11 February 2022

# PENCARROW ESTATE

# 1491 STATE HIGHWAY 2, PONGAKAWA

# GEOTECHNICAL INVESTIGATION REPORT FOR PLAN CHANGE

Kevin and Andrea Marsh

TGA2021-0096AC Rev 0

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# 1 INTRODUCTION

CMW Geosciences (CMW) was engaged by Kevin and Andrea Marsh to carry out a geotechnical investigation of a rural site located at 1491 State Highway 2, Pongakawa, which is being considered for a residential plan change.

The scope of work and associated terms and conditions of our engagement were detailed in our services proposal Ref. TGA2021-0096AB Rev 0, dated 3 November 2021. The purpose of this report is to describe the investigation completed, the ground conditions encountered and to provide recommendations with respect to geotechnical considerations for the proposed plan change.

This report may be used as one of the documents to support a plan change application to Western Bay of Plenty District Council (WBoPDC).

# 2 SITE DESCRIPTION

## 2.1 Site Location

The site comprises an area of approximately 8.8ha and is located at 1491 State Highway 2 as shown on Figure 1 below.

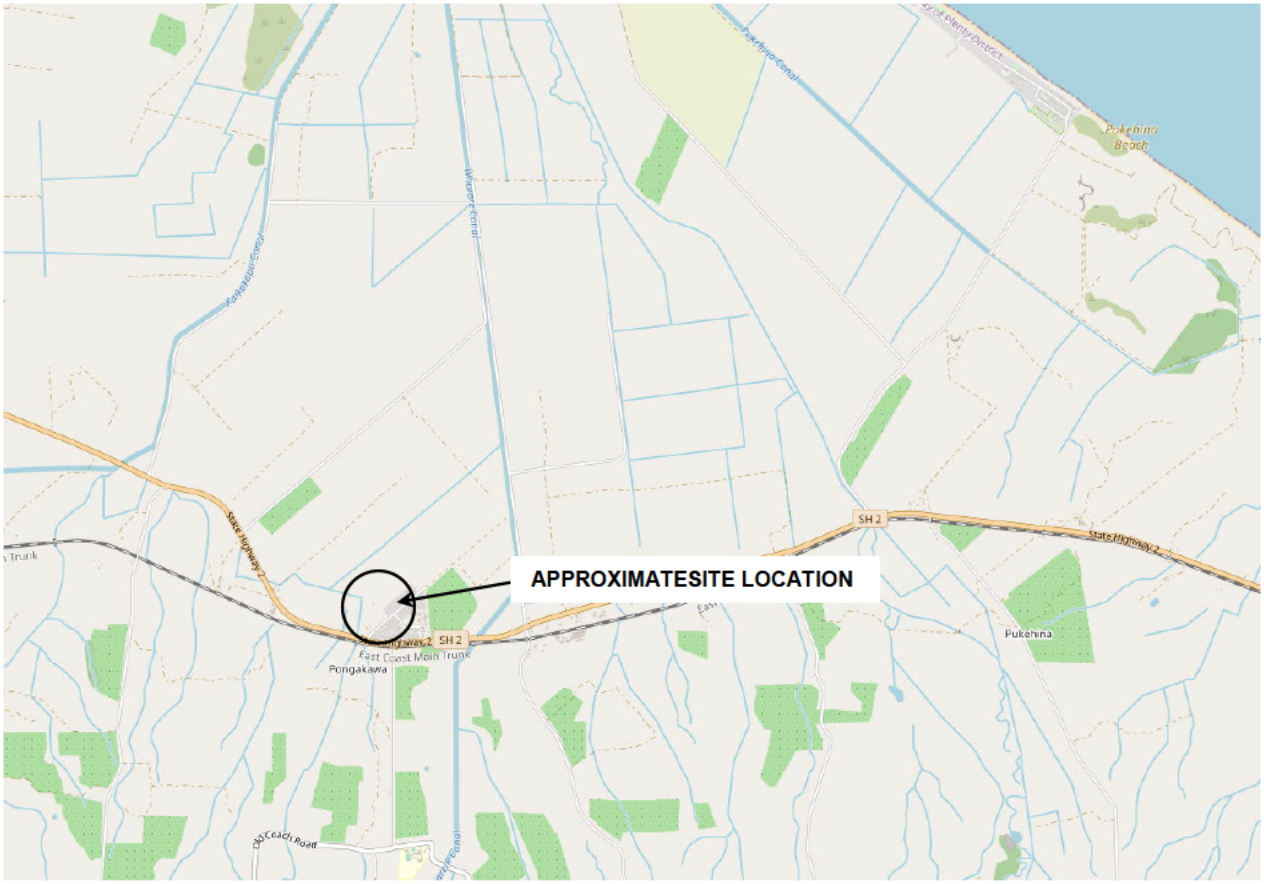



**Figure 1: Site Location Plan (openstreetmaps.org)**

## 2.2 Landform

The current general landform, together with associated features located within and adjacent to the site is presented on the attached Geotechnical Investigation Plan as ***Drawing 01.***

The majority of the site is essentially near level and occupies a broad plateau with existing ground levels ranging from RL 6m to 8m (Moturiki Datum). Several shallow swales bisect the plateau in the south, centre

and north-eastern areas. Immediately to the north, the site grades gently down to level, low lying topography at RL 3m.

The site is occupied by farmland, with a small dwelling and ancillary sheds in the south. It is bound to the north, west and south by rural properties and farm buildings, and to the east by residential properties and Arawa Road. A small pond is present in the far west.

## 2.3 Historic Aerial Photographs

Historical aerial photographs[1] show:

- 1943: The site was in grazed pasture, with small farm sheds in the west. Localised depressions (swales) are evident in the south, central and north-eastern areas of the site;
- 1961: The site remained in grazed pasture, with several hedgerows and a central accessway present;
- 2003: The majority of the hedgerows had been removed. The small pond in the west of the site was evident. Residential dwellings along Arawa Road, immediately to the east had been constructed;
- 2007: A cropped area was present in the west of the site, adjacent to the small pond and farm building. The dwelling was present in the central/southern area;

Little change was noted from 2007 until the present day.

No signs of significant earthworks were noted in our review. Minor earthworks in the west of the site are likely to have occurred as a result of cropping and pond construction.

# 3 PROPOSED DEVELOPMENT

At the time of undertaking this investigation and of writing this report the project was in the early planning stages and a scheme plan had not been supplied. However, it is understood that the site is being considered for a plan change application, to rezone the land from its existing 'rural' status to 'residential'.

Due to the level nature of the site, minor levelling earthworks are anticipated to form building areas and associated roads and infrastructure.

Localised peat undercuts within the swales or low-lying parts of the site may also be undertaken.

Based on discussion with the project planners, Momentum Planning and Design Ltd (MPAD), it is understood that the strip of land immediately to the north of the site (as depicted on ***Drawing 01***) is being considered as a future wastewater disposal zone.

The stormwater disposal method(s) for a future residential development at this site is currently unknown.

# 4 INVESTIGATION SCOPE

Following a dial before you dig search, and onsite service location, the field investigation was carried out between 17th and 18th February 2022. All fieldwork was carried out under the direction of CMW Geosciences in general accordance with the NZGS specifications[2] and logged in accordance with NZGS guidance[3].

The scope of fieldwork completed was as follows:

- An engineering geologist undertook a walkover survey of the site to assess the general landform, site conditions and adjacent structures / infrastructure;

[1] Retrolens website, Sourced from http://retrolens.nz and licensed by LINZ CC-BY 3.0

[2] NZ Geotechnical Society (2017) NZ Ground Investigation Specification, Volume 1 – Master Specification

[3] NZ Geotechnical Society (2005), Field Description of Soil and Rock, Guideline for the field classification and description of soil and rock for engineering purposes.

- An on-site services search was carried out by a specialist contractor to identify the presence of any underground obstructions or hazards prior to the field investigation program commencing;
- Nine Cone Penetrometer Tests (CPTs) and two seismic CPTs (sCPTs) denoted CPT01 to CPT08, and CPT10 to sCPT12 were pushed to depths of up to 20m to define the ground model through the site and for use in liquefaction and static settlement analyses. Results of the CPT's, presented as traces of tip resistance (qc), sleeve friction (fs), dynamic pore pressure (u2) and friction ratio (Rf) are presented in ***Appendix C***;
- Twenty test pits, denoted TP01 to TP20, were excavated using a 12-tonne hydraulic excavator to depths of between 2.2m and 4m below existing ground levels. Shear vane readings and dynamic cone penetrometer tests were taken at regular intervals to provide strength information. Engineering logs and photographs of the test pits are presented in ***Appendix C.***

The approximate locations of the respective investigation sites referred to above are shown on the Geotechnical Investigation Plan (***Drawing 01***). Test locations were approximated using onsite features.

# 5 GROUND MODEL

## 5.1 Published Geology

The published geological map[4] depicts the regional geology for the area as comprising Pleistocene alluvium consisting of variably degraded terraces dominated by pumiceous soils (Tauranga Group- IQa), as illustrated in Figure 2 below. To the north and west of the site, swamp deposits comprising dark brown to black peat, organic-rich mud, silt and sand (Tauranga Group- Q1a) are anticipated.

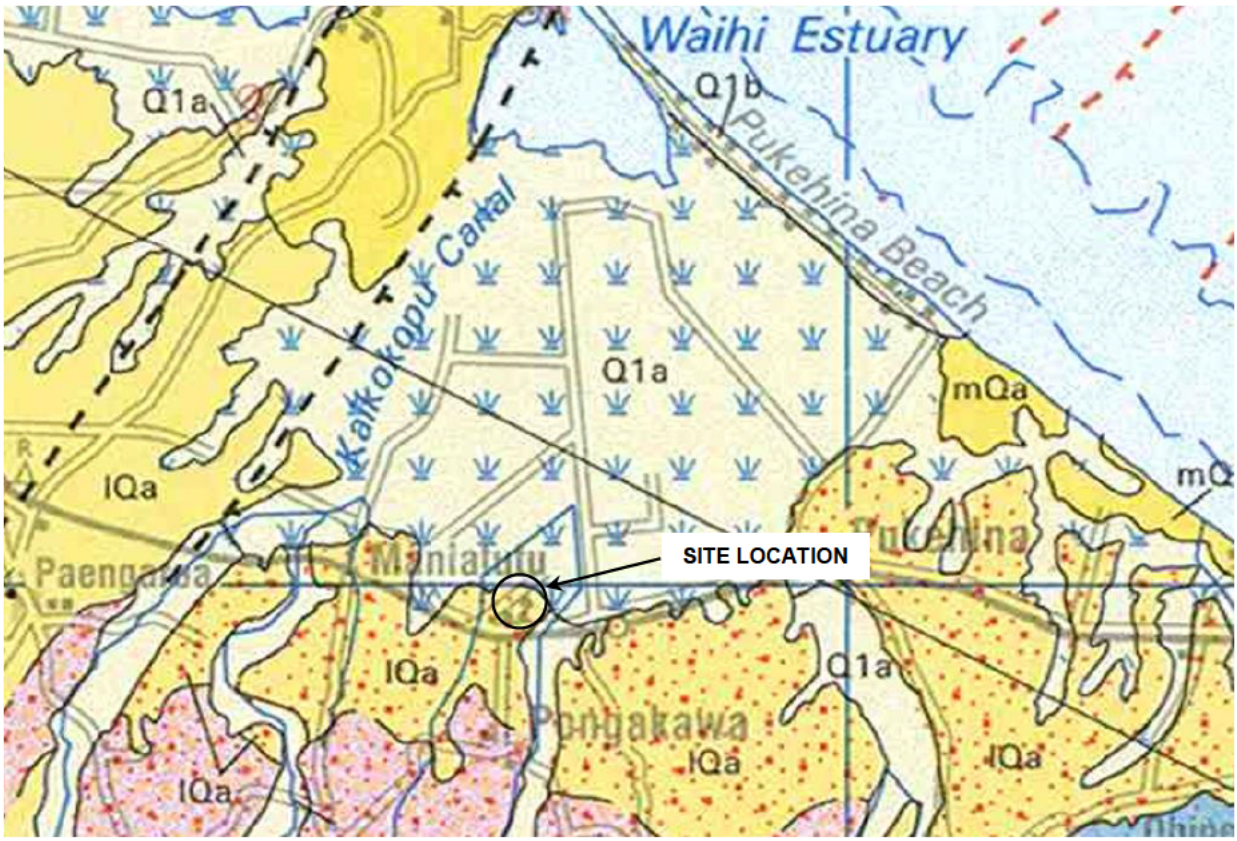



**Figure 2: Regional Geology (Leonard and Begg 2010)**

[4] Leonard and Begg (2010). Geology of the Rotorua Area. GNS, Geological Map 5.

Based on the known history of the site and surrounding land levels, some superficial depths of fill could be anticipated as a result of soft landscaping.

## 5.2 Stratigraphic Units

The ground conditions encountered and inferred from the investigation were generally consistent with the published geology for the area and can be generalised according to the following subsurface sequences.

The distribution of the various units encountered is presented on the appended Geological Section on ***Drawing 02*** and summarised below.

**Table 1: Summary of Strata Encountered**

| Unit | Top of Unit (mbgl) | | Thickness (m) | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| Topsoil – Organic silt | Surface | | 0.1 | 0.4 |
| Peat* – Fibrous, soft to stiff | 0.4 | 0.5 | 0.1 | 3.0 |
| Pleistocene Alluvium** – Interbedded stiff to very stiff silts and loose to medium dense sands | 0.2 | 3.5 | 3.0 | 12.3 |
| Pleistocene Alluvium – Medium dense sands | 6.5 | 12.5 | 3.0 | 7.0 |
| Pleistocene Alluvium – Dense to very dense sands | 12.5 | 15.5 | >10 | |

**Notes:** * Strata only encountered in the low lying far north of site, and within swales
** Areas of loose sand were noted in the upper 1m at several test locations across the site

## 5.3 Groundwater

During the investigation, which was completed in summer conditions (January 2022), groundwater was encountered within the CPTs and test pits at depths ranging from 1.0m to 4.3m below ground level, which equates to a reduced level of approximately RL 2m to RL4m.

# 6 GEOHAZARDS ASSESSMENT

## 6.1 Seismicity

A seismic assessment has been carried out in general accordance with NZGS guidance[5]. The ultimate limit state (ULS) and serviceability limit state (SLS) peak ground accelerations (PGAs) were assessed based on a 50-year design life and Importance Level (IL) 2 buildings in accordance with the New Zealand Building Code.

The recommended PGA values for geotechnical assessment at this site are presented in ***Table 2*** below. Structural designers working on this site should assess seismic parameters in accordance with NZS1170:2004 and using the recommended Site Subsoil Class presented in Section 7.1 below.

**Table 2: Design Peak Ground Acceleration (PGA) for Various Limit States**

| Limit State | AEP | R | PGA(g)[1] | $Magnitude_{eff}$ |
|---|---|---|---|---|
| SLS | 1/25 | 0.25 | 0.08 | 6.0 |

[5] NZ Geotechnical Society publication "Earthquake geotechnical engineering practice, Module 1: Overview of the standards", (November 2021)

| Table 2: Design Peak Ground Acceleration (PGA) for Various Limit States | | | | |
|---|---|---|---|---|
| **Limit State** | **AEP** | **R** | **PGA(g)[1]** | **$Magnitude_{eff}$** |
| ULS | 1/500 | 1.0 | 0.32 | 6.0 |
| Note: R = return period factor; AEP = annual exceedance probability<br>[1]As per Appendix A1 of NZGS Module 1 | | | | |

## 6.2 Preliminary Liquefaction Assessment

### 6.2.1 General

Soil liquefaction is a process where typically saturated, granular soils develop excess pore water pressures during cyclic (earthquake) loading. Following the onset of liquefaction, the shear strength and stiffness of the liquefied soil is effectively lost causing excessive differential settlement of the ground surface, bearing capacity failure and collapse of structures and low-angle lateral spreading of slopes in liquefiable soils.

In accordance with NZGS guidance[6] the liquefaction susceptibility of the soils at the site has been considered with respect to geological age, soil fabric and soil consistency / density as follows:

- The peat soils are of Holocene geological age, and the silt/sand alluvial deposits are of Pleistocene geological age. Therefore, in terms of geological age, the soils are the site may be susceptible to liquefaction;
- Soils below the water table are predominantly sandy, and therefore are considered susceptible to liquefaction where saturated; and
- Sandy soils below the water table are generally medium dense to dense, and therefore in terms of soil density, may be susceptible to liquefaction.

Based on this, preliminary specific liquefaction analyses were undertaken as detailed below.

### 6.2.2 Specific Analyses

Liquefaction analyses were undertaken using the software package CLiq by comparing the cyclic stress ratio (CSR) to the cyclic resistance ratio (CRR) from the conventional CPT.

Calculations were carried out to consider the potential for liquefaction across the full depth of the CPT tests (i.e. 20m). Additional calculations were also undertaken to assess the effects of liquefaction within the upper 10m of the soil profile only to allow the results to be classified in accordance with the estimated 'index settlements' as per MBIE guidance[5].

Due to the geological age of the underlying deposits we assessed the potential for aging effects and reduced liquefaction susceptibility in accordance with Robertson[7]. The calculations followed the method proposed by Hayati and Andrus[8], which compares the ratio of measured to estimated shear wave velocities within effected soils as derived from seismic sCPTs. The calculations indicate that the soils beneath this site are not affected by significant soil aging and the effects of aging where therefore discounted in the liquefaction analyses.

The results of the liquefaction assessment are summarised in ***Table 3***, below and are presented in terms of the ULS 'index' settlements and the depth at which significant liquefaction occurs as this defines the thickness of the crust of non-liquefiable soils below the site Outputs of the calculations are given in ***Appendix D***.

[6]MBIE, Canterbury Residential Technical Guidance, Part D: Guidelines for the geotechnical investigation and assessment of subdivisions in the Canterbury region, Version 2, December 2012
[7] P. K. Robertson (2015). Comparing CPT and Vs Liquefaction Triggering Methods, Journal of Geotechnical and Geoenvironmental Engineering, May 2015
[8] Hayati, H., and Andrus, R. D. (2009). "Updated liquefaction resistance correction factors for aged sands." J. Geotech. Geoenviron. Eng., 10.1061/(ASCE)GT.1943-5606.0000118, 1683–1692.

| Table 3: Preliminary Liquefaction Analyses Results – Index Settlements | | | | |
|---|---|---|---|---|
| **CPT No.** | **SLS Settlement (mm)** | **ULS Index Settlement (mm)** | **ULS Liquefiable Layers (mbgl[2])** | **ULS Crust Thickness (m)** |
| 01 | <10 | 110 | 4.0 – 9.5[1] | 4.0[1] |
| 02 | | 85 | 4.0 – 5.5, 6.5 – 10[1] | 4.0[1] |
| 03 | | 110 | 3.5 – 10[1] | 3.5[1] |
| 04 | | 90 | 5.0 – 10 | 5.0 |
| 05 | | 45 | 7.0 – 10 | 7.0 |
| 06 | | 100 | 3.5 – 5, 6 – 9.5[1] | 3.5[1] |
| 07 | | 110 | 4.0 – 10 | 4.0 |
| 08 | | 60 | 4.5 – 6.5, 8.5 – 10 | 4.5 |
| 10 | | 60 | 4.5 – 101 | 4.5[1] |
| 11 | | 100 | 4.5 – 10 | 4.5 |
| 12 | | <10 | N/A | N/A |
| Note: 1. The effects of isolated shallow layers < 0.1m thick are discounted from this assessment<br>2. Settlements and depths are based on the existing ground profile<br>3. N/A = not applicable due to there being no ULS liquefiable layers | | | | |

Liquefaction mitigation recommendations are discussed in Section 7.2.

## 6.3 Slope Stability

### 6.3.1 General

The site is near level to gently graded with no significant slopes or escarpments. The risk of slope movement under static (i.e. non-earthquake) conditions is therefore assessed as 'low' and specific static slope stability analyses have not been undertaken.

### 6.3.2 Lateral Spread Assessment

Following the onset of liquefaction, the liquefied soils behave as a very weak undrained material, which can give rise to lateral spreading where a free face is present within the vicinity of the site or where slopes are present over or within liquefied soils. To the north of the site, a gently graded, 2m high slope is present where the subject site slopes down towards the near level peat area in the north. Due to the presence of potentially liquefiable soils and low strength peat in this area, lateral spread analyses were undertaken for this slope.

Seismic stability analyses were undertaken for Geological Section A (***Drawing 02***). A liquefied soil strength ratio of 0.1 was applied to the upper interbedded silts/sands of the Pleistocene Alluvium. Liquefied strengths were not applied to the deeper, dense sand of the Pleistocene Alluvium or to soils above the groundwater table as calculations indicated that these are unlikely to liquefy in the SLS or ULS earthquakes.

The calculations considered to stability cases:

1. The stability of the slope assuming liquefied soil conditions under peak (ULS) ground acceleration to assess lateral spreading risk; and
2. The stability of the slope with liquefied soil parameters and zero ground acceleration to assess the risk of post-earthquake failure (termed 'flow failure').

Outputs from the stability models are presented in ***Appendix F***. The calculations indicate that the slope is unlikely to be affected by lateral spreading in an SLS event but may have a low factor of safety (i.e. < 1.0)

against lateral spreading in a ULS earthquake. Further analyses using the empirical methods by Bray & Travasarou (2007) and Jibson (2007) indicate that horizontal displacements along the affected slope would be less than approximately 100mm. Displacements of this magnitude would classify the land adjacent to the northern slope as Technical Category 2 (TC2) as defined by the MBIE guidelines for assessing liquefaction risk developed filling the Canterbury earthquakes[9].

The calculations to assess flow failure risk indicate that the northern slope has a factor of safety >1.0 in these conditions and the slope is therefore unlikely to be affected by post-earthquake flow failure.

## 6.4 Load Induced Settlement

### 6.4.1 General

Load-induced settlements occur in soils that are subject to static loading (e.g. by placing fill and/or building loads) where the magnitude of settlement is governed by the soil stiffness and the applied pressure.

Preliminary analyses have been undertaken to assess the likely magnitudes of settlement on account of future residential building loads. As the magnitude of earthworks is currently unknown, any potential future fill induced settlements have not been assessed.

### 6.4.2 Preliminary Settlement Analyses for Residential Buildings

Analyses have been undertaken to quantify the predicted settlements on account of future building loads, using the geotechnical software package CPeT-IT. This program calculates the change in vertical stress due to the loading according to Boussinesq, with a 1-D constrained soil modulus parameter estimated from CPT data.

The results of our analyses are presented in ***Table 4***, below.

**Table 4: Preliminary Static Settlement Magnitudes for Anticipated Floor Loads**

| CPT No. | Widespread Load (kPa) – To represent a single level dwelling | Peat present? (Y/N) | Primary Settlement (mm) |
|---|---|---|---|
| 01 | 10 | Y | 60 |
| 02 | | Y | 40 |
| 03 | | Y | 80 |
| 04 | | Transition | 35 |
| 05 | | N | 12 |
| 06 | | Y | 10 |
| 07 | | N | 20 |
| 08 | | N | 15 |
| 10 | | Y | 25 |
| 11 | | N | 10 |
| 12 | | N | 22 |

[9] MBIE, 'Canterbury Residential Technical Guidance – Part D: Subdivisions', December 2012.

The results of the preliminary settlement analyses suggest that areas of the site which are underlain by peat soils are likely to experience load induced settlements in excess of the NZ Building Code limits of 1 in 240 (approximately 25mm over a 6-metre length of building).

Additionally, the peat soils are likely to experience significant secondary (creep) settlements, in excess of the reported primary settlement magnitudes in Table 4 above, which are likely to continue for a number of years following construction.

Predicted static settlements due to typical residential building loads on parts of the site not underlain by peat are expected to be within the limits recommended in the NZ Building Code.

Recommendations for remediation of the areas of the site which are underlain by peat soils are provided in Section 7.3.

# 7 GEOTECHNICAL RECOMMENDATIONS

## 7.1 Seismic Site Subsoil Category

The geological units encountered beneath the site comprise soil strength materials, which with respect to the seismic site subsoil category defined in Section 3.1.3 of NZS1170.5, is defined as having an unconfined compressive strength (UCS) < 1MPa.

Based on those ground conditions and the results, the seismic site subsoil category is assessed as being Class D (deep soil site) in accordance with NZS1170.5.

## 7.2 Liquefaction Mitigation

Under the ULS event, the NZ Building Code requires that dwellings do not collapse and therefore preserve life but do not need to remain serviceable. The predicted free-field liquefaction induced settlements under the ULS seismic event are in the order of 45 to 110mm over a 10m depth, with the larger settlements generally occurring beneath more low-lying parts of the site where the non-liquefiable surface crust is less thick.

Reference is made to Ishihara (1985)[10] with respect to assessing the contribution of a non-liquefiable crust and the risk of surface manifestation. This assessment suggests a minimum 6m thick non-liquefiable crust may be required to prevent liquefaction induced ground damage for a ULS seismic event and an Importance Level 2 (IL2) building at this site. Given that the existing crust thickness ranged from 3.5m to 7m, there is the potential for surface manifestation (e.g. sand boils) to occur during a ULS seismic event which can result in further exaggerated differential settlements and affect the ultimate bearing capacity beneath shallow footings.

Therefore, based on the index liquefaction settlement values presented in Table 3 and the marginal non-liquefiable crust present at the site, we recommend adopting an MBIE TC2/TC3 hybrid foundation solution as outlined in Section 15.4.6 of the MBIE Part C Canterbury Rebuild Technical Guidance[11] to address the liquefaction hazard for the proposed development.

Further detail on this has been detailed in Section 7.2.1, below.

### 7.2.1 Enhanced TC2/TC3 Raft

A TC2/TC3 hybrid solution involves the construction of an 800mm thick, geogrid reinforced granular fill raft supporting an engineer designed or proprietary TC2 raft foundation.

[10] Ishihara, K., (1985) “Stability of Natural Deposits During Earthquakes,” Proc. Of the Eleventh International Conference on Soil Mechanics and Foundation Engineering, San Francisco, 12- 16th August 1985, Vol. 1, Theme Lectures Conferences, pp321- 376.
[11] Repairing and Rebuilding Houses Affected by the Canterbury Earthquake: TC3 Technical Guidance , Part C, MBIE (2015).

Prior to the construction of the gravel raft, ground improvement will be required in some areas of the site (such as to undercut loose near surface sands or remediate peat soils). This has been detailed in Section 7.3 and 7.4.2 below.

## 7.3 Ground Improvement for Static Settlement

To minimise post construction static ground settlements on account of the presence of compressible peat, several options have been proposed, including the following:

- Locating buildings and infrastructure on the more elevated plateau areas of the site which are unlikely to experience excessive static settlements under typical residential building loads. Less critical infrastructure such as stormwater ponds may be located within the swales and peat areas, subject to appropriate engineering design;
- Construct a temporary pre-load embankment over and above design ground levels where peat is present to reduce post construction total and differential settlements;
- Remove (excavated) the peat and replace with engineered fill. This would likely require significant dewatering to achieve; and
- Pile building foundations to intercept the dense sands at depths of between approximately 14m and 20m below ground level, which are shown not to be susceptible to liquefaction.

## 7.4 Earthworks

### 7.4.1 General

All earthwork activities must be carried out in general accordance with the requirements of NZS 4431[12] and the requirements of the Western Bay of Plenty District Council Development Code under the guidance of a Category 1 Geo-professional.

High level earthworks recommendations have been provided in Sections 7.4.2 to 7.4.4 below.

### 7.4.2 Subgrade Preparation

Preparation of the stiff and loose/medium dense subgrade beneath the proposed fill areas should comprise stripping of all vegetation, topsoil, any pre-existing fill materials or loose sands/weak silts.

Where any particularly weak materials are encountered (such as the upper 1m of loose sands), they should be undercut and reworked prior to placing engineered fill.

As discussed in Section 7.3, the peat soils will require specific ground improvement/remediation.

### 7.4.3 Cut and Fill Batters

To reduce the effects of ongoing minor slumping or scour, self-supporting long term cut and fill batters in the friable volcanic ashes should be formed to no steeper than 1(V):2.5(H).

All formed batters should be covered by topsoil and then grassed as soon as practicable following construction to reduce the effects of surficial scour or alternatively supported to full height by specifically designed retaining walls.

### 7.4.4 Quality Control

The source and / or type of material used for engineered fill will dictate the type of quality control testing undertaken.

[12] Standards New Zealand (1989) Code of practice for earth fill for residential development, incorporating Amendment No. 1, NZS 4431:1989, NZ Standard

Most of the on-site soils material, excluding the peat, should be suitable for reuse as Engineer Certified Fill. Soil textures and moisture contents will however vary widely and careful management, conditioning and compaction control will be required.

For granular (sand and gravel) fill materials, testing following compaction should be principally in terms of the maximum dry density within the appropriate water content range, with accompanying Dynamic Cone Penetrometers (DCPs).

Where silts and clays are used as filling, alternative test criteria using vane shear strength and air voids should be used.

### 7.4.5 Service Trenches

We anticipate that service trenches could be several metres deep. Based on the field investigation results, the soils to be encountered within this depth are likely to comprise stiff silts and/or loose to medium dense sands across the terrace but with fresh and fibrous peat deposits present within the swale areas.

Provided any organic or otherwise unsuitable material is cut to waste, the natural soils excavated for the trench may be used as backfill. The backfill should be compacted in thin lifts to a strength and consistency equal to the surrounding ground.

## 7.5 Stormwater Disposal

The depth of groundwater beneath the more elevated parts of the site is such that disposal of stormwater to ground soakage could be considered for building sites on the main plateau. Shallow groundwater below the more low-lying areas and the swales may preclude the use of ground soakage in these areas.

Stormwater pond(s) and/or raingardens would also be a suitable method of stormwater disposal for flows from future roofs and hardstand areas. An appropriate location for permanent ponds would be within the swales which cut through the site.

Stormwater disposal options should be further assessed at the resource consent stage for the development.

## 7.6 Wastewater Disposal

Based on discussions with the project planners, MPAD, it is understood that the strip of land immediately to the north of the site (depicted on ***Drawing 01***) is being considered as a potential wastewater disposal field.

Although this has not been assessed in detail, it is anticipated that for wastewater disposal in this zone, a raft of fill would be required to separate the standing groundwater table from the disposal field. There would also need to be an acceptance that differential settlement magnitudes in this area may be significant, particularly on account of fill placement. The effects of this settlement on the disposal system may be reduced by pre-loading the filled disposal field and/or by using a pressure compensating drip line irrigation network.

Further geotechnical input would be required during design of the system (by others), to confirm suitability.

## 7.7 Roading and Services

The main roads are expected to extend across the terrace. Following earthworks and subgrade trimming, a CBR of between 3 and 5 is anticipated for the natural subsoils, whilst for Engineer Certified Fill areas a CBR of 7 may be adopted.

We recommend that a programme of penetration resistance testing is carried out when the roads and pavement areas are being formed to their final levels to confirm actual CBR values.

# 8 FURTHER WORK

Additional geotechnical inputs to support the design and construction of a residential development at this site may include, but not be limited to:

- Investigations including additional test pits, hand auger boreholes, machine boreholes and/or Cone Penetrometer Tests (CPTs) to refine ground model and further assess the extent and depth of peat soils;
- Additional analyses for the proposed development, including liquefaction, static settlement and bearing capacity, to confirm the preliminary recommendations provided in this report;
- Preparation of geotechnical reports to support the resource consent application and detailed design process; and
- Earthworks and construction observations to confirm fill compaction and finished landform.

# 9 CONCLUSION

Provided the recommendations given in this report are followed and subject to appropriate assessment during the resource consent process, the property is considered geotechnically suitable for rezoning and residential development.

Elevated parts of the site would be classified as Technical Category TC2 or TC3 due to potential for liquefaction induced settlement as defined by the MBIE earthquake design guidelines developed for the Christchurch rebuild. Ground adjacent to the slope along the site's northern boundary may also be classified as TC2 due to the potential for lateral spreading in this area.

Residential buildings on this site would therefore require specifically designed foundations. The hybrid TC2/TC3 fill/raft foundation solutions developed in Christchurch would be appropriate for this site.

## USE OF THIS REPORT

Site subsurface conditions cause more construction problems than any other factor and therefore are generally the largest technical risk to a project. These notes have been prepared to help you understand the limitations of your geotechnical report.

### Your geotechnical report is based on project specific criteria

Your geotechnical report has been developed on the basis of our understanding of your project specific requirements and applies only to the site area investigated. Project requirements could include the general nature of the project; its size and configuration; the location of any structures on or around the site; and the presence of underground utilities. If there are any subsequent changes to your project you should seek geotechnical advice as to how such changes affect your report's recommendations. Your geotechnical report should not be applied to a different project given the inherent differences between projects and sites.

### Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface investigation, the conditions may have changed, particularly when large periods of time have elapsed since the investigations were performed.

### Interpretation of factual data

Site investigations identify actual subsurface conditions at points where samples are taken. Additional geotechnical information (e.g., literature and external data source review, laboratory testing on samples, etc) are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can exactly predict what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

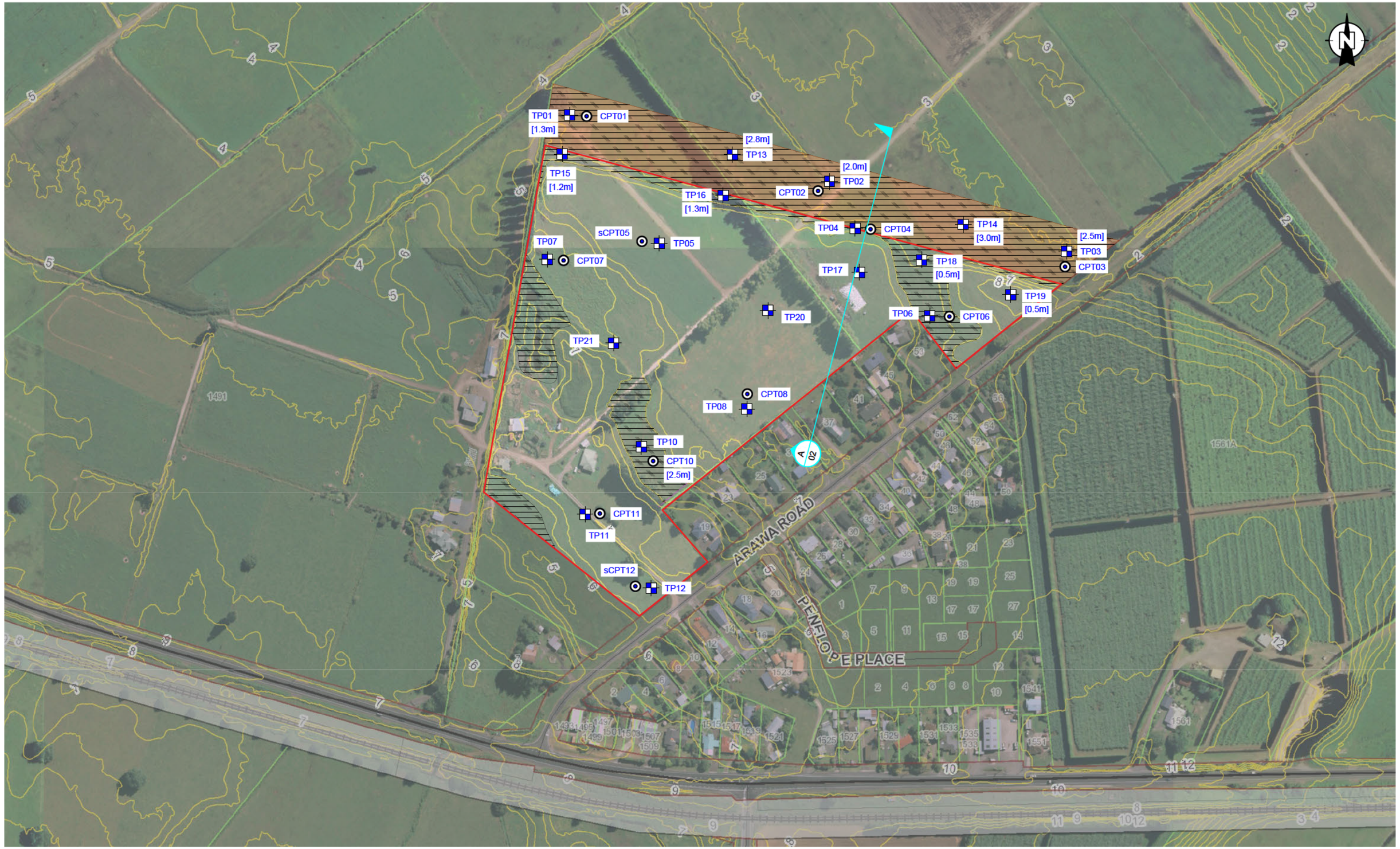
### Your report's recommendations require confirmation during construction

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced. For this reason, you should retain geotechnical services throughout the construction stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site. A geotechnical designer, who is fully familiar with the background information, is able to assess whether the report's recommendations are valid and whether changes should be considered as the project develops. An unfamiliar party using this report increases the risk that the report will be misinterpreted.

### Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical report. Read all geotechnical documents closely and do not hesitate to ask any questions you may have. To help avoid misinterpretations, retain the assistance of geotechnical professionals familiar with the contents of the geotechnical report to work with other project design professionals who need to take account of the contents of the report. Have the report implications explained to design professionals who need to take account of them, and then have the design plans and specifications produced reviewed by a competent Geotechnical Engineer.

# Appendix A: Drawings




LEGEND:

| | | | |
|---|---|---|---|
| TP01 | TEST PIT LOCATION | | WASTEWATER DISPOSAL ZONE/ FUTURE DEVELOPMENT AREA |
| CPT01 | CPT/sCPT LOCATION | | APPROXIMATE EXTENT OF PEAT |
| | SITE BOUNDARY | [1.2m] | APPROXIMATE THICKNESS OF PEAT |

NOTES:

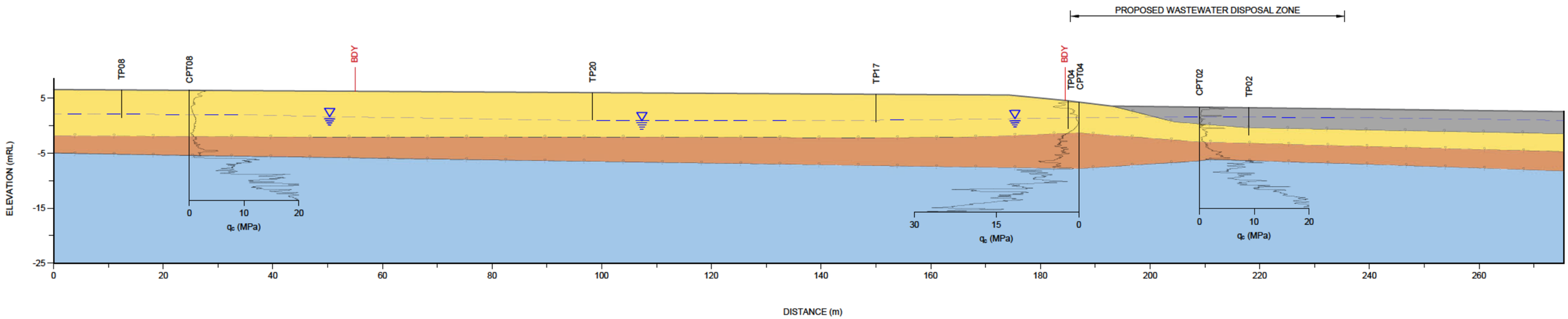
1. BASE PLAN ADAPTED FROM WESTERN BAY OF PLENTY DISTRICT COUNCIL MAPI.
2. CONTOURS ARE IN 1.0m INTERVALS AND ARE IN TERMS OF MOTURIKI DATUM.
3. TEST LOCATIONS ARE APPROXIMATE ONLY.

1:3000 0 30 60 90 120 150 m

CMW Geosciences

| | | | |
|---|---|---|---|
| CLIENT: KEVIN AND ANDREA MARSH | | DRAWN: HR | PROJECT No: TGA2021-0096 |
| PROJECT: PENCARROW ESTATE, 1491 ARAWA ROAD, PONGAKAWA | | CHECKED: LGL | DRAWING: 01 |
| | | REVISION: 0 | SCALE: 1:3000 |
| TITLE: GEOTECHNICAL INVESTIGATION PLAN | | DATE: 28/01/2022 | SHEET: A3 |

C:\USERS\HYSHAMRASHEED\CMW GEOSCIENCES PTY LTD\CMW CONNECT - TGA2021-0096 PENCARROW ESTATE, PONGAKAWA\DRAWINGS\TGA2021-0096 SITE PLAN + SECTION.DWG




LEGEND:

- DESIGN GROUND SURFACE
- EXISTING GROUND SURFACE
- APPROXIMATE GEOLOGICAL BOUNDARY
- APPROXIMATE GROUNDWATER LEVEL
- PEAT
- PLEISTOCENE ALLUVIUM (INTERBEDDED SILTS/SANDS)
- PLEISTOCENE ALLUVIUM (MEDIUM DENSE SANDS)
- PLEISTOCENE ALLUVIUM (DENSE SANDS)

NOTES:

1. TEST LOCATIONS ARE APPROXIMATE ONLY.

1:750 — 0 7.5 15 22.5 30 37.5 m

CMW Geosciences

| | | | |
|---|---|---|---|
| CLIENT: KEVIN AND ANDREA MARSH | DRAWN: HR | PROJECT No: TGA2021-0096 | |
| PROJECT: PENCARROW ESTATE, 1491 ARAWA ROAD, PONGAKAWA | CHECKED: LGL | DRAWING: 02 | |
| | REVISION: 0 | SCALE: 1:750 | |
| TITLE: GEOLOGICAL CROSS-SECTION A | DATE: 28/01/2022 | SHEET: A3 | |

C:\USERS\HYSHAMRASHEED\CMW GEOSCIENCES PTY LTD\CMW CONNECT - TGA2021-0096 PENCARROW ESTATE, PONGAKAWA\DRAWINGS\TGA2021-0096 SITE PLAN + SECTION.DWG

# Appendix B: MPAD Development Plans


## Legend

- Plan Change Boundary
- Flood effected area*
- Existing Building
- Contours with site area
- Open drains

* Flood data sourced from WBOPDC, flood data is modeled for a 1% flood event, adjusted for climate change and 1.25m sea level rise.

## Notes

| | |
|---|---|
| Total Area: | 97722m² |
| Flood effected Area: | 19471m² |
| Unconstrained Land: | 78250m² |
| Lot Yield: | 106* |

* Lot yield has been calculated assuming 25% of unconstrained land will be used for roads and reserves.
Allow for 75% of land to be allocated to lots.
Lot sized assumed to be 550m².
Lot yield indicative and may change.

# Pencarrow Estate

Constraints Map

Drawn - PF
Review - RC
Scale - 1:4000 @ A3
Drawing # - Pencarrow Constraints Map

MOMENTUM
PLANNING AND DESIGN

# Appendix C: Investigation Results

# CMW Geosciences – SOIL (Field Logging Guide)

**SEQUENCE OF TERMS:**
**Fine:** Soil Symbol – Soil Type – Colour – Structure – (Consistency) – (Moisture) – Bedding – Plasticity – Sensitivity – Additional Comments – Origin/Geological Unit
**Coarse:** Soil Symbol – Soil Type – Colour – Structure – Grading – Particle shape – (Relative Density) – (Moisture) – Bedding – Additional Comments – Origin/Geological Unit

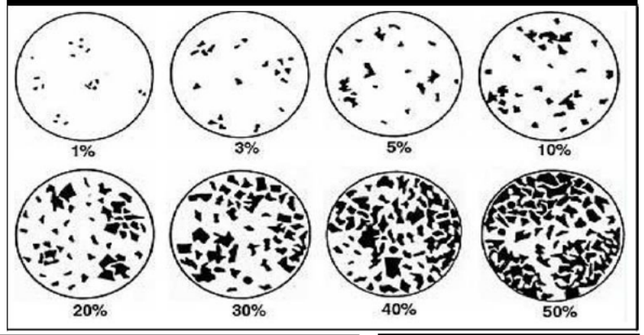
## BEHAVIOURAL SOIL CLASSIFICATION SYSTEM

| Major Divisions (behaviour based logging) | | | Soil Symbol | Soil Name |
|---|---|---|---|---|
| Coarse grained soils more than 65%>0.06mm | Gravel >50% of coarse fraction >2mm | Clean gravel <5% smaller 0.075mm | GW | Well graded gravel, fine to coarse gravel |
| | | | GP | Poorly graded gravel |
| | | Gravel with >12% fines | GM | Silty gravel |
| | | | GC | Clayey gravel |
| | Sand ≥50% of coarse fraction <2mm | Clean sand | SW | Well-graded sand, fine to coarse sand |
| | | | SP | Poorly graded sand |
| | | Sand with >12% fines | SM | Silty sand |
| | | | SC | Clayey sand |
| Fine grained soils 35% or more <0.06mm | Exhibits dilatant behaviour | inorganic | ML | Silt |
| | | | MH | Silt of high plasticity |
| | | organic | OL | Organic silt |
| | No dilatant behaviour | inorganic | CL | Clay of low plasticity |
| | | | CH | Clay of high plasticity |
| | | organic | OH | Organic clay |
| Highly Organic Soils | | | Pt | Peat |

## PROPORTIONAL TERMS DEFINITION

| Fraction | Term | % of Soil Mass | Example |
|---|---|---|---|
| Major | (…) [UPPER CASE] | ≥50 [major constituents] | GRAVEL |
| Subordinate | (…) [lower case] | 20 – 50 | Sandy |
| Minor | with some… | 12 – 20 | with some sand |
| | with minor… | 5 – 12 | with minor sand |
| | with trace of (or slightly) | < 5 | with trace of sand (slightly sandy) |

## VISUAL PROPORTION PERCENTAGE




## GRAIN SIZE CRITERIA

| TYPE | COARSE | | | | | | | | | FINE | | ORGANIC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Gravel | | | Sand | | | | | | |
| | Boulders | Cobbles | coarse | medium | fine | coarse | medium | fine | | Silt | Clay | Organic Soil |
| Size Range (mm) | 200 | 60 | 20 | 6 | 2 | 0.6 | 0.2 | 0.06 | | 0.002 | | |
| Graphic Symbol | | | | | | | | | | | | |

## ADDITIONAL GRAPHIC LOG SYMBOLS

| Term | Symbol |
|---|---|
| Topsoil | |
| Fill | |
| Bitumen | |
| Concrete | |

## ORGANIC SOILS / DESCRIPTORS

| Term | Description |
|---|---|
| Topsoil | Surficial organic soil layer that may contain living matter. However, topsoil may occur at greater depth, having been buried by geological processes or man-made fill, and should be termed a buried topsoil. |
| Organic clay, silt or sand | Contains finely divided organic matter; may have distinctive smell; may stain; may oxidize rapidly. Describe as for inorganic soils. |
| Peat | Consists predominantly of plant remains.<br>**Firm:** Fibres already compressed together<br>**Spongy:** Very compressible and open structure<br>**Plastic:** Can be moulded in hand and smears in fingers<br>**Fibrous:** Plant remains recognisable and retain some strength<br>**Amorphous:** No recognisable plant remains |
| Rootlets | Fine, partly decomposed roots, normally found in the upper part of a soil profile or in a redeposited soil (e.g. colluvium or fill) |
| Carbonaceous | Discrete particles of hardened (carbonised) plant material. |

## SHADE AND COLOUR

| 1 | 2 | 3 |
|---|---|---|
| light<br>dark<br>mottled<br>streaked | pinkish<br>reddish<br>yellowish<br>brownish<br>greenish<br>bluish<br>greyish | pink<br>red<br>orange<br>yellow<br>brown<br>green<br>blue<br>white<br>grey<br>black |

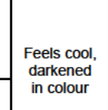
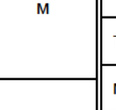
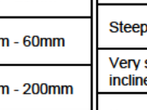
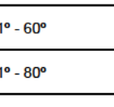
## SOIL STRUCTURE

| Term | Description |
|---|---|
| Homogeneous | The total lack of visible bedding and the same colour and appearance throughout |
| Bedded | The presence of layers |
| Fissured | Breaks along definite planes of fracture with little resistance to fracturing |
| Polished | Fracture planes are polished or glossy |
| Slickensided | Fracture planes are striated |
| Blocky | Cohesive soil that can be broken down into small angular lumps which resist further breakdown |
| Lensoidal | Discontinuous pockets of a soil within a different soil mass |

## GRADING (GRAVELS & SANDS)

| Term | Description | |
|---|---|---|
| Well Graded | Good representation of all particle size ranges from largest to smallest | |
| Poorly Graded | Limited representation of grain sizes – further divided into: | |
| | Uniformly graded | Most particles about the same size |
| | Gap graded | Absence of one or more intermediate sizes |

## ROUNDING/PARTICLE SHAPE

| Rounded | Subrounded | Subangular | Angular |
|---|---|---|---|
|  |  |  |  |

## CONSISTENCY TERMS FOR FINE SOILS

| Descriptive term | Undrained Shear Strength (kPa) | Diagnostic Features | Abbreviation |
|---|---|---|---|
| Very Soft | <12 | Easily exudes between fingers when squeezed | VS |
| Soft | 12-25 | Easily indented by fingers | S |
| Firm | 25-50 | Indented by strong finger pressure and can be indented by thumb pressure | F |
| Stiff | 50-100 | Cannot be indented by thumb pressure | St |
| Very Stiff | 100-200 | Can be indented by thumb nail | VSt |
| Hard | 200-500 | Difficult to indent by thumb nail | H |

## DENSITY INDEX (RELATIVE DENSITY) TERMS FOR COARSE SOILS

| Descriptive term | Density Index (RD) | SPT "N" value (blows/300mm) | Dynamic Cone (blows/100mm) | Abbreviation |
|---|---|---|---|---|
| Very Dense | > 85 | > 50 | > 17 | VD |
| Dense | 65 - 85 | 30 - 50 | 7 - 17 | D |
| Medium dense | 35 - 65 | 10 - 30 | 3 - 7 | MD |
| Loose | 15 - 35 | 4 - 10 | 1 - 3 | L |
| Very loose | < 15 | < 4 | 0 - 2 | VL |

Note:
- No correlation is implied between Standard Penetration Test (SPT) and Dynamic Cone Penetrometer (Scala) Test values.
- SPT "N" values are uncorrected.

## MOISTURE CONDITION

| Condition | Description | Coarse Soils | Fine Soils | Abbreviation |
|---|---|---|---|---|
| Dry | Looks and feels dry | Runs freely through hands | Hard, powdery or friable | D |
| Moist | Feels cool, darkened in colour | Tends to cohere | Weakened by moisture, but no free water on hands when remoulding | M |
| Wet | | | Weakened by moisture, free water forms on hands when handling | W |
| Saturated | Feels cool, darkened in colour and free water is present on the sample | | | S |

## BEDDING THICKNESS (Sedimentary)

| Term | Bed Thickness |
|---|---|
| Thinly laminated | < 2mm |
| Laminated | 2mm - 6mm |
| Very thin | 6mm - 20mm |
| Thin | 20mm - 60mm |
| Moderately thin | 60mm - 200mm |
| Moderately thick | 0.2m - 0.6m |
| Thick | 0.6m - 2m |
| Very thick | > 2m |

## BEDDING INCLINATION

| Term | Inclination (from horizontal) |
|---|---|
| Sub-horizontal | 0° - 5° |
| Gently inclined | 6° - 15° |
| Moderately inclined | 16° - 30° |
| Steeply inclined | 31° - 60° |
| Very steeply inclined | 61° - 80° |
| Sub vertical | 81° - 90° |

## PLASTICITY (CLAYS & SILTS)

| Term | Description |
|---|---|
| High plasticity | Can be moulded or deformed over a wide range of moisture contents without cracking or showing any tendency to volume change |
| Low plasticity | When moulded can be crumbled in the fingers; may show quick or dilatant behaviour |

## SENSITIVITY OF SOIL

| Descriptive Term | Shear Strength Ratio = $\frac{undisturbed}{remoulded}$ |
|---|---|
| Insensitive, normal | < 2 |
| Moderately sensitive | 2 – 4 |
| Sensitive | 4 – 8 |
| Extra sensitive | 8 – 16 |
| Quick | > 16 |

# TEST PIT LOG - TP01

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 336457.1mE; 800518.3mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)) | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations (Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0 | | OL: Organic SILT: with trace sand; dark brownish black. No plasticity; sand, fine. (Topsoil) | | | | |
| | | | | | | SP: Fine SAND: light brownish grey. Uniformly graded. (Alluvial Sands) | | | | |
| | 0.5 | Peak = 17kPa Residual = 9kPa | | | | Pt: PEAT: dark brownish black. Low plasticity, insensitive to moderately sensitive, organic, fibrous, tree stumps. (Peat) | M | F | 5 10 15 20 | |
| | 1.2 | Peak = 43kPa Residual = 17kPa | | 1 | | | | | | |
| | | | | | | | W | | | |
| ▼ | 1.7 | Peak = 43kPa Residual = 17kPa | | | | ML: SILT: light brownish grey mottled orange brown. Low plasticity, moderately sensitive. (Pleistocene Alluvium) | S | St | | |
| | 2.1 | Peak = 78kPa Residual = 35kPa | | 2 | | | | | | |
| | | | | | | Test pit terminated at 2.20 m | | | | |
| | | | | 3 | | | | | | |
| | | | | 4 | | | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Hole collapse
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP02

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400761.8mE; 793560.9mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. No plasticity; sand, fine.<br><br>(Topsoil) | | | 5 10 15 20 | |
| | | | | | | SP: Fine SAND : light brownish grey. Uniformly graded.<br>(Alluvial Sands) | M | | | |
| | 0.7 | Peak = 32kPa<br>Residual = 17kPa | | | | Pt: PEAT<br>: dark brownish black. Low plasticity, insensitive to moderately sensitive, organic, fibrous, tree stumps.<br><br>(Peat) | | | | |
| | | | | 1 | | | W | | | |
| ▼ | 1.4 | Peak = 29kPa<br>Residual = 20kPa | | | | | | | | |
| | 2.0 | Peak = 58kPa<br>Residual = 26kPa | | 2 | | | | F | | |
| | 2.6 | Peak = 41kPa<br>Residual = 20kPa | | | | | S | | | |
| | | | | 3 | | | | | | |
| | 3.2 | Peak = 32kPa<br>Residual = 14kPa | | | | | | | | |
| | 3.6 | Peak = 89kPa<br>Residual = 30kPa | | | | ML: SILT: with minor clay; light brownish grey mottled orange brown. Low plasticity, moderately sensitive<br>(Pleistocene Alluvium) | | St | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No:

Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP03

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 401042.4mE; 793471.9mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | D to M | | | |
| | | | | | | SP: Fine SAND: light brownish grey. Uniformly graded. (Alluvial Sands) | | | | |
| | 0.6 | Peak = 46kPa Residual = 17kPa | | | | Pt: PEAT: dark brownish black. Low plasticity, moderately sensitive, organic, fibrous, tree stumps. (Peat) | W | | | |
| ▼ | 1.1 | Peak = 41kPa Residual = 17kPa | | 1 | | | | F | | |
| | 1.6 | Peak = 46kPa Residual = 14kPa | | | | | S | | | |
| | 2.0 | Peak = 72kPa Residual = 43kPa | | 2 | | | | St | | |
| | 2.5 | Peak = 69kPa Residual = 41kPa | | | | | | | | |
| | | | | 3 | | SP: Fine to medium SAND: brownish grey. Poorly graded, interbedded with sandy SILT. (Pleistocene Alluvium) | | L to MD | 2<br>3<br>2<br>2<br>3 | |
| | | | | | | Test pit terminated at 3.40 m | | | | |
| | | | | 4 | | | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Hole collapse
Shear Vane No: 3403 DCP No: 14
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP04

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400851.8mE; 793452.6mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | D to M | | | |
| | | | | | | SP: Fine SAND: light brownish grey. Uniformly graded. (Pleistocene Alluvium) | | | | |
| | | | | | | ML: Silty fine to medium SAND : light greyish yellow. Poorly graded. (Pleistocene Alluvium) | | | | |
| | 0.8 | Peak = 148kPa Residual = 41kPa | | | | ML: Sandy SILT: greyish brown mottled orange brown. Low plasticity, moderately sensitive to sensitive; sand, fine to coarse. (Pleistocene Alluvium) | | | | |
| | | | | 1 | | | | VSt | | |
| | 1.3 | Peak = 156kPa Residual = 35kPa | | | | | | | | |
| | | | | | | MH: Clayey SILT: with minor sand; light grey mottled orange brown. Low plasticity, moderately sensitive to sensitive; sand, fine. (Pleistocene Alluvium) | | | | |
| | | | | 2 | | | M | | | |
| | | | | | | | | St to VSt | | |
| | 2.5 | Peak = 75kPa Residual = 29kPa | | | | | | | | |
| | 3.0 | Peak = 119kPa Residual = 29kPa | | 3 | | | | | | |
| | | | | | | SM: Silty Fine to coarse SAND: with some gravel and minor clay; light brownish yellow. Well graded; gravel, fine, weathered. (Pleistocene Alluvium) | | L to MD | 2 2 3 3 2 | |
| ▼ | 3.8 | Peak = 75kPa Residual = 14kPa | | | | ML: SILT: grey. Low plasticity, sensitive. (Pleistocene Alluvium) | W to S | St | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No: 14
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP05

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 18/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400626.1mE; 793553.3mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | | | 2 | |
| | | | | | | SM: Silty Fine to medium SAND: light brownish yellow. Poorly graded. (Pleistocene Alluvium) | | L | 2 | |
| | | | | | | | | | 2 | |
| | | | | | | | | | 2 | |
| | | | | | | | | | 1 | |
| | | | | | | | | | 2 | |
| | | | | | | ML: Sandy SILT: light brownish grey mottled orange brown. Low plasticity, moderately sensitive; sand fine to medium. (Pleistocene Alluvium) | | | 1 | |
| | 1.0 | Peak = 75kPa Residual = 20kPa | | 1 | | | | | | |
| | 2.0 | Peak = 119kPa Residual = 20kPa | | 2 | | | M | | | |
| | | | | | | *... at 2.20m, becoming clayey SILT* | | VSt to St | | |
| | 2.5 | Peak = 87kPa Residual = 32kPa | | | | | | | | |
| | 3.0 | Peak = 84kPa Residual = 32kPa | | 3 | | | | | | |
| | | | | | | SM: Silty Fine to coarse SAND: with minor gravel and clay; light yellowish white. Well graded; gravel, fine to medium, weathered. (Pleistocene Alluvium) | | | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No: 14
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP06

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400935.7mE; 793429.2mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | | | 5 10 15 20 | Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks |
| | | | | | | SP: Fine SAND: light brownish grey. Poorly graded. (Alluvial Sands) | | LP | | |
| | | | | | | Pt: PEAT: dark brownish black. Low plasticity, organic, fibrous, tree stumps. (Peat) | | S to F | | |
| | 0.7 | Peak = 46kPa Residual = 17kPa | | | | ML: SILT: orange. Low plasticity, moderately sensitive. (Pleistocene Alluvium) | | | | |
| | | | | 1 | | | | | | |
| | 1.5 | Peak = 69kPa Residual = 35kPa | | | | MH: Clayey SILT: with minor sand; light grey. Low plasticity, moderately sensitive; sand, fine to medium. (Pleistocene Alluvium) | | | | |
| | 2.0 | Peak = 64kPa Residual = 29kPa | | 2 | | | M | | | |
| | 2.5 | Peak = 107kPa Residual = 35kPa | | | | | | VSt to St | | |
| | 3.0 | Peak = 116kPa Residual = 32kPa | | 3 | | | | | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP07

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 18/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400623.5mE; 793505.2mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | | | 5 10 15 20 | Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks |
| | | | | | | SP: Fine SAND: light brownish grey. Poorly graded. (Pleistocene Alluvium) | | | | |
| | 0.5 | Peak = 61kPa Residual = 17kPa | | | | ML: SILT: with some sand; orange. Low plasticity; sand, fine to medium. (Pleistocene Alluvium) | | | | |
| | 1.0 | Peak = 75kPa Residual = 26kPa | | 1 | | MH: Clayey SILT: with minor sand; light grey. Low plasticity, moderately sensitive. (Pleistocene Alluvium) | | | | |
| | 1.5 | Peak = 133kPa Residual = 41kPa | | | | | M | | | |
| | 2.0 | Peak = 90kPa Residual = 32kPa | | 2 | | | | VSt to St | | |
| | 2.5 | Peak = 98kPa Residual = 26kPa | | | | | | | | |
| ▼ | 3.0 | Peak = 133kPa Residual = 41kPa | | 3 | | | | | | |
| | 3.5 | Peak = 113kPa Residual = 26kPa | | | | | W to S | | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP08

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400783.9mE; 793361.7mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: brown. No plasticity. (Topsoil) | | | 5 10 15 20 | Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks |
| | | | | | | SP: Fine SAND: light brownish grey. Poorly graded. (Pleistocene Alluvium) | | | | |
| | | | | | | ML: SILT: with some sand; orange. Low plasticity, insensitive; sand, fine to medium. (Pleistocene Alluvium) | | | | |
| | 0.5 | Peak = 64kPa Residual = 23kPa | | | | | | St | | |
| | | | | | | MH: Clayey SILT: with minor sand; light grey streaked orange brown. Low plasticity, moderately sensitive; sand, medium. (Pleistocene Alluvium) | | | | |
| | 1.0 | Peak = 104kPa Residual = 29kPa | | 1 | | | | | | |
| | 1.5 | Peak = 142kPa Residual = 38kPa | | | | | | | | |
| | 2.0 | Peak = 90kPa Residual = 26kPa | | 2 | | | M | | | |
| | 2.5 | Peak = 107kPa Residual = 29kPa | | | | | | St to VSt | | |
| | 3.0 | Peak = 142kPa Residual = 41kPa | | 3 | | | | | | |
| | 3.5 | Peak = 122kPa Residual = 29kPa | | | | | | | | |
| | | | | | | SM: Silty Fine to coarse SAND: with some gravel and minor clay; light brownish yellow; gravel, fine, weathered. (Pleistocene Alluvium) | | | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP10

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400783.5mE; 793359.2mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) 5 10 15 20 | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: dark brownish black. Non-plastic; sand, fine.<br><br>(Topsoil) | | | | |
| | | | | | | SP: Fine SAND: light brownish grey. poorly graded.<br>(Alluvial Sands) | M | LP | | |
| | 0.8 | Peak = 43kPa<br>Residual = 20kPa | | 1 | | Pt: PEAT: dark brownish black. Low plasticity, , moderately sensitive, organic, fibrous, tree stumps.<br><br>(Peat) | W | | | |
| | 1.5 | Peak = 46kPa<br>Residual = 17kPa | | | | | | | | |
| | 2.0 | Peak = 38kPa<br>Residual = 17kPa | | 2 | | | | F | | |
| | 2.5 | Peak = 43kPa<br>Residual = 20kPa | | | | | W to S | | | |
| | | | | 3 | | ML: SILT: light brownish grey. Low plasticity.<br>(Pleistocene Alluvium) | | | | |
| | 3.6 | Peak = 104kPa<br>Residual = 29kPa | | | | | | VSt | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target epth
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP11

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400673.8mE; 793198.0mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m | Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | | | | |
| | 0.5 | Peak = 77kPa Residual = 30kPa | | | | ML: SILT: with some sand; orange. Low plasticity, moderately sensitive; sand, fine to medium. (Pleistocene Alluvium) | | St | | |
| | 1.0 | Peak = 122kPa Residual = 30kPa | | 1 | | MH: Clayey SILT: with minor sand; light grey streaked orange brown. Low plasticity, moderately sensitive; sand, fine to medium. (Pleistocene Alluvium) | | | | |
| | 1.5 | Peak = 107kPa Residual = 27kPa | | | | | | | | |
| | 2.0 | Peak = 119kPa Residual = 30kPa | | 2 | | | M | VSt | | |
| | 2.5 | Peak = 137kPa Residual = 45kPa | | | | | | | | |
| | 3.0 | Peak = 131kPa Residual = 42kPa | | 3 | | | | | | |
| | 3.5 | Peak = 140kPa Residual = 45kPa | | | | | | | | |
| | | | | | | SM: Silty Fine to coarse SAND: with some gravel and minor clay; light brownish yellow. Well graded, weathered; gravel, fine. (Pleistocene Alluvium) | M to W | | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 0830 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP12

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400673.7mE; 793197.0mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | | | 5 10 15 20 | Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks |
| | | | | | | SP: Fine SAND : light brownish grey. Uniformly graded. (Pleistocene Alluvium) | | | | |
| | 0.5 | Peak = 61kPa Residual = 26kPa | | | | ML: Sandy SILT: orange. Low plasticity, moderately sensitive; sand fine to coarse. (Pleistocene Alluvium) | | St | | |
| | 1.0 | Peak = 119kPa Residual = 26kPa | | 1 | | | | | | |
| | | | | | | MH: Clayey SILT: with minor sand; light grey streaked orange brown. Low plasticity, moderately sensitive to sensitive; sand, medium. (Pleistocene Alluvium) | | | | |
| | 1.5 | Peak = 78kPa Residual = 29kPa | | | | | | VSt to St | | |
| | 2.0 | Peak = 90kPa Residual = 26kPa | | 2 | | | M | | | |
| | 2.5 | Peak = 104kPa Residual = 29kPa | | | | | | | | |
| | 3.0 | Peak = 116kPa Residual = 29kPa | | 3 | | | | VSt | | |
| | 3.5 | Peak = 130kPa Residual = 35kPa | | | | | | | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP13

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: | Projection: BOP2000 | Pit Dimensions: m by m
Datum: Moturiki | Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine.<br><br>(Topsoil) | M | | 5 10 15 20 | Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks |
| | | | | | | SP: Fine SAND: light brownish grey. Uniformly graded.<br>(Alluvial Sands) | | | | |
| | 0.7 | Peak = 41kPa<br>Residual = 17kPa | | 1 | | Pt: PEAT: dark brownish black. Low plasticity, moderately sensitive, organic, fibrous, tree stumps.<br><br>(Peat) | W | | | |
| | 1.2 | Peak = 38kPa<br>Residual = 14kPa | | | | | | | | |
| ▼ | 1.7 | Peak = 43kPa<br>Residual = 20kPa | | 2 | | | | F | | |
| | 2.4 | Peak = 43kPa<br>Residual = 23kPa | | | | | W to S | | | |
| | 2.9 | Peak = 32kPa<br>Residual = 14kPa | | 3 | | | | | | |
| | 3.5 | Peak = 75kPa<br>Residual = 29kPa | | | | ML: Sandy SILT: greyish brown streaked orange brown. Low plasticity, moderately sensitive; sand, fine to coarse.<br>(Pleistocene Alluvium) | | St | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP14

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400974.6mE; 793492.0mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0 | | OL: Organic SILT: dark brownish black. Non-plastic; sand, fine.<br>(Topsoil) | D to M | | | |
| | | | | | | SP: Fine SAND: light brownish grey. Poorly graded.<br>(Alluvial Sands) | | | | |
| | 0.8 | Peak = 49kPa<br>Residual = 14kPa | | 1 | | Pt: PEAT<br>: dark brownish black. Low plasticity; moderately sensitive, organic, fibrous, tree stumps.<br>(Peat) | M to W | | | |
| ▼ | 1.3 | Peak = 43kPa<br>Residual = 14kPa | | | | | | | | |
| | 1.8 | Peak = 43kPa<br>Residual = 17kPa | | 2 | | | W to S | F | | |
| | 2.4 | Peak = 46kPa<br>Residual = 17kPa | | | | | | | | |
| | 2.9 | Peak = 46kPa<br>Residual = 12kPa | | 3 | | | | | | |
| | | | | | | SP: Fine to medium SAND: brownish grey. Poorly graded, interbedded with sandy SILT.<br>(Pleistocene Alluvium) | | L to MD | 2<br>3<br>1<br>1 | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No: 14
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP15

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 18/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400622.4mE; 793550.2mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine.<br><br>(Topsoil) | D to M | LP | | |
| | | | | | | SP: Fine SAND: light brownish grey. Poorly graded.<br>(Alluvial Sands) | | | | |
| | 0.5 | Peak = 43kPa<br>Residual = 14kPa | | | | Pt: PEAT<br>: dark brownish black. Low plasticity, moderately sensitive, organic, fibrous, tree stumps<br><br>(Peat) | | F | | |
| | 1.0 | Peak = 41kPa<br>Residual = 20kPa | | 1 | | | M to W | | | |
| | | | | | | SW: Fine to coarse SAND: grey. Well graded, pumiceous.<br>(Alluvial Sands) | | LP | | |
| ▼ | 1.7 | Peak = 43kPa<br>Residual = 20kPa | | | | Pt: PEAT: dark brownish black. Low plasticity, organic, moderately sensitive, fibrous, tree stumps.<br><br>(Peat) | | F | | |
| | | | | 2 | | SW: Fine to coarse SAND: grey. Well graded, pumiceous.<br>(Pleistocene Alluvium) | W to S | L to MD | 2<br>3<br>4<br>2<br>3<br>4<br>4<br>2<br>3<br>2<br>4 | |
| | | | | 3 | | | | | 4<br>3<br>3<br>3<br>4 | |
| | | | | | | Test pit terminated at 3.50 m | | | | |
| | | | | 4 | | | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Hole collapse
Shear Vane No: 3403 DCP No: 14
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP16

