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Geotechnical Investigation for Proposed Private Plan Change at

Fonterra Te Rapa, Hamilton

Rev A1 **4 December 2024** **Job No. 220489**

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Appendices:

Report Summary

The following summarises the findings of this report however is not to be taken in isolation. It is a requirement that any user of this report review the document in its entirety, including all appendices.

Feature	Commentary
Proposal	Fonterra Limited propose a private plan change (PC17) at Te Rapa, Hamilton to live-zone approximately 91ha of land to 'Te Rapa North Industrial zone'.
Geotechnical Natural Hazards	No geotechnical natural hazards were identified that are considered an undue impediment to future development or that cannot be reasonably addressed by typical engineering design & construction or via ground improvement options suitable for the mitigation of liquefaction-induced settlement.
Fill	Not encountered during our investigation
Natural Soils	Hinuera Formation alluvial deposits comprising intermixed loose to dense sands and firm to very stiff sandy to clayey silts extending to depths of at least 40m.
Unduly Weak, Sensitive, or Compressible Soils	Not encountered.
Groundwater	Recorded at depths ranging between 0.3m and 4.0 below present ground level (bpgl) at the completion of drilling, with an average recorded groundwater depth of 1.4m bpgl. Measurements within standpipe piezometers over a one-month period following drilling recorded groundwater at depths ranging between 0.6m and 3.8m bpgl. The range of groundwater level at any one piezometer over the monitoring period was typically less than 400mm.
Seismic Site Class	Site Class D.
Liquefaction	The Plan Change Area is considered to be of 'Medium Liquefaction Vulnerability' and liquefaction-induced settlement must be considered in future development design.
Static Settlement	Static settlement under typical industrial structures is expected to be within acceptable tolerances or able to be mitigated by common engineering practices.
Slope Stability	In general, the Plan Change Area is near-level to gently sloping however there are localised steep stream/riverbanks. Overall, we consider the site to be suitable for development from a 'global' land stability perspective.
Foundation Guidance	For future land use development, shallow foundations are expected to be capable of supporting typical industrial structures from a static design perspective, however potential for liquefaction-induced damage must be assessed and accommodated for. In this respect piled foundations may be required which would likely extend to depths of at least 12m in order to penetrate liquefaction-prone soils. Individual proposal-specific geotechnical investigation and analysis will be required in this regard.

1.0 Introduction

Soil & Rock Consultants (S&RC) have prepared this geotechnical investigation report on behalf of Fonterra Limited (Fonterra) to inform and support its Private Plan Change 17 (PC17) request at Te Rapa, Hamilton.

The purpose of PC17 is to live-zone approximately 91ha of land surrounding the Te Rapa Dairy Manufacturing Site. PC17 does not seek to change any of the land within Te Rapa Dairy Manufacturing Site or planning provisions relating to the Manufacturing Site.

The objectives of PC17 are to:

- Live-zone all Fonterra-owned land to Te Rapa North Industrial zone.
- Protect the Te Rapa Dairy Manufacturing Site from reverse sensitivity risk.
- Future proof rail access on the North Island Main Trunk Line (NIMT).

Our report is intended to identify any geotechnical constraints to approval of PC17 and provide preliminary high-level geotechnical recommendations for potential future development of the Plan Change Area. Information and advice related to good construction practise are also provided.

1.1 Limitations

This report has been prepared by S&RC for the sole benefit of Fonterra Limited (the client), their appointed consultants, and Council with respect to PC17 and the brief given to us. The data and/or opinions contained in this report may not be used in other contexts, for any other purpose or by any other party without our prior review and agreement. This report may only be read or transmitted in its entirety, including the appendices.

The recommendations given in this report are based on data obtained from discrete locations and soil conditions between locations are inferred only. Our geotechnical models are based on those actual and inferred conditions however variations between test locations may occur and S&RC should be contacted in this event.

S&RC should also be contacted should the scope or scale of development vary from that currently indicated.

2.0 Plan Change Area Description

The Plan Change Area relates to approximately 91ha of land in the northern extent of Te Rapa, approximately 8km north of Central Hamilton.

The Plan Change Area is made up of three distinct areas, all of which are encompassed by the Waikato River to the east, the Waikato Expressway (State Highway 1C) and the NIMT rail line to the west, Hutchinson Road and Bern Road to the north and Ruffell Road, Old Ruffell Road and property boundaries to the south. All three areas have frontage to Te Rapa Road which runs north to south through the centre of the Plan Change Area. The three areas are described as follows:

- **West Block:** Section 1 & 3 SO 456626, Part Lot 1 DPS 10804, Lot 1 DPS 34481, Part Lot 2 DPS 10804, Lot 1 – 6 DPS 11087
- **North Block:** Lot 1 DP 551065 and Lot 1 DPS 8230
- **South-East Block:** Lot 5 DPS 18043, Lot 1 DPS 85687 and Lot 1-3 DPS 61136

Due to site access constraints, our investigation was limited to the land owned by Fonterra at the time of our investigation and did not extend to Section 1, 3 SO 456626 (West Block), Lot 1 DP8230 (North Block), and Lots 1-2 and 3 DPS 61136 (South-East Block). The Plan Change Area extent is shown in Figure 1.

Figure 1: Plan Change Area (Underlay Source: LINZ Data Service)

Te Rapa Stream flows from south to north through the centre of the West Block. The stream channel is reasonably narrow (typically less than 3.0m wide) with vegetated banks.

The topography broadly comprises a central near-level floodplain (see Figure 2) with the slopes of the floodplain descending towards the stream at inclinations generally ranging between <10° and 18°.

Figure 2: Plan Change Area Contours – 1m Contour Intervals (Source: LINZ Data Service)

The North and South-East Blocks are generally near-level, however steep slopes are present at the eastern margins forming the banks of the Waikato River.

The Plan Change Area is currently utilised for rural and residential uses. Built development across the West Block comprises dwellings, a milking shed, and farming sheds/workshops. Structures in the North Block include two dwellings and a barn/shed/workshop. A dwelling and two sheds/workshops are present in the eastern-most portion of the South-East Block. A previous dwelling and other structures in the western portion of the South-East Block have been demolished.

3.0 Geology

Reference to the GNS New Zealand Geological Web Map 1:250,000 Geology map, indicates the Plan Change Area is underlain by Hinuera Formation alluvial soils of the Piako Subgroup (see Figure 3) with recent alluvium present within the floodplain surrounding Te Rapa Stream in the northern portion of the Plan Change Area.

The Hinuera Formation soils are described as comprising fluvial pumiceous sand, gravel, and silt with occasional peat deposits. Pockets of undifferentiated Walton Subgroup alluvium are mapped nearby. These alluvial soils are described as pumiceous mud, silt, sand, and gravel with muddy peat beds.

Alluvial soils are often susceptible to consolidation (resulting in settlement) when subjected to foundation or fill loads, particularly where organic soils are present. Where cohesive material is dominant the soils shrink and swell with soil moisture changes. Alluvium can be sensitive, often rapidly losing strength in response to disturbance by construction plant and/or exposure to the elements. The soils are potentially susceptible to liquefaction where sand-dominant material is present, particularly where saturated. Surface topography is frequently near-level, and shallow groundwater should be expected over most of the year.

'Recent' alluvium, as expected in the stream channel and associated flood plain, is generally unsuited to use as a construction subgrade or re-use as engineered fill and is therefore usually removed from a development site.

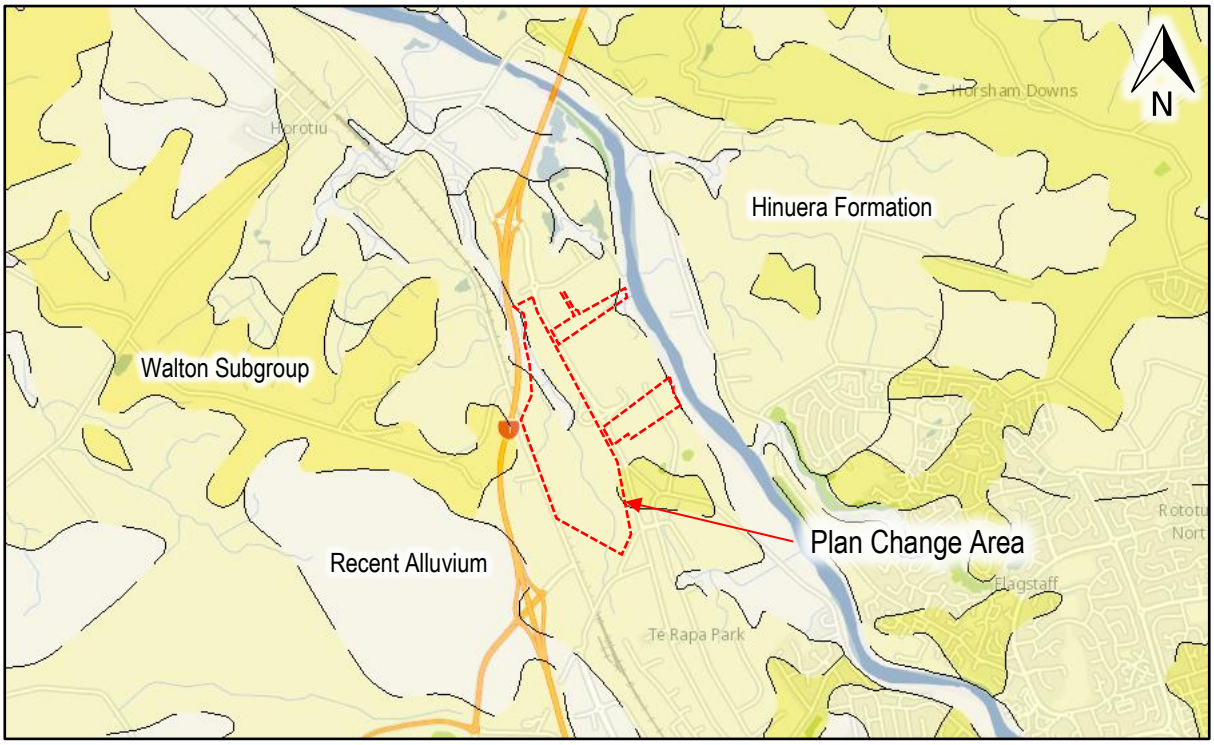


Figure 3: Geological Map (Source: GNS WebMaps Website)

3.1 NZGD Data

Reference has been made to the New Zealand Geotechnical Database (NZGD) regarding the Plan Change Area. Numerous test locations are present to the north and west of the Plan Change Area, and a small number of locations are shown within the Plan Change Area itself as per Figure 4.

The tests to the west and northwest of the Plan Change Area appear to be largely associated with the construction of the Waikato Expressway. The locations include Cone Penetration Test (CPT), test pit, machine borehole, and hand augerhole data. Further CPTs and hand augerholes present to the north of the Plan Change Area appear to be associated with residential/commercial development.

The available data from within the Plan Change Area comprises four CPTs and two test pits carried out for the Waikato Expressway in 2004/05 by Opus. The CPT's were advanced to depths ranging between 14.5m and 21.5m below ground level (bgl). Groundwater was measured at each CPT location at depths ranging between 3.5m and 6.5m bgl.

The two test pits were excavated to depths of 4.1m and 2.6m bgl, with the latter carried out within the floodplain surrounding Te Rapa Stream. In this location the soils comprised silts and sandy silts with groundwater encountered at 1.3m bgl. The deeper test pit completed near the Plan Change Area entrance with Te Rapa Road encountered silty sands with groundwater measured at 3.6m bgl.

Ten machine boreholes were completed immediately west of the Plan Change Area by Opus in 2004/05 as part of the Waikato Expressway works. The majority of the boreholes included corresponding CPT's undertaken within 1.5m of the borehole and standpipe piezometers installed within the boreholes at the completion of drilling.

Each borehole encountered silts and/or sands with varying amounts of clay and occasional gravelly sand deposits to the termination depths of the boreholes. No significant instances of organic material are noted on the majority of the logs, however several instances of soft organic silt up to 3m thick are present in one borehole immediately northwest of the Plan Change Area. This borehole appears to have been undertaken adjacent to Te Rapa Stream.

Strength testing was not typically undertaken within the boreholes, and where such testing was completed, it was at irregular depth intervals. Tactile descriptions on the logs indicate the soils typically ranged between soft and firm where cohesive soils were encountered and loose to very dense where less-cohesive (sandy) soils were encountered. Where recorded, SPT 'N' values ranged from 5 blows for

300mm of penetration to greater than 50 blows for less than 300mm of penetration, however, it appears SPT's were not undertaken within the majority of the lower-strength material.

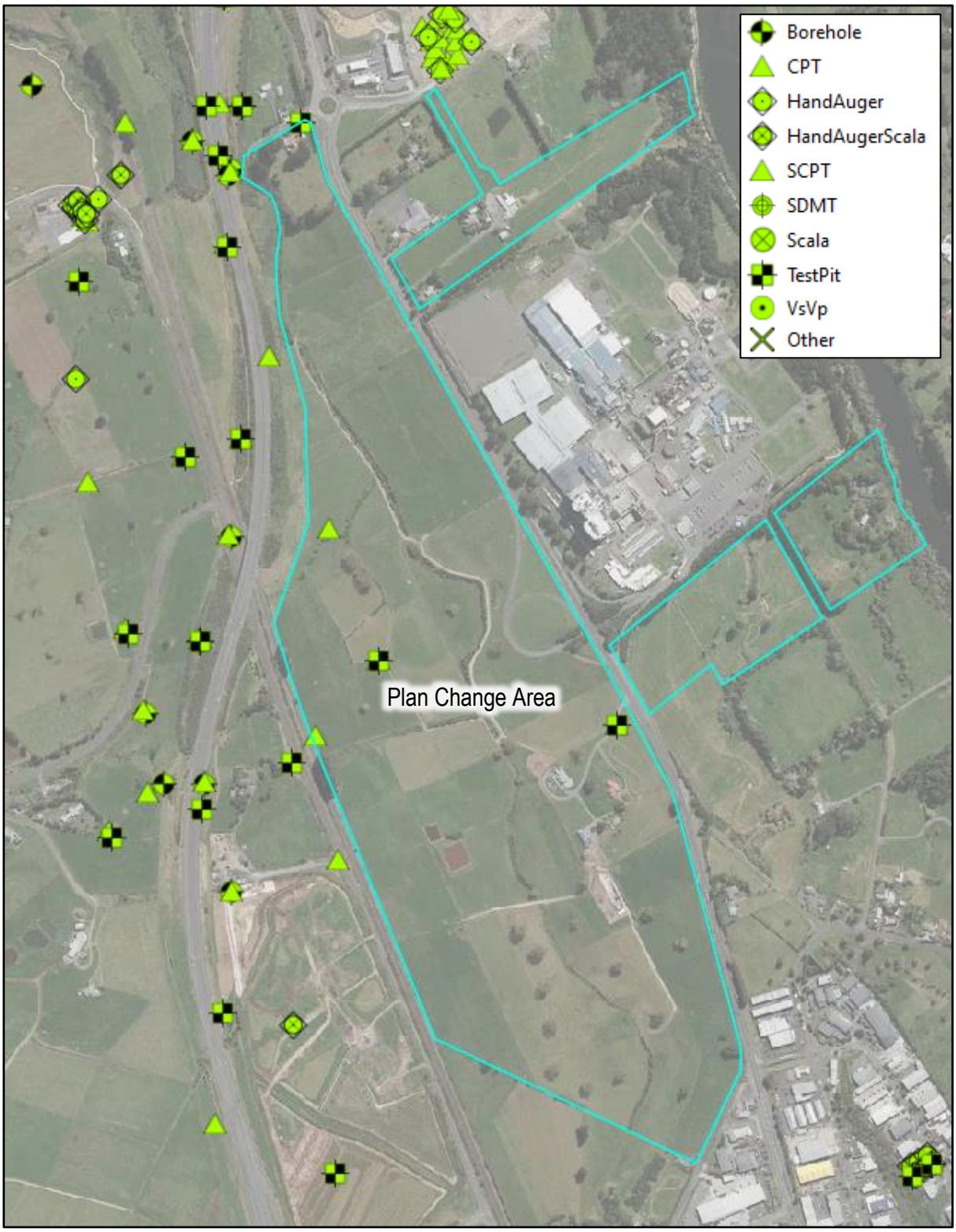


Figure 4: NZGD Test Locations (Source: New Zealand Geotechnical Database – Some locations overlap)

4.0 Field Investigation

The field investigation carried out in July 2023 comprised visual appraisal and the following:

- Drilling of 45 hand augerholes – Appendix B
- Installation of 12 standpipe piezometers – Appendix B
- Machine excavation of 10 shallow test pits – Appendix B
- Advancement of 22 Cone Penetration Tests (CPT's) – Appendix C
- Performing 10 Double Ring Infiltration tests within the test pits – Appendix D
- Performing 8 Soakage 'slug' tests within the installed piezometers – Appendix D

The test locations are shown on the Site Plan, Drawing No 220489/1 (Appendix A). The locations were determined from hand-held GPS and are therefore approximate only.

Measurements of undrained shear strength were undertaken in the augerholes at intervals of depth using a handheld shear vane in accordance with the New Zealand Geotechnical Society (NZGS) '*Guideline for Hand Held Shear Vane Test*', dated August 2001. Peak and remoulded vane shear strengths shown on the attached logs represent dial readings off the shear vane adjusted using the BS 1377 calibration correction factor.

A visual-tactile field classification of the soils encountered during drilling was carried out in accordance with the NZGS '*Guideline for the Field Description of Soil and Rock'* (2005).

Dynamic Cone (Scala) Penetrometer testing was carried out in-lieu of shear vane testing where soils became sand-dominated and from the base of 28 augerholes. Scala Penetrometer testing was also carried out below the augerholes where the target depth could not be reached due to hole collapse during drilling. In these cases, testing was terminated at the target depth of the augerhole (3.0m or 5.0m depth). Elsewhere, testing extended until refusal, or the maximum practical testing depth of the equipment was reached. Refusal is defined as five consecutive blow counts of 10 or greater per 50mm penetration or a blow count of 20 for 50mm penetration or less. The results are provided in Appendix B.

CPT's were carried out by ProDrill in accordance with NZS 4402.6.5.3:1988 and also in general accordance with ASTM D5778-07, DIN 4094-1, and ISSMFE Appendix A TC16. During the test, the CPT probe was pushed into the ground at a constant rate of 20mm/s ± 5mm/s. Sensors in the cone produce continuous analogue data of cone resistance (qc), sleeve friction (fs) and pore water pressure (u2) converted to digital form at intervals of depth. No sample is retrieved for visual or tactile assessment and outputs are largely empirical. The CPT results are attached in Appendix C.

4.1 Ground Model

Subsurface conditions have been interpolated between the test locations and localised variations between and away from the test locations will exist.

In general, Hinuera Formation alluvial deposits were encountered, comprising intermixed sands and silts with lesser amounts of clay. The average hand augerhole depth was 2.1m with further penetration typically prevented due to hole collapse.

Fill was not encountered during our investigation. However, the presence of fill cannot be discounted away from our test locations as it is not uncommon for farms to be subject to this activity, especially where there were previously low-lying areas or ground-surface depressions. Any such material is inferred to be of limited vertical and/or lateral extent and concentrated around existing structures and accessways or at stream banks.

An outline of the soil conditions and hand augerhole investigation results is given below and summarised in Table 1, and detailed descriptions of the soils are given on the attached logs (Appendix B).

- **Topsoil.** Topsoil was encountered at each test location and to a maximum depth of 0.3m below present ground level (bpgl). The average depth of topsoil encountered during our investigation was 150mm.

- **Hinuera Formation.** Hinuera Formation alluvial deposits were encountered at each test location underlying the topsoil to the termination depths of the augerholes (ranging between 0.5m and 5.0m bpgl). The alluvial soils typically comprised intermixed loose to medium dense sands or silty sands and/or firm to very stiff sandy silts or silts, with lesser amounts of clay and gravel.

  Typically, the near-surface (<1.0m) soils tended to be silt-dominant, with sand-dominant material encountered below, however augerholes in the lower portions closer to the Te Rapa Stream show less consistency in this regard. No distinct bedding or bands have been identified and the silts and sands generally appear indistinctly interspersed.

  No instances of peat and/or organic soils/materials were encountered, however organic staining was present in four locations (AH26, AH35, AH37, and PZ02).

  Vane shear strengths recorded within the more-cohesive alluvial soils ranged from 29kPa to greater than 200kPa where the soil strength was in excess of the shear vane dial capacity or were ‘UTP’ – Unable to Penetrate into the soil. The cohesive soils are typically stiff to very stiff and sandy soils were generally loose to medium dense, however very dense sands were

encountered in places, resulting in early termination of the augerhole. This typically coincided with the presence of groundwater resulting in little or no sample recovery.

Scala Penetrometer testing carried out within the less cohesive soils during drilling recorded blow-counts ranging from <1 to 24 blows per 100mm of penetration. However, the testing generally recorded between 2 and 7 blows per 100mm of penetration indicating a loose to medium dense consistency is typical.

- **Scala Penetrometer Testing.** Scala Penetrometer testing was carried out from the base of the majority of the augerholes.

  Refusal, inferred to be contact with dense alluvial deposits, was encountered at depths ranging between 0.9m and 7.1m bpgl. The refusal depth encountered above is not considered representative of an underlying dense stratum and is conversely inferred to be due to contact with unconnected and/or isolated lenses of dense material and/or increasing friction on the rods.

  17 augerholes were unable to advance to their target depth of 3.0m or 5.0m bpgl due to hole collapse or no recovery. In these instances, refusal was not encountered, and penetrometer testing was typically terminated at the intended target depth of the hole.

- **Cone Penetration Testing.** A total of 22 CPTs were undertaken to depths ranging between 0.9m and 20.0m bpgl. The termination depths and groundwater levels recorded at the completion of testing are provided in Table 2. CPT03 and CPT11 could not be completed due to the presence of potential heritage sites in the vicinity of those locations.

  CPT data was processed/interpreted using the CPeT-IT software. The results generally correlate with the profile observed in the hand augerholes with the near-surface soils typically being silt-dominant before encountering intermixed sand-dominant material to depths ranging between approximately 5.5m and 13.0m bpgl. Below this depth lower-strength cohesive deposits are interpreted to be present to the termination depths of the tests.

  Cone Tip Resistance varied from near-zero to greater than 30MPa with higher tip resistance values generally being encountered within dense sand deposits where lesser amounts of silt are inferred. Below the dense sand deposits Tip Resistance typically reduced to levels of between near-zero and 5MPa to the termination depth of the test.

  The majority of the tests were terminated due to Cone Tip Resistance or Friction resulting in ‘refusal’ (i.e., pulling of the rig anchors).

- **Groundwater.** Groundwater measurements were carried out within the hand augerholes at the completion of drilling. Groundwater was recorded at depths ranging between 0.3m and 4.0m bpgl, with an 'average' recorded groundwater depth of 1.4m bpgl.

  Groundwater was not encountered at ten locations (AH07, AH09, AH10, PZ12, PZ16, AH19, AH31, AH33, AH43, and AH48) on the day of drilling. In these instances, the augerhole is in a sloping/elevated area or the augerhole depth is less than 2.0m. We infer groundwater would be encountered at relatively shallow depth below the termination depth of each hole.

  Groundwater levels within the CPT holes at the completion of testing were measured at depths ranging between 0.3m and 2.6m bpgl. CPT01, CPT02, and CPT17 collapsed without a groundwater level being able to be recorded. In these locations a groundwater level of 0.5m bpgl has been adopted in the CPeT-IT interpretive software.

  Groundwater measurements taken on the day of drilling and following CPT testing are not always an accurate portrayal of the actual long-term groundwater table. In order to better understand the groundwater profile, standpipe piezometers were installed at 12 locations within hand augerholes, following completion of drilling. Reference should be made to Section 5.0 of this report regarding subsequent groundwater monitoring following the completion of drilling.

Table 1 – Summary of Ground Conditions

Test ID	Termination		Depth of Topsoil	Strength Range		Scala Penetrometer Termination	Groundwater Depth
	Depth	Cause		Vane Shear (kPa)	Scala Blows per 100mm		
All depths measured in (m) below present ground level. (Rounded to 1 DP)							
AH01	0.5	(NR)	0.1	-	2	3.5*	0.3
PZ02	2.0	(HC)	0.1	-	2 – 6	5.0*	1.0
PZ03	1.2	(HC)	0.1	-	11 – 19	4.2	1.0
PZ04	2.2	(HC)	0.2	29	1 – 11	3.9	1.4
AH05	1.2	(TDTA)	0.2	-	6 – 11	2.0*	0.8
PZ06	4.3	(HC)	0.1	109 – 200+	2 – 12	5.5	1.0
AH07	0.9	(TDTA)	0.2	200+	15	1.0	NE
PZ08	4.2	(TDTA)	0.1	175	3 – 10	4.6	2.5
AH09	1.0	(TDTA)+(NR)	0.3	85	7	3.9	NE
AH10	1.1	(HC)	0.1	163	17 – 19	3.7	NE
PZ11	2.2	(TDTA)+(HC)	0.3	109 – 191	1 – 6	5.0*	2.0

Test ID	Termination		Depth of Topsoil	Strength Range		Scala Penetrometer Termination	Groundwater Depth
	Depth	Cause		Vane Shear (kPa)	Scala Blows per 100mm		
PZ12	3.5	(TDTA)	0.2	185 – 200+	3 – 24	3.6	NE
AH13	3.5	(HC)	0.2	141 – 200+	1 – 12	4.9	3.2
PZ16	2.0	(HC)	0.1	-	3 – 11	5.0*	NE
AH17	2.2	(TDTA)	0.1	60 – 69	1 – 4	5.2	1.4
PZ18	4.3	(HC)	0.1	-	1 – 13	7.1	4.0
AH19	1.2	(HC)	0.2	-	10 – 20	1.2	NE
AH20	3.2	(TDTA)	0.1	200+	3 – 16	4.8	2.0
AH21	1.5	(NR)	0.2	37	2 – 8	4.1	0.7
AH22	2.6	(HC)	0.2	200+	2 – 10	5.0	1.5
AH23	0.8	(NR)	0.2	200+	1 – 2	3.8*	0.5
PZ24	5.0	(TD)	0.2	185 – 200+	1 – 10	5.9*	1.7
PZ25	2.9	(HC)	0.2	115 – 200+	2 – 10	4.8	2.1
AH26	3.1	(HC)	0.3	62 – 150	1 – 8	4.4	1.2
AH27	1.0	(TDTA)	0.3	88 – 200+	-	1.2	0.7
AH28	2.0	(HC)	0.2	153 – 175	2 – 13	2.4	1.4
AH29	2.3	(NR)	0.1	65	2 – 9	3.0*	1.2
AH30	1.9	(HC)	0.2	115	2 – 6	3.0*	1.0
AH31	3.0	(TD)	0.2	34 – 200+	-	NT	NE
AH32	2.5	(HC)	0.1	-	1 – 5	3.0*	2.0
AH33	0.8	(TDTA)	0.2	-	-	0.9	NE
AH34	3.0	(TD)	0.1	-	2 – 8	NT	2.2
AH35	3.0	(TD)	0.2	85 – 200+	<1 – 2	NT	1.2
AH36	2.3	(TDTA)	0.1	-	1 – 15	2.6	1.8
AH37	1.5	(TDTA)	0.2	47 – 109	2 – 4	3.0*	1.0
AH39	1.8	(TDTA)	0.2	86 – 200+	-	3.0*	1.6
AH40	1.5	(TDTA)	0.2	98 – 140	6 – 10	2.8	1.4
AH41	1.0	(HC)	0.2	-	6 – 7	2.8	0.8
AH42	1.1	(TDTA)	0.2	200+	4	1.7	1.0
AH43	0.7	(HC)	0.2m	-	3	3.0*	NE
AH44	2.7	(HC)	0.2	101	2 – 11	2.9*	NE
AH45	2.4	(NR)	0.2	96	1 – 6	2.9*	0.9

Test ID	Termination		Depth of Topsoil	Strength Range		Scala Penetrometer Termination	Groundwater Depth
	Depth	Cause		Vane Shear (kPa)	Scala Blows per 100mm		
AH46	1.6	(HC)	0.2	-	2 – 14	NT	1.0
PZ47	2.8	(NR)	0.3	-	<1 – 4	2.9*	1.0
AH48	1.2	(HC)	0.2	-	1 – 20	1.9*	NE

(HC) = Hole Collapse, (TD) = Target Depth, (TDTA) = Too Dense to Auger, (NR) = No Recovery

NE = Not Encountered, NT = Not Tested, * = Refusal Not Encountered

Table 2 – CPT Summary

Test ID	Termination Depth	Groundwater Depth*
All depths measured in (m) below present ground level. (Rounded to 1 DP)		
CPT01	19.9	-
CPT02	20.0	-
CPT04	15.3	1.1
CPT05	14.3	0.3
CPT06	12.7	0.9
CPT07	20.0	1.0
CPT08	19.6	1.5
CPT09	13.9	1.3
CPT10	15.1	0.7
CPT12	20.0	0.8
CPT13	14.4	0.7
CPT14	15.5	1.1
CPT15	20.0	0.5
CPT16	3.5	0.8
CPT17	20.0	-
CPT18	18.2	0.5
CPT19	16.6	1.2
CPT20	16.5	0.9
CPT21	0.9	0.5
CPT22	20.0	0.9
CPT23	16.8	1.6
CPT24	19.4	2.6

* Groundwater depth measured at completion of testing.

5.0 Groundwater Monitoring

Twelve standpipe piezometers were installed in hand augerholes at the completion of drilling. The augerhole/piezometer locations are shown on the Site Plan, Drawing No 220489/1 (Appendix A). The locations were determined using hand-held GPS and are therefore approximate only. Piezometer construction details are provided on the augerhole logs in Appendix B.

Groundwater level measurements were undertaken utilising downhole digital dataloggers (barometrically compensated) with readings undertaken every 30 minutes between 20-24 July and 29 August 2023.

Piezometer surface elevations have been estimated from Digital Elevation Model (DEM) data available from the LINZ Data Service. These elevations are compared to the measured groundwater depth to establish elevations as given in Table 3. Groundwater was not encountered in PZ12 throughout the monitoring period. The datalogger in PZ25 malfunctioned and no data was retrieved, and the datalogger in PZ47 was disturbed by stock and the data has therefore been excluded.

Table 3 – Groundwater Elevations

Location	Ground Surface (mRL)	Groundwater Elevation (mRL)				Mean Depth (mbgl)	Range (m)
		Maximum		Minimum			
		Level	Date	Level	Date		
PZ02	25.9	24.5	24 Jul	24.3	31 Jul	1.5	0.1
PZ03	20.4	19.5	20 Aug	19.4	26 Aug	1.0	0.1
PZ04	20.6	19.7	22 Aug	18.6	17 Aug	1.0	1.1
PZ06	25.9	23.9	21 Aug	22.8	09 Aug	2.9	1.1
PZ08	29.6	29.0	21 Aug	28.6	09 Aug	0.9	0.4
PZ11	29.0	27.1	24 Jul	27.0	15 Aug	2.0	0.1
PZ12	27.6	NE	-	NE	-	NE	-
PZ16	26.4	24.7	23 Jul	24.4	05 Aug	1.8	0.3
PZ18	27.0	23.4	20 Jul	23.2	29 Aug	3.7	0.2
PZ24	29.7	28.1	24 Jul	27.6	01 Aug	1.9	0.5
PZ25	24.3	-		-		-	-
PZ47	23.0	-		-		-	-

NE = Not Encountered

Groundwater was measured at depths ranging between 0.6m (PZ08 and PZ16) and 3.8m (PZ18) below ground level during the monitoring period with groundwater elevations ranging from 18.6mRL (PZ04 minimum) to 29.0mRL (PZ08 maximum). The range between the minimum and maximum groundwater levels recorded at any one piezometer location was typically less than 0.4m, however ranged between <0.1m (PZ11) and 1.1m (PZ04 and PZ06). Groundwater levels generally fell during the monitoring period.

The measured groundwater elevations are also shown in Figure 5 against local rainfall data recorded throughout the monitoring period at the Ruakura Climate (NIWA) rainfall monitoring station.

During the monitoring period the response in groundwater levels to rainfall events was generally minimal with groundwater levels rising by less than approximately 300mm in all piezometers and generally returning to pre-rainfall levels within less than a week. The exception is PZ06 which shows a 0.7m rise in response to 20.8mm of rainfall on 20 August 2023, although the level still returned to pre-rainfall levels within less than a week.

Groundwater monitoring was carried out in mid-winter (July-August 2023) and whilst it may be expected that the shallowest groundwater level would occur during winter conditions, given the nature of the Waikato basin a significant lag between high rainfall periods and groundwater levels may exist. This may result in higher groundwater levels during summer than might otherwise be expected.

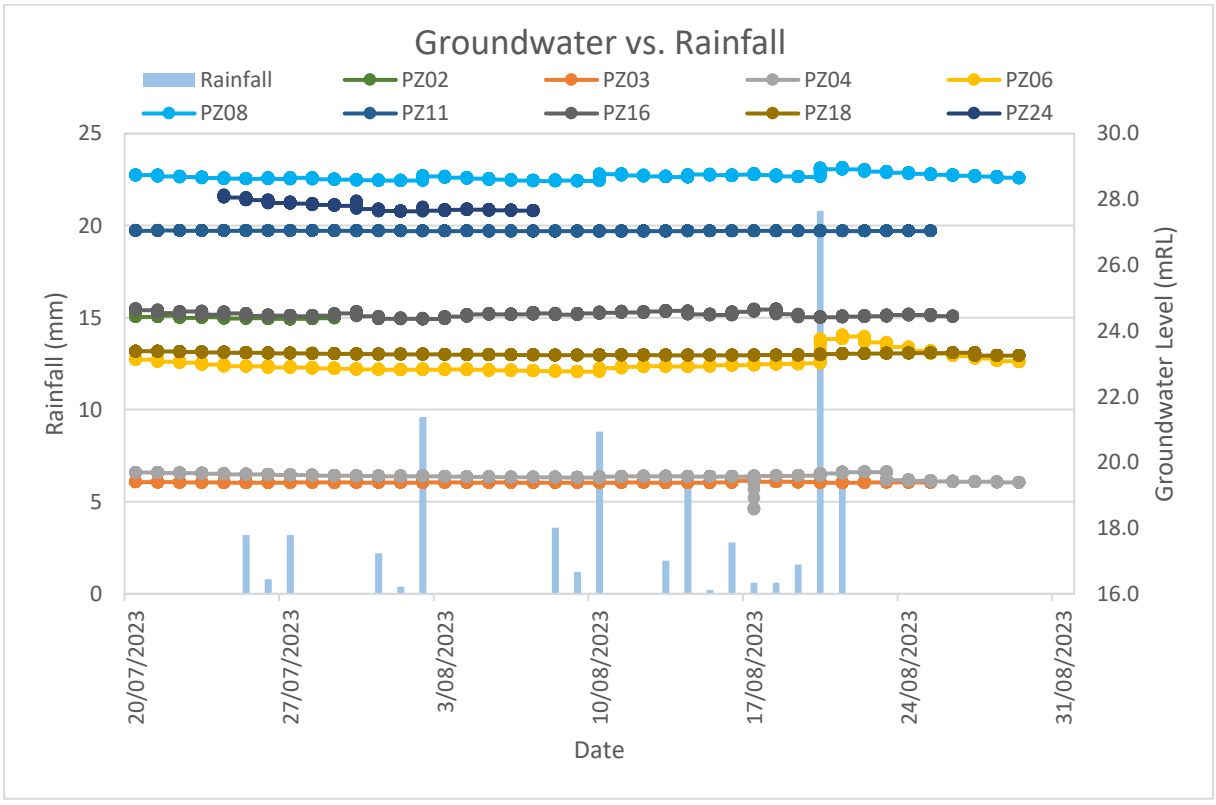


Figure 5: Hydrograph (Recorded Groundwater Levels and Rainfall)

5.1 Infiltration Testing

Ten vertical infiltration (Double Ring Infiltrometer) tests (DR01 – DR10 inclusive) were undertaken across the Plan Change Area to assess the vertical infiltration velocity. The tests were undertaken within machine-excavated test pits at a depth of 1.0m below ground level. A summary of the test results is presented in Table 4 and the calculation outputs are attached in Appendix D.

Testing was undertaken in accordance with ASTM D3385-03 (Standard Test Method for Infiltration rate of Soils in Field Using Double-Ring Infiltrometer), as specified by the New Zealand Ground Investigation Specification (April 2017; Volume 1: Section 12.10).

Table 4 – Double Ring Infiltrometer Testing Summary

Location ID	Test Depth (m)	Initial Water Depth (cm)	Test Result	
			Time to stasis (minutes)	Infiltration Velocity (V_{IR}; cm/h)
DR01	1.0	5.0	25	2.4
DR02	1.0	5.0	NI	-
DR03	1.0	5.0	30	2.4
DR04	1.0	5.0	NI	-
DR05	1.0	5.6	NI	-
DR06	1.0	5.6	33	60.0
DR07	1.0	5.6	NI	-
DR08	1.0	5.0	50	36.0
DR09	1.0	5.0	20	60.0
DR10	1.0	5.0	NI	-

NI = No Infiltration

5.2 Soakage Testing

In-situ hydraulic tests were conducted on 19 and 20 July 2023 within piezometers PZ04, PZ06, PZ08, PZ16, PZ18, PZ25, and PZ47. Slug tests (rising or falling head) were measured in each location with downhole level dataloggers. Rising Head tests were completed by rapidly removing water from the piezometer with a hand pump, Falling Head tests were completed by rapidly filling the piezometer. In both tests, continuous measurement of the returning groundwater level was carried out until static water levels were achieved (or at least to 90%). No pre-soaking was undertaken.

Rising Head tests were carried out in PZ04, PZ08, and PZ47, Falling Head tests were carried out in PZ06, PZ16, PZ18, and PZ25.

To calculate the hydraulic conductivity of the material at each location, the recorded data was analysed using the Aqtesolv software package utilising the Bouwer & Rice and Hvorslev methods. The results of the analyses are presented in Table 5 and the calculation outputs are attached in Appendix D.

The results from PZ16 indicate very high soakage which is disparate to the rest of the investigation results and for the purposes of conservativeness the results from this test have therefore been excluded from the calculated averages. A lower (more representative) soakage rate is expected at this location should pre-soaking be carried out.

Table 5 – Hydraulic Conductivity Testing Results

Piezometer ID	Bouwer & Rice Method m/sec	Hvorslev Method m/sec	Average
PZ04	5.84E-09	1.71E-08	1.15E-08
PZ06	2.67E-09	1.72E-09	2.20E-09
PZ08	6.00E-09	7.57E-09	6.79E-09
PZ16	0.00017*	0.000128*	1.49E-04
PZ18	1.81E-08	2.18E-08	2.00E-08
PZ25	3.23E-09	5.09E-09	4.16E-09
PZ47	1.35E-08	6.21E-08	3.78E-08
Average	8.22E-09	1.92E-08	1.37E-08
Overall Average	**1.37E-08**		

* Excluded from Method and Overall Averages

6.0 Sensitive Soils

The soils encountered during our investigation are generally sandy and particularly susceptible to mechanical disturbance and/or exposure to the elements. These soils can test well in-situ but perform poorly when construction is underway.

Care is therefore required during future development works to ensure the soils are protected to ensure favourable short and long-term subgrade and foundation performance. The level of care required is not considered to be extraordinary for an experienced and competent contractor.

7.0 Seismic Design Parameters

The Plan Change Area is not a Class A, B or E site as defined by NZS 1170.5:2004. Based on nearby borehole data (see Section 3.1 of this report), the depth of soils is expected to exceed that listed in Table 3.2 of the above standard for loose non-cohesive soils (i.e. greater than 40m). We therefore consider the Plan Change Area should be classified as a 'Class D – Deep or Soft Soil Site'.

The Peak Ground Acceleration (PGA) values adopted for stability and liquefaction analysis with respect to Importance Level 2 structures are 0.25g (Ultimate Limit State – ULS) and 0.09 (Serviceability Limit State - SLS) with an effective earthquake magnitude of 5.9. These values have been adopted based on Ministry for Business, Innovation, Employment (MBIE)/NZGS Module 1 guidance.

7.1 Liquefaction Vulnerability

Reference has been made to a report titled "*Liquefaction Desktop Study*" prepared by Tonkin + Taylor for HCC dated February 2019. That report indicates the Plan Change Area has been subject to a Level A (Basic Desktop Assessment) as defined in MBIE's '*Planning and engineering guidance for potentially liquefaction-prone land Resource Management Act and Building Act aspects'* dated September 2017.

The above report classifies the Plan Change Area as 'Liquefaction Damage is Possible' under the Level A assessment. As industrial development is likely, Table 3.5 of the above document indicates a Level B assessment is required to support a plan change application.

The CPTs, hand augerholes, and groundwater monitoring undertaken during our investigation and reference to the data available from the NZGD (per Section 3.1 of this report) satisfy the requirements for informing a Level B assessment as per the MBIE guidelines. In addition, we have undertaken quantitative analyses to assess liquefaction risk.

Quantitative Assessment

Quantitative analyses of liquefaction potential utilising the GeoLogismiki CLiq software were carried out based on the method of Boulanger & Idriss (2014) following the Zhang et. al. (2002) procedure to determine possible ground subsidence during design seismic events. Analyses have been carried out for ULS (1:500-year return period) and SLS (1:50-year return period) design seismic events. The analysis outputs are attached in Appendix C.

Lateral displacements were assessed only for those CPT locations within approximately 50m of the stream channel/banks or other slopes steeper than 14°, i.e. CPT04 – CPT08, CPT10, CPT13, CPT15, CPT16, and CPT19 – CPT22.

Lateral displacements have not been assessed at the other CPT locations where the ground surface is near-level to very gently sloping. A conservative groundwater depth of 0.5m bpgl has been adopted for each CPT location. The 'actual' groundwater depth will vary seasonally.

Liquefaction Conclusions

The majority of the sands encountered during our investigation were medium dense to dense and in 15 locations the density of the material prevented further penetration with the hand auger resulting in early termination of the augerhole. Scala Penetrometer testing indicated the sands are generally medium dense. Whilst groundwater is present at relatively shallow depth, given the general density of the material and age of the deposit, we qualitatively consider the liquefaction potential of the in-situ soils to be low.

Where testing penetrated deeper than 3.5m below present ground level the quantitative analyses indicate vertical liquefaction-induced settlements are projected to range between 52mm and 480mm under a ULS design event, and from <1mm to 74mm under an SLS design event. Lateral displacements are projected to range between 7mm and 1.75m under a ULS design event, and between <1mm and 20mm under an SLS design event.

Based on the results above and the findings of our geotechnical investigation and groundwater monitoring, the Plan Change Area is considered to have a 'Medium' liquefaction vulnerability. A Level C assessment would therefore be required to support any future Building Consent application within PC17.

The requirement for a ULS event is that the general structure does not collapse, and non-structural components do not cause a hazard to human life, and neither outcome is expected given built development in the immediate vicinity of the stream bank will require some form of erosion protection and/or instability mitigation that will have a positive collateral effect on lateral displacement risk.

8.0 Slope Stability

Qualitative Assessment

The ground surface across the Plan Change Area is generally near-level to gently sloping towards Te Rapa Stream. Steeper slopes are present around the stream channel. These slopes are of limited height (<2m) and of a localised lateral extent. Any associated instability potential is therefore considered to be of a localised nature and limited to minor failures of the near-surface soils forming the stream banks i.e., unlikely to affect structures.

The banks of the central floodplain are generally inclined down towards the stream at inclinations ranging from <10° to approximately 18° with isolated areas as steep as approximately 25°-30°. These steeper sections are limited to localised areas as visible in Figure 6.

Steep slopes are also present along the eastern boundaries of the North and South-East Blocks, however due to the presence of a potential heritage area in the North Block, and lack of access to the eastern portion of the South-East Block, testing and assessment has not been undertaken in these areas.

At the time of our investigation no visual evidence of major, deep-seated instability was identified.

A slope model has been prepared for the Plan Change Area as shown in Figure 6. The shading is underlain by contours derived from LINZ DEM data (1m intervals) and aerial imagery.

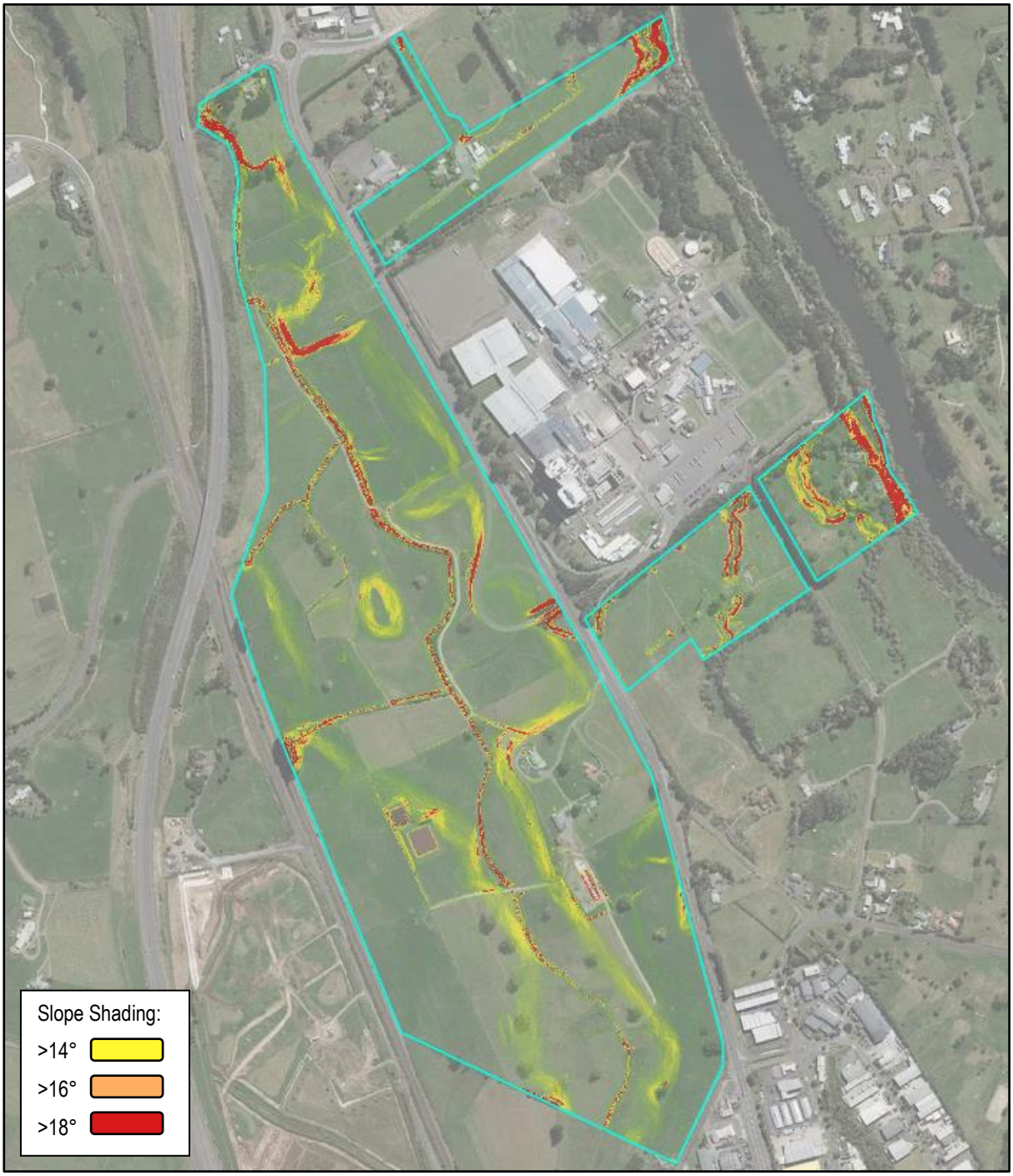


Figure 6: Slope Shade Model

Quantitative Assessment

The extent of any proposed earthworks for future development of the Plan Change Area was not known at the time of preparation of this report and the slopes are generally gentle. Quantitative stability analyses have therefore been undertaken for representative slopes of varying heights to assess potential cut batter stability and inform qualitative assessment of global stability.

The RocScience Inc. SLIDE2 software was used for stability analyses. Stability of theoretical translational surfaces was assessed using the Morgenstern-Price method.

Stability analyses have been undertaken for a 'normal groundwater', extreme (worst credible) groundwater, and seismic conditions. The normal groundwater condition assumes a groundwater level 1.0m below the surface (typical of the results of our investigation) and the extreme groundwater condition assumes a fully saturated ground surface. The normal groundwater condition has been adopted for the seismic condition. PGA values for the region have been determined as per Section 7.0 of this report.

Lower-bound effective stress parameters used for our analyses are summarised in Table 6. These have been developed from the soil description, in-situ strength testing, limited back analysis, and our experience with these soil types in the wider region.

Table 6 – Effective Stress Parameters

Soil Type	Estimated Unit Weight γ (Kn/m^3)	Effective Cohesion on the Failure Plane c' (kPa)	Effective Angle of Internal Friction ø' (°)
Hinuera Formation Alluvial Deposits	18	2	30

The ratio of resisting forces to disturbing forces is presented as a 'Factor of Safety' (FOS) against slope instability occurring.

A FOS of 1 indicates a slope near or at equilibrium. The minimum factors of safety typically acceptable to Council are provided in the 'Required' column in Table 7 alongside the calculated FOS results.

The theoretical failure surfaces with FOS results less than the typical Council requirements are shown on the analyses outputs provided in Appendix E and those FOS results are shown in red in Table 7.

Table 7 – Stability Analysis Results

Slope Angle	Slope Height	Minimum Factor of Safety		
		Normal Groundwater (Required = 1.5)	**Worst Credible Groundwater** (Required = 1.3)	**Seismic Loading** (Required = 1.0)
14°	2m	2.9	1.7	1.3
	3m	2.4	1.5	1.1
	4m	2.2	1.4	1.0
16°	2m	2.7	1.6	1.3
	3m	2.2	1.4	1.1
	4m	2.0	1.3	1.0
18°	2m	2.5	1.4	1.3
	3m	2.0	**1.2**	1.1
	4m	1.8	**1.1**	1.0

Stability Conclusions

The global minimum FOS results in Table 7, and as shown on the outputs in Appendix E, are greater than or equal to typical Council requirements under all conditions except the extreme groundwater condition for a slope angle of 18° at slope heights of 3m and 4m. Marginal FOS results are also projected at slope heights of 4m at an angle of 16° under extreme groundwater and seismic conditions.

Based on the above and our qualitative assessment, we consider no impediment to PC17 and future development from a global land stability perspective contingent upon the recommendations of this report being adopted in design and construction.

In any case, future development will result in modification to the existing landform. Sharp changes in elevation will be supported by engineered retaining or be removed by earthworking.

Proposal-specific stability assessment is recommended where development is proposed adjacent to or over (in the case of bridges/culverts) the stream bank and in the vicinity of the banks of the floodplain and steep slopes above the Waikato River.

Proposal-specific stability analysis is also recommended for any future development in the vicinity of the steeper slopes in the eastern portions of the North and South-East Blocks.

9.0 Static Settlement

Significant thicknesses of organic or otherwise compressible soils were not encountered during our investigation. In the case of 'typical' industrial structures where foundation loads are limited to 150kPa and floor slab loads to 20kPa Uniformly Distributed Load, we consider the potential for intolerable total or differential static settlement as a result of development to be low, however this should be confirmed by specific investigation and analysis prior to Consent application for any proposed structure. Greater loads may be required by building designs and will be accommodated by specific design.

10.0 Natural Hazards Assessment

The RMA requires consenting authorities to consider the possible risks that various natural hazards pose to sites where development is planned. The likelihood of each of the possible natural hazards of a geotechnical basis affecting PC17 has been assessed as summarised below.

- **Earthquake.** The Plan Change Area is considered to have a 'Medium' liquefaction vulnerability. Reference to the GNS 1:250,000 Geology map, indicates the nearest mapped active fault is the Kerepehi Fault approximately 40km east of the Plan Change Area. Near-source hazards such as fault rupture are therefore not expected.
- **Coastal, Bank, and Sheet Erosion.** The Plan Change Area is not coastal and therefore no coastal hazards exist. The potential for sheet erosion is considered to be negligible given the topography. Following PC17, development will likely reduce runoff and any structure/earthworks in the vicinity of the Te Rapa Stream bank will require stream bank improvement, therefore post-development erosion is likely to be less than is currently occurring naturally.
- **Volcanic and Geothermal Activity.** The Plan Change Area is located more than 95km from the nearest known active volcano (Rotorua Caldera) and no known geothermal areas are noted within the immediate vicinity. The Plan Change Area is therefore not considered to be subject to any unusual risk of volcanic or geothermal activity.
- **Landslip.** The Plan Change Area generally comprises gently sloping to near-level topography. Whilst steeper slopes exist within the banks of the current Te Rapa Stream channel and floodplain, these slopes are of limited height and/or lateral extent and any instability is expected to be of a localised nature. Development in the vicinity of the steeper slopes in the eastern portions of the North and South-East Blocks should be subject to specific stability analysis during the Resource/Building Consent (as applicable). We consider the Plan Change Area to be suitable for development from a global land stability perspective. No landslip inundation risk exists.

- **Subsidence.** Significant thicknesses of organic or otherwise compressible soils were not encountered during our investigation and the risk of intolerable static settlement or subsidence is therefore considered to be low.
- **Sedimentation.** The risk of significant sedimentation affecting the Plan Change Area is considered to be negligible.

No geotechnical natural hazards were identified that are considered an undue impediment to approval of PC17 and future development or that cannot be reasonably addressed by typical engineering design and construction.

Natural hazards such as Tsunami, Inundation by flood and Atmospheric hazards are not of a geotechnical nature and therefore excluded from our assessment.

11.0 Geotechnical Constraints

We consider the Plan Change Area to be geotechnically suitable for future development provided the recommendations given in this report are observed.

Geotechnical constraints requiring specific consideration by the development designers are outlined below. We recommend these aspects be subject to development-specific geotechnical investigation at the Resource/Building Consent stage (as appropriate).

Liquefaction

The Plan Change Area is considered to have a 'Medium' liquefaction vulnerability. Our quantitative analyses indicate moderate to high vertical liquefaction-induced settlements and lateral displacements are projected under ULS conditions. Under SLS conditions vertical liquefaction-induced settlements and lateral displacements are projected to be significantly less, however specific assessment will be required for any proposed earthworks or development to determine the extent of any mitigation required.

Specific liquefaction assessment should be undertaken prior to Resource Consent application with respect to any proposed earthworks, particularly any filling. Filling is likely to have a beneficial effect as a stiff and non-liquefiable 'raft' can be created that (partially) mitigates the effects of liquefaction at depth.

Ground improvement in the form of reinforced gravel rafts or Rammed Aggregate Piers (RAPs) may be required to mitigate liquefaction and/or lateral spreading effects for any proposed structures in the vicinity of the stream or banks of the floodplain. Pile foundations to mitigate liquefaction would likely require embedment depths in excess of 12m to penetrate beyond potentially liquefiable soils.

Groundwater

Groundwater was recorded within the hand augerholes at the completion of drilling at depths ranging between 0.3m and 4.0 bpgl, with an average recorded groundwater depth of 1.4m bpgl.

Subsequent monitoring of standpipe piezometers over a one-month period recorded maximum groundwater levels of between 1.0m and 3.8m bpgl and minimum levels of between 0.6m and 3.6m bpgl. The range of groundwater level at any one piezometer over the monitoring period was typically less than 400mm.

Bulk excavations are likely to require dewatering during construction and given the sandy nature of the soils, temporary support and a specific methodology are likely to be required for deeper excavations.

Static Settlement

Significant thicknesses of organic or otherwise compressible soils were not encountered during our investigation, however cut-to-fill earthworks are likely to be required as part of future development works.

The scale or scope of any future development was unknown at the time of preparation of this report. Specific analysis of static settlement is recommended where any cutting or filling exceeding 1.0m deep/thick is proposed, particularly with respect to the placement of fill. Fill placement has the potential to induce settlement of the underlying ground and significant 'mucking out' of unsuitable material in the vicinity of the stream channel is likely to be required prior to filling. In addition, settlement monitoring during and following earthworks may be required.

Slope Stability

Slopes throughout the Plan Change Area are typically gentle with the exception of the banks of the Te Rapa Stream channel, floodplain, and the eastern portions of the North and South-East Blocks. Whilst the risk of large-scale 'global' instability is considered to be negligible outside of the eastern portions of the North and South-East Blocks, development (including bulk earthworks) in the vicinity of Te Rapa Stream and floodplain banks should be carefully considered. Specific stability analysis will be required for development in proximity of the eastern portions of the North and South-East Blocks.

Quantitative stability analysis of slopes representative of the geology and topography indicate suitable factors of safety for permanent cut batters and in-situ slopes to a maximum inclination of approximately 16° and maximum slope height of 4m. Steeper slopes indicate suitable factors of safety under normal groundwater conditions however factors of safety reduce below typical Council requirements under extreme groundwater and seismic conditions.

We consider the Plan Change Area to be suitable for development from a global land stability perspective. However, specific stability analysis is recommended for all slopes (in-situ and proposed) steeper than approximately 14° to confirm an acceptable factor of safety is available and maintained during, and following, any proposed development.

Earthworks

The soils encountered during our investigation are sandy (generally non-cohesive) and therefore particularly susceptible to mechanical disturbance and/or exposure to the elements.

Soils of this type that test well in-situ can perform poorly when earthworks or construction are underway. Care is therefore required during development works to protect the soils to ensure favourable short and long-term subgrade and foundation performance.

The natural soils are generally expected to be suitable for use as engineered fill capable of achieving the requirements of NZS 4431:2022, however moisture conditioning is likely to be required in combination with a specific earthworks methodology/specification. That specification should be informed by specific testing including New Zealand Standard Compaction testing.

Bulk excavations are likely to encounter groundwater and reference should be made to the groundwater constraints section above in this regard.

It is common for farms to contain rubbish and/or offal pits. Neither of these were encountered during our investigation however they could be present (albeit small compared to the scale of the Plan Change Area). Where these are encountered during earthworks or future development, they should be excavated and engineered fill placed.

Bearing Capacity

The near-surface soils typically comprise loose to medium-dense sands or firm to stiff sandy silts and clayey silts, however very loose saturated sands and soft clayey silts were encountered.

Whilst an Ultimate Bearing Capacity of 300kPa is typically expected to be available, the in-situ soils may present a reduced bearing capacity (relative to the above) in some areas within the Plan Change Area. Additional geotechnical investigation is required to determine the extent of such areas (if present).

Expansive Soils

The near-surface soils are typically comprised of sands or sandy silts, therefore significantly expansive soils as defined in AS2870:2011 are not expected to be present. However, clayey silts were encountered

in places and where any exposed subgrade presents such material, we recommend laboratory testing be carried out to confirm the soil expansivity classification.

That testing is best carried out at the Building Consent stage as it then better reflects the actual development proposal and post-earthworks ground conditions.

12.0 Preliminary Geotechnical Design Guidance

Preliminary geotechnical guidance intended to inform concept design is provided in Sections 12.1 through 12.7 of this report. Specific geotechnical assessment is recommended to confirm or modify this guidance as appropriate for any proposed development given the constraints outlined in Section 11.0 of this report.

12.1 Earthworks

Any proposal to create cuts or fills greater than 0.8m in height should be the subject of specific design advice as groundwater and settlement constraints should be assessed.

The potential for groundwater ingress should be considered for any proposed excavations. Bulk excavations are likely to require dewatering during construction and given the sandy nature of the soils encountered during our investigation, temporary support and a specific construction methodology are likely to be required for deep excavations. Specific assessment of groundwater drawdown related settlement effects will be required should permanent dewatering be proposed.

Sumps/pumps will be required to remove groundwater from the excavations and earthworks/construction during summer is likely to be beneficial in this regard.

The soils encountered during our investigation are expected to be suitable for use as engineered fill, however moisture conditioning is likely to be required in combination with a specific earthworks methodology/specification. That specification should be informed by specific testing including New Zealand Standard Compaction testing.

Should the use of external (off-site) earth (cohesive) fill be proposed, inspection of the material prior to importing to site is recommended in addition to a New Zealand Standard Compaction Curve to inform compaction requirements.

All fills, regardless of depth, must be placed in accordance with NZS 4431:2022 with respect to subgrade preparation and standard of compaction.

12.2 Ground Improvement

Ground improvement may be required to mitigate liquefaction and/or lateral spreading effects in the vicinity of Te Rapa Stream. This typically comprises the installation of Rammed Aggregate Piers (RAPs) or stone columns below the load-bearing walls of proposed structures, however ground improvement 'reinforcement' solutions covering wider areas may be more cost-effective given the large area of potential development.

Reinforcement options typically involve the construction of underground walls which usually interact to form a lattice. The subterranean walls can be formed using ground solidification techniques or contiguous/closely spaced concrete piles.

The use of such ground improvement methods typically results in only minor changes to traditional shallow foundation design as those foundations can be directly supported by the same.

Ground improvement can greatly increase the stiffness of the soil profile resulting in amplification of seismic accelerations at the surface and may also influence seismic wave propagation and the seismic response at neighbouring sites. Therefore, the potential effect of ground improvement on the seismic response of adjacent properties and structures should be considered in the future design.

Reference should be made to the MBIE '*Earthquake Geotechnical Engineering Practice Module 5. Ground Improvement of Soils Prone to Liquefaction*' for further information regarding ground improvement design considerations. Additional investigation and laboratory testing will be required to assess and/or confirm the appropriate ground improvement method.

Following detailed geotechnical investigation, we recommend a specialist contractor assess the findings of that investigation, analyses, and report in order that a suitable ground improvement design be prepared.

12.3 Temporary Stability

The shallow depth to groundwater and sandy nature of the Plan Change Area soils will necessitate the use of temporary support if/where bulk excavations are proposed. The use of sheet piling, or similar 'sealed' support systems, are likely to be required for all bulk excavations related to building construction including temporary excavations for service trenches. Trench shields will likely be required for all temporary excavations for service trenches deeper than approximately 1.0m.

We recommend the '*Good Practice Guidelines – Excavation Safety*' by WorkSafe New Zealand (2016) be followed by the designer and the contractor.

Care should be taken with regard to the use and movement of machine plant above any cut faces during construction. The surcharge effect of heavy machinery could cause local instability and as such should be considered in the earthworks design.

In-ground barrier-pile or 'soldier-pile' walls may be considered with respect to the stability of development areas in close proximity to stream banks, however the potential for material to 'flow through' such a wall should be considered in the design and grout curtains, multiple parallel rows, or other improvement measures may be required.

12.4 Retaining Structures

The soils encountered during our investigation are generally suited to all types of retaining, however bored excavations for retaining poles will be susceptible to collapse due to groundwater ingress and temporary casing will most likely be required where traditional bored excavations are proposed. Use of Continuous Flight Auger (CFA) for bored holes or construction of Mechanically Stabilised Earth (MSE) or other gravity walls are likely to be easier to construct, particularly where supporting engineered fill.

We recommend retaining systems be Engineer-designed and consider both the local and global stability of the site, and any surcharge applicable to the wall. Particular attention should be paid to the influence of building surcharges above, and sloping ground below, any retaining wall.

Factors of safety and surcharge loadings appropriate to the conditions should be in accordance with '*Limit State Design of Retaining Walls and Foundations for Geotechnical and Structural Engineers*' New Zealand Structural Engineering Society (SESOC) Seminar Series 2005 and/or '*Module 6: Earthquake resistant retaining wall design*' prepared by MBIE dated November 2021 as applicable.

12.5 Floor Slabs and Pavements

All topsoil, non-engineered fill, vegetation, organic or otherwise unsuitable material should be removed from under floor slab and pavement areas prior to construction.

Any subgrade should be protected from desiccation, rain damage, and plant-trafficking immediately upon excavating or filling to grade following inspection by S&RC.

Protection may take the form of topsoil, mulching, or by placing a protective layer of granular fill. The granular fill can later be left in-situ as a construction sub-base or basecourse if managed well and protected from damage. We recommend watering expansive subgrades approximately 48 hours prior to concrete placement to return the subgrade to its inferred pre-excavation moisture content.

Given the elevated groundwater levels observed during our investigation, any concrete floor slab or pavement is required to be underlain by a basecourse of clean, free-draining granular fill as specified by the designer.

Under-slab drainage or 'tanking' will be required should excavations below the groundwater table be proposed.

12.6 Shallow Foundations

The natural soils are generally considered suitable for the use of shallow foundations comprising 'waffle' or 'rib-raft' slabs (surface-supported, no embedment) or traditional spread footings subject to liquefaction and settlement considerations.

The use of shallow (spread) foundations is subject to site specific requirements to mitigate liquefaction risk. In the absence of broader ground improvement, reinforced gravel rafts extending outside of the building footprint are likely to be required for the purposes of mitigating intolerable liquefaction-induced settlement effects.

Any existing drainage/irrigation trenches within the influence zone of foundations must be excavated and backfilled to an engineered standard. The slab designer can determine whether or not this work is required for any trenches present under floor slabs.

For concept design purposes we expect a Design (Dependable) Bearing Capacity of 150kPa likely to be available for Ultimate Limit State Design of shallow foundations. However, the in-situ soils may present a reduced bearing capacity (relative to the above) or increased static settlement risk in some areas. Additional geotechnical investigation is required to determine the extent of such areas (if present).

A Strength Reduction Factor ($Ø_{bc}$) of 0.5 has been applied to the Geotechnical Ultimate Bearing Capacity value above to determine the Design Bearing Capacity.

12.7 Pile Foundations

Pile foundations will be required where structural or civil design calls for:

- The bridging of public underground services.
- Bearing capacity requirements greater than those available for shallow foundations.
- Significant depths of non-engineered fill or other unsuitable material to remain in-situ.
- The mitigation of intolerable static or liquefaction-induced settlement.

Pile foundations would likely require embedment depths in excess of 12m to penetrate beyond liquefiable soils. Specific geotechnical investigation in the form of machine boreholes and detailed analysis is recommended to inform pile parameters, and design should be followed by installation of 'test' piles.

Where practical (in terms of pile length) driven piles are recommended as pile excavations that penetrate groundwater or very loose sands will be susceptible to collapse and casing will be required, likely over the full length of the pile.

13.0 Underground Services

Underground services, public or private, mapped or unmapped, of any type (gas, pipelines, fibre, electricity etc) could be present. A thorough service-search should be carried out prior to commencement of excavations.

We reiterate that trench shields will likely be required for all temporary service trench excavations deeper than approximately 1.0m due to the shallow depth to groundwater and presence of sandy soils. Shallower support or wide battering of trenches may be required where the groundwater is particularly shallow.

14.0 Future Work

Geotechnical constraints requiring specific consideration by development designers are outlined herein. We recommend these aspects be subject to development-specific geotechnical investigation and assessment at the Resource/Building Consent stage (as appropriate).

The purpose of such additional investigation/assessment is to mitigate the risk of the geotechnical constraints discussed in Section 11.0 of this report, confirm or modify the preliminary geotechnical design guidance provided in Sections 12.1 through 12.7 of this report, and provide geotechnical design parameters suitable to inform preliminary and detailed earthworks/foundation design.

15.0 Closure

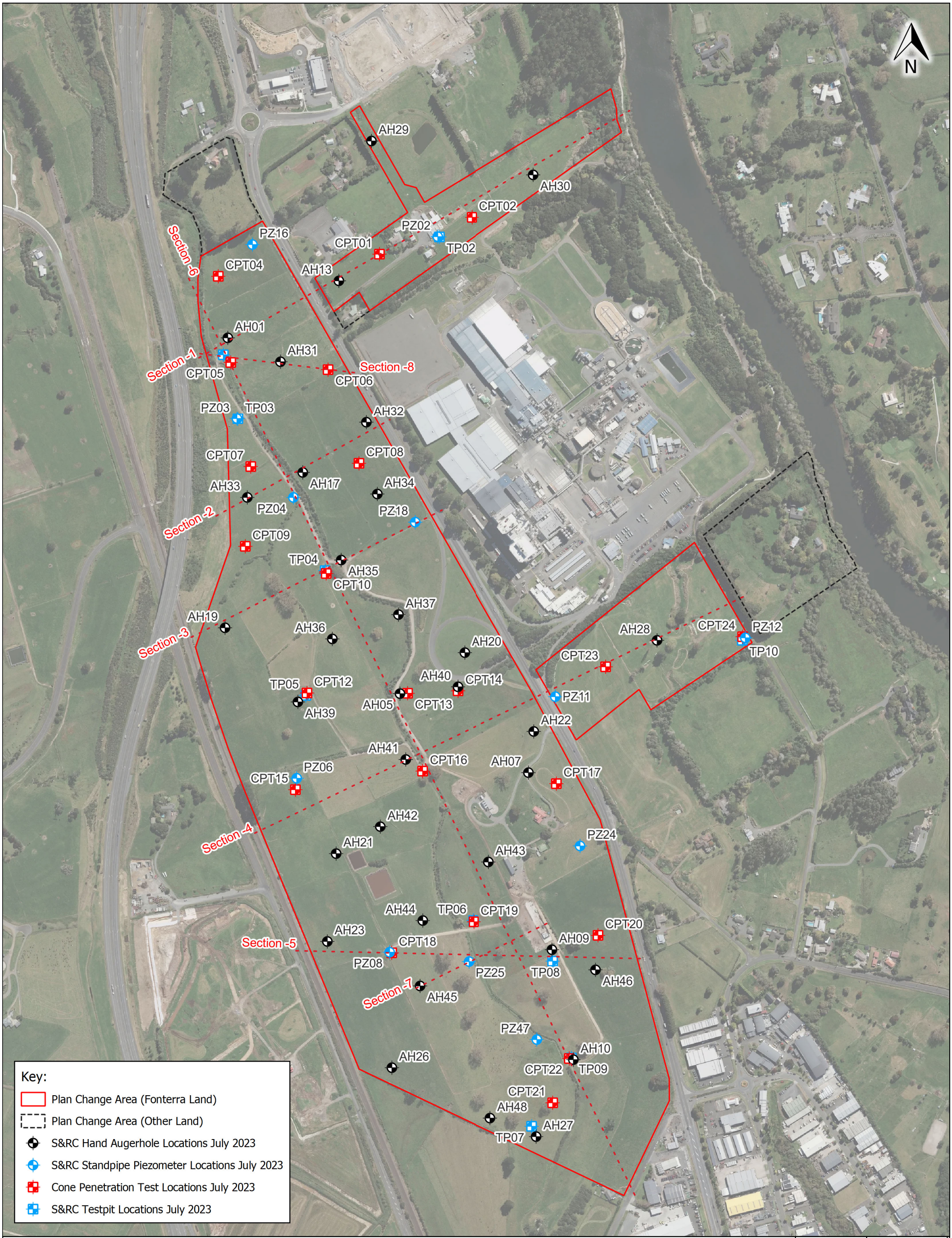
This report has been prepared to support PC17 based on data from discrete locations in properties within the Plan Change Area that were accessible to S&RC at the time of our investigation.

We consider PC17 to be geotechnically suitable for future development provided the recommendations given in this report are observed.

End of Report Text – Appendices Follow

Appendix A

Drawings



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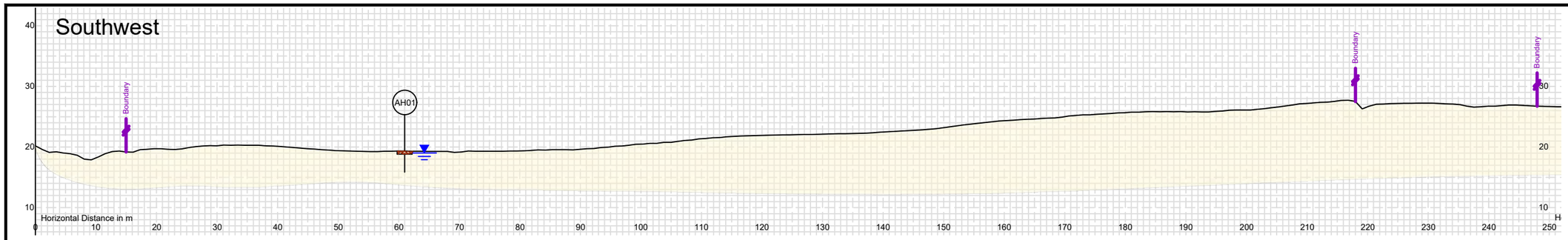
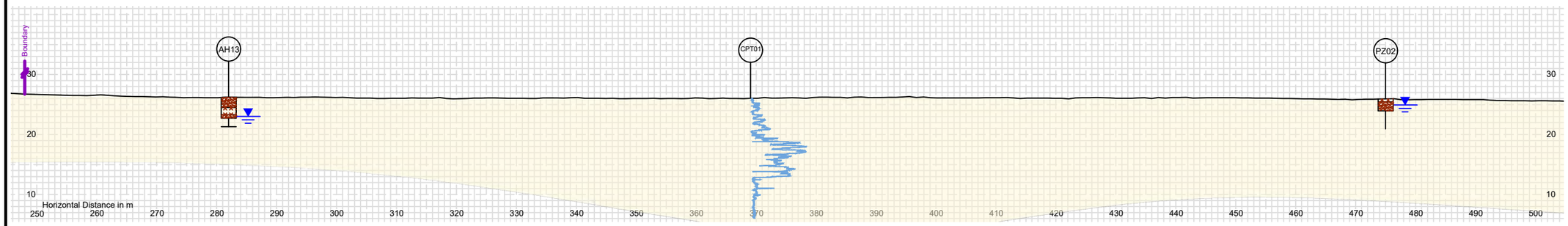
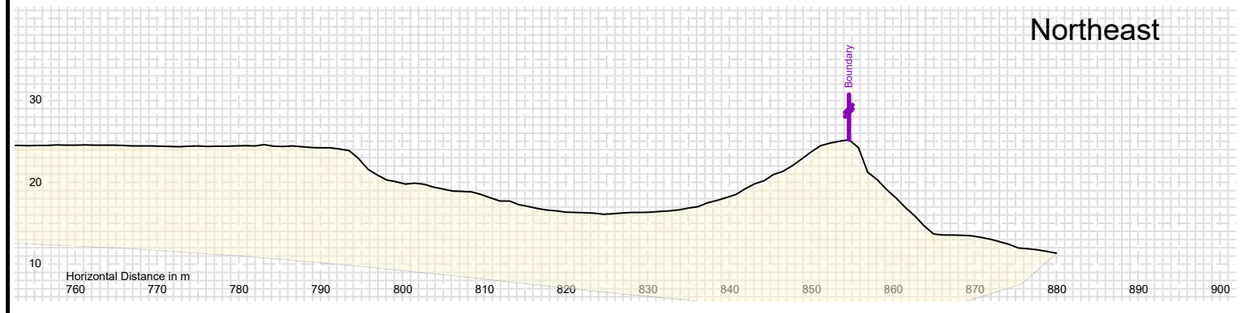
Site Plan

Fonterra Te Rapa
1344 Te Rapa Road, Hamilton

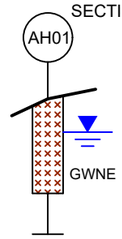
Dwg. No.	220489/1
Drawn By:	B.Smith
Date:	08 Oct 2024
Scale:	1:6000
Rev.	C







KEY TO CROSS SECTION SYMBOLS



Hand Drilled Augerhole

Groundwater Level

GWNE Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

Fill

Clay

Silt

Sand

Gravel

Peat / Organic Material

Sandstone

NOTES:

1. Ground surface generated from Waikato District Council LiDar data.
2. Soil descriptions shown approximate only, refer to borelogs for details.
3. Extrapolation of ground conditions away from test locations has been made but cannot be guaranteed.
4. Groundwater measurements were made at completion of drilling.
5. Locations of features approximate only.

