASSESSMENT 100 HOBSONVILLE ROAD, HOBSONVILLE
TITLE:	GEOHAZARDS ASSESSMENT & MITIGATION RISK REGISTER

DESIGNER:	FK
CHECKED:	EC
JOB NO:	AKS2023-0062
DATE:	30/07/2024
ISSUED FOR:	RFI Response

Geotechnical Hazard	Description	Area Assessed	Assessment Outcome	Existing Risk of Damage to Land / Structures			Mitigation Measure	Residual Risk of Damage to Land / Structures		
				Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Water/Groundwater	Surface Water	Margins of Precinct 2	Whilst there are no watercourses defined with the site, nor are there any overland flow paths entering into the site, we do note that, from Auckland Council Geomaps, the potential for overland flow paths developing along the margins and flowing into the defined watercourses to the east, west and north of the landform.	4	2	8	For the purposes of this report, we have assumed that the overland flowpath extents can be filled. It can be assumed that any filling will have underfill drainage placed beneath it to allow the flow of any occasional water flows to continue and to prevent the build-up of groundwater pressures from developing beneath the fill.	1	2	2
	Stormwater Disposal	Entire Site	Stormwater runoff around the site, affecting future development in terms of surface eroison, shrink/swell and slope instability.	5	2	10	Stormwater soakage to ground is typically not feasible and will need to be reticulated and discharged away from the site.	1	2	2
Erosion	Cut Batters	Future cut areas	At the time of writing this report the extent of the cut areas are unknown. Mitigation is provided based on the factual data and observations made on site.	4	3	12	Mitigated by designing for maximum 1V:3H gradient, or steeper with surface stabilisation / treatment included in design (such as undercuts, by over excavation and replacement) as well as support with retaining walls.	1	3	3
	Fill Batters	Future fill areas	At the time of writing this report the extent of the fill areas are unknown. Mitigation is provided based on the factual data and observations made on site.	4	3	12	Mitigated by designing for maximum 1V:3H gradient, stormwater control and/ or steeper with surface stabilisation / treatment in design (such as reinforced earth slopes / retaining walls).	1	3	3
Landslip/Instability	Global Slope Instability	Elevated areas and slopes.	Most of the site is relatively gently sloping and not considered subject to instability risk.	2	4	8	The western and eastern margins of Precinct 2, adjacent to the watercourses may require slope stability remedial works comprising undercuts and/or small shear keys. Installation of retaining walls, palisade piles, or set-backs from the steeper slopes, may be required. This would be subject to detailed investigation and stability analysis, dependant on the earthworks and/or future development proposed.	1	4	4
	Soil Creep	Elevated areas and slopes.	A function of slope gradient and the expansive nature of the materials, movement is likely to be limited to approximately 1m to 1.5m depth, where present. Creep is limited to the sloped areas partially along ridge flanks.	4	3	12	To be mitigated by design of slope gradients, including use of retaining walls, subsoil drainage and by design of footings.	1	3	3
	Cut & Fill Batter Instability	Future cut, and fill areas	Both temporary and permanent batters need to be considered.	4	3	12	Mitigated by smart construction staging as well as controls on gradient, stormwater and surface stabilisation.	1	3	3
Expansive soils	Expansive Soils	Entire Site	Testing for expansive soils to be undertaken in future phases	4	4	16	Expansive soils are classified in NZS 3604 as those soils having a liquid limit of more than 50% and linear shrinkage of more than 15%. Alluvial soils are typically highly expansive. Mitigation of the expansive soil hazard is by foundation design at Building Consent stage and will be addressed on a lot-by-lot basis in the Geotechnical Completion Report(s) at the conclusion of the development works.	2	4	8

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TITLE:	GEOHAZARDS ASSESSMENT & MITIGATION RISK REGISTER	DATE:	30/07/2024
		ISSUED FOR:	RFI Response

Geotechnical Hazard	Description	Area Assessed	Assessment Outcome	Existing Risk of Damage to Land / Structures			Mitigation Measure	Residual Risk of Damage to Land / Structures		
				Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Subsidence	Soft soils/Load induced Settlement	Entire Site	The topography and existing information indicate that there are no significant concerns across Precinct 1 as well as within the upper 5m of the soil profile across Precinct 2. CPT test reuslts indicate that the depth of Puketoka Alluvial soils, should not exceed 9m depth, with the strengths in the stiff to very stiff range in turn overlying very stiff to hard residual ECBF materials.	3	4	12	In areas where fills and/ or significant building construction or storage loads are placed over soft deposits, allowance needs to be made for post-construction settlement of the fills and the underlying ground that could cause damage to structures. Consideration in the design needs to be given to the quantum of settlement that is likely to occur (i.e. ensuring it is insufficient to influence the cut/ fill volumes and balance during earthworks and/ or damage structures) and the time taken for the settlement to occur (i.e. ensuring it will be largely completed by the time a normal civil works programme would likely be commencing).The most appropriate mitigation is to avoid the potential for highly loaded structures in areas of weak/compressible materials during Master Planning, or to allow for ground improvement / piled foundations. However another remedial option for accelerating settlements in localised areas of deep alluvium / peat soils involve preloading. Locations and heights of surcharge must be subject to geotechnical review to avoid causing bearing capacity failure in the underlying alluvium.	2	4	8
Seismicity	Liquefaction	Entire Site	From the site-specific CPT investigation and analysis we confirm the liquefaction potential and probability of liquefaction to be low risk.	1	4	4	Not required.	1	4	4
Existing Fill	Uncontrolled fill overlying engineered fill	Precinct 1	Fill stockpile present at Precinct 1 will need to be removed.	5	4	20	Underlying engineered fill to be either approved or removed and replaced based on assessment from geotechnical engineer	2	4	8
	Uncontrolled fill	Precinct 2	Existing uncontrolled fill has been identified in an isolated location.	5	4	20	Re-engineering of existing fill may be required in some areas. Following environmental testing (by others) material reworking may be considered appropriate.	2	4	8