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400640.8mE; 793583.8mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency / Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine.<br>(Topsoil) | D to M | | 5 10 15 20 | |
| | 0.4 | Peak = 58kPa<br>Residual = 14kPa | | | | SP: Fine SAND : light brownish grey. Poorly graded.<br>(Alluvial Sands) | | LP | | |
| | | | | | | Pt: PEAT<br>: dark brownish black. Low plasticity, , moderately sensitive, organic, fibrous, tree stumps.<br>(Peat) | W | F | | |
| | 1.0 | Peak = 38kPa<br>Residual = 17kPa | | 1 | | | | | | |
| | 1.5 | Peak = 43kPa<br>Residual = 14kPa | | | | SW: Fine to coarse SAND: with trace gravel; light grey. Well graded, pumiceous.<br>(Alluvial Sands) | | | | |
| ▼ | | | | 2 | | *... from 2.00m to 2.05m, Thin organic layer* | | LP | | |
| | 2.2 | Peak = 67kPa<br>Residual = 17kPa | | | | ML: Sandy SILT: greyish brown streaked orange brown. Low plasticity, moderately sensitive; sand, fine to coarse.<br>(Pleistocene Alluvium) | W to S | St | | |
| | | | | | | Test pit terminated at 2.40 m | | | | |
| | | | | 3 | | | | | | |
| | | | | 4 | | | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Hole collapse
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP17

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400865.3mE; 793446.0mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)) | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations (Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | D to M | | | |
| | | | | | | SP: Fine SAND: light brownish grey. Uniformly graded. (Pleistocene Alluvium) | | | 1 2 2 3 4 2 2 | |
| | | | | | | SM: Silty Fine to medium SAND: light greyish yellow. Poorly graded. (Pleistocene Alluvium) | | L to MD | | |
| | | | | 1 | | ML: Sandy SILT: greyish brown streaked orange brown. Low plasticity, moderately sensitive; sand, fine to coarse. (Pleistocene Alluvium) | | | | |
| | 1.5 | Peak = 142kPa Residual = 43kPa | | | | | | | | |
| | 2.0 | Peak = 96kPa Residual = 29kPa | | 2 | | | | | | |
| | | | | | | MH: Clayey SILT: with minor sand; light grey streaked orange brown. Low plasticity, moderately sensitive; sand, fine to medium. (Pleistocene Alluvium) | M | St to VSt | | |
| | 2.5 | Peak = 188kPa Residual = 43kPa | | | | | | | | |
| | 3.0 | Peak = 101kPa Residual = 29kPa | | 3 | | | | | | |
| | 3.5 | Peak = 174kPa Residual = 29kPa | | | | | | | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target depth
Shear Vane No: 3403 DCP No: 14
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP18

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400924.0mE; 793473.6mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. | D to M | | | |
| | | | | | | (Topsoil) | | | | |
| | | | | | | SP: Fine SAND: light brownish grey. Poorly graded. (Alluvial Sands) | M to W | | | |
| | | | | | | Pt: PEAT: dark brownish black. Low plasticity, moderately sensitive, organic, fibrous, tree stumps. | | | | |
| | | | | | | (Peat) | | | | |
| | 0.7 | Peak = 43kPa Residual = 17kPa | | | | ML: Sandy SILT: light brownish grey. Low plasticity, moderately sensitive; sand, fine to medium. (Matua Subgroup) | | | | |
| | | | | 1 | | | M | F to St | | |
| | 1.2 | Peak = 75kPa Residual = 41kPa | | | | | | | | |
| | 1.8 | Peak = 75kPa Residual = 20kPa | | | | | | | | |
| ▼ | | | | 2 | | MH: Clayey SILT: with minor sand; light grey. Low plasticity; sand, fine to medium. (Matua Subgroup) | | | | |
| | | | | | | ... *at 2.20m, Interbedded with thin sand layers* | | | | |
| | 2.5 | Peak = 119kPa Residual = 46kPa | | | | | W to S | VSt | | |
| | 3.0 | Peak = 104kPa Residual = 41kPa | | 3 | | | | | | |
| | 3.5 | Peak = 116kPa Residual = 26kPa | | | | | | | | |
| | | | | | | Test pit terminated at 3.60 m | | | | |
| | | | | 4 | | | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Hole collapse
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP19

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400988.8mE; 793444.7mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)) | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations (Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine.<br><br>(Topsoil) | | | | |
| | 0.4 | Peak = 43kPa<br>Residual = 26kPa | | | | ML: SILT: orange. Low plasticity, moderately sensitive to sensitive.<br>(Pleistocene Alluvium) | D to M | F to St | | |
| | 0.9 | Peak = 61kPa<br>Residual = 32kPa | | 1 | | ... at 1.20m, becoming light brown | | | | |
| | 1.5 | Peak = 127kPa<br>Residual = 26kPa | | | | MH: Clayey SILT: light brown streaked orange. Low plasticity, moderately sensitive to sensitive.<br>(Pleistocene Alluvium) | | | | |
| | 2.0 | Peak = 142kPa<br>Residual = 29kPa | | 2 | | | | | | |
| | 2.5 | Peak = 119kPa<br>Residual = 29kPa | | | | | M | VSt | | |
| | | | | | | ... at 2.90m, contains minor sand | | | | |
| | 3.0 | Peak = 142kPa<br>Residual = 38kPa | | 3 | | | | | | |
| | 3.5 | Peak = 116kPa<br>Residual = 43kPa | | | | SW: Fine to coarse SAND: with minor gravel and trace silt; light yellowish white. Well graded, pumiceous.<br>(Pleistocene Alluvium) | | | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

# TEST PIT LOG - TP20

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 17/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: ~~LGL~~ | Scale: 1:25 | Sheet 1 of 1
Position: 400788.4mE; 793433.4mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit)) | Moisture Condition | Consistency / Relative Density | Dynamic Cone Penetrometer (Blows/100mm) 5 10 15 20 | Structure & Other Observations (Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks) |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0.5 | Peak = 104kPa Residual = 35kPa | | 0 | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | D to M | | | |
| | | | | | | ML: SILT: with some sand; orange. Low plasticity, moderately sensitive; sand, fine. (Pleistocene Alluvium) | | | | |
| | 1.0 | Peak = 104kPa Residual = 29kPa | | 1 | | | | | | |
| | | | | | | MH: Clayey SILT: with minor sand; light grey streaked orange brown. Low plasticity, moderately sensitive; sand, fine to medium. (Pleistocene Alluvium) | | | | |
| | 1.5 | Peak = 119kPa Residual = 35kPa | | | | | | | | |
| | 2.0 | Peak = 104kPa Residual = 29kPa | | 2 | | | M | VSt | | |
| | 2.5 | Peak = 174kPa Residual = 43kPa | | | | | | | | |
| | 3.0 | Peak = 122kPa Residual = 35kPa | | 3 | | | | | | |
| | 3.5 | Peak = 101kPa Residual = 35kPa | | | | | | | | |
| | | | | | | SM: Silty Fine to coarse SAND: light brownish grey. Well graded. (Pleistocene Alluvium) | | LP | | |
| | | | | 4 | | Test pit terminated at 4.00 m | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Target Depth
Shear Vane No: 3403 DCP No:
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

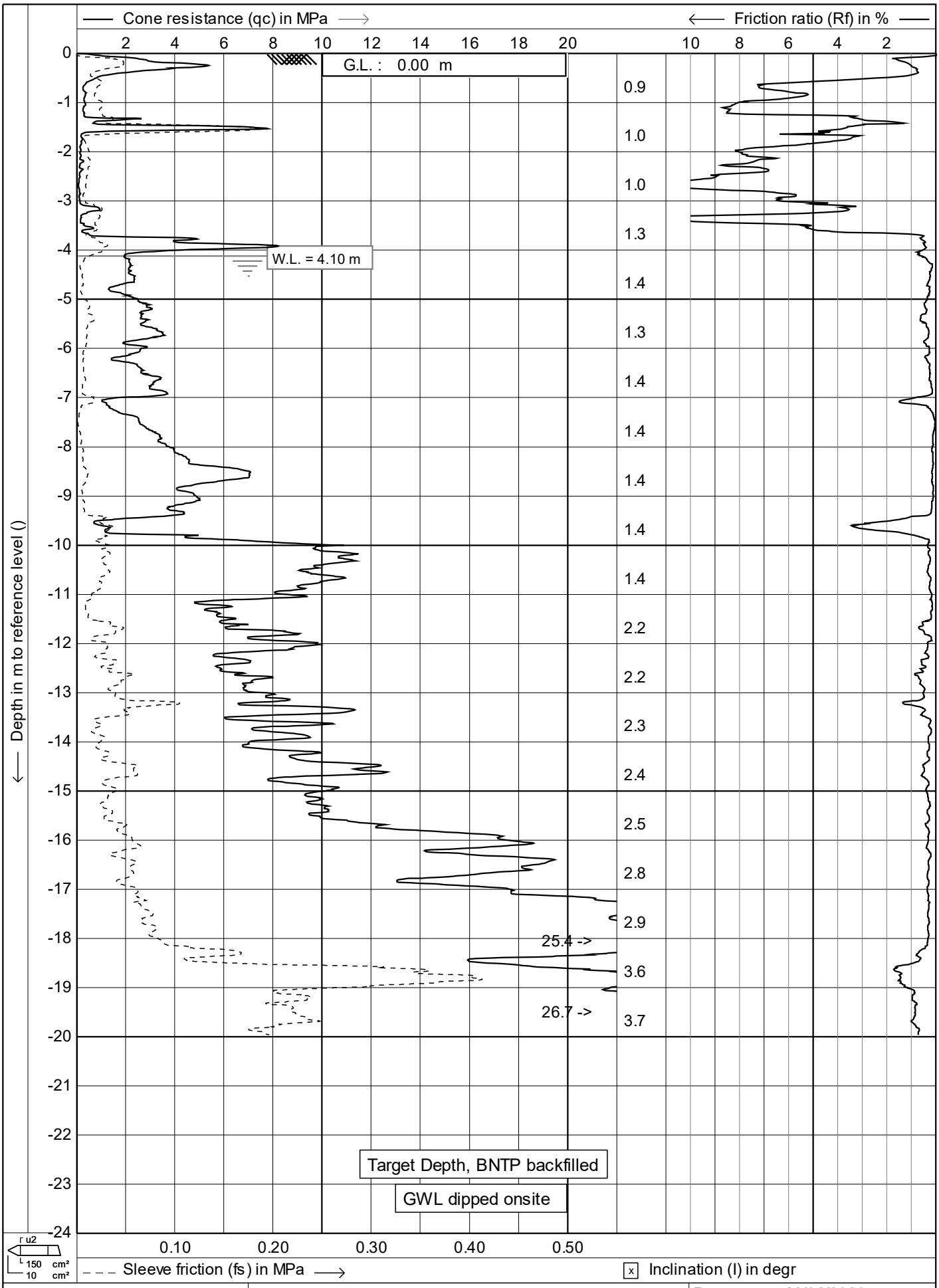
# TEST PIT LOG - TP21

Client: Kevin & Andrea Marsh
Project: Pencarrow Estate, 1491 Arawa Road, Pongakawa
Site Location: Pongakawa
Project No.: TGA2021-0096
Date: 18/01/2022
Test Pit Location: Refer to Drawing 01 | Logged by: BM | Checked by: LGL | Scale: 1:25 | Sheet 1 of 1
Position: 400672.7mE; 793405.6mN | Projection: BOP2000 | Datum: Moturiki
Pit Dimensions: m by m
Survey Source: pLog tablet

| Groundwater | Samples & Insitu Tests: Depth | Samples & Insitu Tests: Type & Results | RL (m) | Depth (m) | Graphic Log | Material Description | Moisture Condition | Consistency/ Relative Density | Dynamic Cone Penetrometer (Blows/100mm) | Structure & Other Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | OL: Organic SILT: with trace sand; dark brownish black. Non-plastic; sand, fine. (Topsoil) | D to M | | | |
| | | | | | | ML: SILT: light orange. Low plasticity. (Pleistocene Alluvium) | | | | |
| | 0.5 | Peak = 90kPa Residual = 17kPa | | | | MH: Clayey SILT: with minor sand; light grey streaked orange brown. Low plasticity, moderately sensitive; sand, fine to medium. (Pleistocene Alluvium) | | | | |
| | 1.0 | Peak = 87kPa Residual = 23kPa | | 1 | | | M to W | St | | |
| | 1.5 | Peak = 75kPa Residual = 35kPa | | | | | | | | |
| | 2.0 | Peak = 93kPa Residual = 35kPa | | 2 | | | | | | |
| ▼ | | | | | | SW: Fine to coarse SAND: grey. Well graded, pumiceous. (Pleistocene Alluvium) | W to S | L to MD | 3 4 3 4 2 4 | |
| | | | | 3 | | Test pit terminated at 3.00 m | | | | |
| | | | | 4 | | | | | | |
| | | | | 5 | | | | | | |

Termination Reason: Hole collapse
Shear Vane No: 3403 DCP No: 14
Remarks:

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

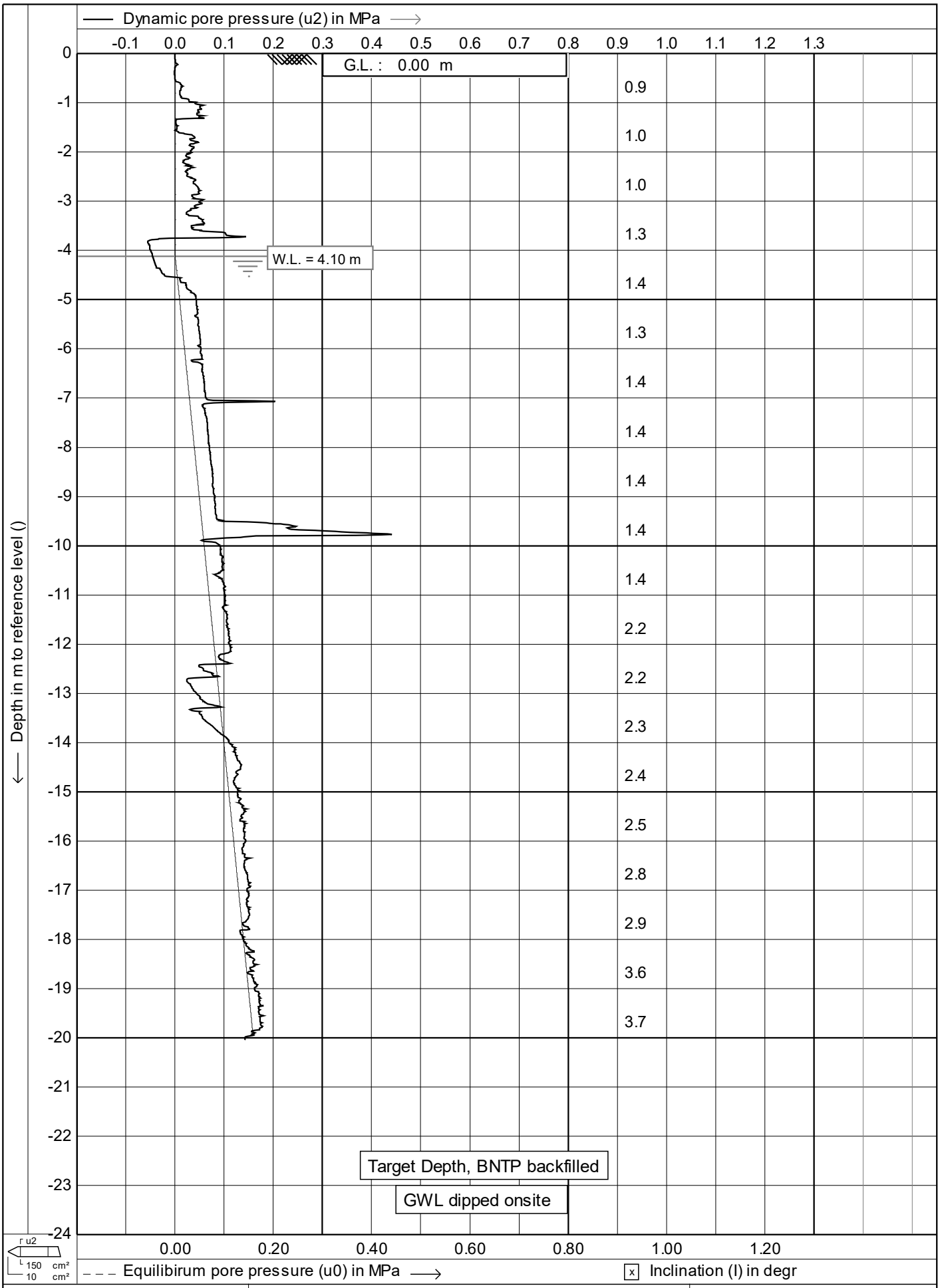
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **01**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

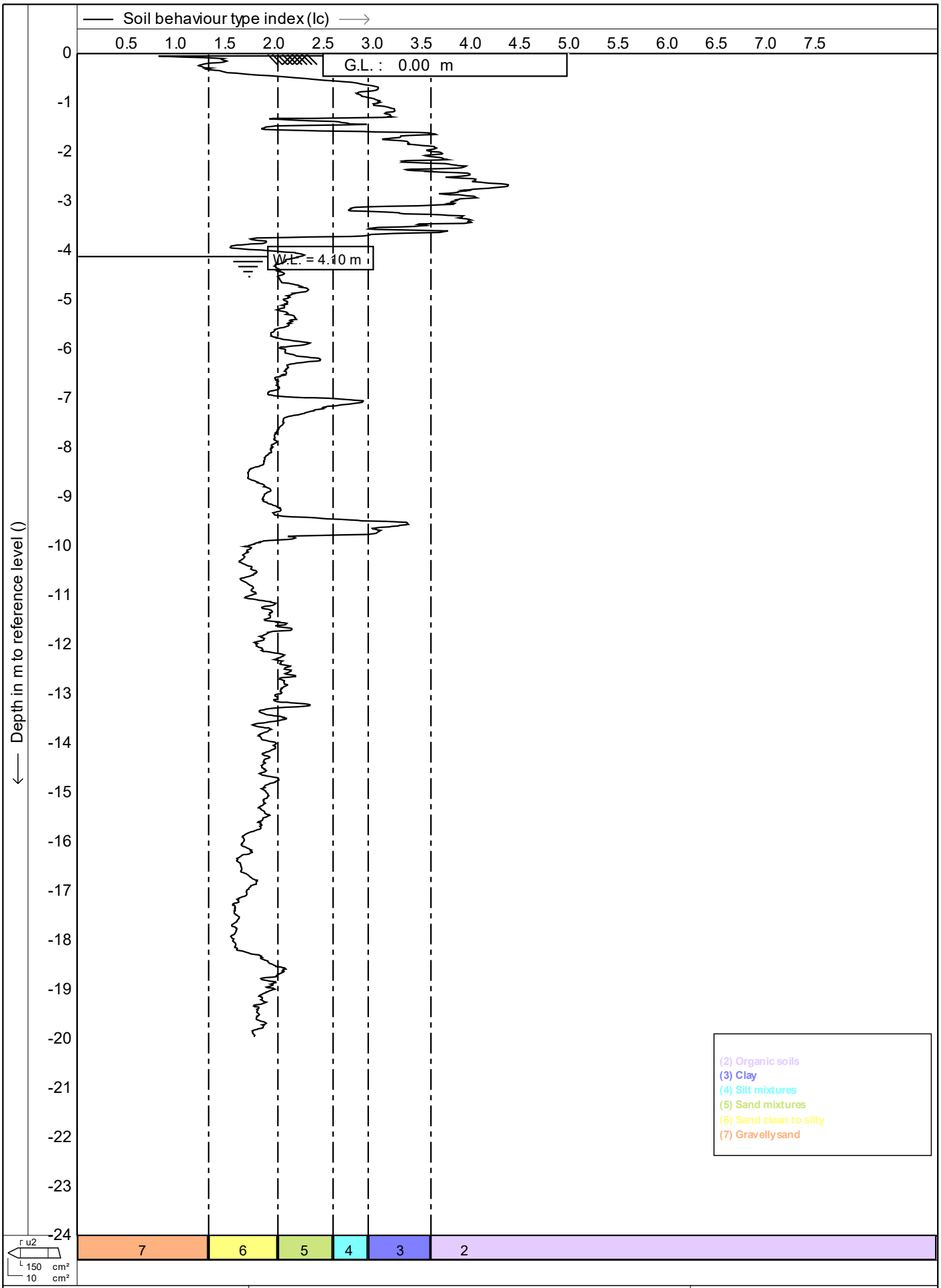
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **01**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

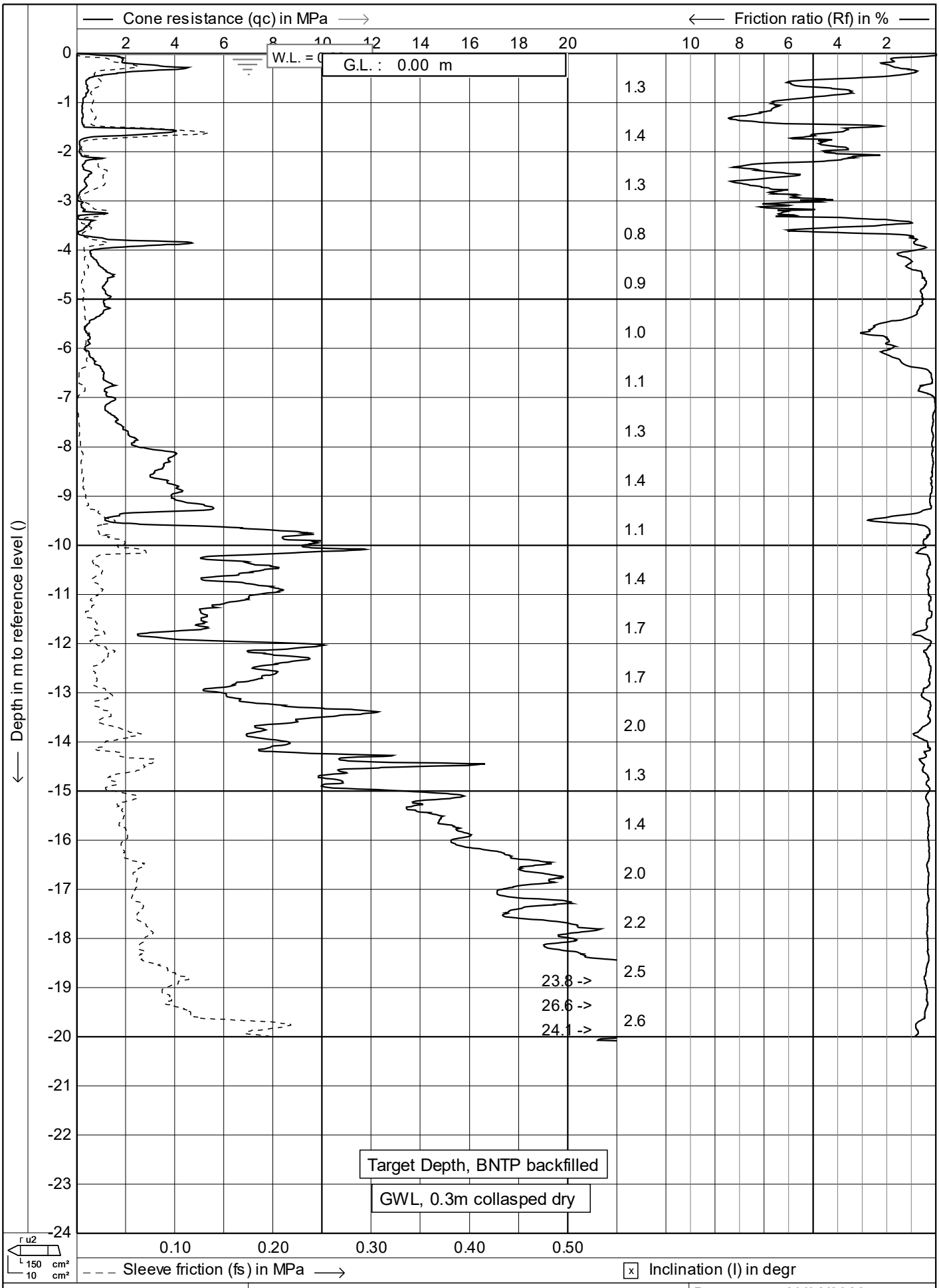
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **01**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **19/01/2022**

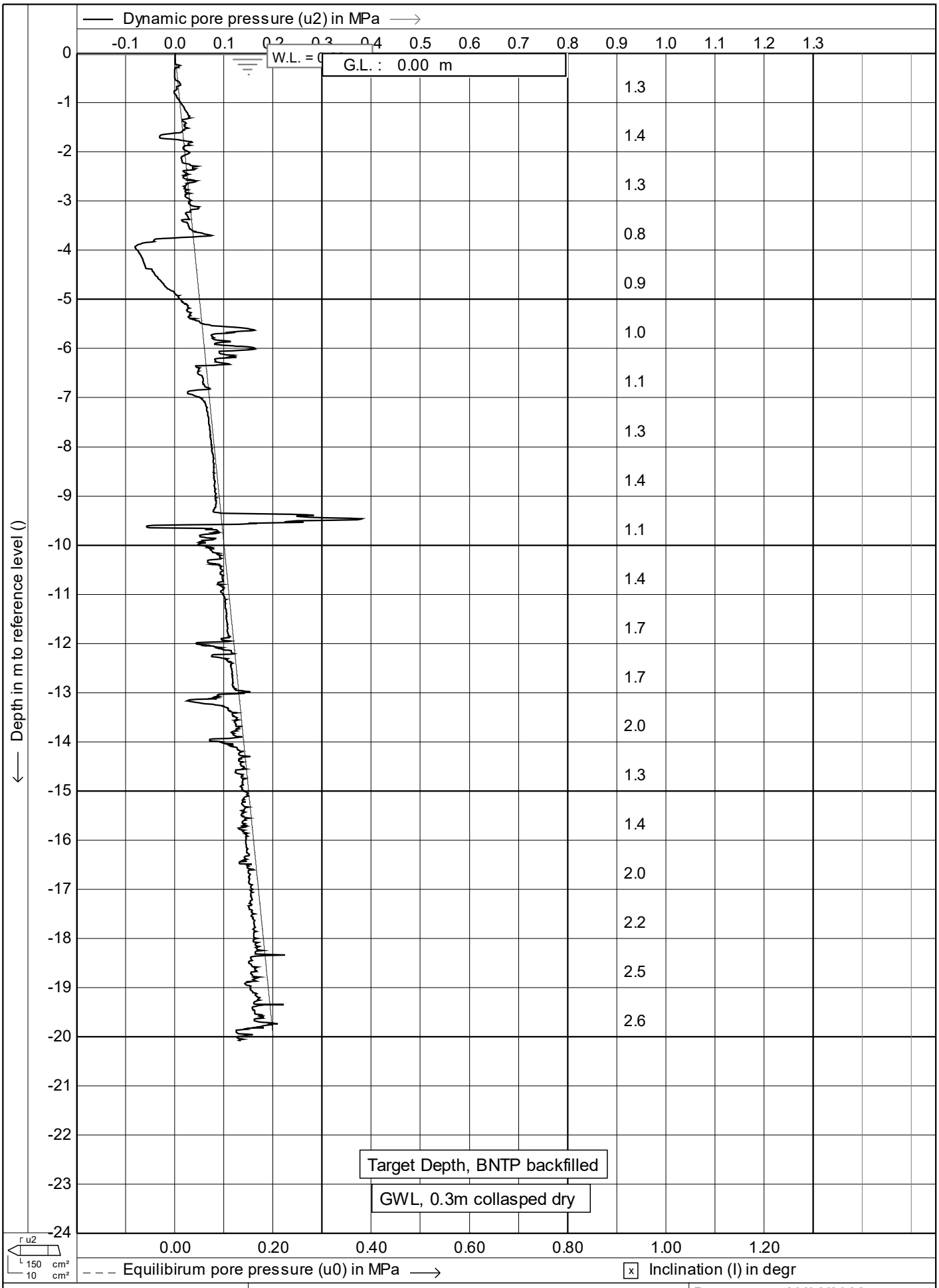
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **02**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **19/01/2022**

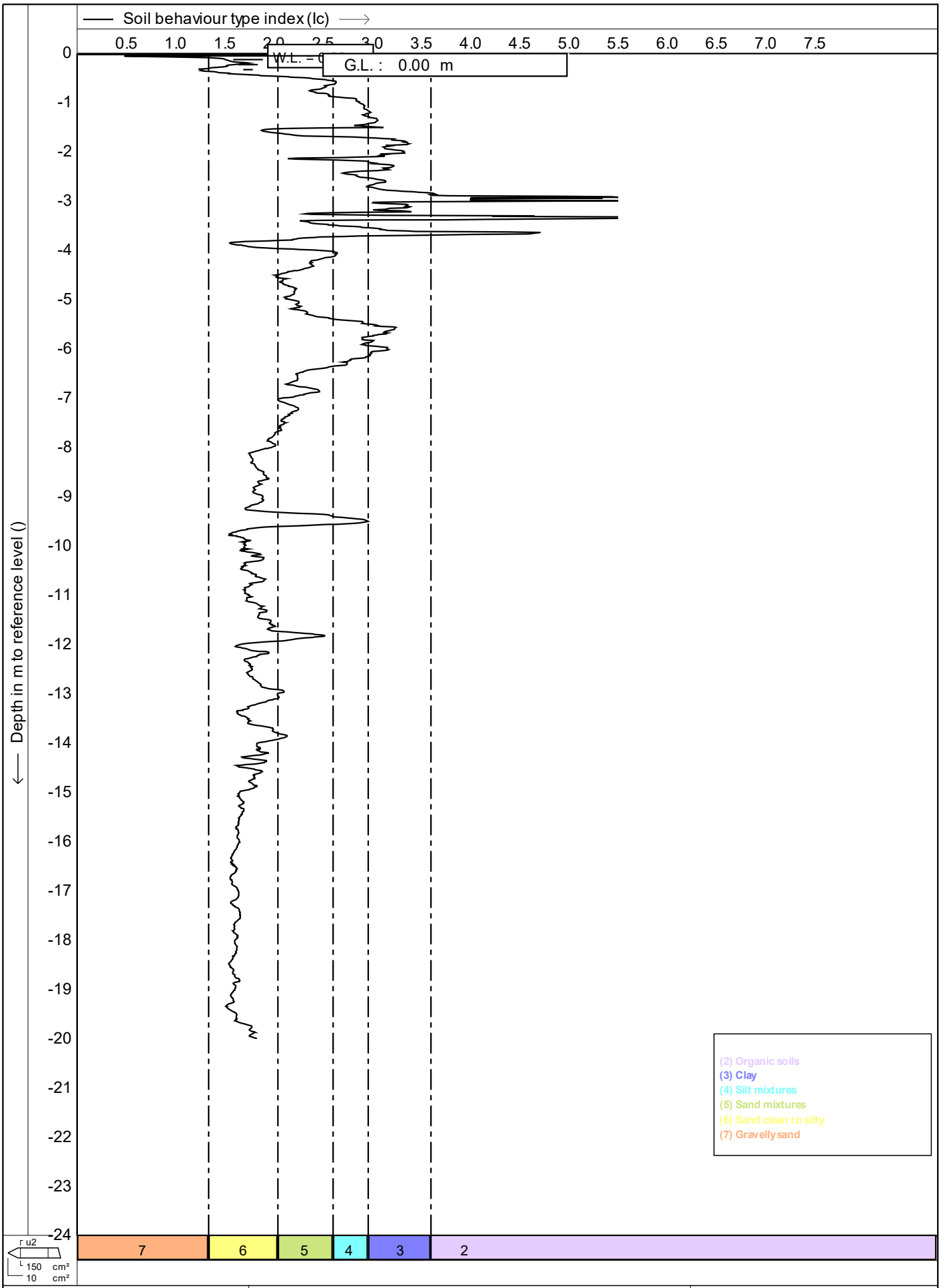
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **02**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