AMENDMENTS		
DATE	REV	DESCRIPTION

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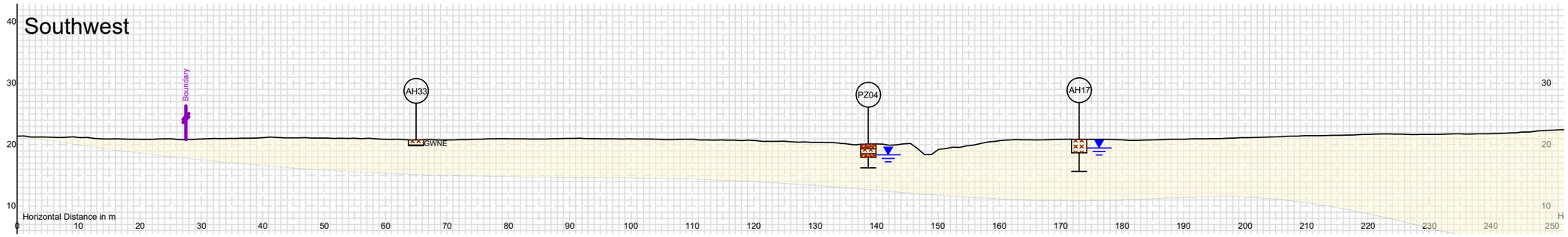
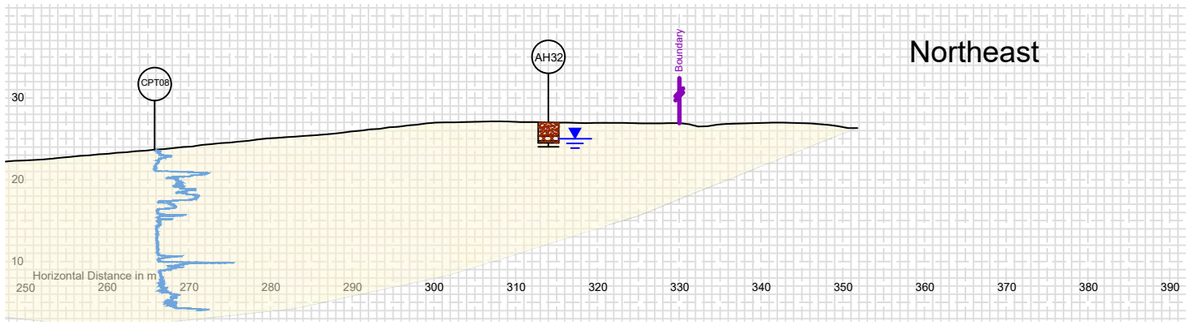
FONTERRA TE RAPA
1344 TE RAPA ROAD
HAMILTON

SECTION 1

220489/S1	DRAWN: B.Smith	DATE: 31-Oct-23
SCALES: 1: 750 AT A3	CHECKED:	REV.
	DESIGNED:	

Filename: 220489 - sections -nov2023.dwg





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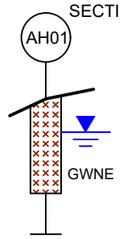

Hand Drilled Augerhole

Groundwater Level

Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

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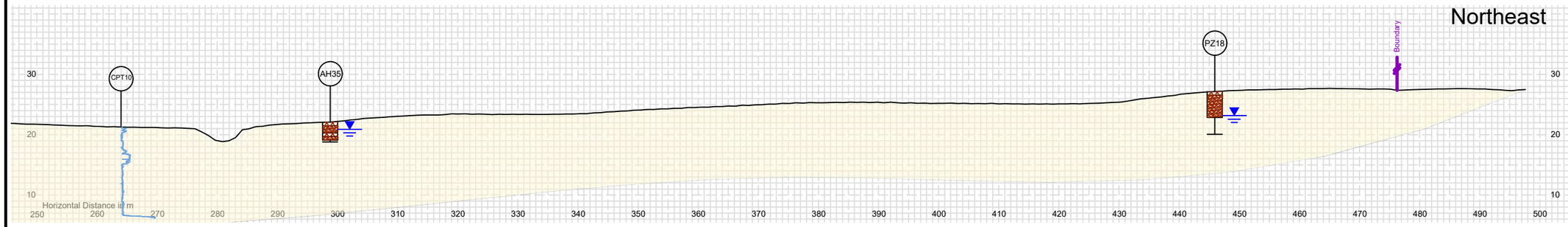
SECTION 2

220489/S2	DRAWN: B.Smith	DATE: 31-Oct-23
SCALES: 1: 750 AT A3	CHECKED:	REV.
	DESIGNED:	
Filename: 220489 - sections -nov2023.dwg		



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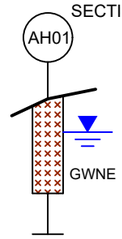

Hand Drilled Augerhole

Groundwater Level

Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

Fill

Clay

Silt

Sand

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Sandstone

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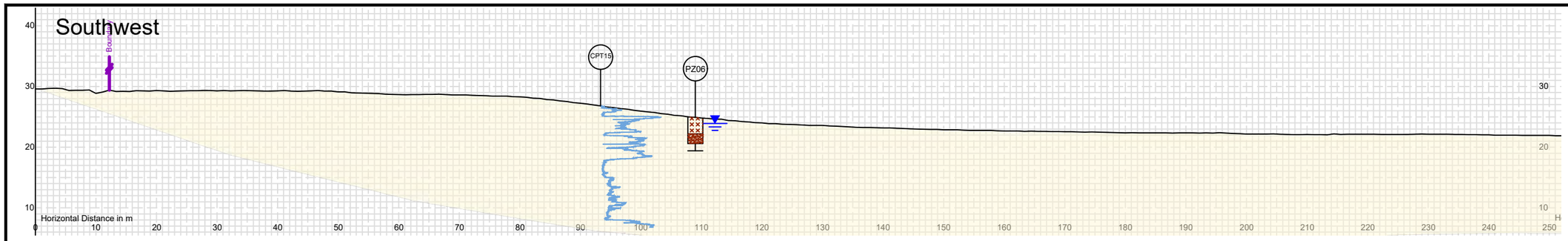
SECTION 3

220489/S3	DRAWN: B.Smith	DATE: 31-Oct-23
SCALES: 1: 750 AT A3	CHECKED:	REV.
	DESIGNED:	
Filename: 220489 - sections -nov2023.dwg		



KEY TO CROSS SECTION SYMBOLS

AH01 — Hand Drilled Augerhole

Groundwater Level

GWNE — Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill

Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

Fill
Clay
Silt
Sand
Gravel
Peat / Organic Material
Sandstone

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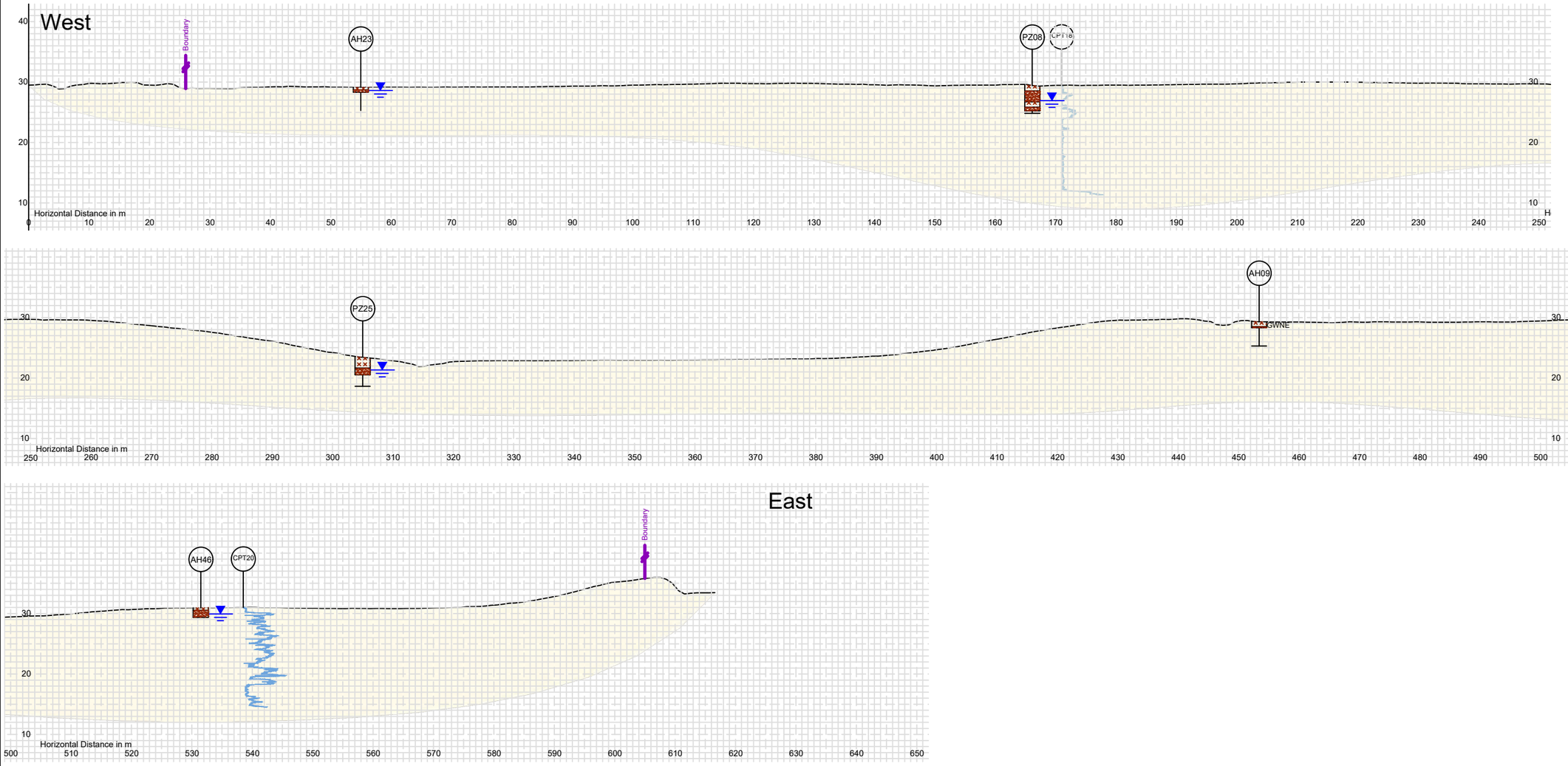
SECTION 4

220489/S4	DRAWN: B.Smith	DATE: 31-Oct-23	
SCALES: 1: 750 AT A3	CHECKED:		REV.
	DESIGNED:		
Filename: 220489 - sections -nov2023.dwg			



KEY TO CROSS SECTION SYMBOLS

AH01 — Hand Drilled Augerhole

Groundwater Level

GWNE — Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

- Non-Engineered Fill
- Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

- Fill
- Clay
- Silt
- Sand
- Gravel
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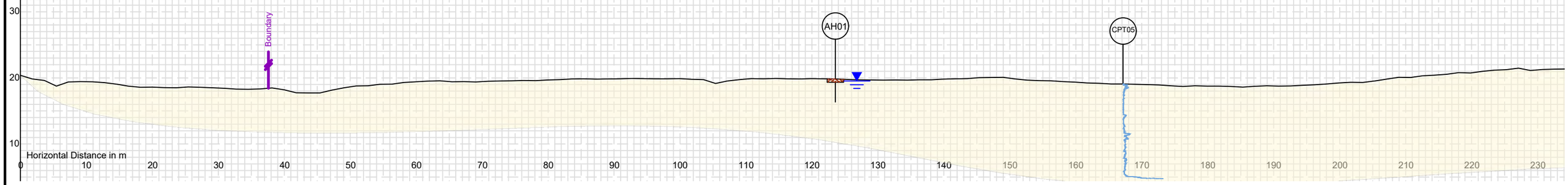
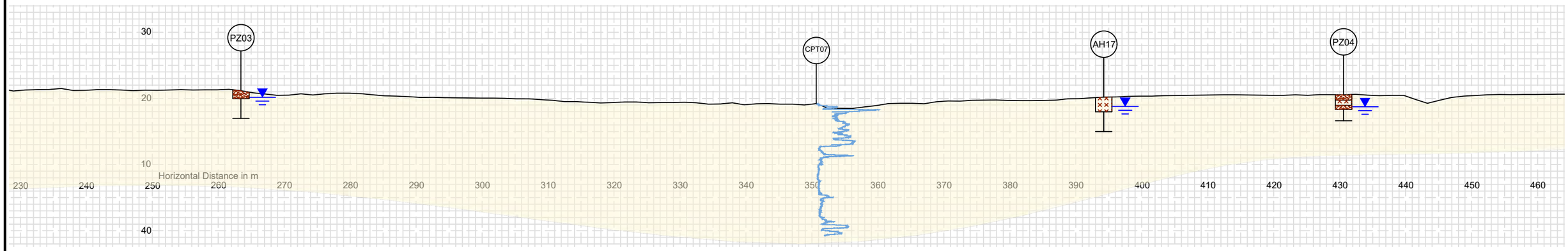
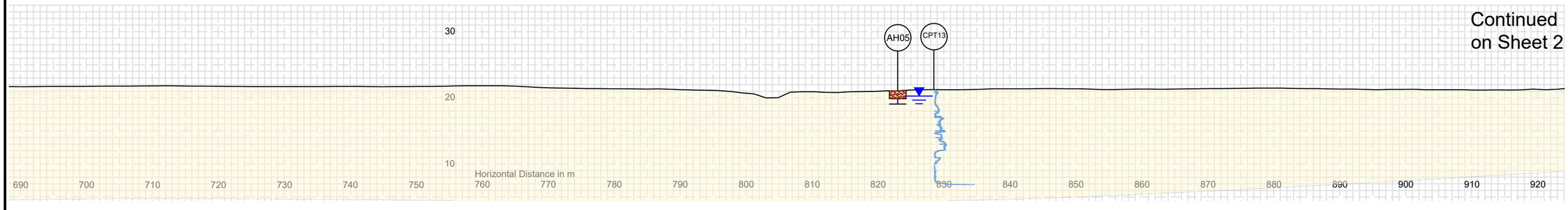
SECTION 5

220489/S5	DRAWN: B.Smith	DATE: 31-Oct-23	
SCALES: 1: 750 AT A3	CHECKED:		REV.
	DESIGNED:		
Filename: 220489 - sections -nov2023.dwg			

North







Continued on Sheet 2

AH01 — Hand Drilled Augerhole

GWNE — Groundwater Level / Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill
Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

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Clay
Silt
Sand
Gravel
Peat / Organic Material
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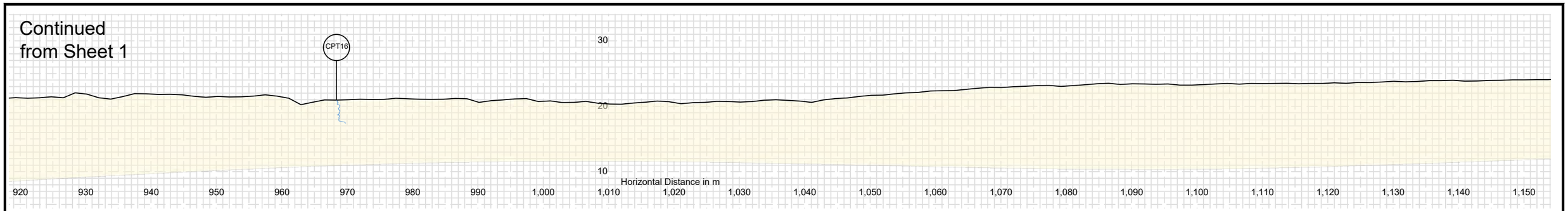
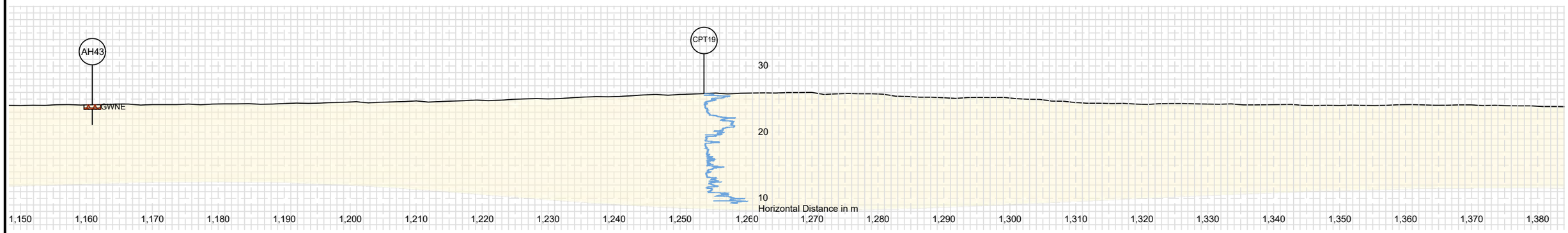
SECTION 6
SHEET 1

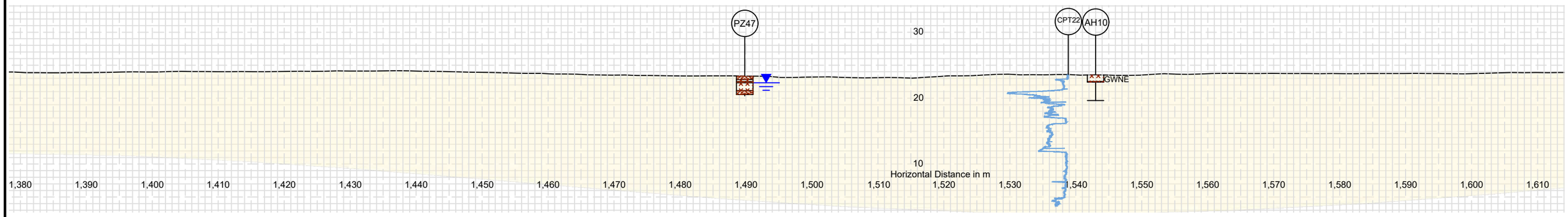
220489/S6-1	DRAWN: B.Smith	DATE: 31-Oct-23	
SCALES: 1: 750 AT A3	CHECKED:		REV.
	DESIGNED:		

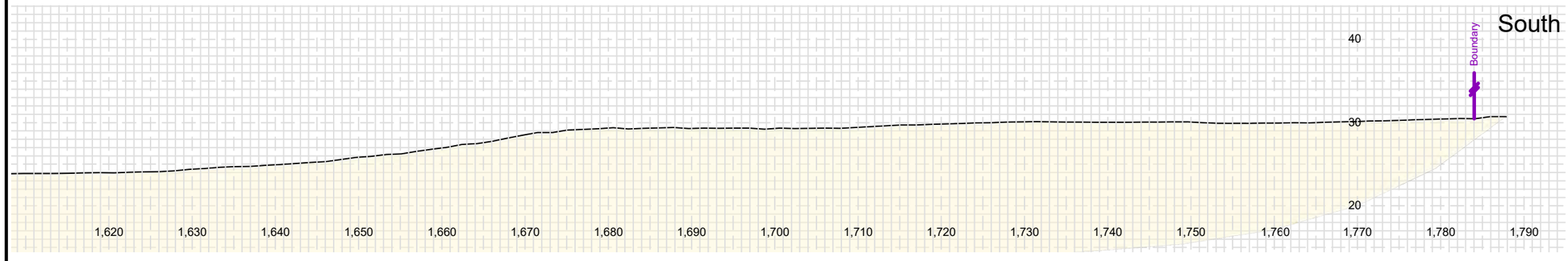
Filename: 220489 - sections -nov2023.dwg

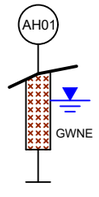
Continued
from Sheet 1











Hand Drilled Augerhole

Groundwater Level

Groundwater Not Encountered

Scala Penetrometer Test
from base of Augerhole

KEY TO LITHOLOGY SHADES

Non-Engineered Fill
Alluvial Deposits

KEY TO DOMINANT LITHOLOGY HATCHES

Fill
Clay
Silt
Sand
Gravel
Peat / Organic Material
Sandstone

NOTES:

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5. Locations of features approximate only.

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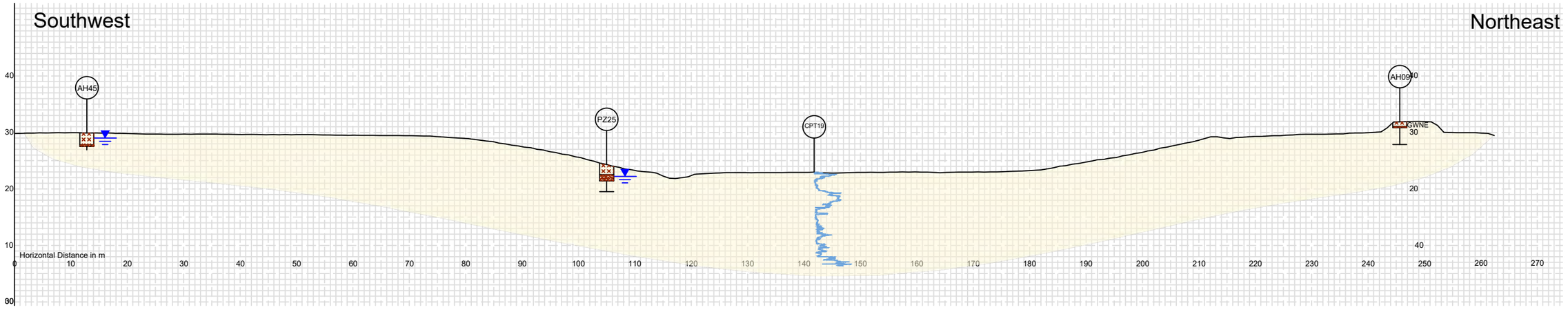
HAMILTON

SECTION 6
SHEET 2

220489/S6-2	DRAWN: B.Smith	DATE: 31-Oct-23
SCALES: 1: 750 AT A3	CHECKED:	REV.
	DESIGNED:	

Filename: 220489 - sections -nov2023.dwg



KEY TO DOMINANT LITHOLOGY HATCHES

- Fill
- Clay
- Silt
- Sand
- Gravel
- Peat / Organic Material
- Sandstone

KEY TO CROSS SECTION SYMBOLS

AH01 — Hand Drilled Augerhole

GWNE — Groundwater Level

Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

- Non-Engineered Fill
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AMENDMENTS		
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SECTION 7

220489/S7	DRAWN: B.Smith	DATE: 31-Oct-23	
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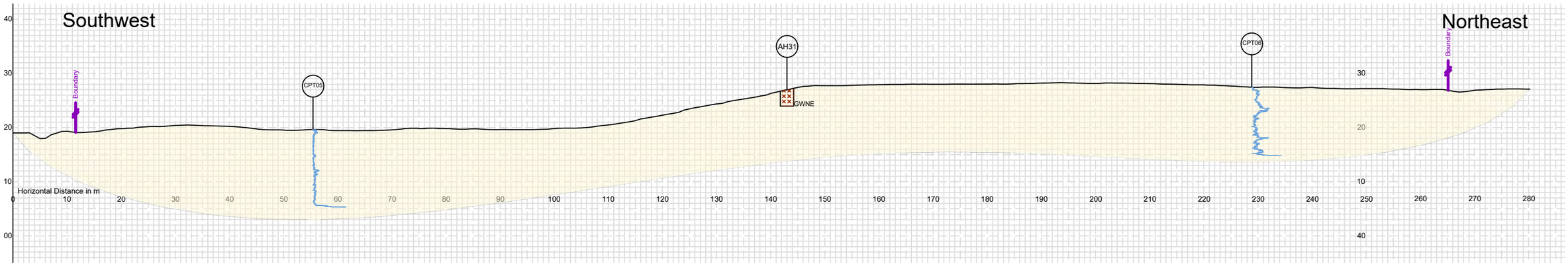
	DESIGNED:		
Filename: 220489 - sections -nov2023.dwg			



KEY TO DOMINANT LITHOLOGY HATCHES

- Fill
- Clay
- Silt
- Sand
- Gravel
- Peat / Organic Material
- Sandstone

KEY TO CROSS SECTION SYMBOLS

AH01 — Hand Drilled Augerhole

GWNE — Groundwater Level / Groundwater Not Encountered

Scala Penetrometer Test from base of Augerhole

KEY TO LITHOLOGY SHADES

- Non-Engineered Fill
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SECTION 8

220489/S8	DRAWN: B.Smith	DATE: 31-Oct-23
SCALES: 1: 750 AT A3	CHECKED:	REV.
	DESIGNED:	
Filename: 220489 - sections -nov2023.dwg		

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Appendix B

Investigation Logs

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH01

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	17/7/23	Water Level:	0.3m 17/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HF			fine to coarse SAND, grey brown, very loose, moist (RIVER DEPOSITS)	
			fine to coarse SAND, some silt, grey, very loose, saturated	17/07/23
	0.5		trace fine sub-angular gravel no recovery	
			END OF BORE. 0.50 METRES. (NO RECOVERY)	
	1.0			
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

2

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ02

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	17/7/23	Water Level:	1.0m 17/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA c_u (kPa) / (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
T		TOPSOIL		0.0					Bentonite
HINUERA FORMATION		fine to medium sandy SILT, trace fine to coarse angular gravel, brown, loose, moist (RIVER DEPOSITS)							
		SILT, fine to coarse sand, light grey, organic streaks, stiff, moist, slightly plastic		0.5		2			
		silty fine to coarse SAND, trace clay, light grey, orange specks, loose, moist				2			
		silty, fine to medium SAND, wet				2			
		saturated	17/07/23	1.0		2			
		fine to coarse SAND, some silt, light grey, black and orange specks, loose, saturated				2			
		silty fine to coarse SAND, light grey, black and orange specks, medium dense, moist				4			
						4			Filter Pack
						4			
						4			
				1.5		4			Slotted Pipe
						4			
						3			
						2			
						6			
				2.0		4			
		END OF BORE. 2.00 METRES. (HOLE COLLAPSE)							
				2.5					
				3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ03

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	ZP
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	17/7/23	Water Level:	1.0m 17/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA c_u (kPa) / (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
T		TOPSOIL		0.0					Bentonite
HINUERA FORMATION		silty fine to coarse SAND, trace clay, light brown, red brown specks, medium dense, moist (RIVER DEPOSITS)				18			
		trace fine angular gravel, white specks		0.5		18			
		dense				19			
		minor fine angular gravel				19			
			17/07/23			11			Filter Pack
		trace cay, black, orange patches, light grey		1.0		15			
		saturated				15			
		medium to coarse SAND, some silt, light grey, orange and grey specks, dense, saturated				12			Slotted Pipe
						14			
		END OF BORE. 1.20 METRES. (HOLE COLLAPSE)		1.5					
				2.0					
				2.5					
				3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ04

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	17/7/23	Water Level:	1.4m 17/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					Bentonite
HINUERA FORMATION		fine to medium SAND, some silt, brown, white specks, medium dense, moist (RIVER DEPOSITS) fine to coarse SAND, minor fine to medium angular gravel yellow and red specks		0.5		11 9 9			
		fine to medium sandy SILT, minor clay, minor fine angular gravel, bluish grey, orange mottles, firm, wet, slightly plastic dark green light grey, saturated	17/07/23	1.0 1.5		1 1 V,29 VR,13			Filter Pack
		fine to coarse SAND, minor silt, bluish grey, loose, saturated poor recovery >10% hole collapsing		2.0					Slotted Pipe
		END OF BORE. 2.20 METRES. (HOLE COLLAPSE)		2.5 3.0 3.5 4.0 4.5 5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH05

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	17/7/23	Water Level:	0.8m 17/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION			fine to medium sandy SILT, brown, white and orange specks, stiff, moist, non-plastic (RIVER DEPOSITS)	
	0.5		fine to coarse SAND, minor silt, minor fine angular gravel, white, orange and green specks, medium dense, moist	
			saturated	17/07/23
	1.0			
			END OF BORE. 1.20 METRES. (TOO DENSE TO AUGER)	
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)

DEPTH (m)	Blows per 100mm
0.5	10
	10
	11
	7
	6
1.0	8
	10
	11

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ06

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	17/7/23	Water Level:	1.0m 17/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
T		TOPSOIL		0.0					
HINUERA FORMATION		fine to medium sandy SILT, trace clay, light orange, very stiff, moist, non-plastic (RIVER DEPOSITS) grey light yellow		0.5		V,182 VR,68			Bentonite
		SILT, some fine sand, minor clay, grey, orange steaks, very stiff, moist, slightly plastic	17/07/23						
		fine to medium sandy SILT, trace clay, light grey, very stiff, moist, non-plastic		1.0		V,206			
		light orange patches no light orange patches fine sandy SILT		1.5		V,123 VR,47			
		fine to medium sandy SILT, wet		2.0		V,132 VR,53			
		saturated, dilatant		2.5		V,109 VR,44			Filter Pack Slotted Pipe
		fine to medium SAND, minor silt, light grey, loose, saturated, dilatant		3.0		2			
		fine SAND, medium dense				2 3 4 5			
		fine to medium SAND, dense		3.5		6 12 9 9			
		medium dense loose				5 2			
		dark grey, medium dense		4.0		5 7 9			
		END OF BORE. 4.30 METRES. (HOLE COLLAPSE)		4.5					
				5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH07

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	17/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
T	0.0		TOPSOIL
HF	0.5		fine to medium sandy SILT, light yellow, orange patches, very stiff, moist (RIVER DEPOSITS)
			fine to coarse SAND, minor silt, minor fine to medium sub-angular gravel, dark yellow brown, dense, moist
	1.0		END OF BORE. 0.90 METRES. (TOO DENSE TO AUGER)

WATER LEVEL (m)

DEPTH (m)

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)

206 V

15

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ08

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	17/7/23	Water Level:	2.5m 17/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
T		TOPSOIL		0.0					
HINUERA FORMATION		fine to medium sandy SILT, minor clay, brown, yellow, very stiff, moist, slightly plastic (RIVER DEPOSITS)							
		silty fine to medium, SAND, grey, loose, moist							
		fine to medium sandy SILT, trace fine angular gravel, minor clay, brown, red brown mottles, very stiff, moist, slightly plastic		0.5		V,175 VR,32			Bentonite
		light grey, no gravel							
		silty fine to coarse, SAND, light grey, orange mottles, medium dense, saturated		1.0					
		fine to coarse SAND, some silt, light grey, orange mottles, medium dense, saturated				6			
		light grey, bluish grey, dilatant				6			
						6			
						3			
				1.5		3			
						7			
		dense				8			
						10			
						10			
				2.0		6			
		medium dense				7			
			17/07/23			6			
						9			
						7			
				2.5		6			
		silty, fine to medium SAND, light grey, medium dense, saturated, dilatant				4			Filter Pack
		fine sandy SILT, light grey, blue grey, stiff, saturated, dilatant				3			Slotted Pipe
				3.0		V,76 VR,40			
		dark grey streaks							
		trace fine angular gravel							
				3.5		V,173 VR,79			
		fine to coarse SAND, some silt, grey, blue grey, medium dense, saturated, dilatant							
		blue grey, white specks							
				4.0		4			
						8			
						13			
		END OF BORE. 4.20 METRES. (TOO DENSE TO AUGER)							
				4.5					
				5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

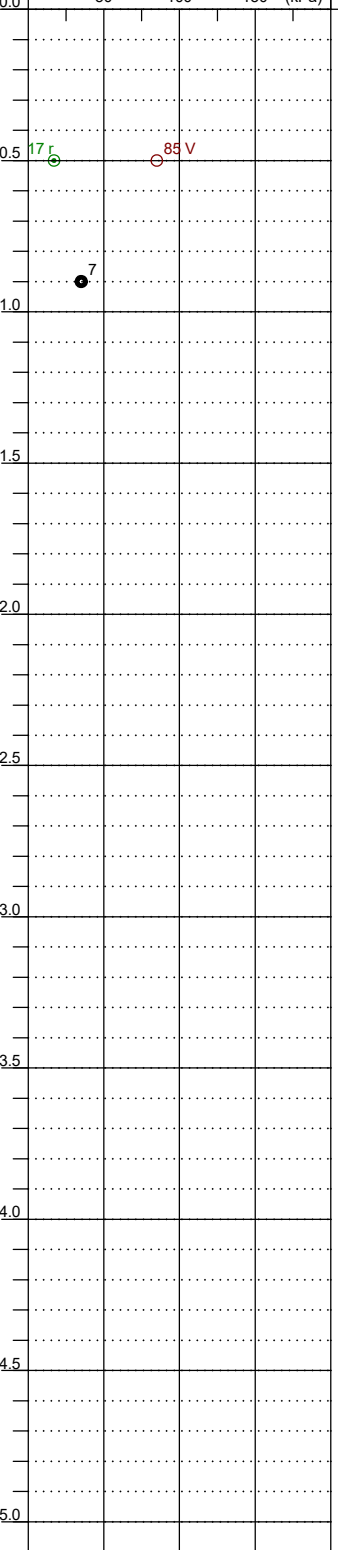
PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH09

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	18/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
H. FORMATION	0.5		SILT, minor clay, trace fine sand, orange brown, stiff, moist, slightly plastic (RIVER DEPOSITS)	
			fine to medium sandy SILT, orange brown, stiff, moist, slightly plastic	
	1.0		fine to coarse SAND, minor silt, trace sub-angular gravel, orange brown, medium dense, moist	
			END OF BORE. 1.00 METRES. (TOO DENSE TO AUGER + NO RECOVERY)	



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH10

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	18/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
T	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT, minor fine to coarse sand, some clay, grey brown, very stiff, moist, slightly plastic (RIVER DEPOSITS) for 50mm clayey SILT, some fine to coarse sand, orange brown, very stiff, moist, moderately plastic
	1.0		fine to coarse sandy SILT, minor clay, grey brown, very stiff, moist, slightly plastic
			fine to coarse SAND, some silt, grey, dense, wet
	1.5		END OF BORE. 1.10 METRES. (HOLE COLLAPSE)
	2.0		
	2.5		
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m)

DEPTH (m)

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)

34 r
163 V
19
17

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ11

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	18/7/23	Water Level:	2.0m 18/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					Bentonite
HINUERA FORMATION		SILT, some clay, some fine sand, orange, dark orange specks, very stiff, moist, slightly plastic (RIVER DEPOSITS)		0.5		V,109 VR,29			
		fine to coarse sandy SILT, minor clay, dark orange, white specks, very stiff, moist, slightly plastic							
		light grey		1.0		V,191 VR,18			
		fine sandy SILT							
		white		1.5					Filter Pack
		fine to medium SAND, some silt, trace clay, light grey, loose, moist				1			Slotted Pipe
		fine to coarse SAND, dark grey, grey specks, wet	18/07/23			3			
		saturated		2.0		9			
						6			
						6			
						5			
		END OF BORE. 2.20 METRES. (TOO DENSE TO AUGER + HOLE COLLAPSE)		2.5					
				3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ12

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	18/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					
HINUERA FORMATION		SILT, some fine sand, minor clay, light grey, orange streaks, very stiff, moist, slightly plastic (RIVER DEPOSITS)		0.5		V,206			Bentonite
		fine to medium sandy SILT, minor clay, whitish grey, very stiff, moist, slightly plastic							
		SILT, some clay, minor fine sand, whitish grey, very stiff, moist, slightly plastic		1.0		V,185 VR,35			
		dark orange specks		1.5		V,206			
		fine SAND, minor silt, whitish grey, orage specks, medium dense, wet, non-plastic							
		fine to coarse SAND, trace silt, light grey, white specks		2.0		7			
		reddish orange specks				5			
		fine sandy SILT, minor clay, light grey, orange streaks, very stiff, wet, slightly plastic				10			Filter Pack
		fine to coarse SAND, minor silt, light yellow, white specks, dense, wet		2.5		3			
		yellowish orange mottles and specks				5			Slotted Pipe
		dark orange specks		3.0		10			
		dark grey and orange specks				9			
						11			
						16			
						17			
						14			
						20			
						16			
						20			
						18			
				3.5		24			
		END OF BORE. 3.50 METRES. (TOO DENSE TO AUGER)							
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH13

Sheet 1 of 1

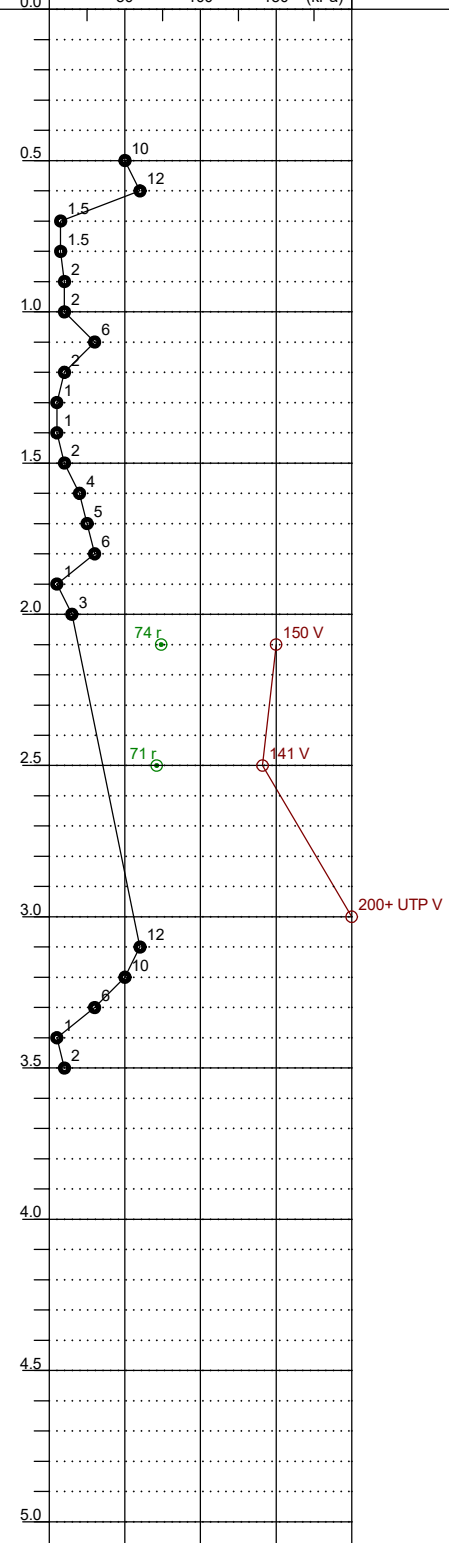
Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	3.2m 19/07/23		

STRATIGRAPHY	DEPTH (m)	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0	TOPSOIL
		fine to medium sandy SILT, minor clay, white, orange specks, stiff, moist, non-plastic (RIVER DEPOSITS)
HINUERA FORMATION	0.5	fine to medium SAND, some silt, whitish grey, orange specks, loose, moist, non-plastic
	1.0	
	1.5	silty, fine to coarse SAND, dark orange, white specks, loose, moist
	2.0	fine sandy SILT, some clay, white, orange mottles, very stiff, moist, slightly plastic
		dark orange patches
	2.5	wet
	3.0	silty, fine to coarse SAND, light grey, white specks, medium dense, wet
		saturated
		loose
	3.5	light orange specks
		END OF BORE. 3.50 METRES. (HOLE COLLAPSE)
	4.0	
	4.5	
	5.0	

WATER LEVEL (m): 19/07/23

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ16

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	18/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA c_u (kPa) / (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					Bentonite
HINUERA FORMATION		silty fine to coarse SAND, orange brown, very loose, moist (RIVER DEPOSITS) minor clay, slightly plastic		0.5		3 7			
		no clay, trace fine sub-angular gravel				6 6			
		fine to coarse SAND, minor silt, trace fine sub-angular gravel, orange brown, loose, moist		1.0		8 8			
		minor fine sub-angular gravel, light grey				8 7			Filter Pack
		trace fine sub-angular gravel, trace silt		1.5		7 6 8			Slotted Pipe
		END OF BORE. 2.00 METRES. (HOLE COLLAPSE)		2.0		8 11 10 10 9			
				2.5					
				3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH17

Sheet 1 of 1

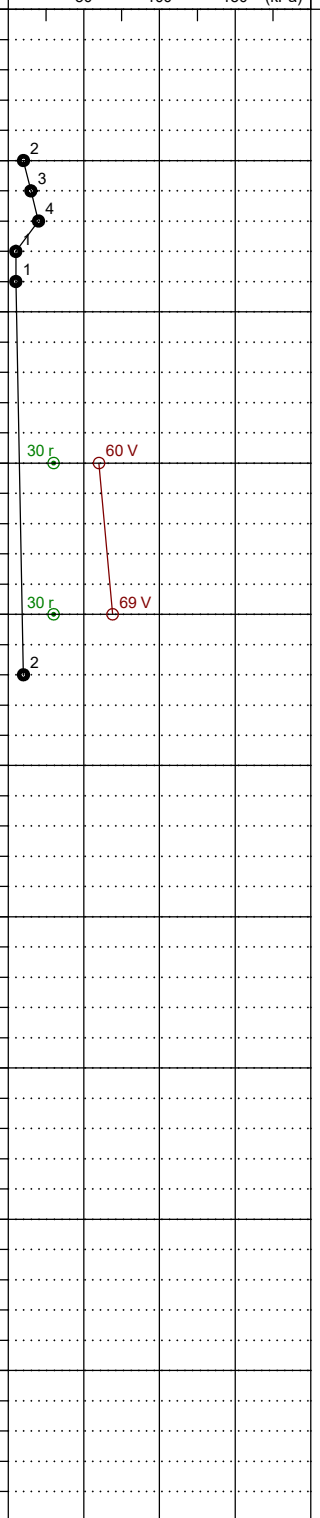
Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	1.4m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION			fine to medium sandy SILT, trace clay, grey, white, very stiff, moist, non-plastic (RIVER DEPOSITS)
			silty fine to medium sand, brown, white and grey specks, loose, moist
	0.5		fine to coarse SAND, minor silt, minor fine angular gravel, brown, grey specks, loose, moist
			fine to coarse sandy SILT, some clay, minor fine angular gravel, orange light grey, orange mottles, stiff, moist slightly plastic
			minor fine to medium angular gravel, wet
	1.0		intermixed with clayey SILT, some fine to medium sand, light grey
			SILT, some fine to medium sand, trace clay, minor fine to medium angular gravel, orange, grey, stiff, saturated, non-plastic
			some fine sand, light grey, blue grey, orange
	1.5		light brown, poor recovery 20%
			no recovery 1.8m to EOB
	2.0		
			END OF BORE. 2.20 METRES. (TOO DENSE TO AUGER)
	2.5		
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 19/07/23

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ18

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	18/7/23	Water Level:	4.0m 18/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA c_u (kPa) / (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					
HINUERA FORMATION		SILT, minor clay, trace fine sand, brown, light brown, very stiff, moist, slightly plastic (RIVER DEPOSITS)							
		white, light grey							
		orange brown		0.5					Bentonite
		fine to medium sand, trace silt, light orange, brown, very loose, moist				1			
		SILT, minor clay, trace fine sand, dark brown, black speckles, stiff, moist, slightly plastic				2			
		fine to medium SAND, some silt, trace clay, orange brown, medium dense, moist		1.0		4			
		minor silt, light grey, orange brown				7			
		fine to coarse SAND, light grey				8			
		trace fine subangular gravel				8			
		light brown, light grey				13			
						13			
				1.5		7			
		fine to medium SAND				9			
						8			
						6			
		light grey, orange brown streaks				8			
				2.0		8			
						2			
						4			
						3			
						3			
				2.5		5			
		light orange brown, light grey				4			
						6			Filter Pack
						6			
		light grey, orange brown streaks				6			Slotted Pipe
				3.0		5			
		silty fine to medium SAND, light grey, light orange brown streaks, loose, moist				5			
						6			
		wet				7			
						5			
				3.5		6			
						6			
		light grey	18/07/23			5			
						6			
						6			
		saturated		4.0		5			
						6			
						7			
		END OF BORE. 4.30 METRES. (HOLE COLLAPSE)		4.5					
				5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH19

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	17/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows) / SHEAR STRENGTH REMOULDED SHEAR v r 50 100 150 (kPa)	LABORATORY TESTS
TS	0.0		TOPSOIL		0.0		
HINUERA FORMATION	0.5		fine to medium sandy SILT, minor clay, dark greyish orange, white speckles, very stiff, moist, slightly plastic (RIVER ALLUVIAL DEPOSITS) white with black speckles		0.5	12 10 13 12	
	1.0		fine to medium SAND, some silt, white, orange speckles, dense, moist, non plastic		1.0	20 20	
	1.5		END OF BORE. 1.15 METRES. (HOLE COLLAPSE)		1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH20

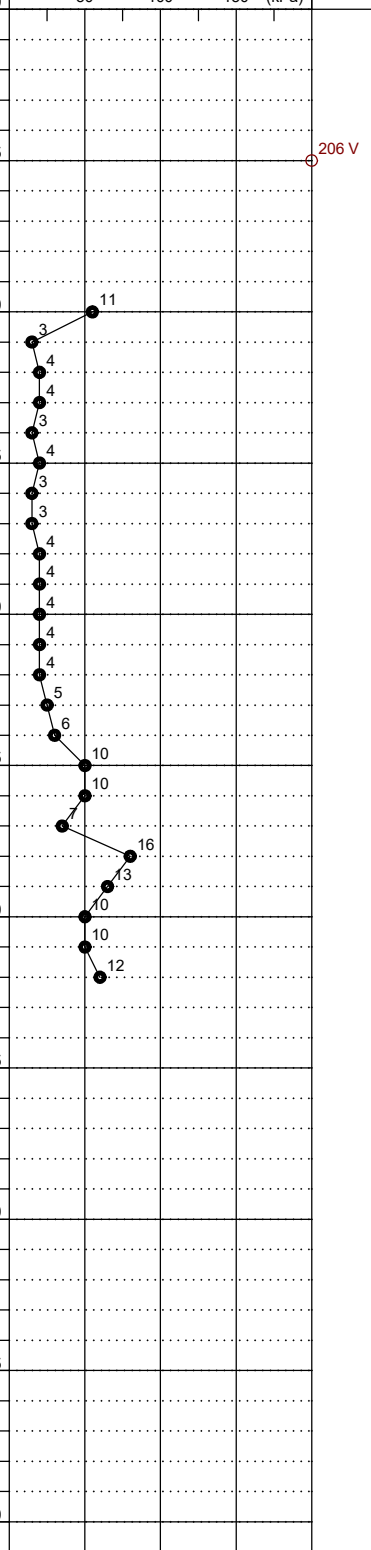
Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	20/7/23	Water Level:	2.0m 20/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION			fine to medium sandy SILT, trace clay, brown, very stiff, moist, slightly plastic (RIVER DEPOSITS) light greyish yellow	
	0.5		brown	
			SILT, some fine to medium sand, minor clay, orange, very stiff, moist, slightly plastic orange brown	
	1.0		fine to coarse SAND, minor silt, trace fine angular gravel, brown, light yellow, medium dense, moist loose	
			fine to medium sandy SILT, minor clay, light yellowish orange, very stiff, moist, non plastic	
	1.5		fine to coarse SAND, minor silt, minor fine to medium angular gravel, brown, light yellow, loose, wet, non plastic	
			silty fine to coarse SAND, minor fine to angular, trace clay, light yellowish brown, loose, wet, non plastic	
	2.0		some clay, slightly plastic very loose, saturated	20/07/23
			medium to coarse SAND, some fine angular gravel, trace silt, black, grey, very loose, saturated	
	2.5		some silt	
			dense	
	3.0			
			END OF BORE. 3.20 METRES. (TOO DENSE TO AUGER)	
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH21

Sheet 1 of 1

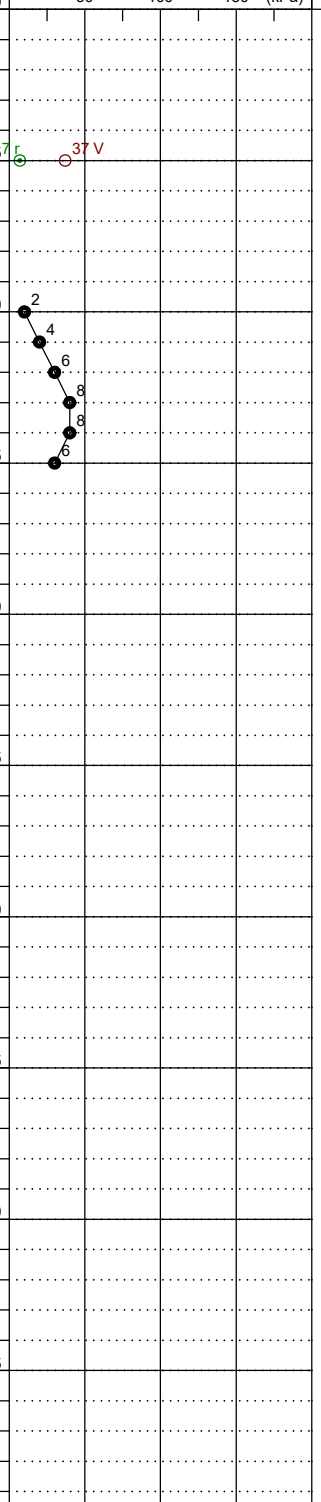
Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	0.7m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		SILT, some fine sand, some clay, light grey, firm, moist, slightly plastic (RIVER DEPOSITS)	
			fine to medium sandy SILT, trace clay, grey, red brown & orange, firm, wet, non-plastic saturated	19/07/23
	1.0		silty fine to medium SAND, grey, orange brown patches, loose, saturated	
			fine to medium sand, some silt, grey, loose, saturated	
	1.5		no recovery	
			END OF BORE. 1.50 METRES. (NO RECOVERY)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r

50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH22

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	20/7/23	Water Level:	1.5m 20/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION			fine to medium sandy SILT, trace clay, dark orange, very stiff, moist, non-plastic (RIVER DEPOSITS)
	0.5		fine to medium SAND, some silt, orange, brown, light yellow, grey specks, loose, moist
			fine sandy SILT, minor clay, white, very stiff, moist, slightly plastic white, light yellow mottles
	1.0		silty fine to medium SAND, trace clay, light yellow, yellow steaks, loose, moist
			yellow, orange mottles
			light grey streaks, saturated/dilatant
	1.5		white
			orange, dark orange patches
	2.0		white, yellow
	2.5		medium dense, poor recovery 20%
			END OF BORE. 2.60 METRES. (HOLE COLLAPSE)
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 20/07/23

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)

206 V

2 3 2 2 2 2 2 4 3 4 3 2 4 7 6 10

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH23

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	ZP
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	20/7/23	Water Level:	0.5m 20/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HF			SILT, minor clay, minor fine sand, light brown, light grey, hard, moist, slightly plastic (RIVER DEPOSITS)	
	0.5		silty fine to coarse SAND, light brown, light orange, very loose, wet	20/07/23
			fine to coarse SAND, trace silt, light grey, very loose, saturated	
	1.0		END OF BORE. 0.75 METRES. (NO RECOVERY)	
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)

DEPTH (m)

0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

1
2

200+ UTP V

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ24

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	20/7/23	Water Level:	1.7m 20/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					
HINUERA FORMATION		fine sandy SILT, some clay, light orange, light brown, yellow grey, very stiff, mist, slightly plastic (RIVER DEPOSITS)		0.5		V,185 VR,26			Bentonite
		silty fine SAND, trace clay, light grey, yellow, orange mottles, very stiff, moist, non-plastic fine to medium SAND		1.0		2			
		medium dense				3 4 5			
			20/07/23	1.5		3 5 4			
		fine sandy SILT, light grey, stiff, saturated, non-plastic		2.0		6 6 V,147 VR,41			
		silty fine SAND, light grey, loose, saturated		2.5		6			Filter Pack
		fine to medium SAND, some silty, light grey, loose, saturated				5 4			
		silty fine to medium SAND, light grey, loose, saturated				4			
		fine to medium SAND, some silt, light grey, loose, saturated		3.0		6 6			
		fine to medium sandy SILT, dark grey, stiff, saturated, non plastic				4 5			Slotted Pipe
		Less than 20% recovery up to 4.0m		3.5		6 1.5 1			
				4.0		1 1.5 5 6 6			
				4.5		7 6 6 6 5 6			
				5.0		6 8 10 V,280			
		END OF BORE. 5.00 METRES. (TARGET DEPTH)							

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ25

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	19/7/23	Water Level:	2.1m 19/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					Bentonite
HINUERA FORMATION		fine sandy SILT, minor clay, yellow, light orange streaks, very stiff, moist, slightly plastic (RIVER DEPOSITS)		0.5		V,121 VR,59			
		fine to medium sandy							
		yellowish orange,white orange specks		1.0		V,115 VR,50			
		dark orange mottles							
		wet		1.5		V,206			
		fine to medium SAND, some silt, light grey, white specks, medium dense, wet, non-plastic	19/07/23	2.0		2			Filter Pack
		saturated				2			
		silty fine to coarse SAND, yellowish orange, light grey, white specks, loose, saturated, non-plastic		2.5		4 10 8 3 2 5 4			Slotted Pipe
		END OF BORE. 2.90 METRES. (HOLE COLLAPSE)		3.0					
				3.5					
				4.0					
				4.5					
				5.0					

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH26

Sheet 1 of 1

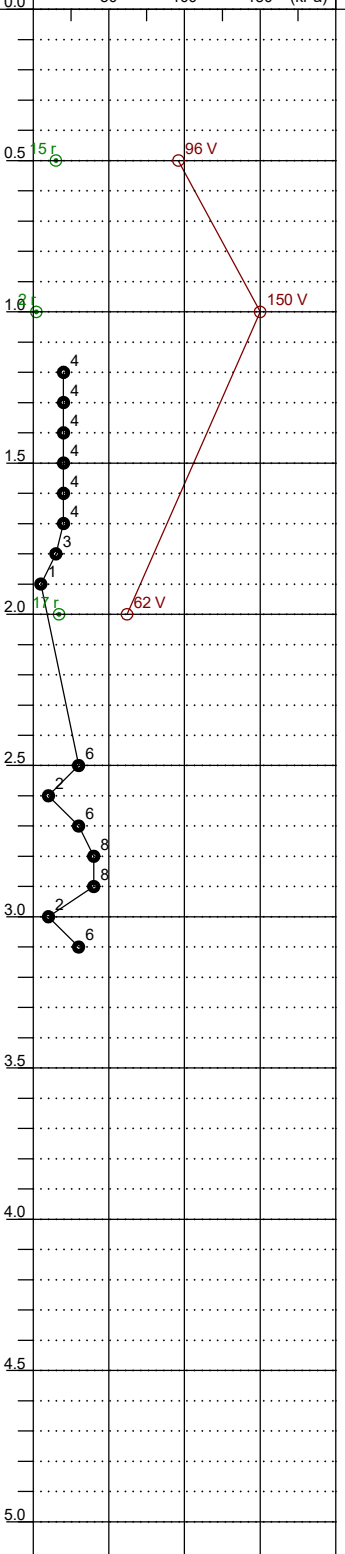
Drill Type:	Hand Auger	Project No:	220489	Logged By:	ZP
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	20/7/23	Water Level:	1.2m 20/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT, some clay, minor fine sand, light yellow, orange brown, orange streaks, stiff, moist, slightly plastic (RIVER DEPOSITS) light grey
	1.0		fine sandy SILT, light grey, very stiff, moist, non-plastic
	1.5		silty fine SAND, light grey, light orange mottles, very stiff, moist saturated fine to medium sand
	2.0		SILT, trace clay, yellow, light grey, stiff, saturated, non-plastic trace fine sand, black organic stained streaks
	2.5		silty fine to medium SAND, grey, loose, saturated
	3.0		fine to coarse SAND, minor silt, light grey, medium dense, saturated
	3.10		END OF BORE. 3.10 METRES. (HOLE COLLAPSE)
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 20/07/23

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
○ v
◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH27

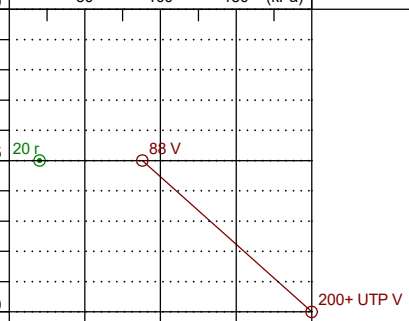
Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	18/7/23	Water Level:	0.7m 180/7/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HF	0.5		SILT, minor clay, minor fine to coarse sand, grey brown, moist, non-plastic (RIVER DEPOSITS)	
			some clay, some fine coarse sand, light grey wet	
			silt fine to coarse SAND, minor clay, light grey, hard, saturated	180/7/23
	1.0		clayey SILT, trace fine to medium sand, light grey, orange brown, stiff, saturated, moderately plastic	
			fine to coarse SAND, some silt, some clay, grey, hard	
			END OF BORE. 1.00 METRES. (TOO DENSE TO AUGER)	

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
○ v
◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH28

Sheet 1 of 1

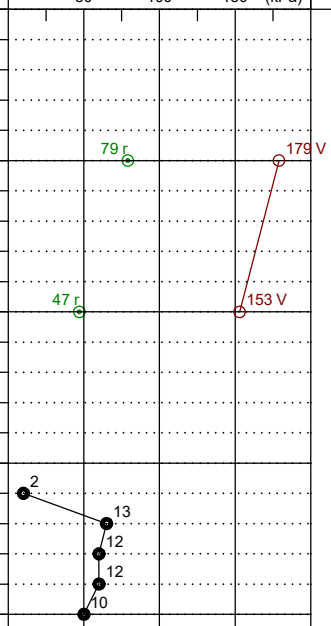
Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	18/7/23	Water Level:	1.4m 18/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT, some fine to medium sand, some clay, brown, grey streaks, very stiff, moist, slightly plastic (RIVER DEPOSITS)
			yellow, grey, orange mottles
			some fine sand, light grey, brown
	1.0		light grey
			fine sandy SILT, minor clay, light grey, very stiff, moist, slightly plastic
	1.5		fine to medium SAND, some silt, trace clay, yellow grey, loose, moist
			fine to coarse SAND, saturated
			dense
	2.0		END OF BORE. 2.00 METRES. (HOLE COLLAPSE)
	2.5		
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 18/07/23

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH29

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	1.2m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
T	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT, minor clay, some fine to medium sand, grey brown, orange mottles, stiff, moist, slightly plastic (RIVER DEPOSITS) some clay, light grey, orange mottles
	1.0		fine to coarse SAND, trace silt, light grey, orange mottles, loose, wet silty fine to medium SAND, light grey, orange mottles, loose, wet saturated
	1.5		fine to coarse SAND, some silt, grey, black specks, medium dense, saturated dense
	2.0		minor silt
	2.5		END OF BORE. 2.25 METRES. (NO RECOVERY)
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 19/07/23

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)

65 V

DEPTH (m)	Blows
1.0	2
	2
	3
	5
	4
	4
1.5	7
	8
	9
	8
	8
2.0	8
	8
	8

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

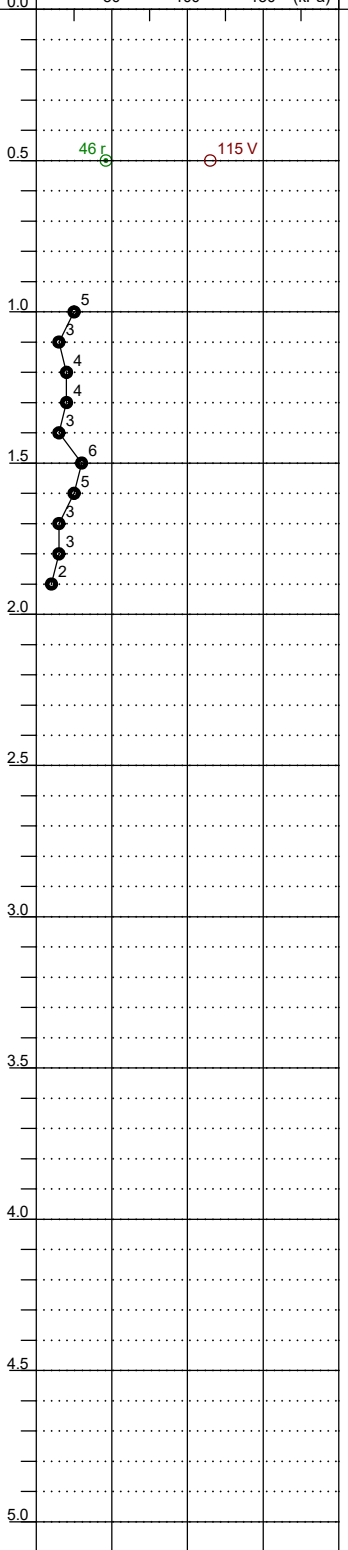
PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH30

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	1.0m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		fine sandy SILT, minor clay, light orange, yellowish orange streaks, very stiff, moist, slightly plastic (RIVER DEPOSITS)	
	1.0		silty fine to medium SAND, whitish yellow, dark orange specks, loose, wet, non-plastic	
			saturated	19/07/23
	1.5		fine to coarse SAND, some silt, whitish grey, medium dense, saturated, non-plastic	
			white specks	
			dark orange specks	
	2.0		END OF BORE. 1.90 METRES. (HOLE COLLAPSE)	
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH31

Sheet 1 of 1

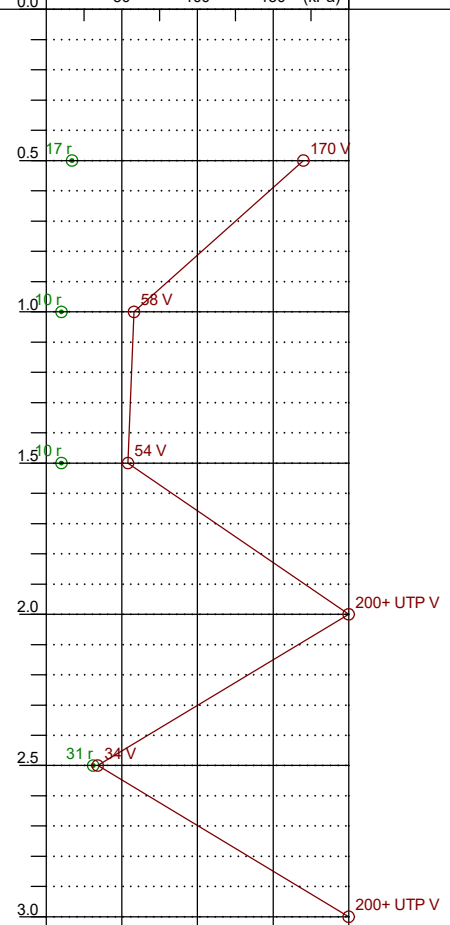
Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	18/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT, minor fine to medium sand, trace clay, orange brown, white specks, very stiff, moist, non-plastic (RIVER DEPOSITS)
			trace fine to medium sub-angular gravel
			fine to medium sandy SILT, trace clay, orange brown patches, very stiff, moist, non-plastic
	1.0		SILT, some fine to medium sand, brown, orange brown patches, very stiff, moist, non-plastic
			some clay, light grey, brown inclusions, stiff, slightly plastic
	1.5		minor clay, grey brown
			fine sandy SILT, some clay, grey brown, light grey mottles, very stiff, moist, slightly plastic
	2.0		
			fine to medium sandy SILT
	2.5		
	3.0		END OF BORE. 3.00 METRES. (TARGET DEPTH)
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m)

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH32

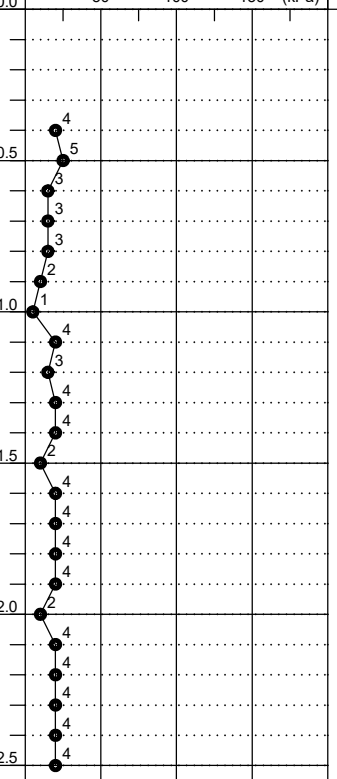
Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	18/7/23	Water Level:	2.0m 18/07/2023		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION			fine to medium SAND, minor silt, orange brown, loose, moist (RIVER DEPOSITS)	
			SILT, some fine sand, trace clay, yellow, grey, very stiff, moist, slightly plastic	
	0.5		silty fine SAND, light grey, medium dense, moist	
			fine to medium SAND, light orange brown	
			loose	
	1.0		fine SAND, wet	
	1.5			
			SILT, minor fine sand, white, light grey, stiff, moist, non-plastic	
	2.0		saturated	18/07/2023
			some fine sand	
	2.5		silty fine SAND, light grey, medium dense, saturated	
			END OF BORE. 2.50 METRES. (HOLE COLLAPSE)	
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH33

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	17/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	17/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SCALA PENETROMETER TEST NZS:4402:1986 test 6.5.2 (Blows per 100mm Increment) 10 20 30 (Blows) / SHEAR STRENGTH REMOULDED SHEAR ○ v ◉ r 50 100 150 (kPa)	LABORATORY TESTS
TS	0.0		TOPSOIL		0.0		
H. FORMATION	0.5		fine to medium sandy SILT, minor clay, dark grey, white specks, very stiff, moist, slightly plastic (RIVER DEPOSITS) minor fine to medium sub-rounded gravel		0.5		
			SILT, some clay, some fine to medium sand, light grey, dark orange streaks, very stiff, moist, slightly plastic minor clay				
			fine to corse SAND, minor silt, dark orange, light grey specks, medium dense, moist				
	1.0		END OF BORE. 0.80 METRES. (TOO DENSE TO AUGER)		1.0		
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		
	3.5				3.5		
	4.0				4.0		
	4.5				4.5		
	5.0				5.0		

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH34

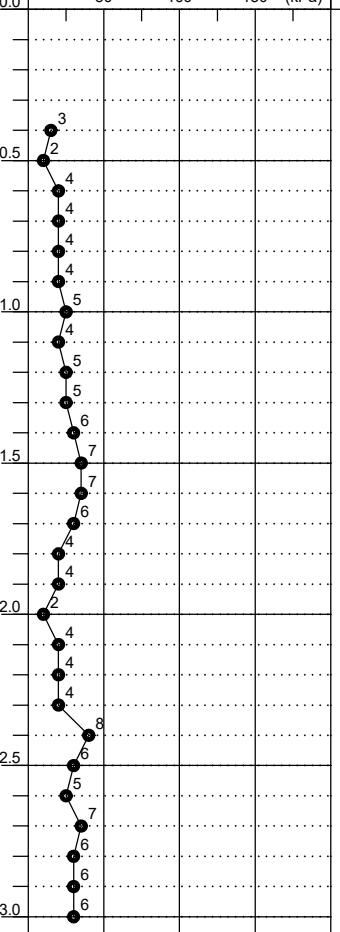
Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	18/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	18/7/23	Water Level:	2.2m 18/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION	0.5		fine to medium SAND, minor silt, orange brown, very soft, moist (RIVER DEPOSITS) fine SAND, some silt, light grey grey brown streaks	
	1.0		silty fine SAND, light grey, medium dense, moist	
	1.5		grey streaks	
	2.0		wet	
	2.5		fine SAND, saturated	18/07/23
	3.0		fine to medium SAND	
	3.5		END OF BORE. 3.00 METRES. (TARGET DEPTH)	
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH35

Sheet 1 of 1

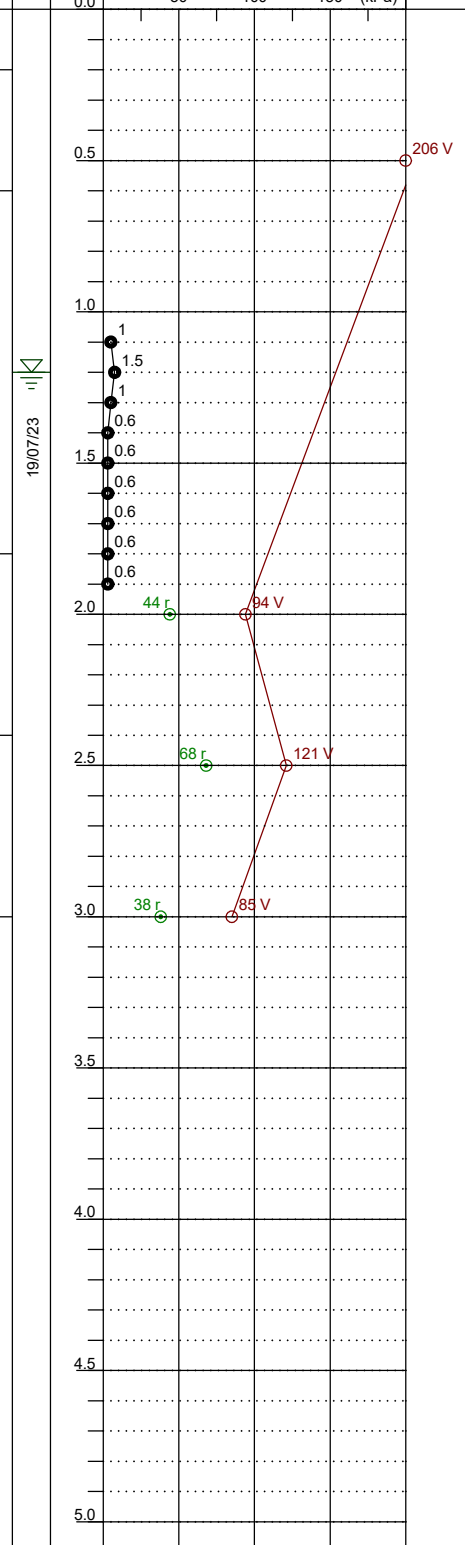
Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	1.2m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT, some fine sand, trace clay, light grey, hard, moist, non-plastic (RIVER DEPOSITS)
	1.0		silty fine to coarse SAND, trace fine sub-angular gravel, loose, brown, dark brown, orange mottles, moist grey brown very loose saturated
	1.5		
	2.0		SILT, trace fine sand, dark brown, grown, grey organic staining, stiff, saturated, non-plastic minor fine to coarse sand
	2.5		for 100mm silty fine to coarse SAND, grey, light grey, saturated trace fine to coarse sand dark brown, brown
	3.0		END OF BORE. 3.00 METRES. (TARGET DEPTH)
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m): 19/07/23

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
○ v
◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH36

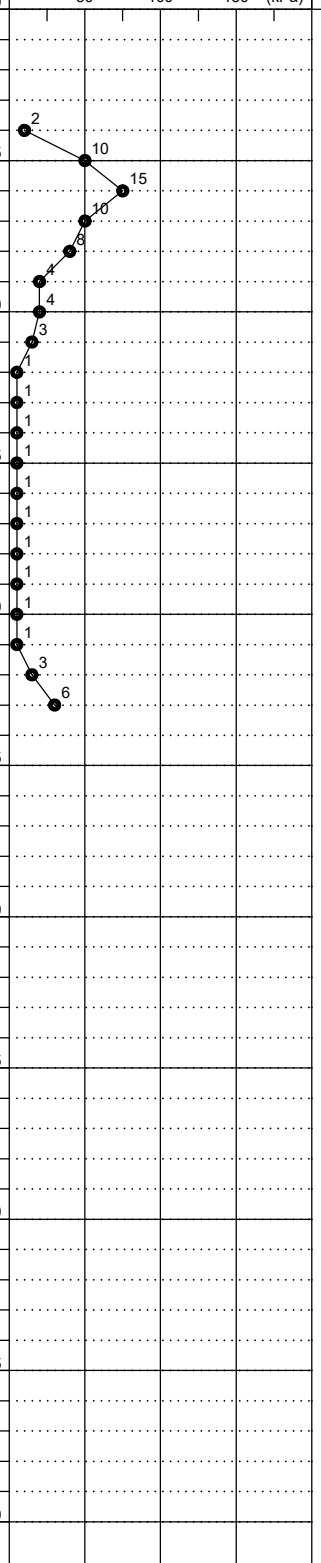
Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	1.8m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
T	0.0		TOPSOIL	
HINUERA FORMATION			SILT, minor fine to medium sand, minor clay, brown, yellow, very stiff, moist, slightly plastic (RIVER DEPOSITS)	
			fine to medium sandy SILT, minor clay, light yellow, orange specks, very stiff, moist, slightly plastic	
	0.5		brown, orange brown mottles, trace fine angular gravel	
			fine to coarse SAND, minor silt, minor fine angular gravel, brown, grey, loose, moist	
			minor fine to medium angular gravel	
			some silt, minor clay, minor fine angular gravel, slighty plastic	
	1.0		minor silt, non-plastic	
	1.5		for 50mm fine SAND, some silt, white	
			blue grey, grey	
			saturated	19/07/23
	2.0			
	2.5		END OF BORE. 2.30 METRES. (TOO DENSE TO AUGER)	
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

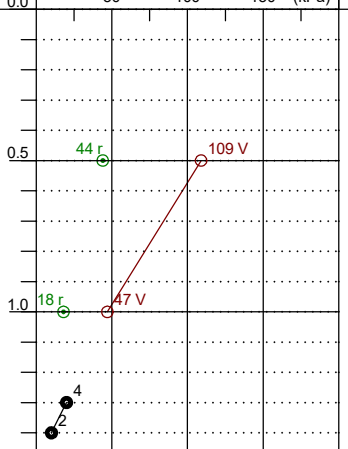
PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH37

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	1.0m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		fine to medium sandy SILT, minor clay, dark brown, orange, very stiff, moist, slightly plastic (RIVER DEPOSITS)	
			black organic staining	
			fine to coarse sandy SILT	
	1.0		saturated	19/07/23
			silty fine SAND, black, white specks, medium dense, saturated, non-plastic	
	1.5		END OF BORE. 1.50 METRES. (TOO DENSE TO AUGER)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH39

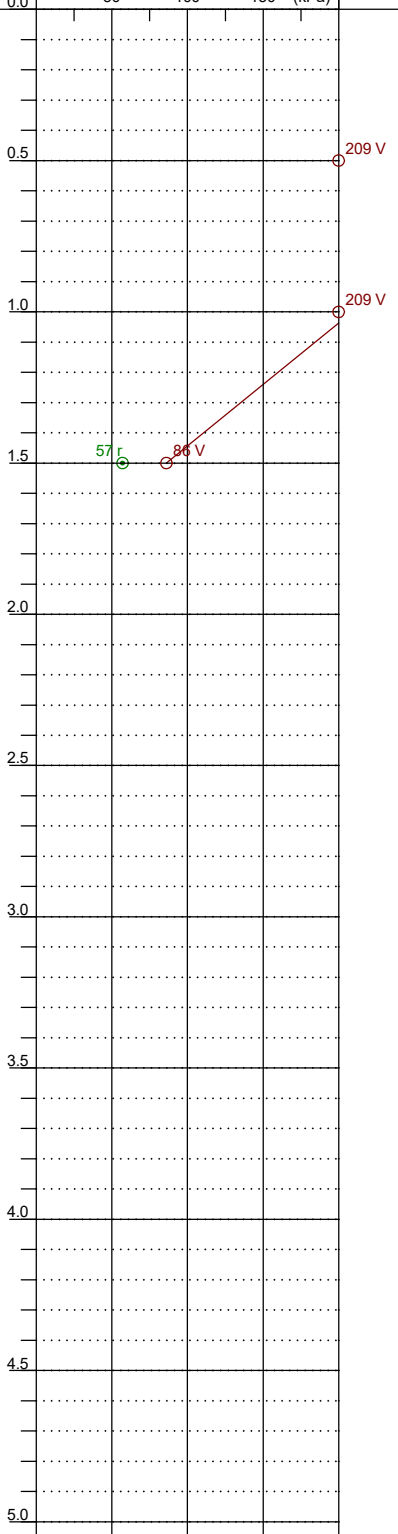
Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	1.6m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		fine to medium sandy SILT, some clay, light grey, light yellow, very stiff, moist, slightly plastic (RIVER DEPOSITS)	
			SILT, minor clay, some fine to medium sand, brown, orange mottles, very stiff, moist, slightly plastic	
			fine to medium sandy SILT, trace clay, orange, very stiff, moist, non-plastic	
			fine to coarse SAND, minor silt, minor fine to medium angular gravel, dark brown, dark orange, dense, moist brown grey, yellow specks	
	1.0		fine sandy SILT, white, light blue grey, very stiff, moist, non-plastic	
	1.5		stiff trace fine to medium angular gravel, saturated	19/07/23
	2.0		END OF BORE. 1.80 METRES. (TOO DENSE TO AUGER)	
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
○ v
◉ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
Your responsive & cost-effective engineers

CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH40

Sheet 1 of 1

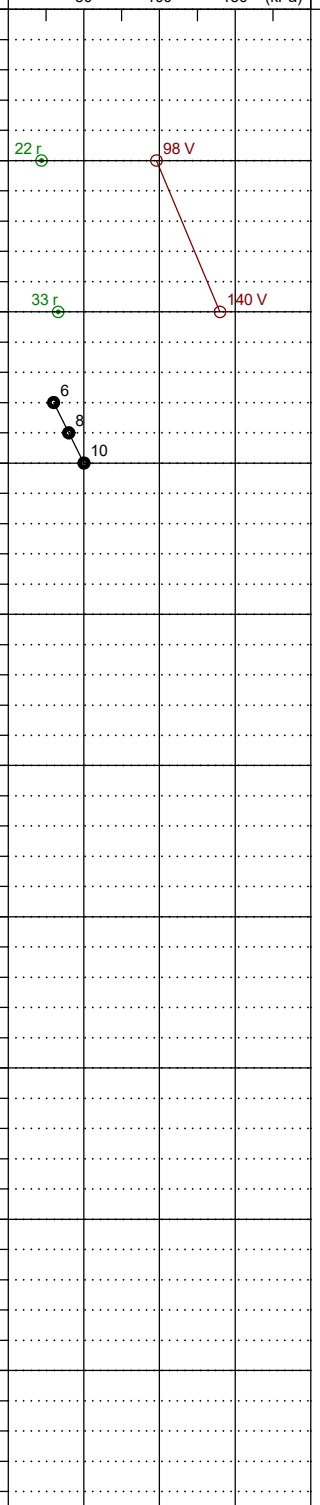
Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO3562 - 2/05/2023
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	20/7/23	Water Level:	1.4m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT, some clay, minor fine to medium sand, trace fine to medium angular gravel, brown orange, orange mottles, stiff, moist, slightly plastic (RIVER DEPOSITS)
	1.0		fine sandy SILT, minor clay, light grey, grey, stiff, moist, slightly plastic wet
	1.5		medium to coarse SAND, minor silt, minor fine angular gravel, light brown, white and grey specks, loose, wet light brown, blue grey saturated
			END OF BORE. 1.50 METRES. (TOO DENSE TO AUGER)

WATER LEVEL (m): 19/07/23

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
v
r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH41

Sheet 1 of 1

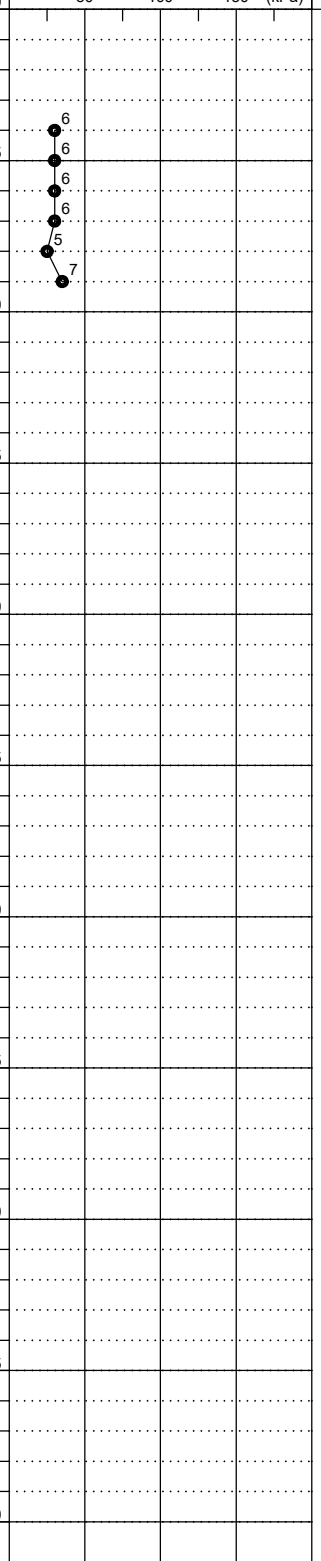
Drill Type:	Hand Auger	Project No:	220489	Logged By:	JN
Drilled By:	JN	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	20/7/23	Water Level:	0.8m 20/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		silty fine to coarse SAND, trace fine to medium angular gravel, brown, grey, brown mottles, loose, moist (RIVER DEPOSITS)	
			fine to coarse SAND, some silt, minor fine angular gravel, brown, loose, moist	
	1.0		saturated	20/07/23
			END OF BORE. 1.00 METRES. (HOLE COLLAPSE)	
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
○ v
◉ r
50 100 150 (kPa)

DEPTH (m)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH42

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	1.0m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		SILT, some fine to medium sand, minor clay, light grey, orange and grey streaks, moist, slightly plastic (RIVER DEPOSITS) some fine to coarse sand	
	1.0		fine to coarse sandy SILT, minor clay, light orange, orange mottles, grey mottles, hard, moist, slightly plastic saturated grey, light grey	19/07/23
	1.5		END OF BORE. 1.10 METRES. (TOO DENSE TO AUGER)	
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
50 100 150 (kPa)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

4

LABORATORY TESTS
200+ UTP V
200+ UTP V

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH43

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	ZP
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	20/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HF			SILT, minor fine medium sand, orange brown, very stiff, moist, non-plastic (RIVER DEPOSITS)	
	0.5		fine to medium sandy SILT, orange brown, very stiff, moist, non-plastic	
			fine to medium SAND, trace silt, orange, white specks, loose, moist minor fine angular gravel	
			END OF BORE. 0.70 METRES. (HOLE COLLAPSE)	
	1.0			
	1.5			
	2.0			
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0

3

LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH44

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	ZP
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	20/7/23	Water Level:	Groundwater Not Encountered		

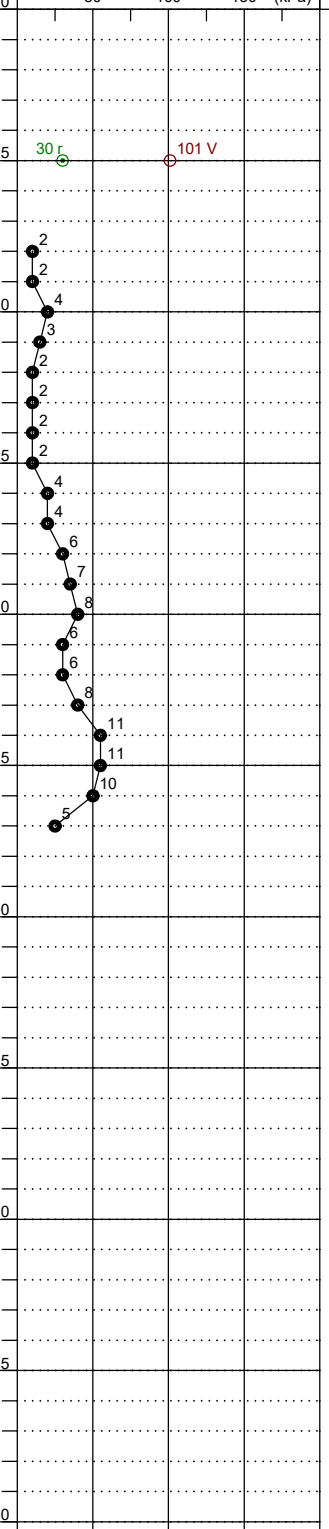
STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		fine sandy SILT, light grey, stiff, moist, non-plastic (RIVER DEPOSITS)
			silty fine SAND, light grey, loose, moist
			wet
	1.0		fine to coarse SAND
	1.5		fine to medium SAND
			brown, grey
	2.0		wet
			saturated, poor recovery <20%
	2.5		fine to medium sand, minor silt, yellow grey, orange patches, loose, saturated
			END OF BORE. 2.70 METRES. (HOLE COLLAPSE)
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		

WATER LEVEL (m)

DEPTH (m)

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH
REMOULDED SHEAR
○ v
⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

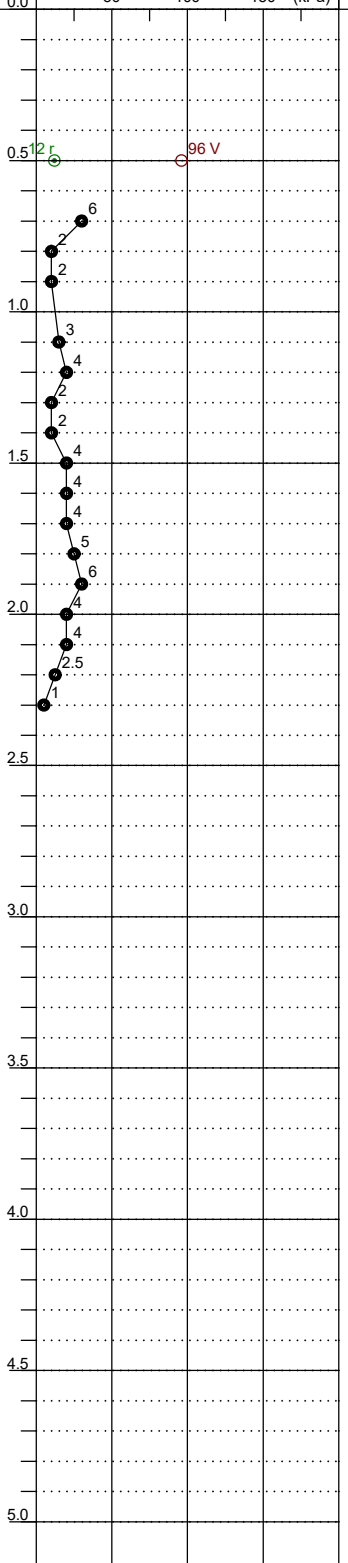
PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH45

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	ZP
Drilled By:	ZP	Coordinates:		Shear Vane No - Calibration Date:	DR2871 - 23/11/220
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	20/7/23	Water Level:	0.9m 20/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION			fine to medium sandy SILT, grey, stiff, moist, non-plastic (RIVER DEPOSITS)	
	0.5		silty fine to coarse SAND, grey, loose, wet light grey, orange streaks	
	1.0		trace clay, very loose, saturated	20/07/23
	1.5		fine to medium sand	
			fine sand	
			fine to medium sand, loose	
	2.0		very loose	
			SILT, minor fine sand, light grey, stiff, saturated, non-plastic	
	2.5		END OF BORE. 2.35 METRES. (NO RECOVERY)	
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

Soil&Rock Consultants
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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH46

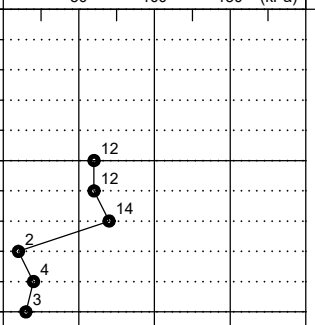
Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	SMB
Drilled By:	SMB	Coordinates:		Shear Vane No - Calibration Date:	GEO2239 - 20/09/2022
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	19/7/23	Water Level:	1.0m 19/07/23		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION			fine to medium sandy, SILT, , minor clay, dark brownish orange, grey specks, very stiff, moist, slightly plastic (RIVER DEPOSITS)	
	0.5		fine to medium SAND, some silt, dark orage, black specks, dense, moist, non-plastic	
	1.0		silty, fine to medium SAND, dark orange, light grey specks, loose, wet, non-plastic	19/07/23
			saturated	
	1.5		fine to coarse SAND	
	2.0		END OF BORE. 1.60 METRES. (HOLE COLLAPSE)	
	2.5			
	3.0			
	3.5			
	4.0			
	4.5			
	5.0			

SCALA PENETROMETER TEST
NZS:4402:1986 test 6.5.2
(Blows per 100mm Increment)
10 20 30 (Blows)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
50 100 150 (kPa)



LABORATORY TESTS

HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: PZ47

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Near Level Grass
Date Finished:	19/7/23	Water Level:	1.0m 19/07/23		

STRATIGRAPHY	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	SAMPLE TYPE	SCALA / c_u (kPa) (blows/100mm)	DRILLING METHOD	RECOVERY (%)	STANDPIPE PIEZOMETER Ø32mm
TS		TOPSOIL		0.0					
HINUERA FORMATION		fine to coarse SAND, minor silt, orange brown, brown, very loose, moist (RIVER DEPOSITS)		0.5		3			Bentonite
		SILT, some clay, minor fine to coarse sand, dark brown, brown, stiff, moist, slightly plastic				3 1.5 3.5			
		silty, fine to coarse SAND, trace clay, dark brown, brown, very loose, moist trace fine sub-angular gravel	19/07/23	1.0		2 2			
		SILT, minor clay, minor fine to coarse sand, dark brown, black organic staining, firm, saturated, slightly plastic trace fine to medium sand fibrous				0 0.25 0.5 0.75			
		minor fine to coarse sand, minor roots and vegetation matter		1.5		1 0.8 0.6 0.6 1.3			Filter Pack
		fine to medium SAND, some silt, grey, very loose, saturated		2.0		2 2 1 2			Slotted Pipe
		END OF BORE. 2.75 METRES. (NO RECOVERY)		2.5 3.0 3.5 4.0 4.5 5.0		3 4 2			

CONTAM AH WELL 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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CLIENT: Fonterra Co-operative Group Ltd

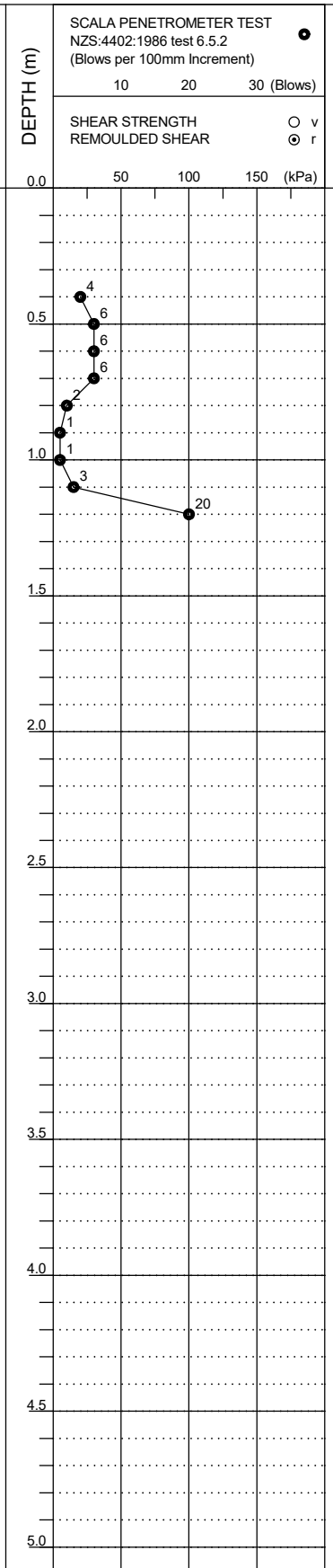
PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Auger Hole No: AH48

Sheet 1 of 1

Drill Type:	Hand Auger	Project No:	220489	Logged By:	KMac
Drilled By:	KMac	Coordinates:		Shear Vane No - Calibration Date:	GEO604 - 22/03/2023
Date Started:	19/7/23	Ground Elevation:		Surface Conditions:	Slightly Sloping Grass
Date Finished:	19/7/23	Water Level:	Groundwater Not Encountered		

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)
TS	0.0		TOPSOIL	
HINUERA FORMATION	0.5		silty fine to coarse SAND, light grey, loose, moist (RIVER DEPOSITS) fine to medium SAND orange brown some clay, light grey	
	1.0		clayey SILT, some fine to medium, sand, light brown, light grey, very stiff, moist, moderately plastic	
			SILT, some clay, some fine to medium sand, light brown, light grey, stiff, moist, slightly plastic	
			END OF BORE. 1.20 METRES. (HOLE COLLAPSE)	



HAND AUGER LOG WITH SCALA 220489 - AH01-48 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 9/28/23

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 220489 **TESTED BY:** Kmac/JN, SMB, ZP

JOB NAME: Fonterra Te Rapa, Hamilton **DATE:** 1/07/2023

Depth of Penetration [mm]	AH01	Con't	PZ02	Con't	PZ03	Con't	PZ04	AH05	PZ06	AH07	PZ08	
DEPTH START[m]	0.50	2.50	2.00	4.00	1.20	3.20	2.20	1.20	4.30	0.90	4.20	
50 mm	1	7	2	6	6	9	SUNK	4	5	10	8	
100	1	7	2	6	7	10	SUNK	4	6	20+	9	
150	1	8	2	6	6	9	0.25	5	8		12	
200	1	9	1	8	7	10	0.25	5	6		12	
250	4	9	1	10	7	9	0.25	6	4		16	
300	5	9	3	10	5	10	0.25	5	1		12	
350	5	6	3	10	5	9	1	7	1		14	
400	6	8	3	8	6	8	3	6	2			
450	1	8	4	6	6	8	2	6	2			
500	2	8	3	6	5	6	2	5	1			
550	3	9	2	6	5	6	3	5	2			
600	5	7	2	8	6	7	2	6	2			
650	5	7	1	7	6	9	3	6	4			
700	4	8	2	9	6	8	3	6	5			
750	3	9	3	7	7	11	3	6	4			
800	4	9	5	8	7	12	3	5	6			
850	3	7	5	7	6	11	4		8			
900	4	8	5	7	7	10	3		10			
950	3	9	2	7	8	10	6		6			
1000	4	9	2	7	8		4		10			
1050	5		6		9		5		11			
1100	5		6		7		5		10			
1150	5		6		7		3		12			
1200	4		5		7		5		14			
1250	5		5		6		6					
1300	4		5		8		5					
1350	3		5		9		4					
1400	5		6		10		5					
1450	4		6		8		14					
1500	6		6		8		11					
1550	6		5		8		11					
1600	6		4		7		10					
1650	7		4		8		16					
1700	8		4		7							
1750	7		4		10							
1800	7		4		10							
1850	7		3		9							
1900	7		2		10							
1950	7		6		10							
2000	7		6		9							
DEPTH END [m]		3.50		5.00		4.15	3.85	2.00	5.50	1.00	4.55	

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 220489 **TESTED BY:** Kmac/JN, SMB, ZP

JOB NAME: Fonterra Te Rapa, Hamilton **DATE:** 1/07/2023

Depth of Penetration [mm]	AH09	Con't	AH10	Con't	PZ11	Con't	PZ12	AH13	PZ16	Con't	AH17	Con't
DEPTH START[m]	1.00	3.00	1.10	3.10	2.20	4.20	3.50	3.50	2.00	4.00	2.20	4.20
50 mm	3	5	8	10	3	7	13	1	5	2	1	7
100	3	4	5	8	3	8	20+	1	4	4	2	8
150	1	5	5	8	4	7		2	4	3	1	8
200	1	6	4	5	4	7		1	4	2	2	8
250	1	9	4	6	4	7		2	3	2	1	8
300	3	9	5	9	4	7		2	4	2	2	8
350	9	11	6	9	5	10		1	4	2	2	8
400	7	9	5	10	5	10		1	4	3	2	8
450	6	7	5	10	5	10		1	3	4	3	10
500	7	7	5	12	5	7		1	4	5	3	10
550	6	9	5	11	5	7		1	4	3	3	10
600	6	9	4	10	5	6		3	6	3	3	10
650	6	10	4		5	8		5	5	3	3	8
700	6	10	5		6	10		5	5	3	3	10
750	7	12	5		6	8		3	5	4	2	11
800	9	10	5		5	10		5	5	3	3	10
850	9	10	4		5			1	4	3	4	10
900	9		3		5			1	3	3	5	10
950	10		4		5			5	0.25	3	6	10
1000	10		4		5			5	0.25	3	6	
1050	6		5		6			7	0.25		6	
1100	7		5		5			7	0.25		6	
1150	3		5		5			10	1		6	
1200	4		6		5			10	1		6	
1250	4		6		3			12	0.5		5	
1300	3		6		6			10	0.5		5	
1350	4		5		5			11	0.5		5	
1400	6		6		5				0.5		5	
1450	5		5		5				1		5	
1500	5		6		6				1		5	
1550	5		5		5				1		5	
1600	5		6		5				1		7	
1650	7		5		6				1		7	
1700	6		6		8				1		6	
1750	6		10		7				1		6	
1800	6		9		10				2		7	
1850	6		8		6				2		6	
1900	4		9		7				3		6	
1950	6		8		7				2		7	
2000	4		8		7				2		8	
DEPTH END [m]		3.85		3.70		5.00	3.60	4.85		5.00		5.15

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 220489 **TESTED BY:** Kmac/JN, SMB, ZP

JOB NAME: Fonterra Te Rapa, Hamilton **DATE:** 1/07/2023

Depth of Penetration [mm]	PZ18	Con't	AH19	AH20	AH21	Con't	AH22	Con't	AH23	Con't	PZ24	
DEPTH START[m]	4.30	6.30	1.15	3.20	1.50	3.50	2.60	4.60	0.75	2.75	5.00	
50 mm	4	10	20+	6	3	4	6	6	1	5	5	
100	3	7		5	4	4	5	7	1	5	6	
150	3	8		2	5	4	4	10	1	5	5	
200	3	8		4	5	5	6	10	1	4	4	
250	3	8		4	6	6	4	10	1	7	4	
300	3	5		5	5	6	4	10	2	4	5	
350	4	4		5	5	11	1	10	2	5	4	
400	5	6		5	4	10	1		2	5	5	
450	4	7		6	3	10	1		3	5	5	
500	4	7		4	4	11	2		4	6	4	
550	4	7		4	5	15	4		4	8	5	
600	3	11		3	5		4		4	8	6	
650	3	12		11	2		4		4	12	6	
700	3	13		1	3		4		3	11	7	
750	3	13		9	3		4		3	10	7	
800	5	14		8	1		4		4	10	8	
850	4			6	1		2		3	8	9	
900	5			8	1		4		4	5	8	
950	6			8	1		4		3	6		
1000	4			6	1		4		4	9		
1050	5			6	1		5		4			
1100	6			6	3		5		4			
1150	4			6	3		5		4			
1200	7			10	4		6		3			
1250	7			10	7		7		3			
1300	6			8	5		4		3			
1350	6			8	5		4		2			
1400	6			10	5		5		2			
1450	6			10	4		6		3			
1500	6			10	5		7		4			
1550	4			10	5		8		4			
1600	7			10	8		8		4			
1650	6				8		8		4			
1700	7				9		8		4			
1750	10				5		6		3			
1800	10				4		6		4			
1850	10				2		6		3			
1900	8				3		6		7			
1950	7				4		3		6			
2000	7				4		6		7			
DEPTH END [m]		7.10	1.20	4.80		4.05		4.95		3.75	5.90	

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 220489 **TESTED BY:** Kmac/JN, SMB, ZP

JOB NAME: Fonterra Te Rapa, Hamilton **DATE:** 1/07/2023

Depth of Penetration [mm]	PZ25	AH26	AH27	AH28	AH29	AH30	AH32	AH33	AH36	AH37	AH39	AH40
DEPTH START[m]	2.90	3.10	1.00	2.00	2.25	1.90	2.50	0.80	2.30	1.50	1.80	1.50
50 mm	2	6	4	5	4	2	3	14	10	0.5	5	8
100	2	6	18	8	3	1	3	20+	10	0.5	5	7
150	2	6	20+	12	2	2	3		10	0.5	4	6
200	3	6		10	1	2	3		15	0.5	5	5
250	5	7		10	2	3	3		12	1	4	6
300	5	6		10	2	2	3			1	4	9
350	7	2		10	2	5	2			3	5	8
400	5	1			2	2	2			1	5	7
450	7	3			2	3	2			3	7	8
500	5	2			2	1	2			3	3	8
550	3	2			1	3				3	5	8
600	0.5	3			0.5	1				5	5	11
650	0.5	8			0.5	1				7	7	7
700	0.5	8			1	1				5	5	5
750	0.5	7			1	2				7	5	4
800	1	7				1				7	5	6
850	1	8				1				5	6	6
900	3	8				3				7	6	6
950	3	10				3				5	10	6
1000	3	9				5				3	9	6
1050	2	10				5				5	8	10
1100	3	10				5				5	7	11
1150	3	10								5	7	12
1200	3	10								7	7	16
1250	5	10								7		10
1300	3									5		
1350	7									7		
1400	7									7		
1450	7									5		
1500	5									8		
1550	7											
1600	9											
1650	8											
1700	10											
1750	10											
1800	10											
1850	11											
1900	15											
1950												
2000												
DEPTH END [m]	4.80	4.35	1.15	2.35	3.00	3.00	3.00	0.90	2.55	3.00	3.00	2.75

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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SCALA PENETROMETER SHEET - TABLE OF BLOWS PER INCREMENT

JOB NO: 220489 **TESTED BY:** Kmac/JN, SMB, ZP

JOB NAME: Fonterra Te Rapa, Hamilton **DATE:** 1/07/2023

Depth of Penetration [mm]	AH41	AH42	AH43	Con't	AH44	AH45	PZ47	AH48				
DEPTH START[m]	1.00	1.10	0.70	2.70	2.70	2.35	2.75	1.20				
50 mm	8	3	2	4	3	0.5	1	7				
100	5	4	4	4	4	0.5	2	4				
150	6	7	3	5	3	1	2	5				
200	4	5	6	3	3	1		4				
250	7	4	13	3		1		3				
300	4	4	13	3		1		2				
350	5	5	7			1		3				
400	4	18	6			1		2				
450	5	15	7			1		2				
500	6	14	5			1		2				
550	8	11	3			1		2				
600	8	11	3					2				
650	8		3					2				
700	8		1					1				
750	8		0.5									
800	6		0.5									
850	6		1									
900	6		4									
950	8		6									
1000	8		4									
1050	8		4									
1100	8		4									
1150	8		7									
1200	10		7									
1250	10		8									
1300	9		6									
1350	10		2									
1400	10		2									
1450	8		2									
1500	8		2									
1550	11		2									
1600	10		2									
1650	12		2									
1700	14		2									
1750	20+		2									
1800			2									
1850			3									
1900			3									
1950			4									
2000			4									
DEPTH END [m]	2.75	1.70		3.00	2.90	2.90	2.90	1.90				

Testing Method: NZS 4402:1988 Test 6.5.2 Dynamic Cone Penetrometer

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP01

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	TDS
Drilled By:	TDS	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	20/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		silty fine to coarse SAND, minor rounded gravel, moist [ALLUVIAL DEPOSITS]
	1.0		SAND minor silt, saturated
			END OF TEST PIT. 1.00 METRES.

WATER LEVEL (m)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

TEST PIT FULL PAGE 220489 - TP01-10 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 11/22/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP02

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	TDS
Drilled By:	TDS	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	24/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	24/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	LABORATORY TESTS
TS	0.0		TOPSOIL		0.0	
HINUERA FORMATION			fine to coarse sandy SILT, brown [ALLUVIAL DEPOSITS]			
	0.5		SILT some clay, some fine to coarse sand, grey brown		0.5	
	1.0		fine to coarse SAND, trace silt		1.0	
			END OF TEST PIT. 1.00 METRES.			
	1.5				1.5	
	2.0				2.0	
	2.5				2.5	
	3.0				3.0	

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

TEST PIT FULL PAGE 220489 - TP01-10 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 11/22/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP03

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	TDS
Drilled By:	TDS	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	24/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	24/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ◉ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
TS	0.0		TOPSOIL		0.0		
HINUERA FORMATION	0.5		fine to coarse SAND, some silt, brown orange [ALLUVIAL DEPOSITS] minor fine to coarse cobbles		0.5		
	1.0		END OF TEST PIT. 1.00 METRES.		1.0		
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP04

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	TDS
Drilled By:	TDS	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	20/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ◉ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
TS	0.0		TOPSOIL		0.0		
HINUERA FORMATION			SILT, minor clay, minor fine to coarse sand, minor fine to medium rounded gravel, brown [ALLUVIAL DEPOSITS]				
			fine sandy SILT, white				
	0.5				0.5		
			SILT, some fine to medium sand, trace clay, minor organic material				
	1.0				1.0		
			END OF TEST PIT. 1.00 METRES.				
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP05

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	TDS
Drilled By:	TDS	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	24/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	24/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		clayey SILT, some fine to coarse sand, orange brown [ALLUVIAL DEPOSITS]
			fine to coarse SAND, some silt, trace clay, brown orange
			clayey SILT, some fine to coarse sand, grey
	1.0		fine to coarse SAND, minor silt, grey
			END OF TEST PIT. 1.00 METRES.
	1.5		
	2.0		
	2.5		
	3.0		

WATER LEVEL (m)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

TEST PIT FULL PAGE 220489 - TP01-10 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 11/22/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP06

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	JP
Drilled By:	JP	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	20/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ◉ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
TS	0.0		TOPSOIL		0.0		
HINUERA FORMATION	0.5		fine to medium SAND, some coarse gravel, orenage, brown, medium dense, wet [ALLUVIAL DEPOSITS] grey trace coarse grael, minor fine gravel, orange		0.5		
	1.0		END OF TEST PIT. 1.00 METRES.		1.0		
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		

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PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP07

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	JP
Drilled By:	JP	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	20/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ◉ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
TS	0.0		TOPSOIL		0.0		
HINUERA FORMATION	0.5		fine sandy SILT, orange, grey, brown, very stiff, moist, non plastic [ALLUVIAL DEPOSITS]		0.5		
			SILT, some fine to medium sand, minor clay,grey, orange streaks, very stiff, moist to wet, non plastic				
			wet, dark grey streaks				
	1.0		wet to saturated		1.0		
			END OF TEST PIT. 1.00 METRES.				
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP08

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	TDS
Drilled By:	TDS	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	20/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION	0.5		SILT, some fine to coarse sand, trace clay, dark orange brown [ALLUVIAL DEPOSITS]
	1.0		fine to coarse SAND, some silt, orange brown
	1.5		END OF TEST PIT. 1.00 METRES.
	2.0		
	2.5		
	3.0		

WATER LEVEL (m)

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

TEST PIT FULL PAGE 220489 - TP01-10 - FONTERA TE RAPA - 25JULY2023.GPJ S+R_2013.GDT 11/22/23

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP09

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	TDS/JP
Drilled By:	TDS/JP	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	20/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	20/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"
TS	0.0		TOPSOIL
HINUERA FORMATION			SILT, some clay, some fine to coarse sand, brown, stiff, moist [ALLUVIAL DEPOSITS]
	0.5		fine to coarse sandy SILT, some clay, grey
	1.0		fine to coarse SAND, trace silt, grey, loose
			END OF TEST PIT. 1.00 METRES.
	1.5		
	2.0		
	2.5		
	3.0		

WATER LEVEL (m)

DEPTH (m)

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ◉ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)

LABORATORY TESTS

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CLIENT: Fonterra Co-operative Group Ltd

PROJECT: Fonterra Te Rapa, 1315 Te Rapa Road, Hamilton

Test Pit No: TP10

Sheet 1 of 1

Drill Type:	Machine Test Pit	Project No:	220489	Logged By:	TDS
Drilled By:	TDS	Coordinates:		Shear Vane No - Calibration Date:	
Date Started:	24/7/23	Ground Elevation:		Surface Conditions:	Near Level, Grass
Date Finished:	24/7/23	Water Level:			

STRATIGRAPHY	DEPTH (m)	GRAPHIC LOG	Soil description in accordance with the NZ Geotechnical Society Inc 2005 "Guidelines for Field Description of Soil and Rock in Engineering Use"	WATER LEVEL (m)	DEPTH (m)	NATURAL WATER CONTENT △ LIQUID LIMIT ✕ PLASTIC LIMIT □ 50 100 150 (%) SHEAR STRENGTH ○ v REMOULDED SHEAR ◉ r POCKET PENETROMETER ○ p 50 100 150 (kPa)	LABORATORY TESTS
TS	0.0		TOPSOIL		0.0		
HINUERA FORMATION			SILT, some clay, trace fine sand [ALLUVIAL DEPOSITS]				
	0.5		SILT, some fine sand, minor clay		0.5		
			some clay, minor sand				
	1.0		END OF TEST PIT. 1.00 METRES.		1.0		
	1.5				1.5		
	2.0				2.0		
	2.5				2.5		
	3.0				3.0		

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Appendix C

CPT and Liquefaction Analysis Results

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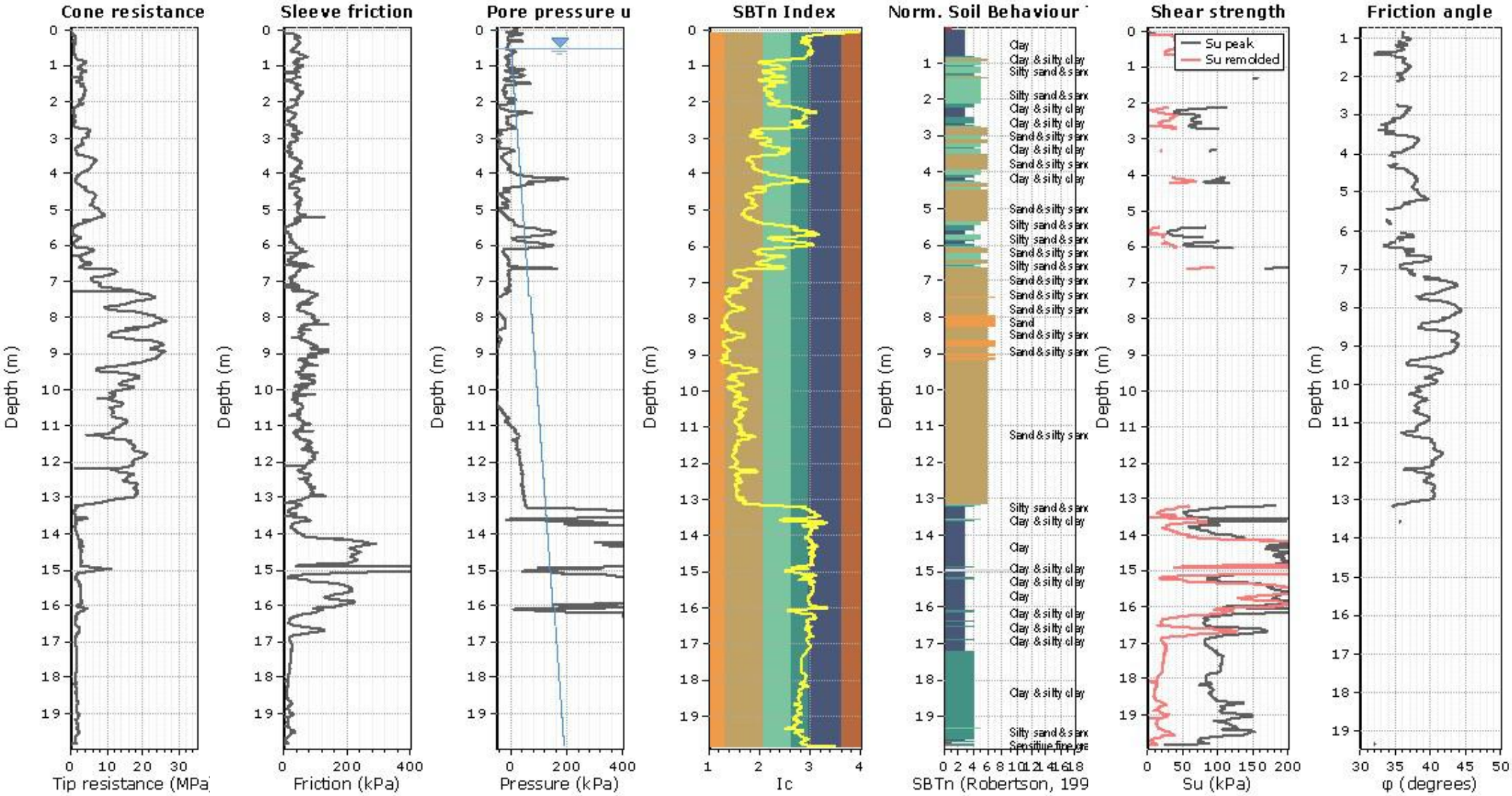
Project: 220489
Location: Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton

CPT: CPT01
Total depth: 19.90 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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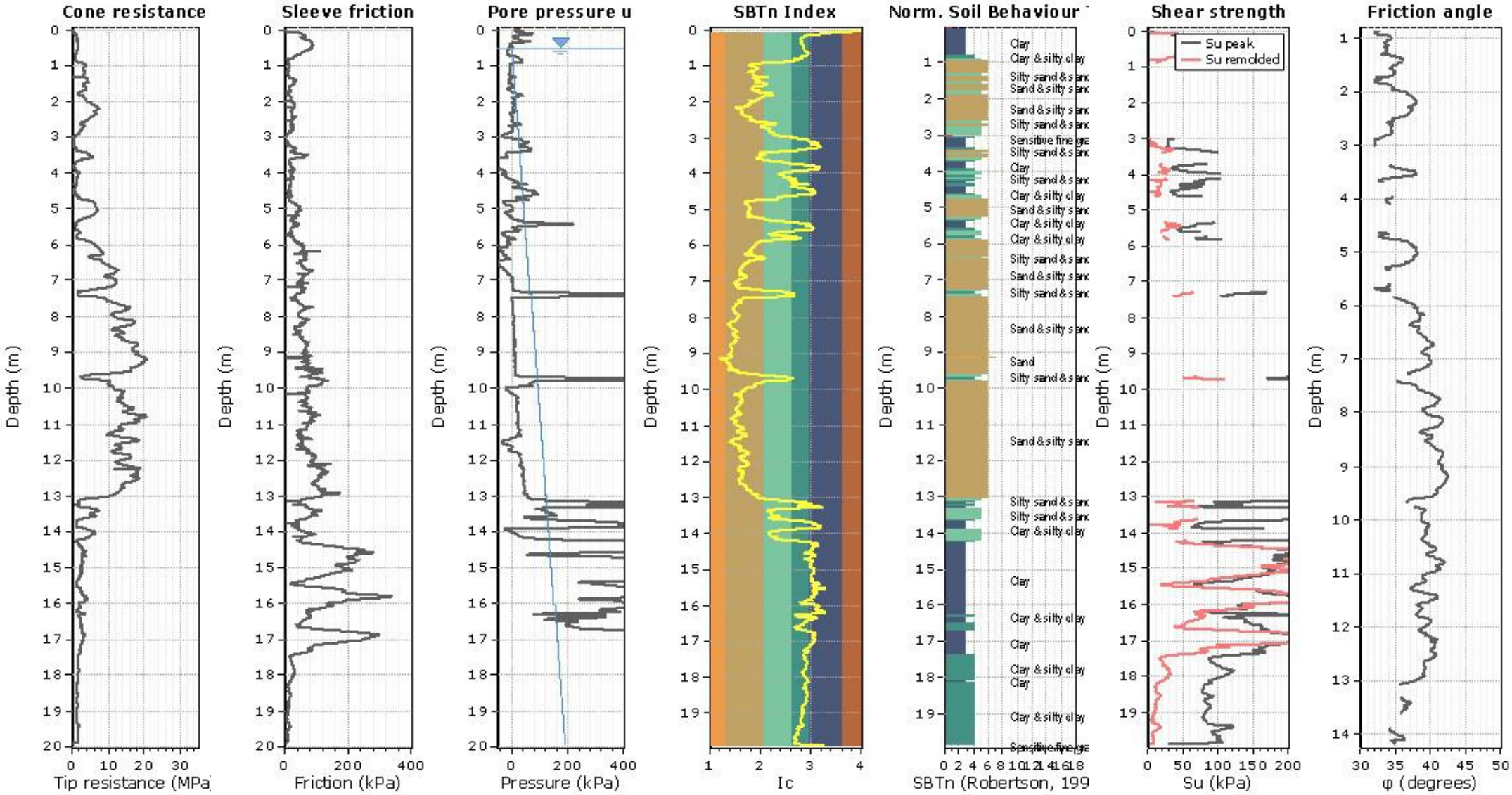
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT02
Total depth: 19.95 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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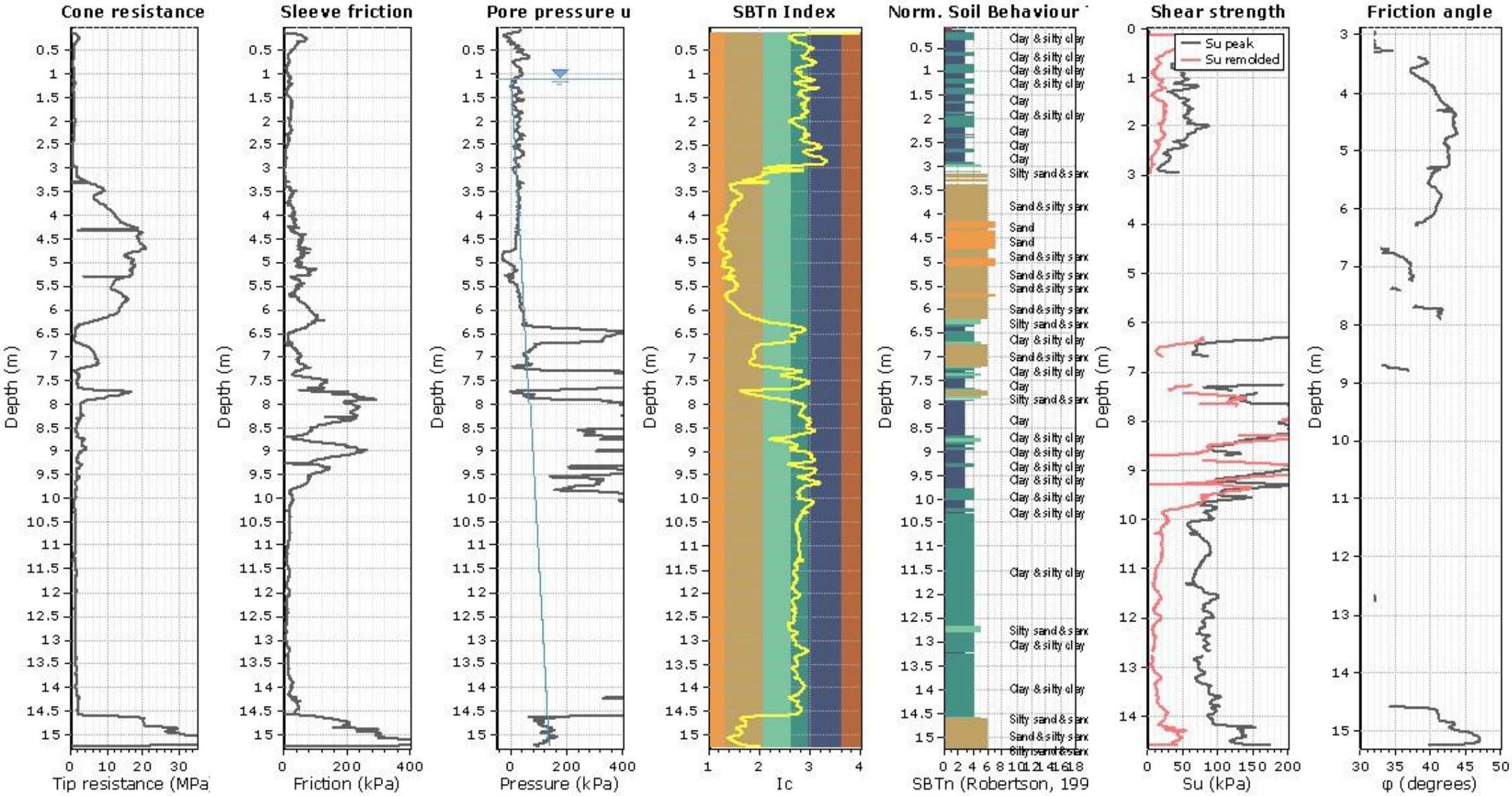
Project: 220489
Location: Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton

CPT: CPT04
Total depth: 15.25 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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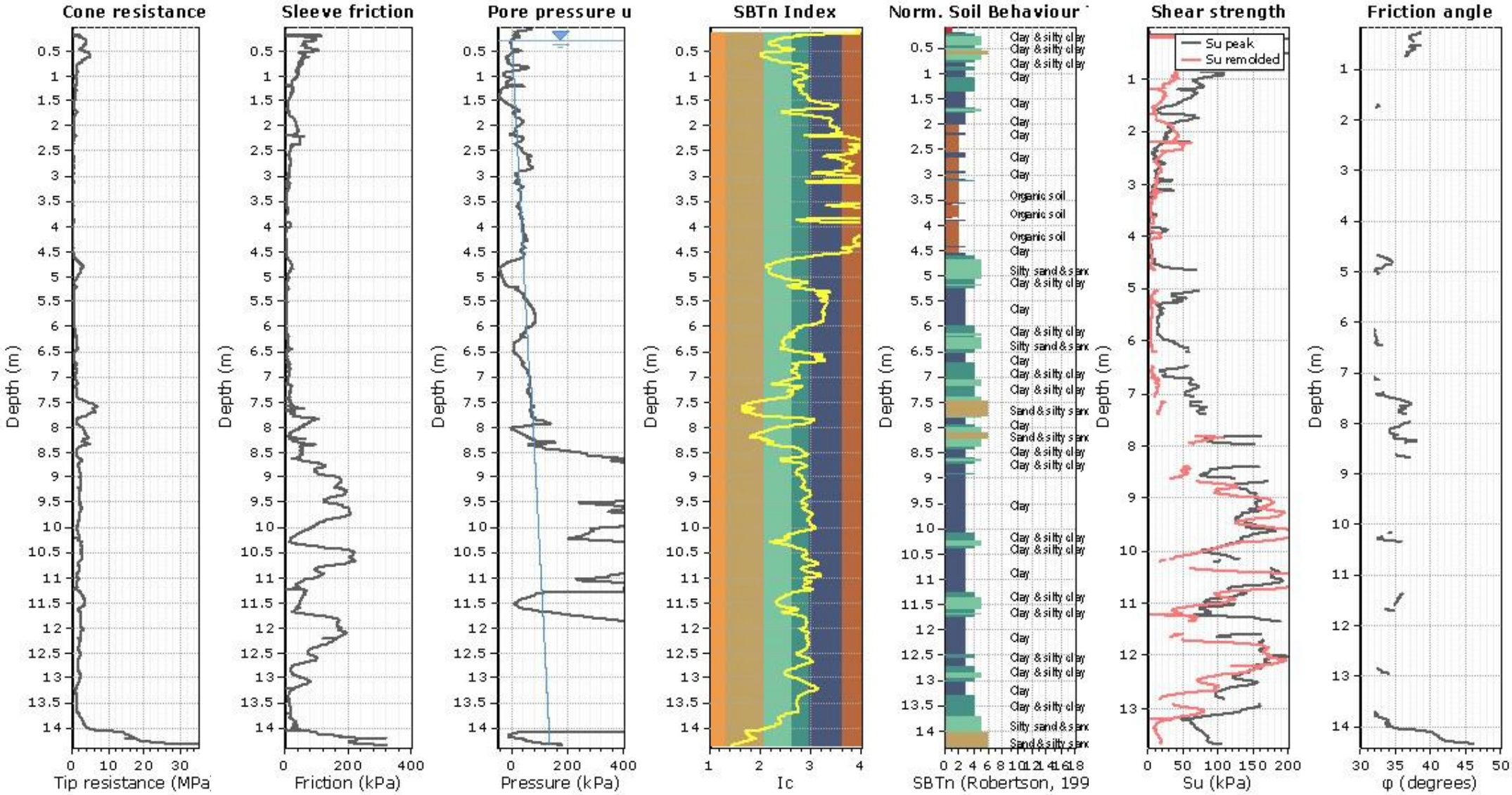
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT05
Total depth: 14.33 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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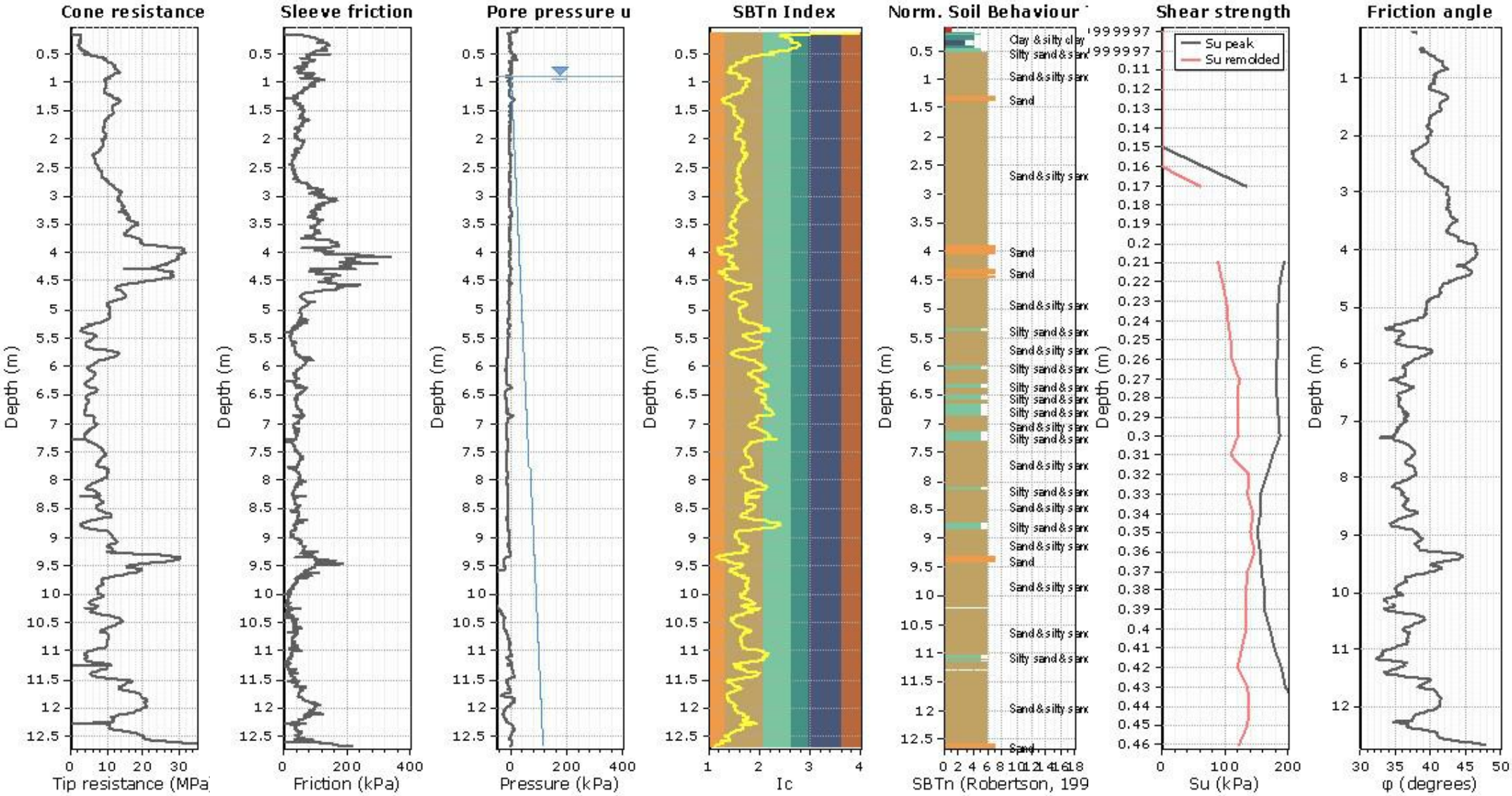
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT06
Total depth: 12.67 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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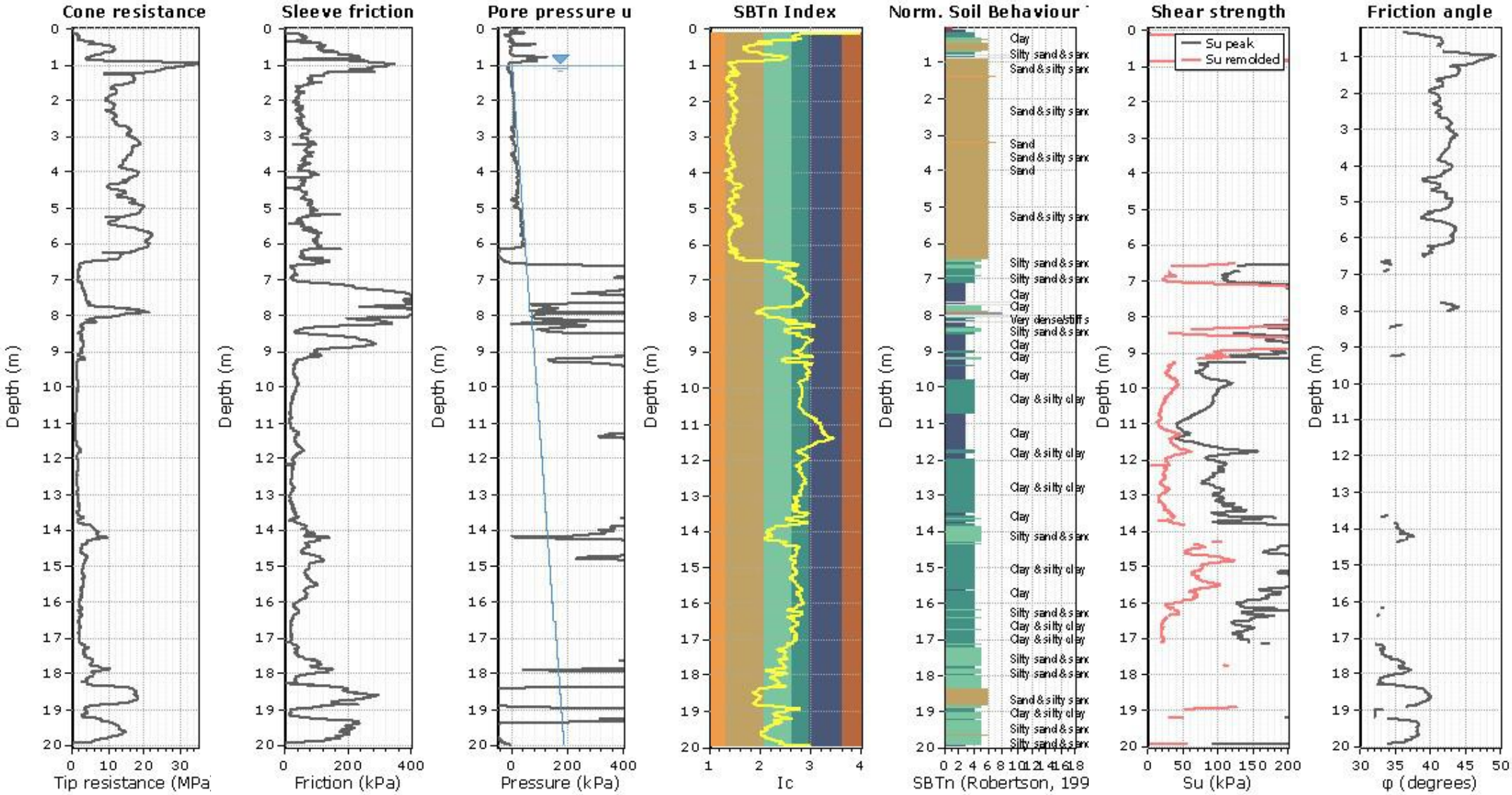
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT07
Total depth: 20.00 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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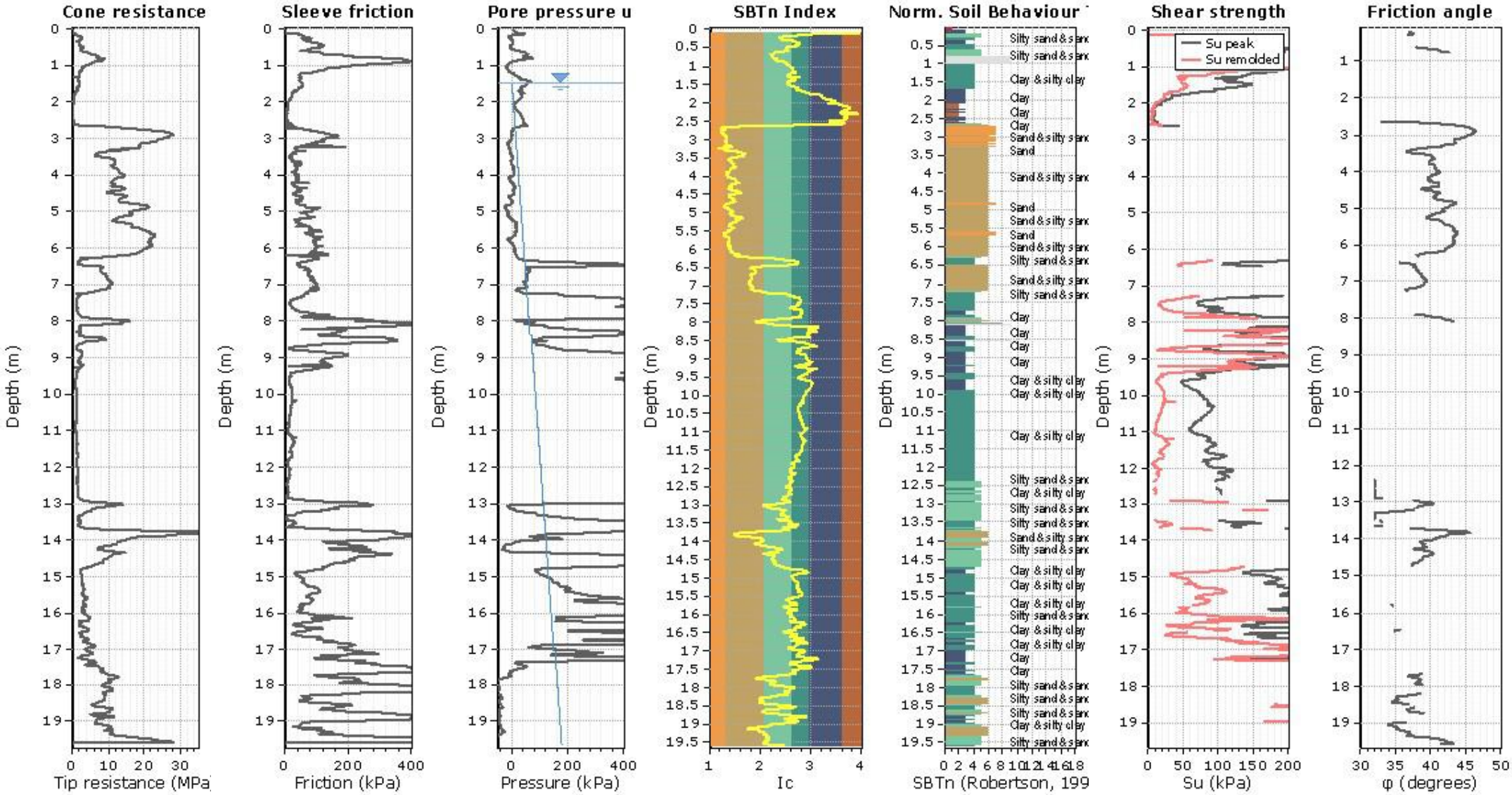
CPT: CPT08
Total depth: 19.64 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill

Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**



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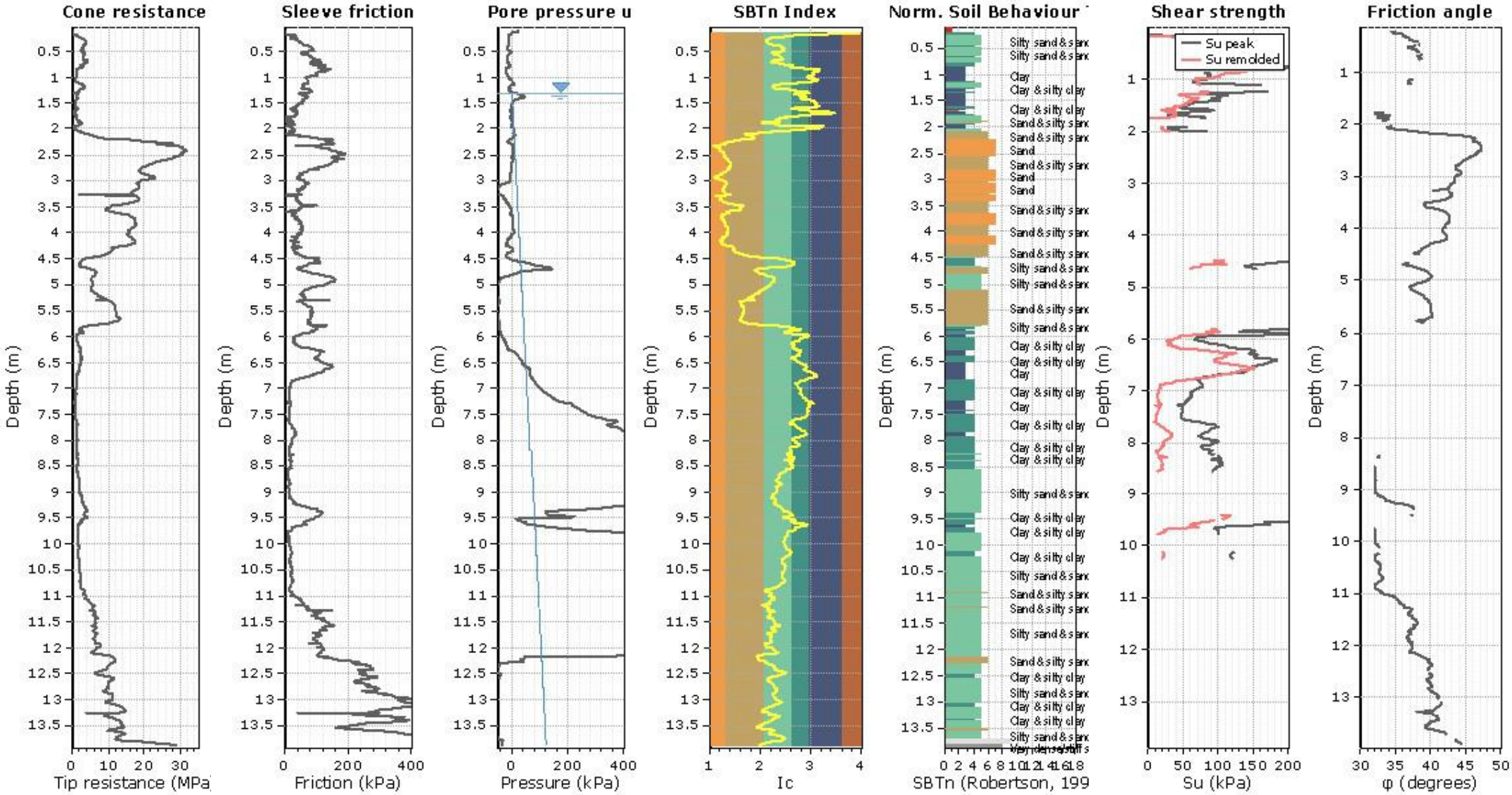
CPT: CPT09
Total depth: 13.88 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill

Project: 220489
Location: Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton



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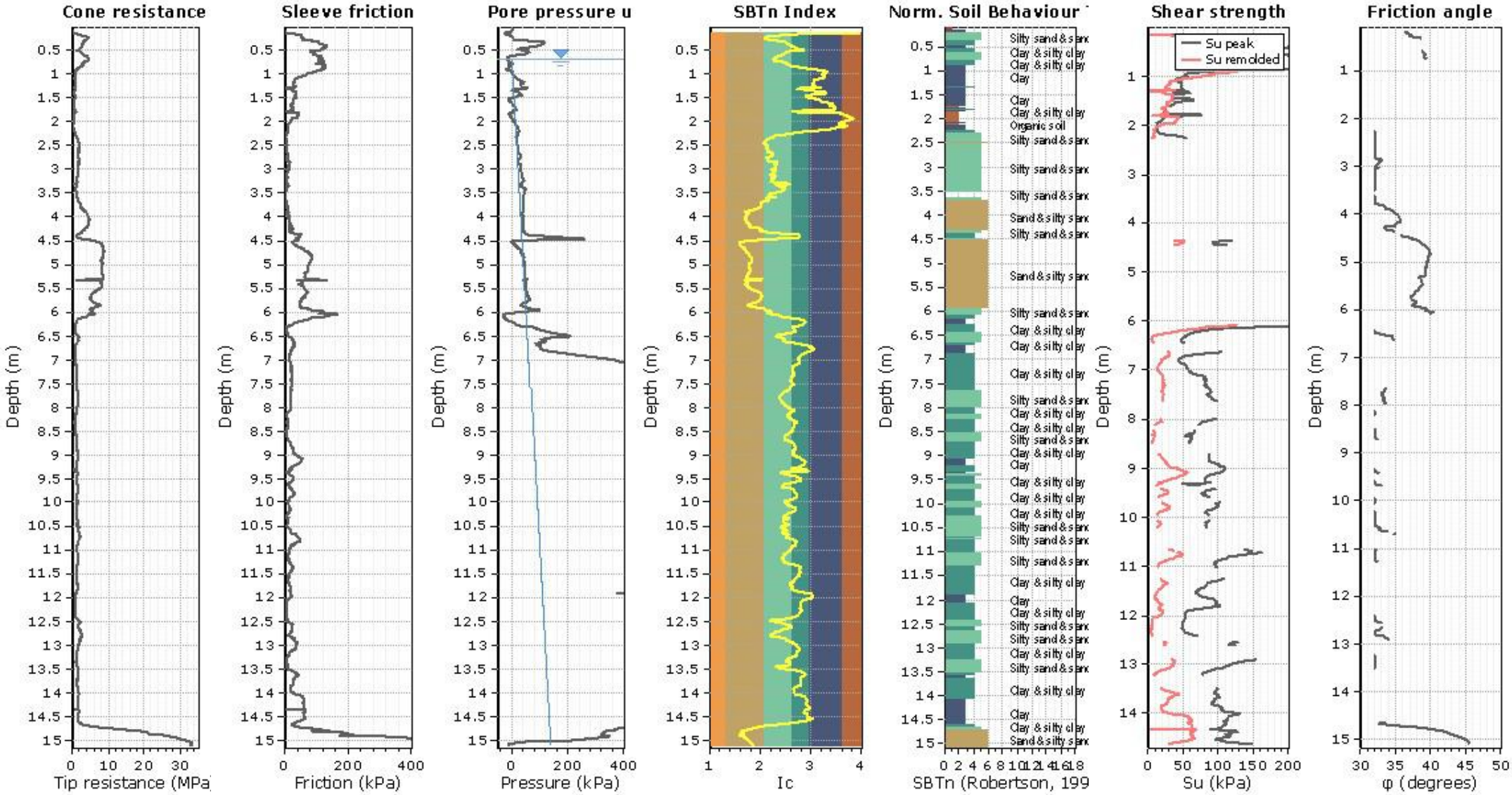
CPT: CPT10
Total depth: 15.08 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill

Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**



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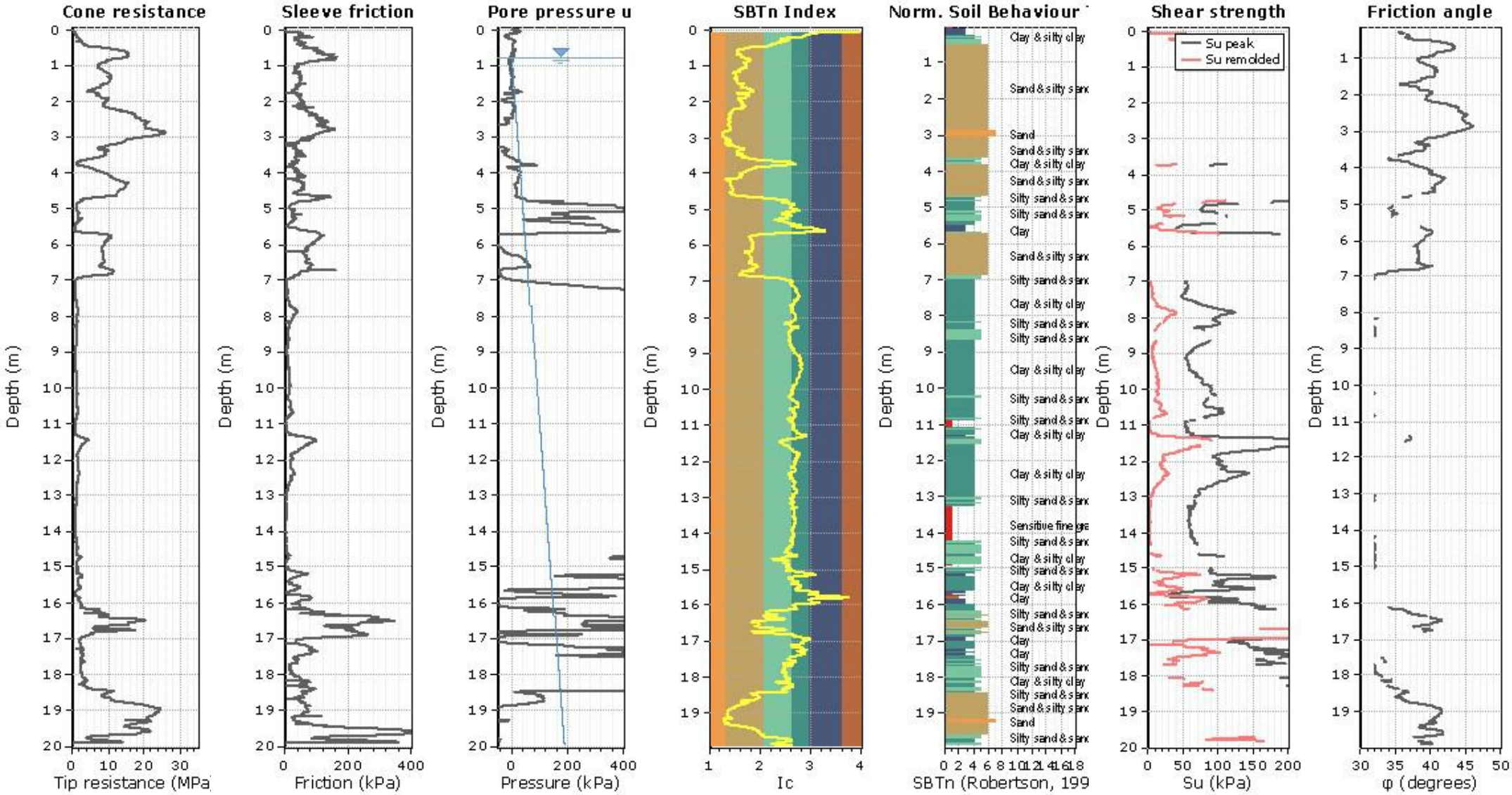
CPT: CPT12
Total depth: 19.96 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill

Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**



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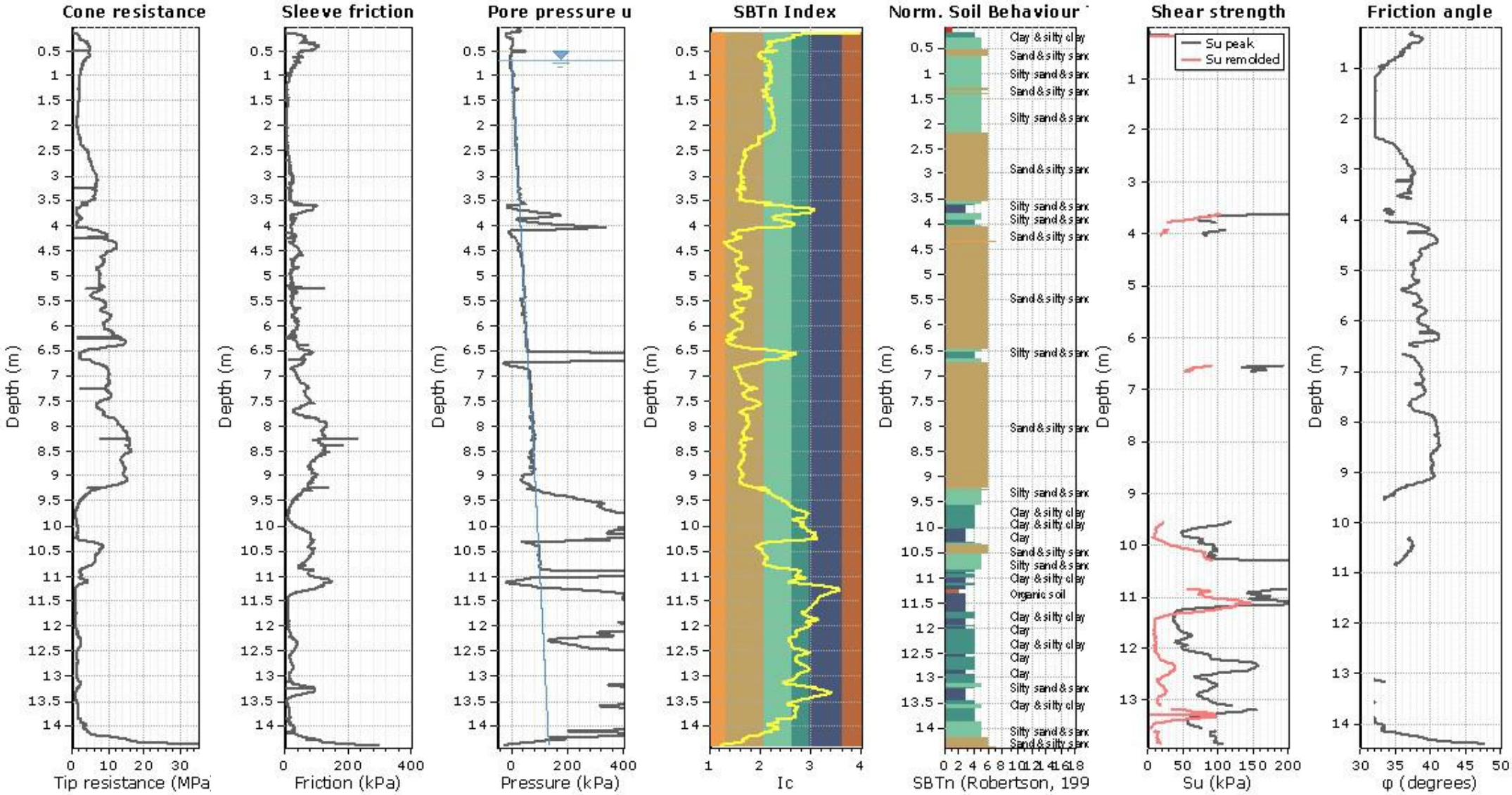
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT13
Total depth: 14.38 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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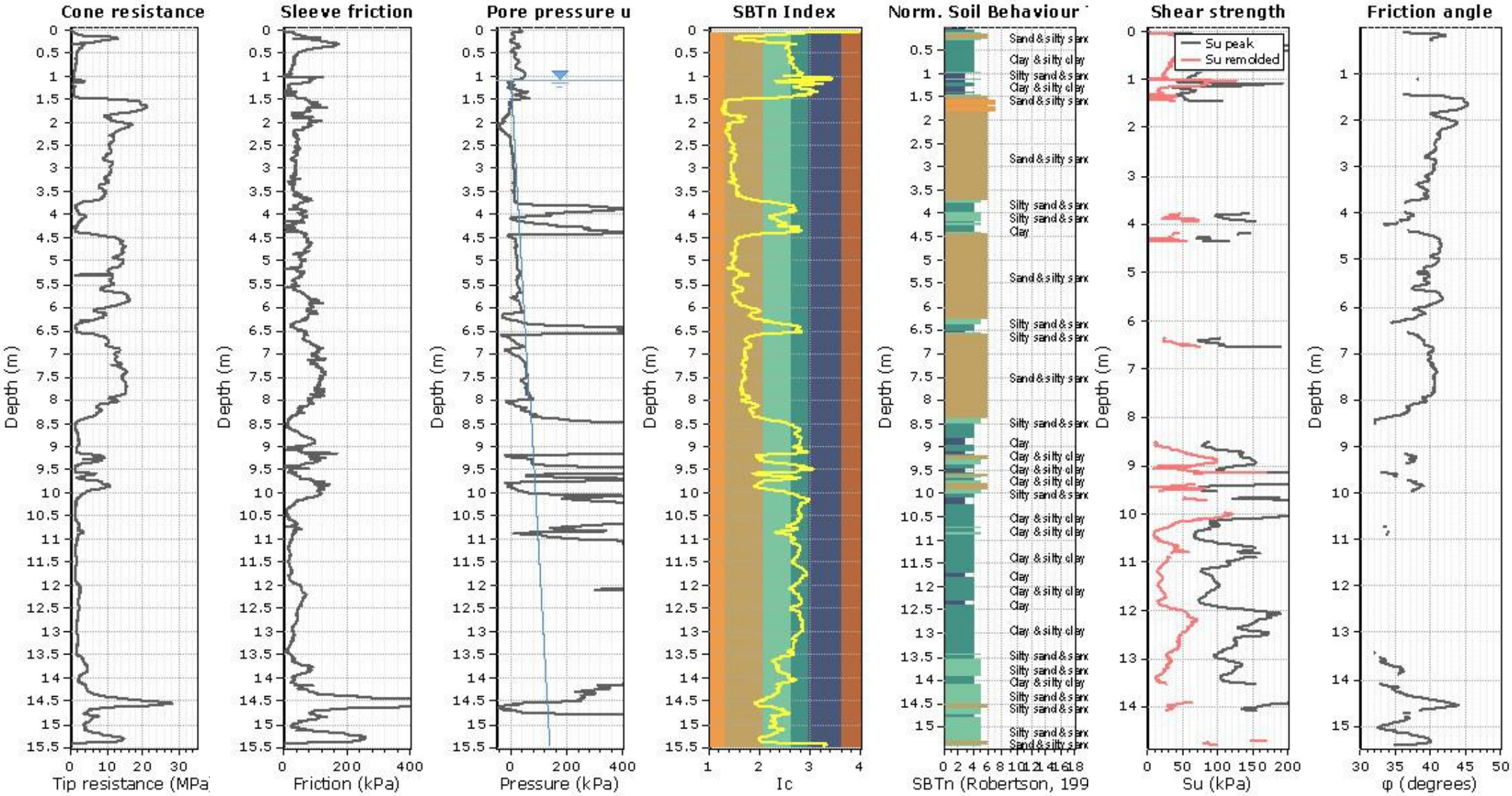
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT14
Total depth: 15.47 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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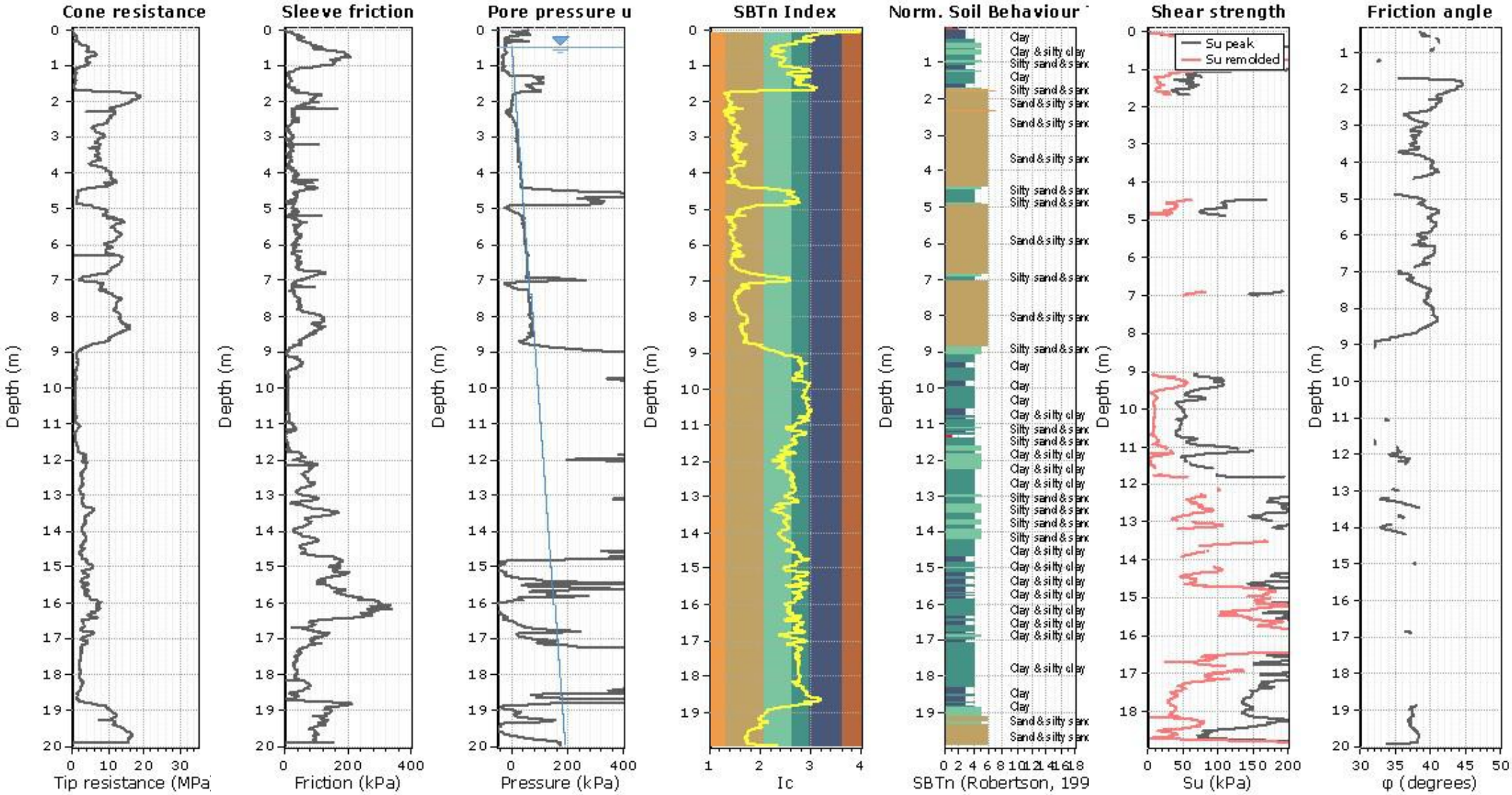
Project: 220489
Location: Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton