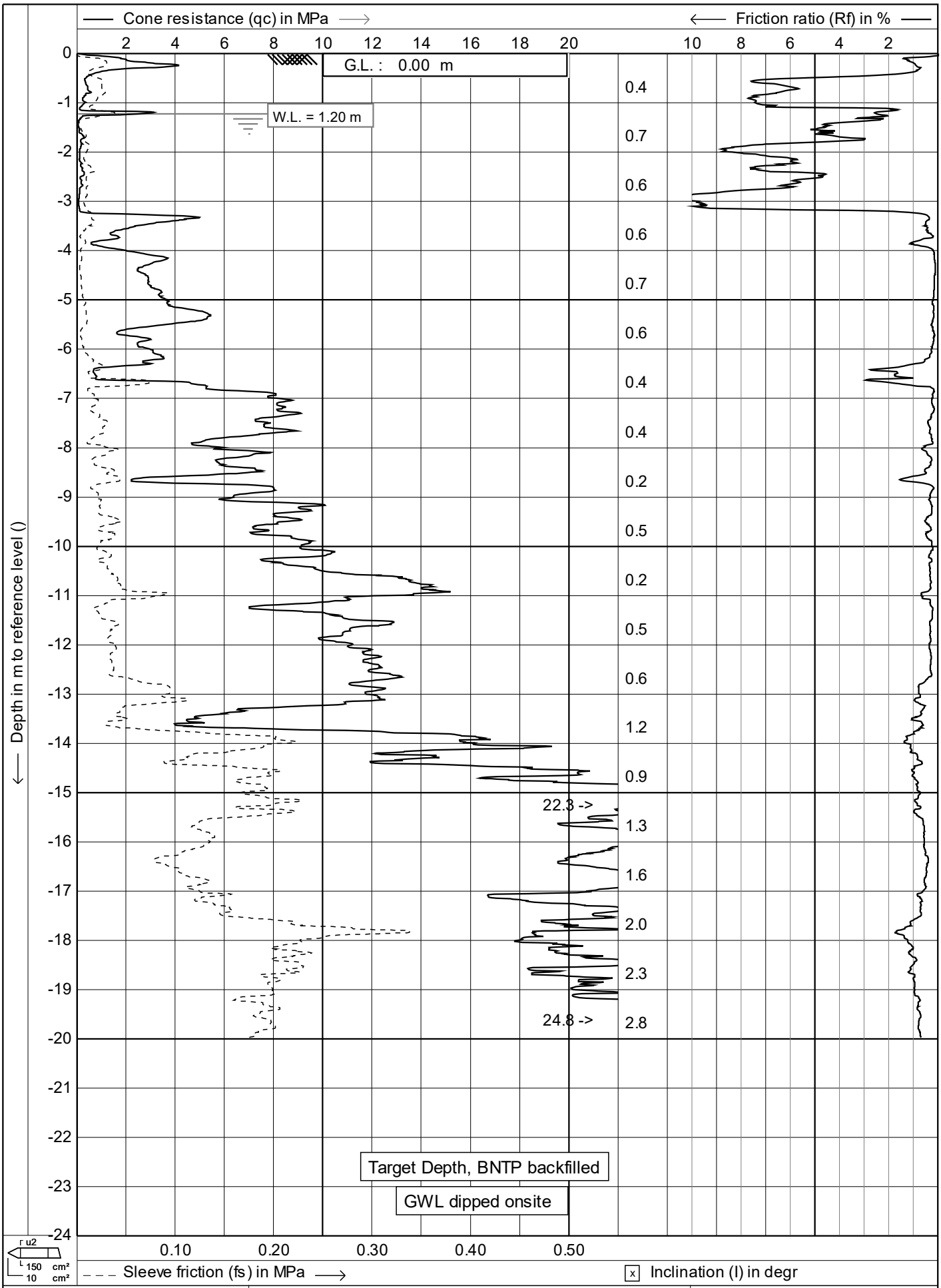
Date : **19/01/2022**

Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **02** **9/14**

1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **19/01/2022**

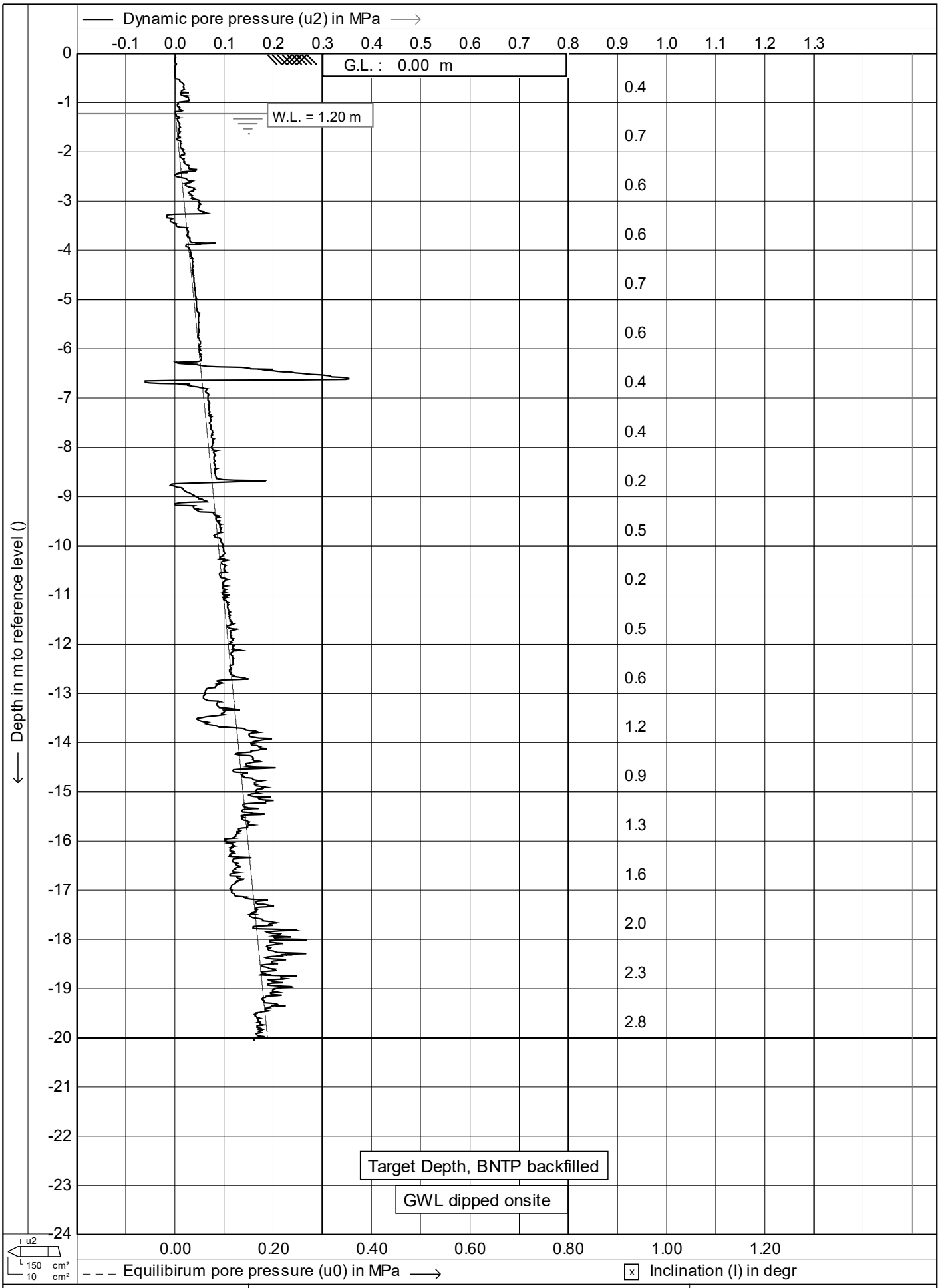
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **03**

**1/14**

1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **19/01/2022**

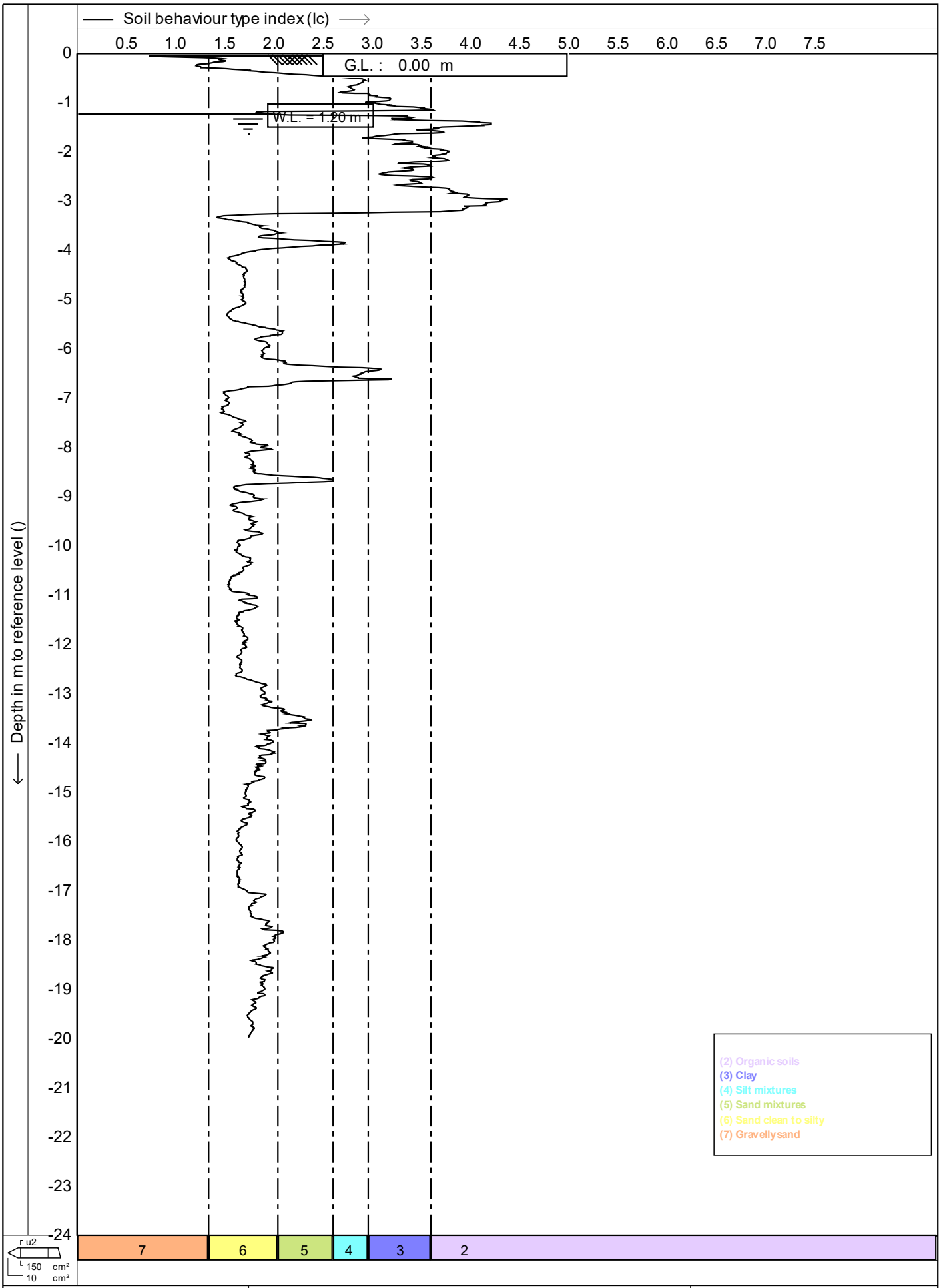
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **03**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **19/01/2022**

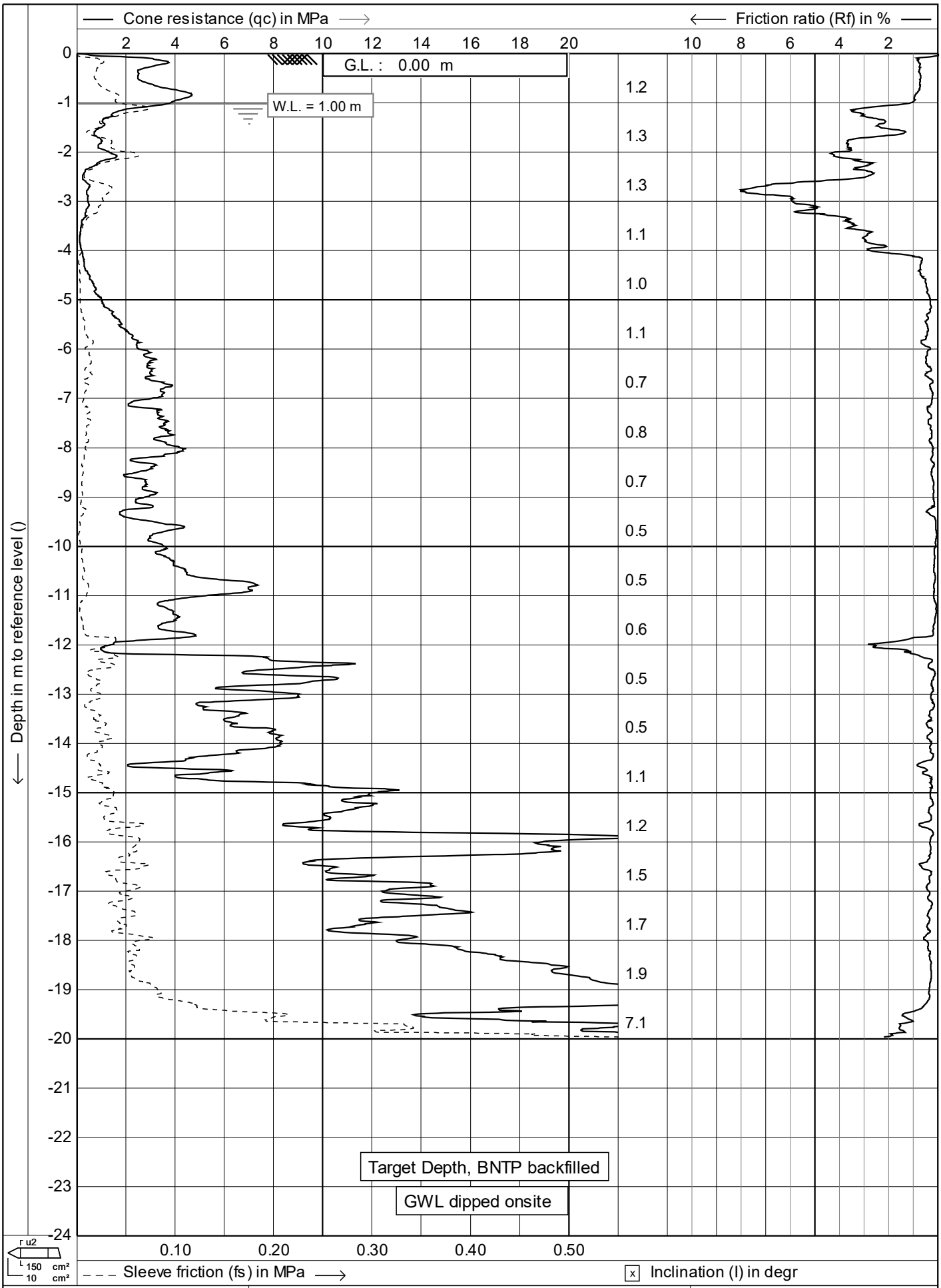
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **03**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

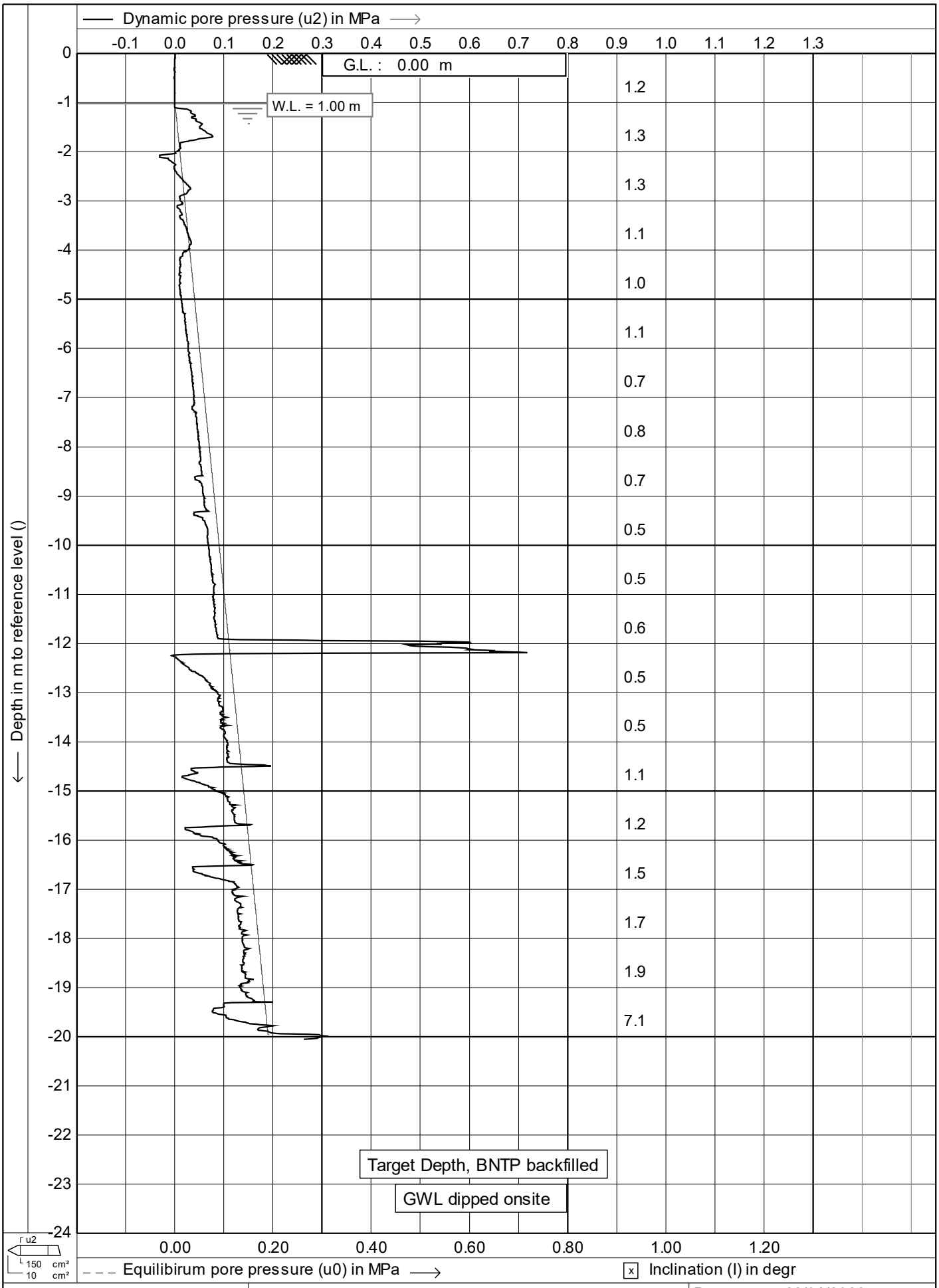
Date : **18/01/2022**

Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **04** **1/14**

1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

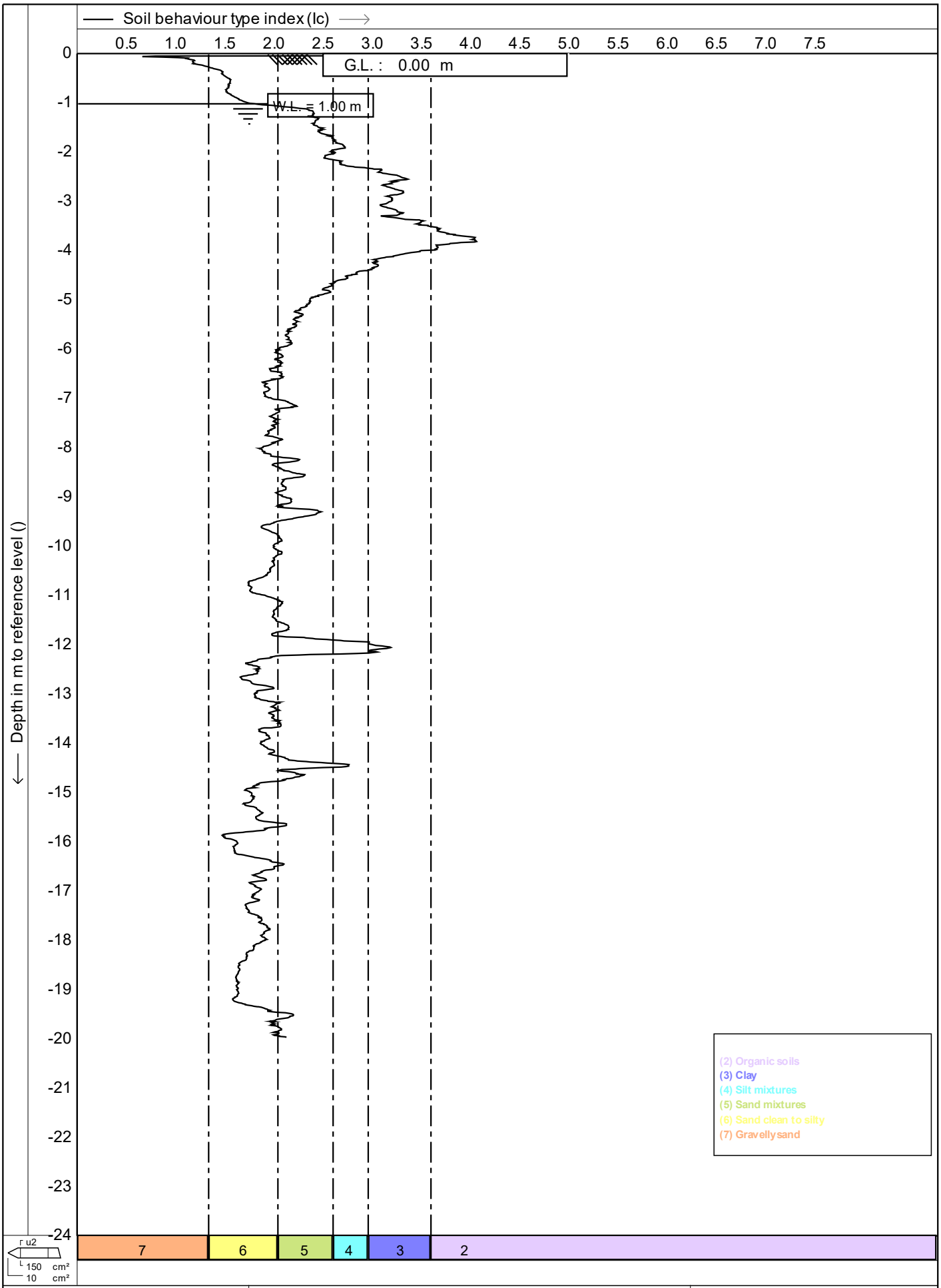
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **04**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

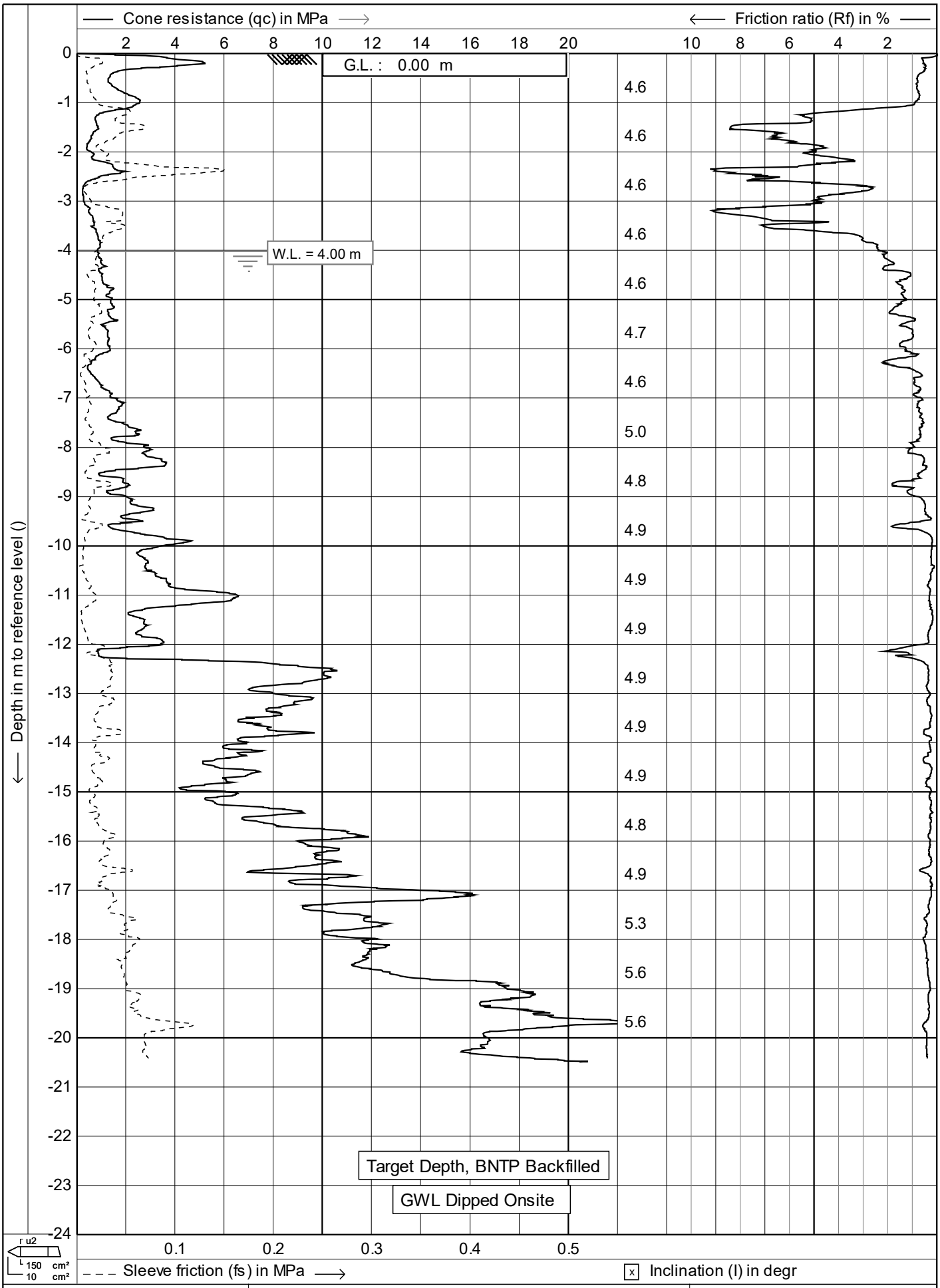
Date : **18/01/2022**

Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **04** **9/14**

1.48




A.S.T.M D5778-12

Project : **Site Investigations**

Location: **Arawa Rd - Pongakawa**

Position: **0, 0**

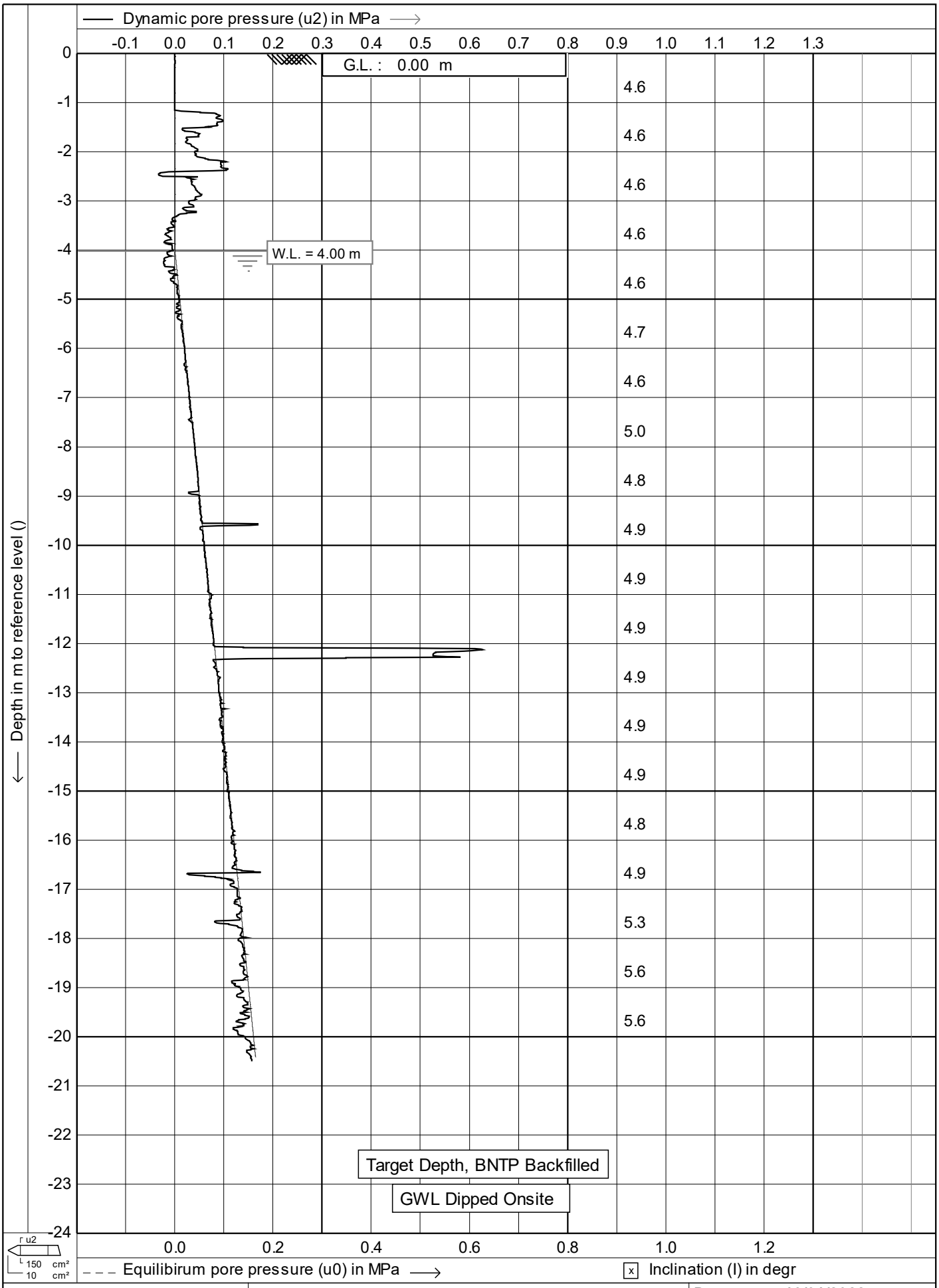
Date : **19/01/2022**

Cone no. : **C10CFIIP.C15212**

Project no. : **02CMW099**

CPT no. : **SCPT05** **1/14**

1.49




PERRY GEOTECH

A.S.T.M D5778-12

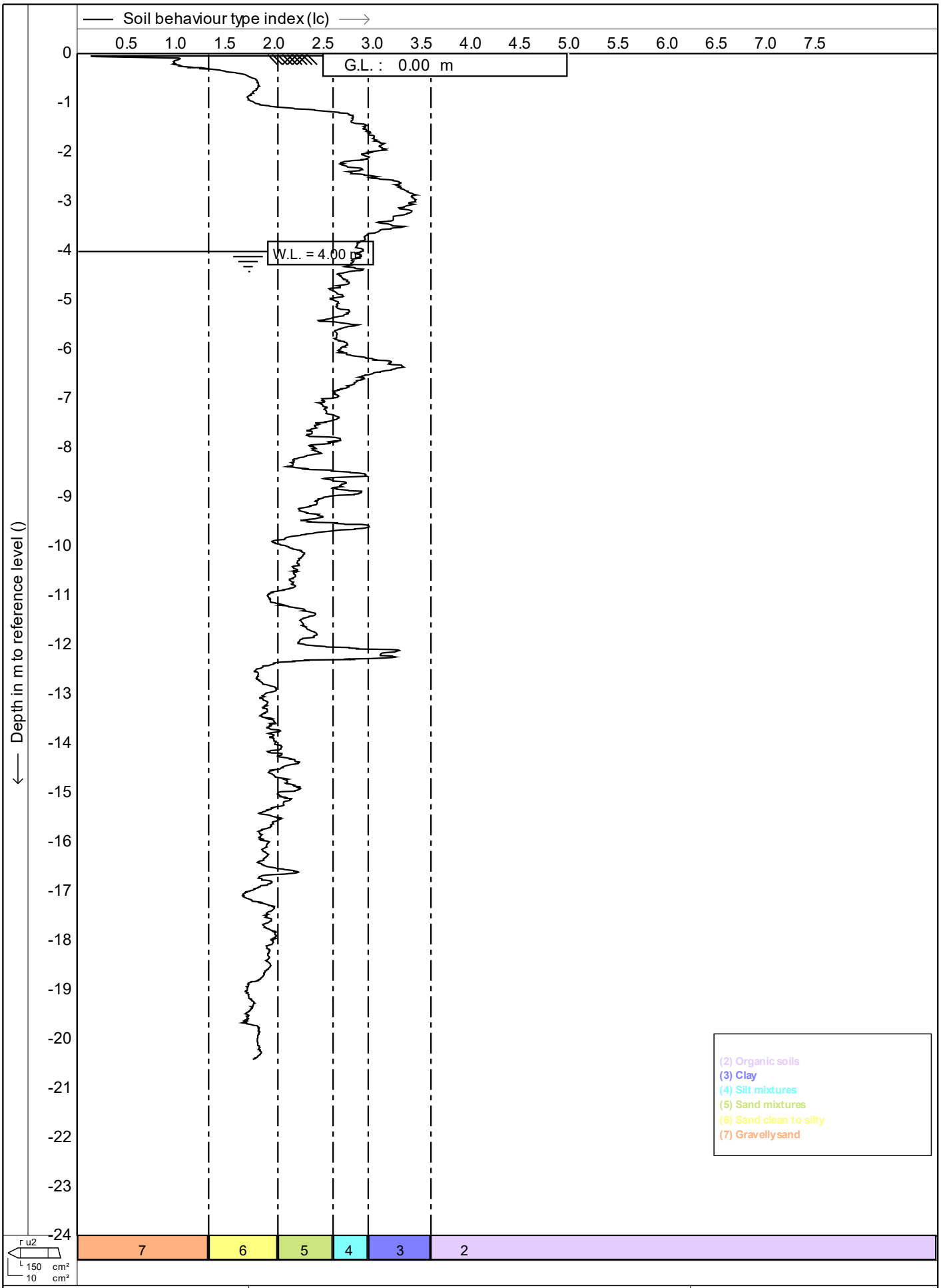
Project : **Site Investigations**

Location: **Arawa Rd - Pongakawa**

Position: **0, 0**

| | |
|---|---|
| Date | : **19/01/2022** |
| Cone no. | : **C10CFIIP.C15212** |
| Project no. | : **02CMW099** |
| CPT no. | : **SCPT05** 2/14 |

1.49




A.S.T.M D5778-12

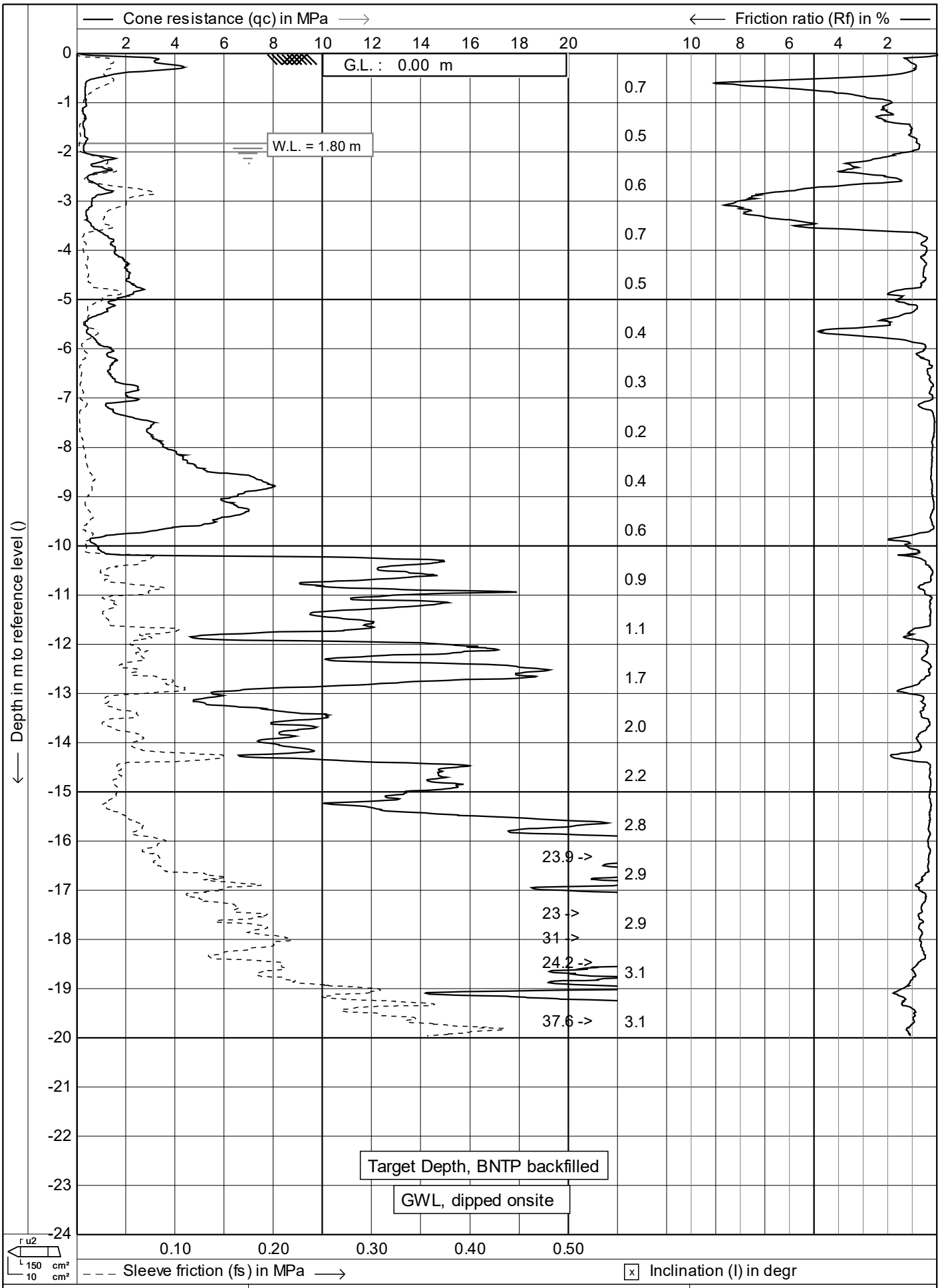
Project : **Site Investigations**

Location: **Arawa Rd - Pongakawa**

Position: **0, 0**

| | |
|---|---|
| Date | : **19/01/2022** |
| Cone no. | : **C10CFIIP.C15212** |
| Project no. | : **02CMW099** |
| CPT no. | : **SCPT05** **9/14** |