CPT: CPT15
Total depth: 19.98 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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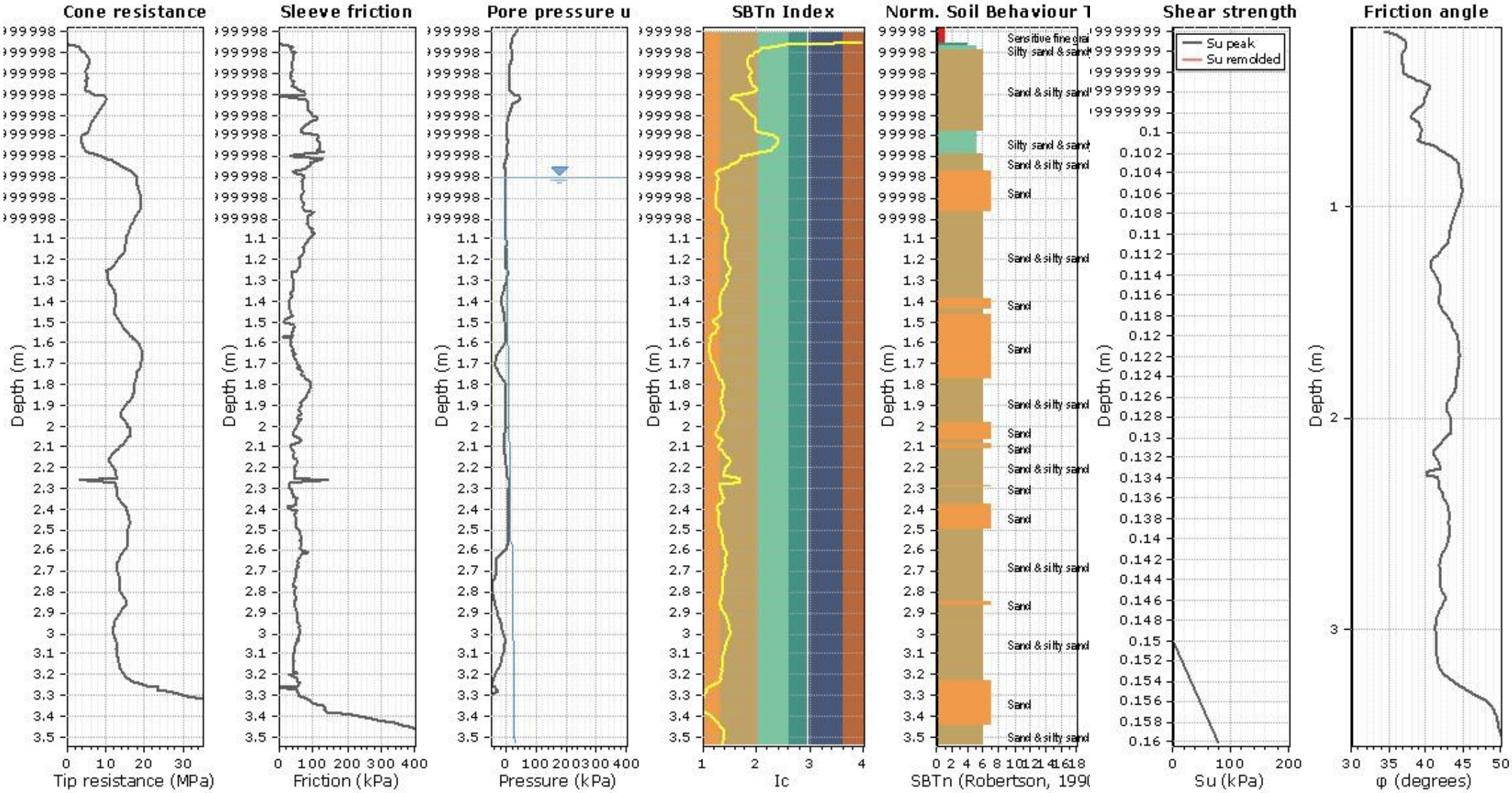
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT16
Total depth: 3.53 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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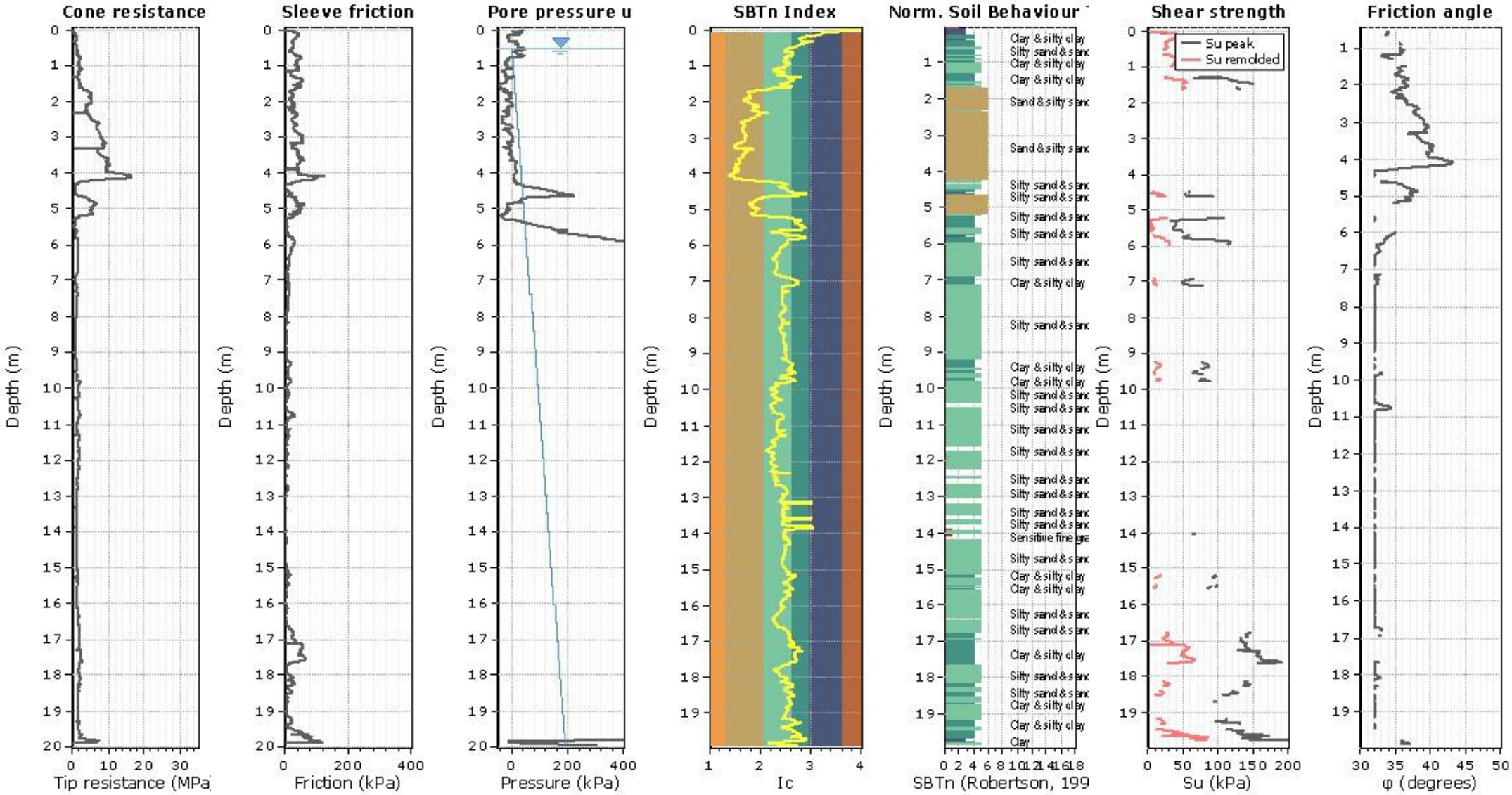
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT17
Total depth: 19.95 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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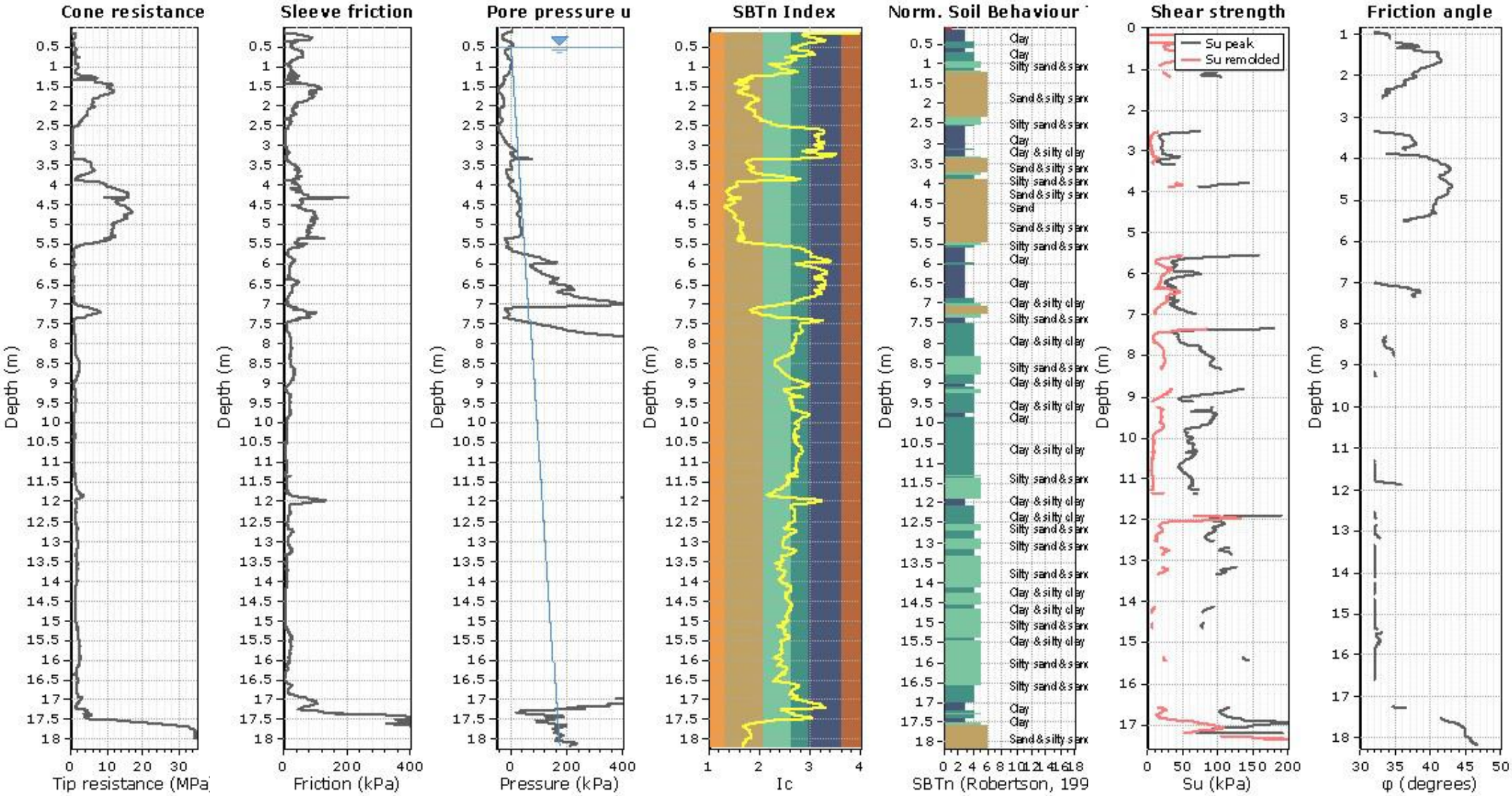
CPT: CPT18
Total depth: 18.16 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill

Project: 220489
Location: Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton



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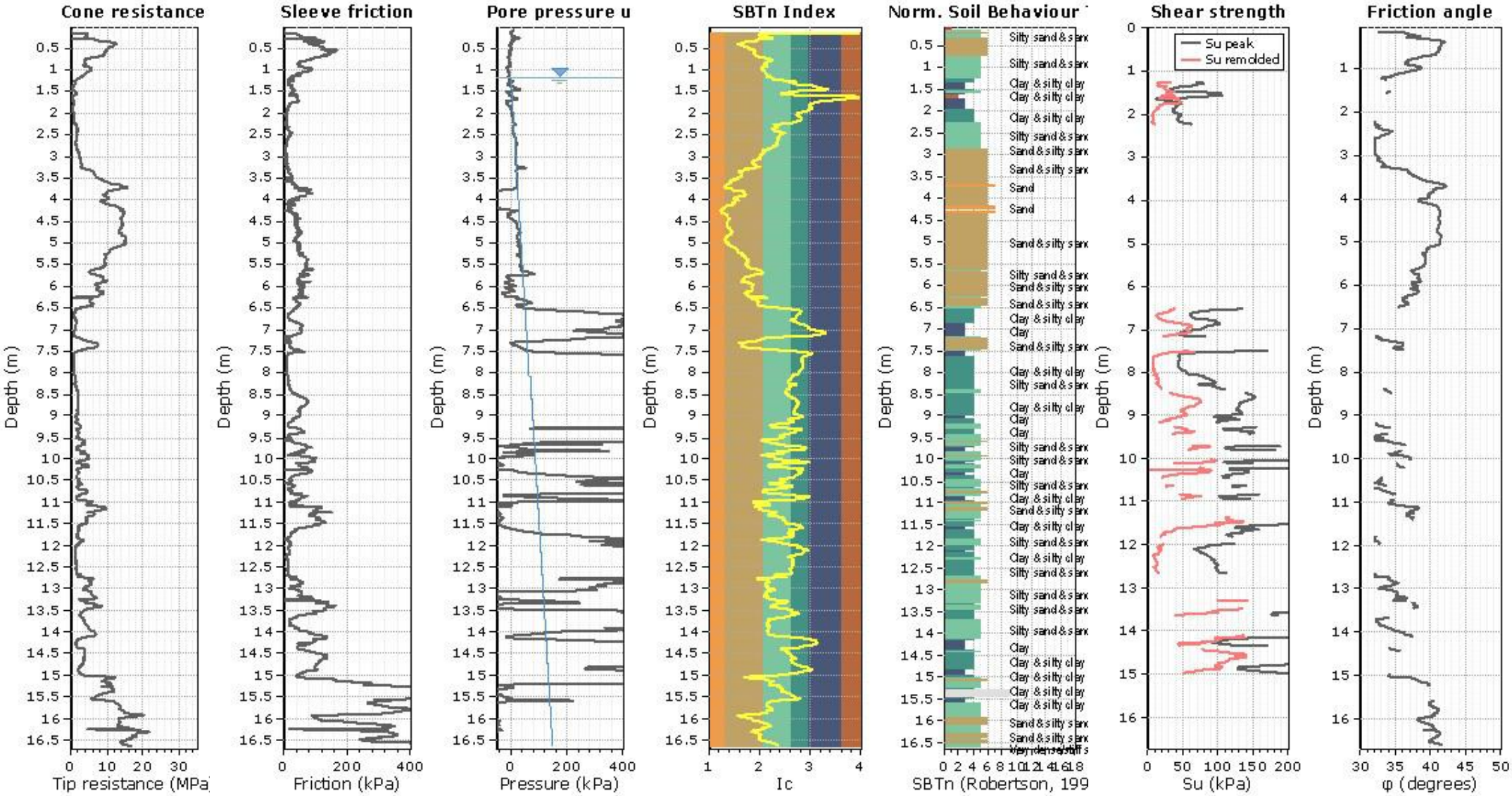
CPT: CPT19
Total depth: 16.63 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill

Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**



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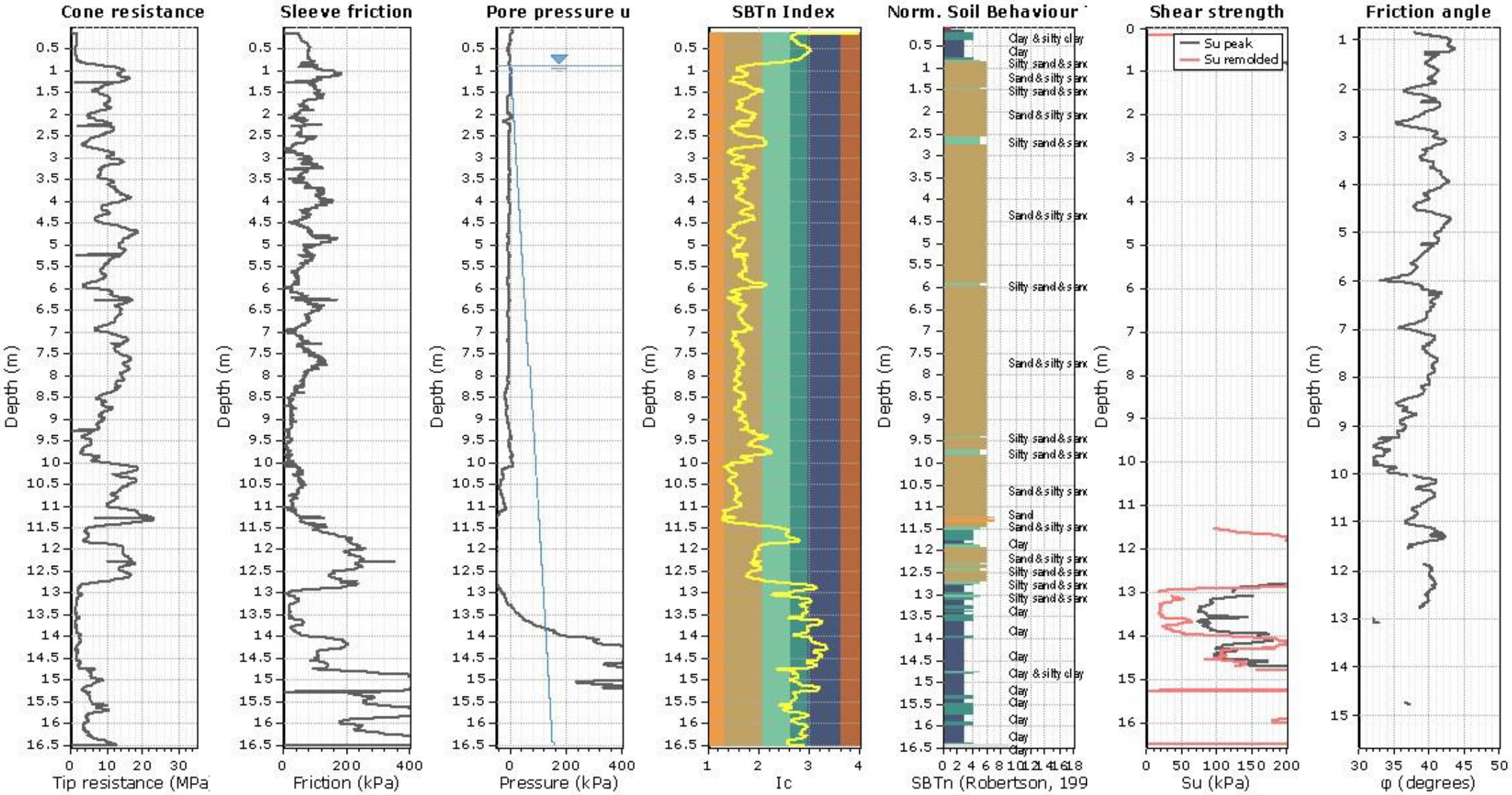
Project: 220489
Location: Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton

CPT: CPT20
Total depth: 16.50 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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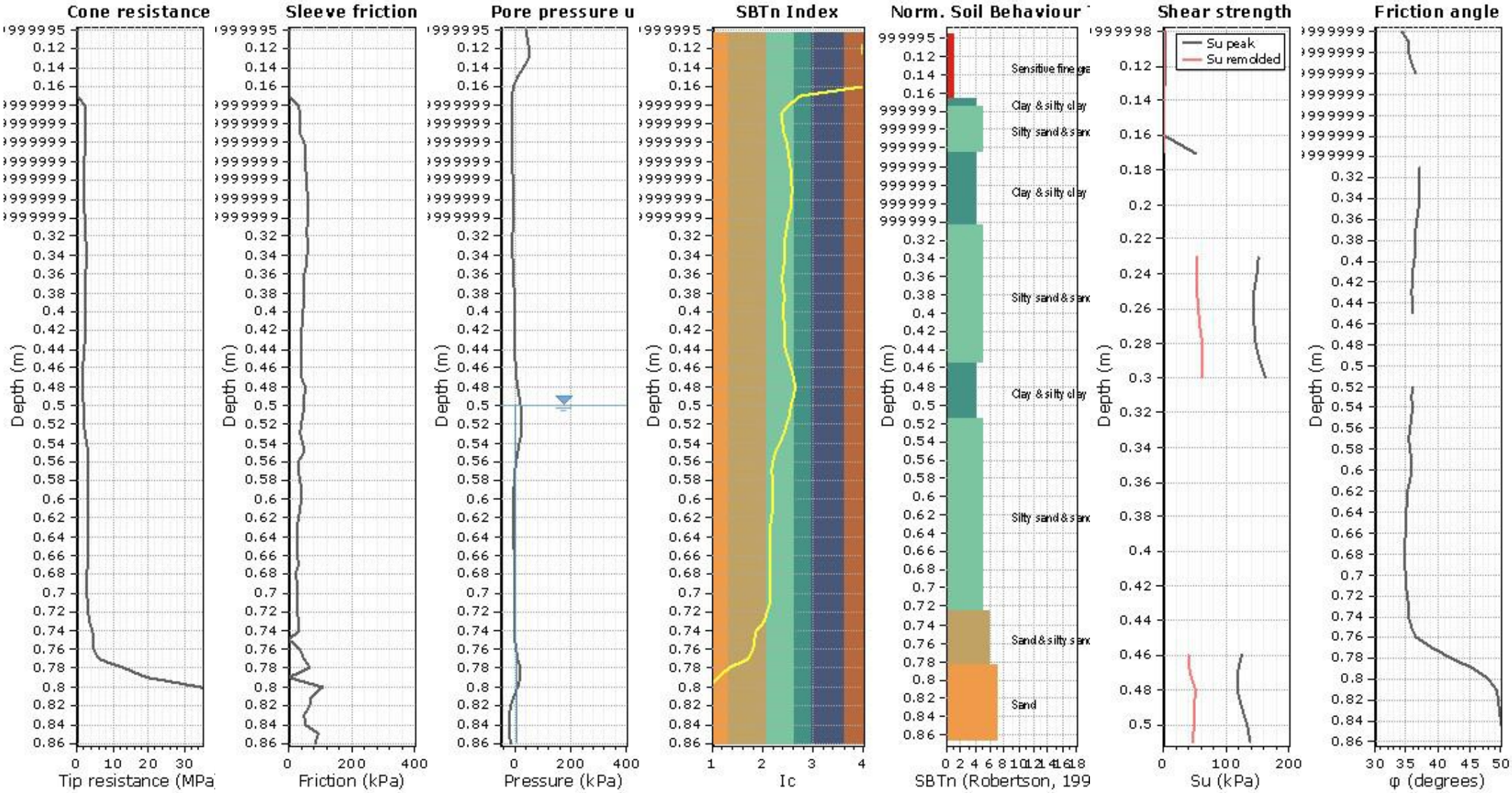
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT21
Total depth: 0.86 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



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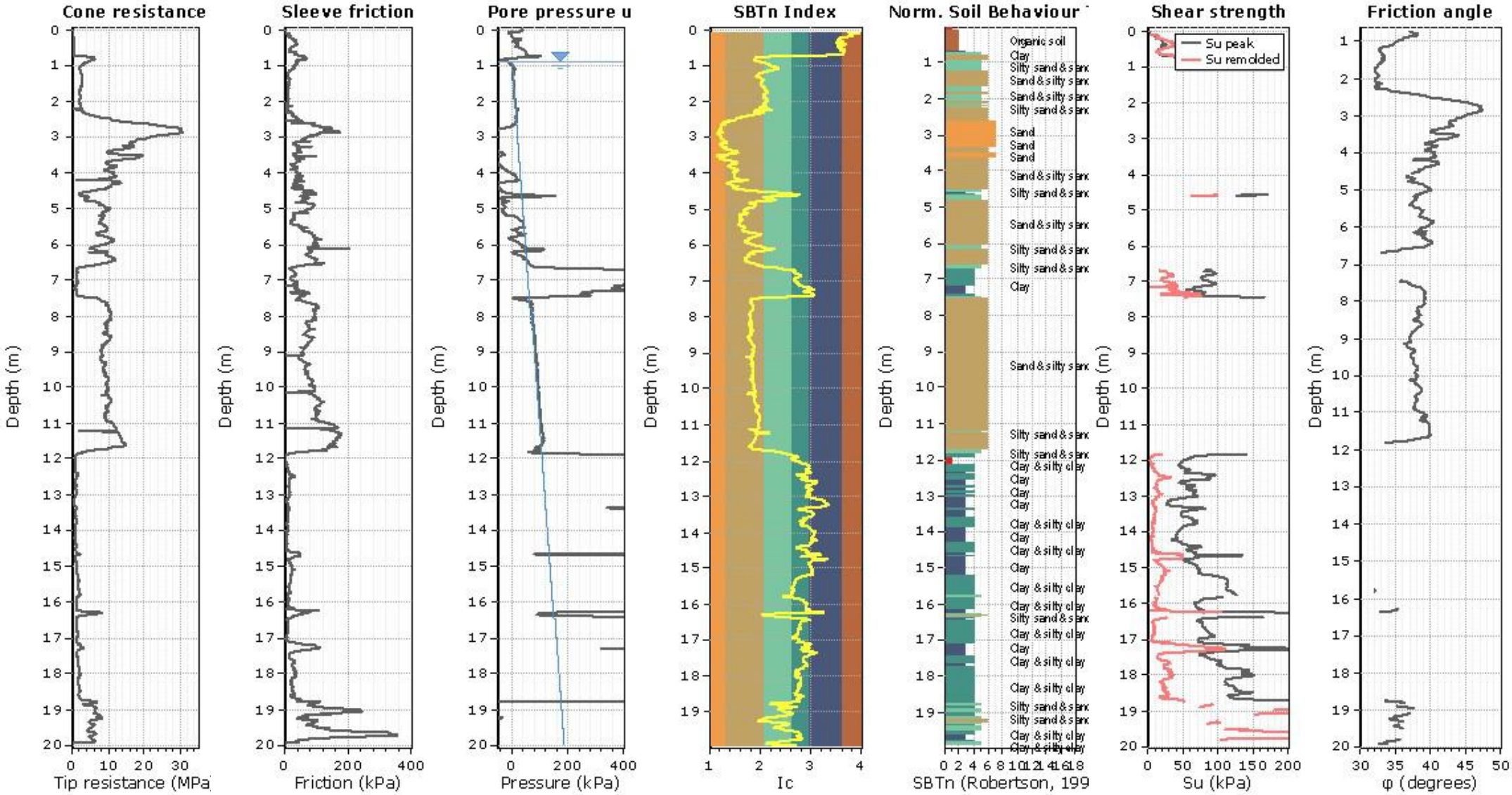
CPT: CPT22
Total depth: 19.99 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill

Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**



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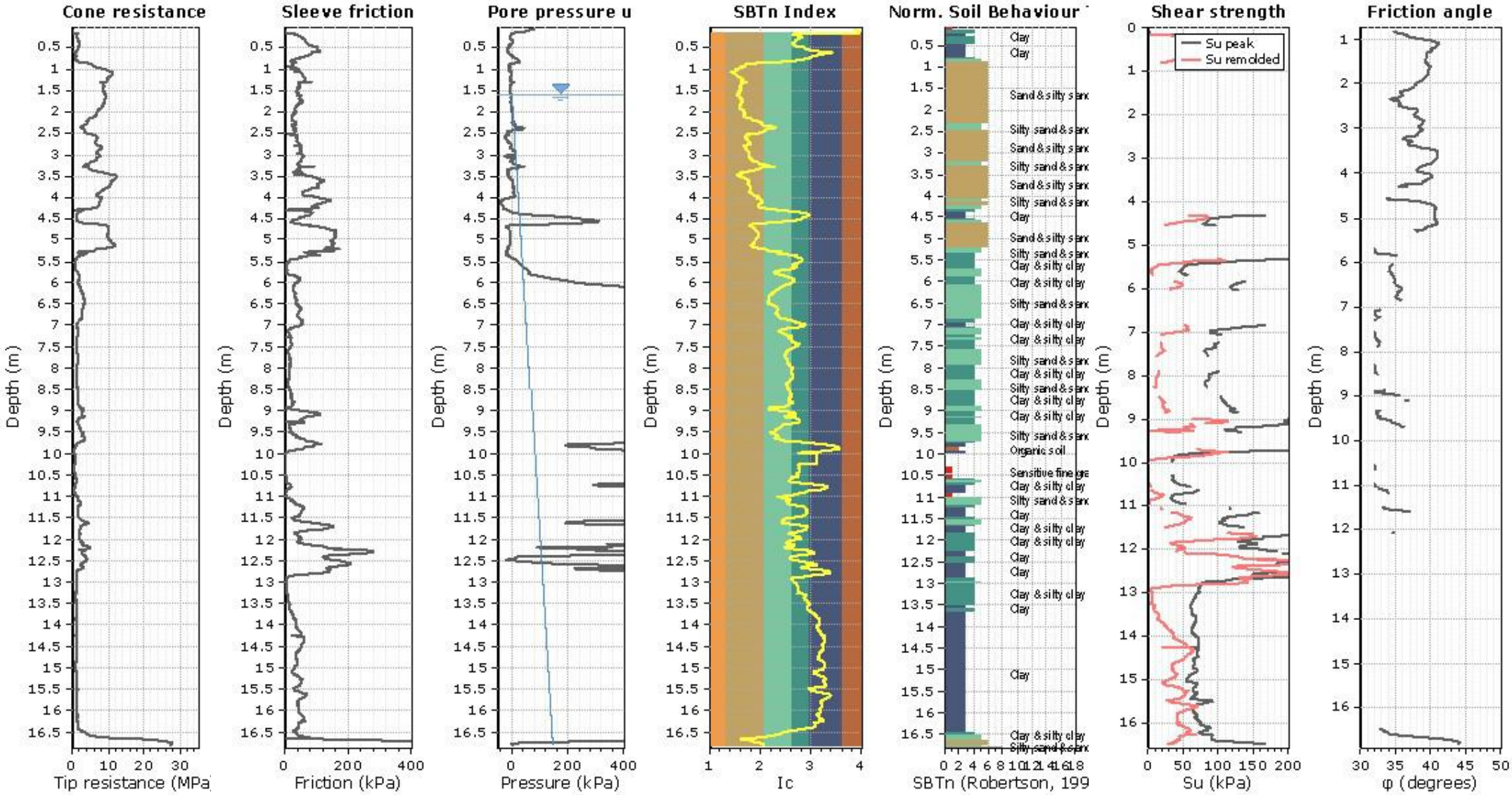
CPT: CPT23
Total depth: 16.81 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator: ProDrill

Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**



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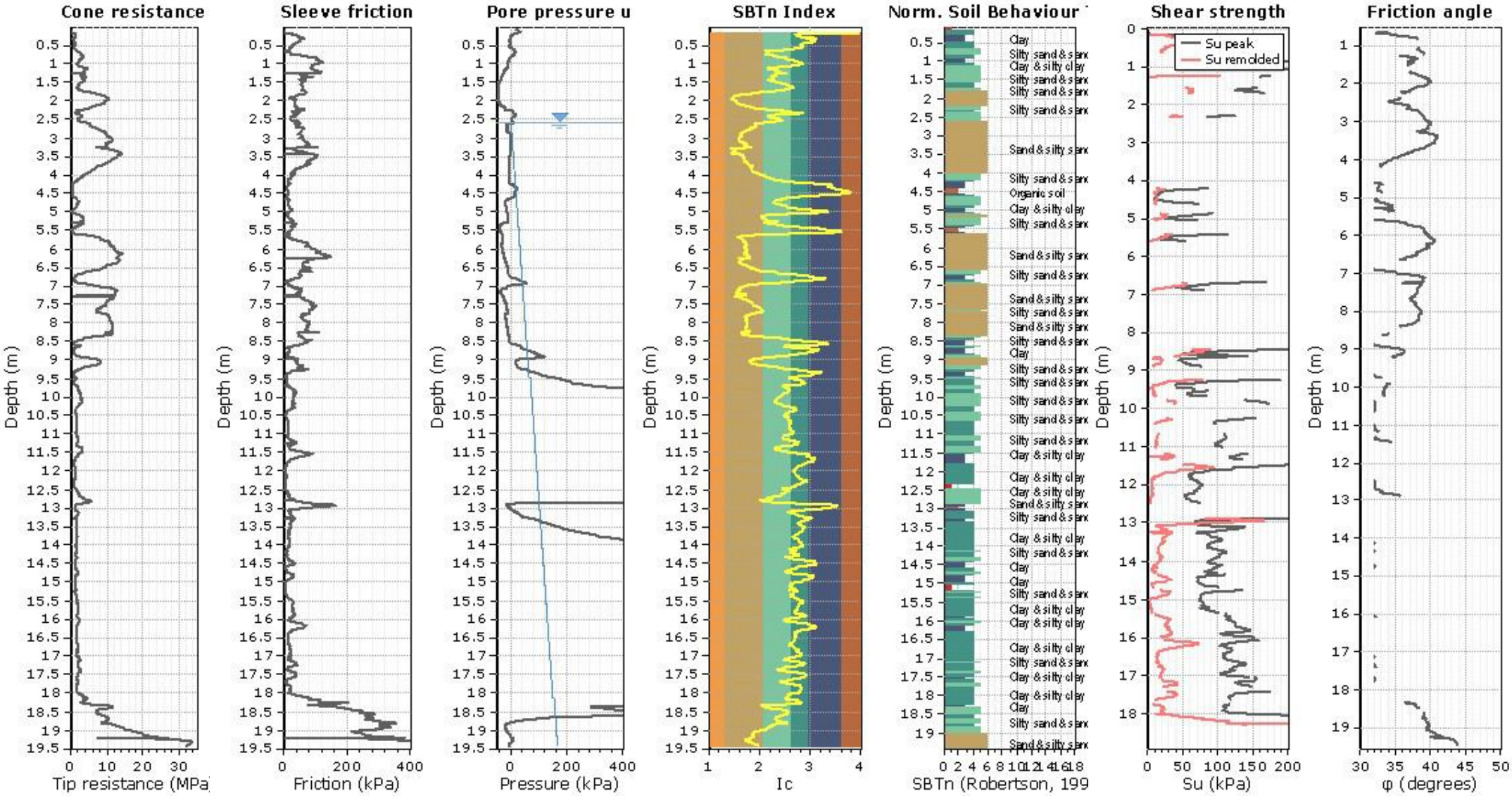
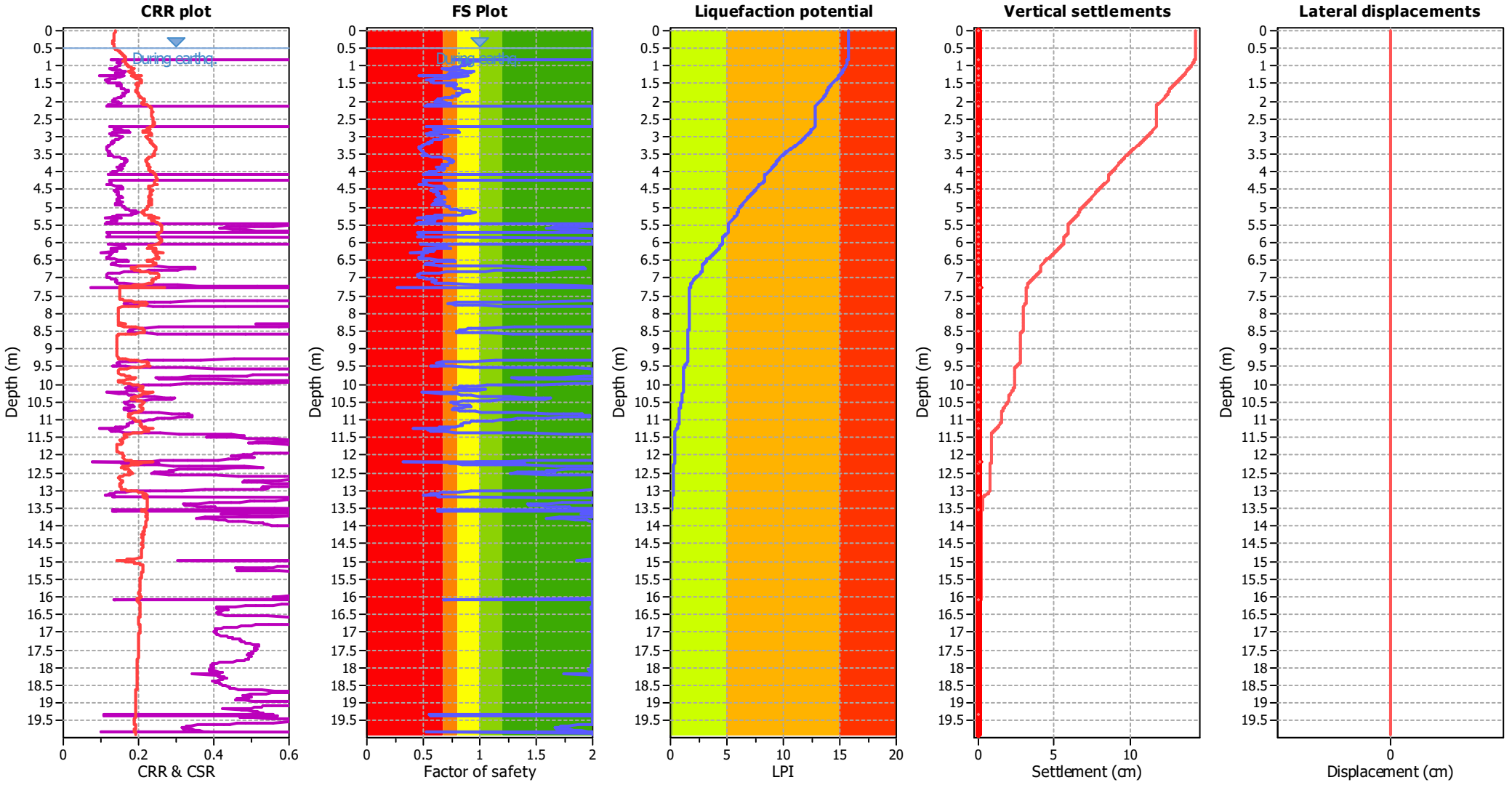
Project: **220489**
Location: **Fonterra Te Rapa, 1314 Te Rapa Road, Hamilton**

CPT: CPT24
Total depth: 19.43 m, Date: 20/11/2023
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Electronic Subtraction
Cone Operator: ProDrill



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

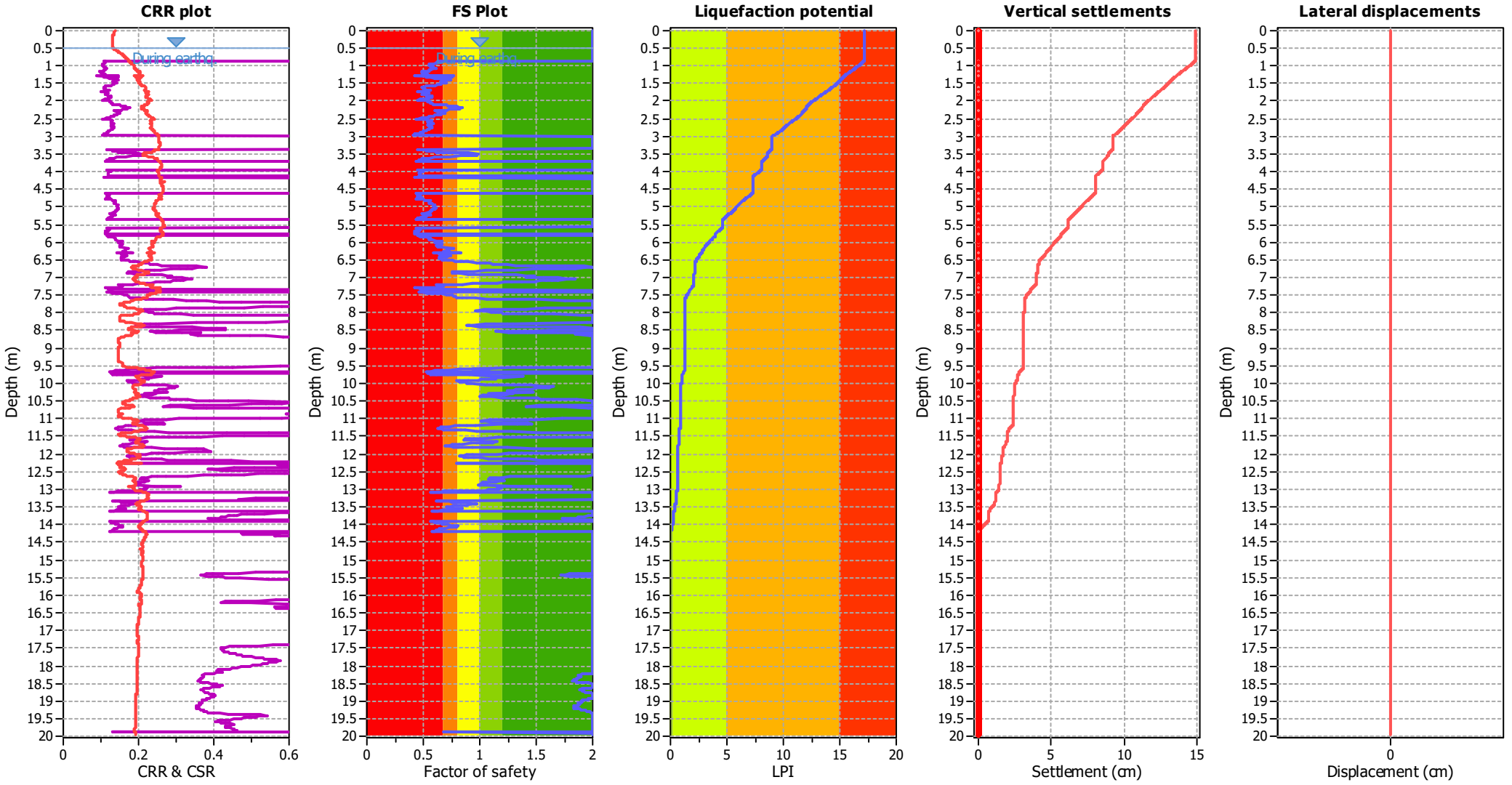
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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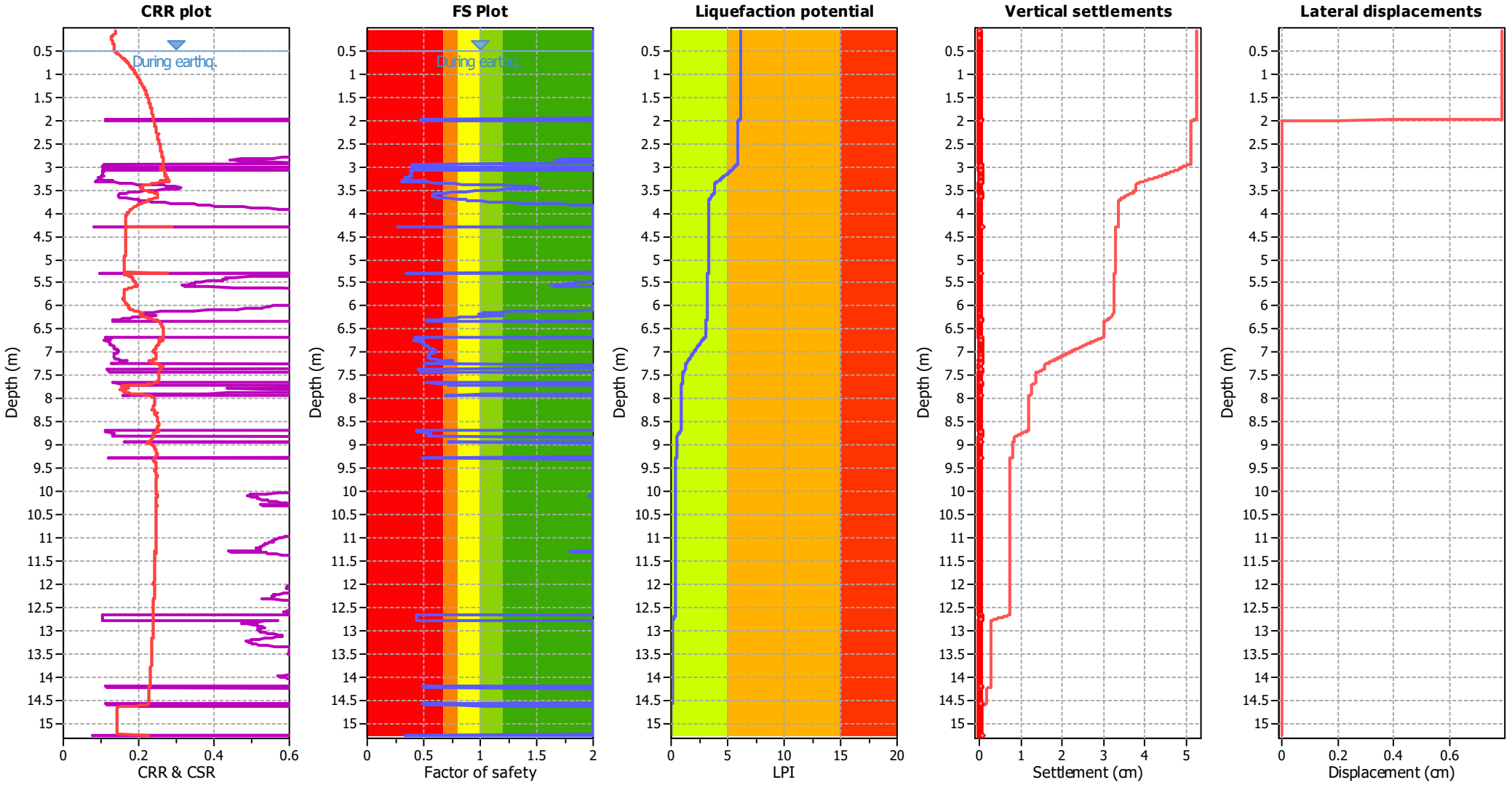
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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- Unlike to liquefy
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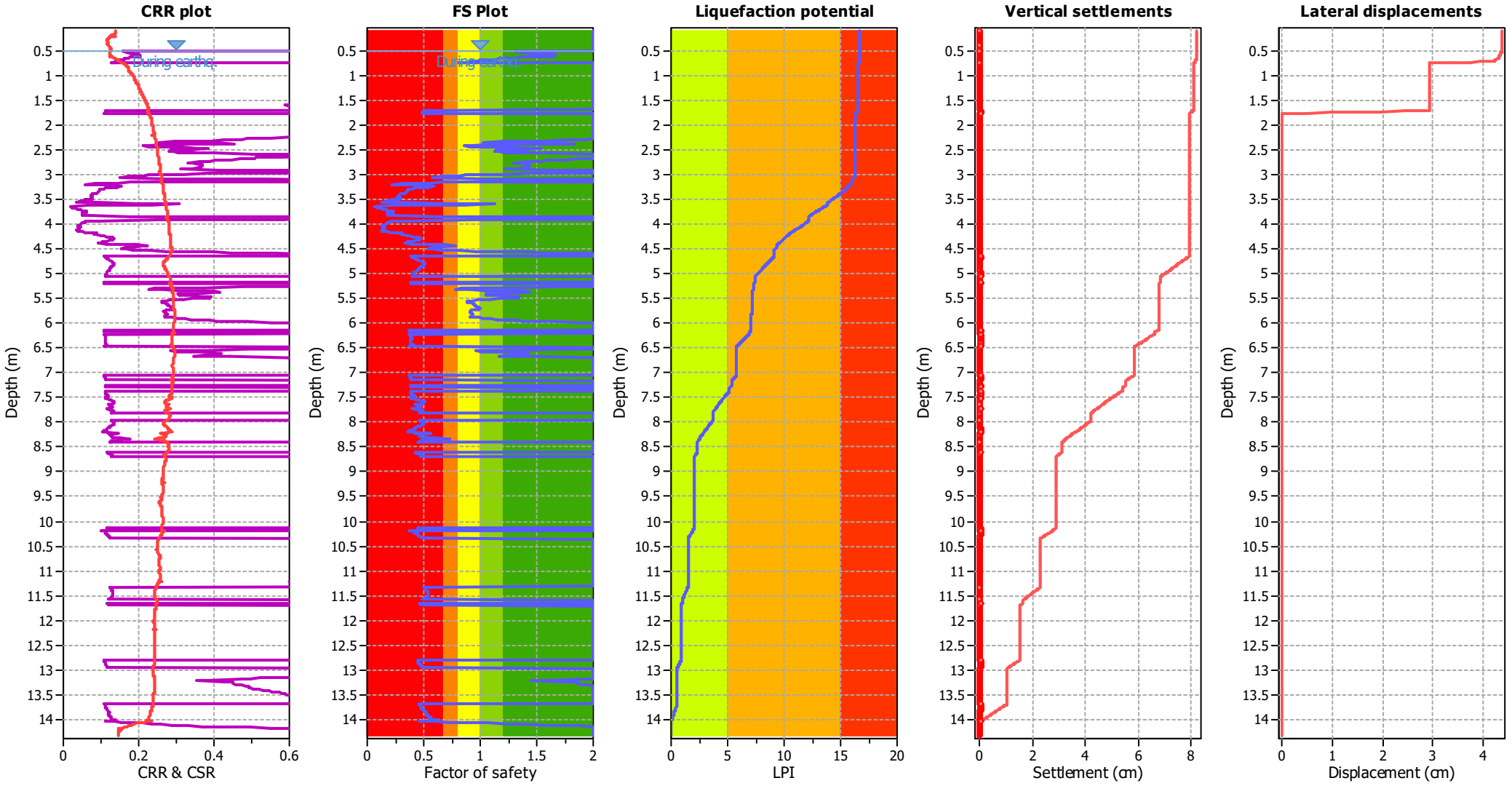
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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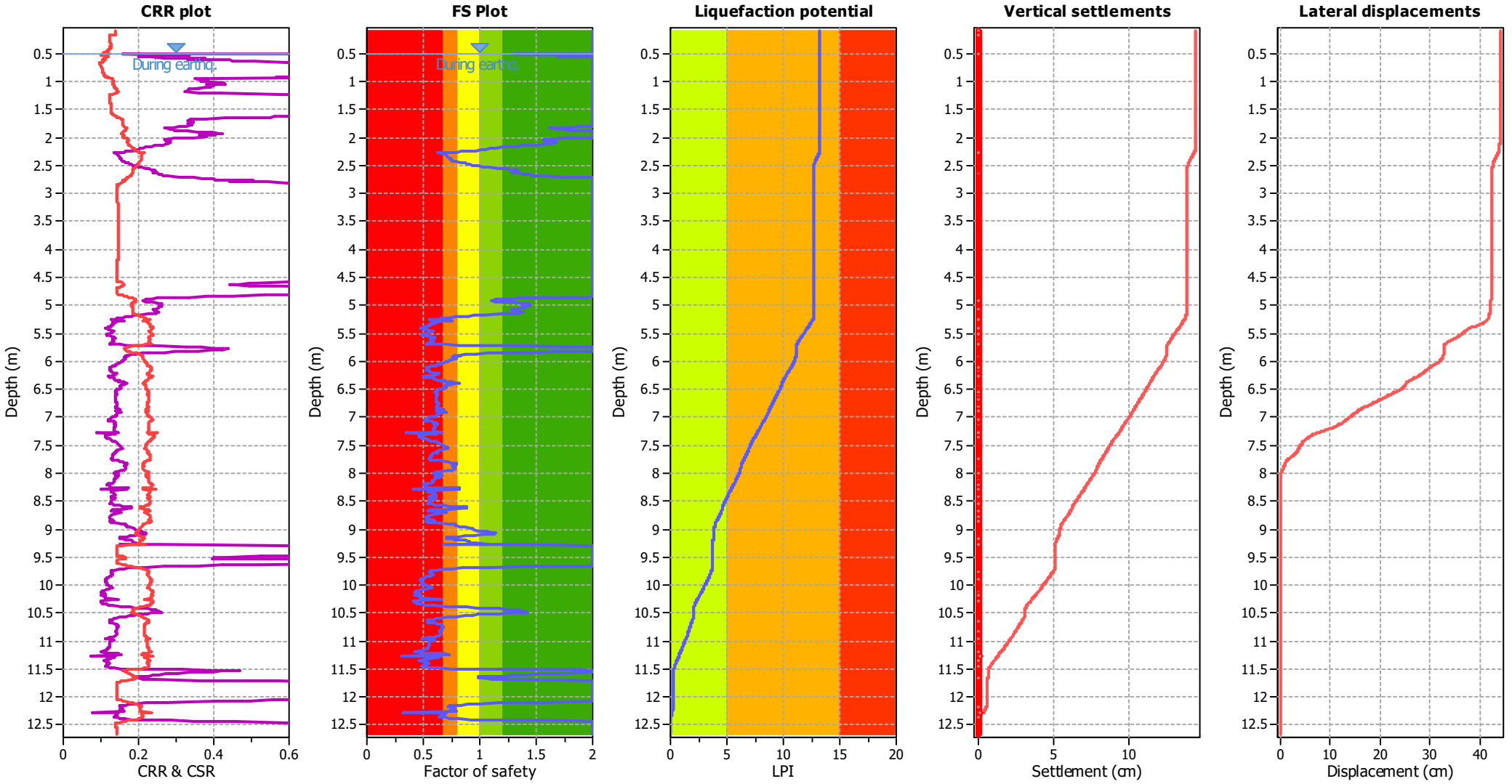
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

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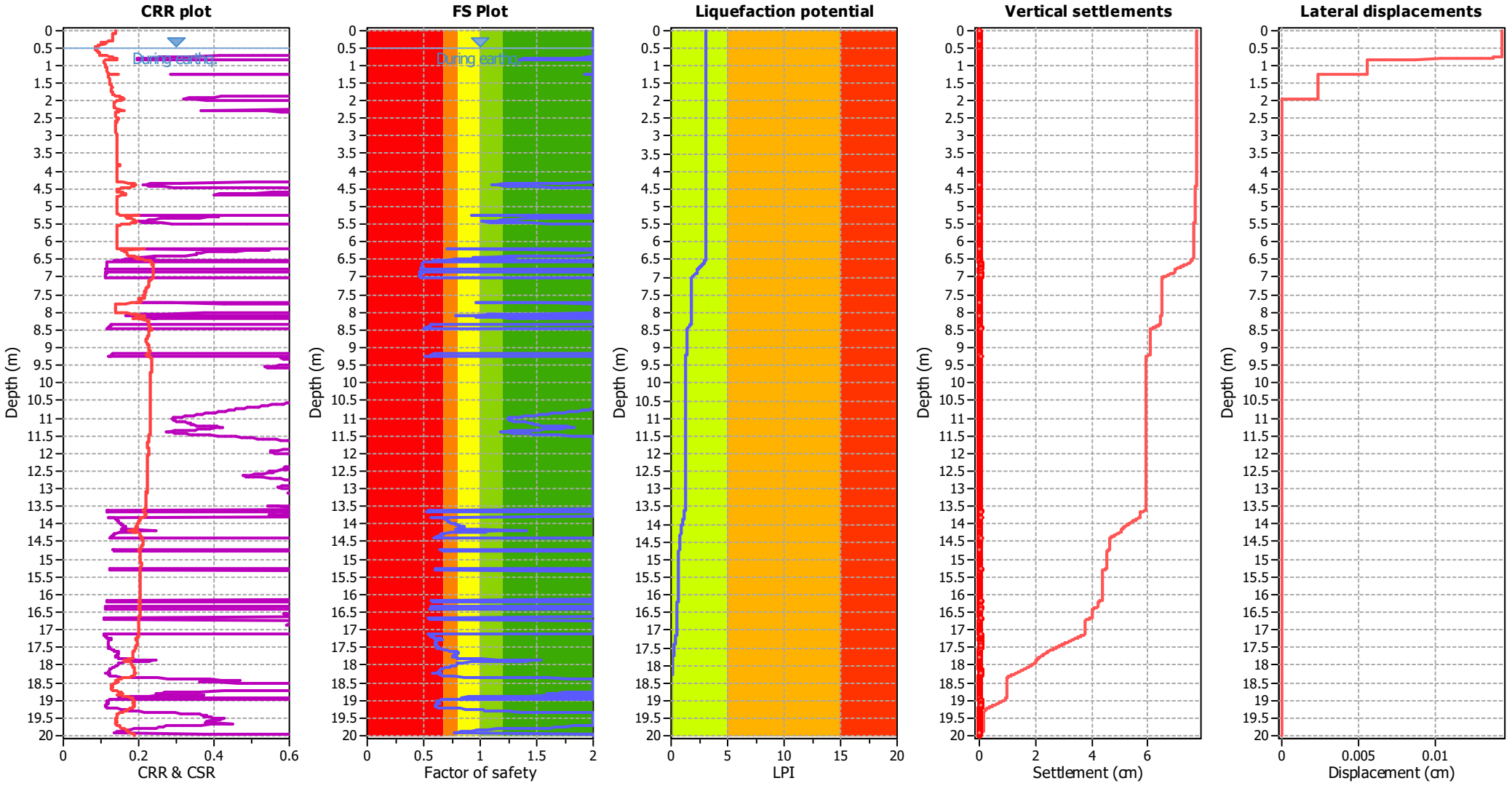
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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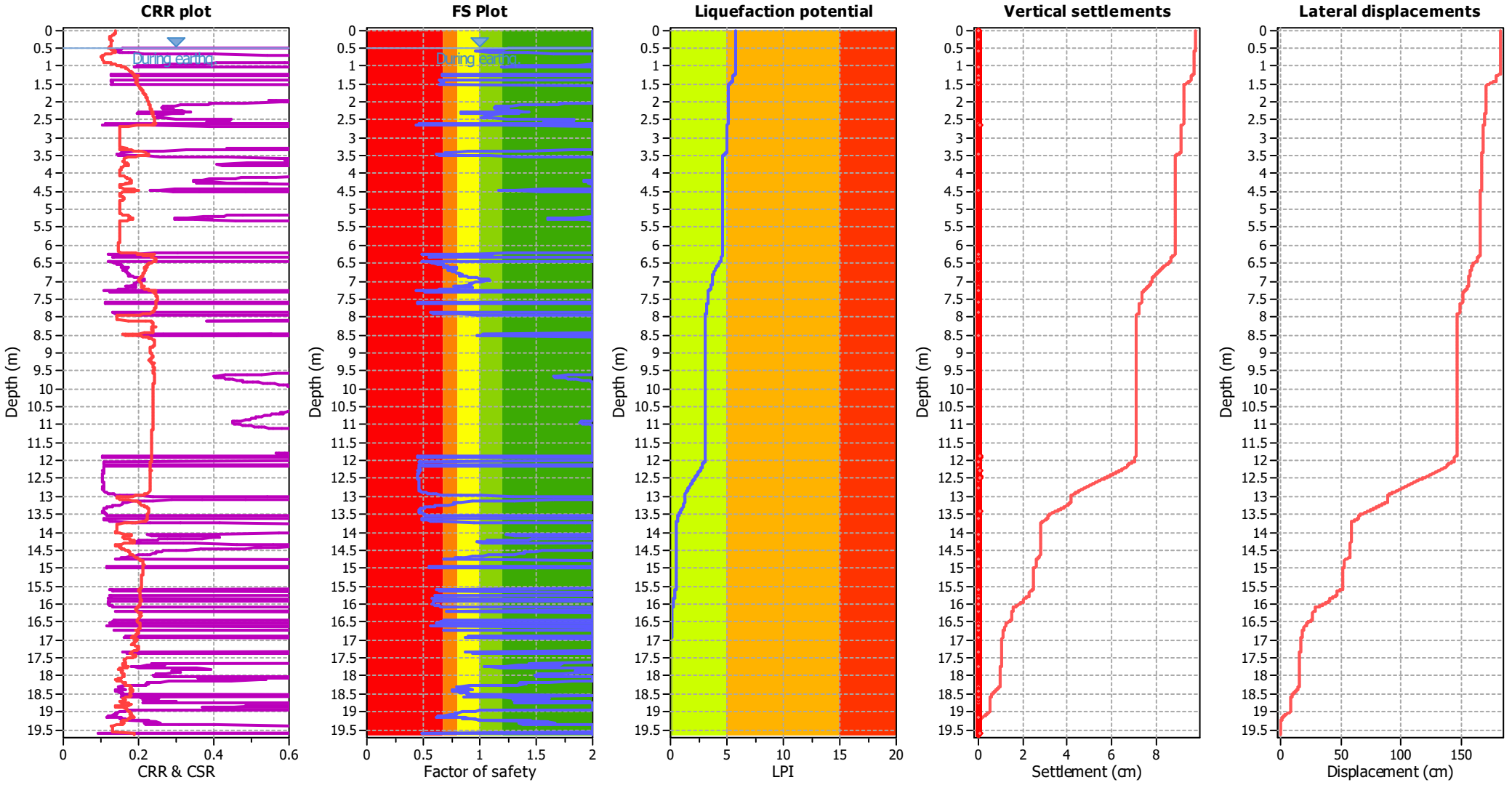
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.25	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
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LPI color scheme

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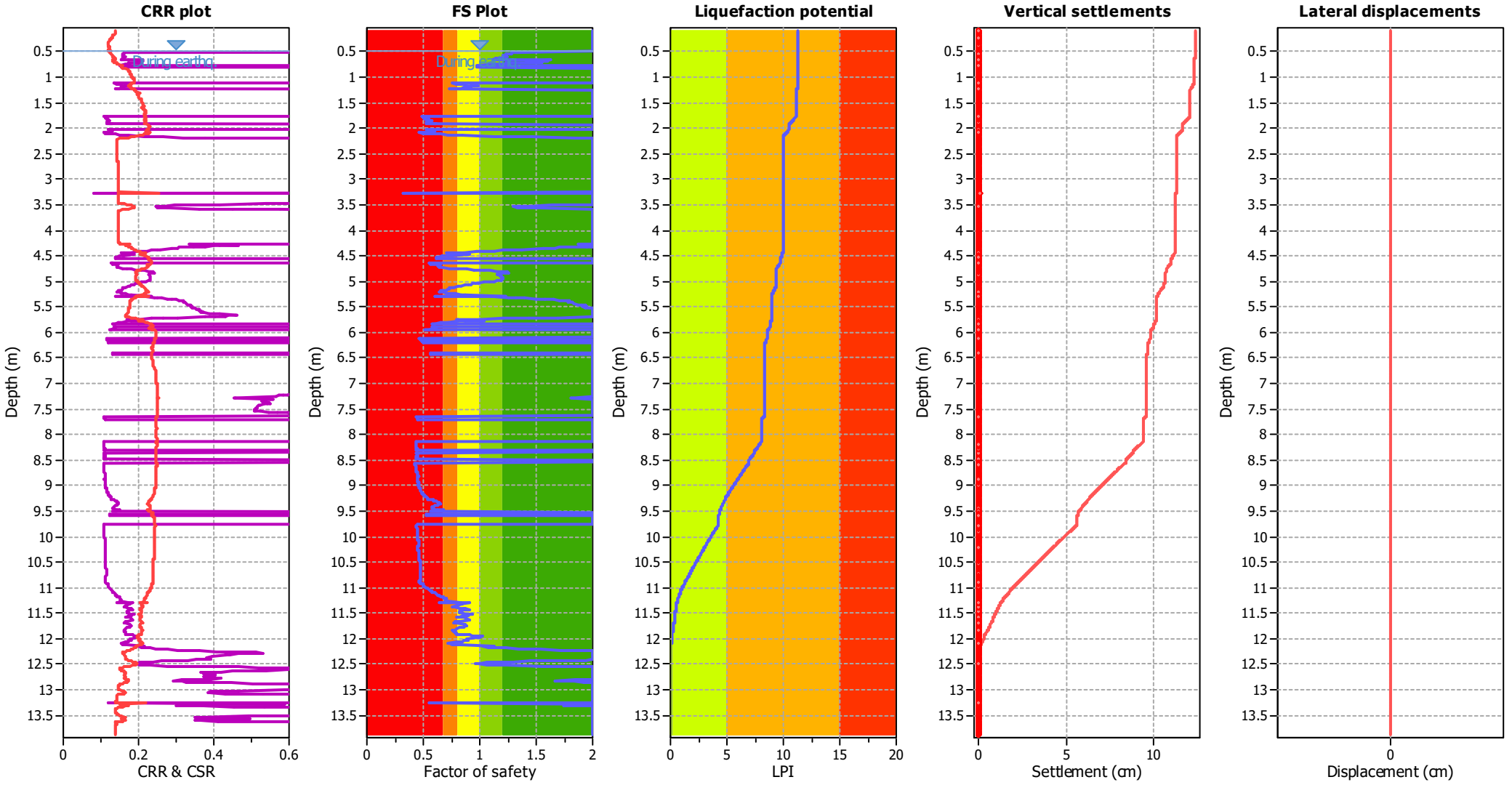
- Low risk

Liquefaction analysis overall plots



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F.S. color scheme

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- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
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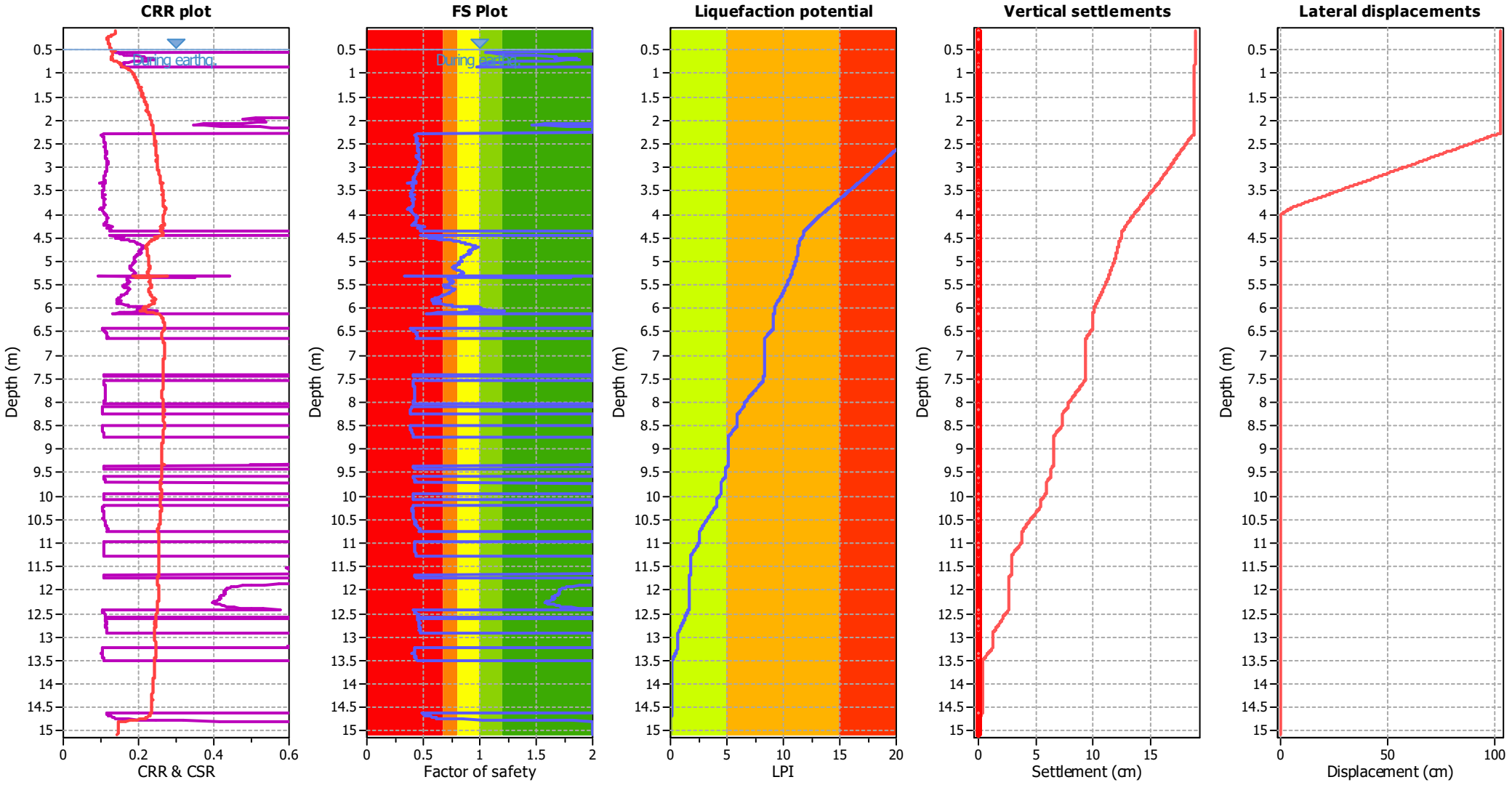

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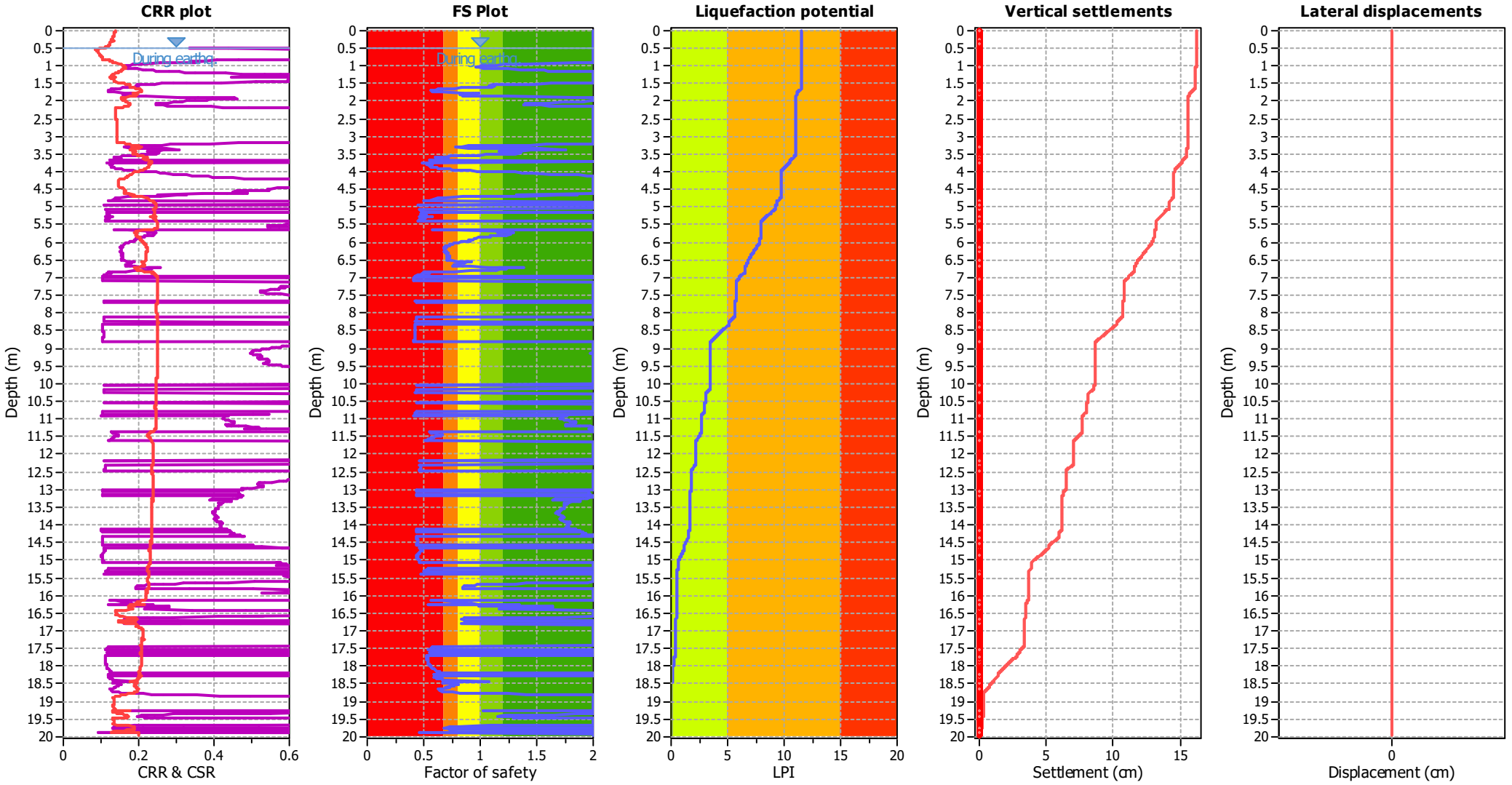

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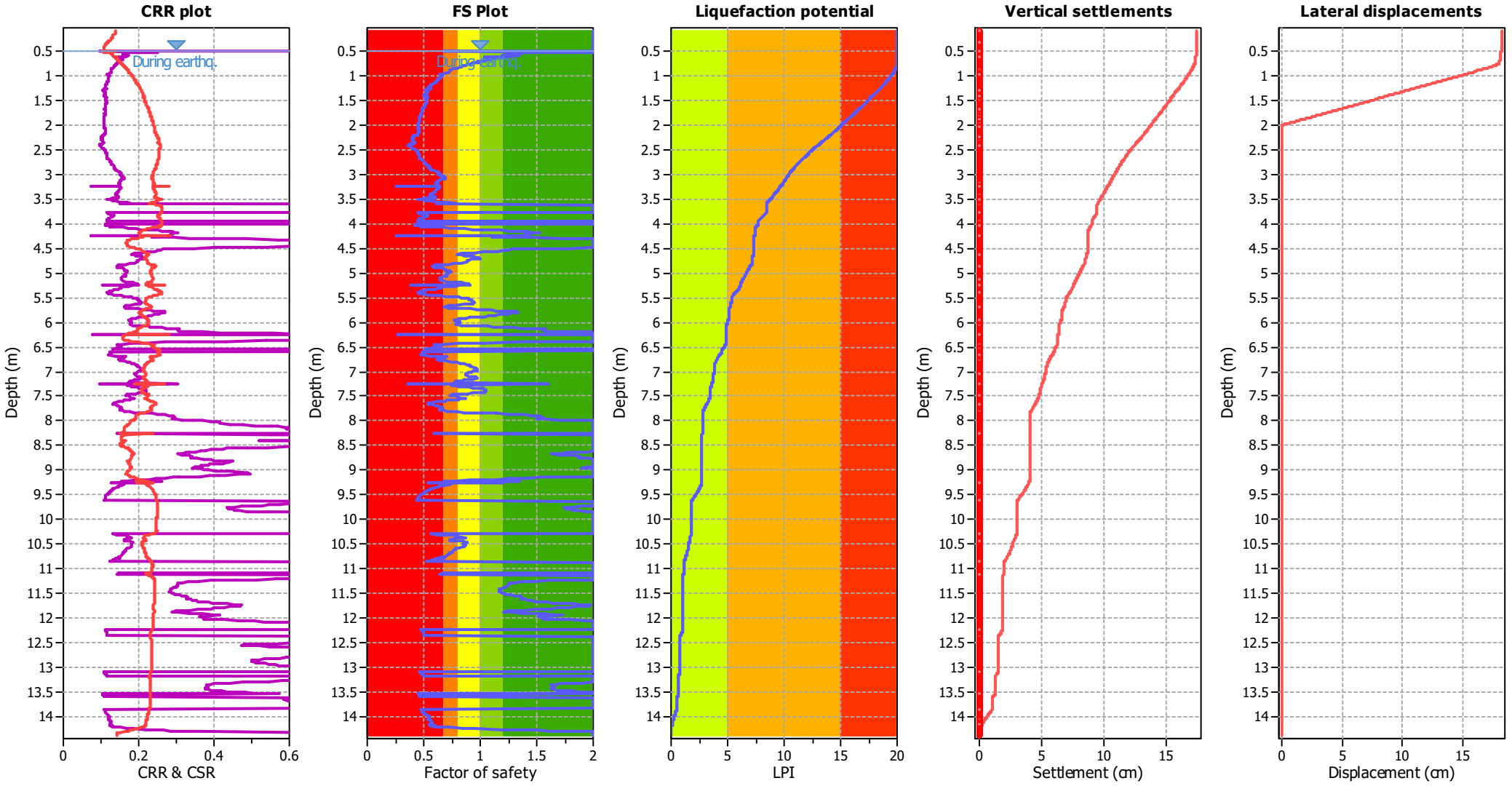

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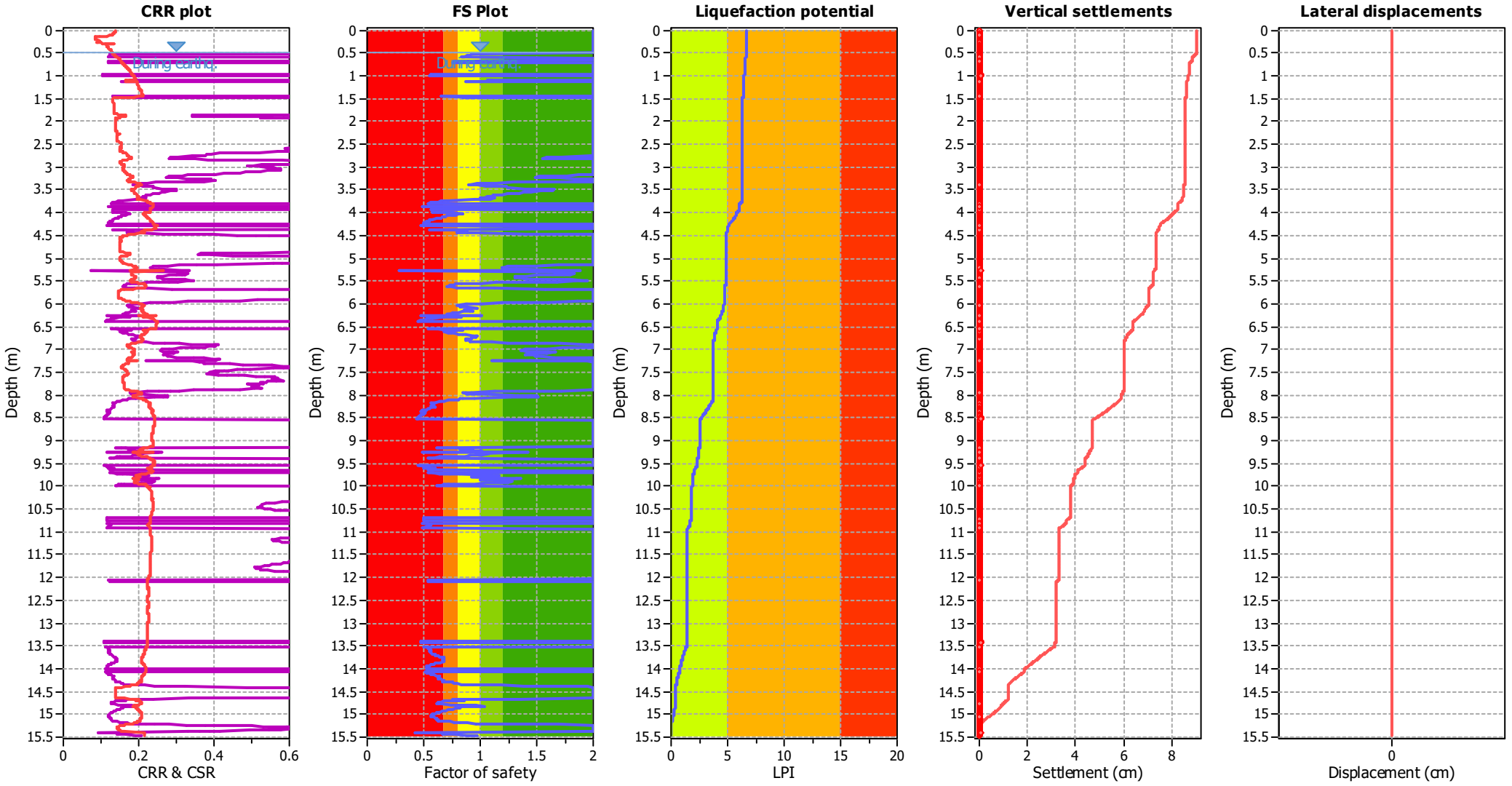

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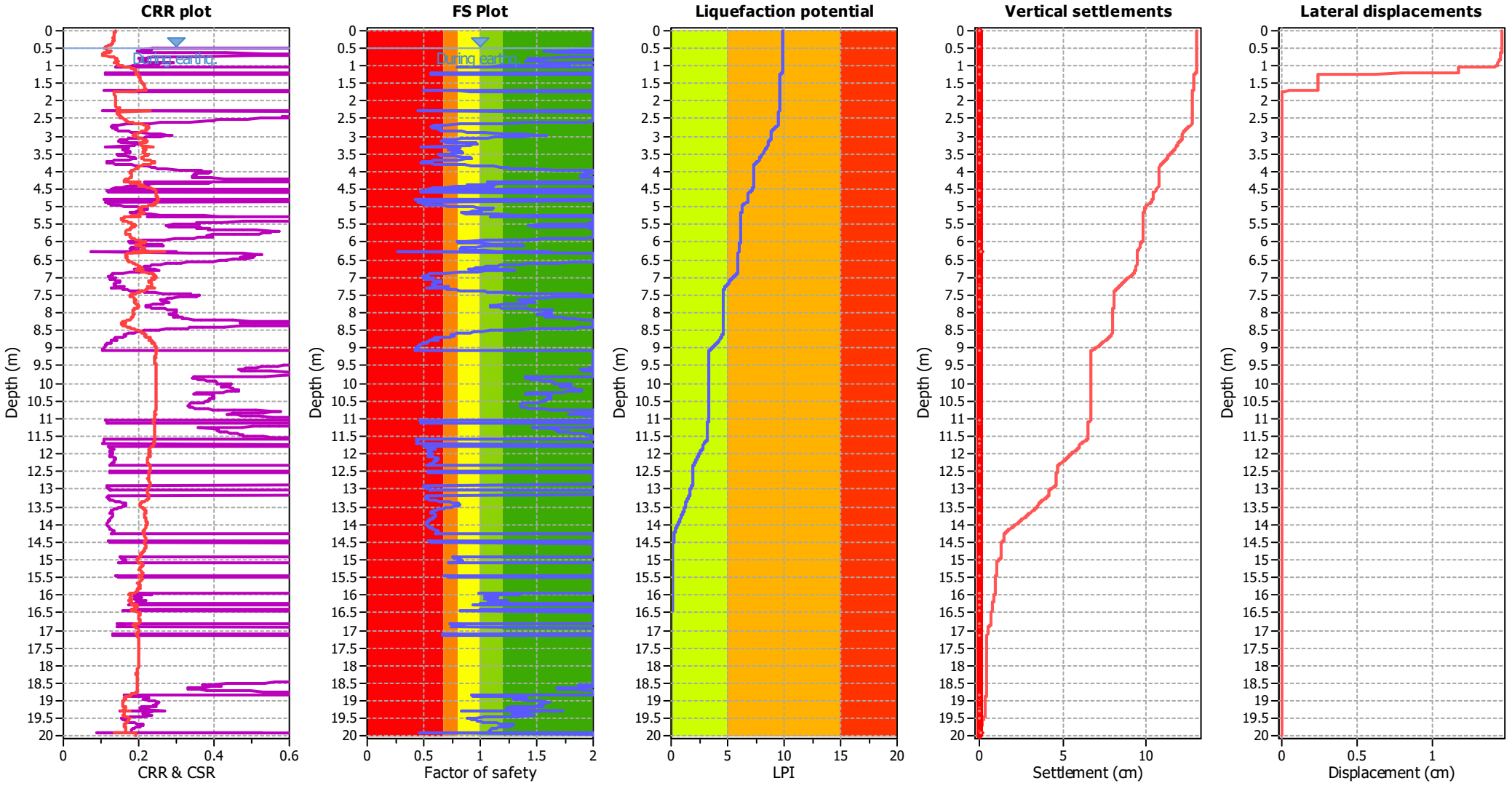

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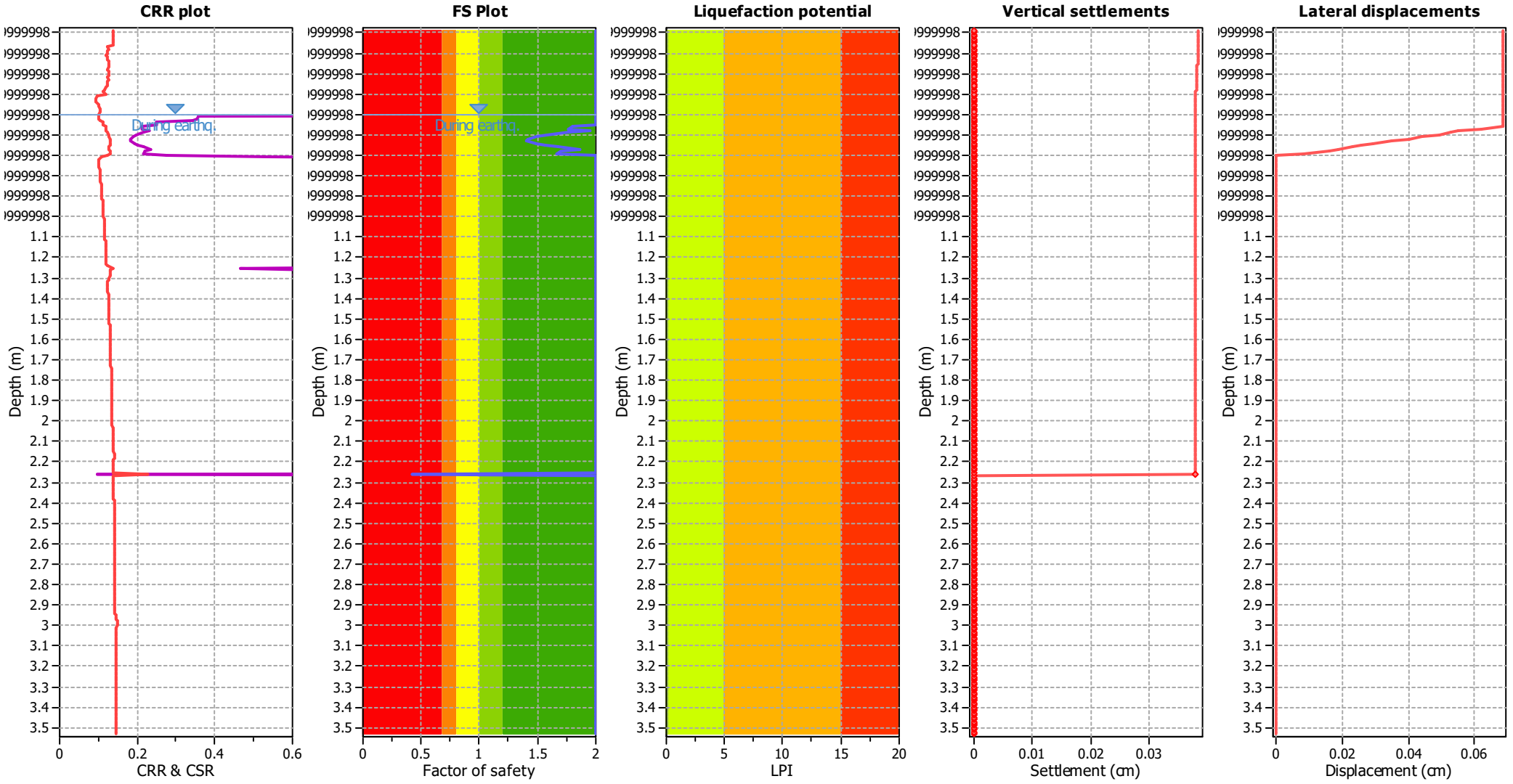

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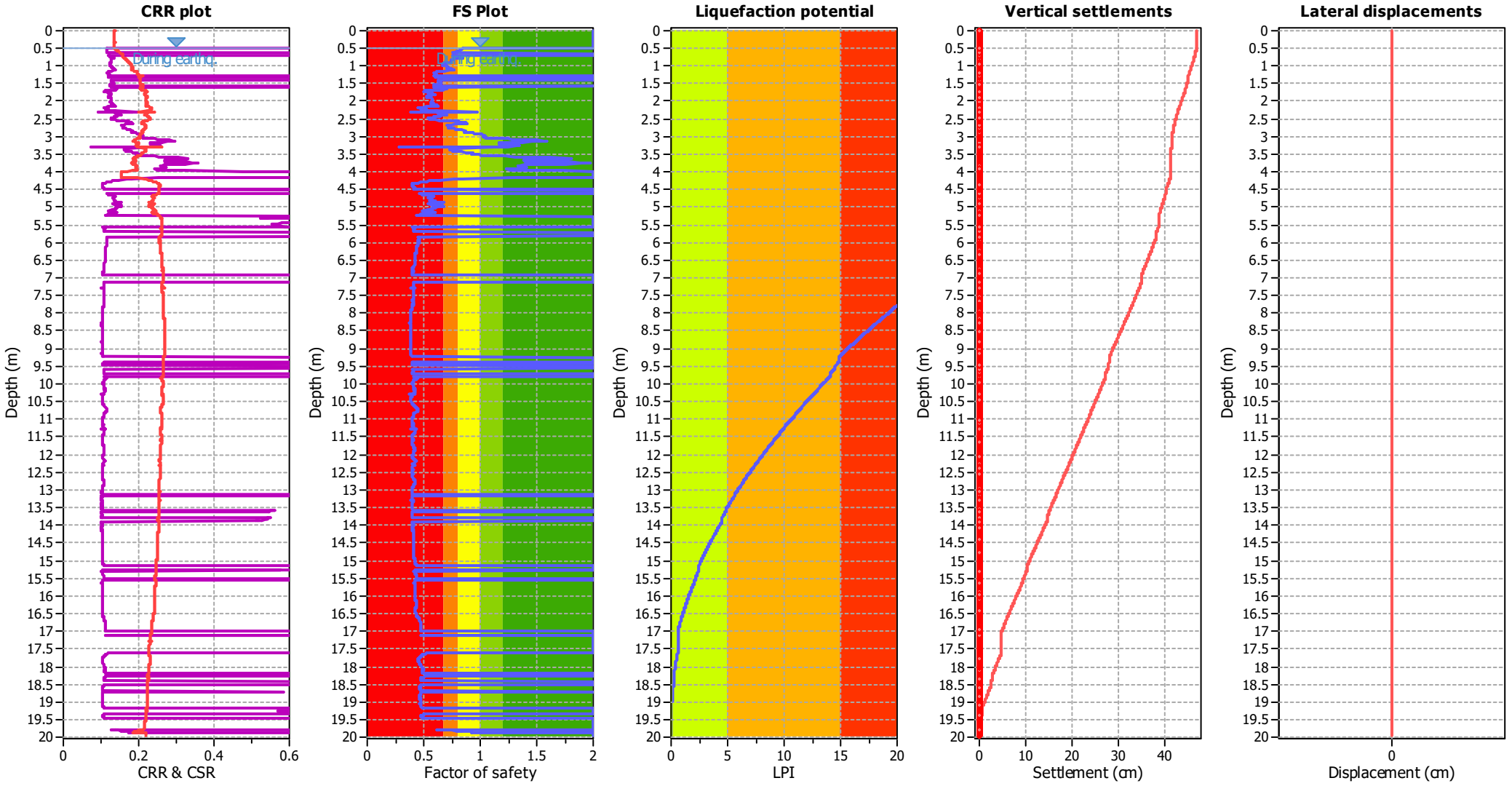

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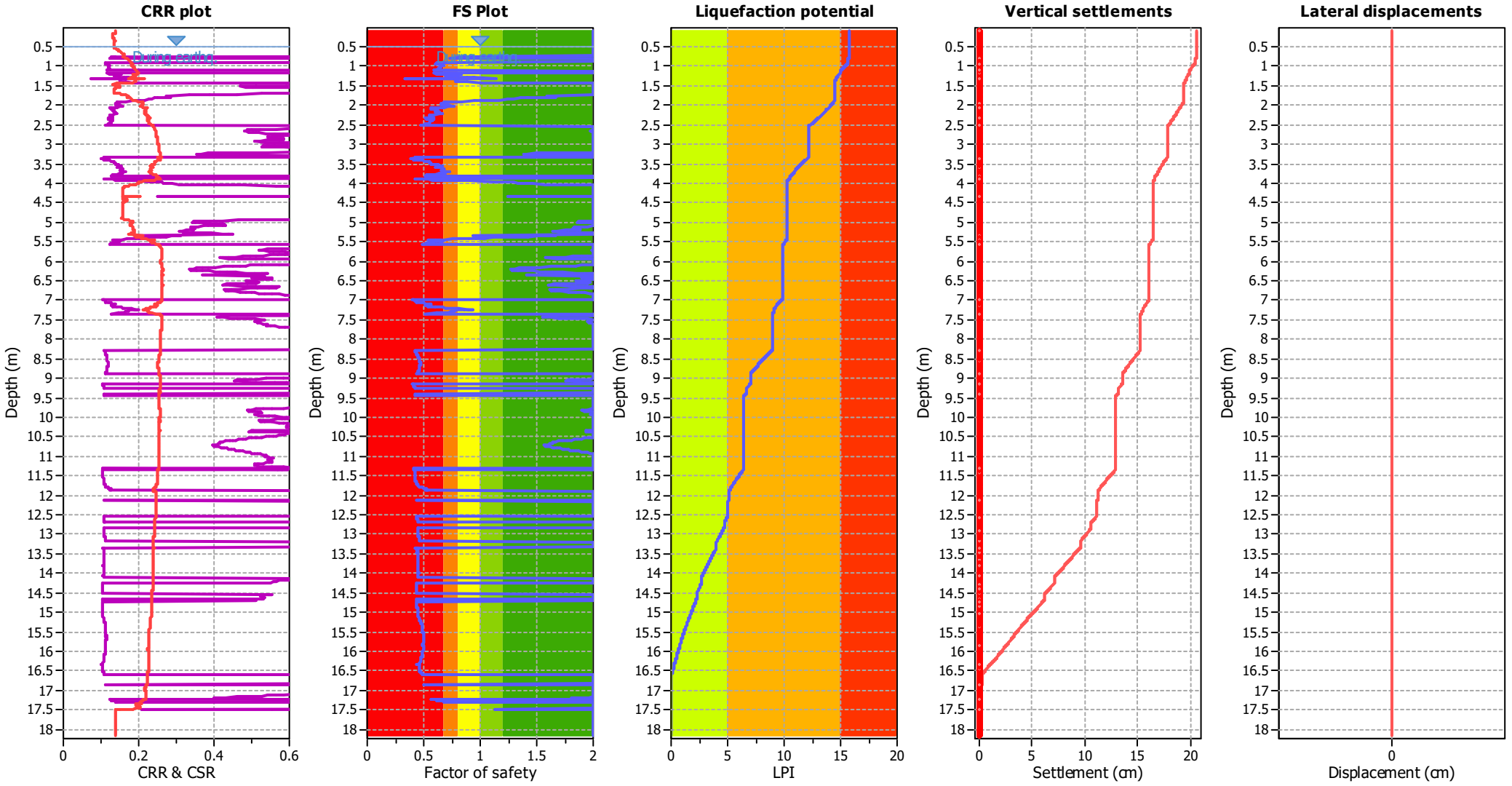

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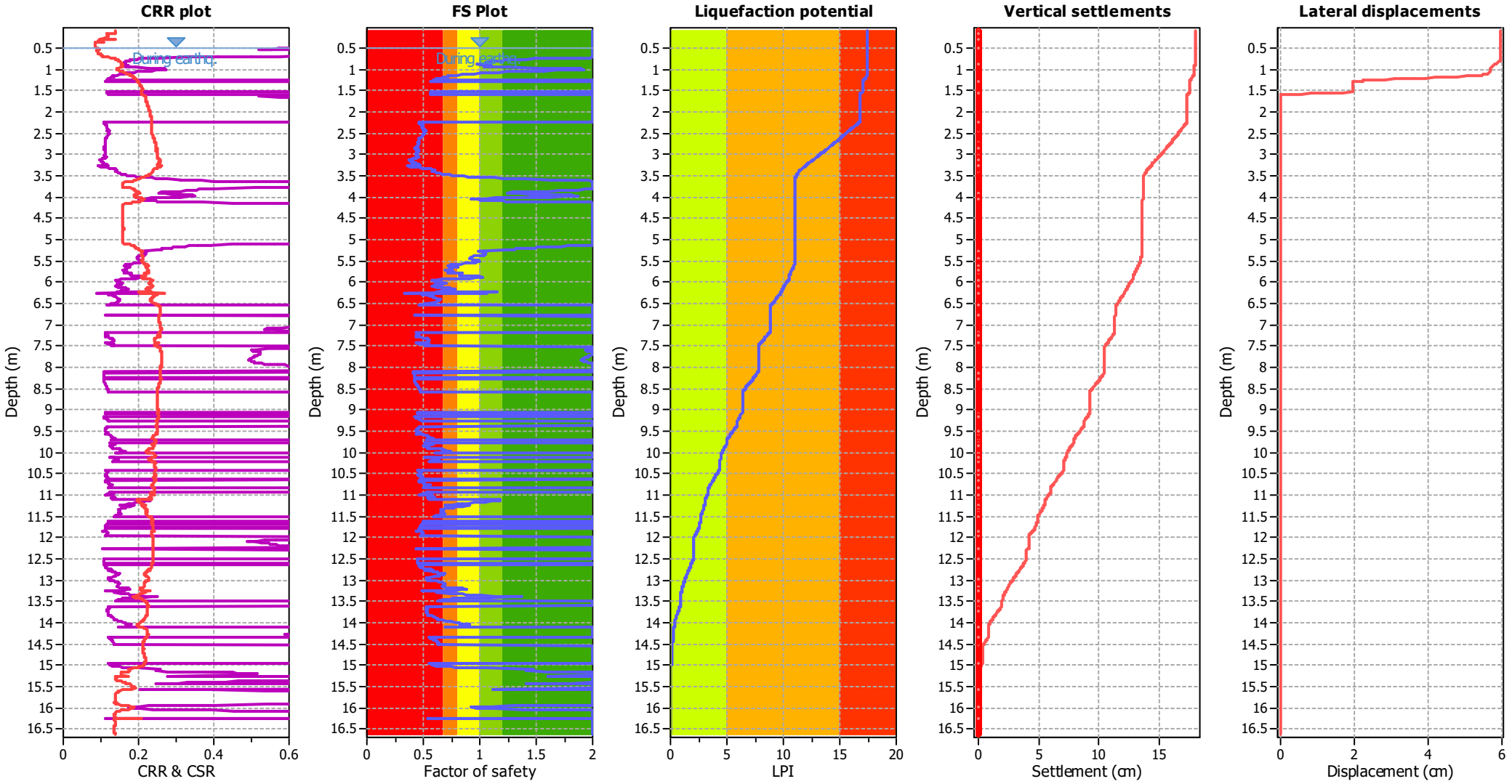

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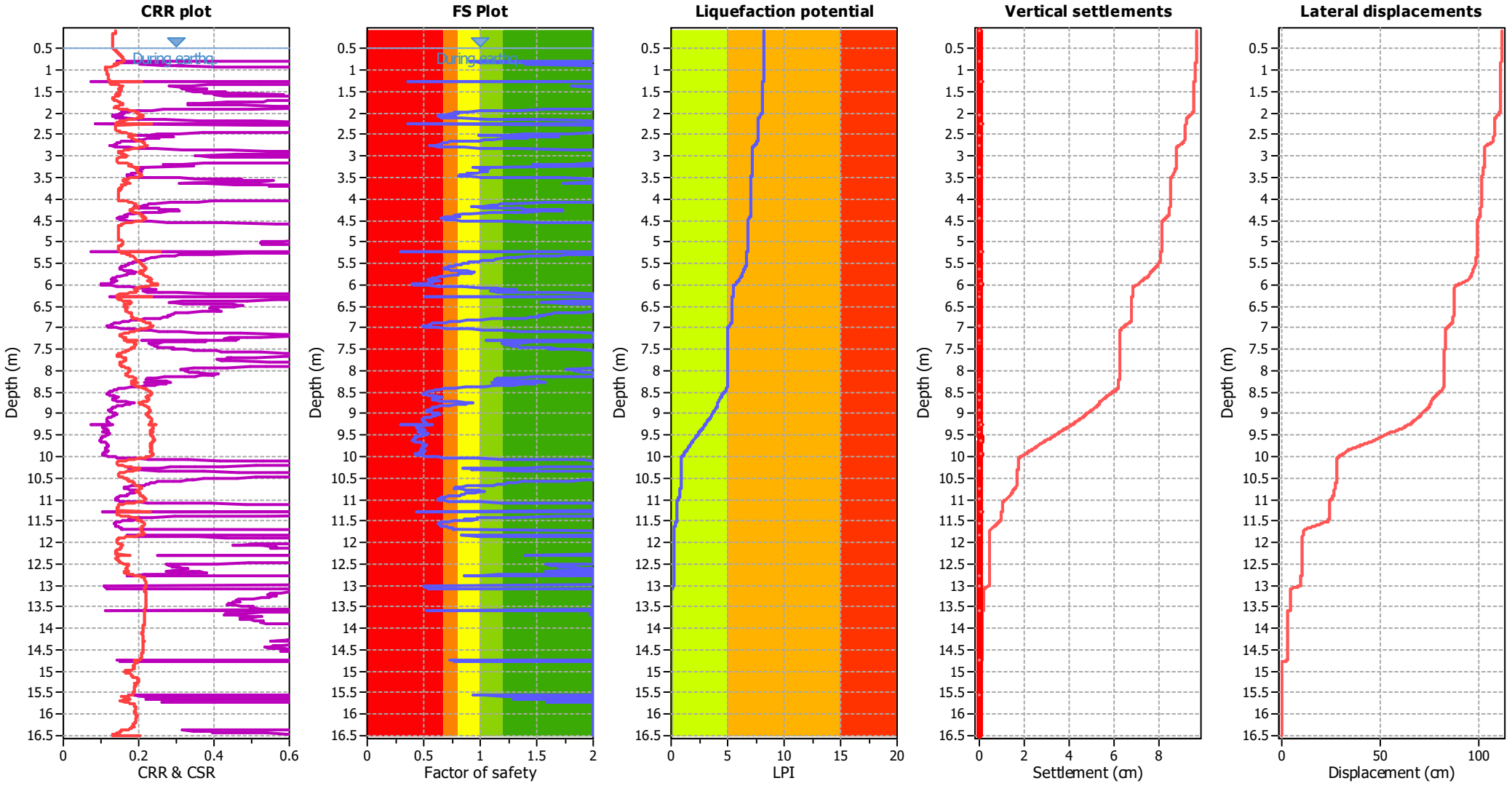

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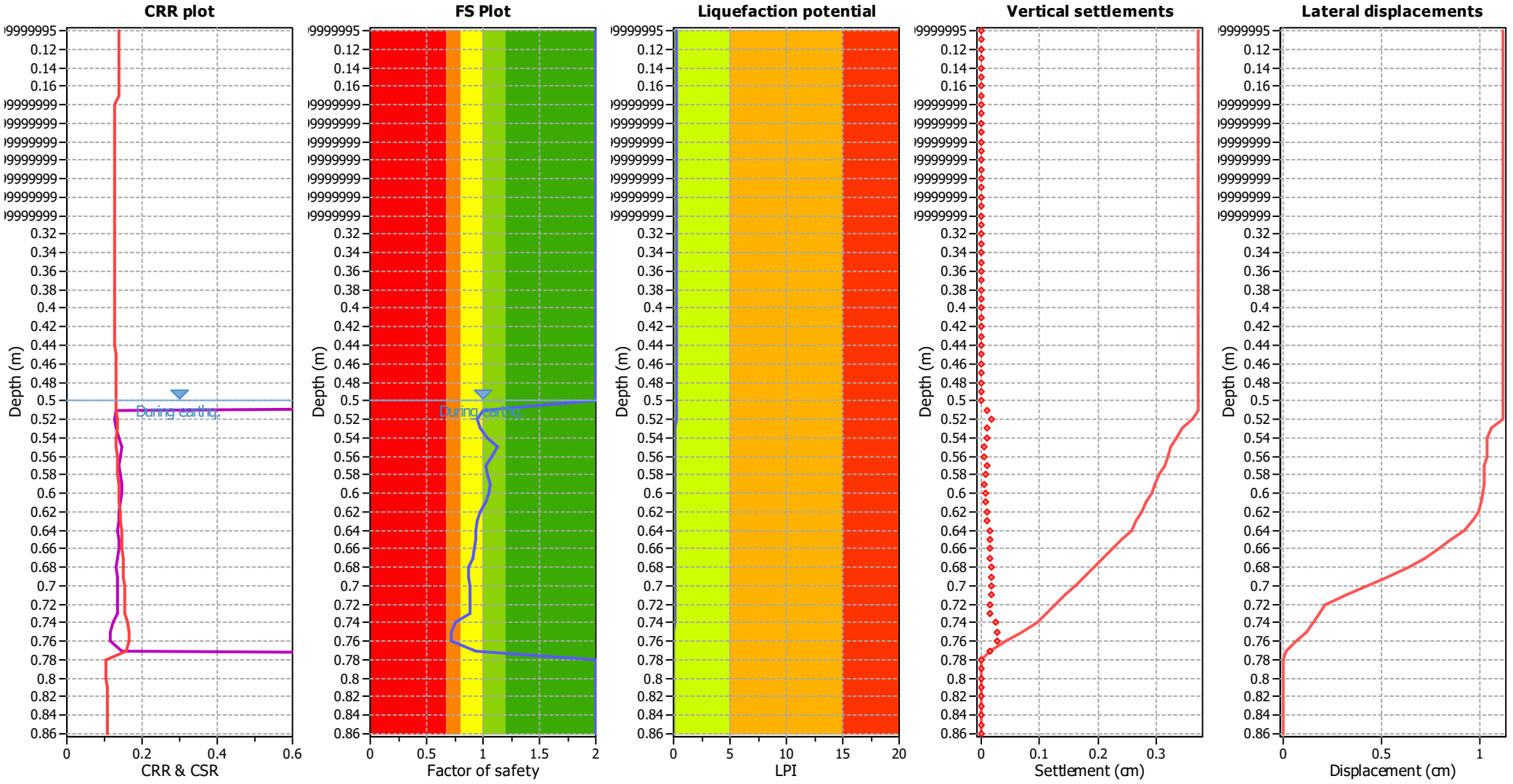

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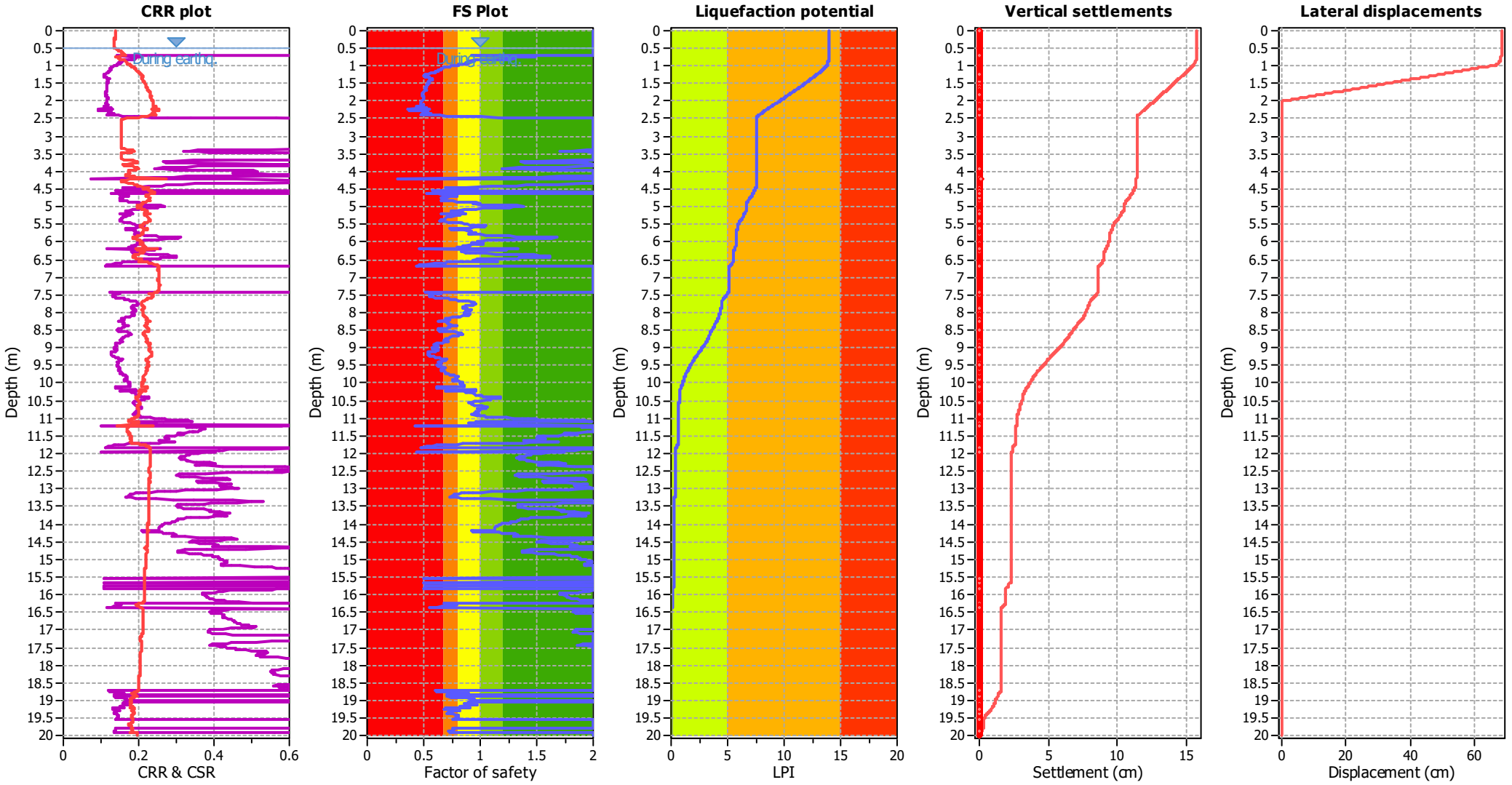

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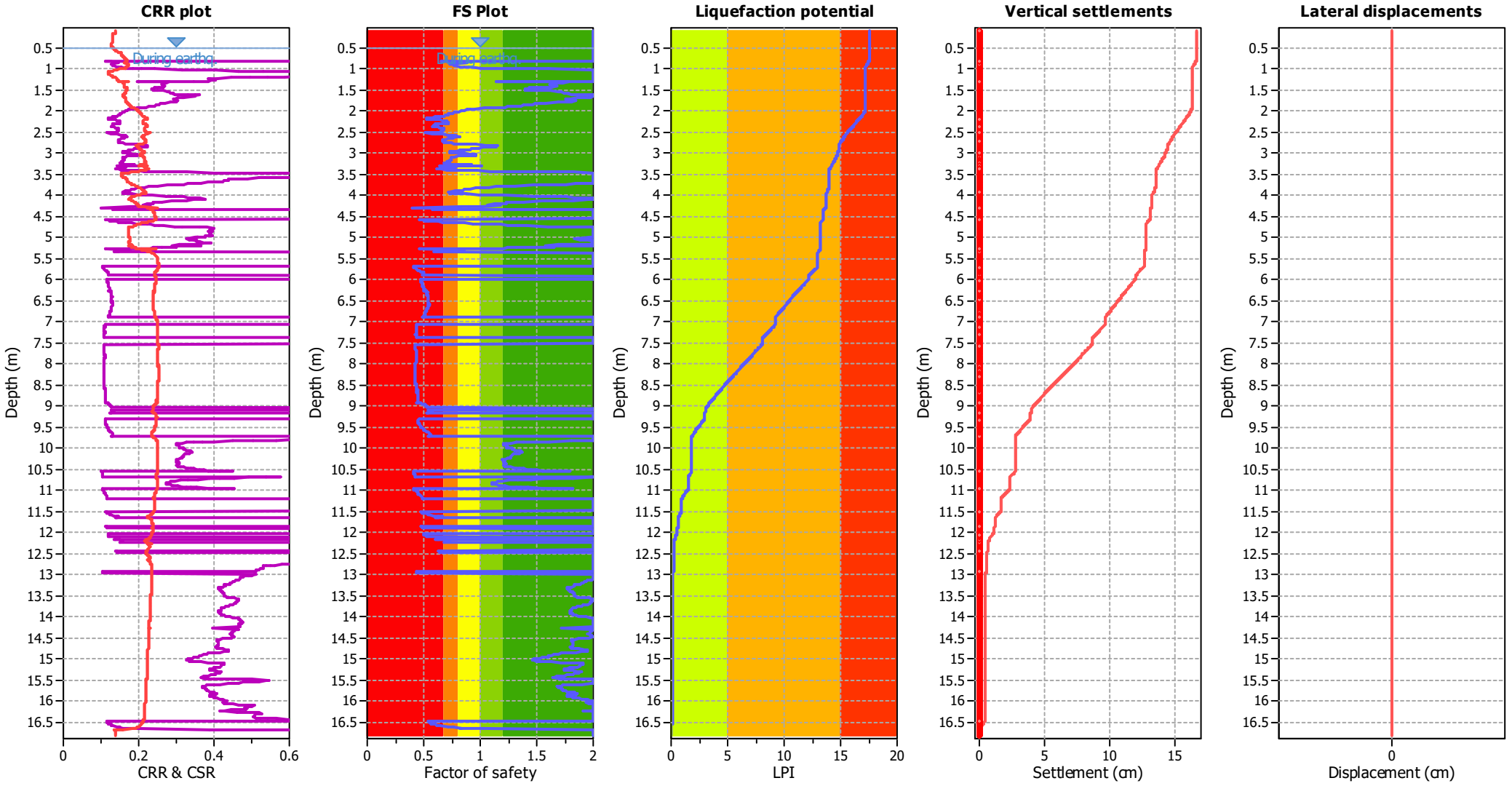

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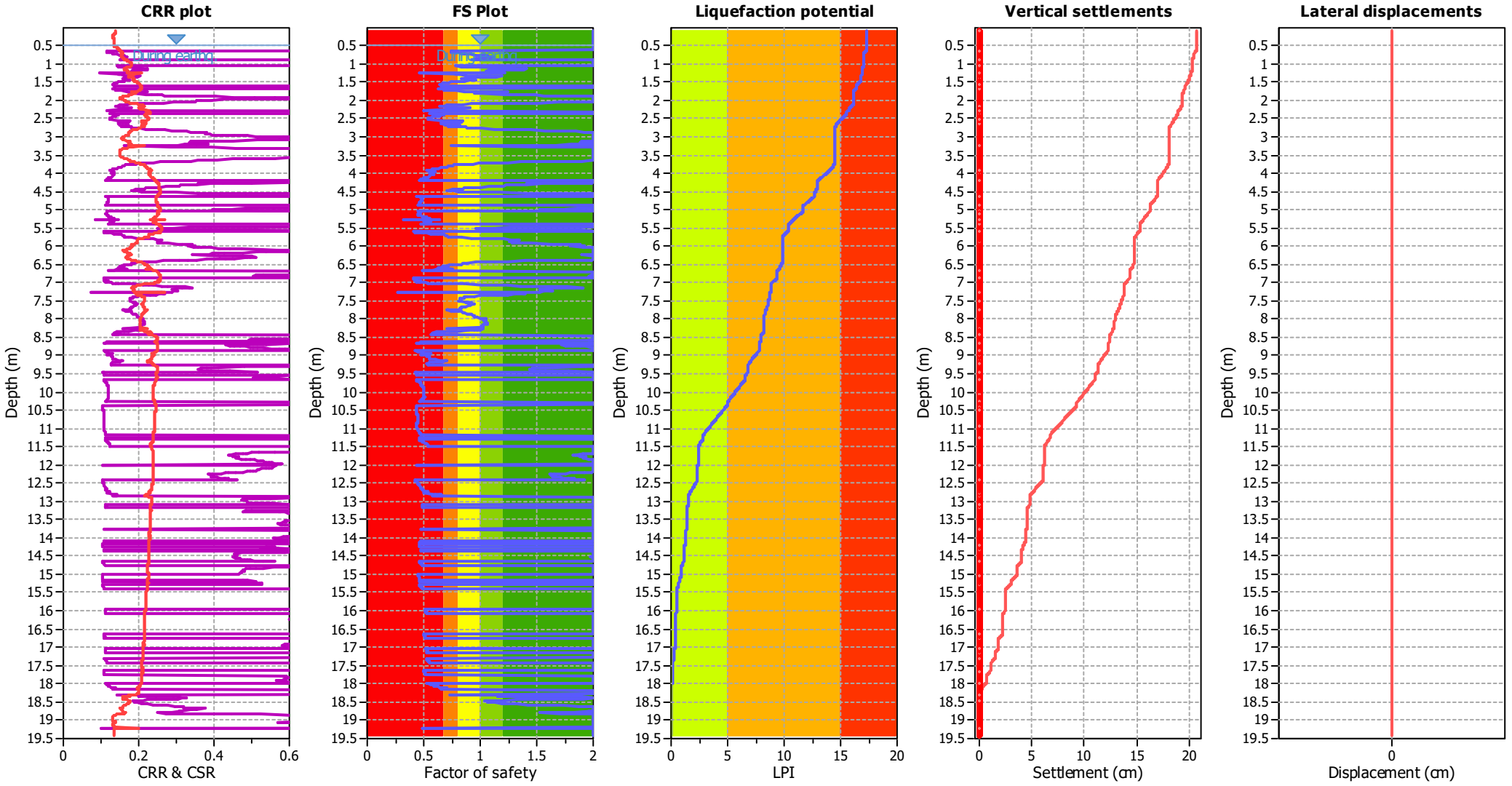

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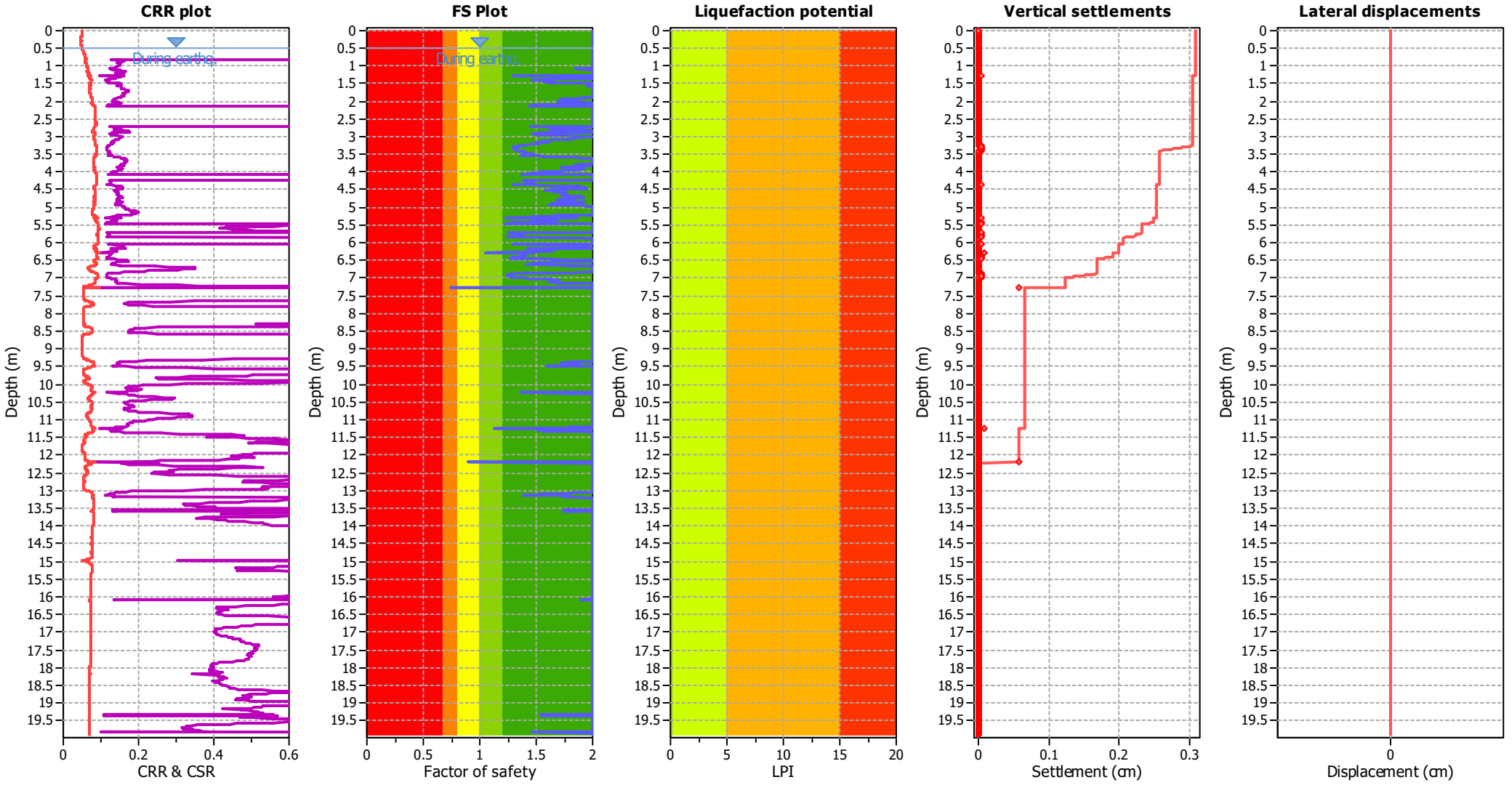

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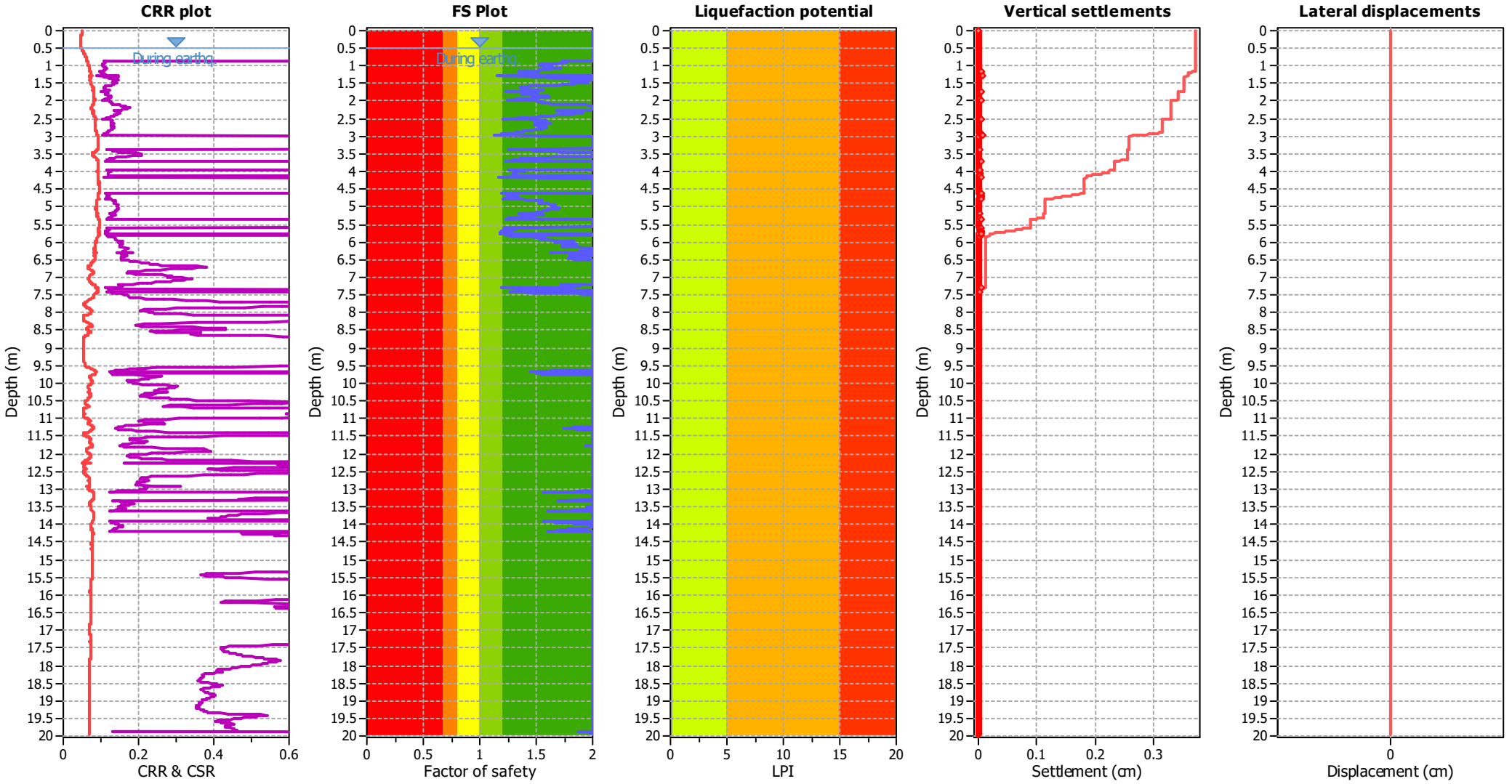

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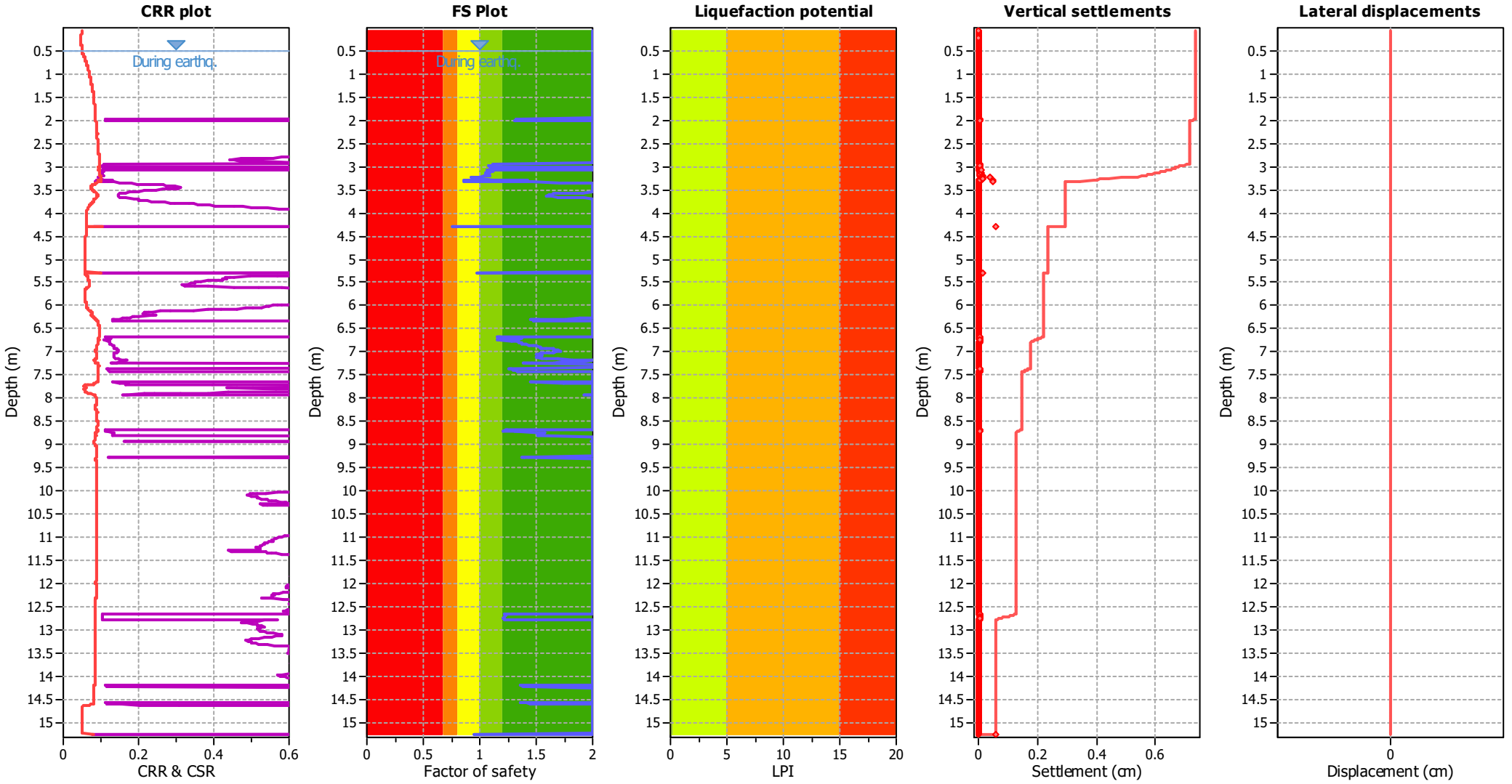

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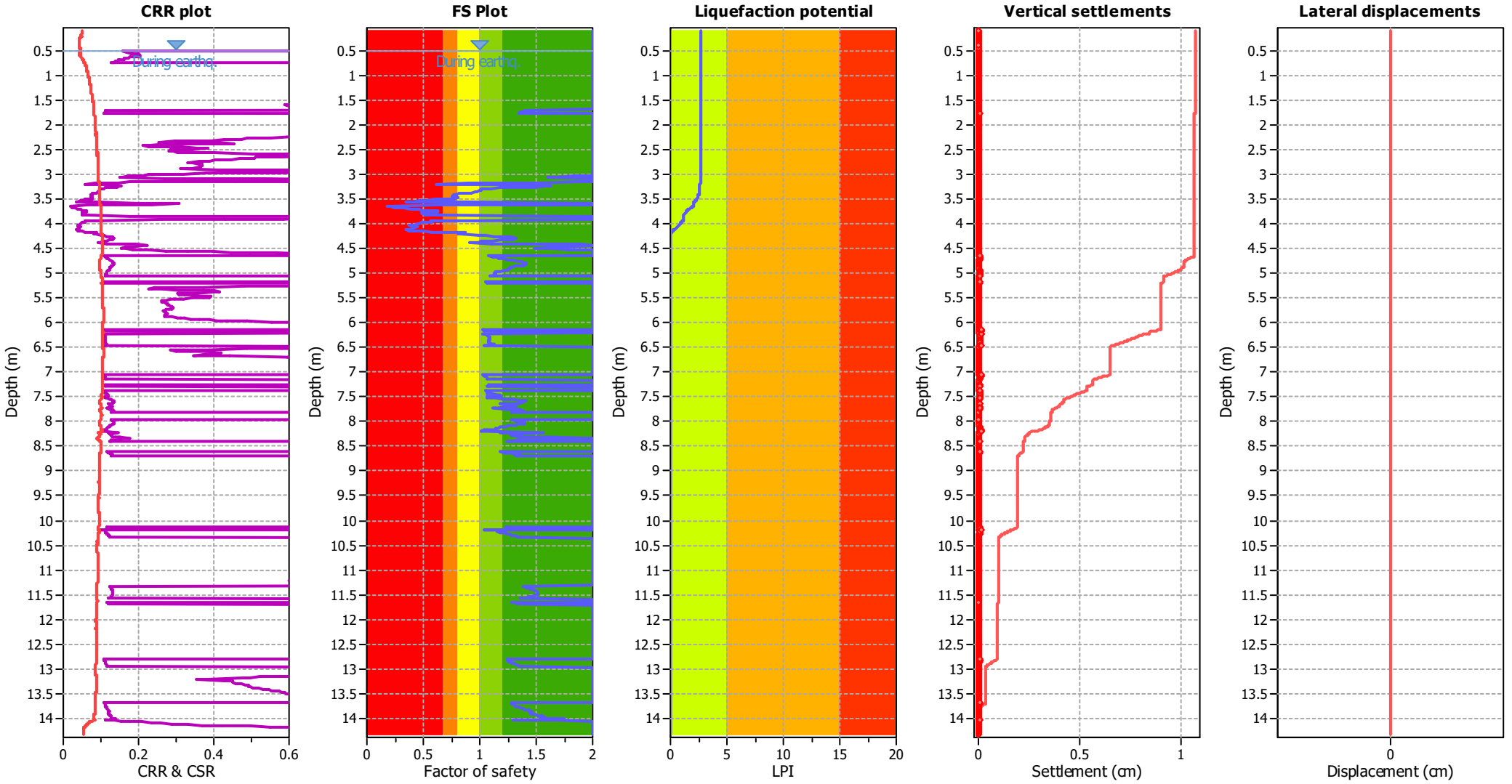

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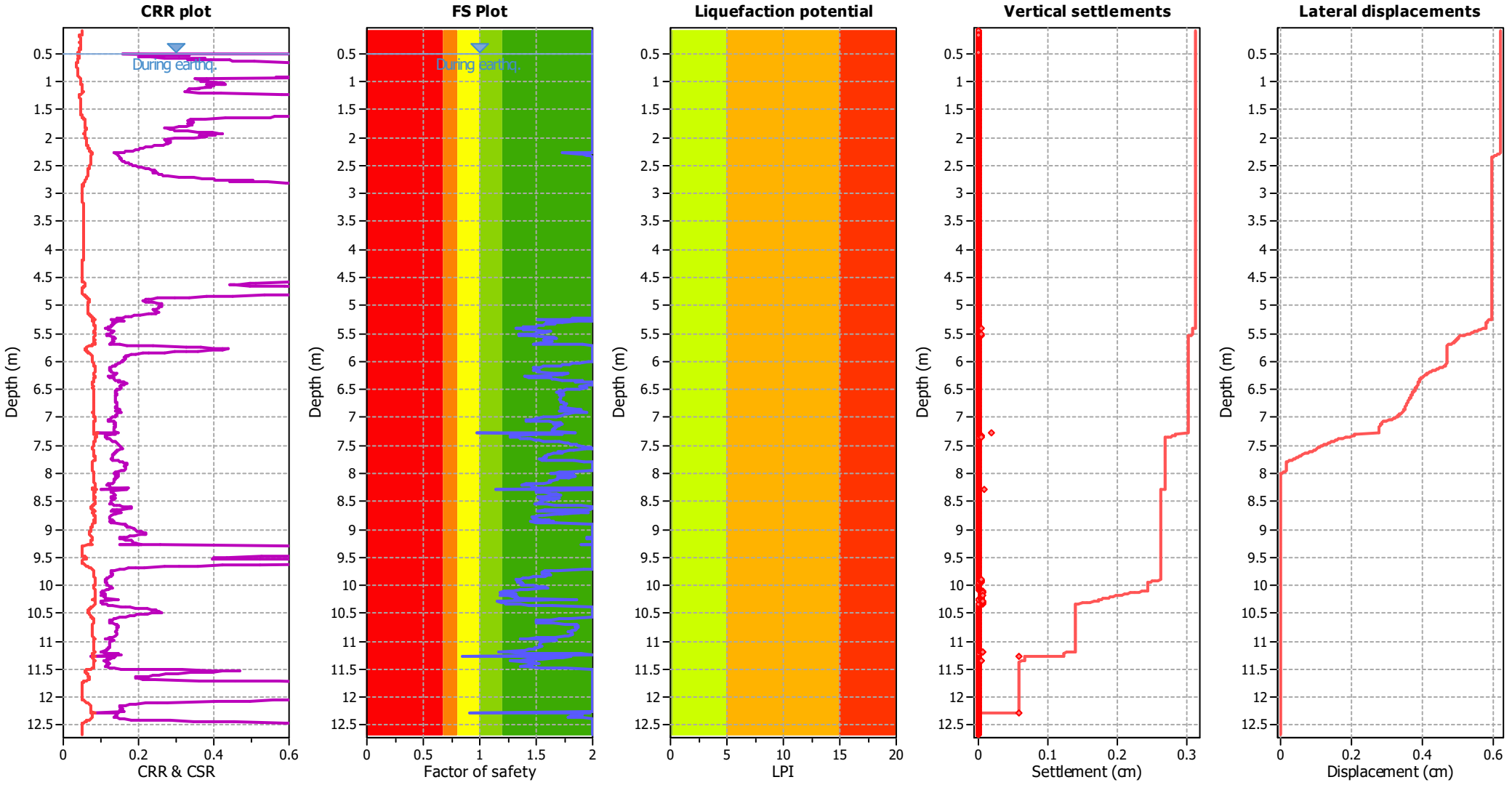

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Depth to water table (insitu):	0.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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- Very likely to liquefy
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- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
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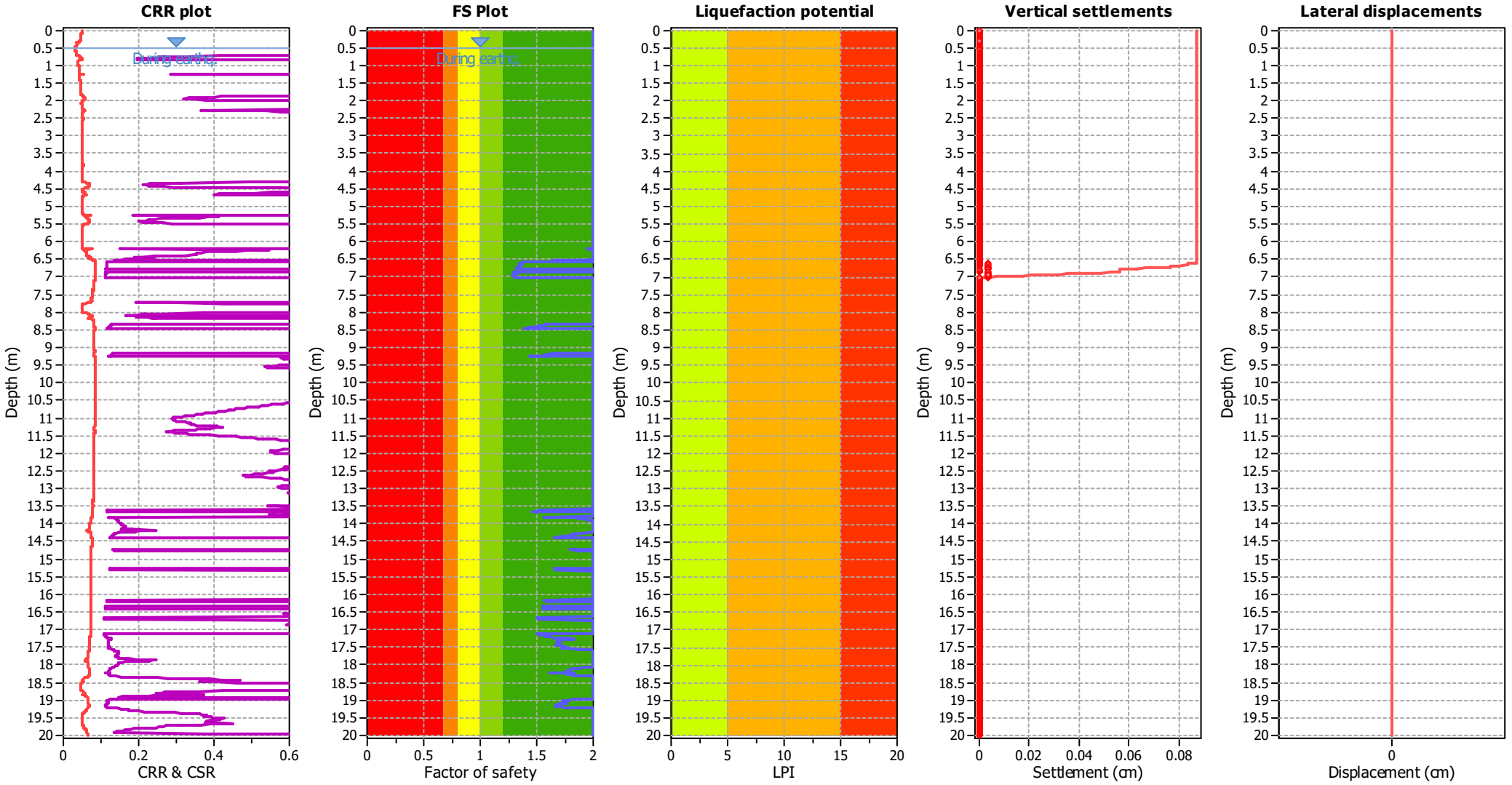
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	5.90	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
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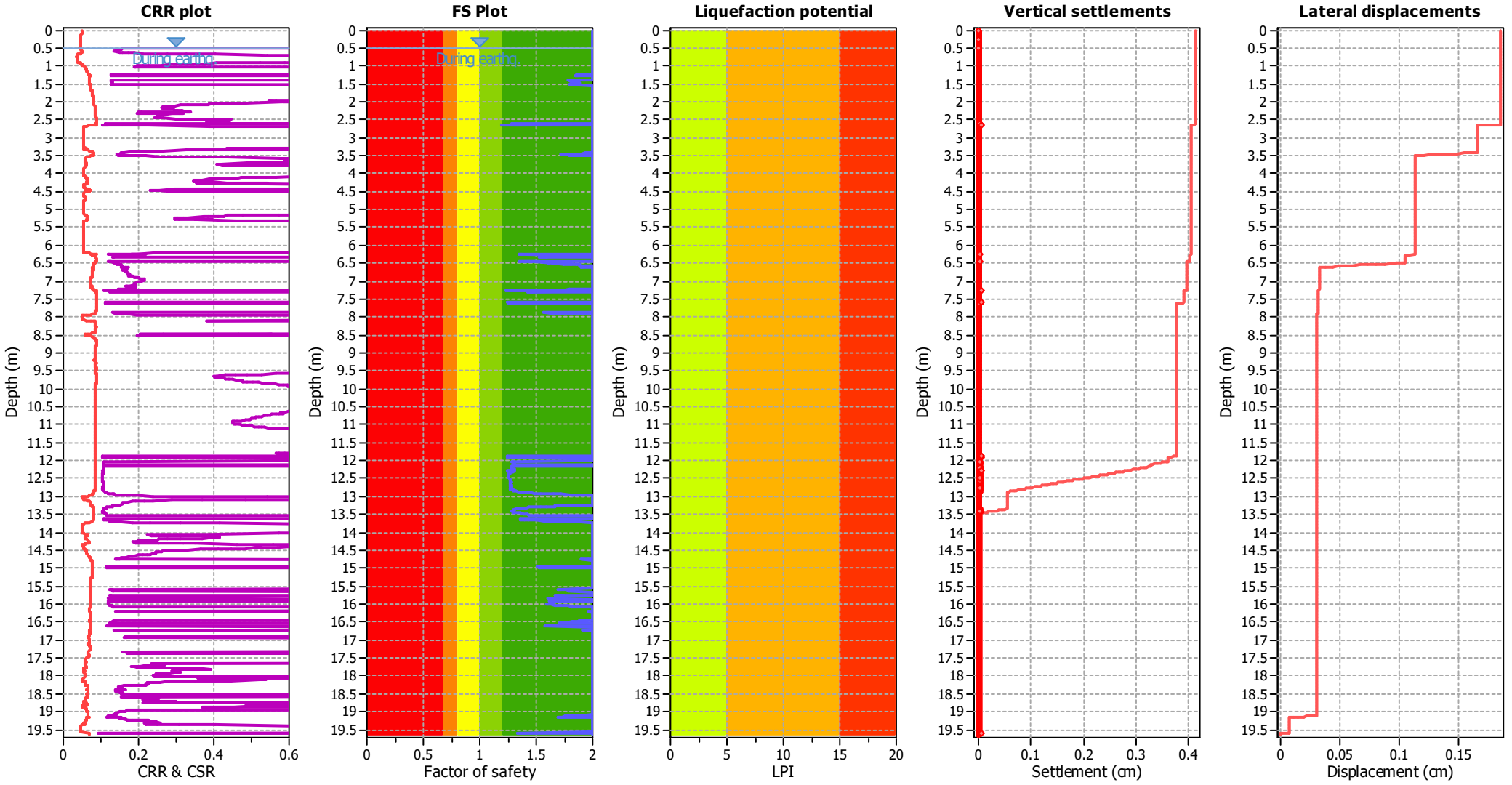

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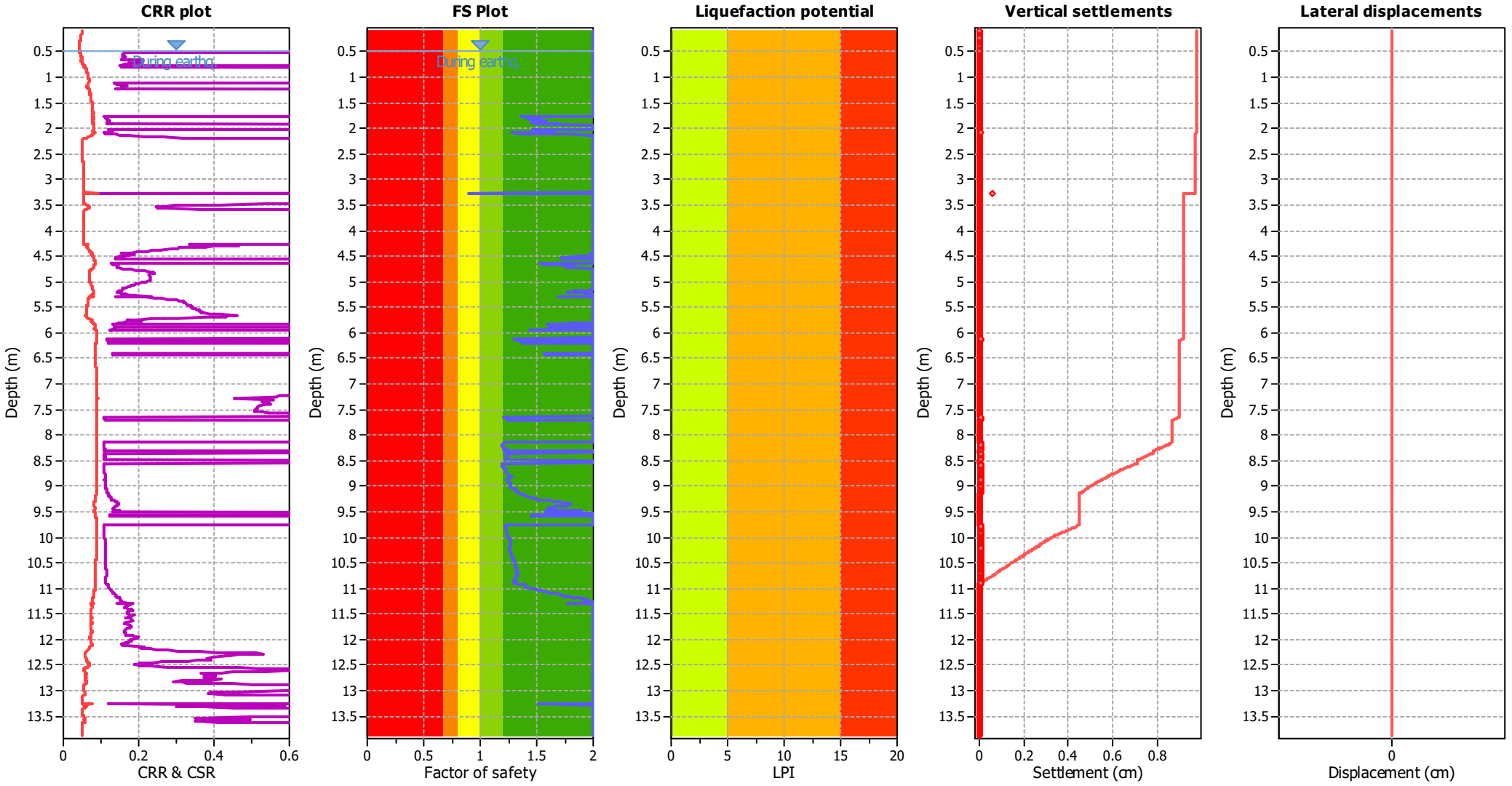

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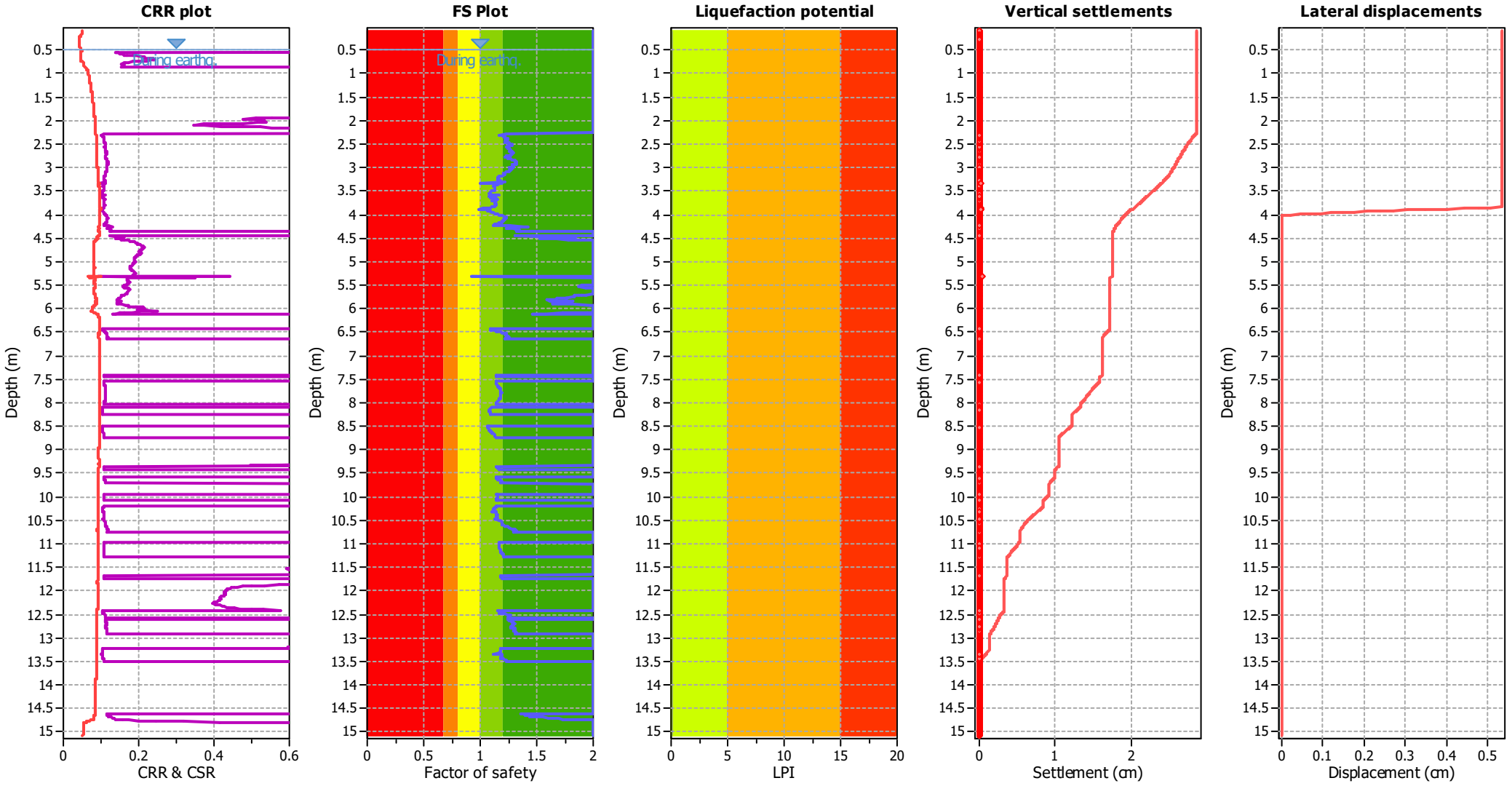

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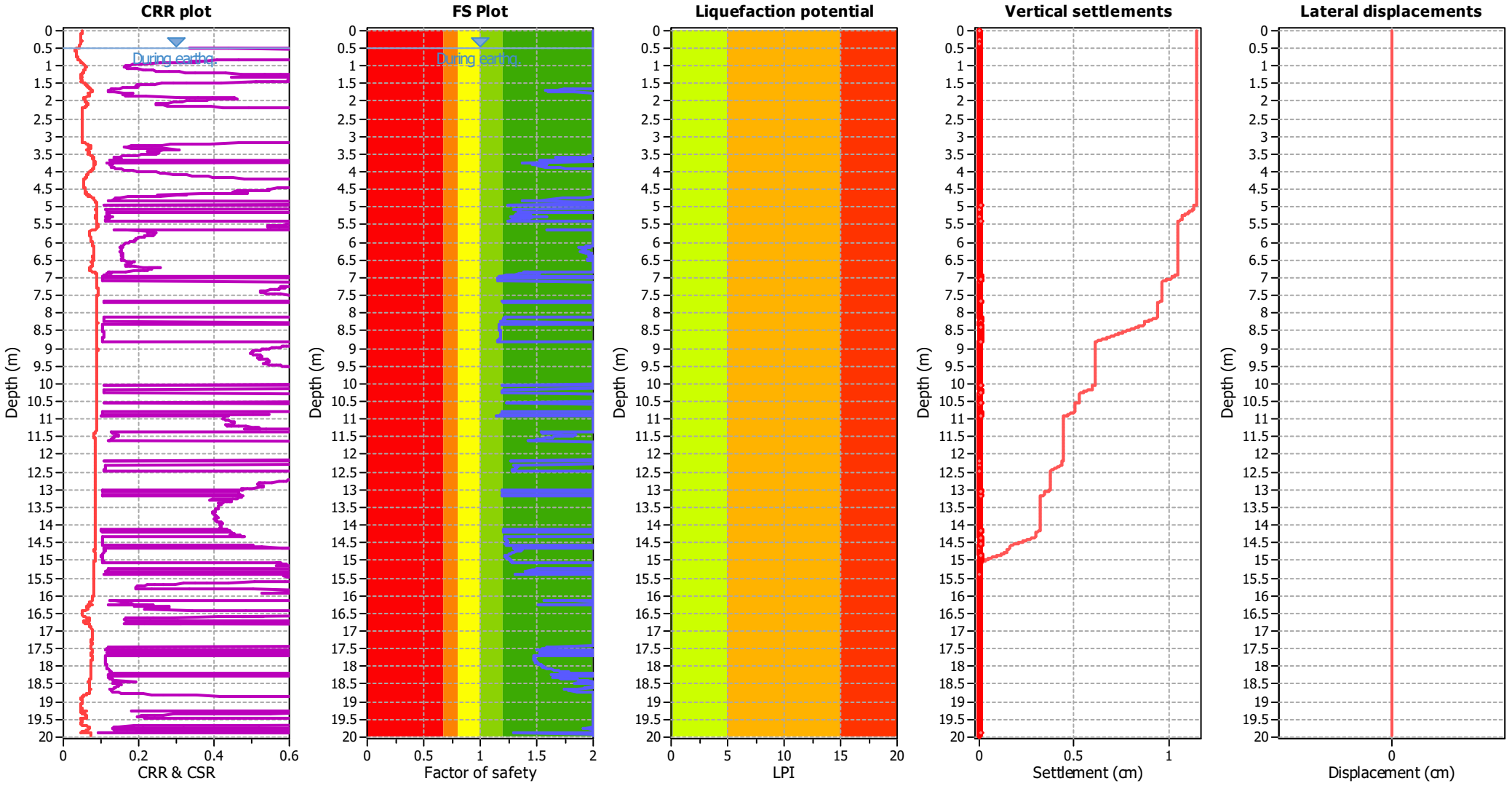

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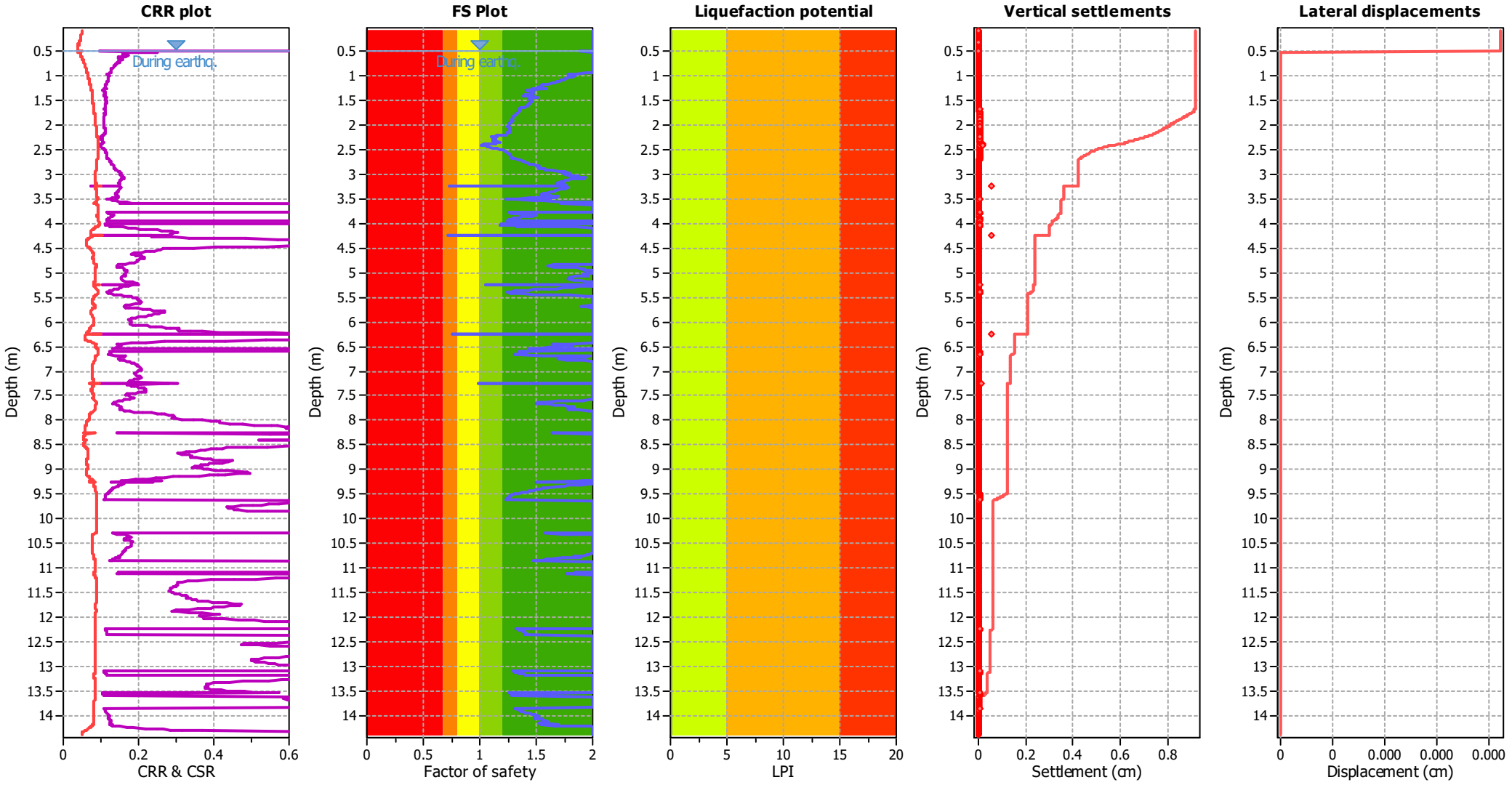