1.49




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **19/01/2022**

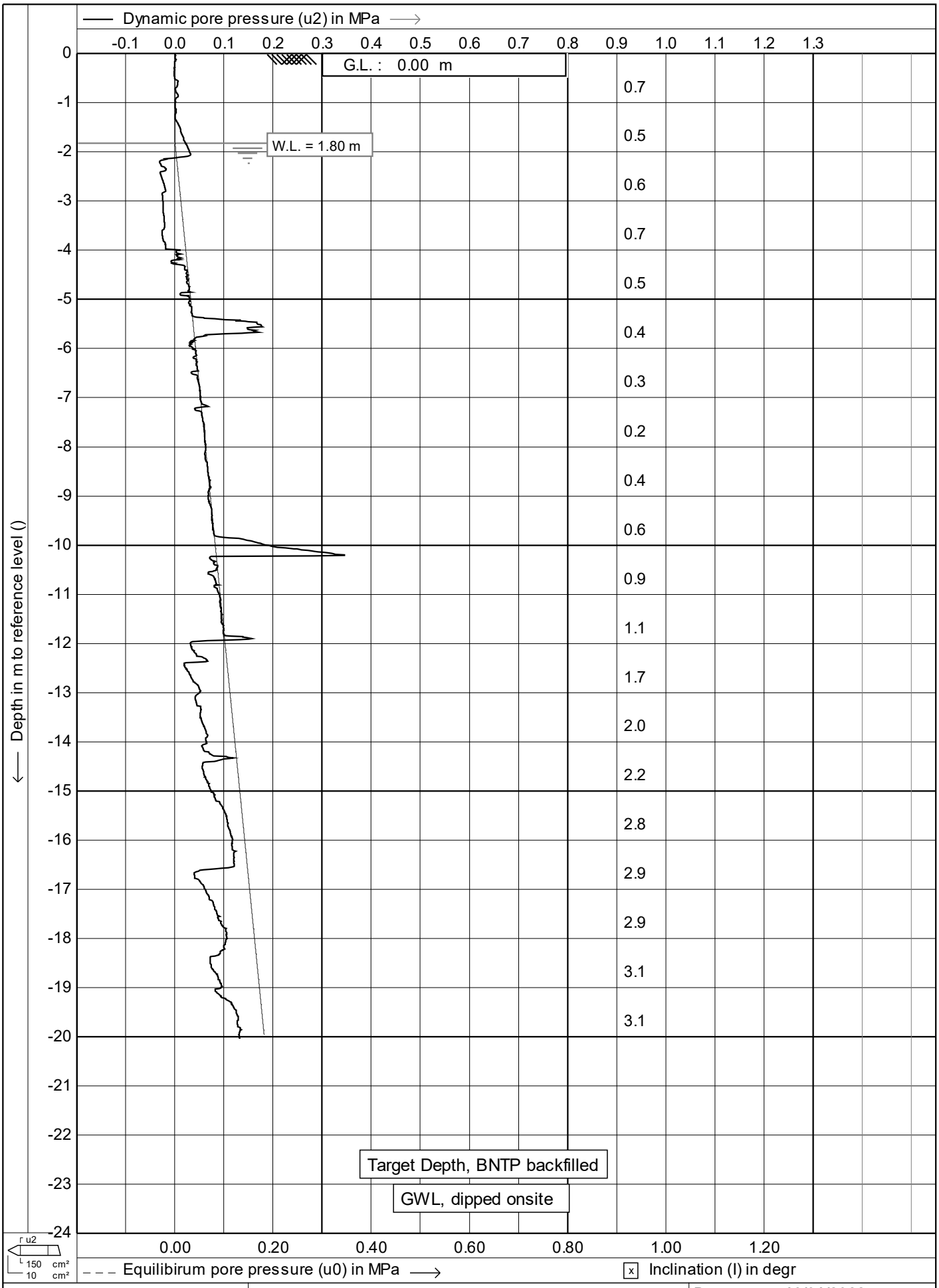
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **06**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **19/01/2022**

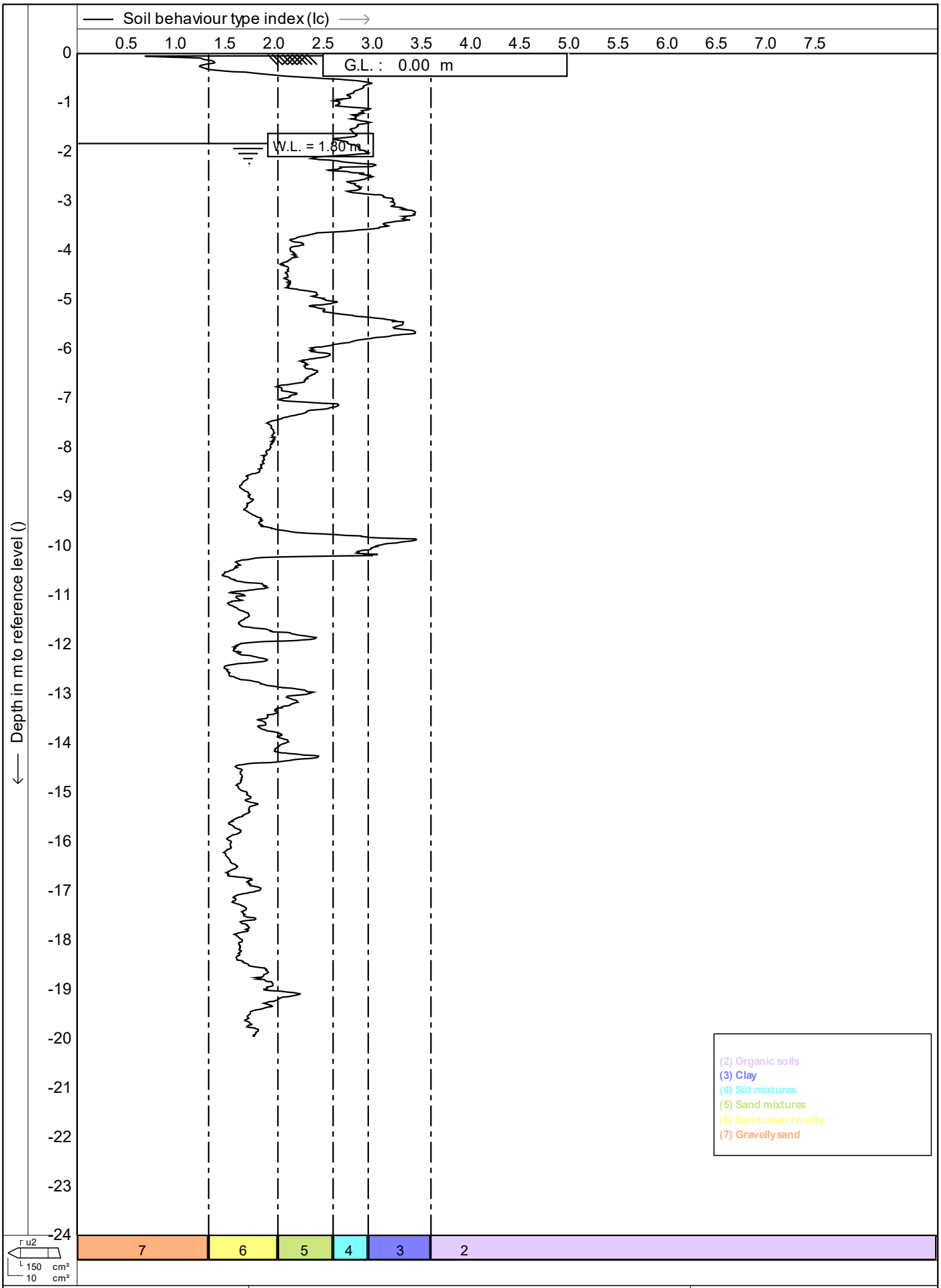
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **06**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

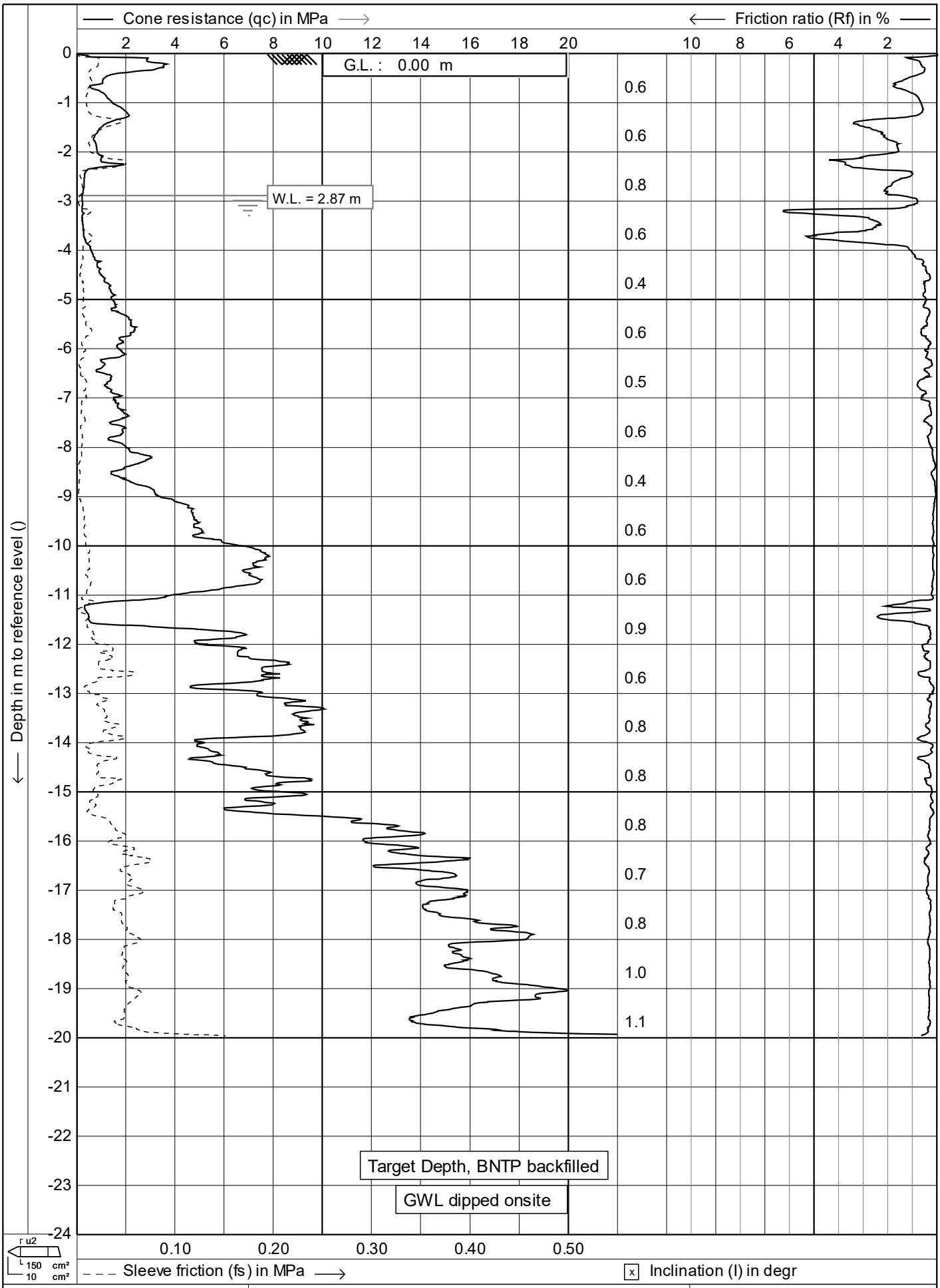
Date : **19/01/2022**

Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **06** **9/14**

1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

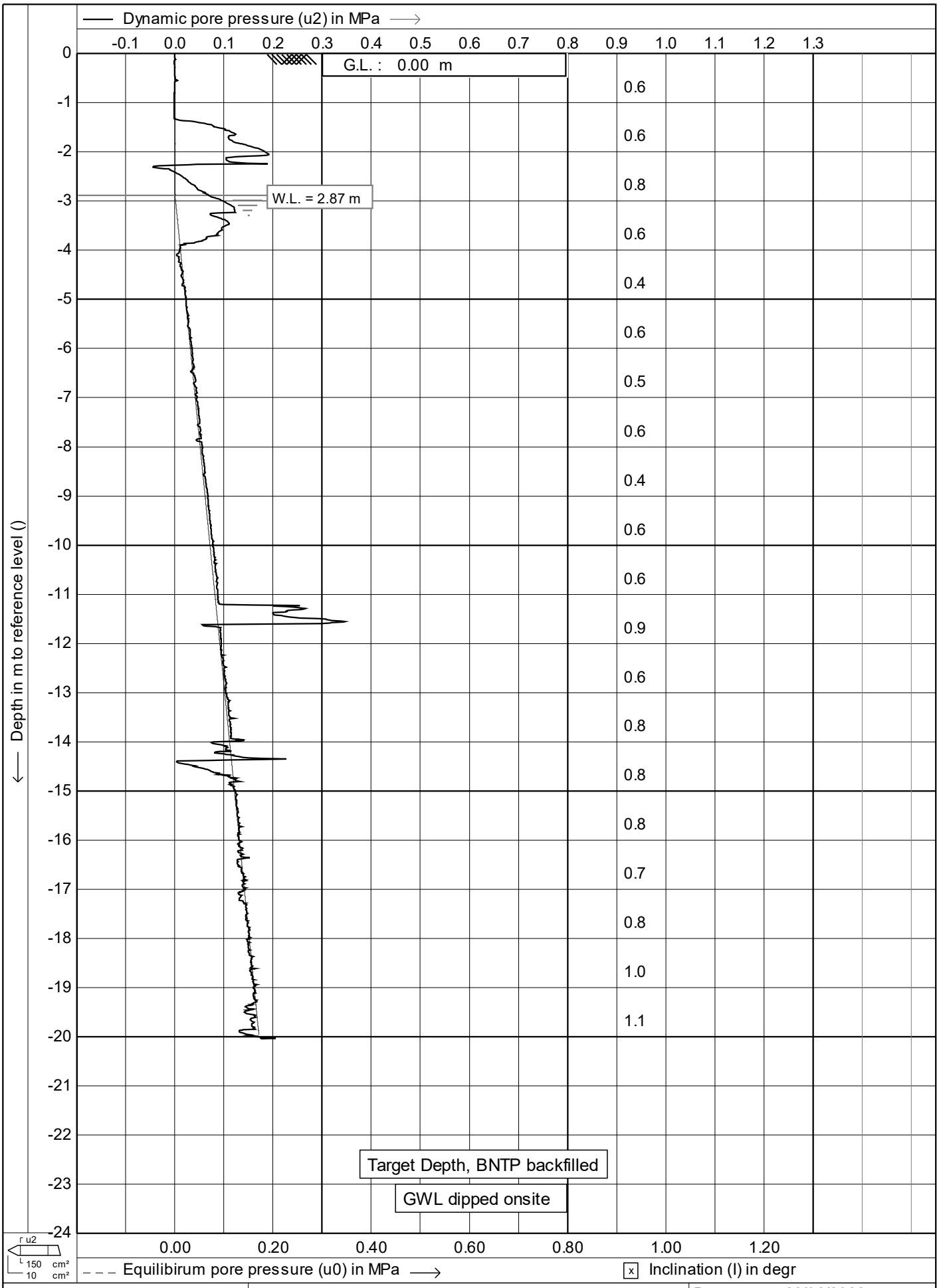
Position: **0, 0**

Date : **18/01/2022**

Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **07**




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

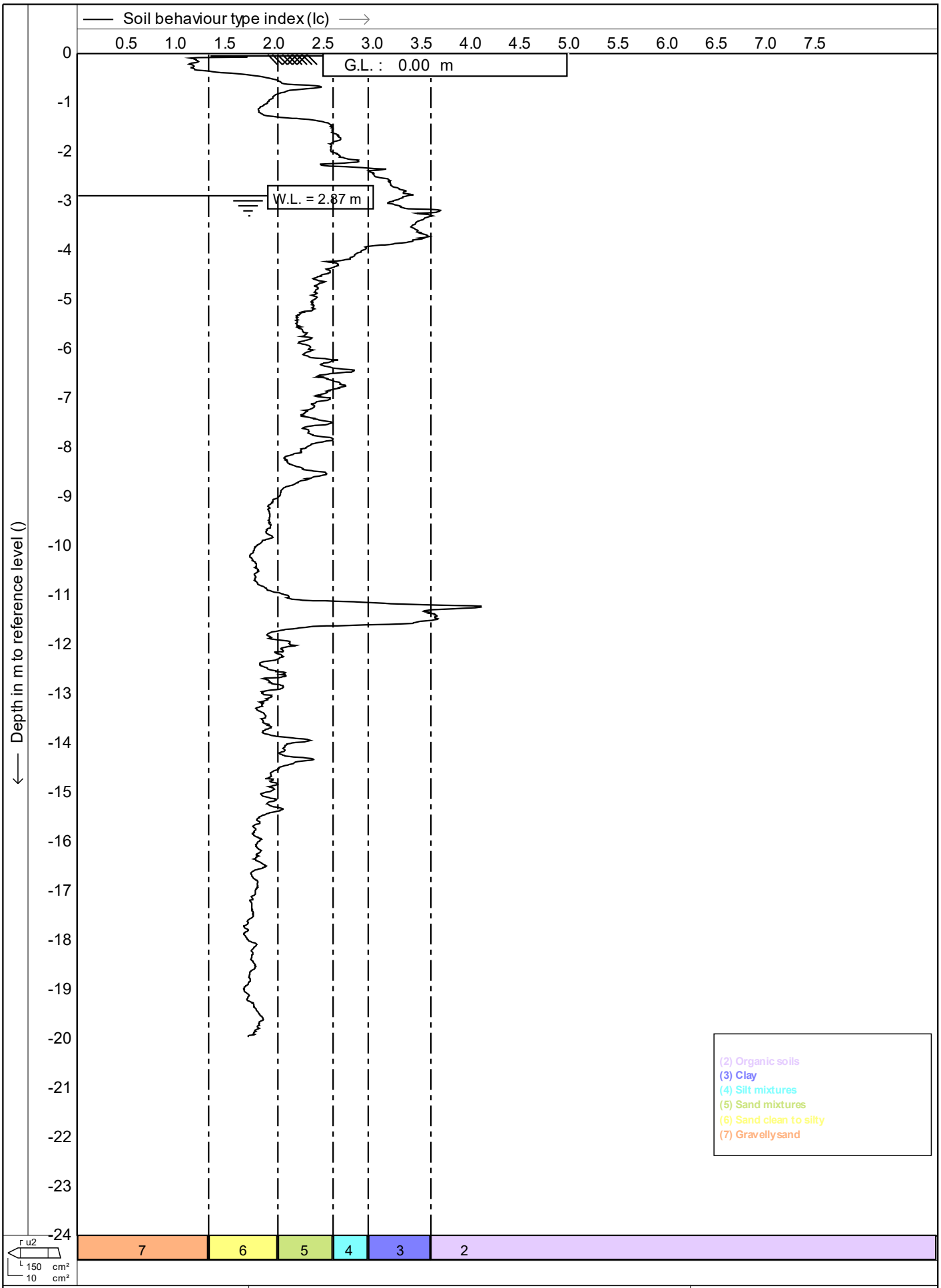
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **07**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

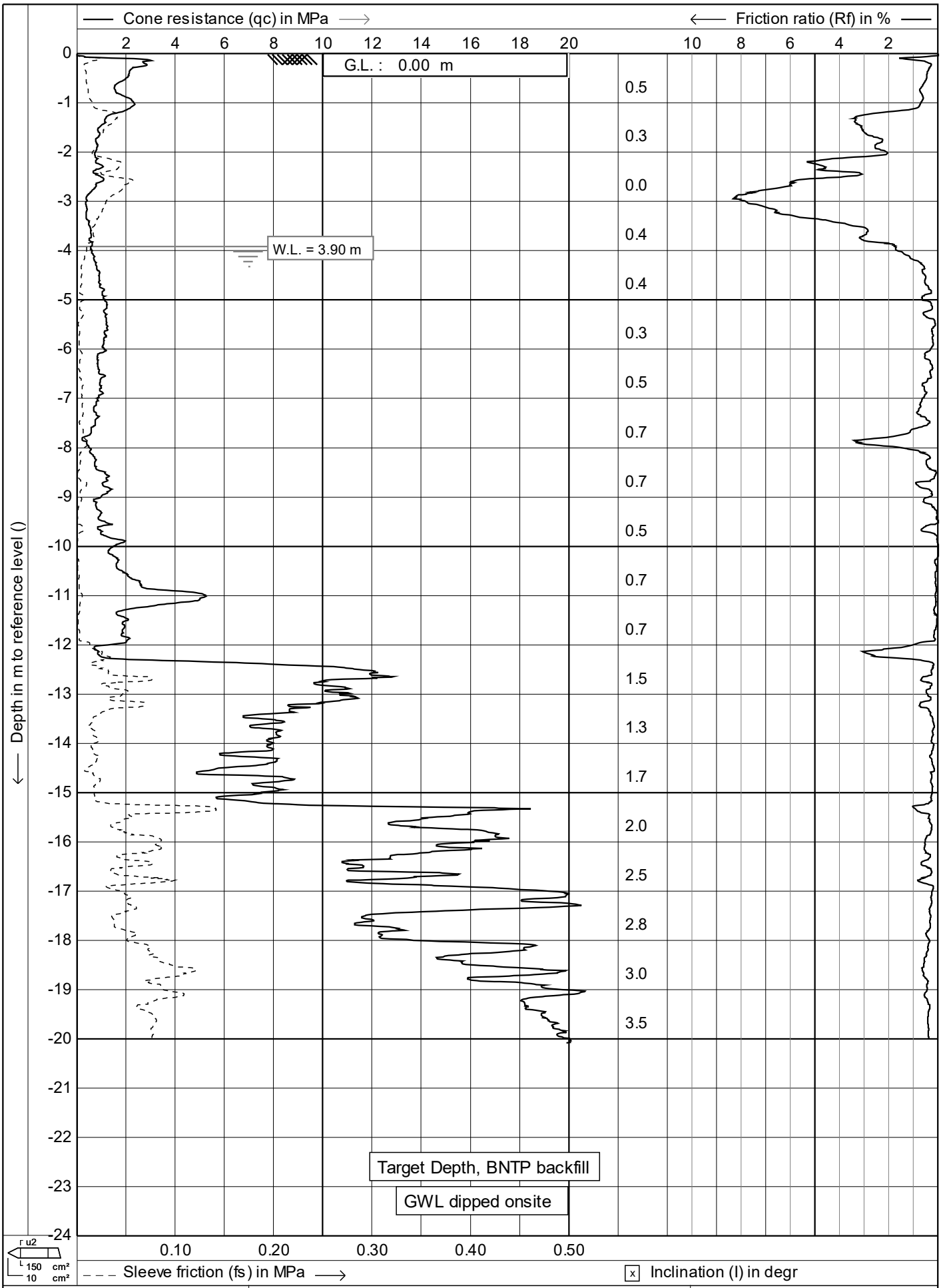
Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

| | |
|---|---|
| Date | : **18/01/2022** |
| Cone no. | : **C10CFIIP.C17803** |
| Project no. | : **05CMW099** |
| CPT no. | : **07** |



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

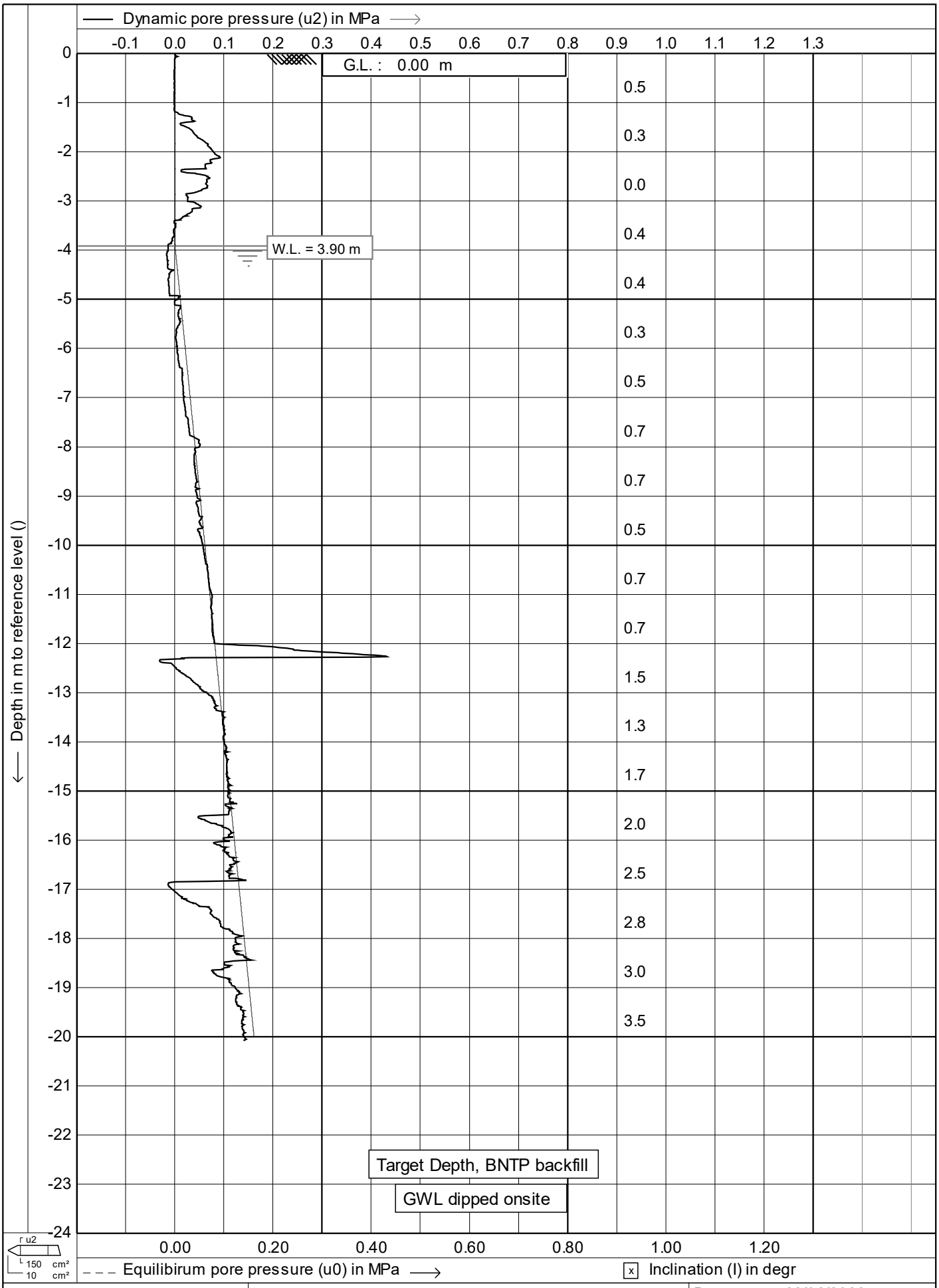
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **08**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

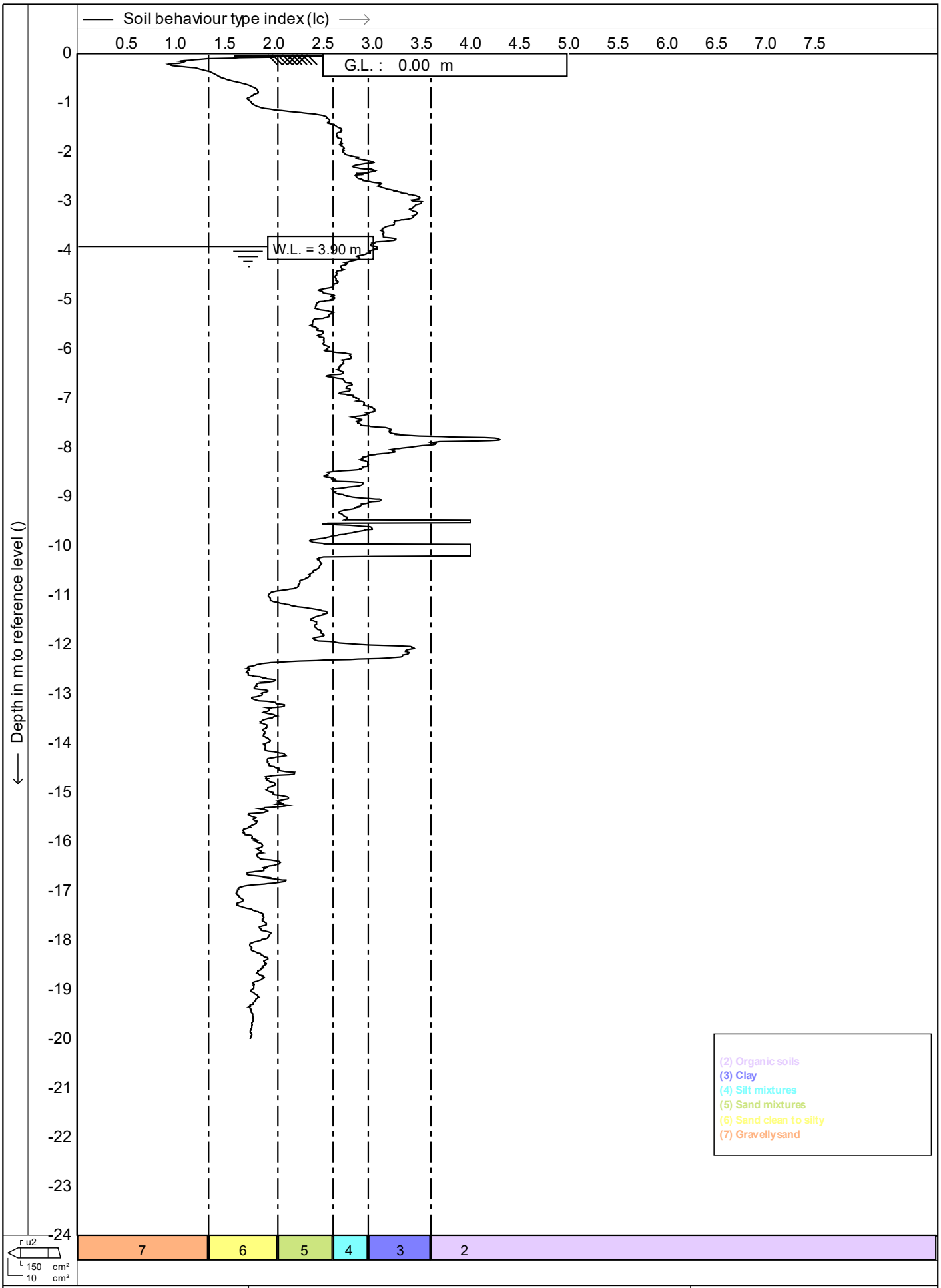
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **08**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