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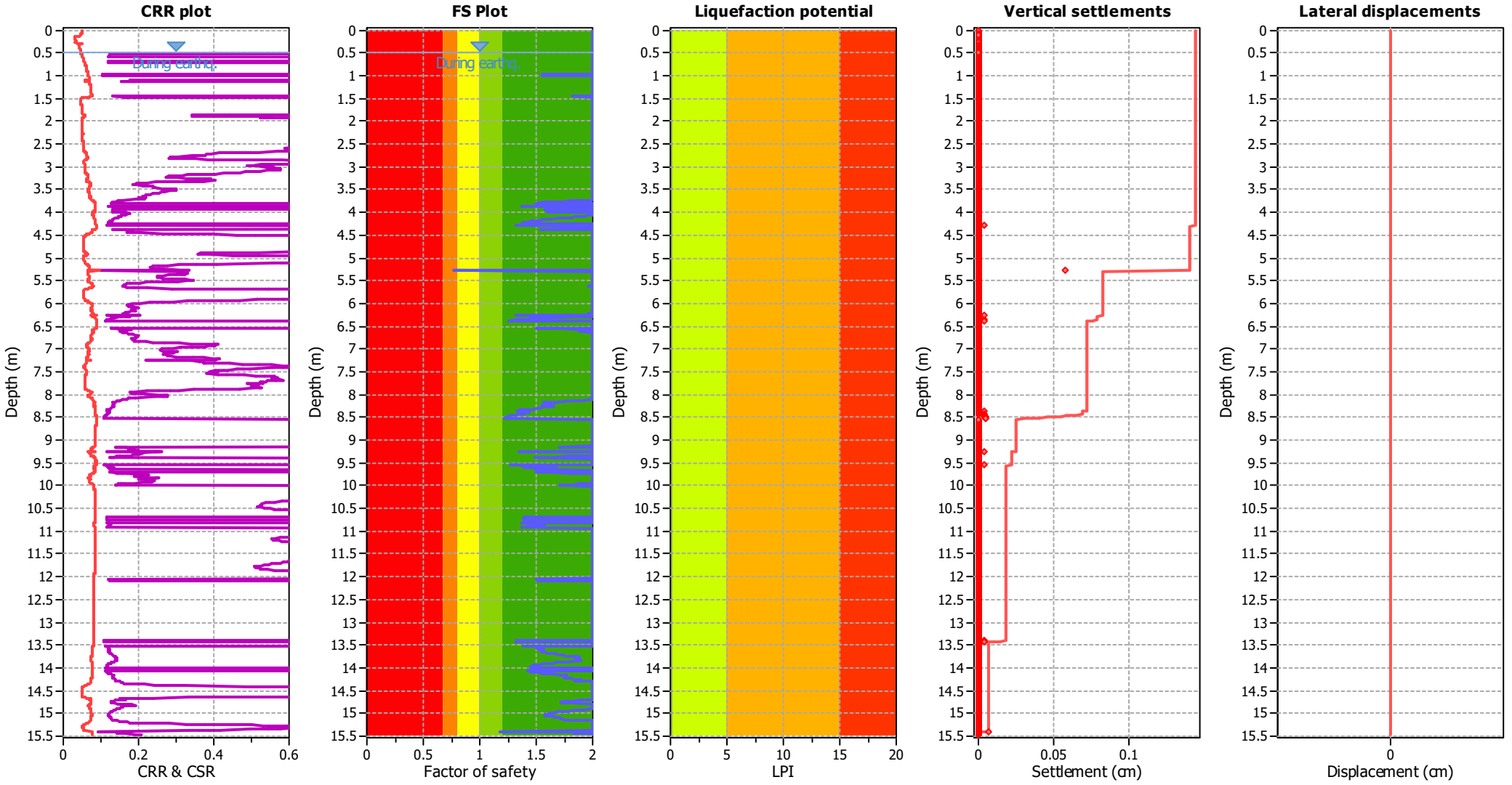

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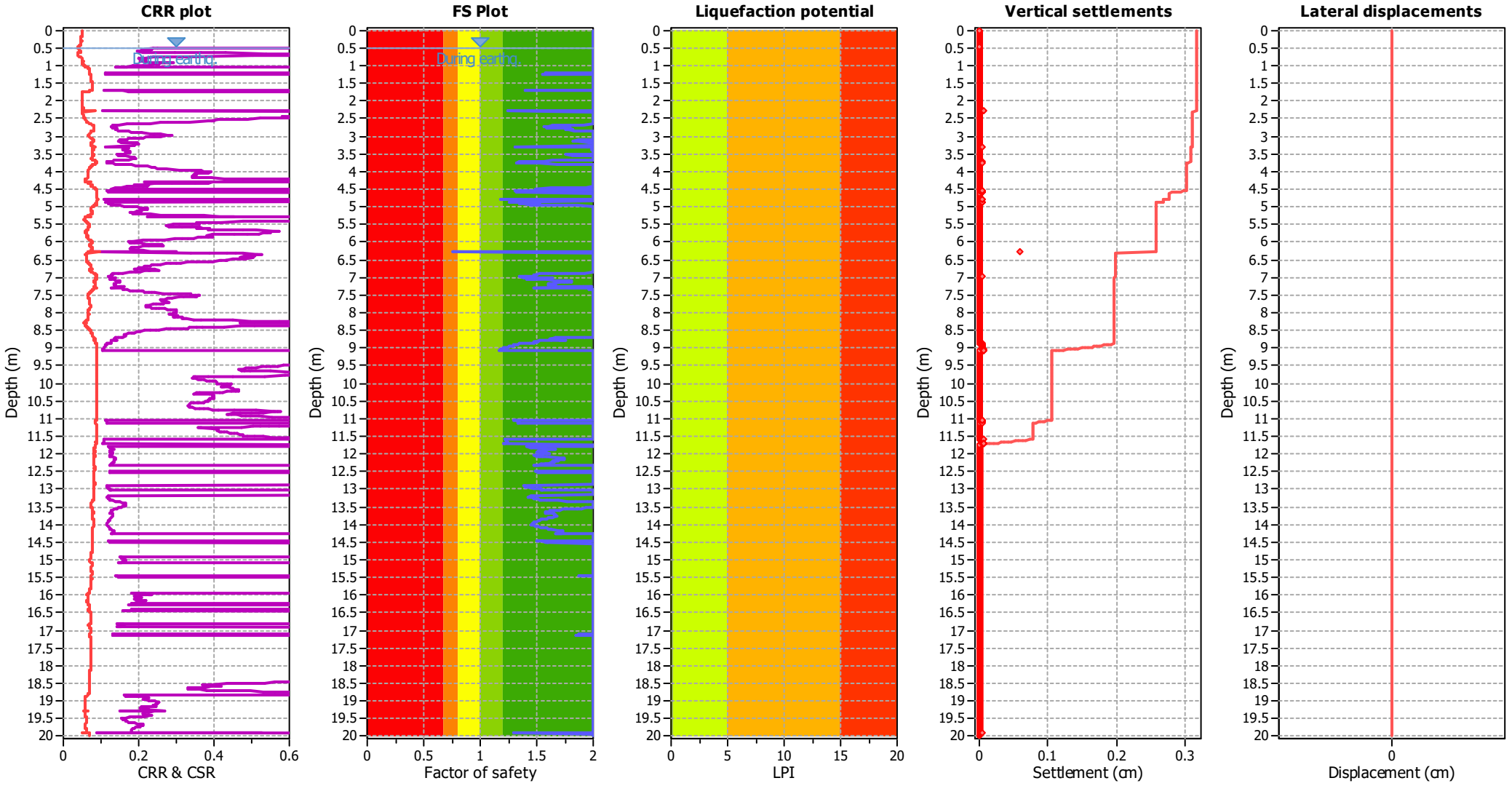

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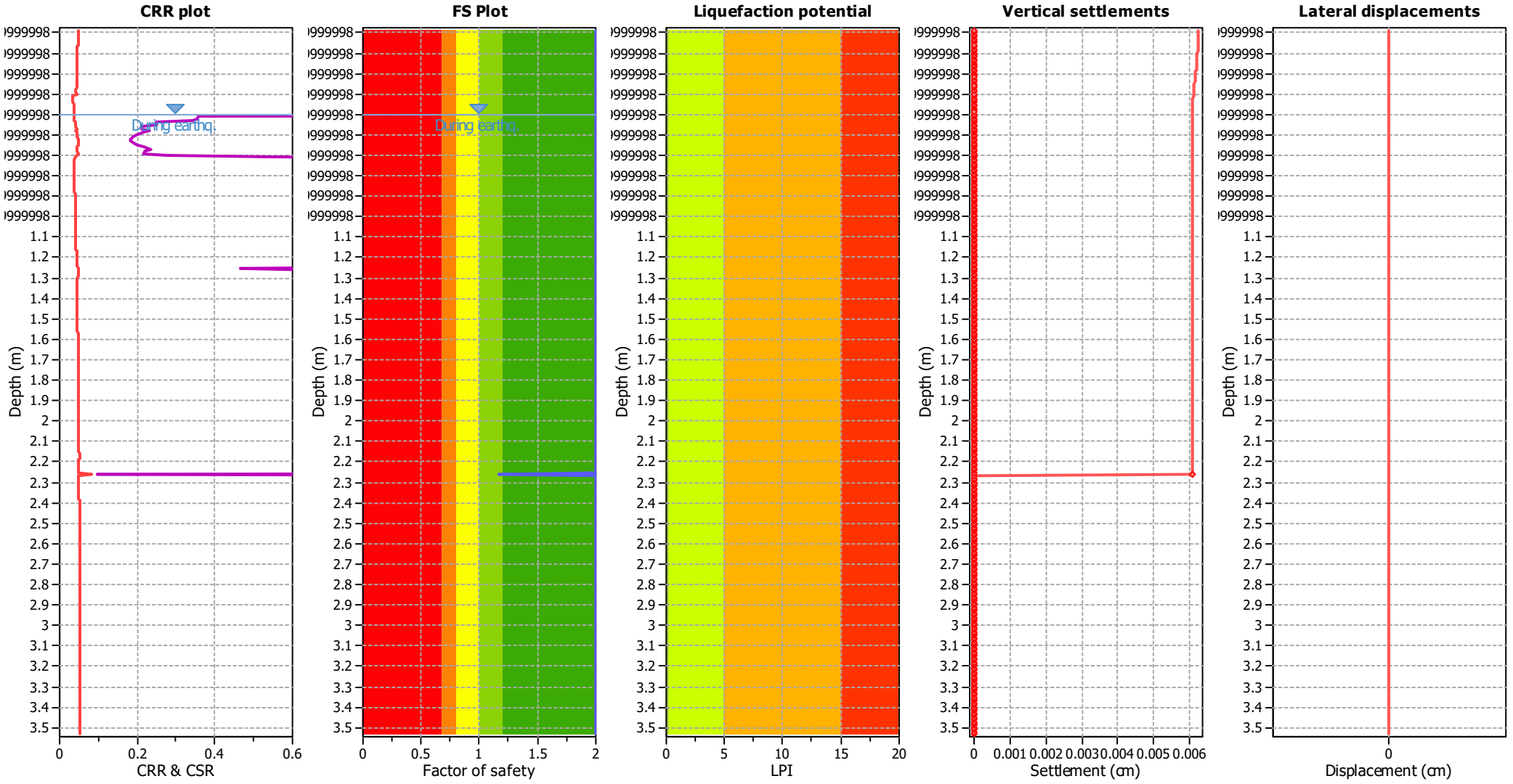

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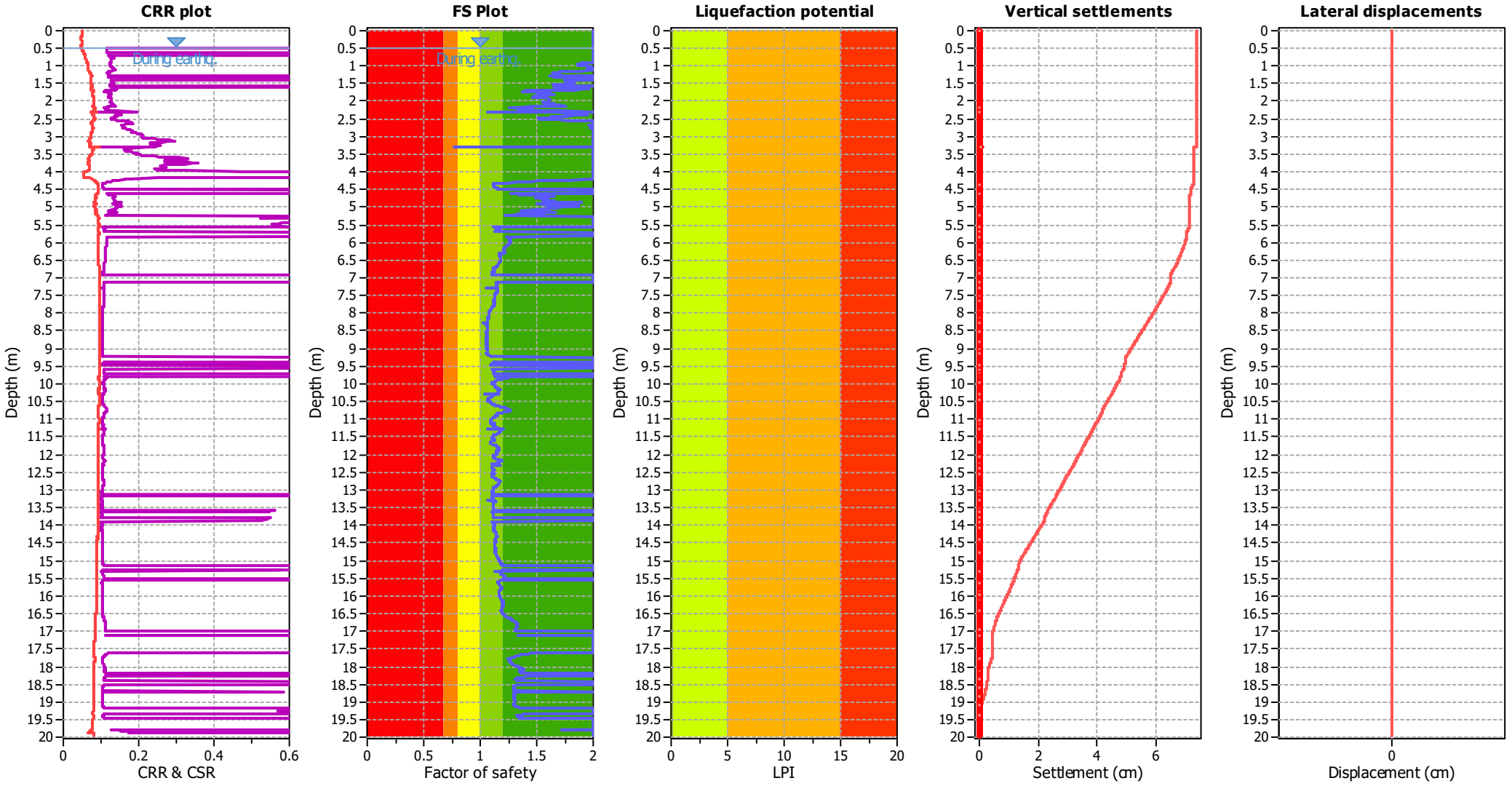

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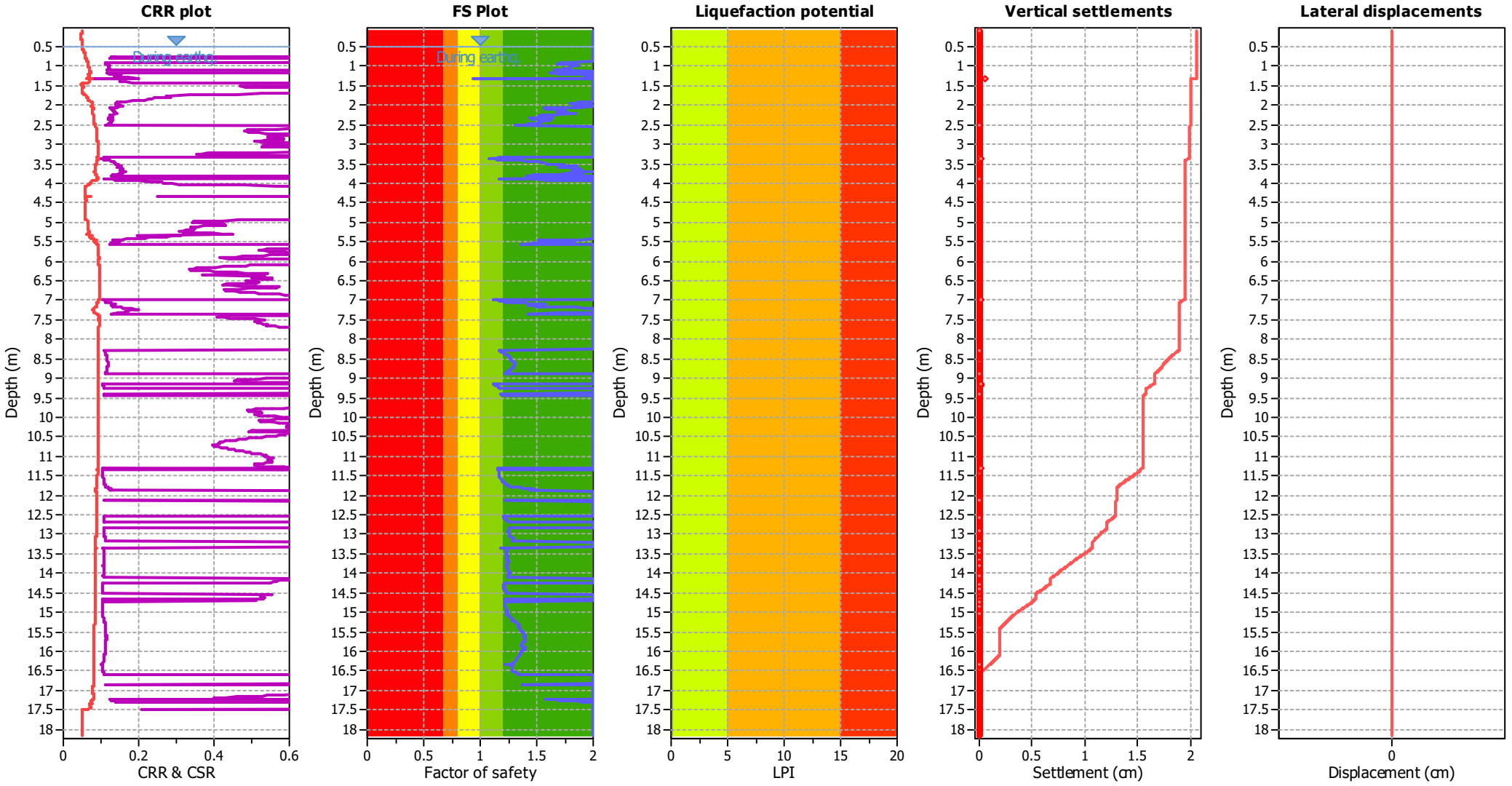

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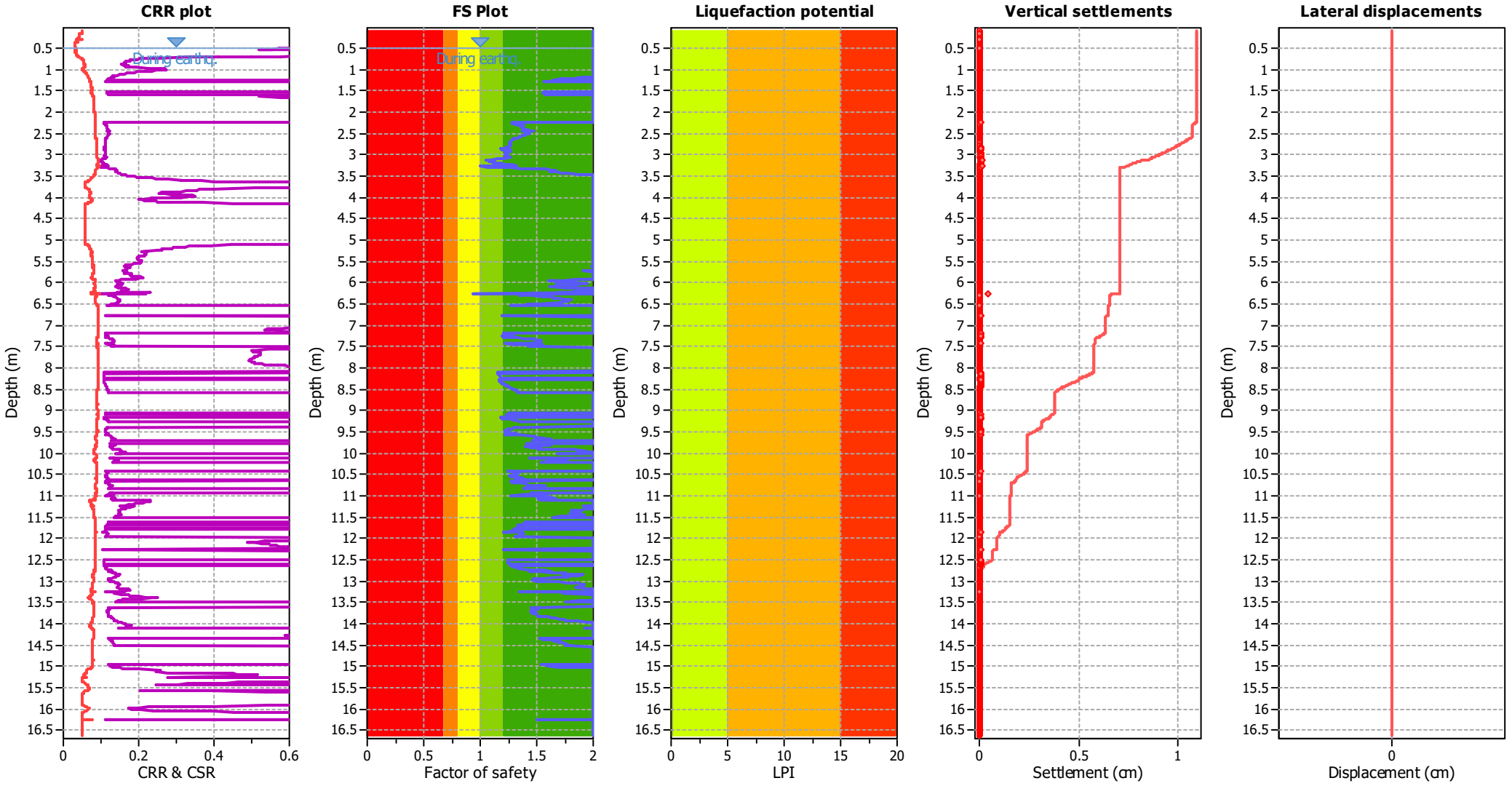

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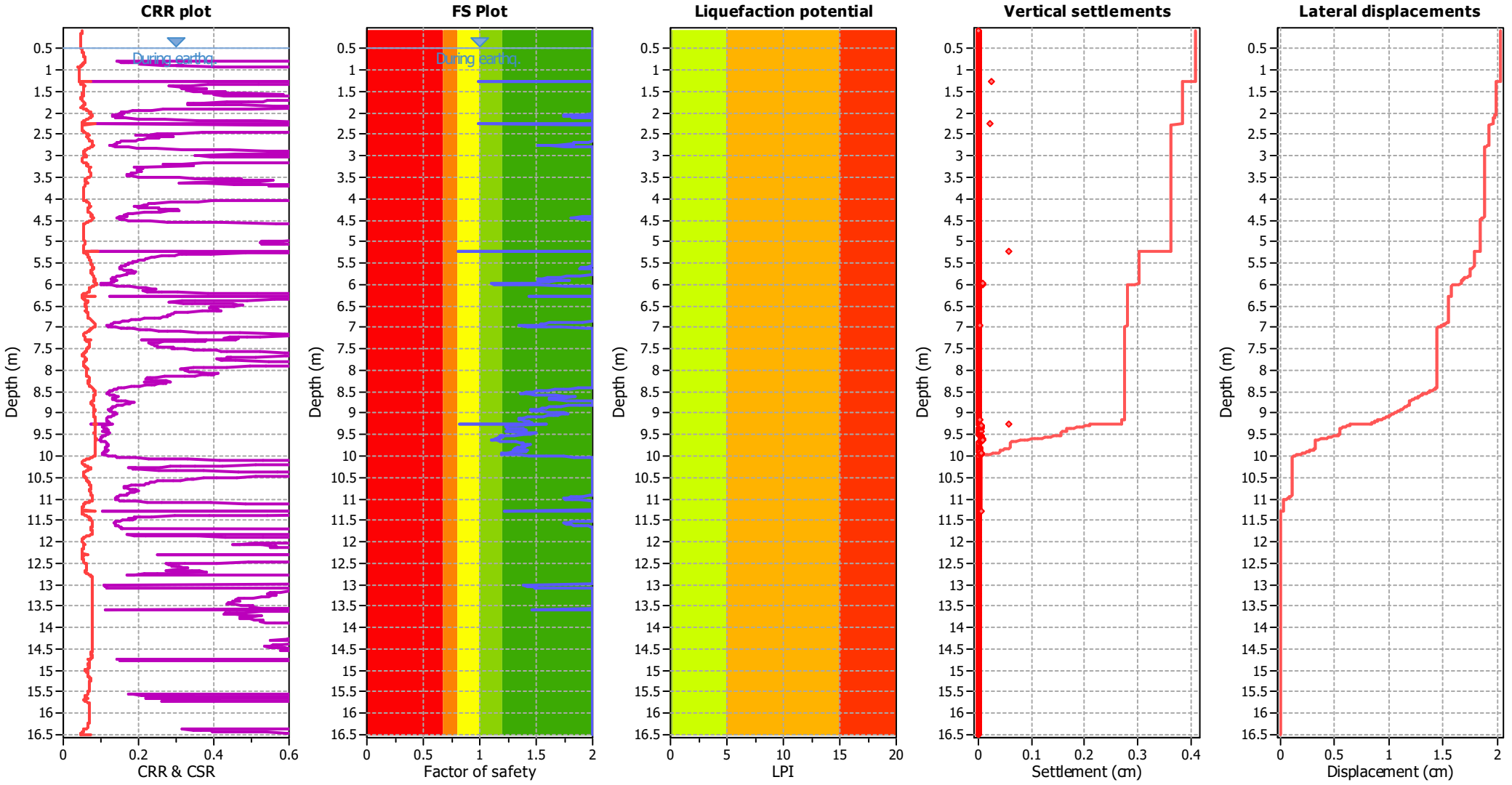

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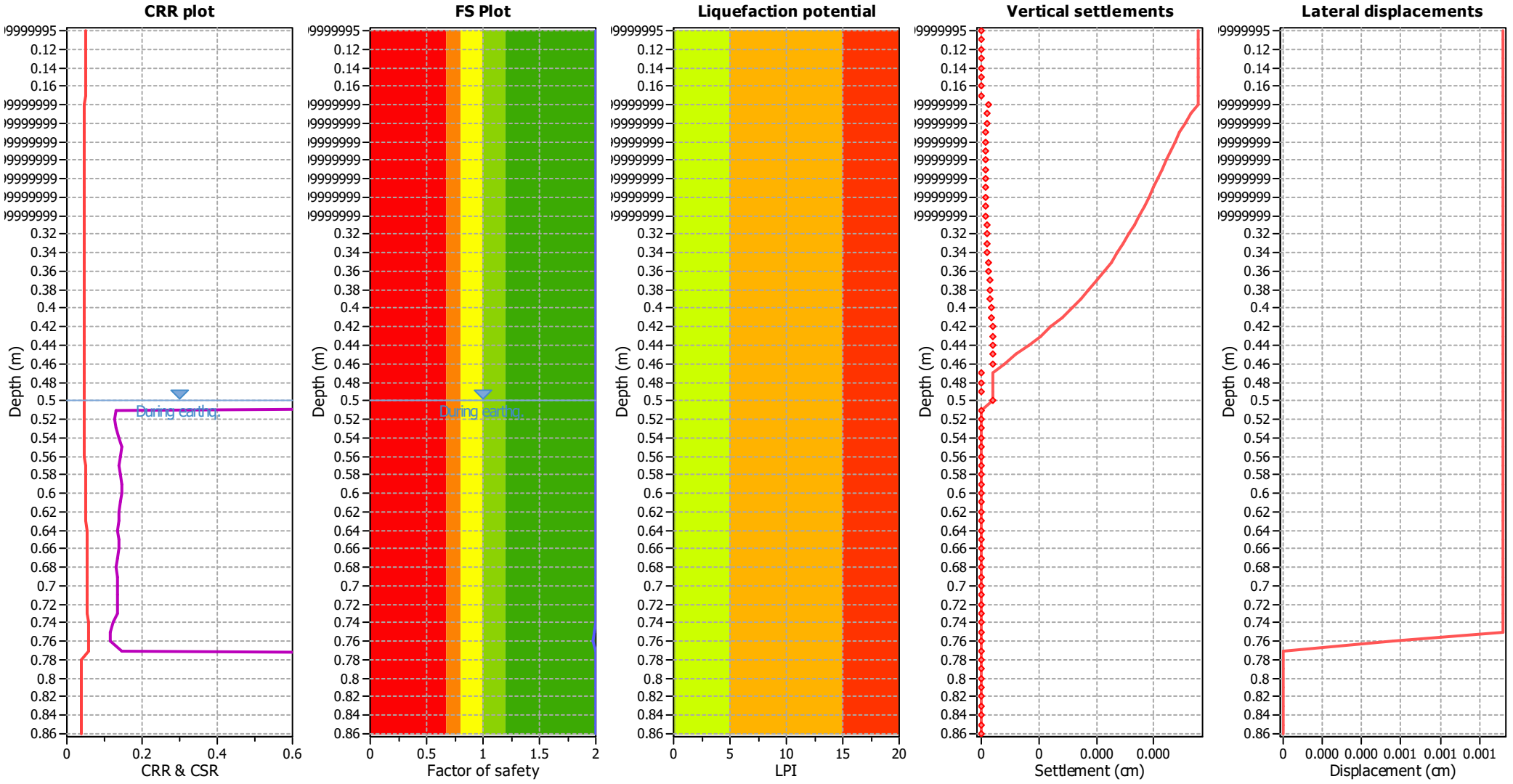

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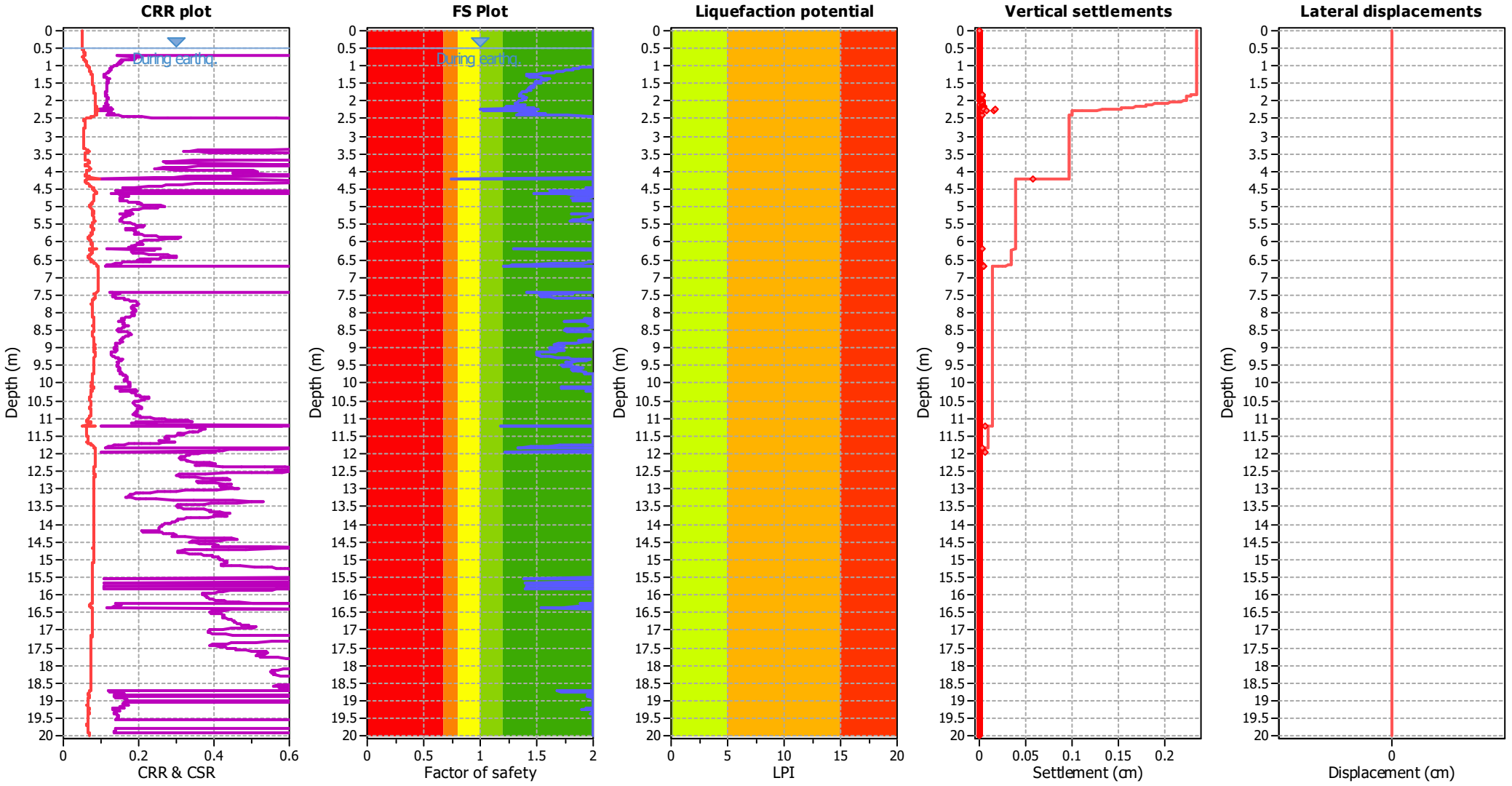

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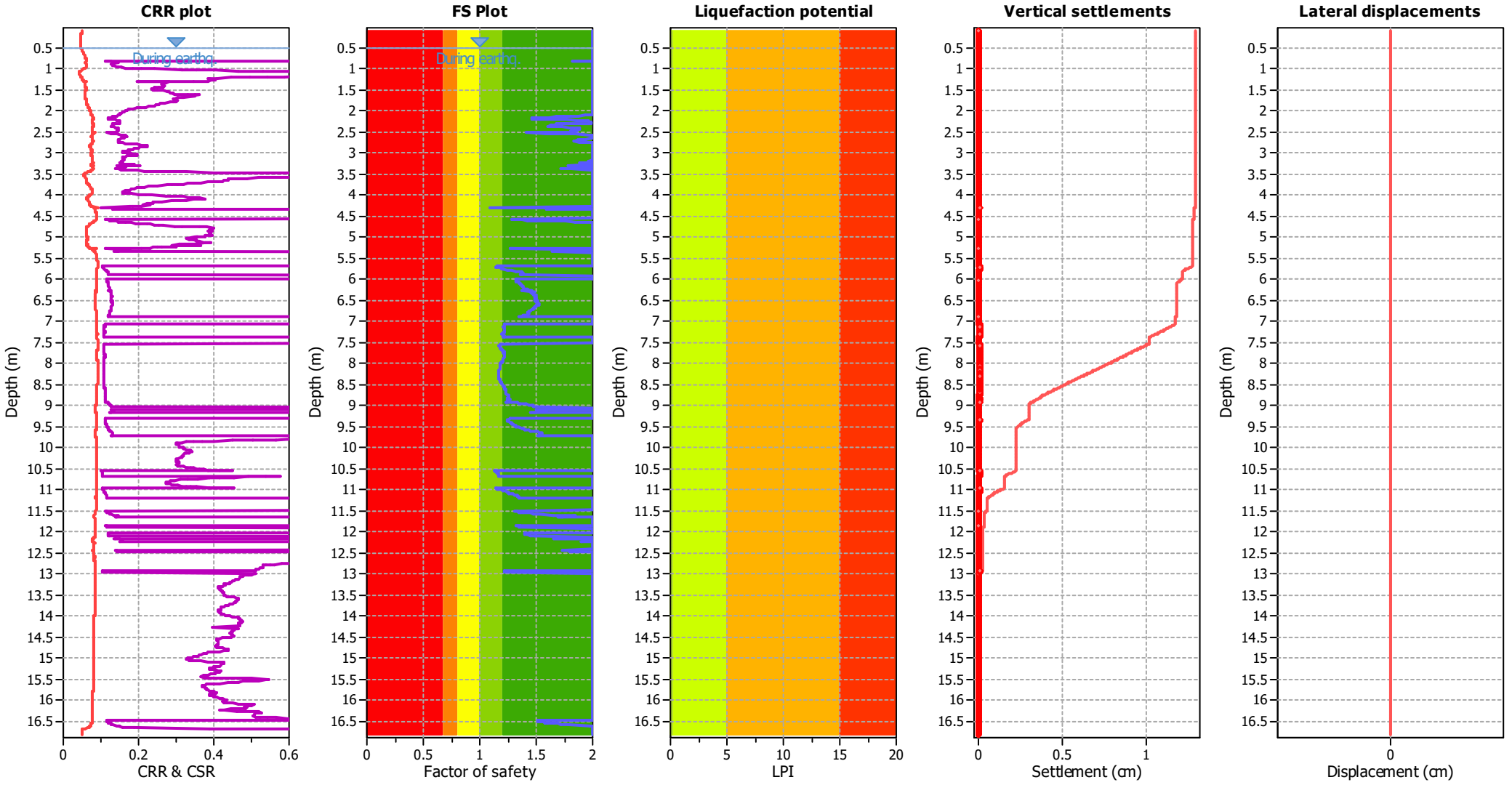

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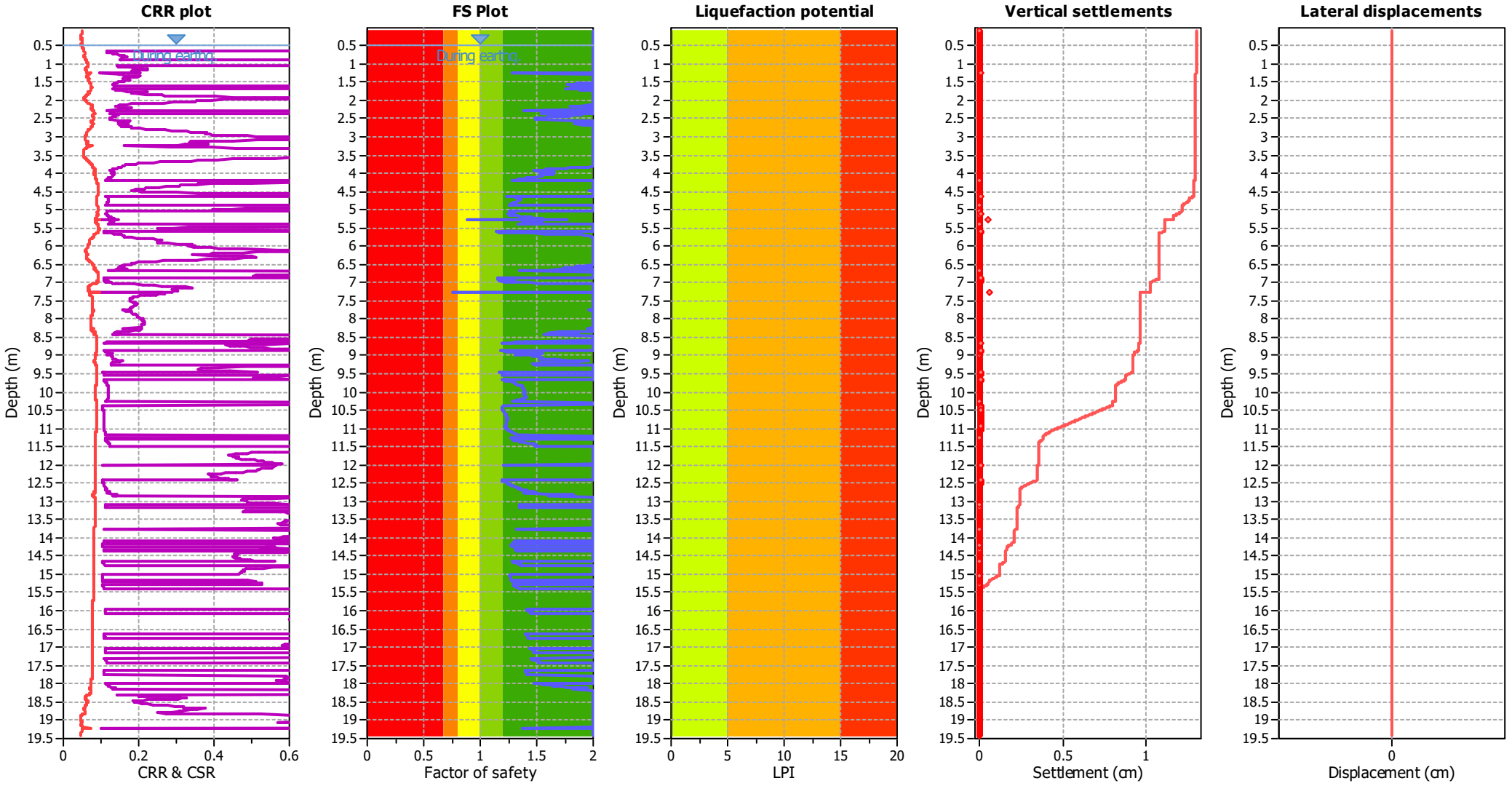

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Soil&Rock Consultants

Your responsive & cost-effective engineers

Appendix D

Soakage Testing Results

Double-Ring Infiltrometer Test Record & Analyses

SOIL & ROCK CONSULTANTS
289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

Soil&Rock Consultants
Your responsive & cost-effective engineers

Project Number: 230489 Date: 20/07/2023 Time: 2:15:00 PM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR01 Test #: 1 of total 1 tests Test by: TDS
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.0*	*5.0*	*N/A*	*N/A*	*1*	*3*	*0*	*0*
5	4.8	4.8	0.2	0.2	0.04	0.11	2.4	2.4
10	4.8	5.0	0.2	0.0	0.04	0.00	2.4	0.0
15	5.0	5.0	0.0	0.0	0.00	0.00	0.0	0.0
20	4.5	4.5	0.5	0.5	0.09	0.27	6.0	6.0
25	4.8	4.8	0.2	0.2	0.04	0.11	2.4	2.4
30	4.8	4.8	0.2	0.2	0.04	0.11	2.4	2.4
35	4.8	4.8	0.2	0.2	0.04	0.11	2.4	2.4
40	4.9	4.9	0.1	0.1	0.02	0.05	1.2	1.2
45	4.8	4.8	0.2	0.2	0.04	0.11	2.4	2.4

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.0 cm agl)

Double-Ring Infiltrometer Record Chart

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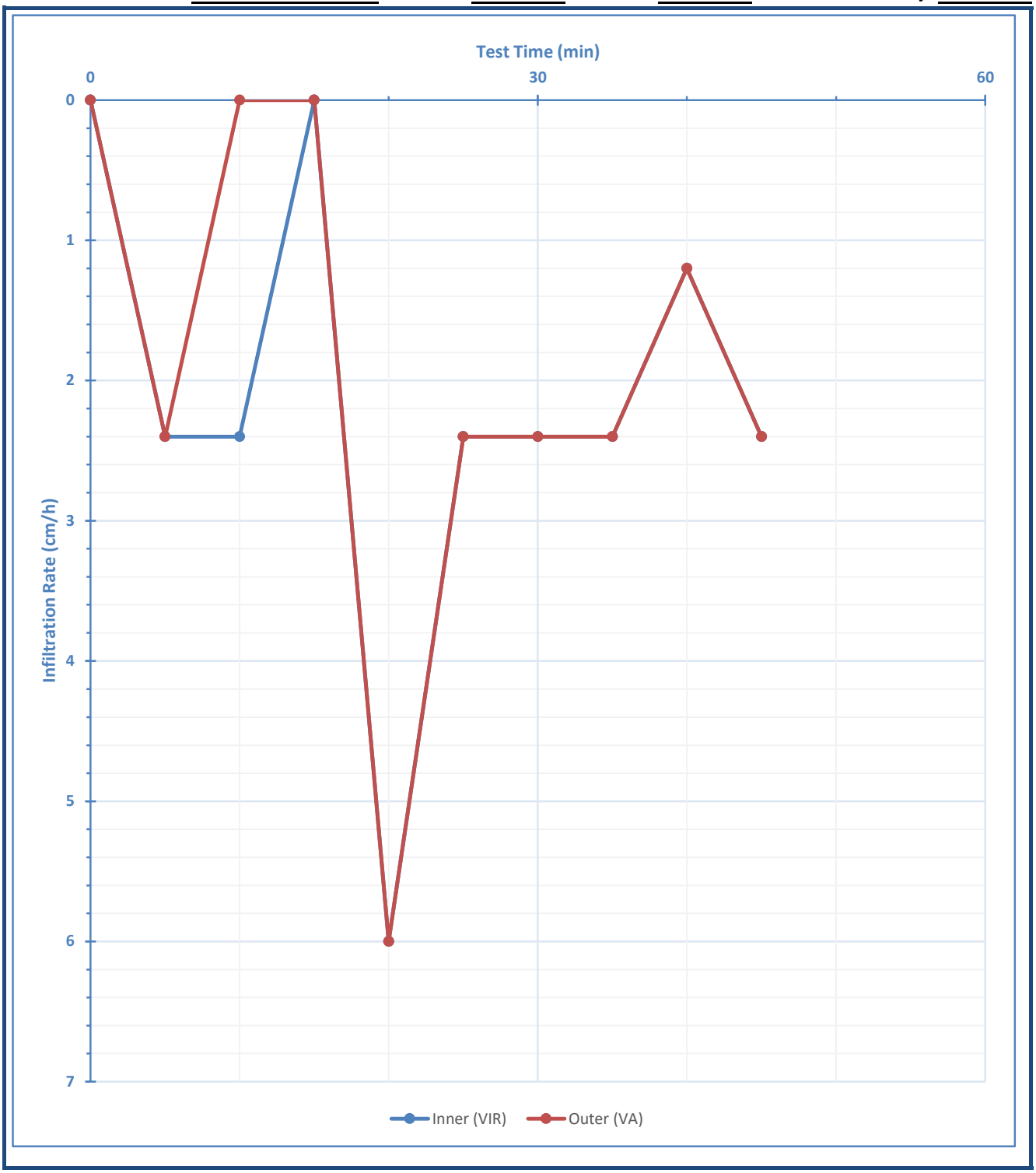
Project Number: 230489 Date: 20/07/2023 Time: 2:15:00 PM

Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR01 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

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Project Number: 230489 Date: 24/07/2023 Time: 1:40:00 PM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR02 Test #: 1 of total 1 tests Test by: TDS
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.0*	*5.0*	*N/A*	*N/A*	*2.25*	*2.25*	*0*	*0*
5	5.0	5.0	0.0	0.0	0.00	0.00	0.0	0.0
10	5.0	5.0	0.0	0.0	0.00	0.00	0.0	0.0
15	5.0	5.0	0.0	0.0	0.00	0.00	0.0	0.0
20	5.0	5.0	0.0	0.0	0.00	0.00	0.0	0.0
25	5.0	5.0	0.0	0.0	0.00	0.00	0.0	0.0
30	5.0	5.0	0.0	0.0	0.00	0.00	0.0	0.0

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.0 cm agl)

Double-Ring Infiltrometer Record Chart

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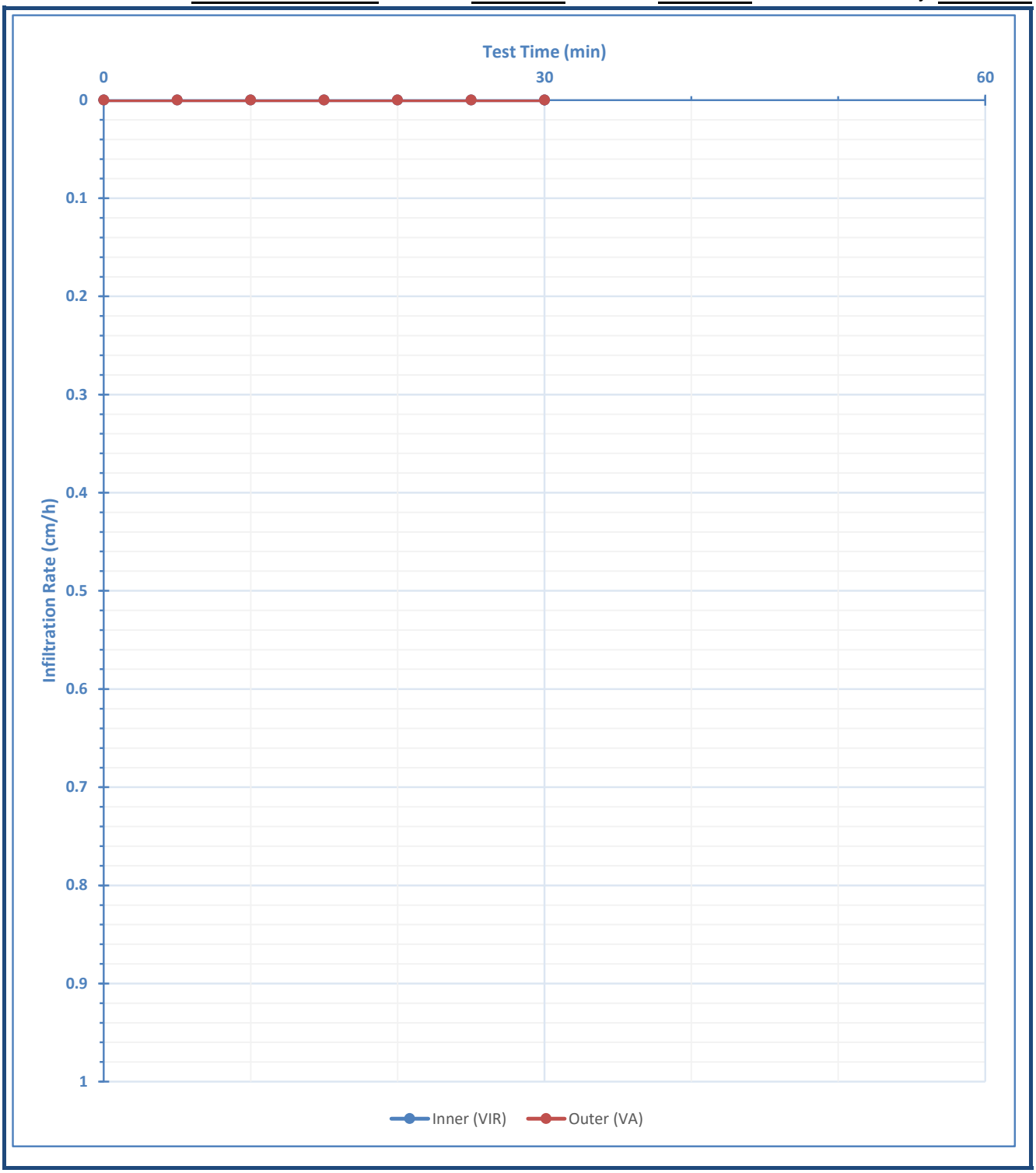
Project Number: 230489 Date: 24/07/2023 Time: 1:40:00 PM

Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR02 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

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Project Number: 230489 Date: 24/07/2023 Time: 11:00:00 AM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR03 Test #: 1 of total 1 tests Test by: TDS
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.0*	*5.0*	*N/A*	*N/A*	*1.7*	*3.3*	*0*	*0*
5.00	3.5	4.0	1.5	1.0	*0.3*	*0.5*	18.0	12.0
10.00	4.0	4.3	1.0	0.7	*0.2*	*0.4*	12.0	8.4
15.00	4.1	4.4	0.9	0.6	*0.2*	*0.3*	10.8	7.2
20.00	4.3	4.5	0.7	0.5	*0.1*	*0.3*	8.4	6.0
25.00	4.7	4.7	0.3	0.3	*0.1*	*0.2*	3.6	3.6
30.00	4.8	4.8	0.2	0.2	*0.0*	*0.1*	2.4	2.4
35.00	4.8	4.8	0.2	0.2	*0.0*	*0.1*	2.4	2.4
40.00	4.8	4.8	0.2	0.2	*0.0*	*0.1*	2.4	2.4
45.00	5.0	5.0	0.0	0.0	*0.0*	*0.0*	0.0	0.0
50.00	5.0	5.0	0.0	0.0	*0.0*	*0.0*	0.0	0.0

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.0 cm agl)

Double-Ring Infiltrometer Record Chart

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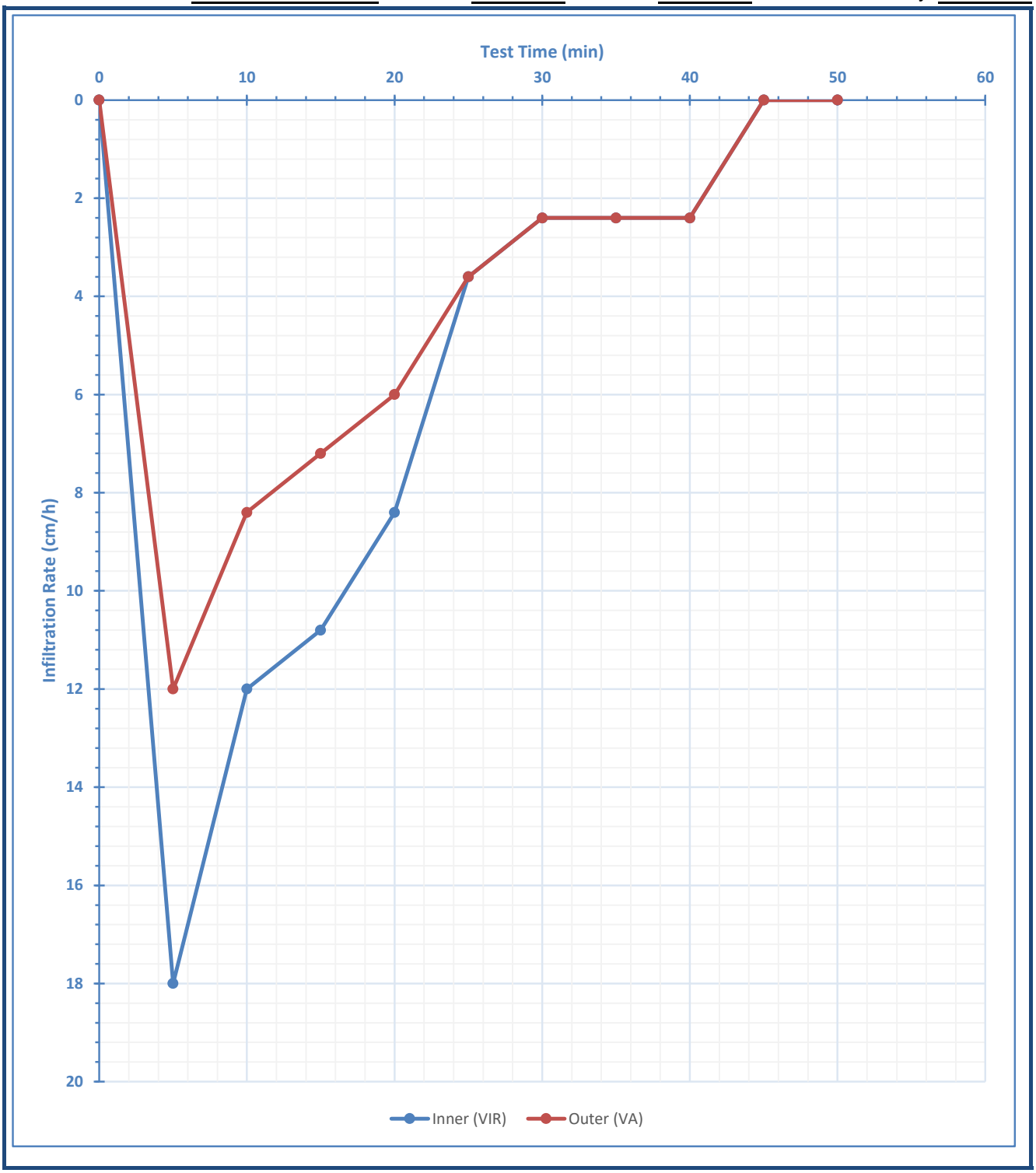
Project Number: 230489 Date: 24/07/2023 Time: 11am

Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR03 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

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Project Number: 230489 Date: 24/07/2023 Time: 1:10:00 PM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR04 Test #: 1 of total 1 tests Test by: TDS
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.0*	*5.0*	*N/A*	*N/A*	*2*	*2*	*0*	*0*
5.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
10.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
15.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
20.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
25.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
30.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
35.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
40.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
45.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
50.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.0 cm agl)

Double-Ring Infiltrometer Record Chart

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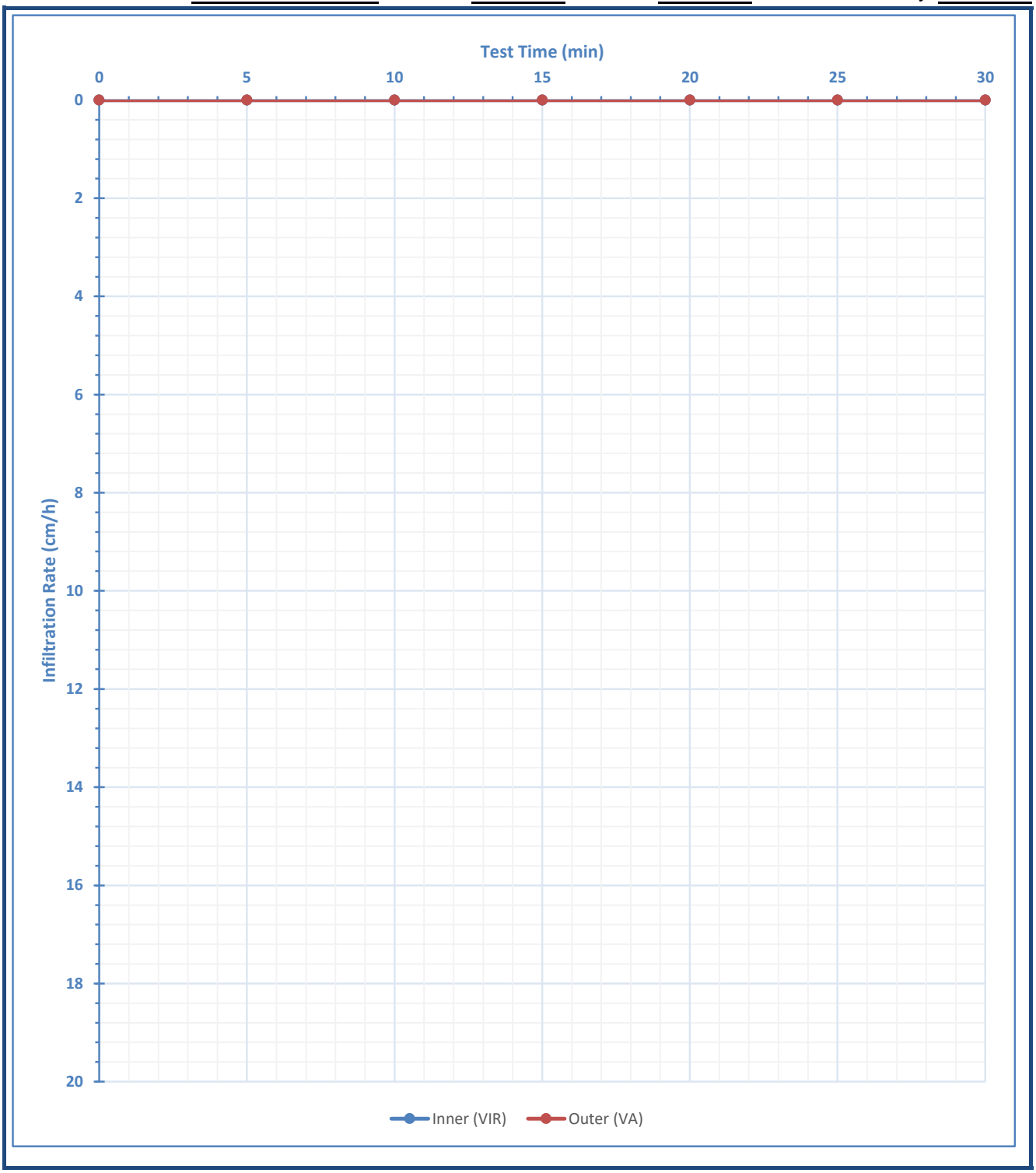
Project Number: 230489 Date: 24/07/2023 Time: 1:10:00 PM

Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR04 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

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Project Number: 230489 Date: 24/07/2023 Time: 10:02:00 AM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR05 Test #: 1 of total 1 tests Test by: TDS/DEG
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.6	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.0*	*5.0*	*N/A*	*N/A*	*1*	*2*	*0*	*0*
5.00	4.8	5.0	0.2	0.0	*0.04*	*0*	2.4	0.0
10.00	4.9	5.0	0.1	0.0	*0.02*	*0*	1.2	0.0
15.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
20.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
25.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
30.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
35.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.6 cm agl)

Double-Ring Infiltrometer Record Chart

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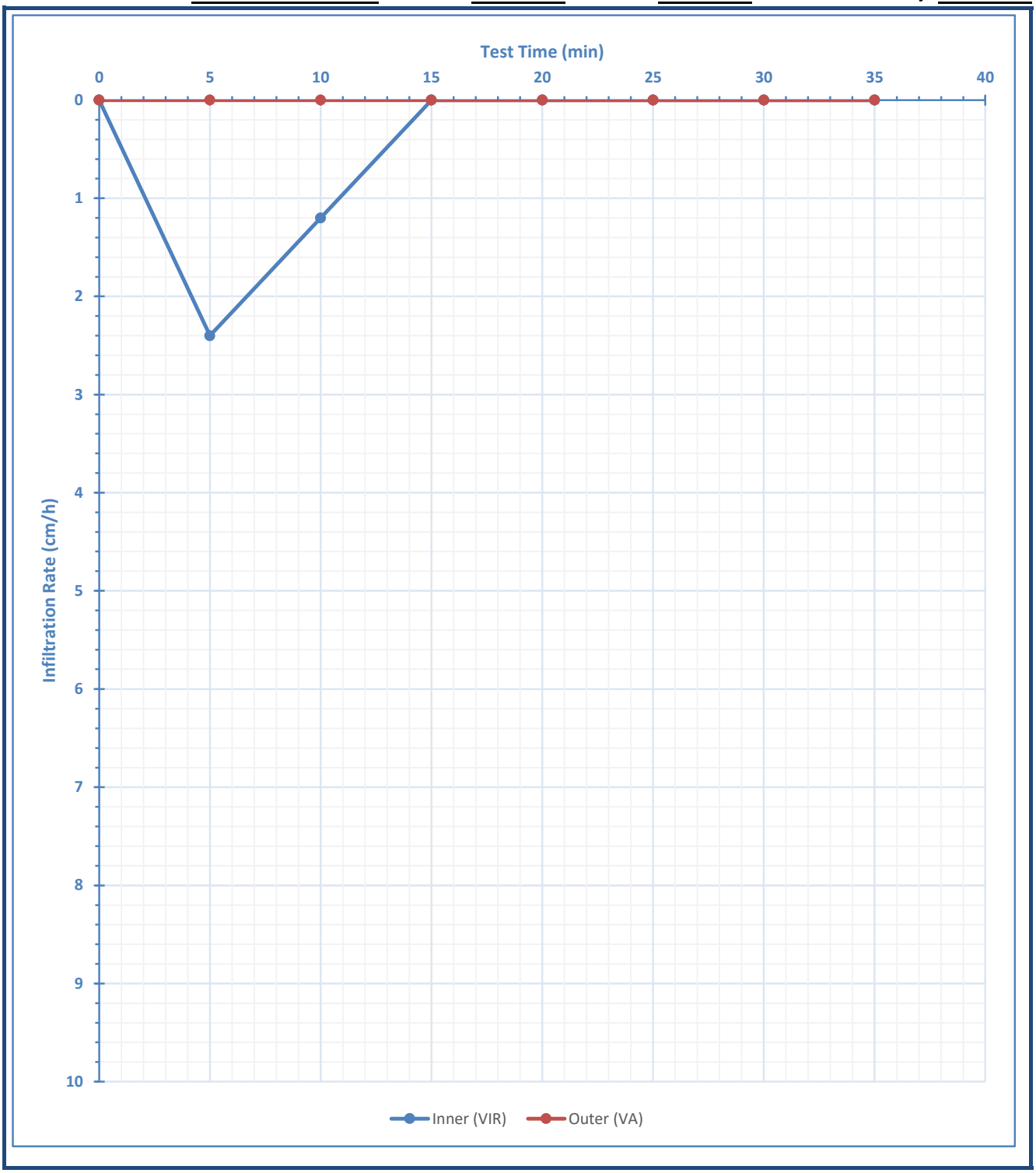
Project Number: 230489 Date: 24/07/2023 Time: 10:02:00 AM

Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR05 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

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Project Number: 230489 Date: 20/07/2023 Time: 11:48:00 AM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR06 Test #: 1 of total 1 tests Test by: JP
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.6	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.6*	*5.6*	*N/A*	*N/A*	*3*	*3*	*0*	*0*
2.00		0.0		5.6		3.06		168.0
2.58	0.0		5.6		1.02		130.2	
4.08		0.0		5.6		3.06		161.3
5.08	0.0		5.6		1.02		134.4	
6.68		0.0		5.6		3.06		129.2
8.08	0.0		5.6		1.02		112.0	
9.63		0.0		5.6		3.06		113.9
10.75	0.0		5.6		1.02		125.8	
13.47		0.0		5.6		3.06		87.7
14.25	0.0		5.6		1.02		96.0	
17.60		0.0		5.6		3.06		81.3
17.83	0.0		5.6		1.02		93.9	
22.60		0.0		5.6		3.06		67.2
22.68	0.6		5.0		0.91		61.9	
27.6		0.0		5.6		3.06		67.2
27.53	0.6		5.0		0.91		61.9	
32.6		0.6		5.0		2.74		60.0
32.52	0.6		5.0		0.91		60.1	
37.6		0.6		5.0		2.74		60.0
37.53	0.6		5.0		0.91		59.9	
42.6		0.6		5.0		2.74		60.0
42.53	0.6		5.0		0.91		60.0	
47.6		0.6		5.0		2.74		60.0
47.53	0.6		5.0		0.91		60.0	
52.6		0.6		5.0		2.74		60.0
52.53	0.6		5.0		0.91		60.0	

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.6 cm agl)

Double-Ring Infiltrometer Record Chart

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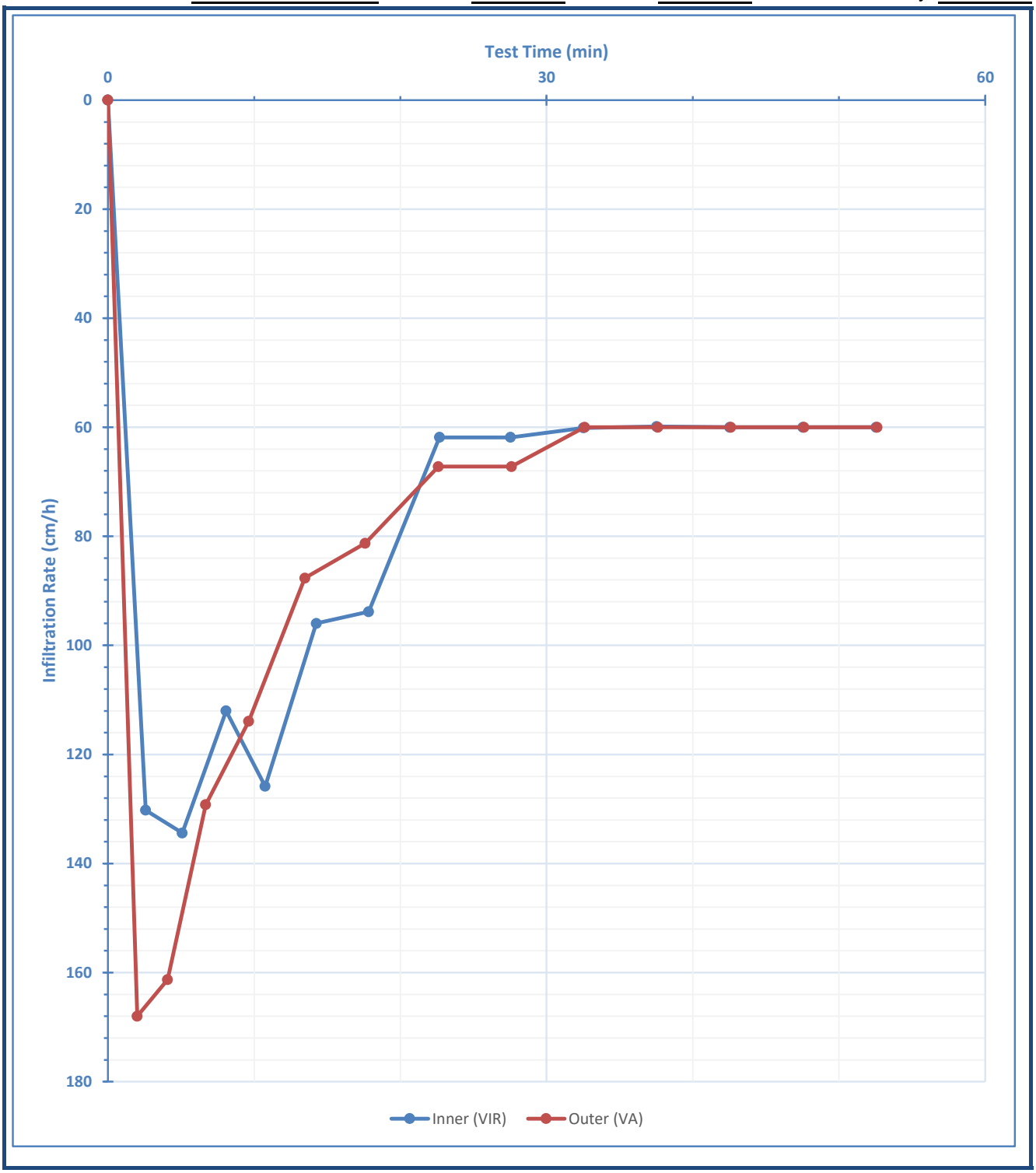
Project Number: 230489 Date: 20/07/2023 Time: 11:48:00 AM

Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR06 Test #: 1 of total 1 tests Test by: JP



Double-Ring Infiltrometer Test Record & Analyses

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Project Number: 230489 Date: 20/07/2023 Time: 9:54:00 AM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR07 Test #: 1 of total 1 tests Test by: JP
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.6	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.6*	*5.6*	*N/A*	*N/A*	*1.75*	*1.75*	*0*	*0*
5.00	5.6	5.6	0.0	0.0	0.00	0.00	0.0	0.0
10.00	5.6	5.6	0.0	0.0	0.00	0.00	0.0	0.0
15.00	5.6	5.6	0.0	0.0	0.00	0.00	0.0	0.0
20.00	5.6	5.6	0.0	0.0	0.00	0.00	0.0	0.0
25.00	5.6	5.6	0.0	0.0	0.00	0.00	0.0	0.0
30.00	5.6	5.6	0.0	0.0	0.00	0.00	0.0	0.0

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.6 cm agl)

Double-Ring Infiltrometer Record Chart

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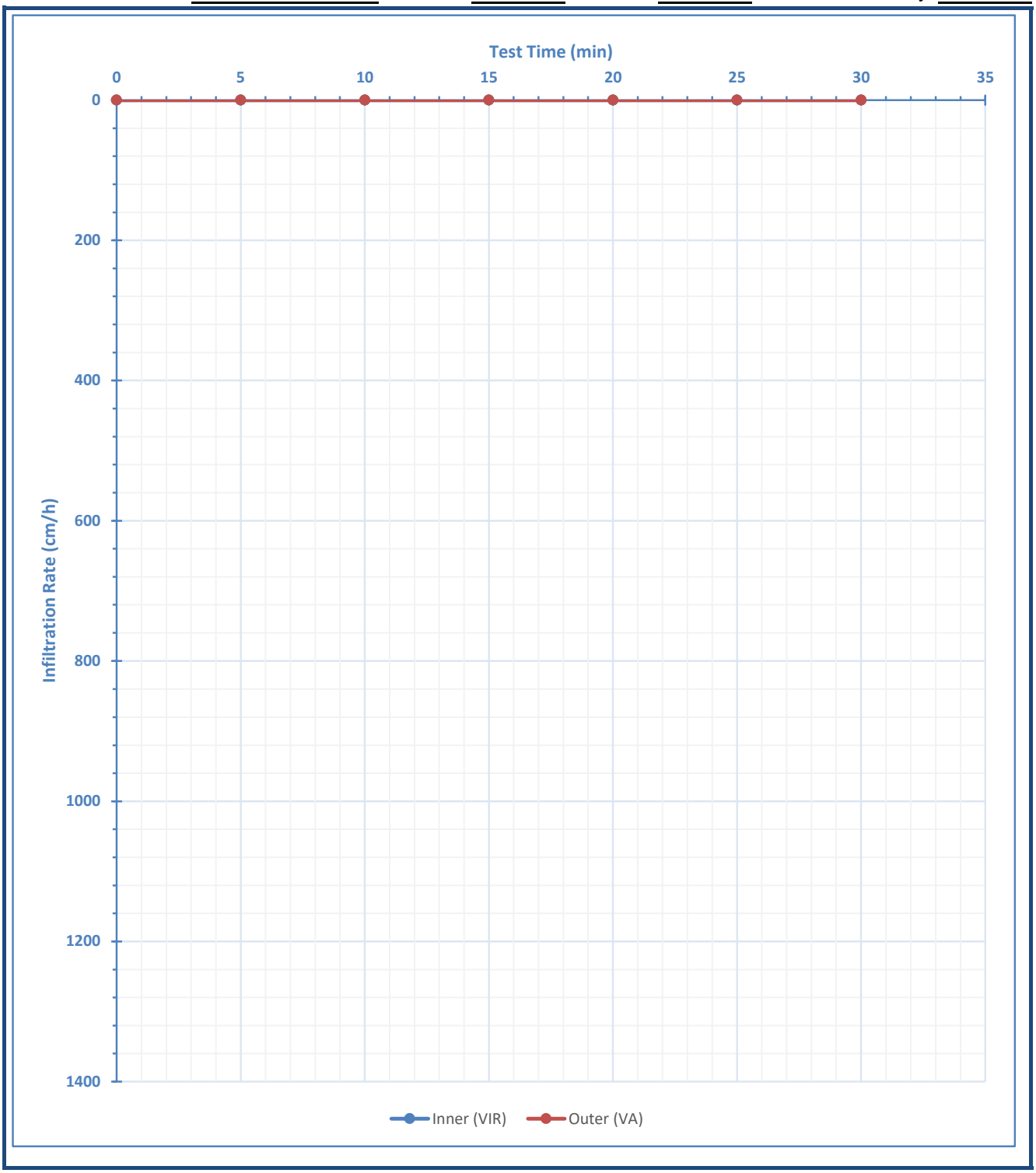
Project Number: 230489 Date: 20/07/2023 Time: 9:54:00 AM

Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR07 Test #: 1 of total 1 tests Test by: JP



Double-Ring Infiltrometer Test Record & Analyses

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Project Number: 230489 Date: 20/07/2023 Time: 10:33:00 AM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR08 Test #: 1 of total 1 tests Test by: TDS
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.0*	*5.0*	*N/A*	*N/A*	*1.67*	*3.3*	*0*	*0*
5.00	1.0	0.0	4.0	5.0	0.73	2.74	48.0	60.0
10.00	1.0	0.5	4.0	4.5	0.73	2.46	48.0	54.0
15.00	2.0	1.0	3.0	4.0	0.55	2.19	36.0	48.0
20.00	3.0	2.0	2.0	3.0	0.36	1.64	24.0	36.0
25.00	2.8	2.5	2.2	2.5	0.40	1.37	26.4	30.0
30.00	3.0	2.0	2.0	3.0	0.36	1.64	24.0	36.0
35.00	3.0	2.0	2.0	3.0	0.36	1.64	24.0	36.0
40.00	3.0	2.0	2.0	3.0	0.36	1.64	24.0	36.0
45.00	3.0	1.0	2.0	4.0	0.36	2.19	24.0	48.0
50.00	2.0	1.0	3.0	4.0	0.55	2.19	36.0	48.0
55.00	2.0	1.0	3.0	4.0	0.55	2.19	36.0	48.0
60.00	2.0	1.0	3.0	4.0	0.55	2.19	36.0	48.0
65.00	2.0	1.0	3.0	4.0	0.55	2.19	36.0	48.0