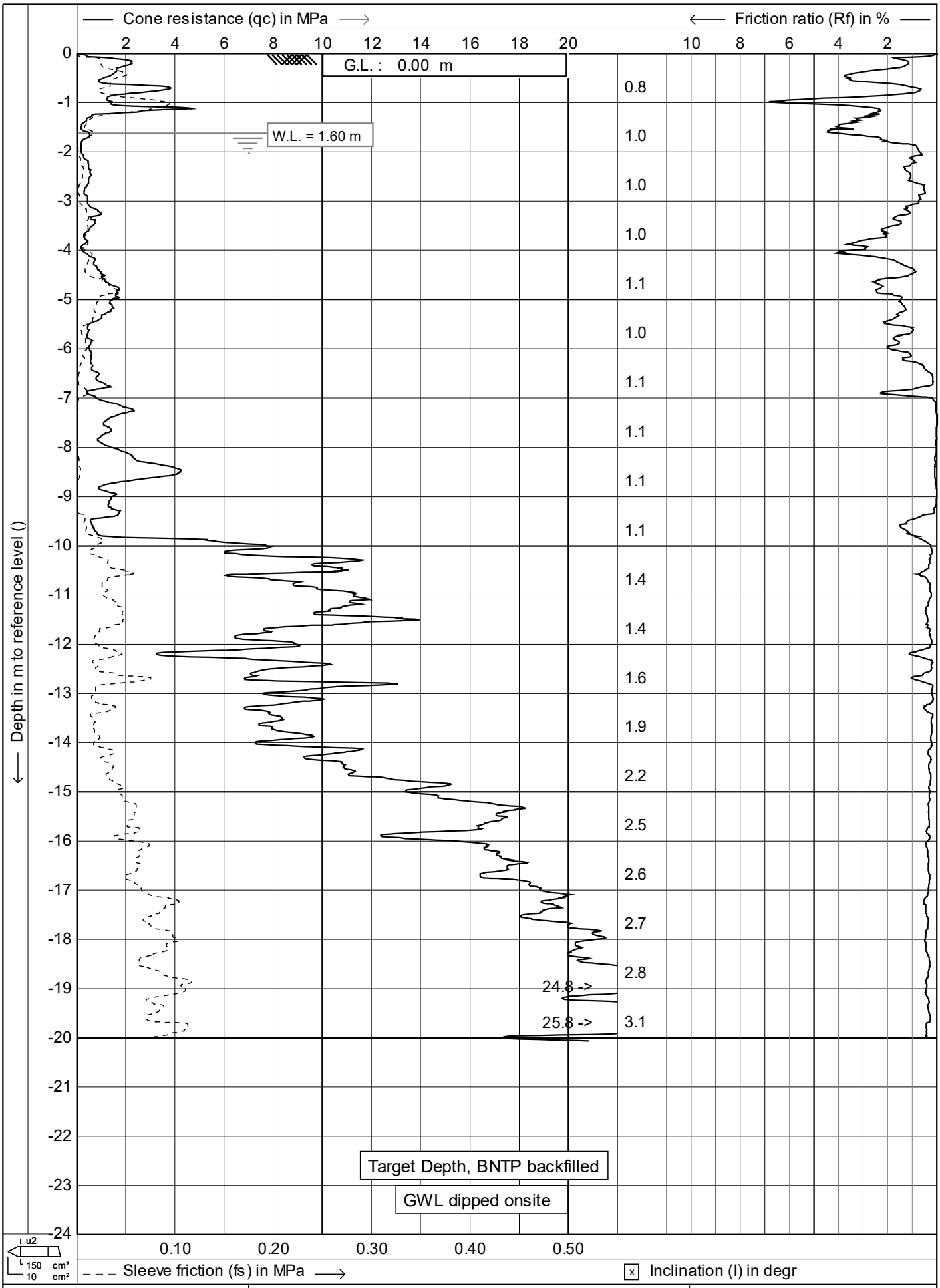
Date : **18/01/2022**

Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **08** **9/14**

1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

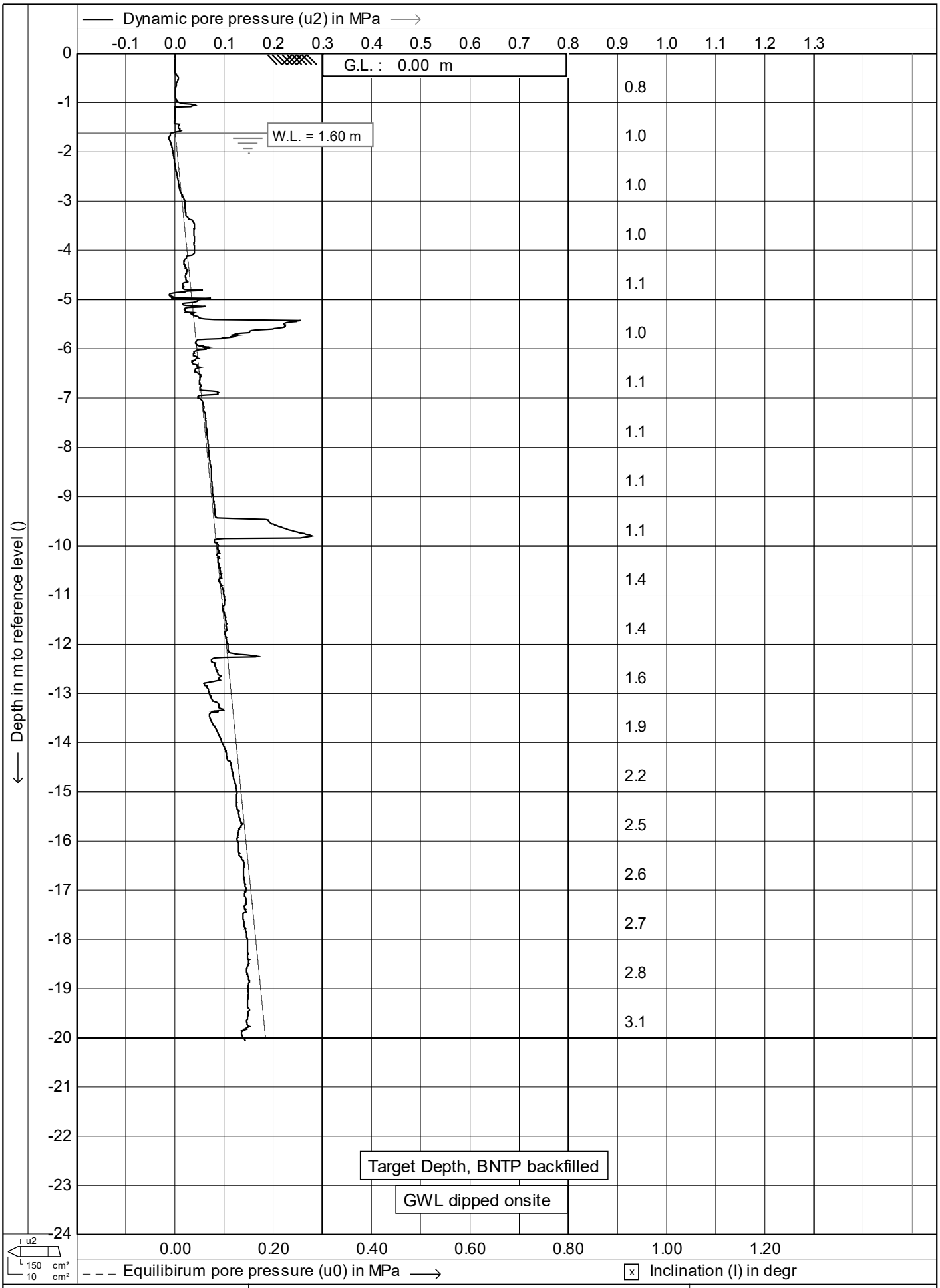
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **10**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

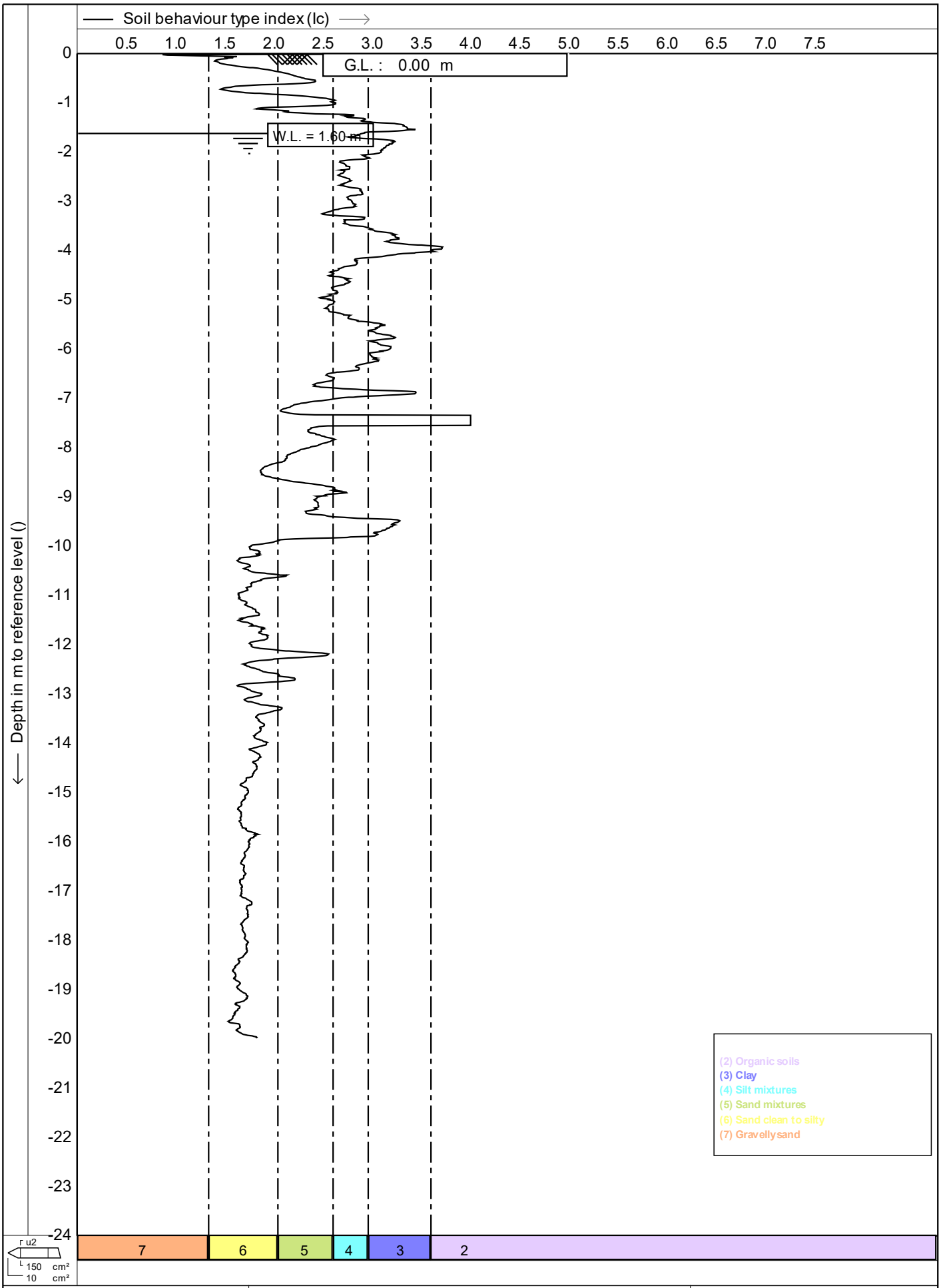
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **10**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

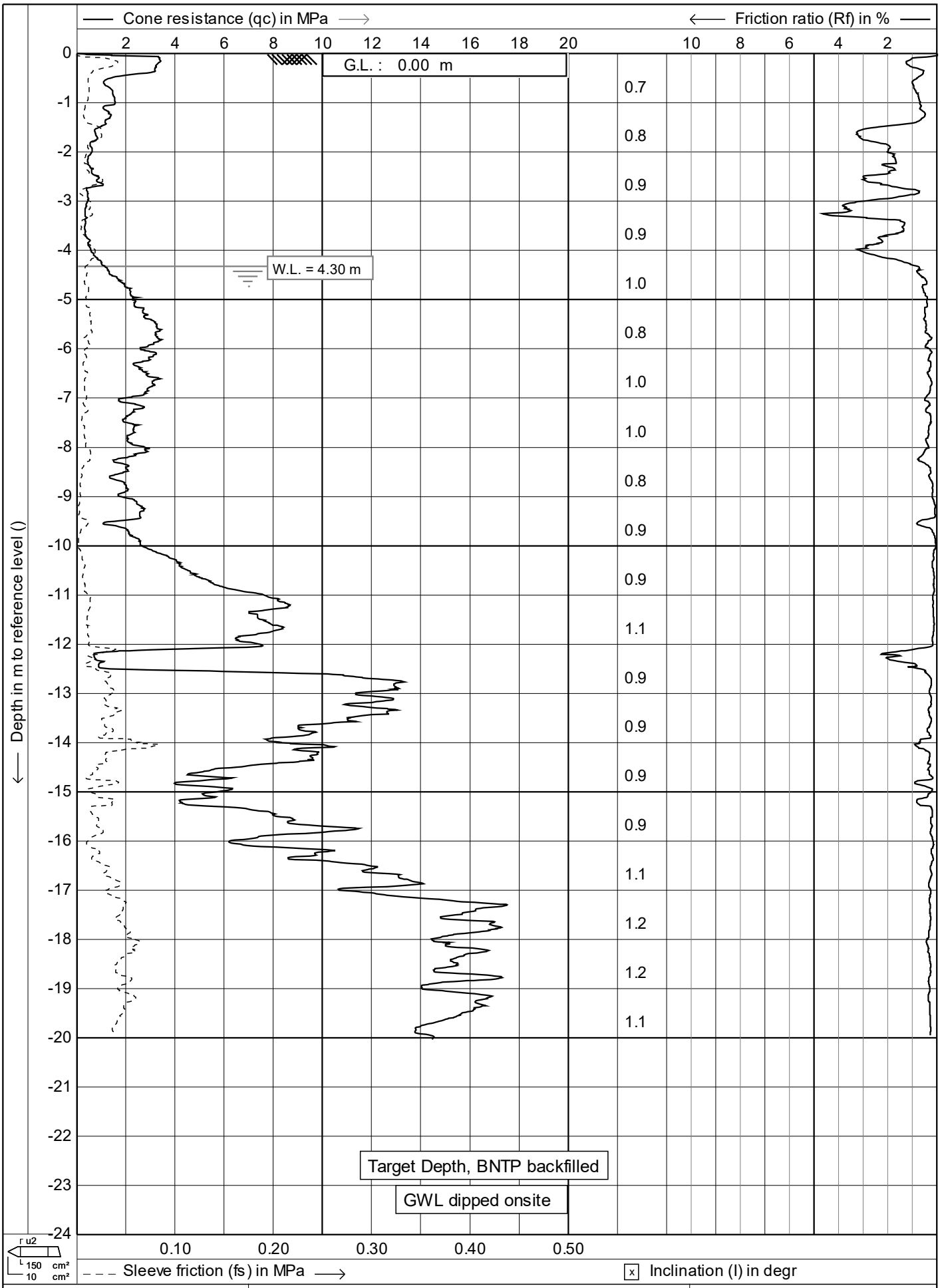
Date : **18/01/2022**

Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **10** **9/14**

1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

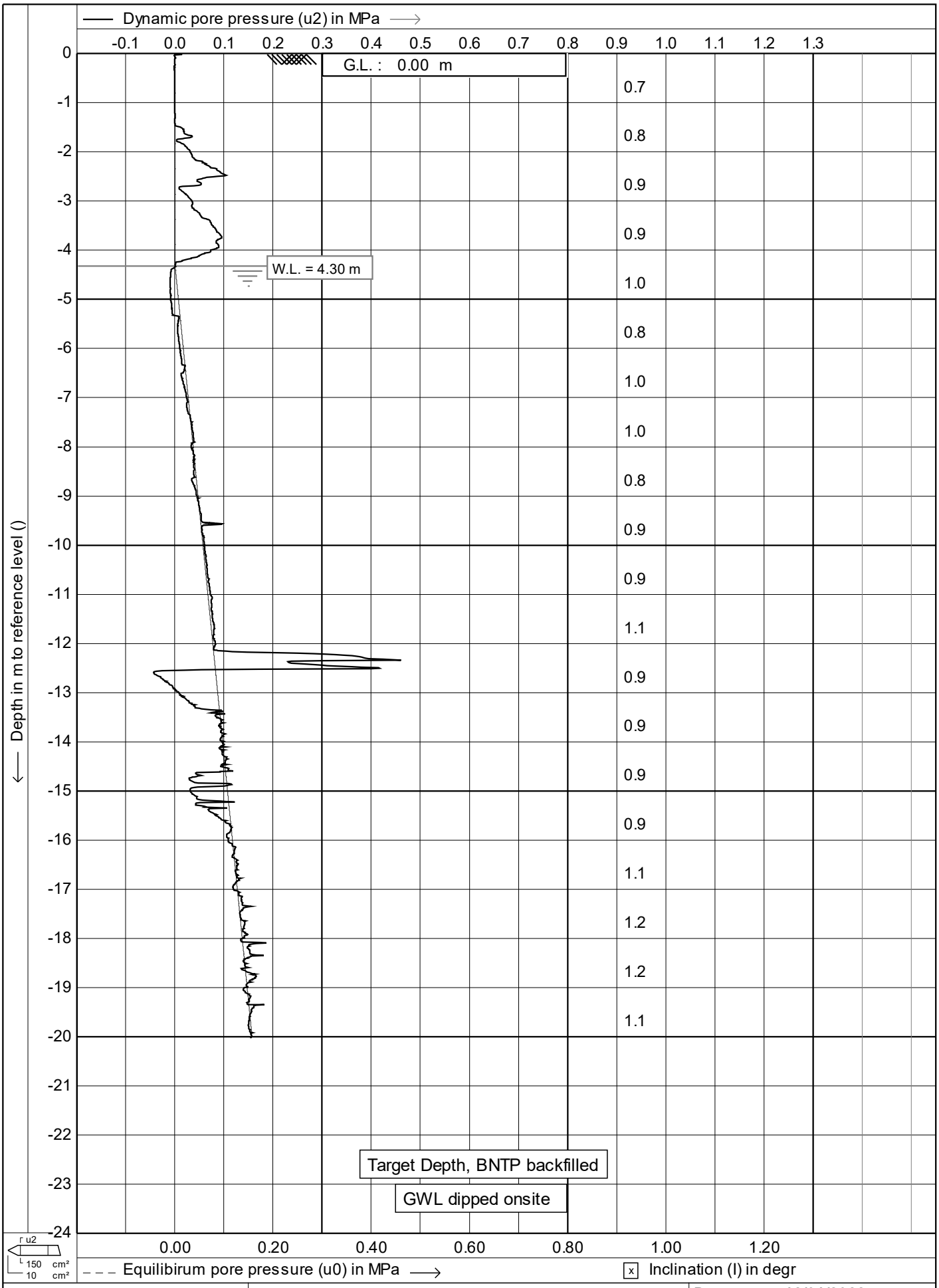
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **11**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

Date : **18/01/2022**

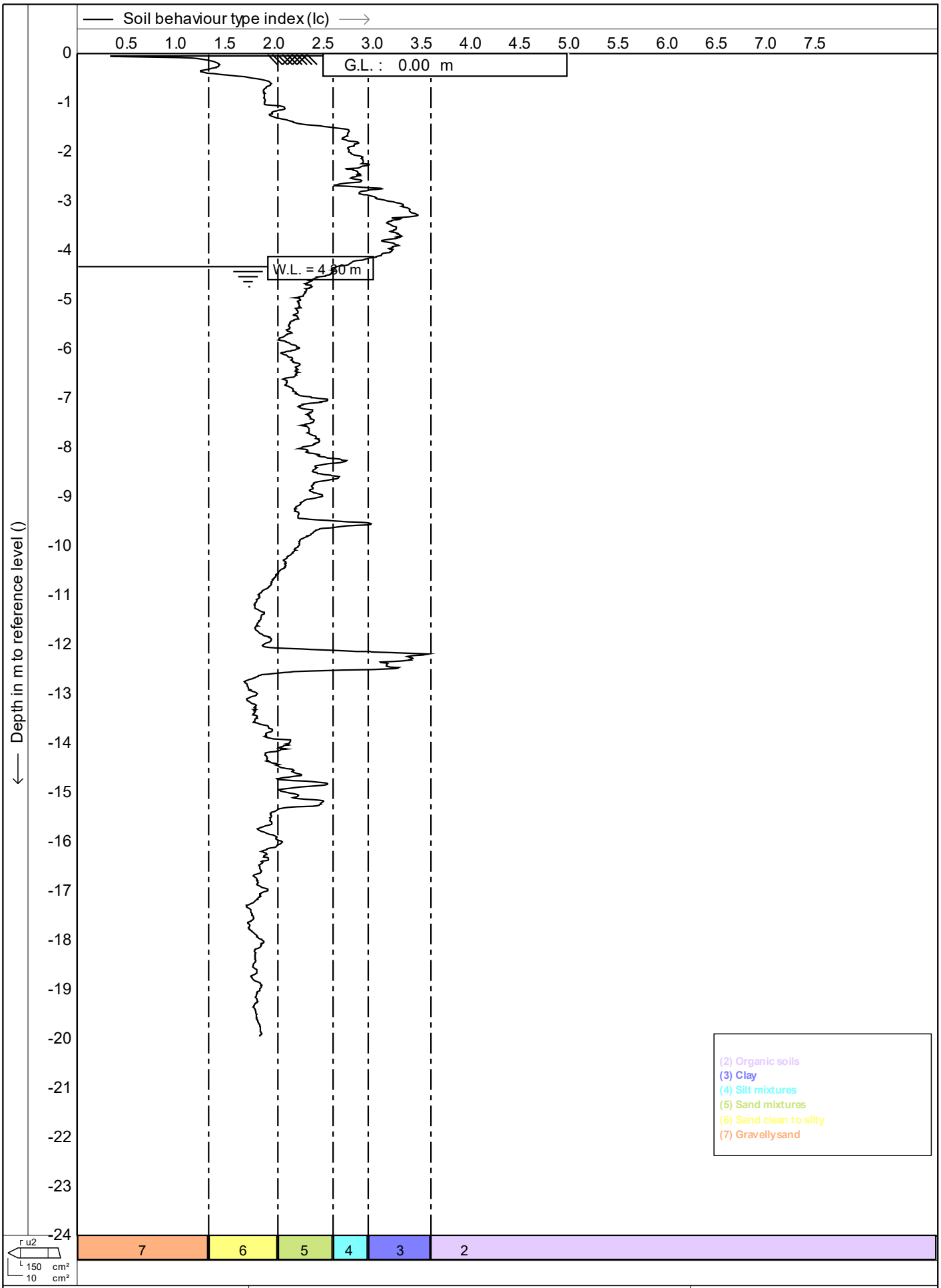
Cone no. : **C10CFIIP.C17803**

Project no. : **05CMW099**

CPT no. : **11**



1.48




PERRY GEOTECH

Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

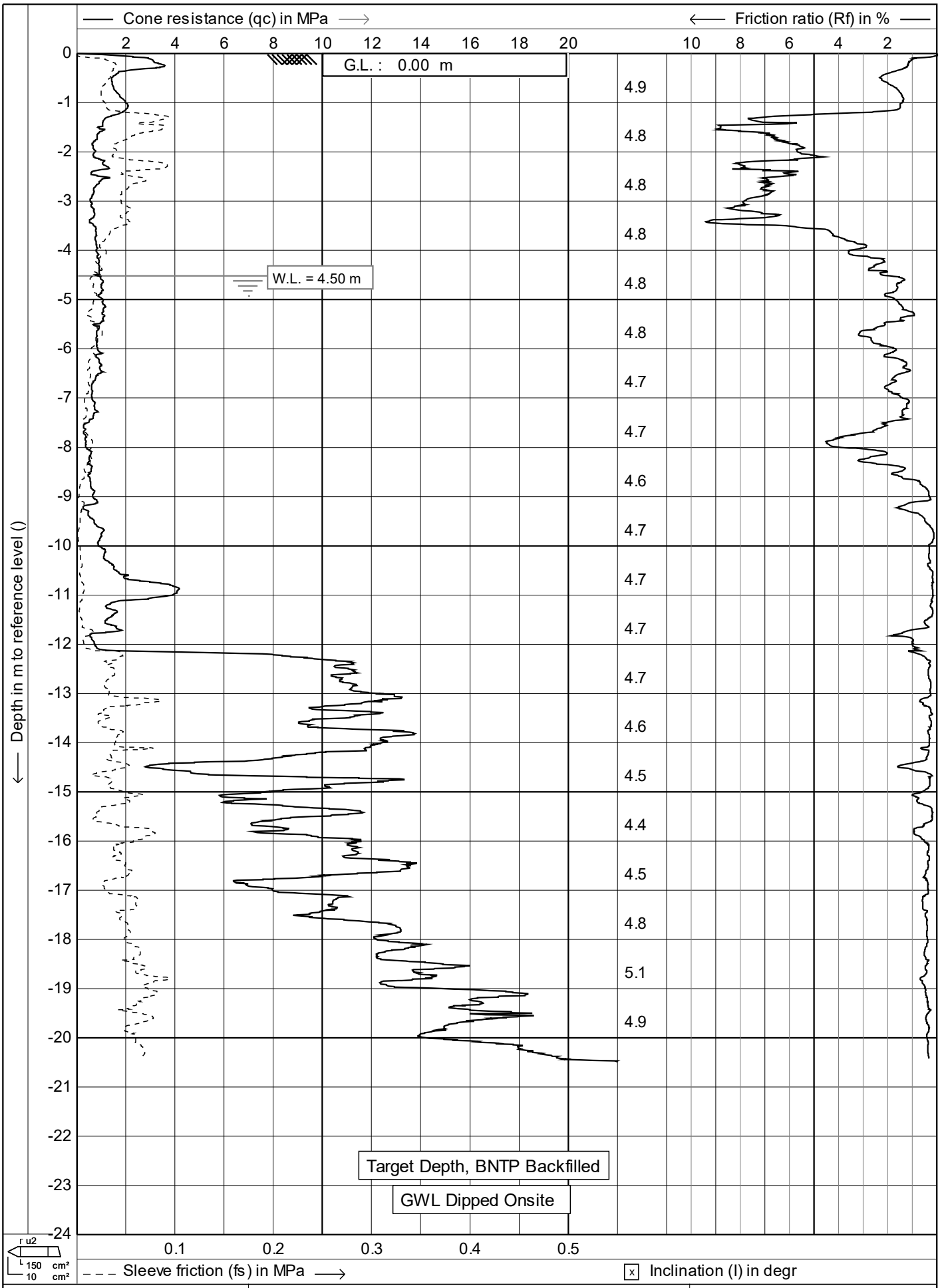
Location: **1491 Arawa Rd Pongakawa**

Position: **0, 0**

| | |
|---|---|
| Date | : **18/01/2022** |
| Cone no. | : **C10CFIIP.C17803** |
| Project no. | : **05CMW099** |
| CPT no. | : **11** |



1.48




PERRY GEOTECH

A.S.T.M D5778-12

Project : **Site Investigations**

Location: **Arawa Rd - Pongakawa**

Position: **0, 0**

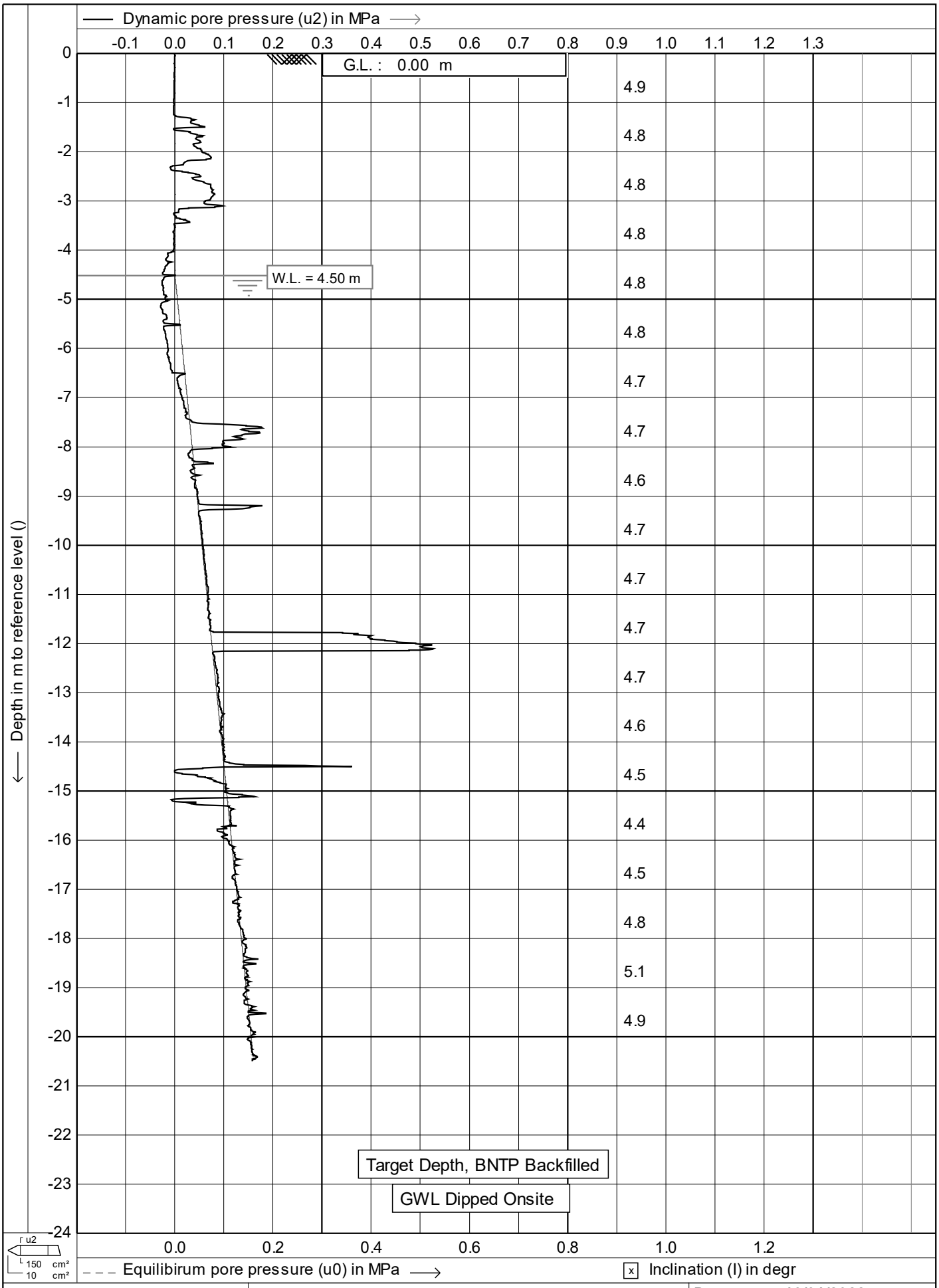
Date : **19/01/2022**

Cone no. : **C10CFIIP.C15212**

Project no. : **02CMW099**

CPT no. : **SCPT12** **1/14**

1.49




PERRY GEOTECH

A.S.T.M D5778-12

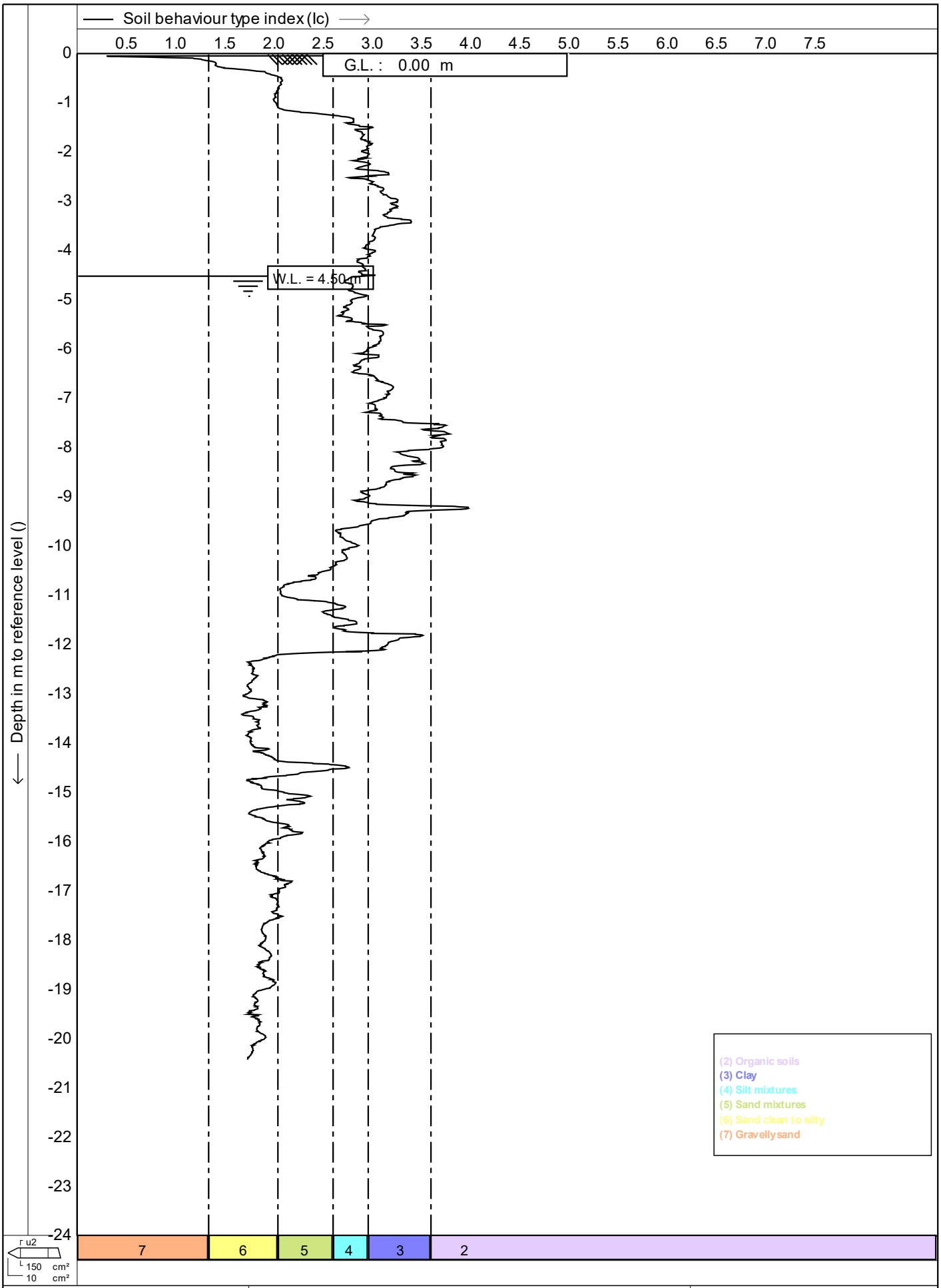
Project : **Site Investigations**

Location: **Arawa Rd - Pongakawa**

Position: **0, 0**

| | |
|---|---|
| Date | : **19/01/2022** |
| Cone no. | : **C10CFIIP.C15212** |
| Project no. | : **02CMW099** |
| CPT no. | : **SCPT12** **2/14** |

1.49




PERRY GEOTECH

A.S.T.M D5778-12

Project : **Site Investigations**

Location: **Arawa Rd - Pongakawa**

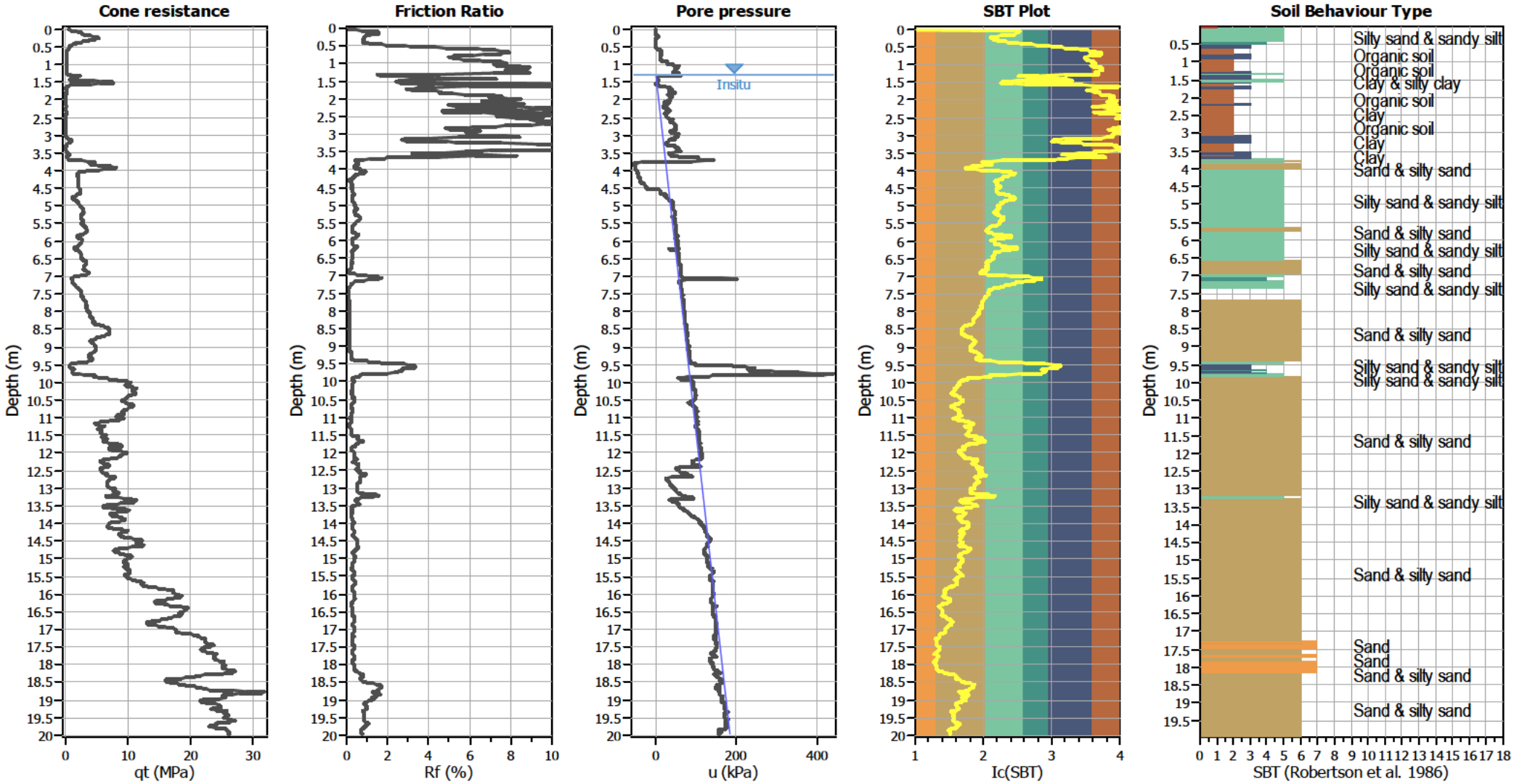
Position: **0, 0**

| | |
|---|---|
| Date | : **19/01/2022** |
| Cone no. | : **C10CFIIP.C15212** |
| Project no. | : **02CMW099** |
| CPT no. | : **SCPT12** **9/14** |

1.49

# Appendix D: Liquefaction Analyses

# CPT basic interpretation plots



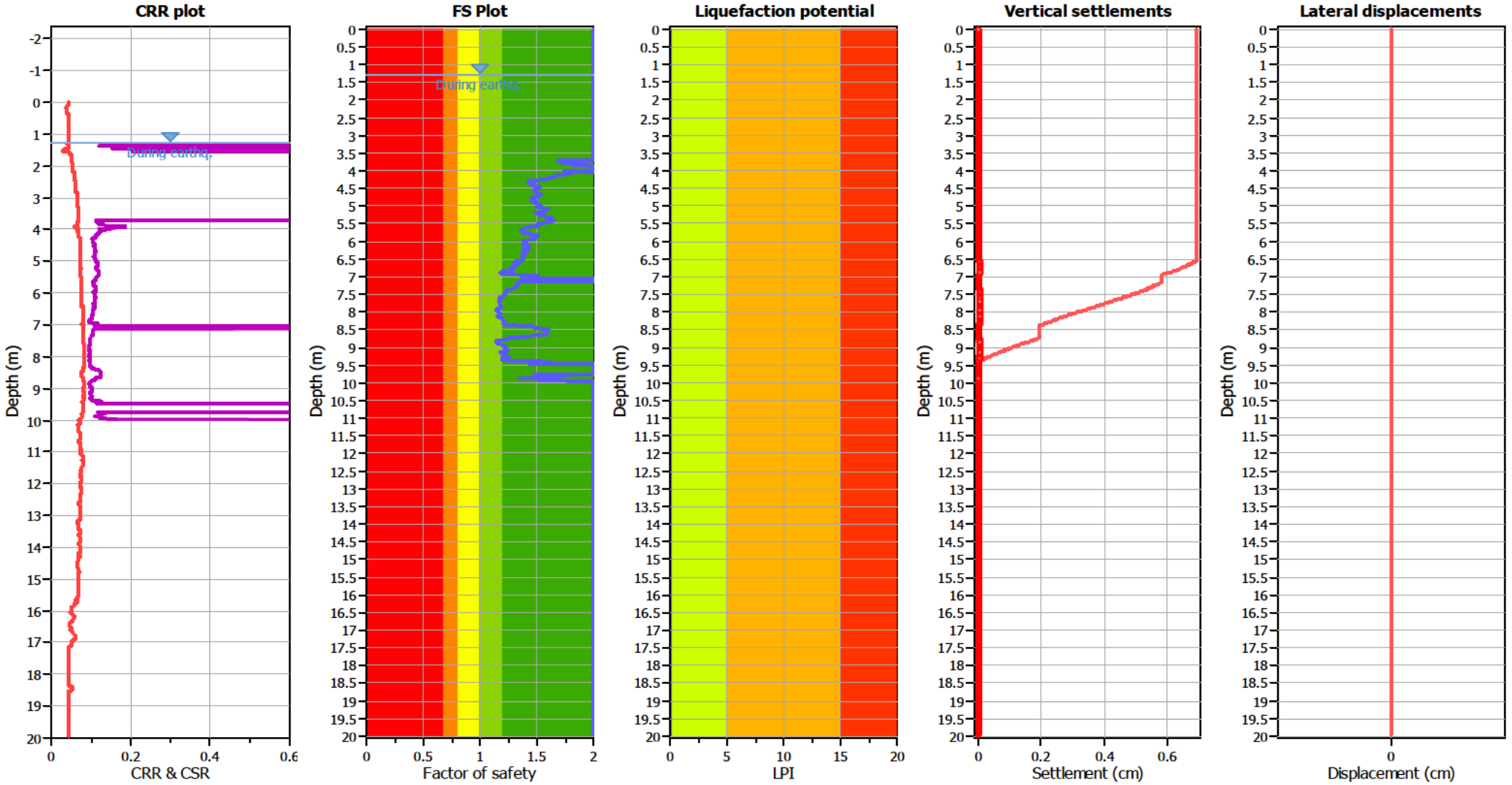

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

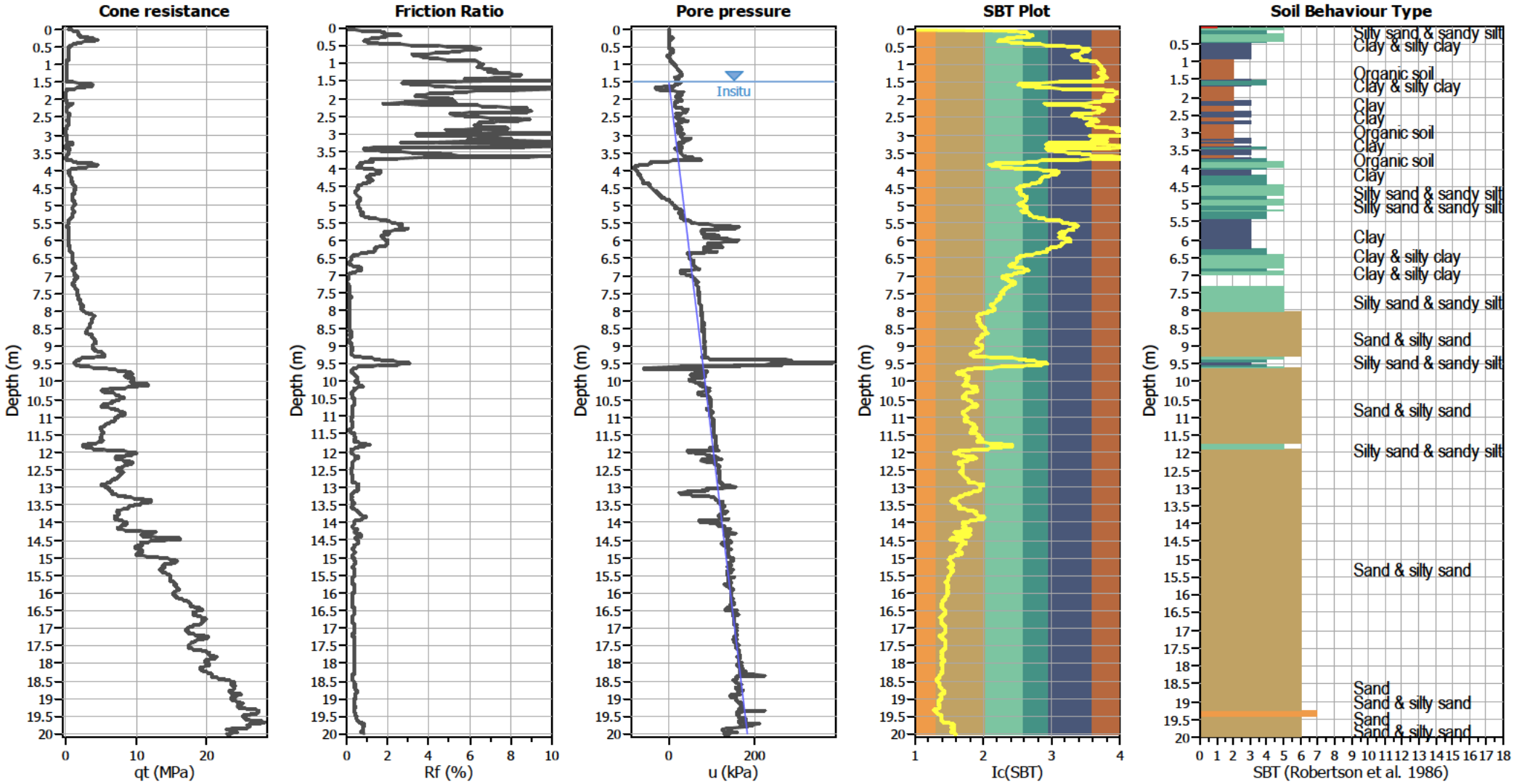
**F.S. color scheme**

- 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

# CPT basic interpretation plots



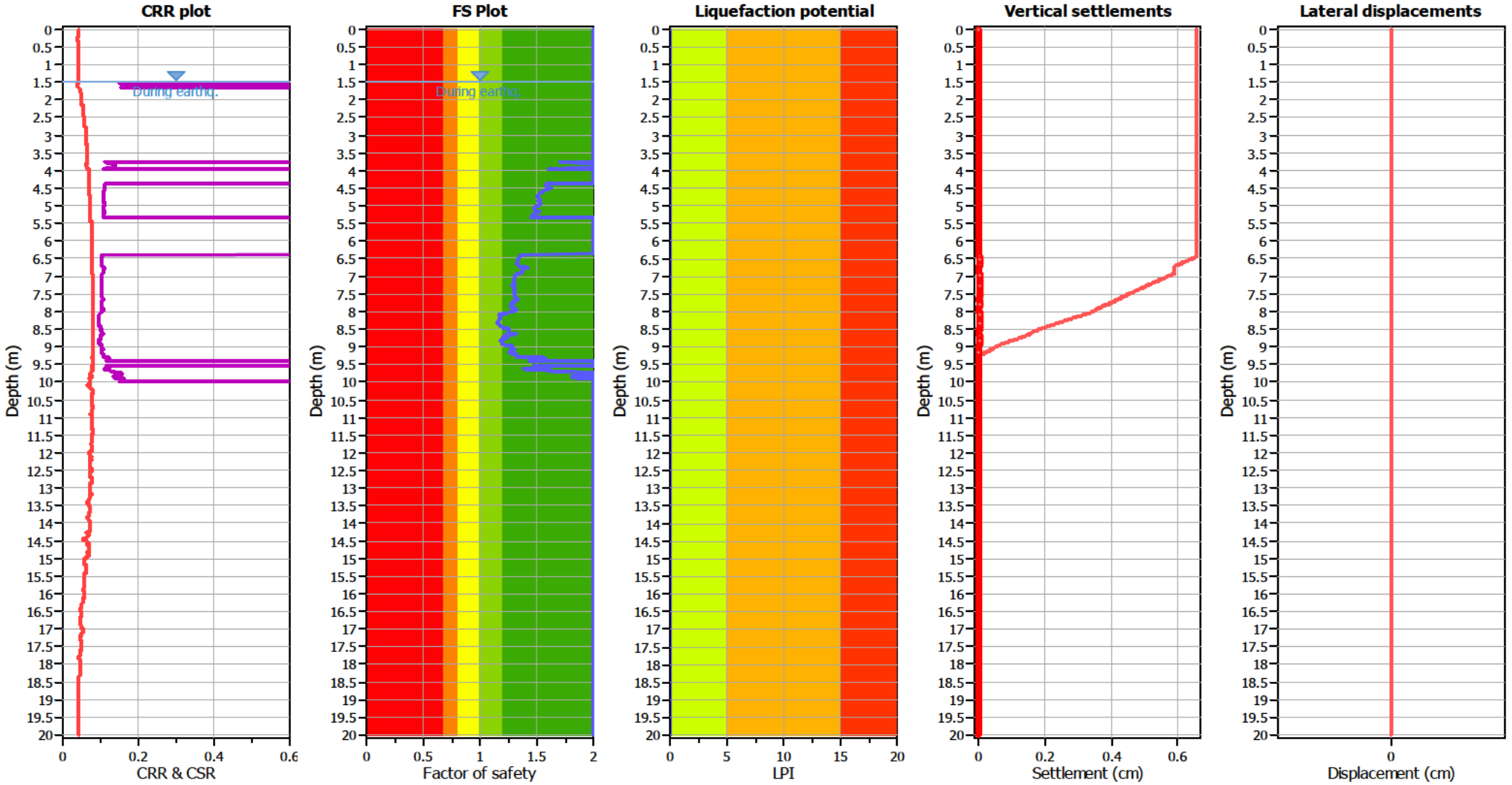

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.50 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.50 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.50 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.50 m | Fill height: | N/A | Limit depth: | 10.00 m |

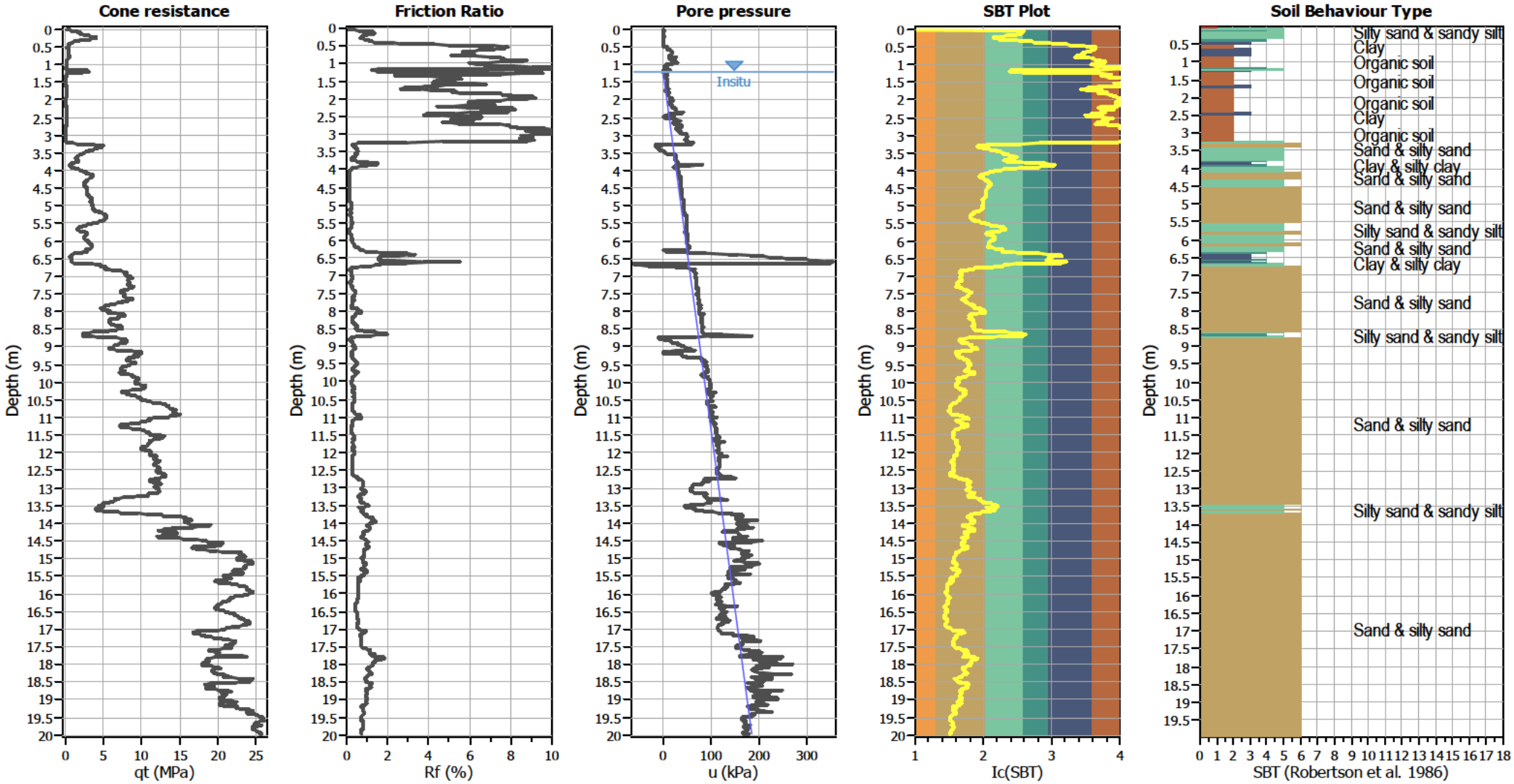
**F.S. color scheme**

- 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

# CPT basic interpretation plots



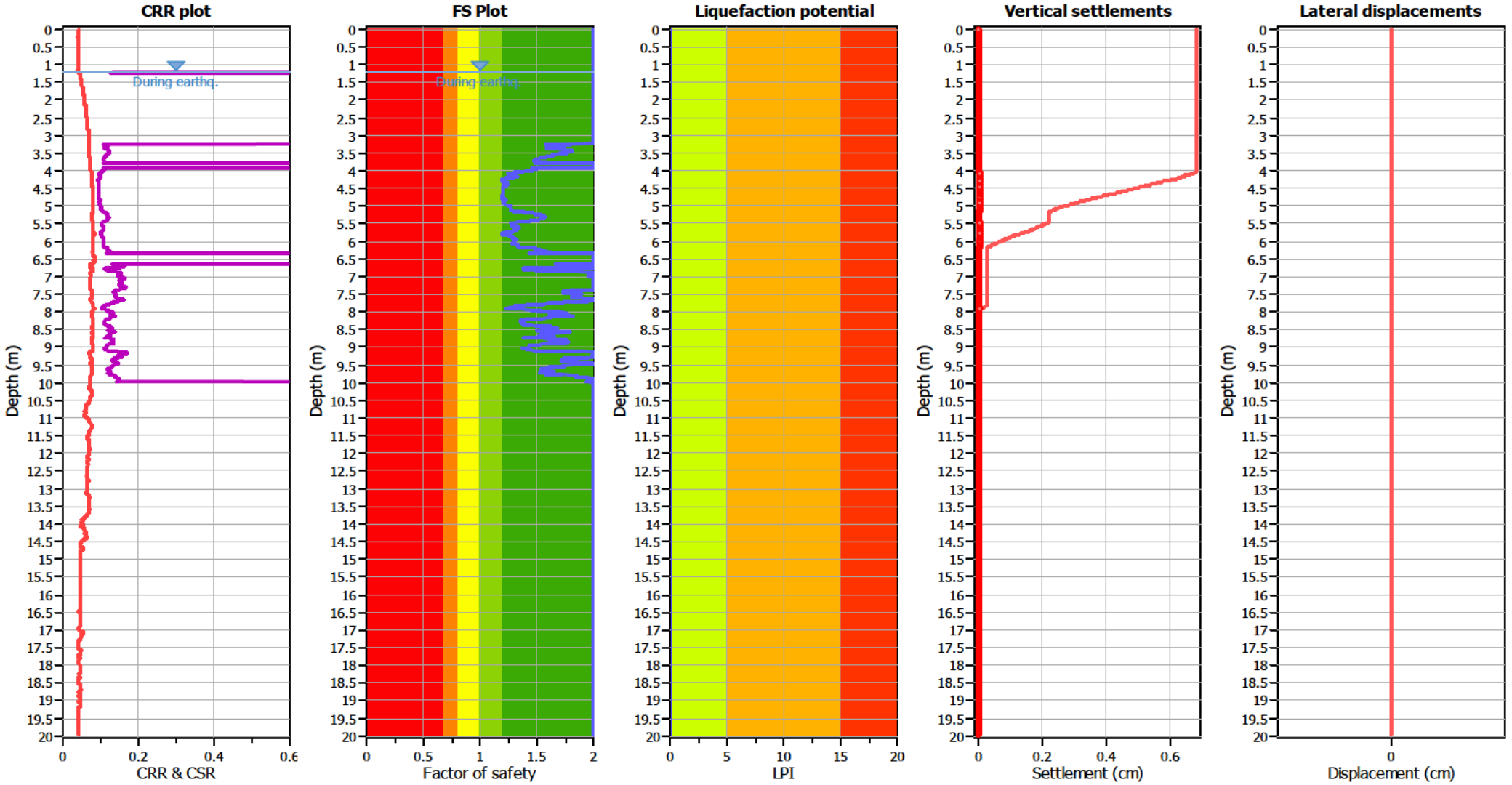

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.20 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.20 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.20 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.20 m | Fill height: | N/A | Limit depth: | 10.00 m |

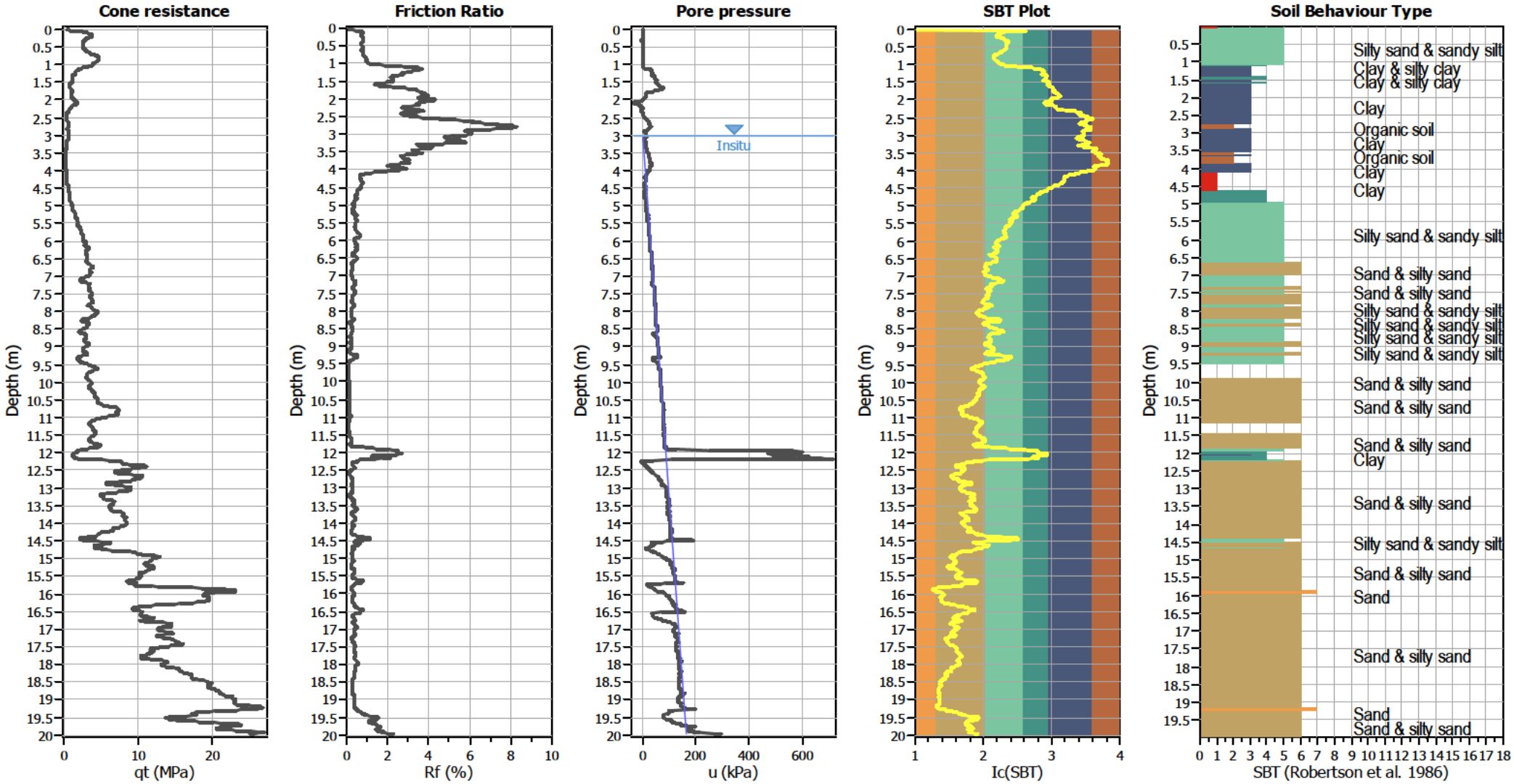
**F.S. color scheme**

- 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

## CPT basic interpretation plots



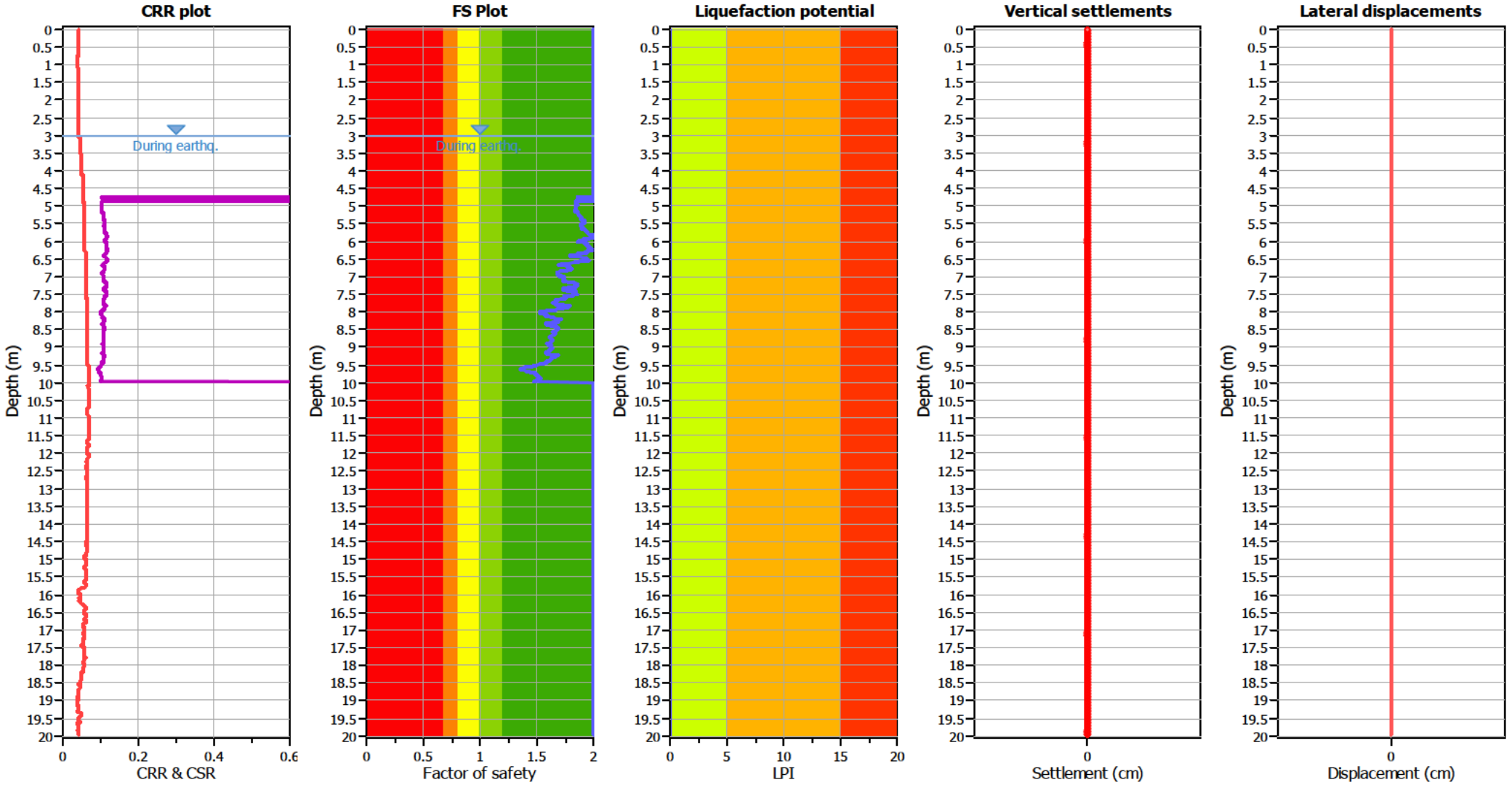

### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 3.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 3.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 3.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 3.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