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.0 cm agl)

Double-Ring Infiltrometer Record Chart

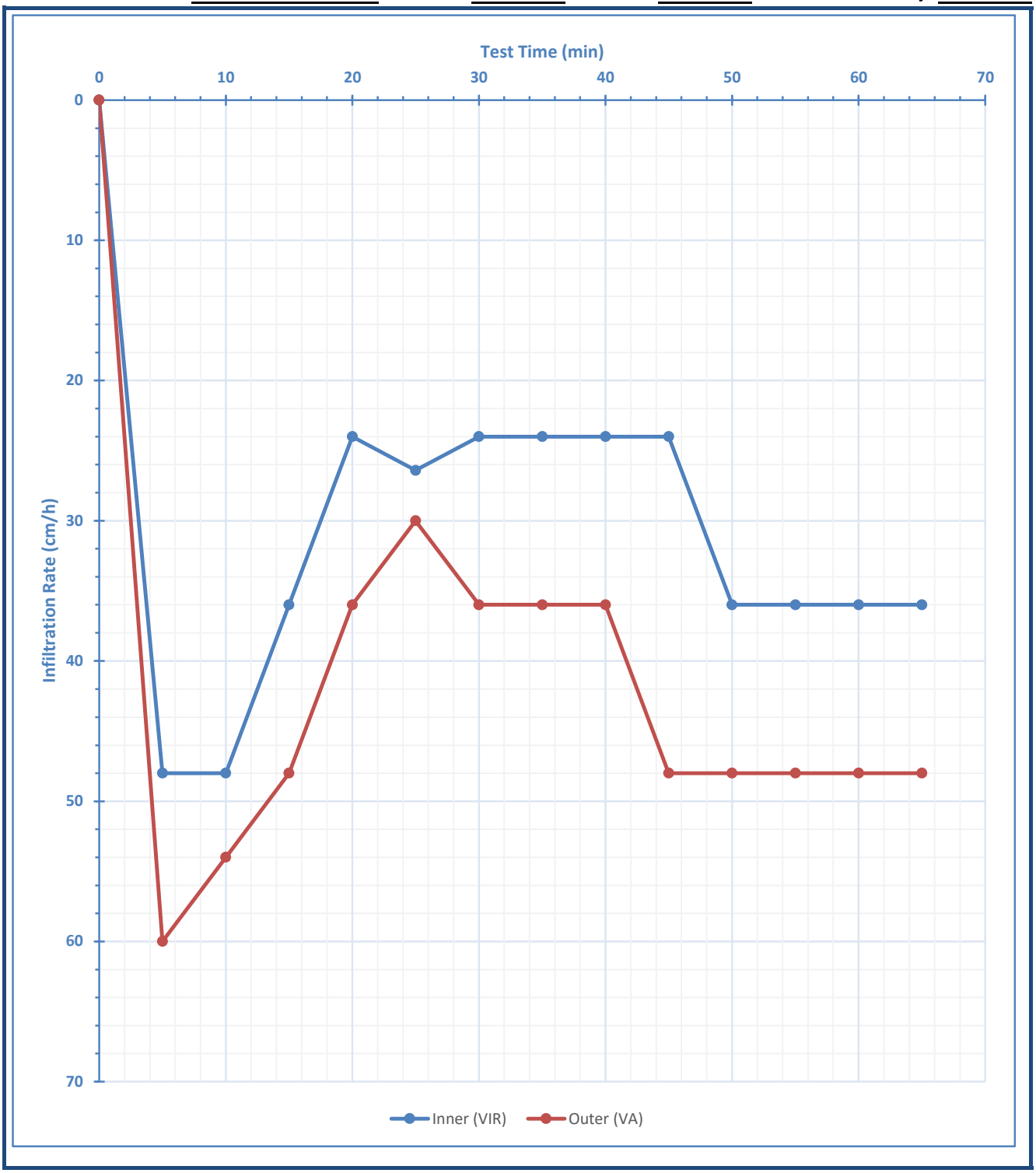
SOIL & ROCK CONSULTANTS
289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

Soil&Rock Consultants
Your responsive & cost-effective engineers

Project Number: 230489 Date: 20/07/2023 Time: 10:33:00 AM

Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR08 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

SOIL & ROCK CONSULTANTS
289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

Soil&Rock Consultants
Your responsive & cost-effective engineers

Project Number: 230489 Date: 20/07/2023 Time: 9:07:00 AM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR09 Test #: 1 of total 1 tests Test by: TDS
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.0*	*5.0*	*N/A*	*N/A*	*2.25*	*2.25*	*0*	*0*
5.00	0.5	0.5	4.5	4.5	*0.82087*	*2.46261*	54.0	54.0
10.00	0.0	0.7	5.0	4.3	*0.91208*	*2.35316*	60.0	51.6
15.00	0.2	1.0	4.8	4.0	*0.87559*	*2.18899*	57.6	48.0
20.00	0.0	1.0	5.0	4.0	*0.91208*	*2.18899*	60.0	48.0
25.00	0.0	1.0	5.0	4.0	*0.91208*	*2.18899*	60.0	48.0
30.00	0.0	1.0	5.0	4.0	*0.91208*	*2.18899*	60.0	48.0
35.00	0.0	1.0	5.0	4.0	*0.91208*	*2.18899*	60.0	48.0
40.00	0.0	1.0	5.0	4.0	*0.91208*	*2.18899*	60.0	48.0

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.0 cm agl)

Double-Ring Infiltrometer Record Chart

SOIL & ROCK CONSULTANTS
289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

Soil&Rock Consultants
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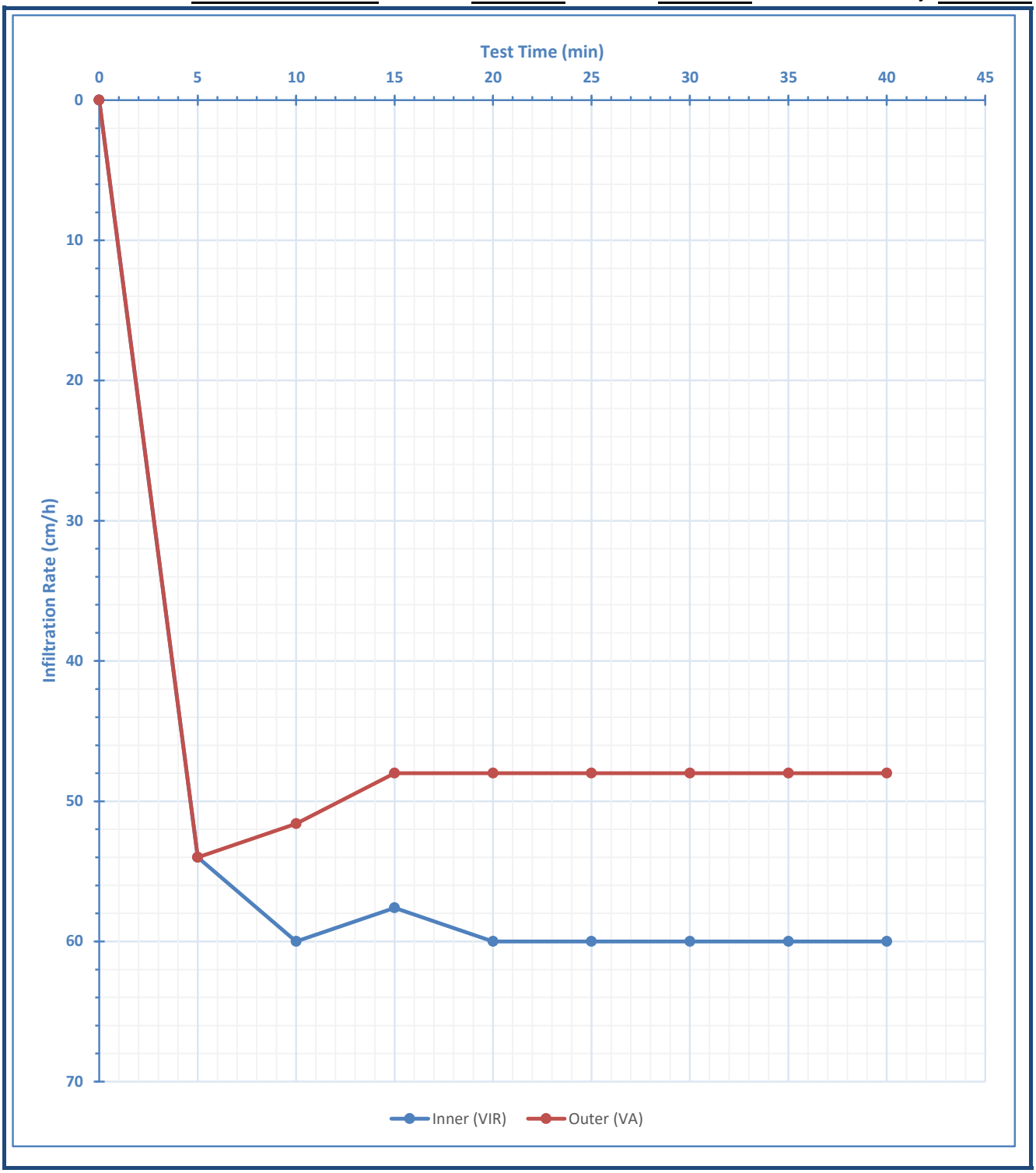
Project Number: 230489 Date: 20/07/2023 Time: 2:45pm

Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR09 Test #: 1 of total 1 tests Test by: TDS



Double-Ring Infiltrometer Test Record & Analyses

SOIL & ROCK CONSULTANTS
289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

Soil&Rock Consultants
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Project Number: 230489 Date: 24/07/2023 Time: 12:40:00 PM
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton
Test Location ID: DR10 Test #: 1 of total 1 tests Test by: TDS
Position x: see plan Position y: mbgl 1.00
Other boreholes within influence distance (test simultaneously):

1. Attach the following (tick once attached)

√	Graph of Water Level against Time
√	Site Plan Showing location of test(s)

2. General Information

Ring embedment depth:	5	cm bgl	Ring height:	10.6	cm
Inner Ring diameter:	6	(inches)	Outer Ring diameter:	12	(inches)
Inner Ring diameter:	0.1524	(m)	Outer Ring diameter:	0.3048	(m)
Inner Ring volume:	0.182	(l/cm agl)	Outer Ring volume:	0.547	(l/cm agl)
Weather at time of test:	Fine		Initial water height:	5.0	cm agl

3. Test Log

Test Time (Min)	Water Depth (cm above ground level)		Level Drop (cm)		Infiltrated Volume (l; refilled at time step		Infiltration Velocity (cm/h)	
	Inner	Outer	Inner	Outer	Inner	Outer	Inner (V_{IR})	Outer (V_A)
0	*5.0*	*5.0*	*N/A*	*N/A*	*1*	*2*	*0*	*0*
5.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
10.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
15.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
20.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
25.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
30.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0
35.00	5.0	5.0	0.0	0.0	*0*	*0*	0.0	0.0

Notes: [1] Test method & calculations in accordance with ASTM D3385-03 (June 2003)
[2] cm bgl - cm below ground level (stripped level for testing)
[3] cm agl - cm above ground level (stripped level for testing)
[4] Head maintained manually at each time step to return levels to intial reference point
(i.e. Initial water height: 5.0 cm agl)

Double-Ring Infiltrometer Record Chart

SOIL & ROCK CONSULTANTS
289 Lincoln Road
PO Box 21 424, Henderson Auckland 0650

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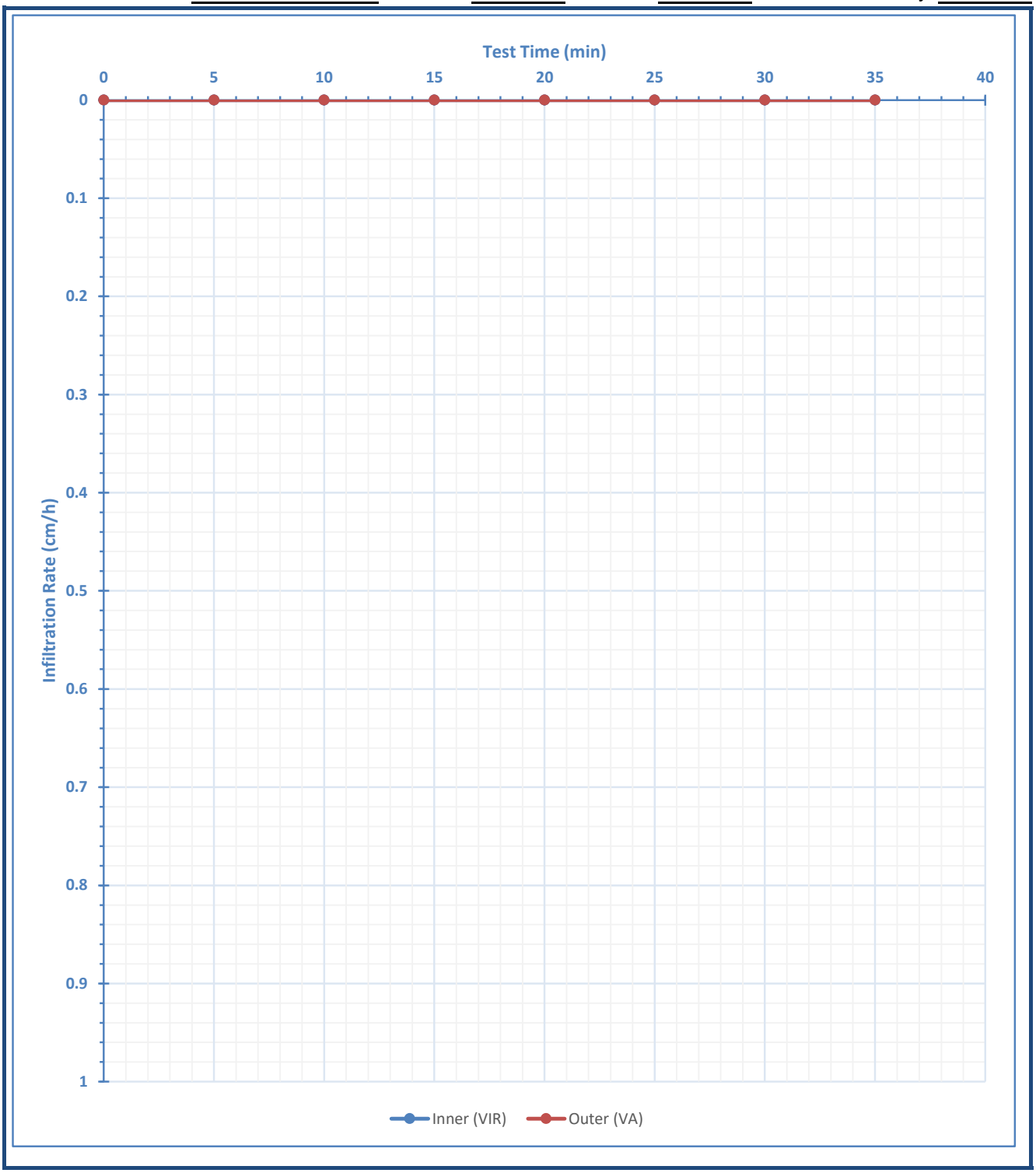
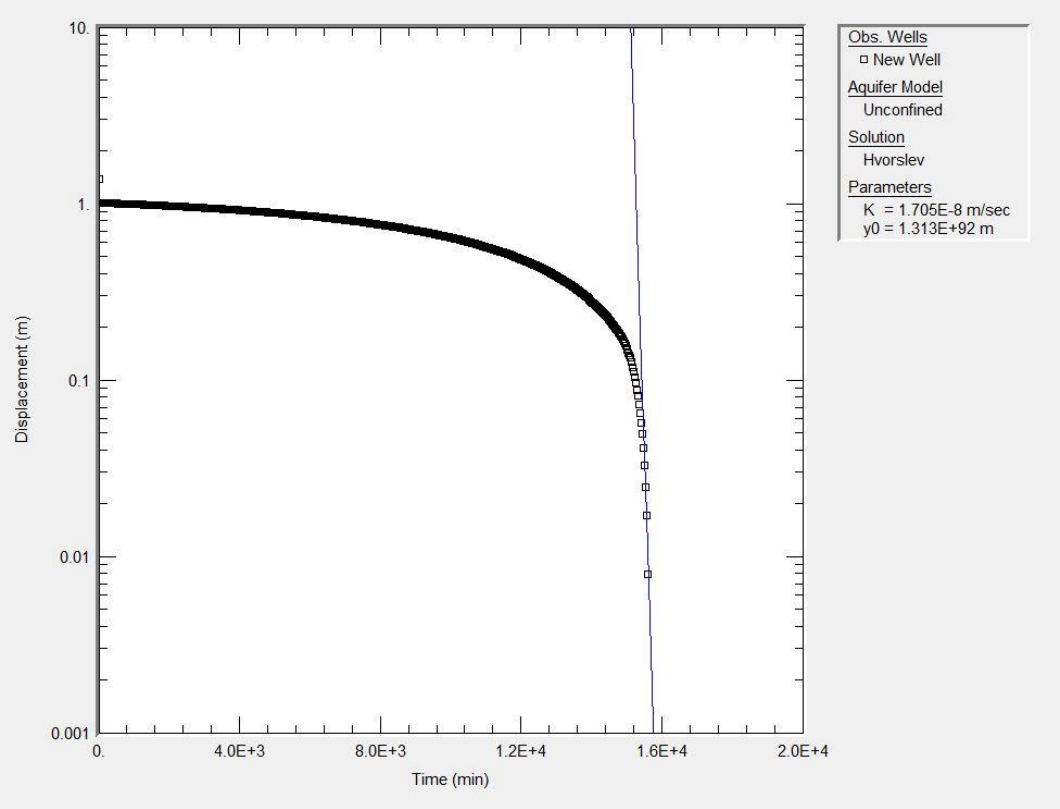
Project Number: 230489 Date: 24/07/2023 Time: 12:40:00 PM

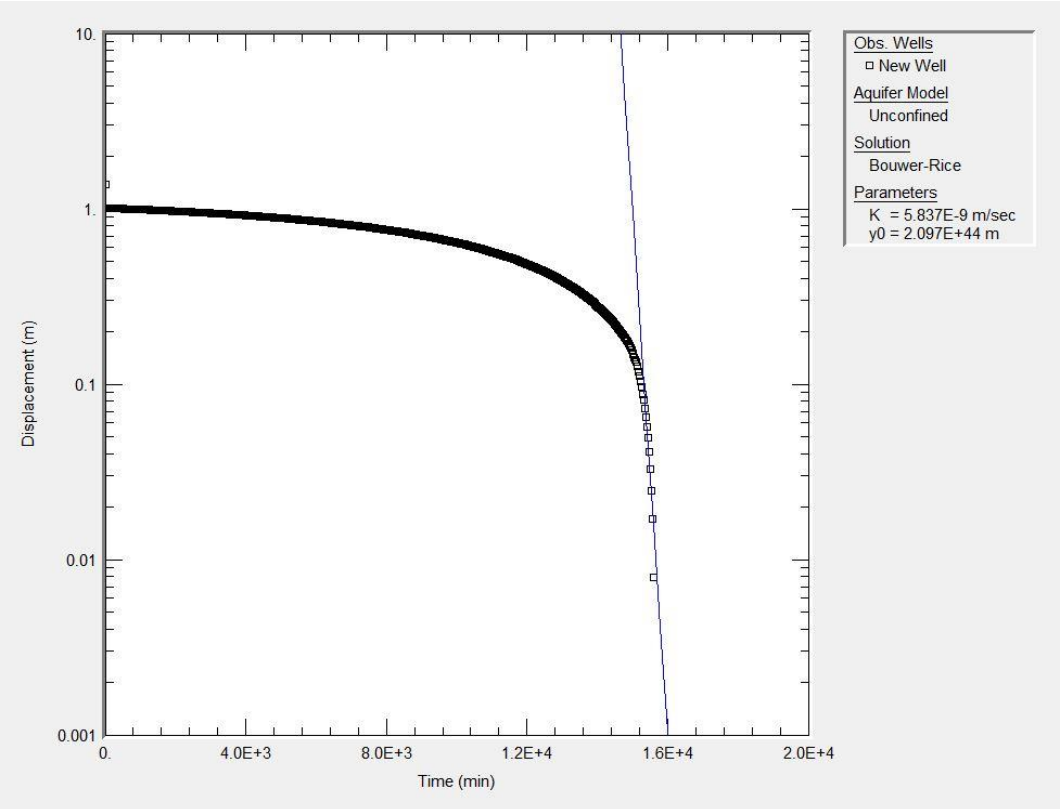
Site Address: Fonterra Te Rapa, 1344 Te Rapa Road, Hamilton

Test Location ID: DR09 Test #: 1 of total 1 tests Test by: TDS

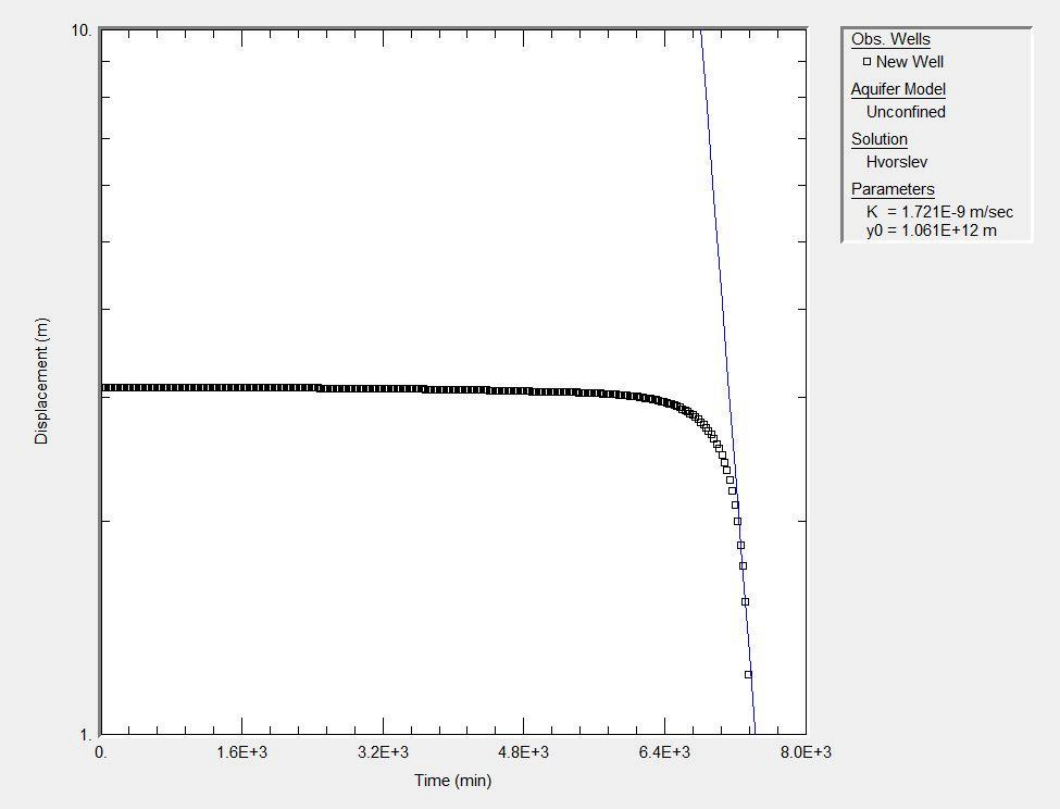




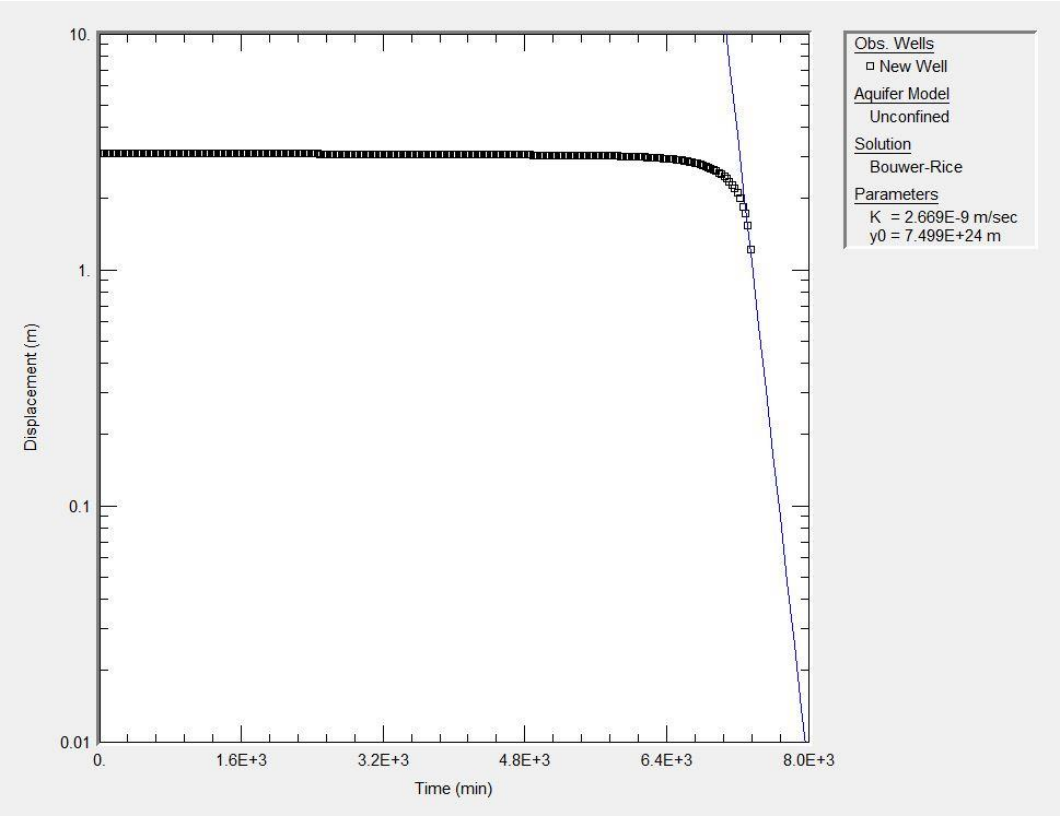
PZ04 – Rising Head Test – HV



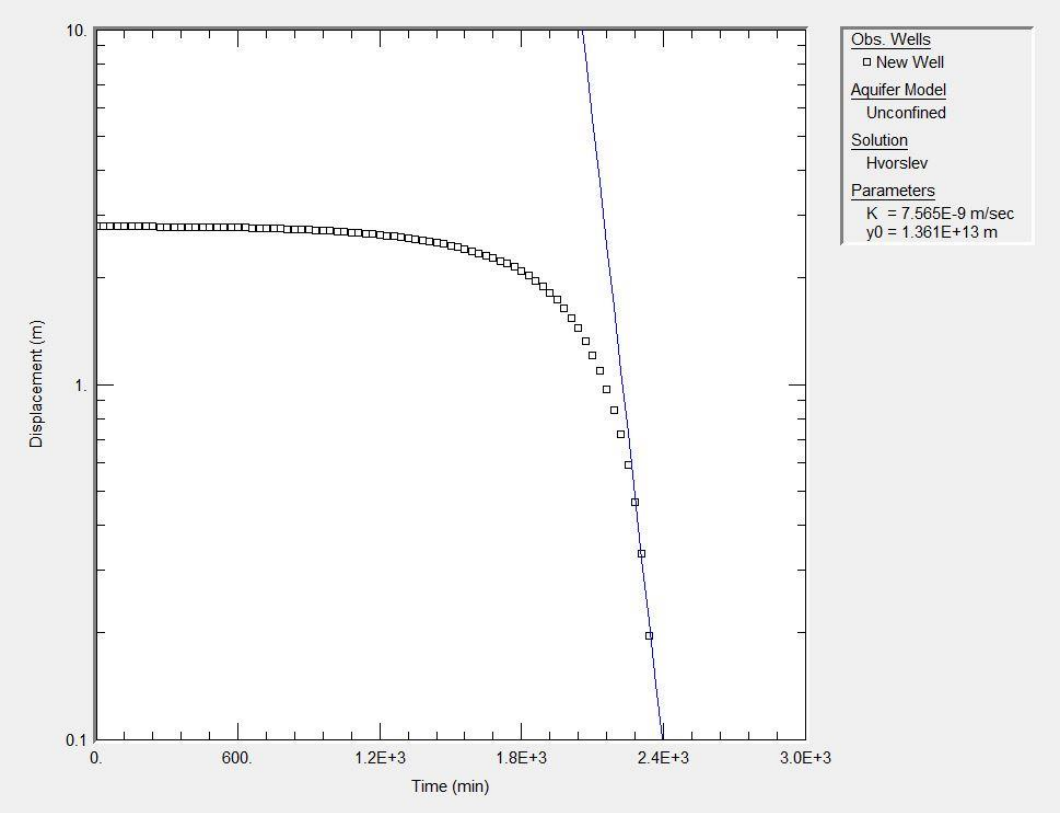
PZ04 – Rising Head Test – Bouwer Rice



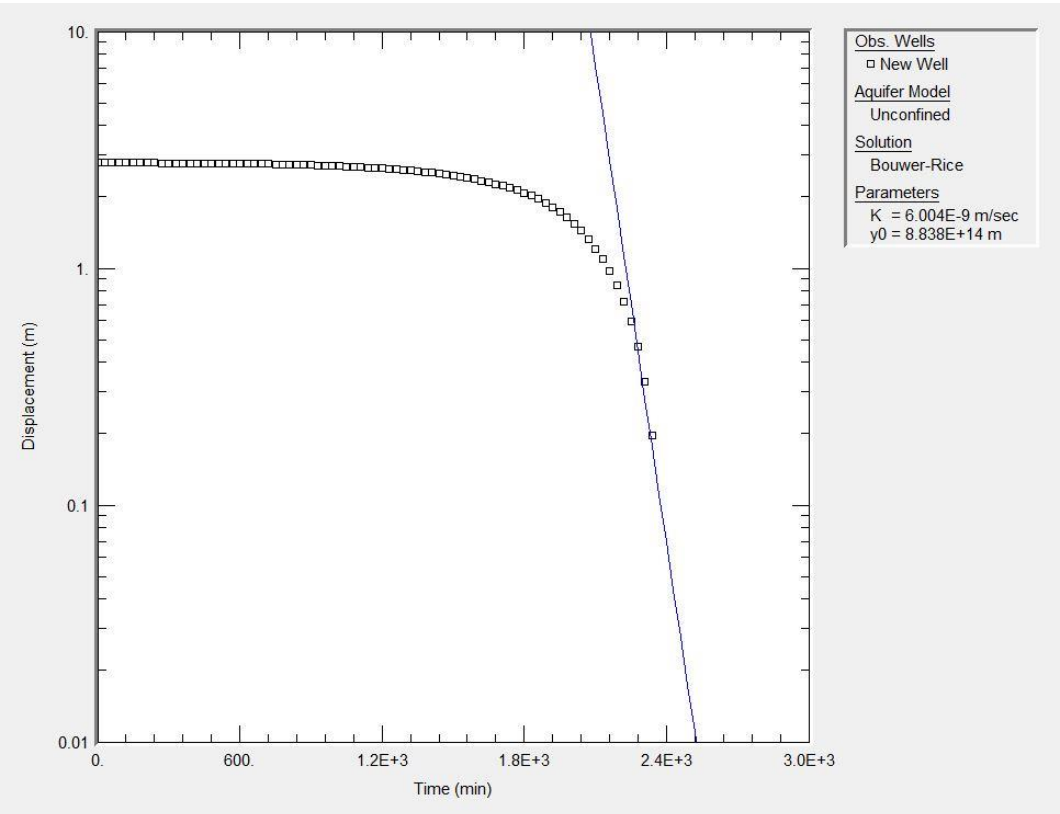
PZ06 – Falling Head Test – HV



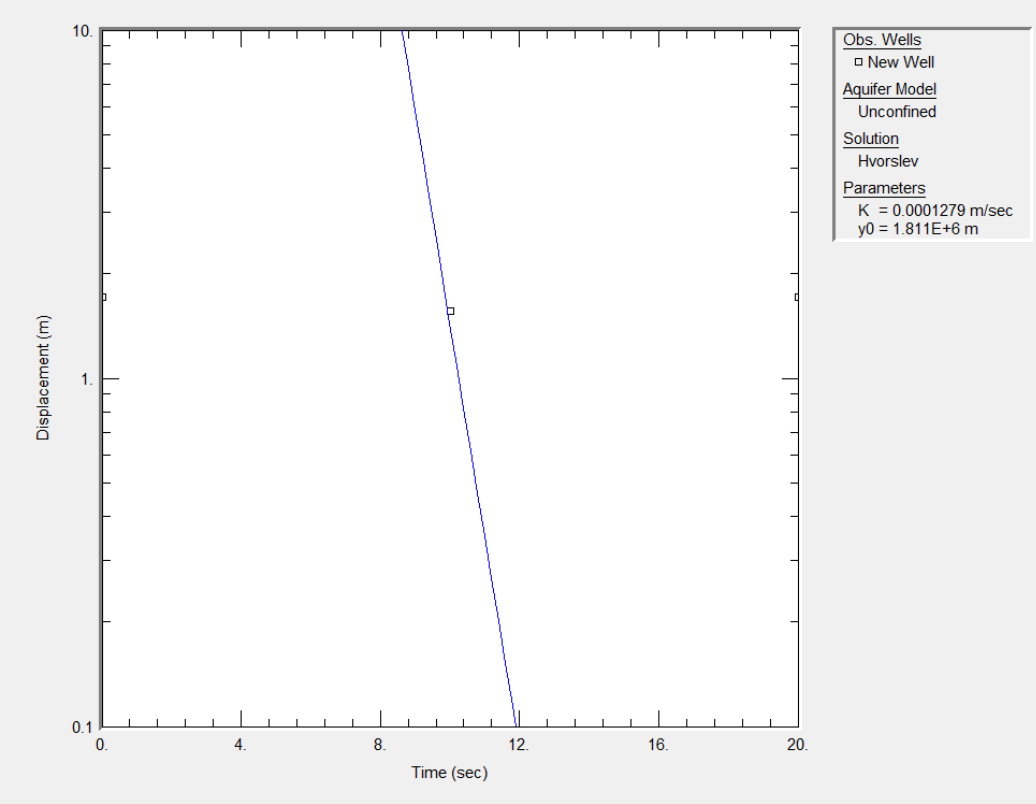
PZ06 – Falling Head Test – Bouwer Rice



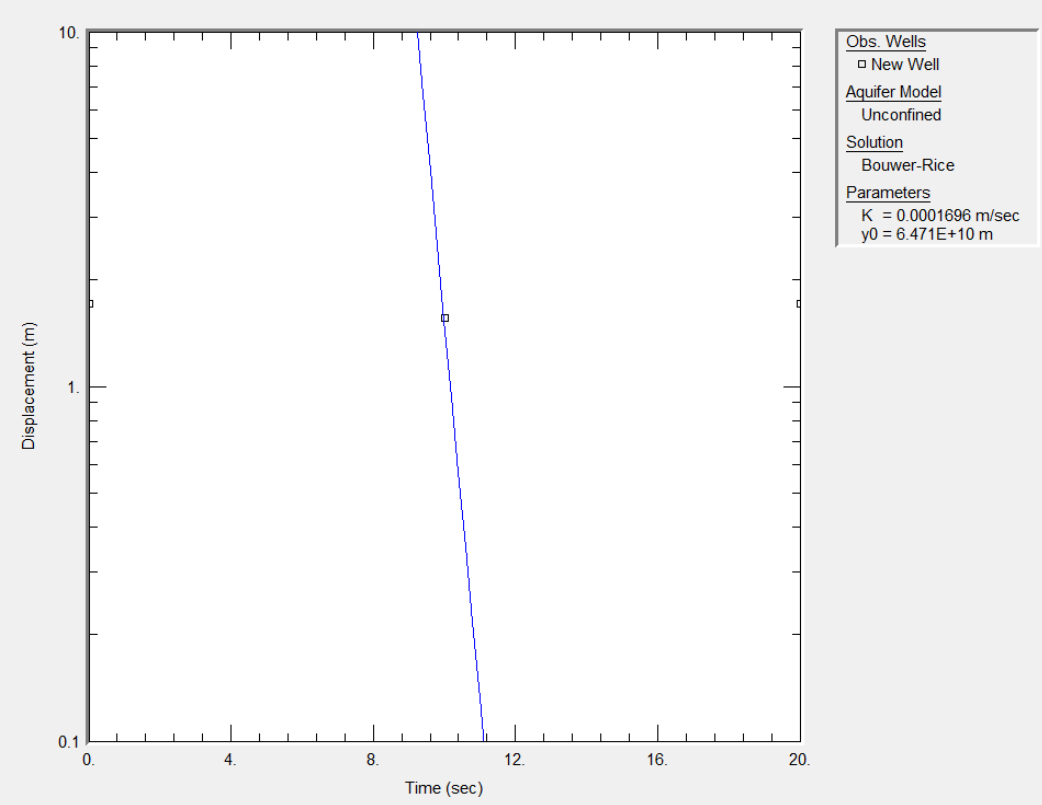
PZ08 – Rising Head Test – HV



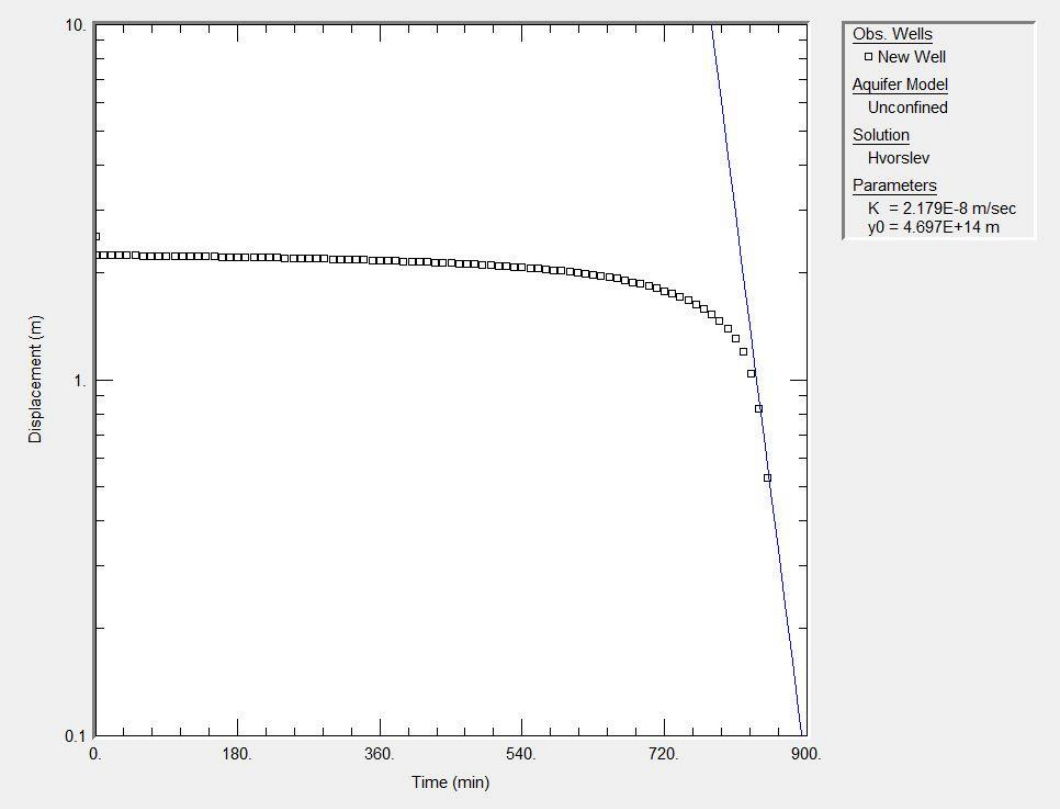
PZ08 – Rising Head Test – Bouwer Rice



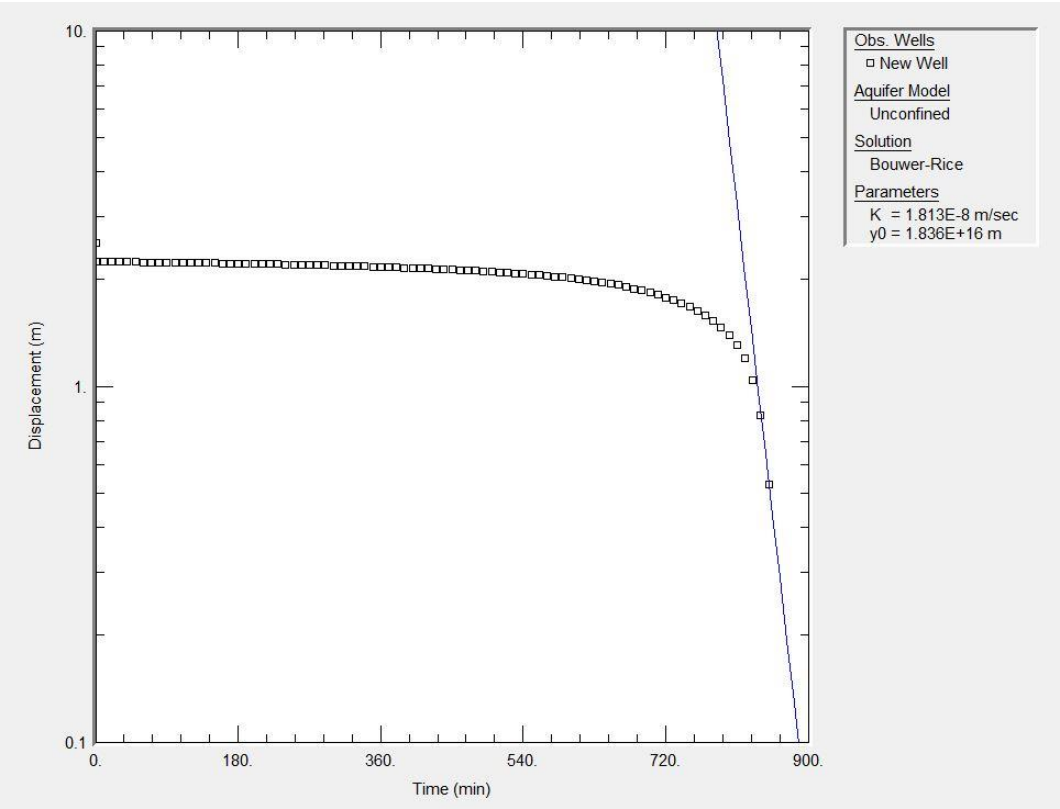
PZ16 – Falling Head Test – HV



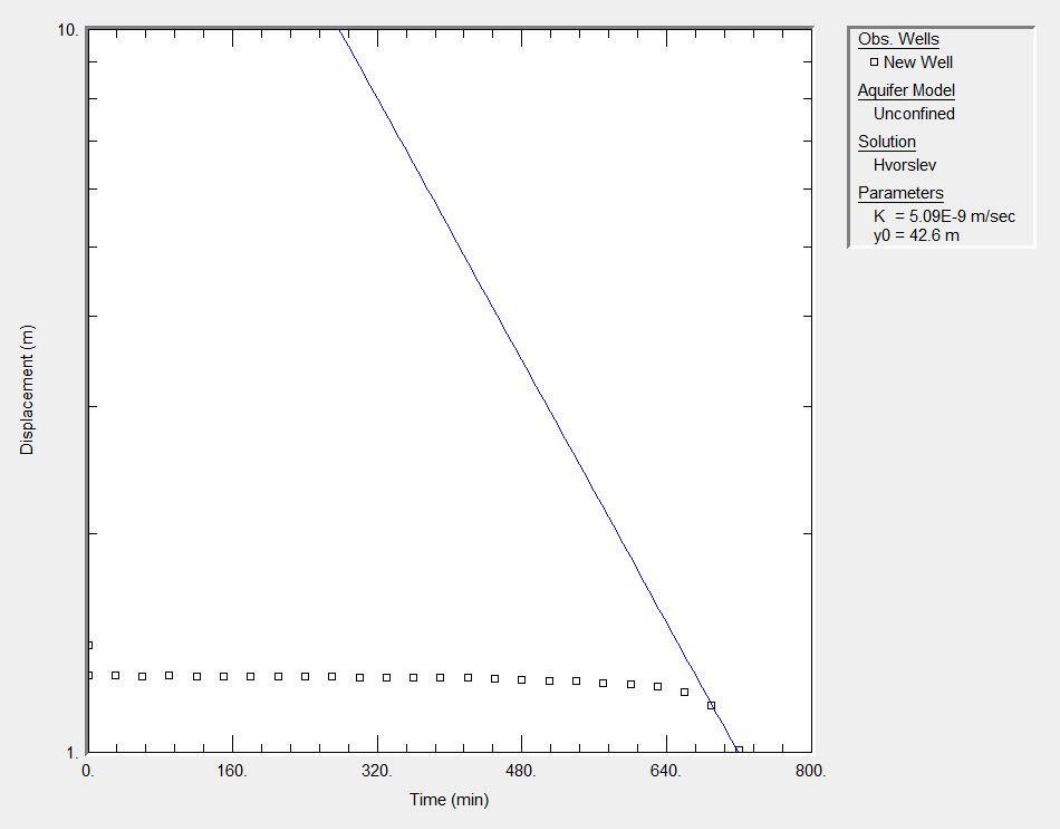
PZ16 – Falling Head Test – Bouwer Rice



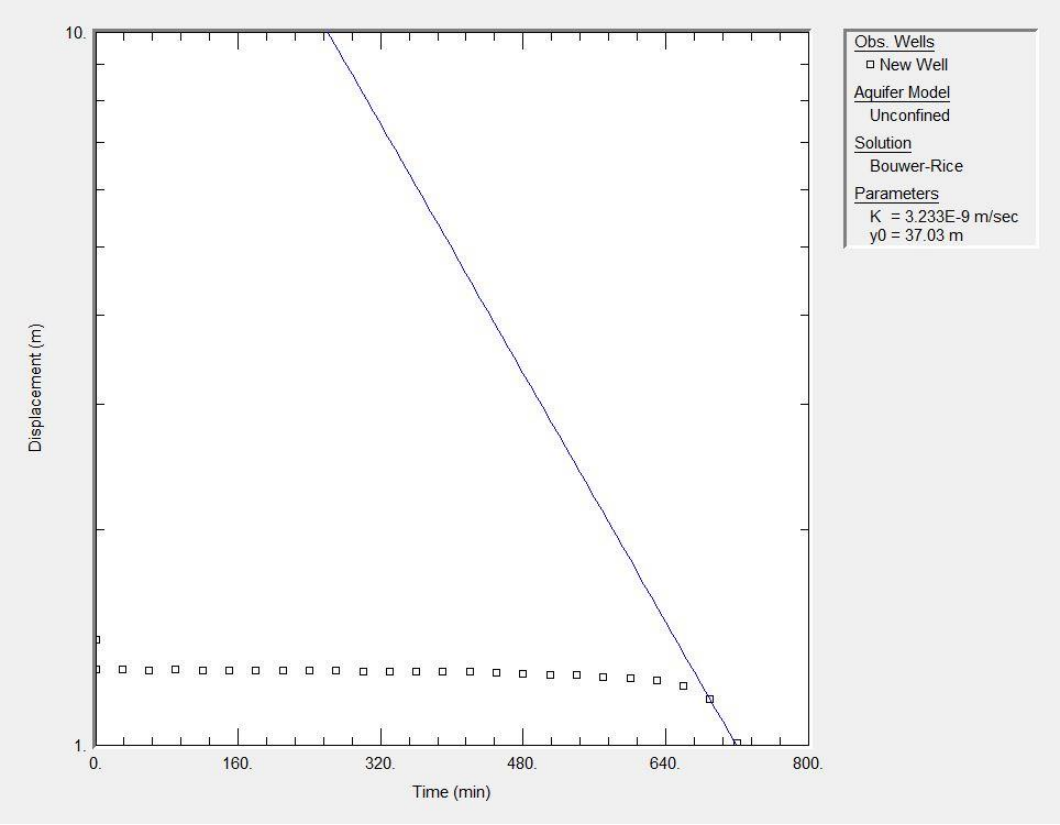
PZ18 – Falling Head Test – HV



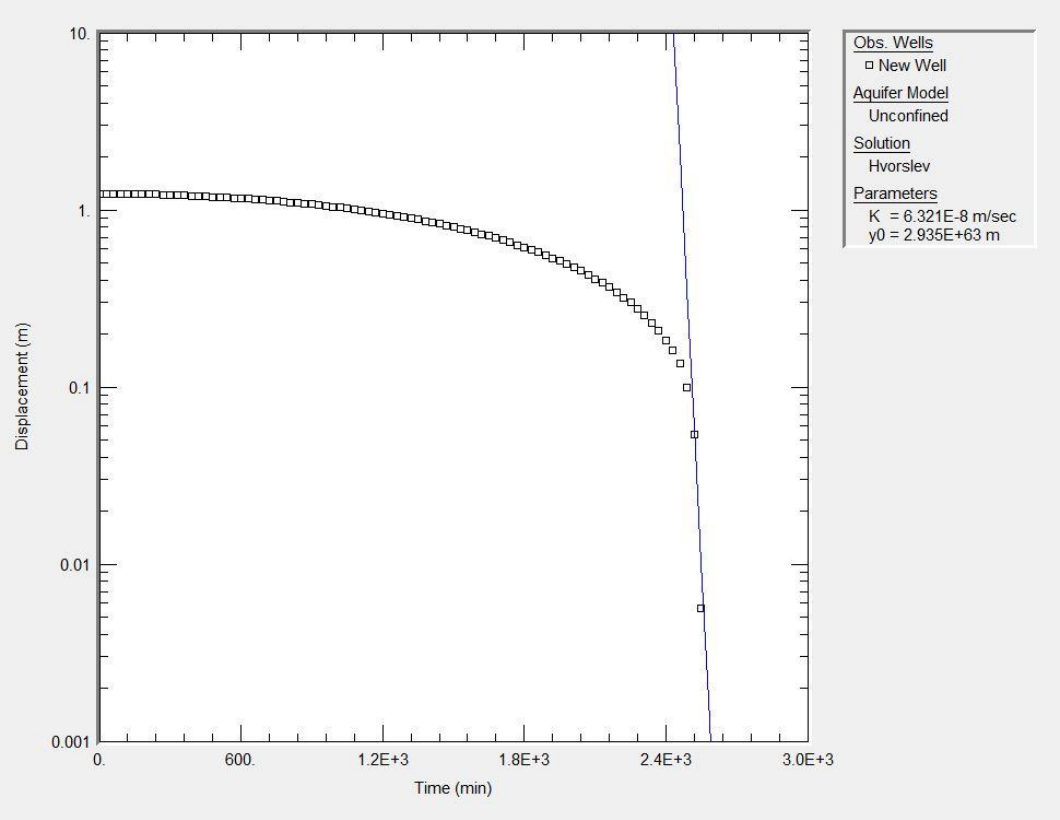
PZ18 – Falling Head Test – Bouwer Rice



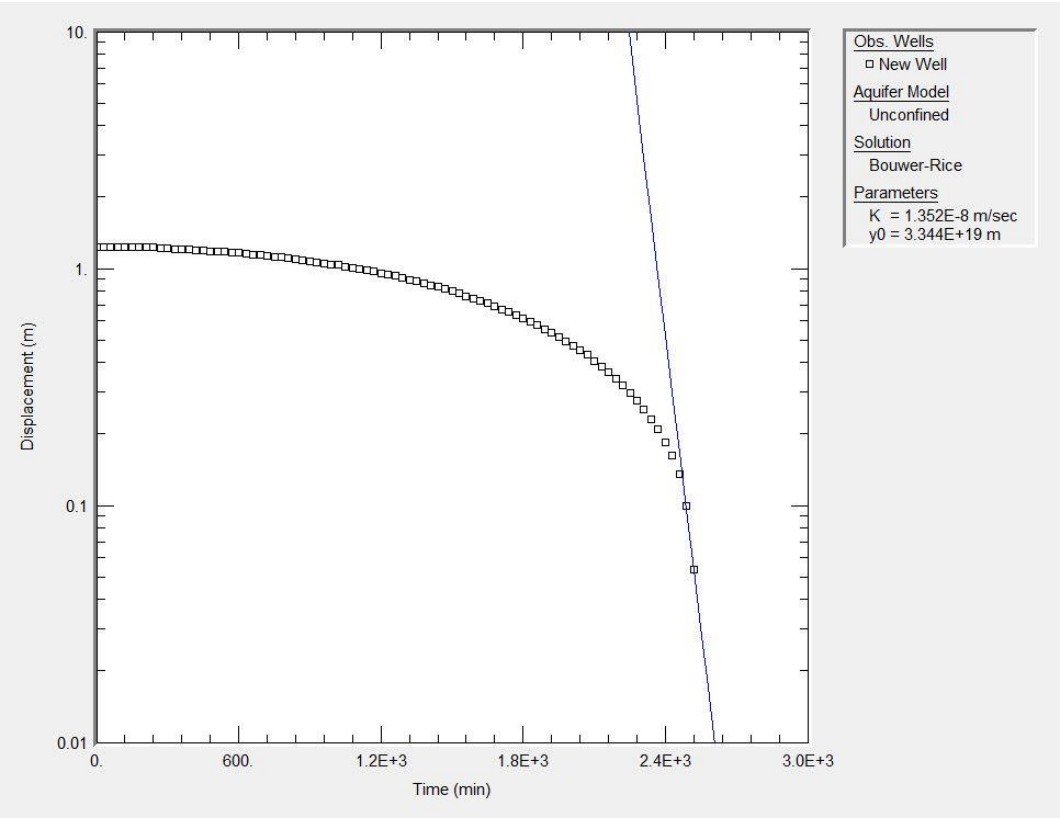
PZ25 – Falling Head Test – HV



PZ25 – Falling Head Test – Bouwer Rice



PZ47 – Rising Head Test – HV



PZ47 – Rising Head Test – Bouwer Rice

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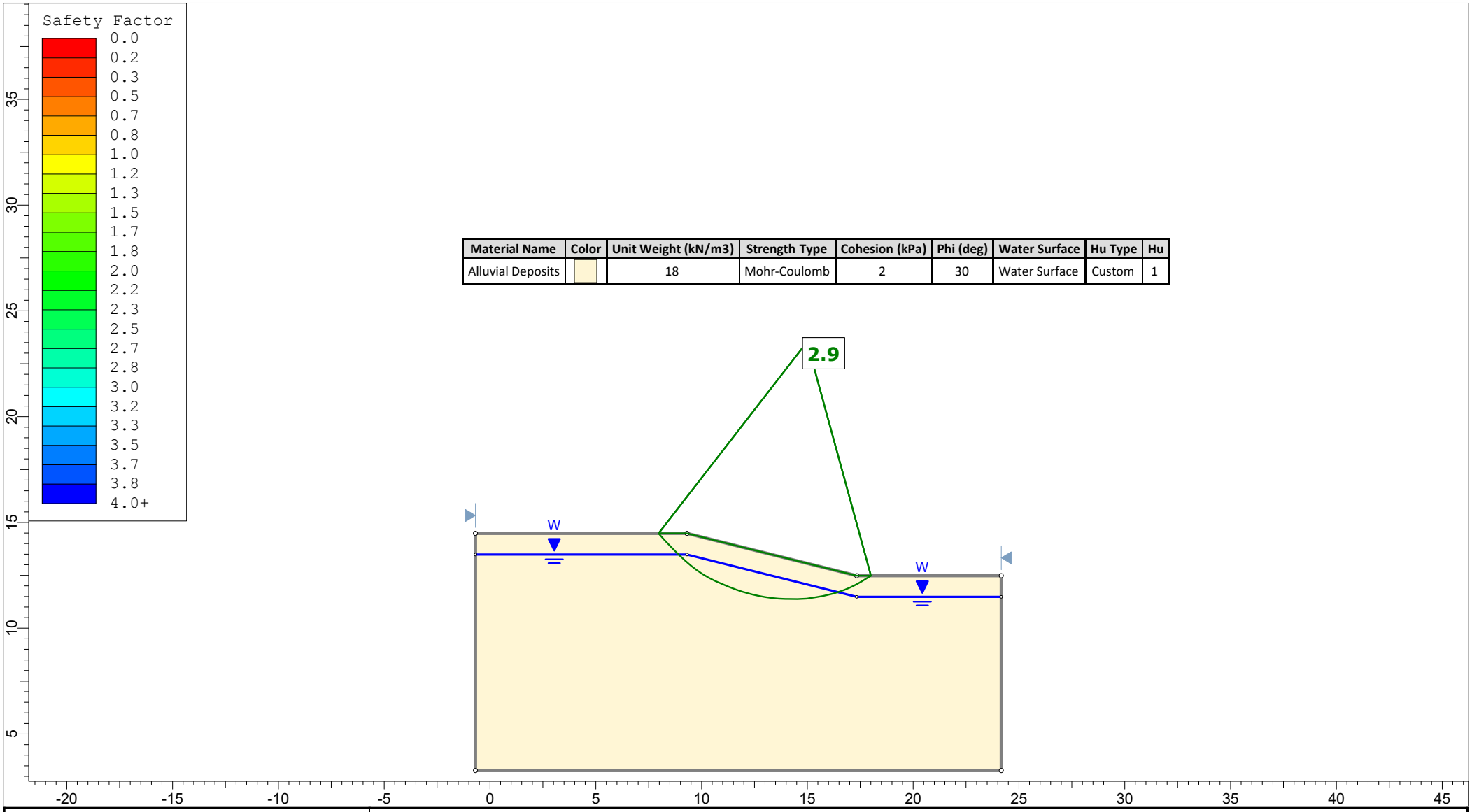
Appendix E

Stability Analysis Results



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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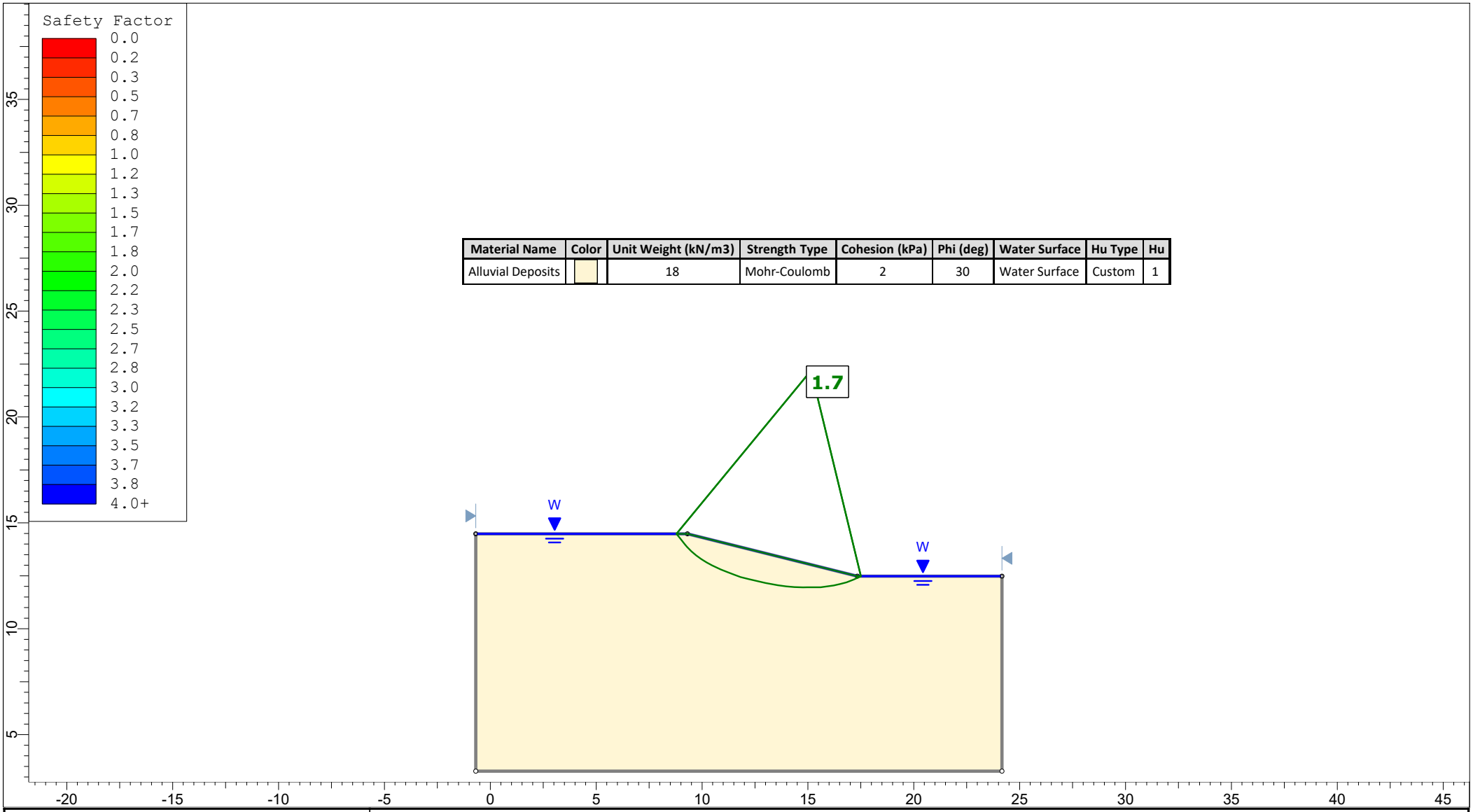
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa		
Analysis	220489 - 14Deg Slope - 2m Height	*Scenario*	Measured Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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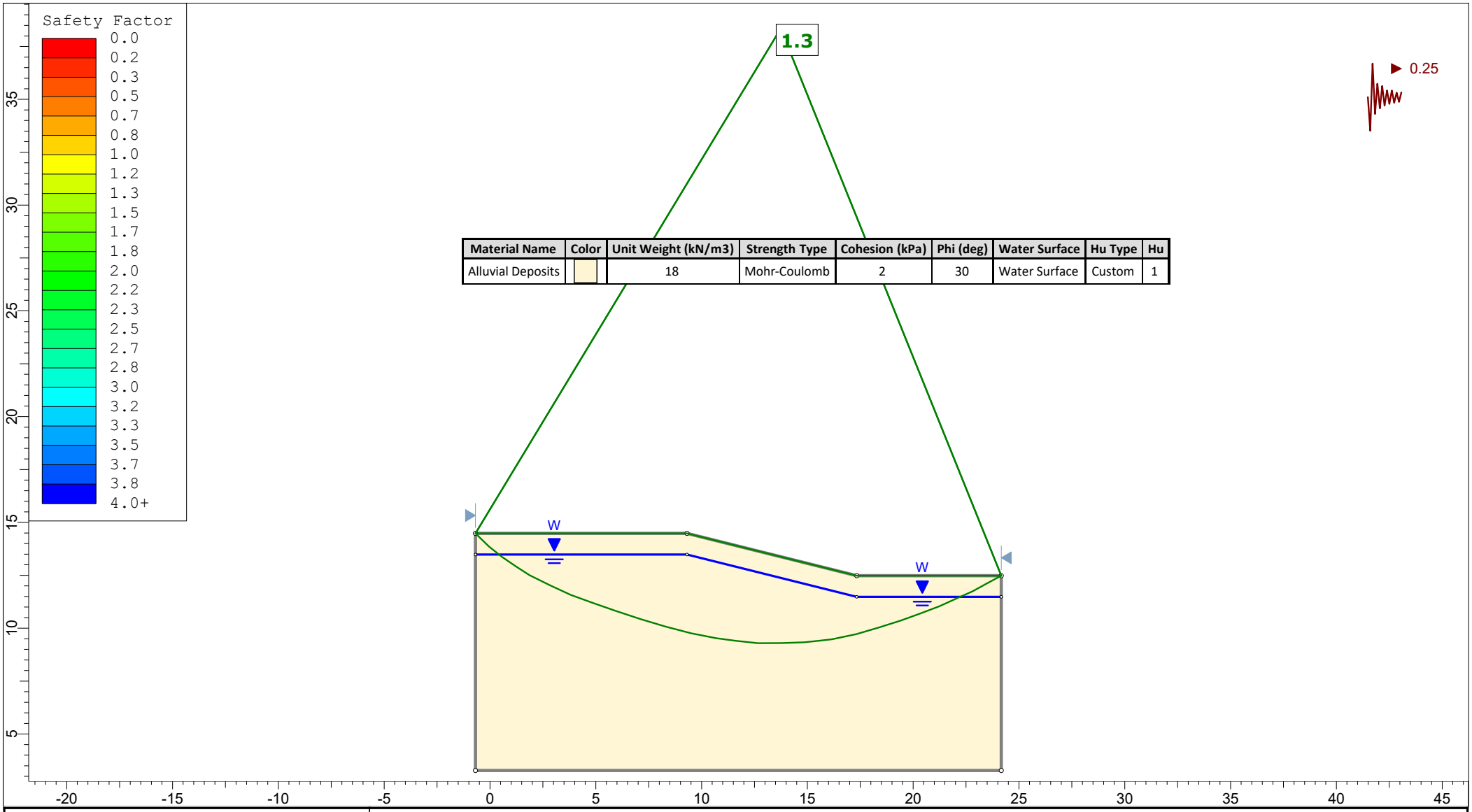
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa		
Analysis	220489 - 14Deg Slope - 2m Height	*Scenario*	Extreme (Worst Credible) Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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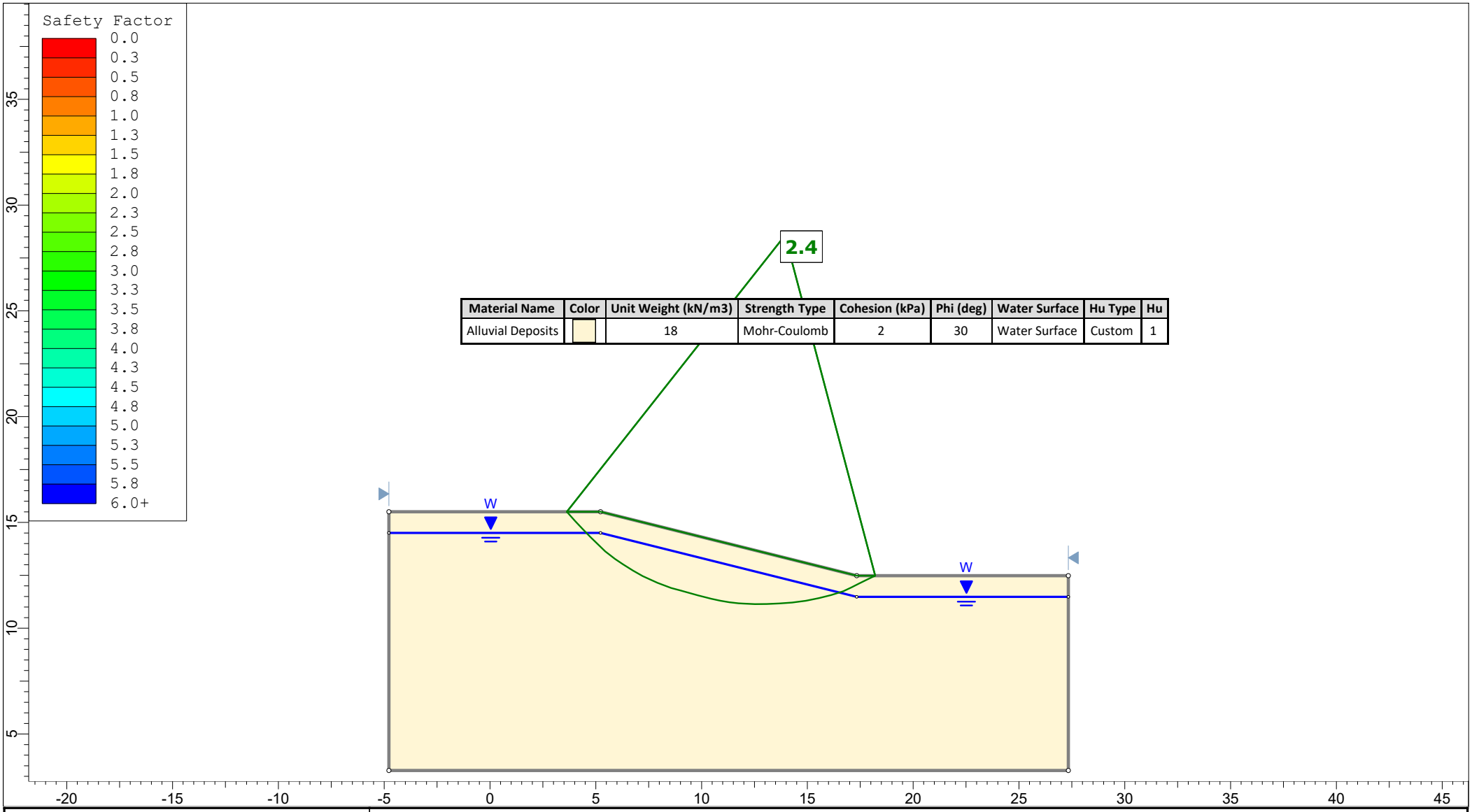
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa		
Analysis	220489 - 14Deg Slope - 2m Height	*Scenario*	Seismic Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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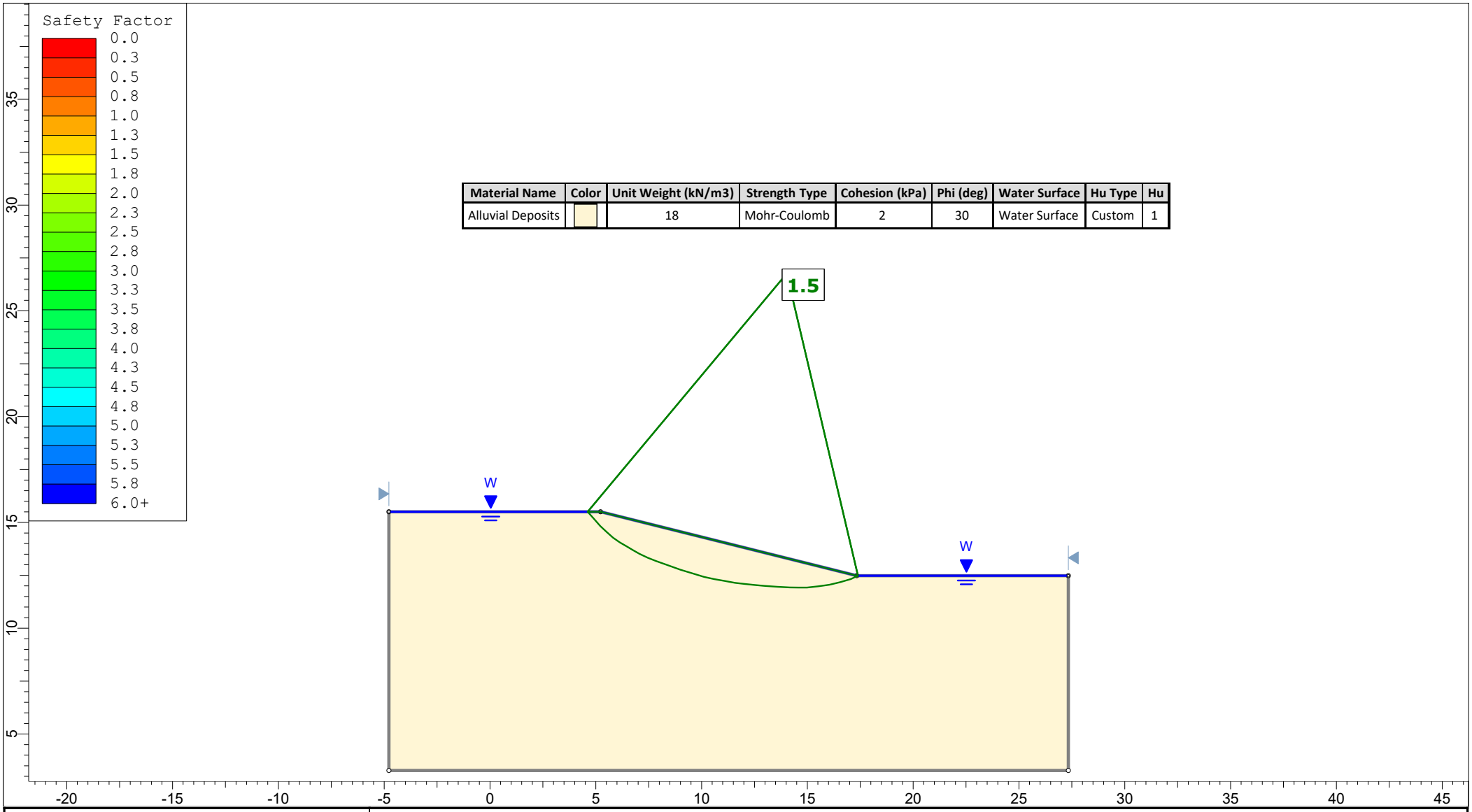
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa		
Analysis	220489 - 14Deg Slope - 3m Height	*Scenario*	Measured Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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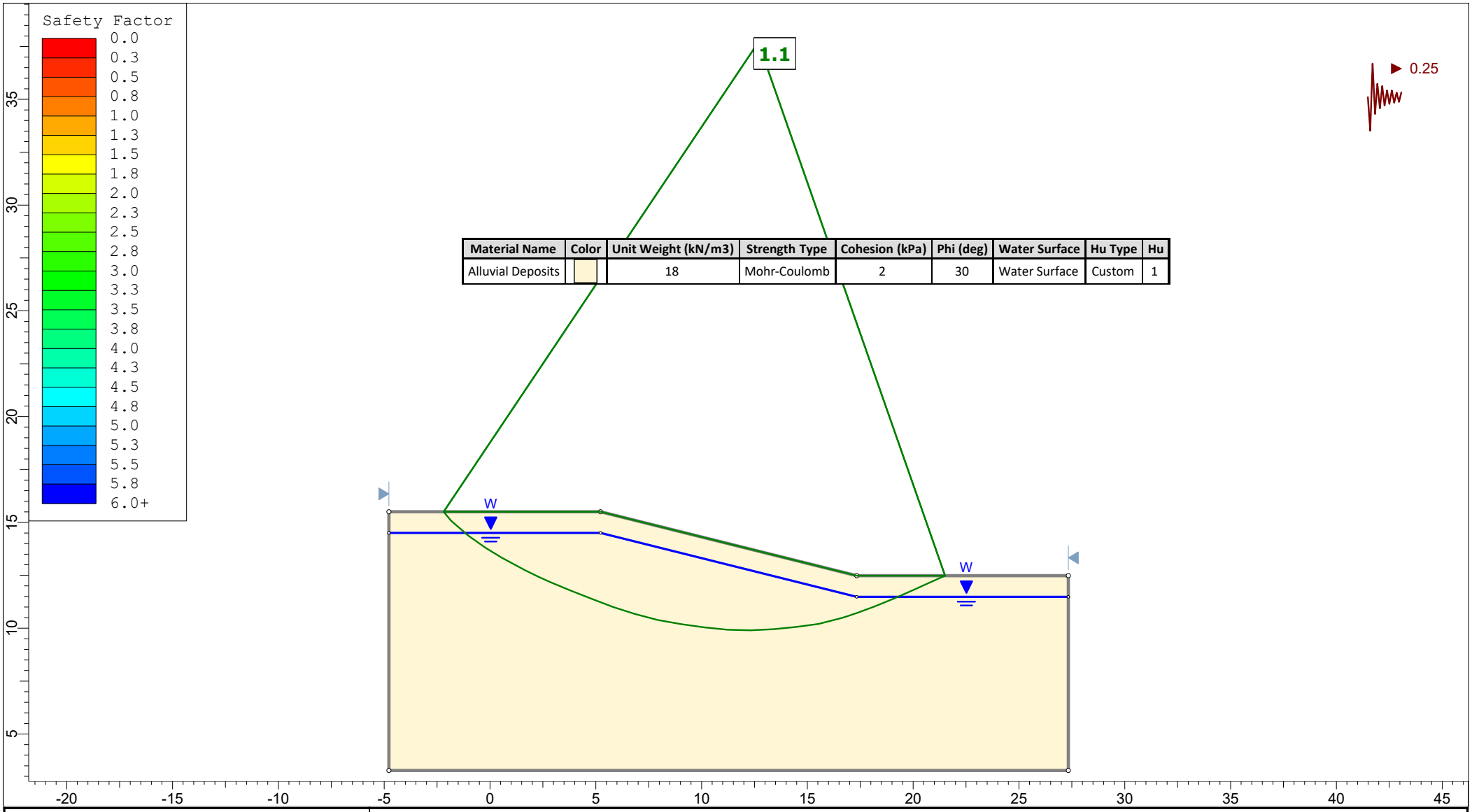
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa		
Analysis	220489 - 14Deg Slope - 3m Height	*Scenario*	Extreme (Worst Credible) Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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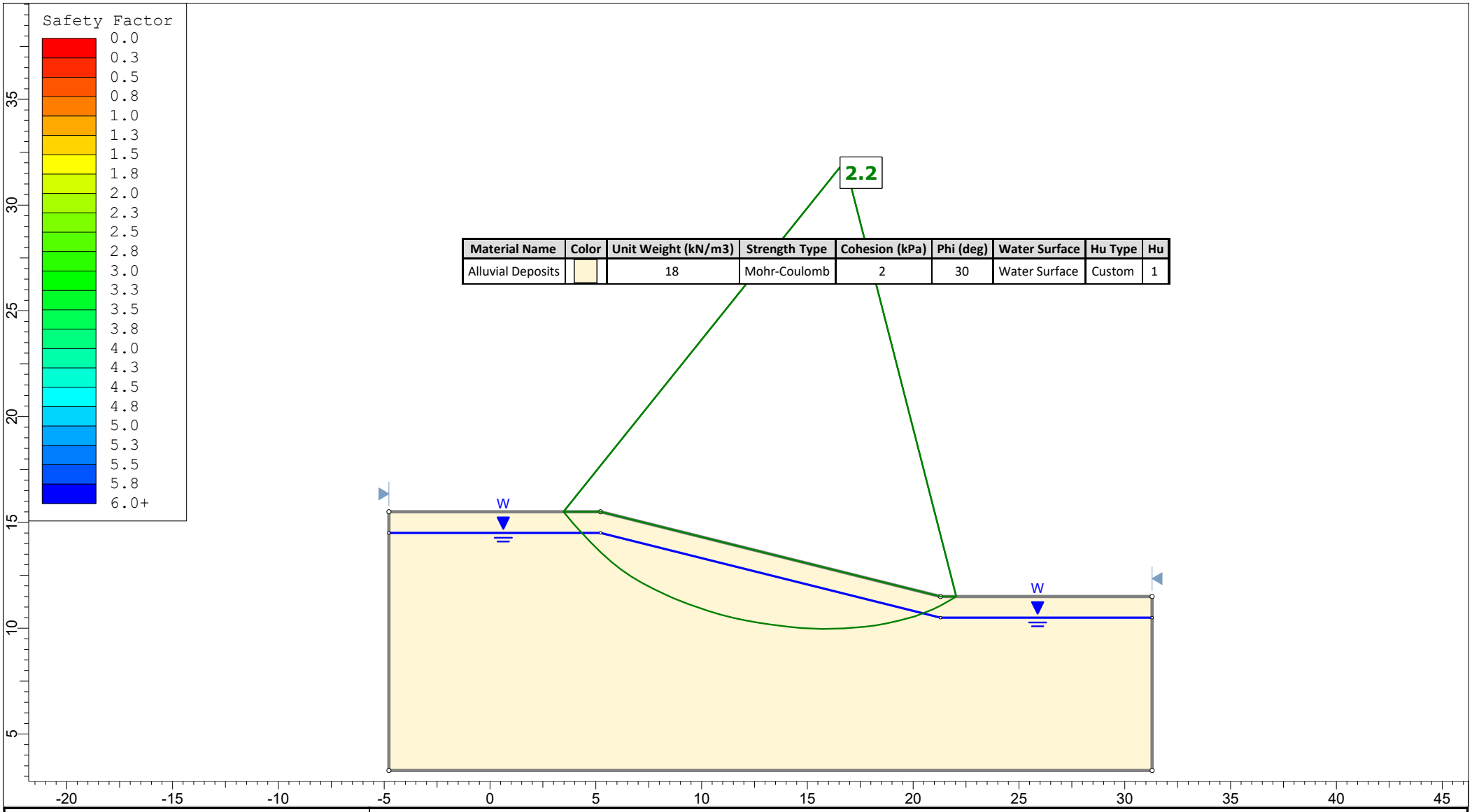
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa		
Analysis	220489 - 14Deg Slope - 3m Height	*Scenario*	Seismic Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



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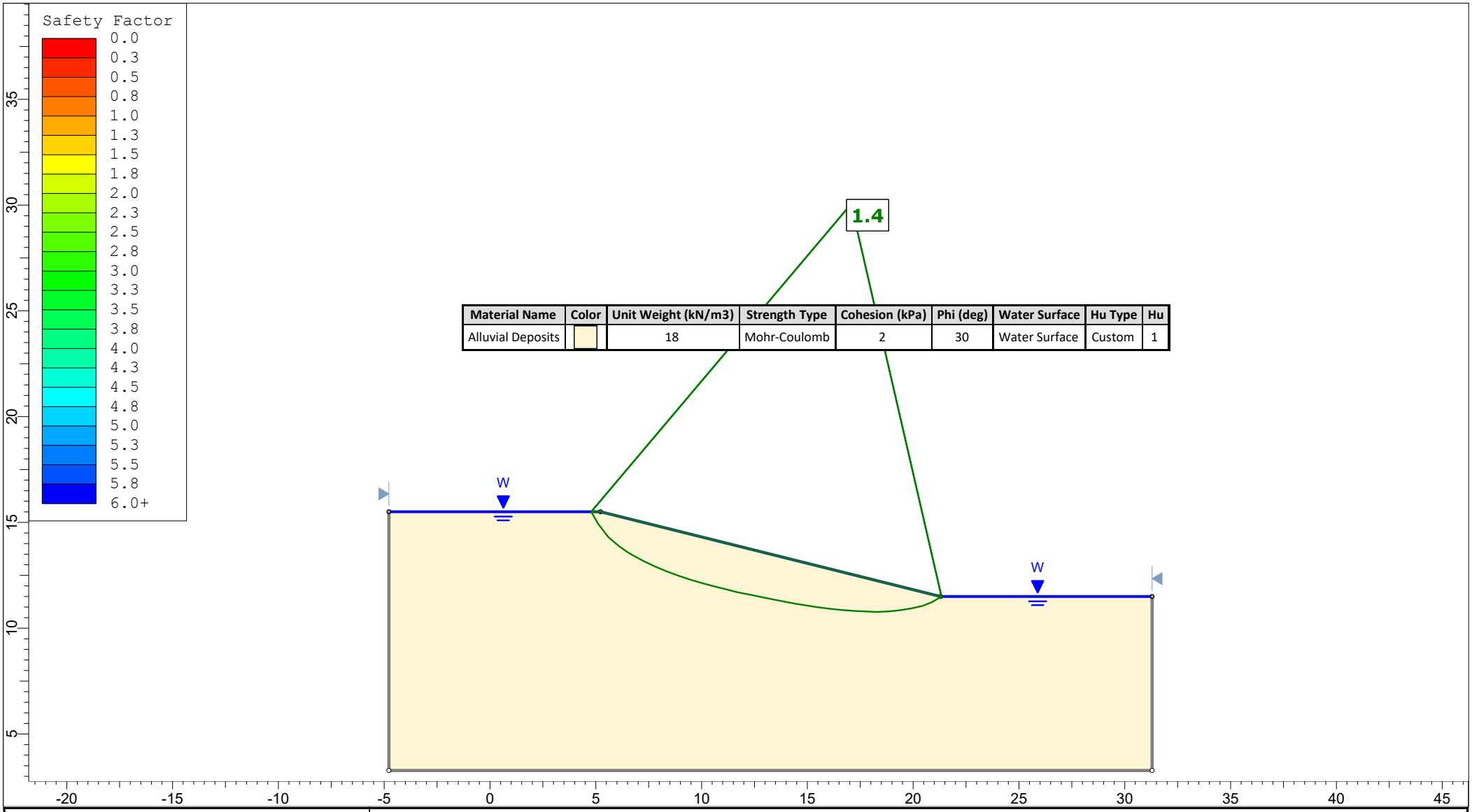
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa		
Analysis	220489 - 14Deg Slope - 4m Height	*Scenario*	Measured Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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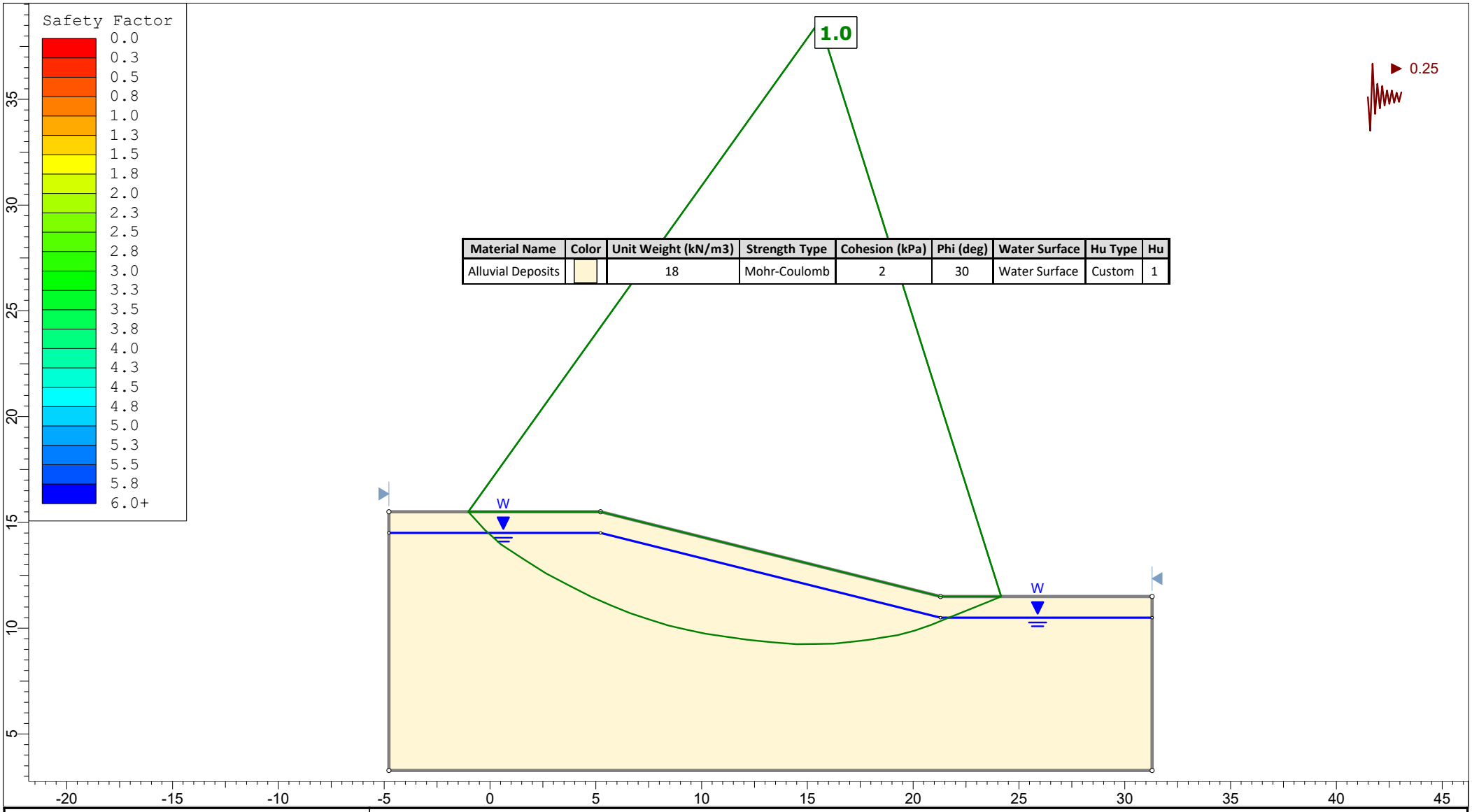
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa		
Analysis	220489 - 14Deg Slope - 4m Height	*Scenario*	Extreme (Worst Credible) Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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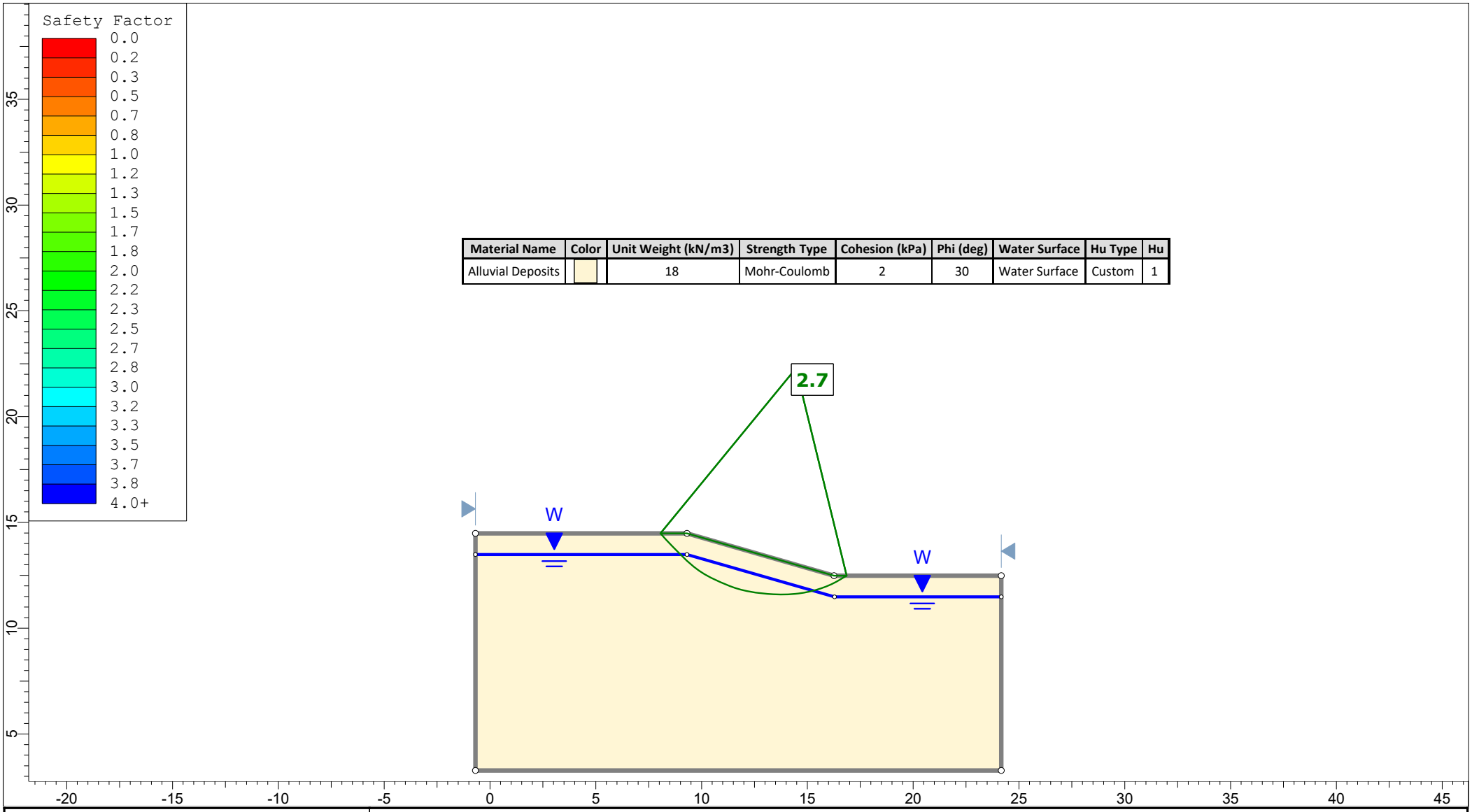
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa		
Analysis	220489 - 14Deg Slope - 4m Height	*Scenario*	Seismic Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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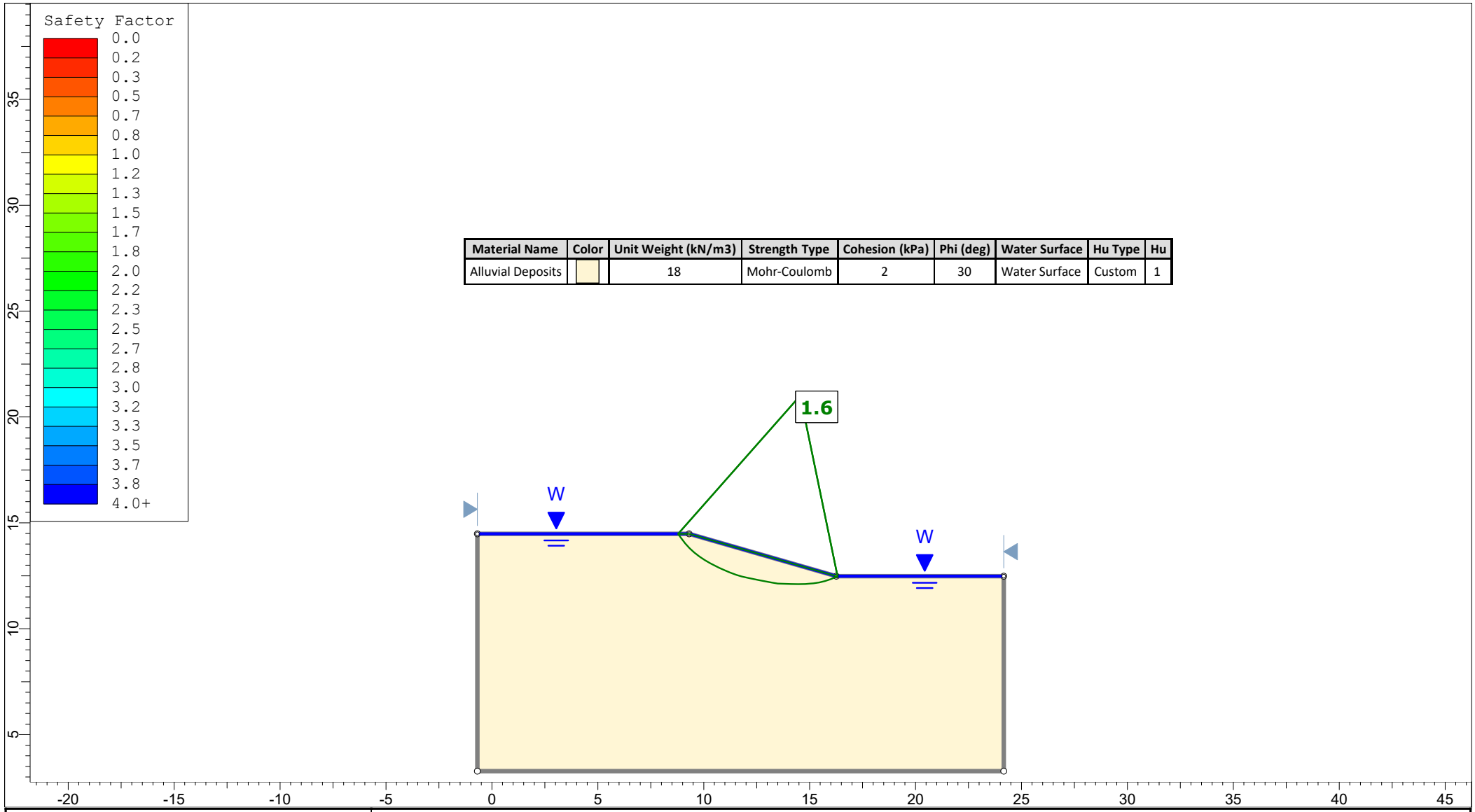
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa, 1314 Te Rapa Rd, Hamilton		
Analysis	220489 - 16Deg Slope - 2m Height	*Scenario*	Measured Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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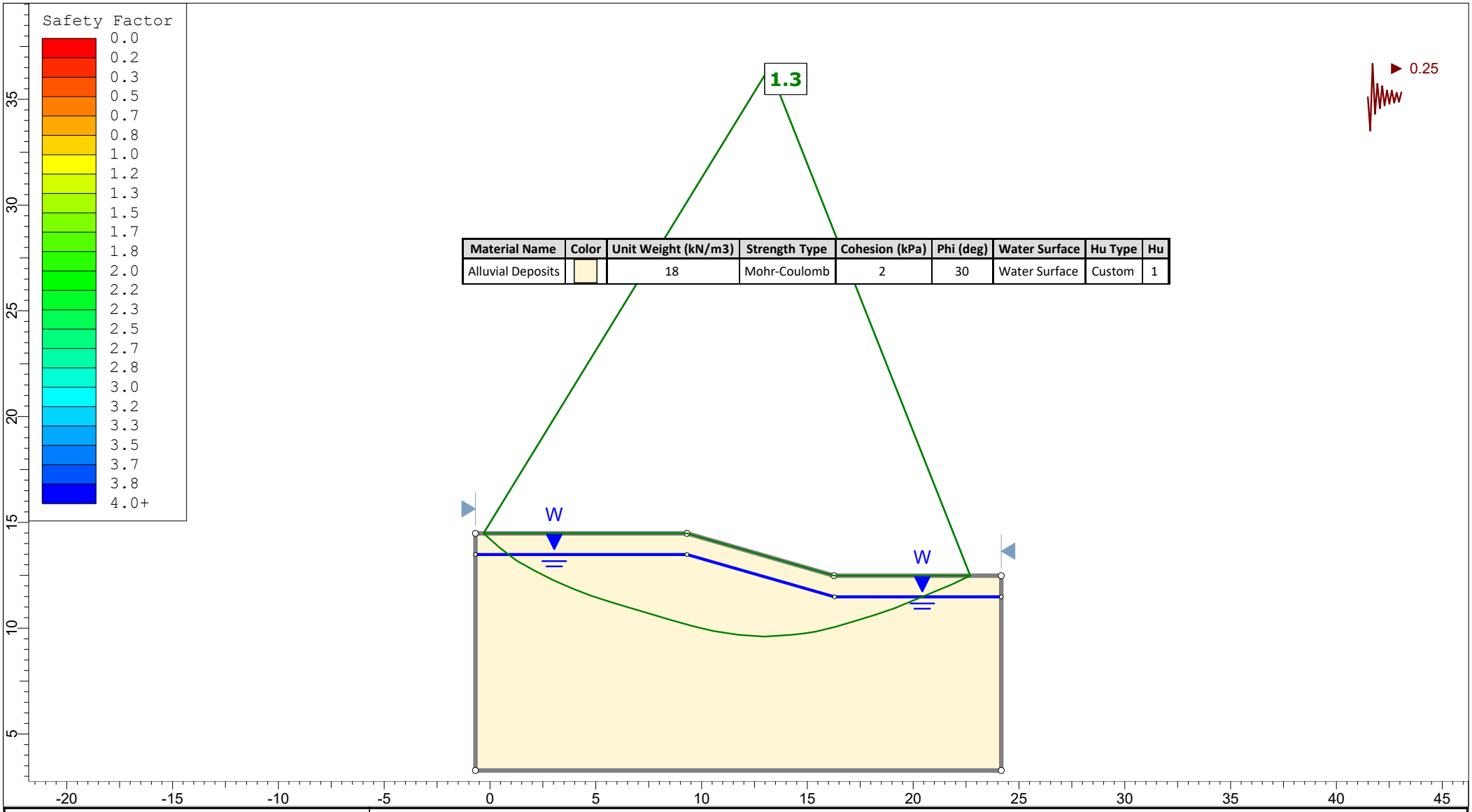
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa, 1314 Te Rapa Rd, Hamilton		
Analysis	220489 - 16Deg Slope - 2m Height	*Scenario*	Extreme (Worst Credible) Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



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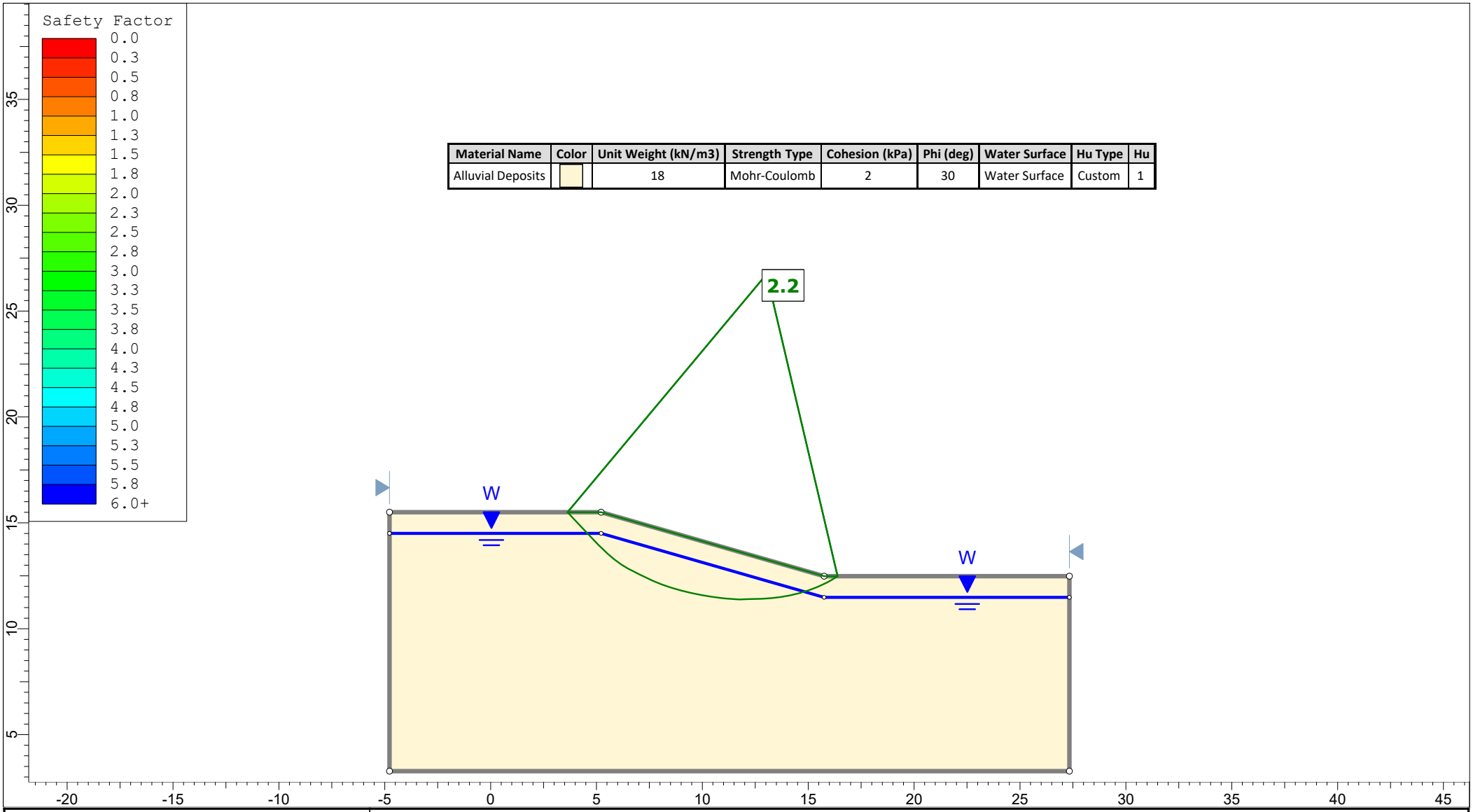
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa, 1314 Te Rapa Rd, Hamilton		
Analysis	220489 - 16Deg Slope - 2m Height	*Scenario*	Seismic Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu
Alluvial Deposits		18	Mohr-Coulomb	2	30	Water Surface	Custom	1

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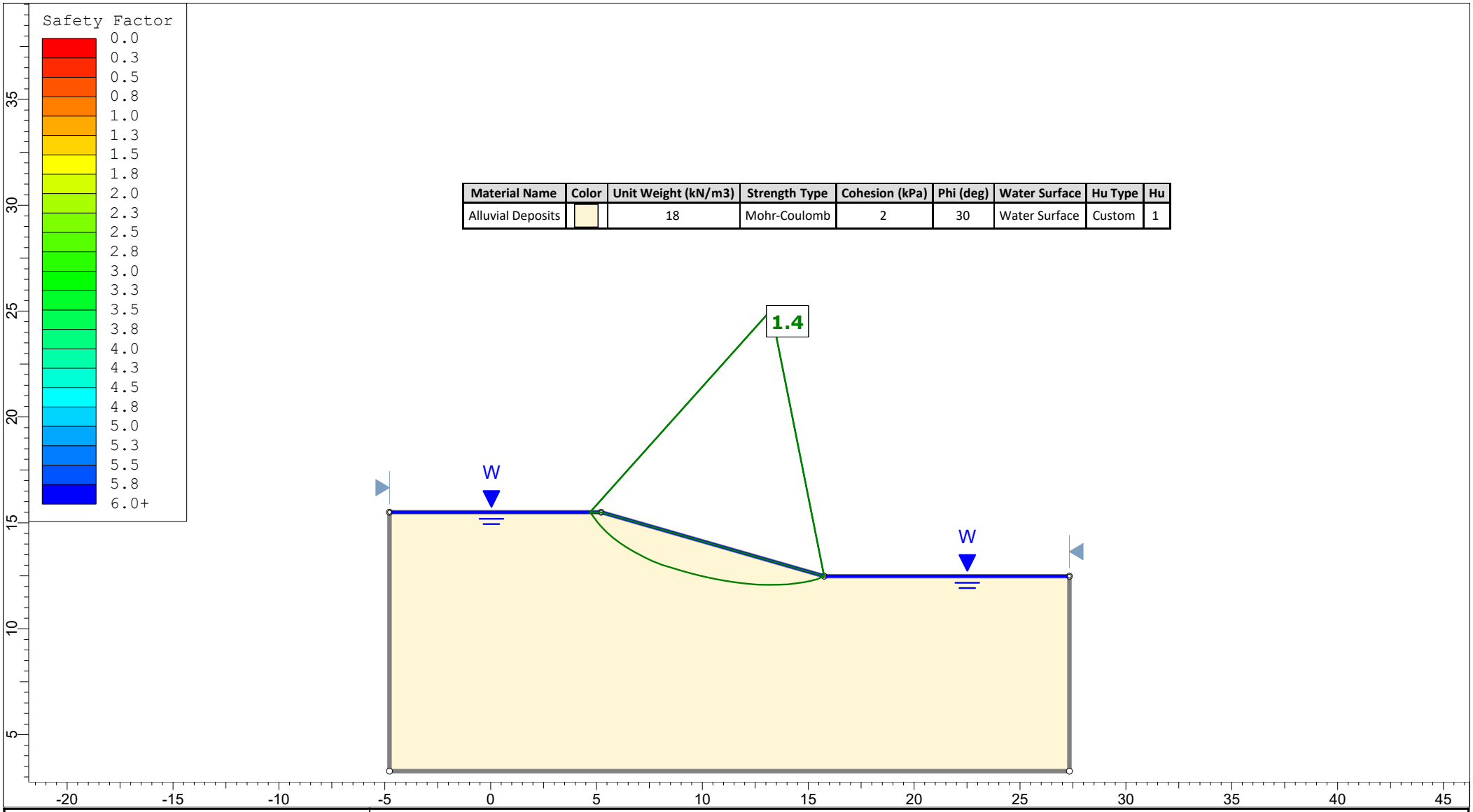
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa, 1314 Te Rapa Rd, Hamilton		
Analysis	220489 - 16Deg Slope - 3m Height	*Scenario*	Measured Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



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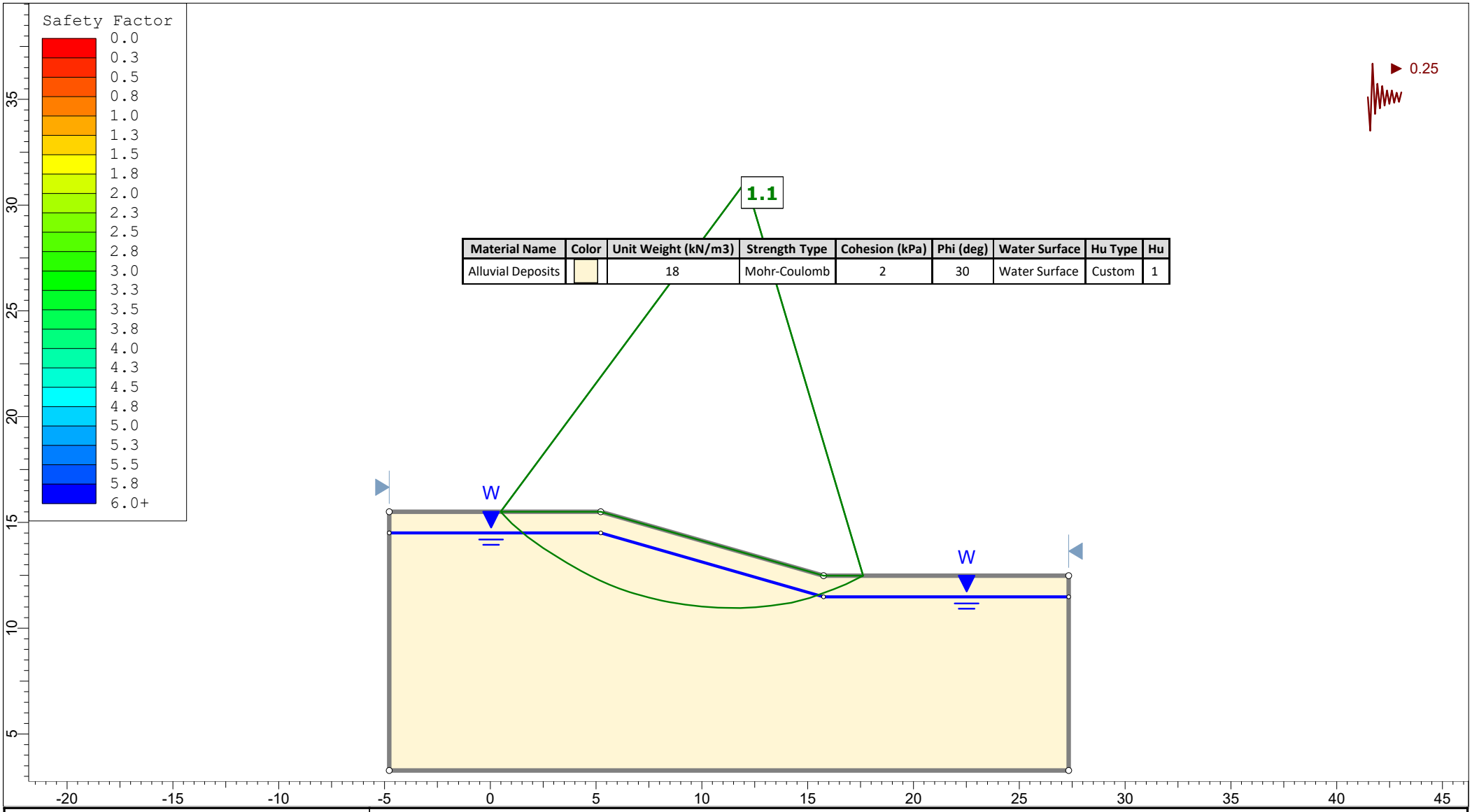
Project	Fonterra Te Rapa, 1314 Te Rapa Rd, Hamilton		
Analysis	220489 - 16Deg Slope - 3m Height	*Scenario*	Extreme (Worst Credible) Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



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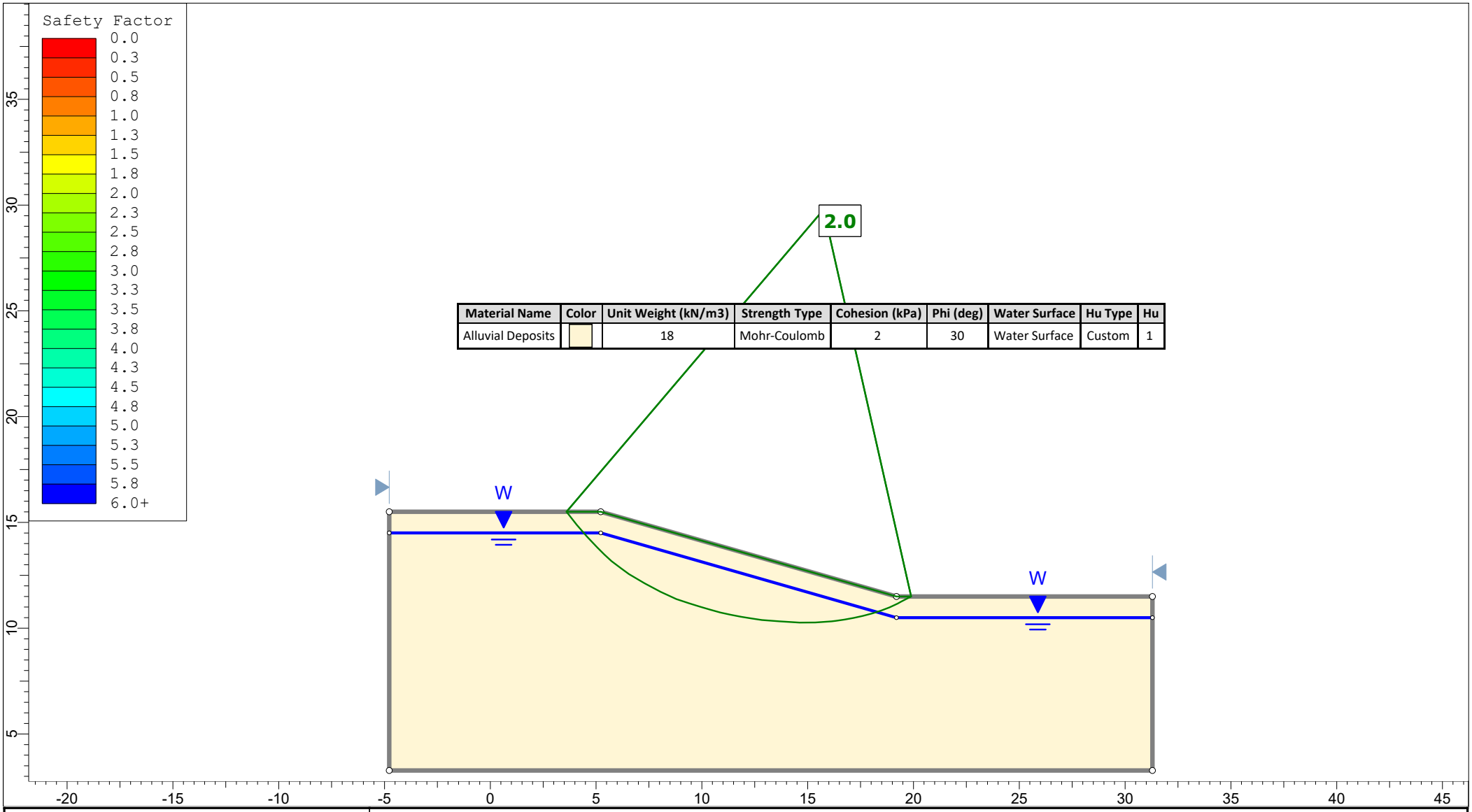

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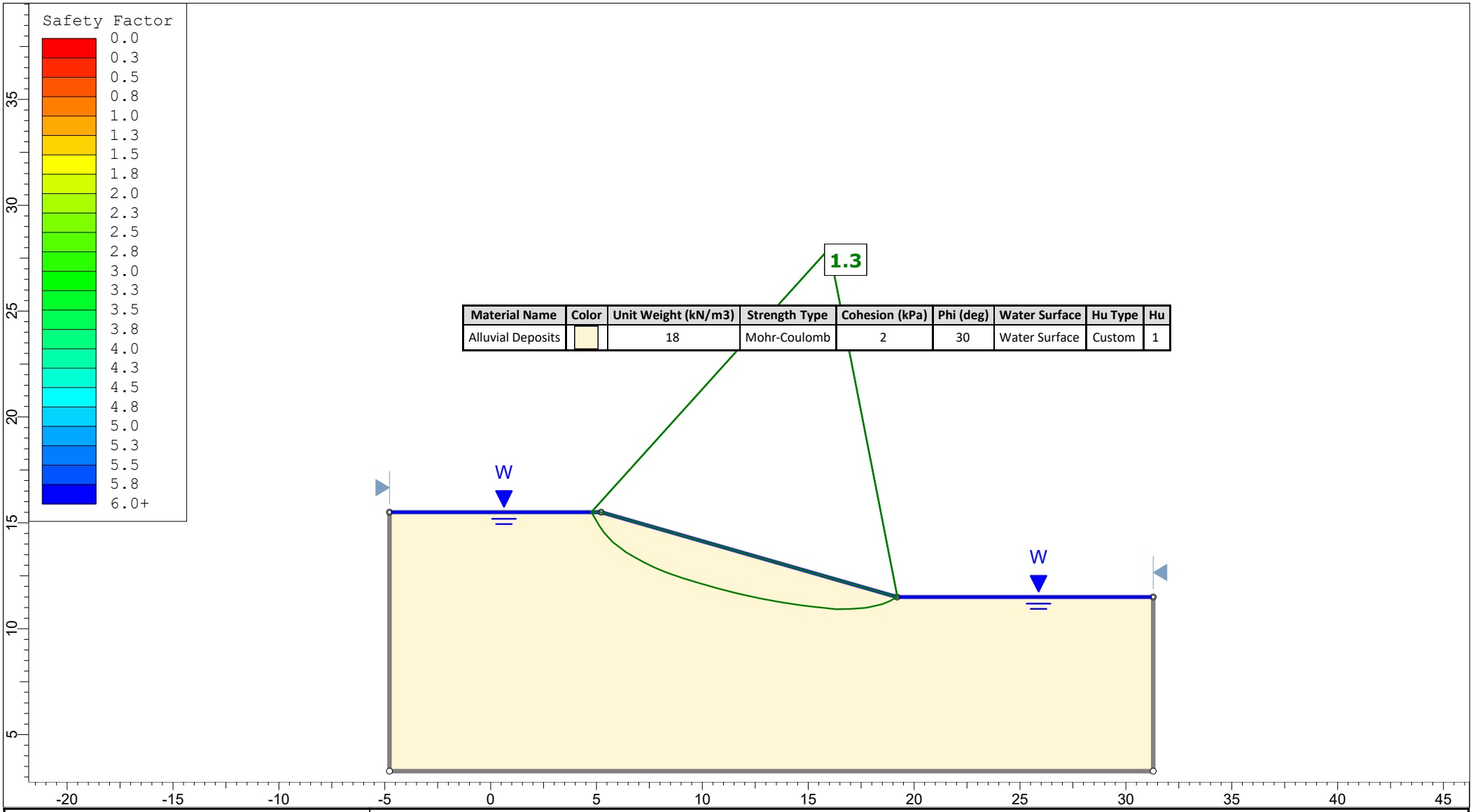
SLIDEINTERPRET 9.016

Project	Fonterra Te Rapa, 1314 Te Rapa Rd, Hamilton		
Analysis	220489 - 16Deg Slope - 4m Height	*Scenario*	Measured Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
Date	Sept 2023	*Scale*	1:250



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Analysis	220489 - 16Deg Slope - 4m Height	*Scenario*	Extreme (Worst Credible) Groundwater Condition
Drawn By	B.SMITH	*Company*	Soil & Rock Consultants
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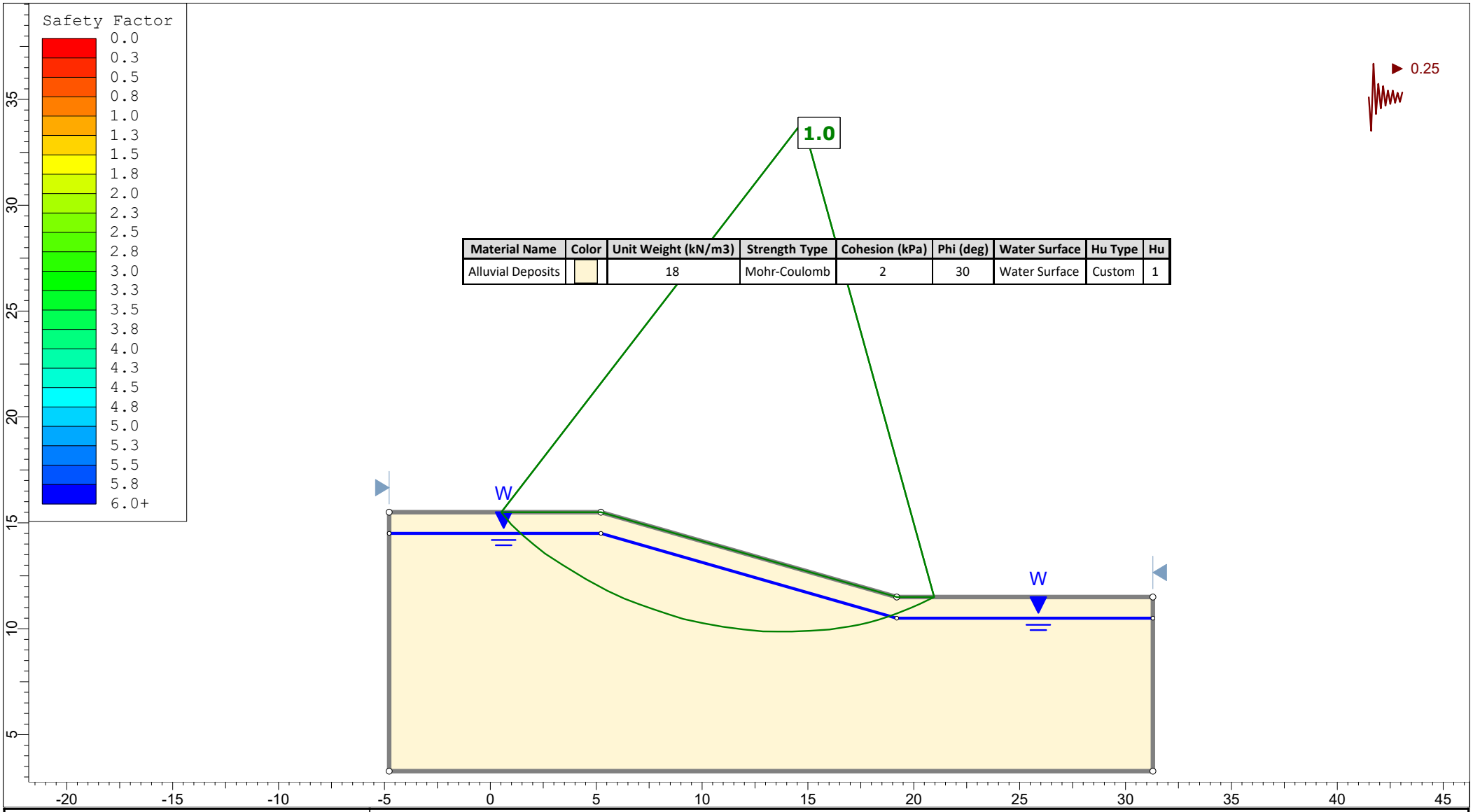

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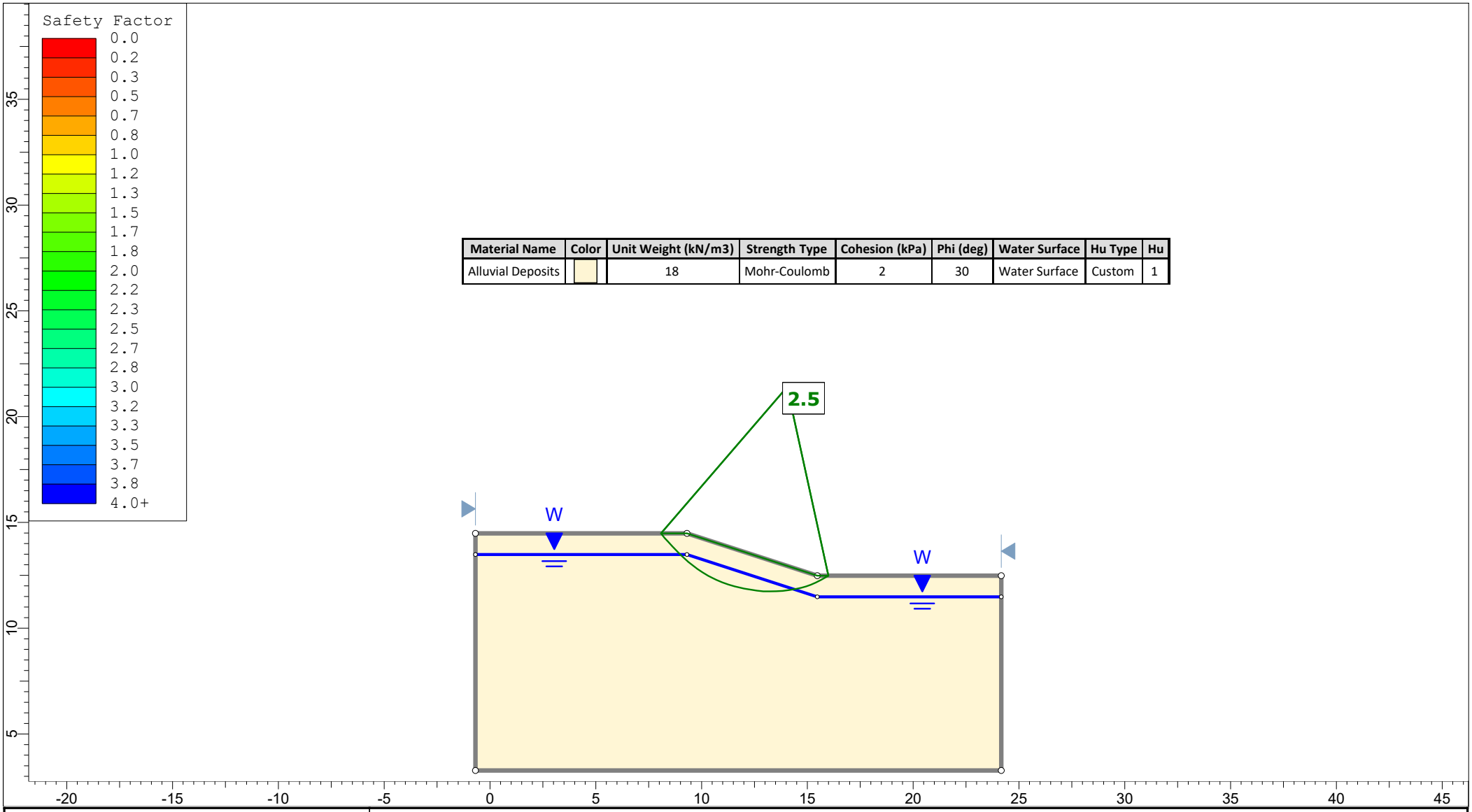

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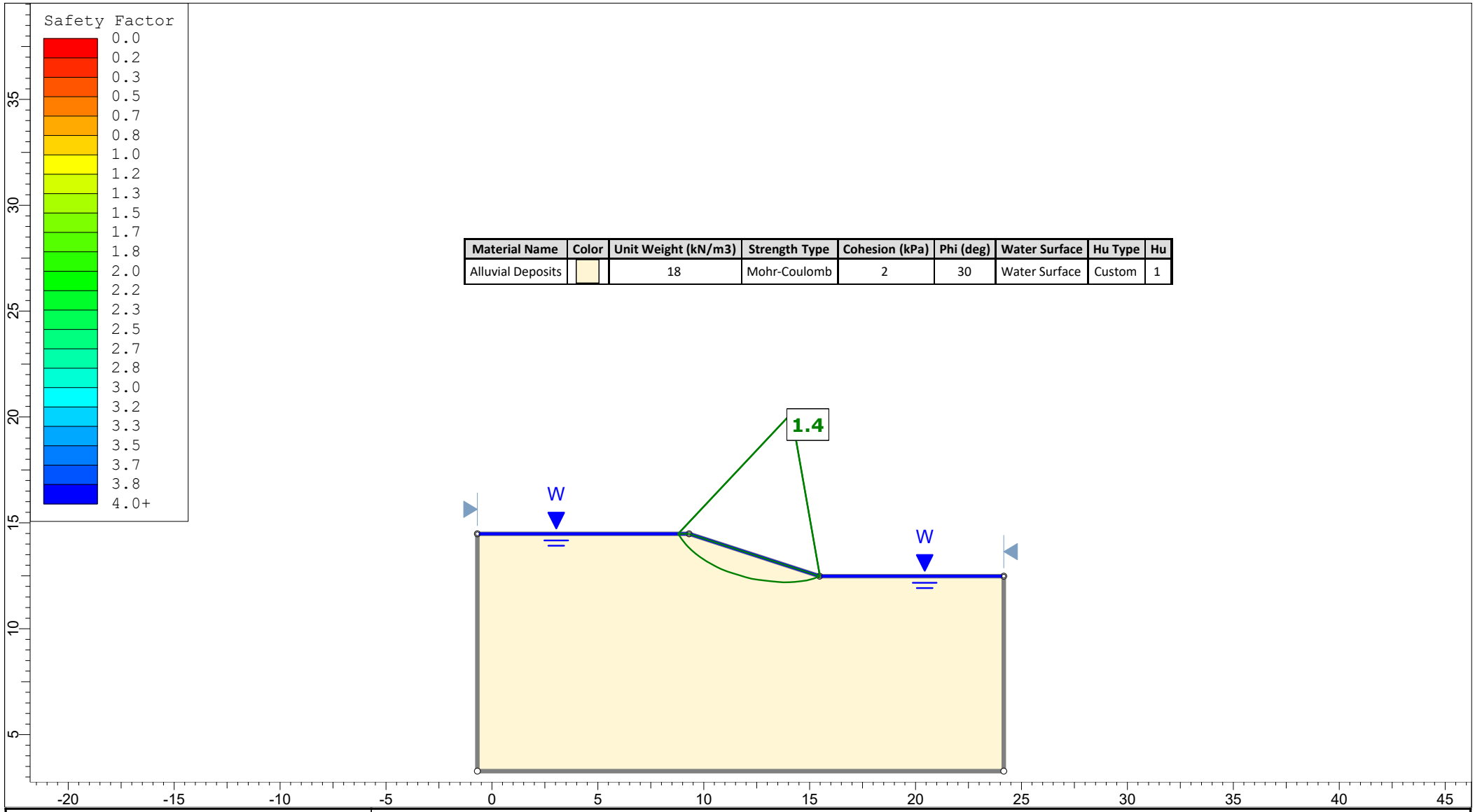

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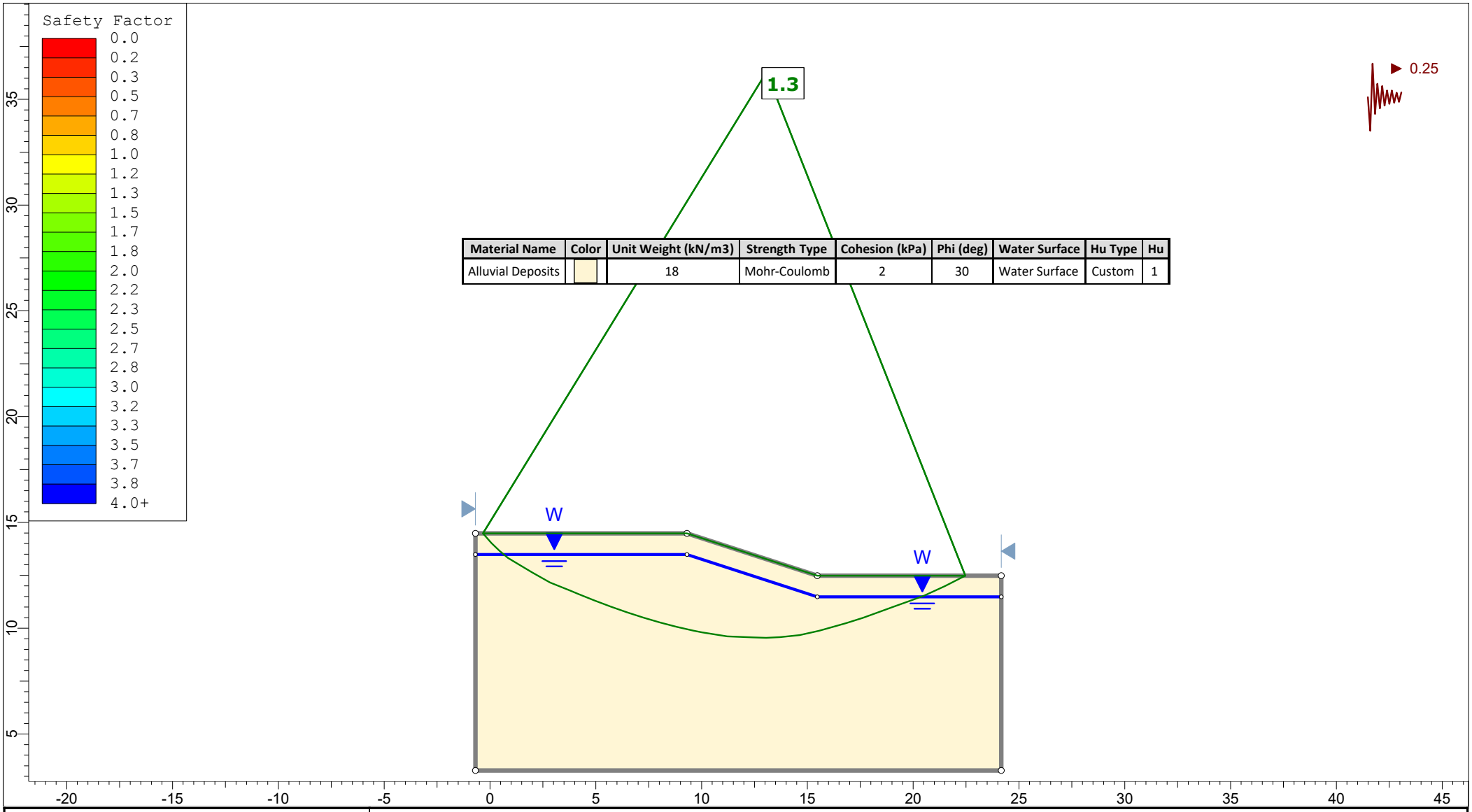

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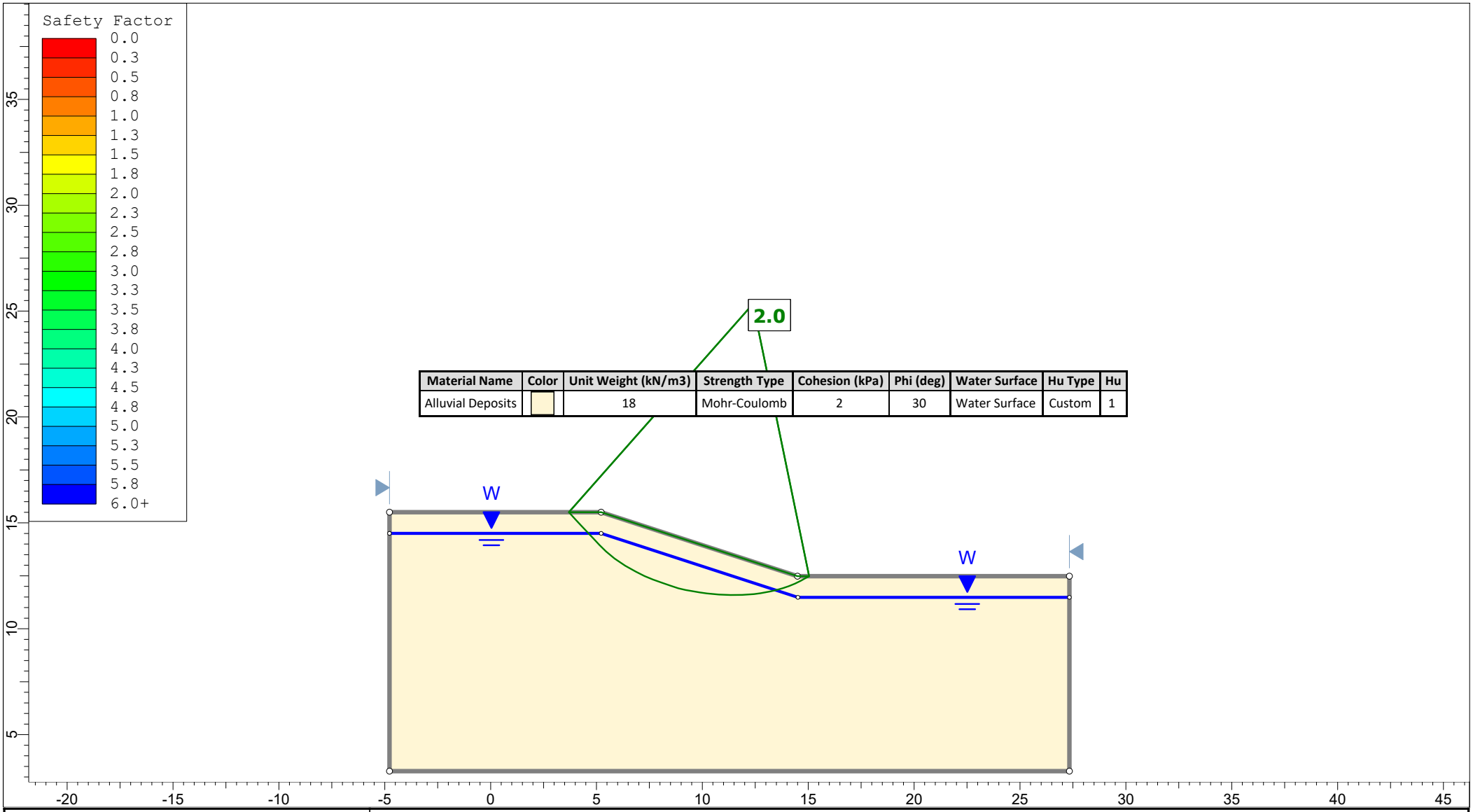

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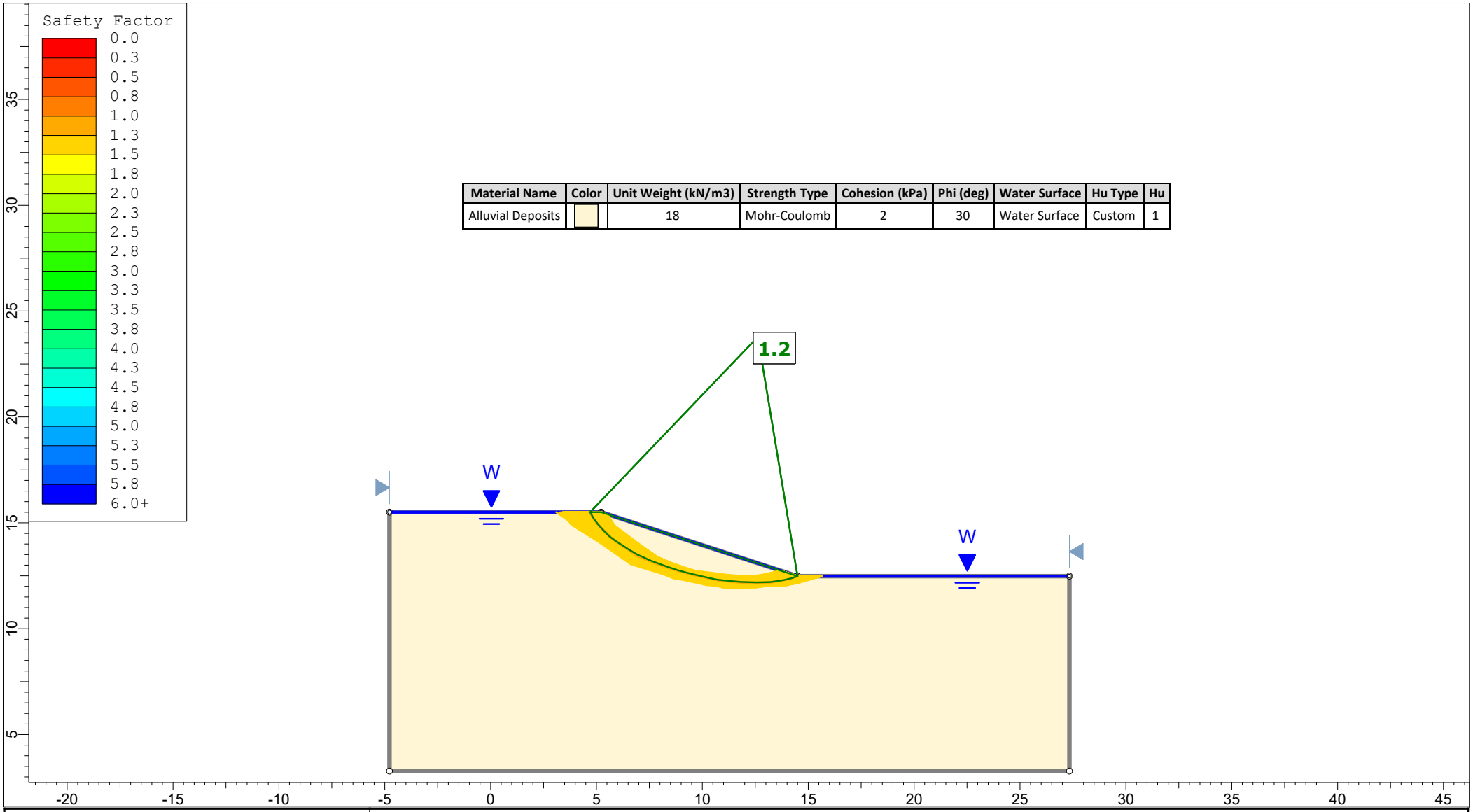

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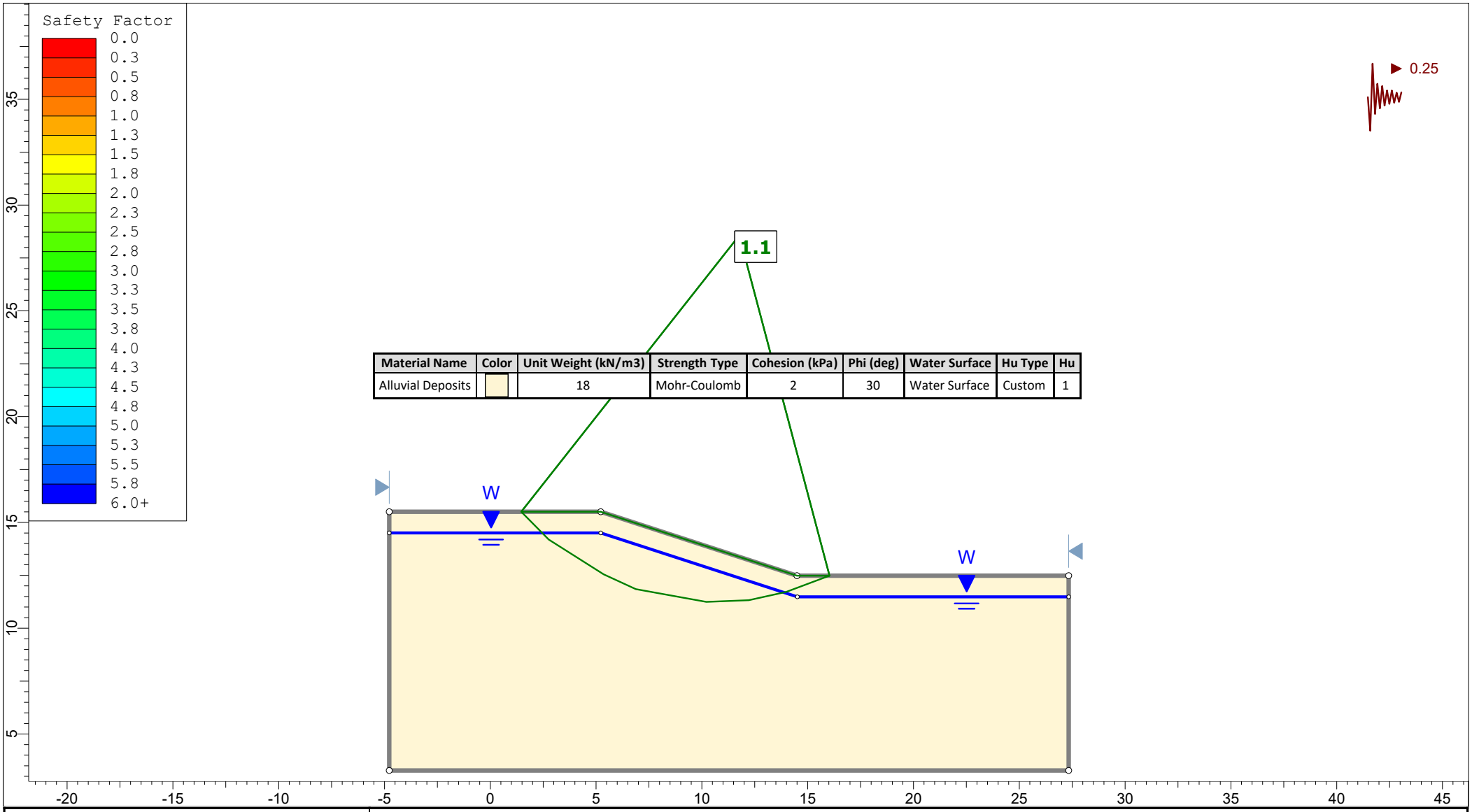

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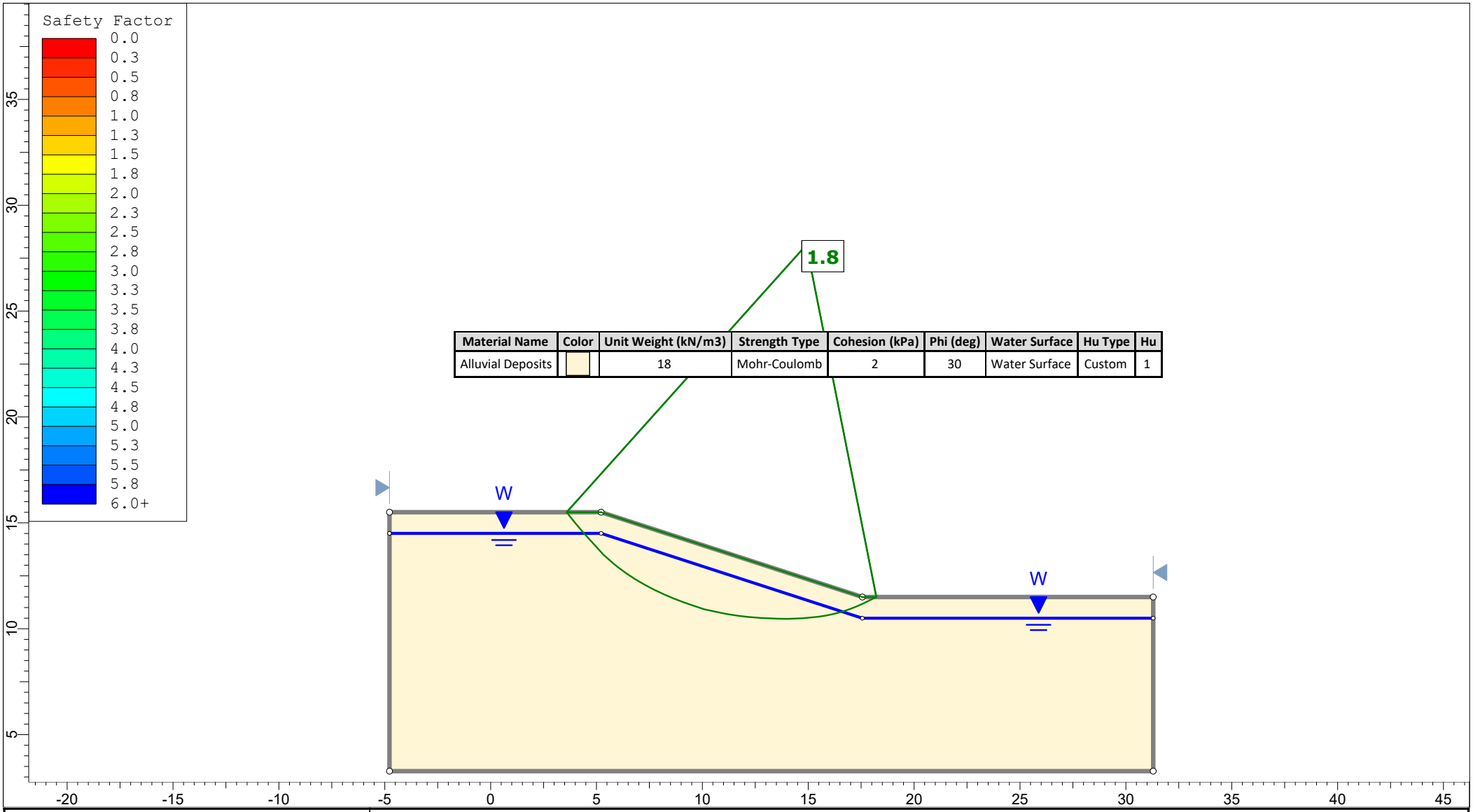

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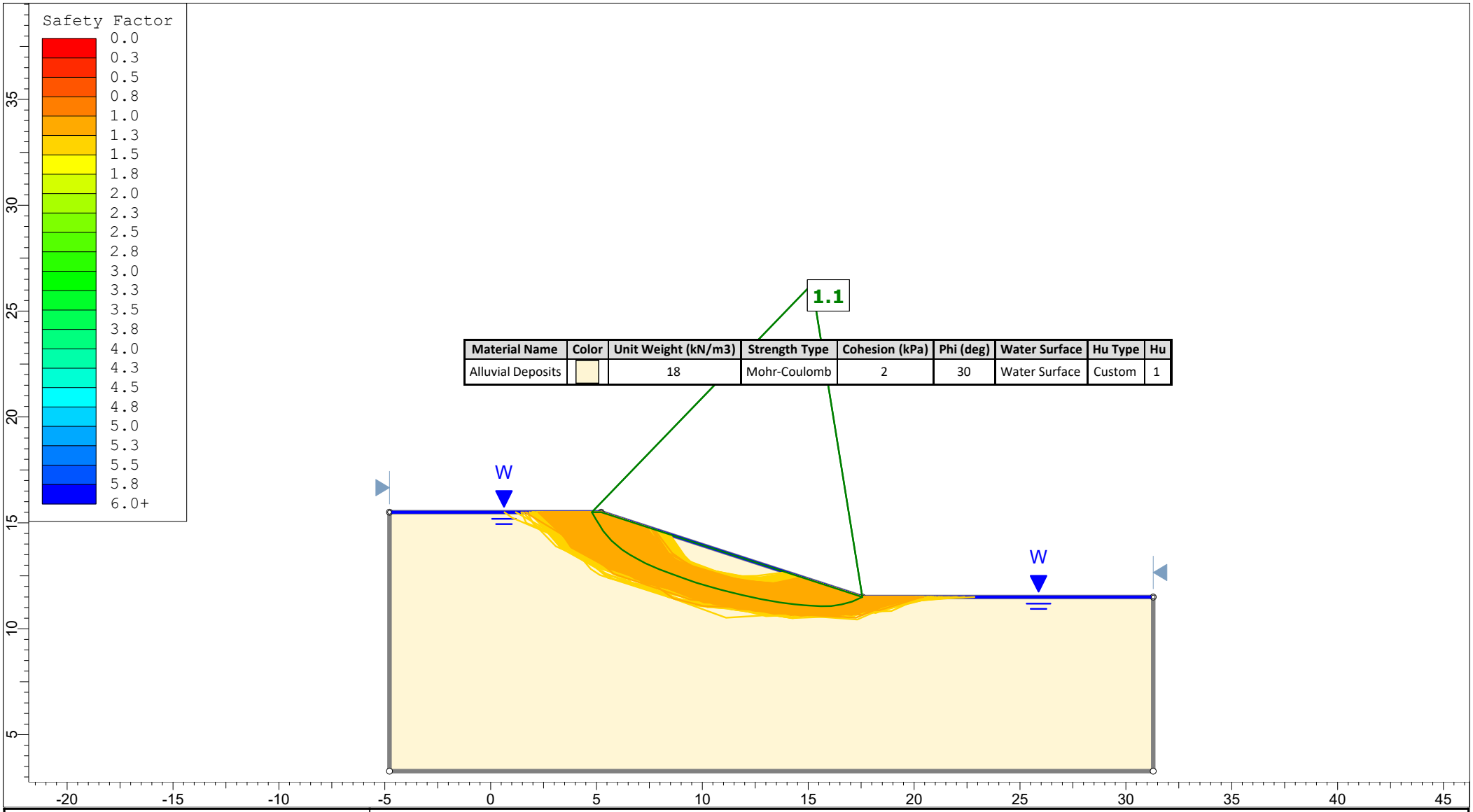

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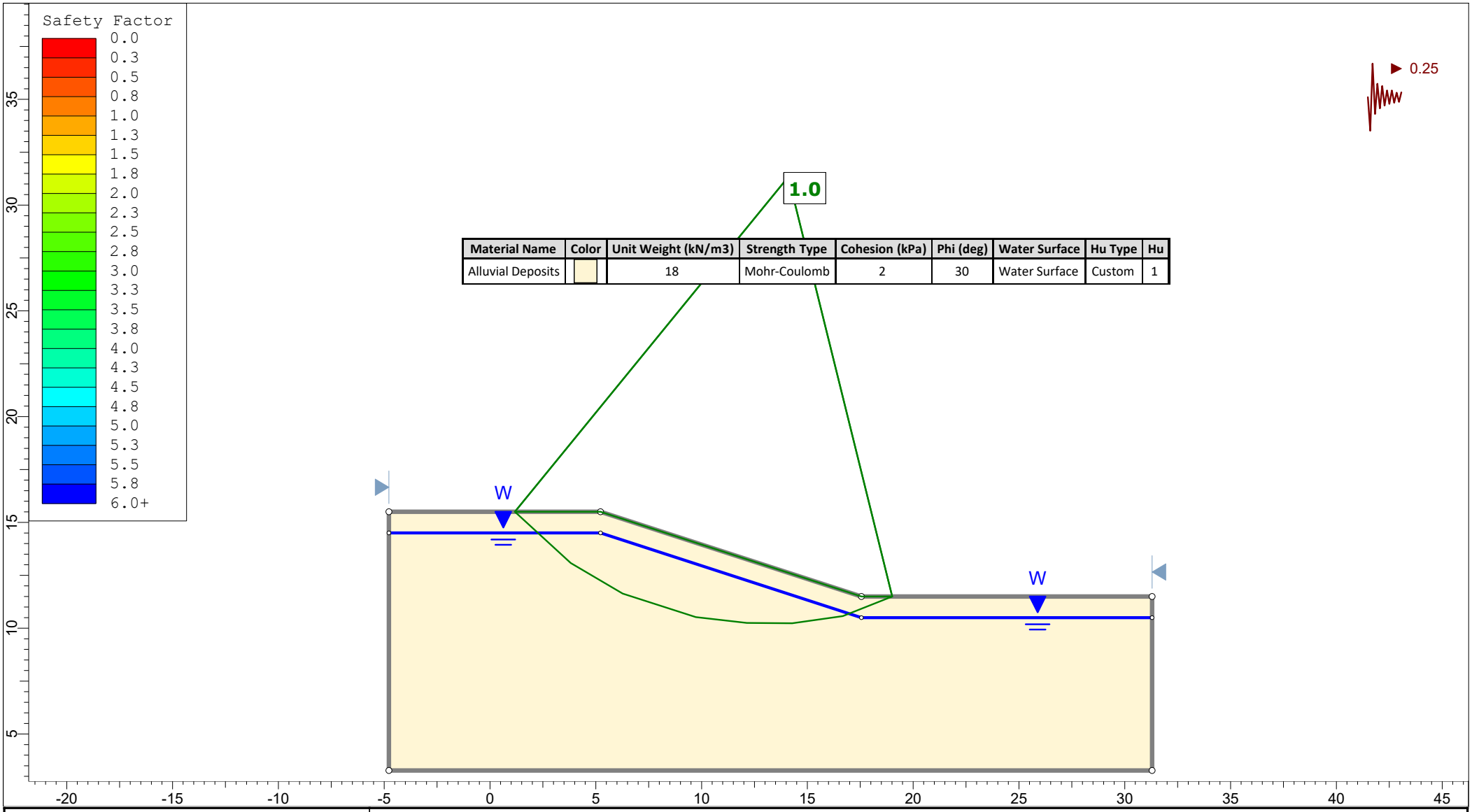

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