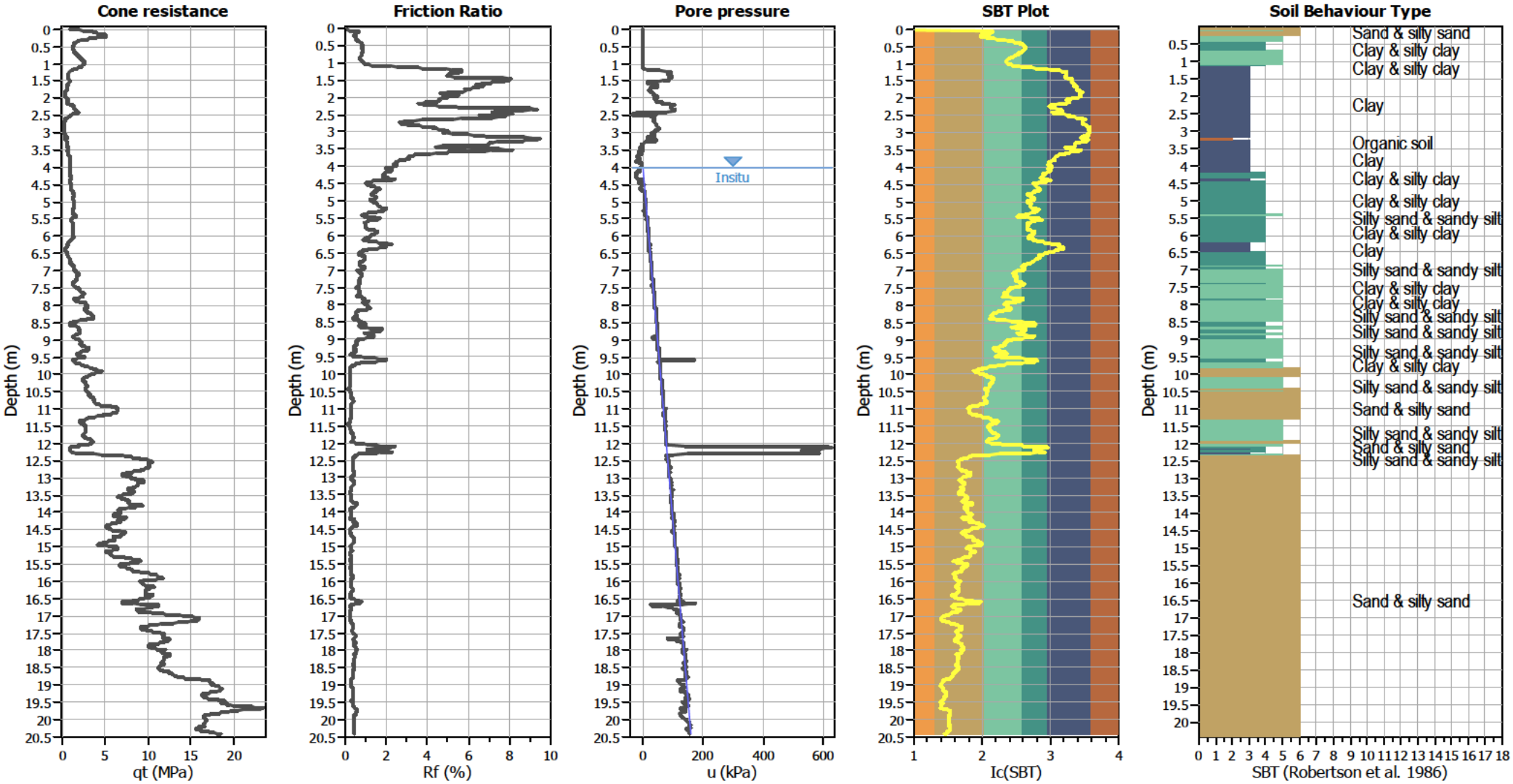
**F.S. color scheme**

- 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

# CPT basic interpretation plots



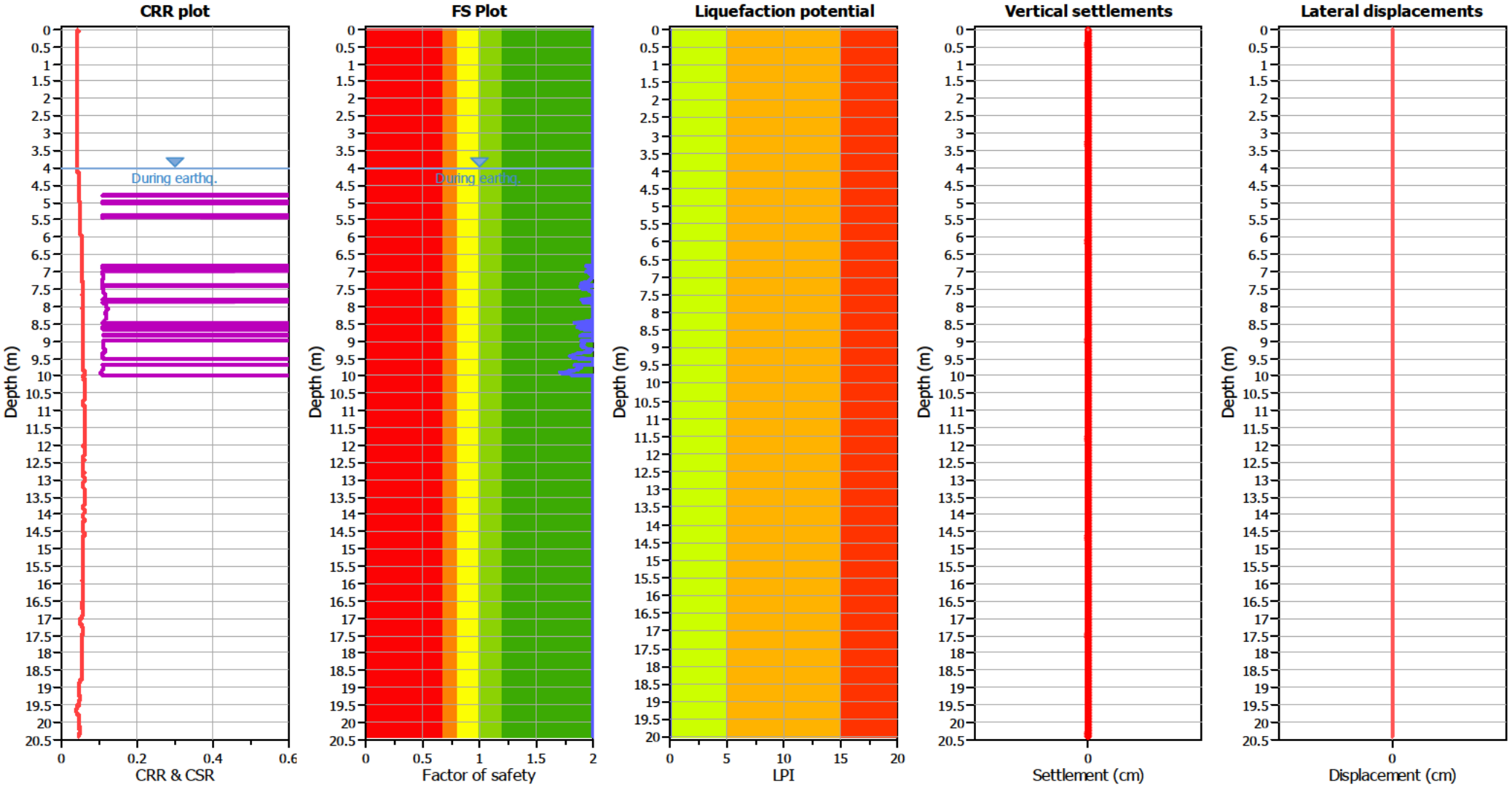

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

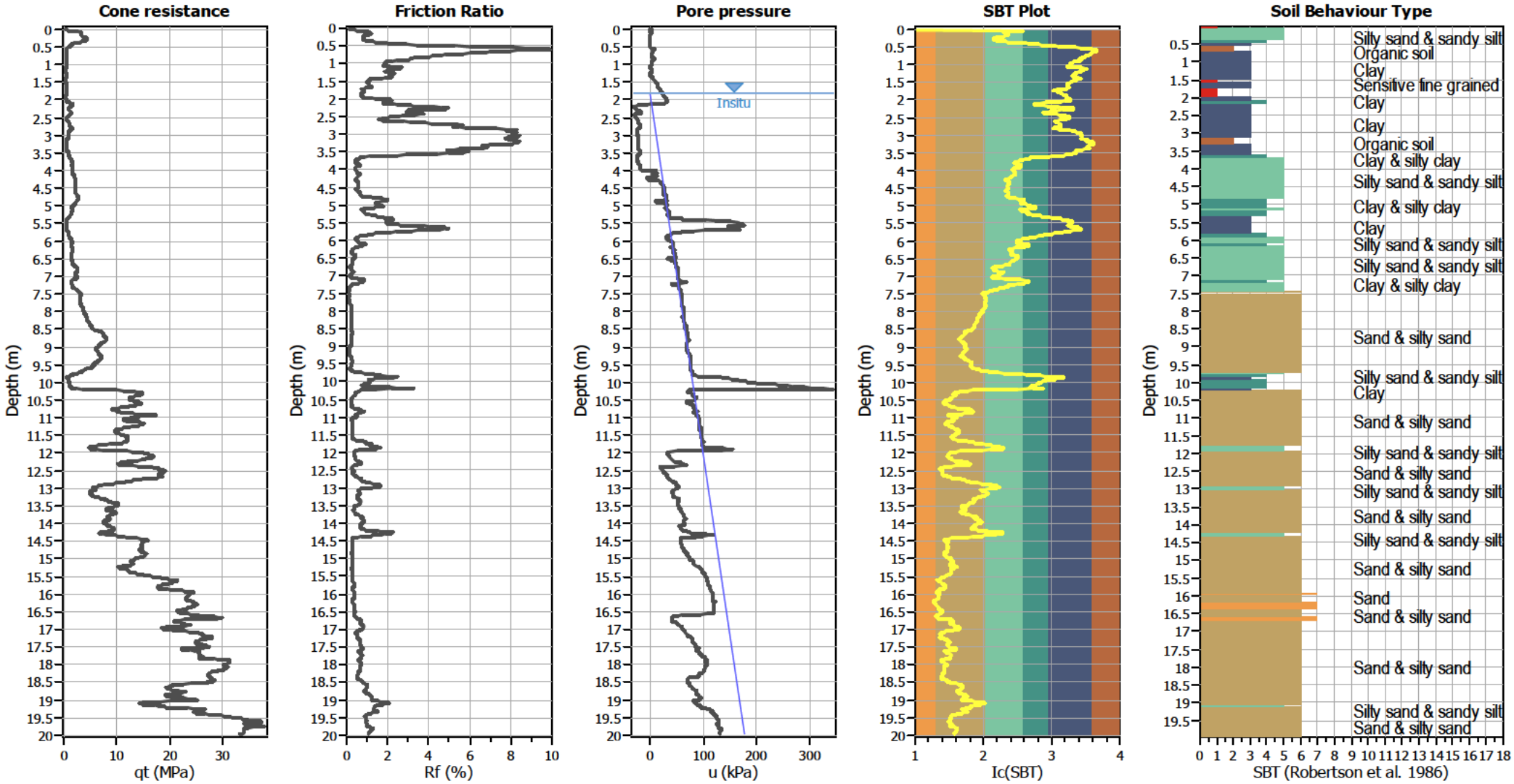
**F.S. color scheme**

- 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

# CPT basic interpretation plots



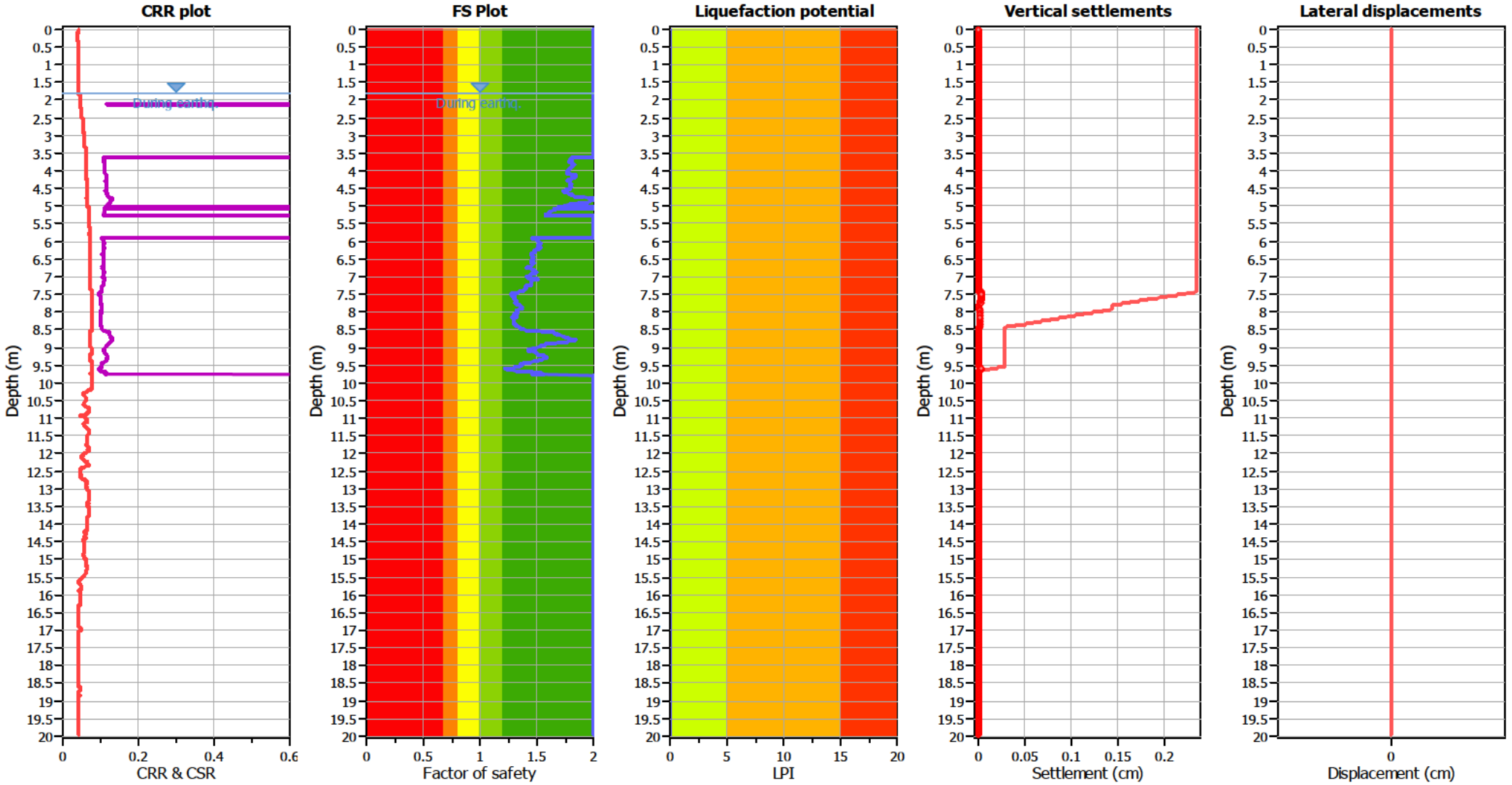

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.80 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.80 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.80 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.80 m | Fill height: | N/A | Limit depth: | 10.00 m |

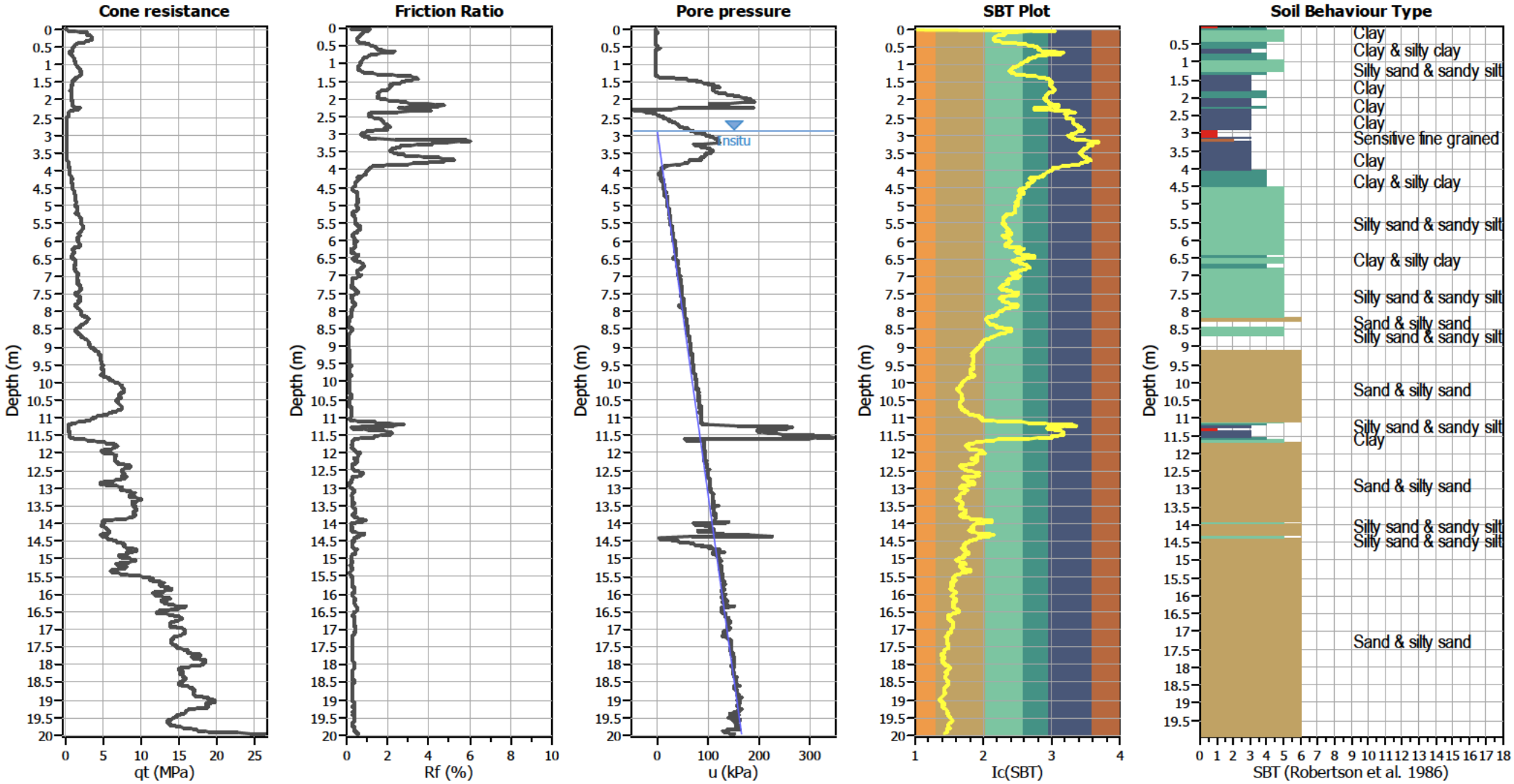
**F.S. color scheme**

- 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

# CPT basic interpretation plots



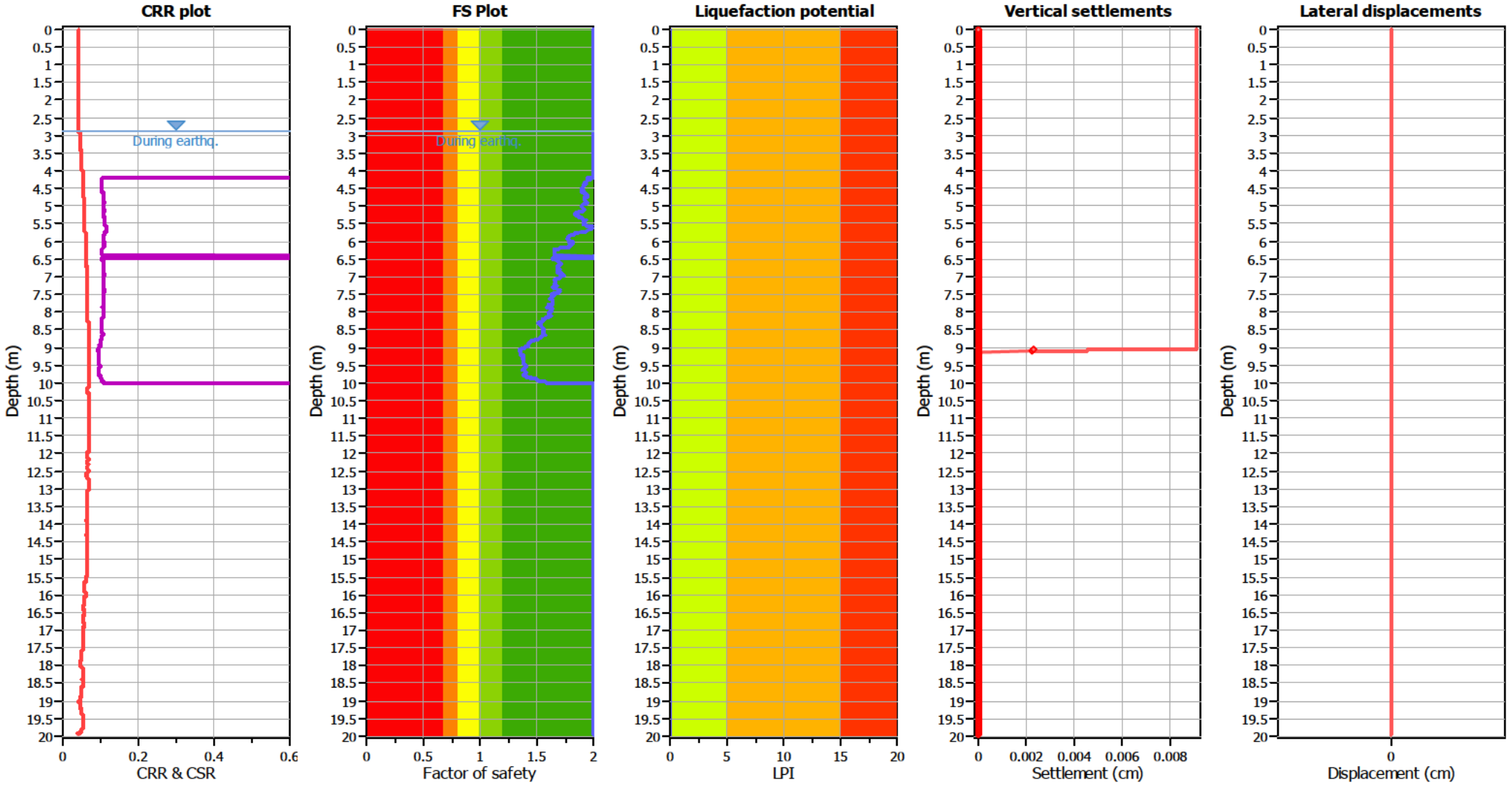

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 2.90 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 2.90 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 2.90 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 2.90 m | Fill height: | N/A | Limit depth: | 10.00 m |

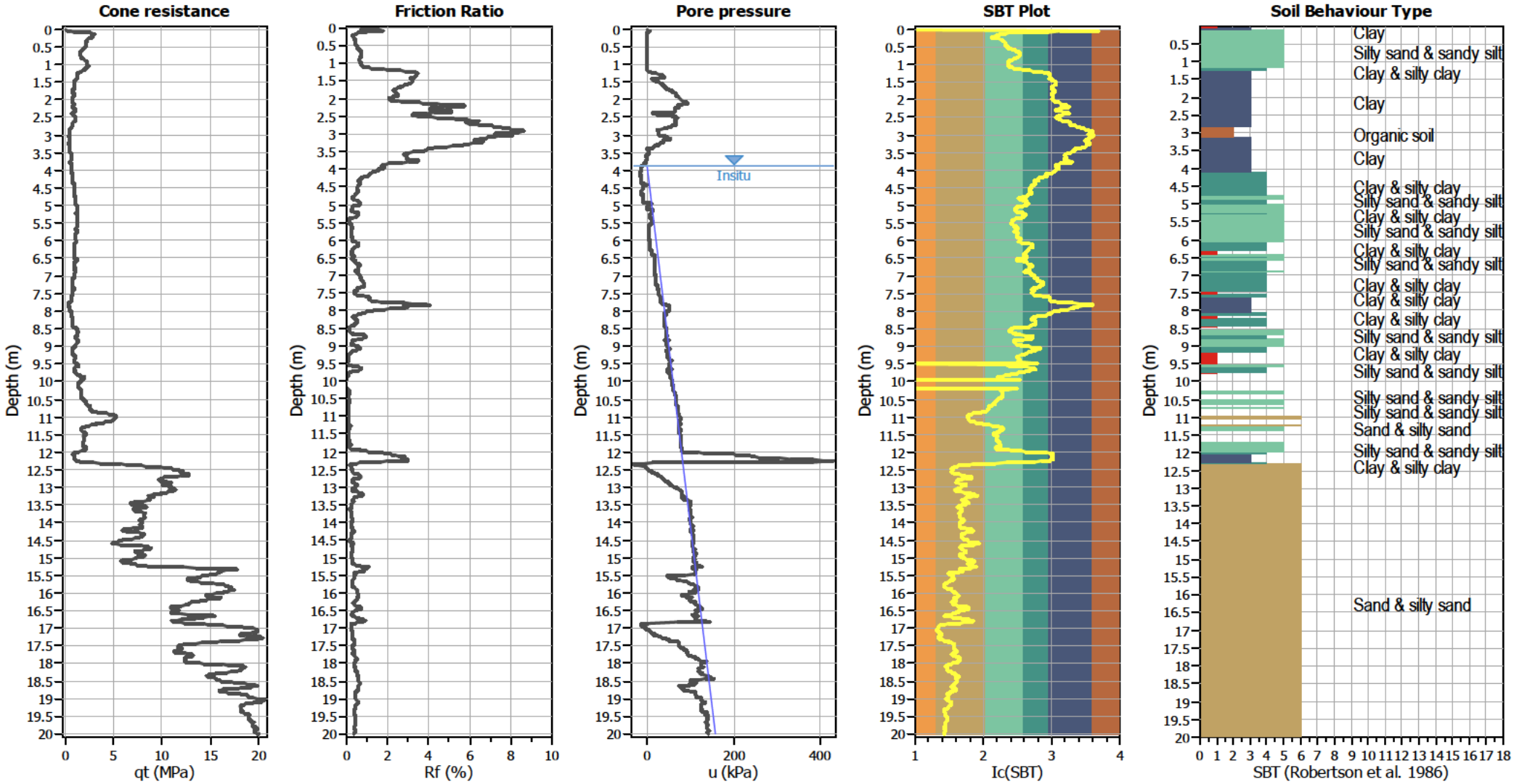
**F.S. color scheme**

- 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

# CPT basic interpretation plots



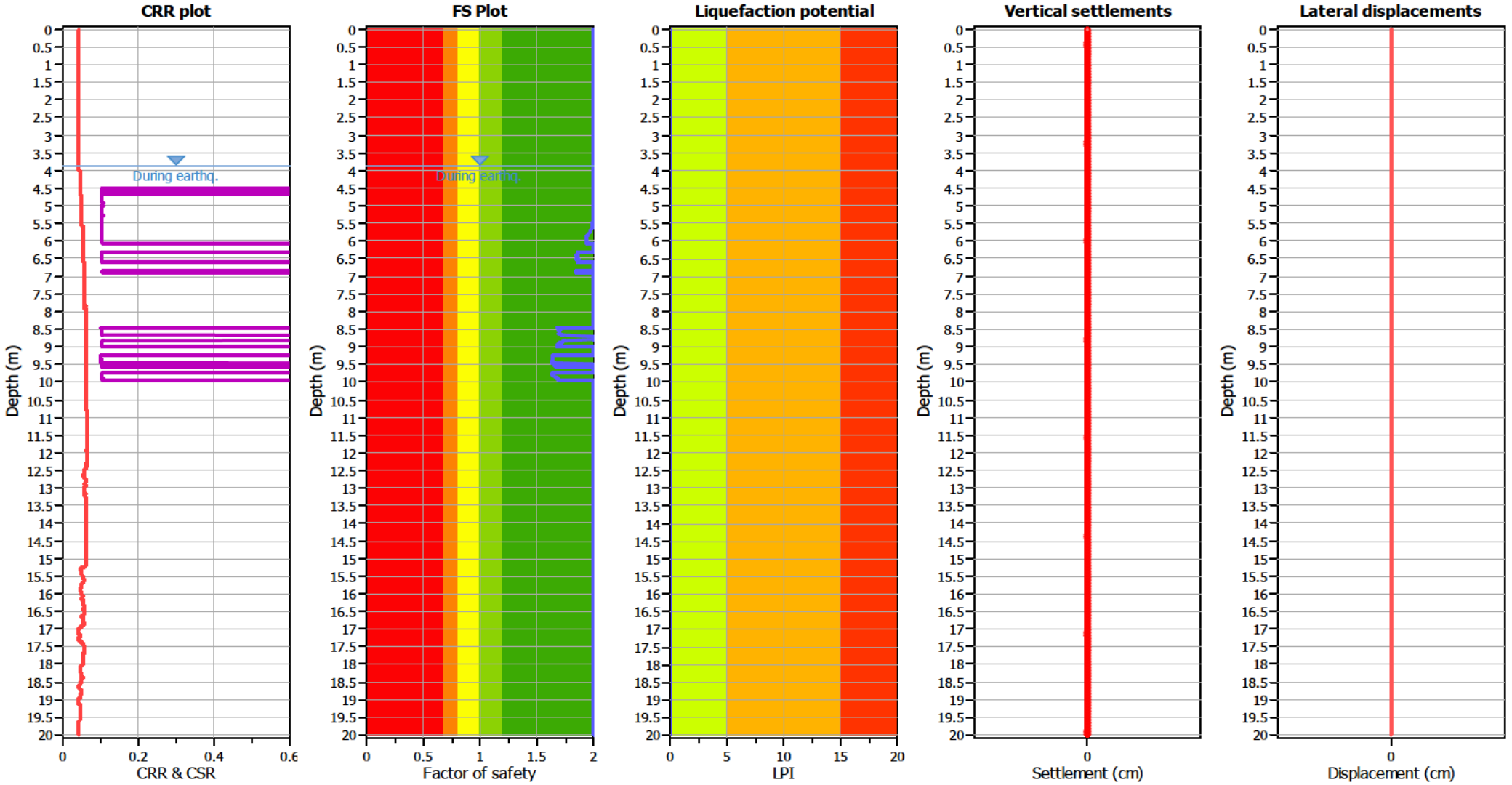

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 3.90 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 3.90 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 3.90 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 3.90 m | Fill height: | N/A | Limit depth: | 10.00 m |

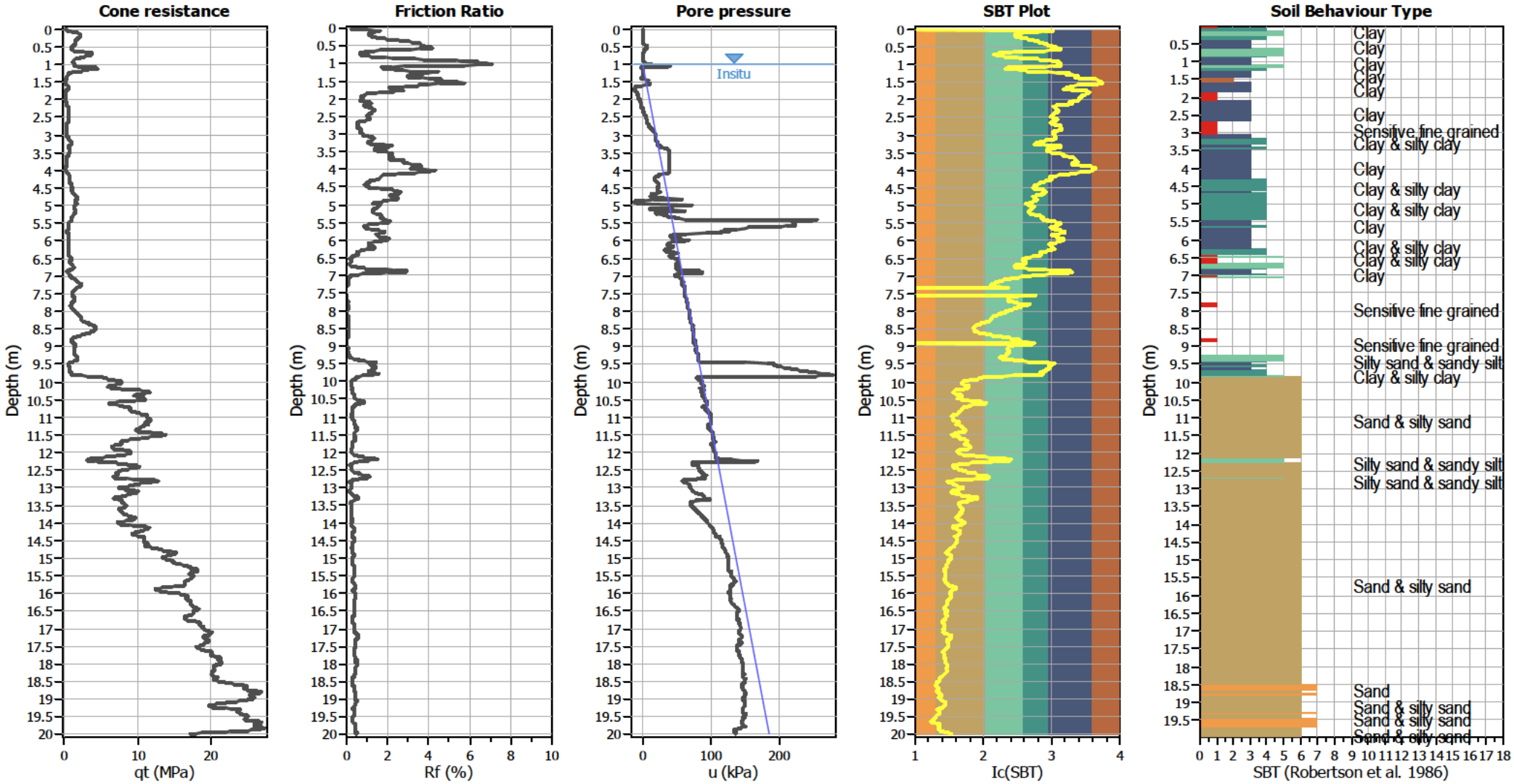
**F.S. color scheme**

- 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

# CPT basic interpretation plots



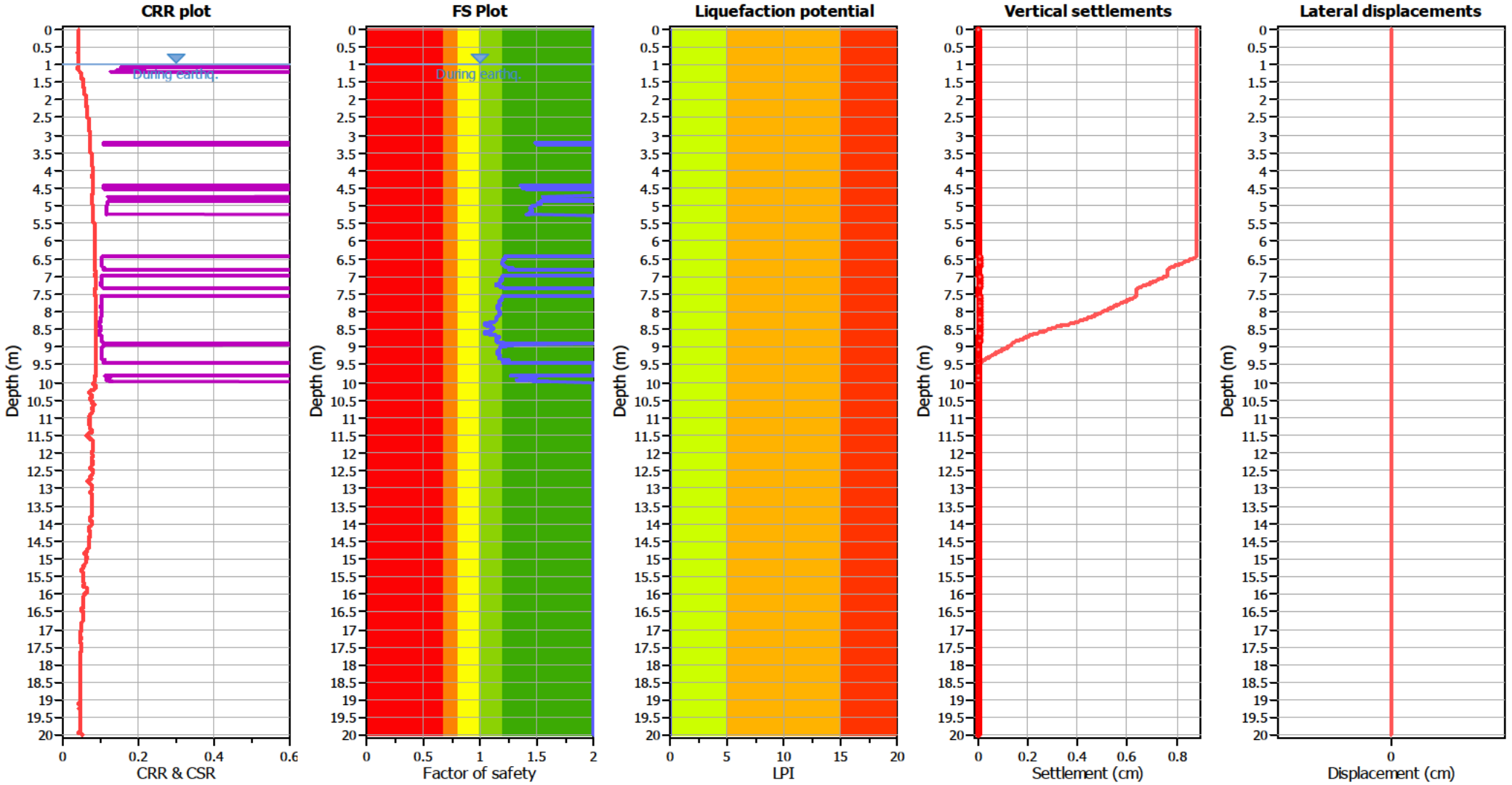

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

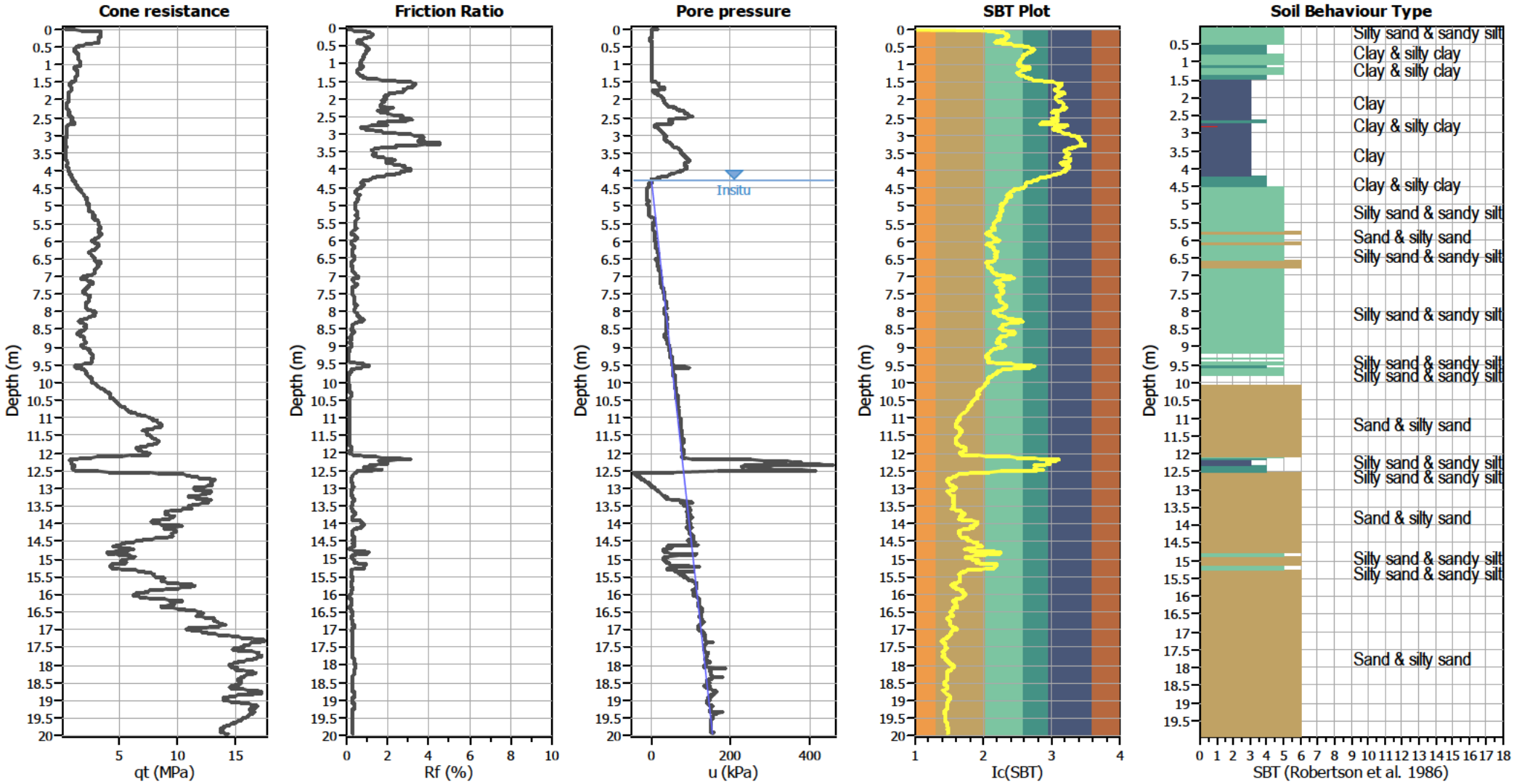
**F.S. color scheme**

- 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

# CPT basic interpretation plots



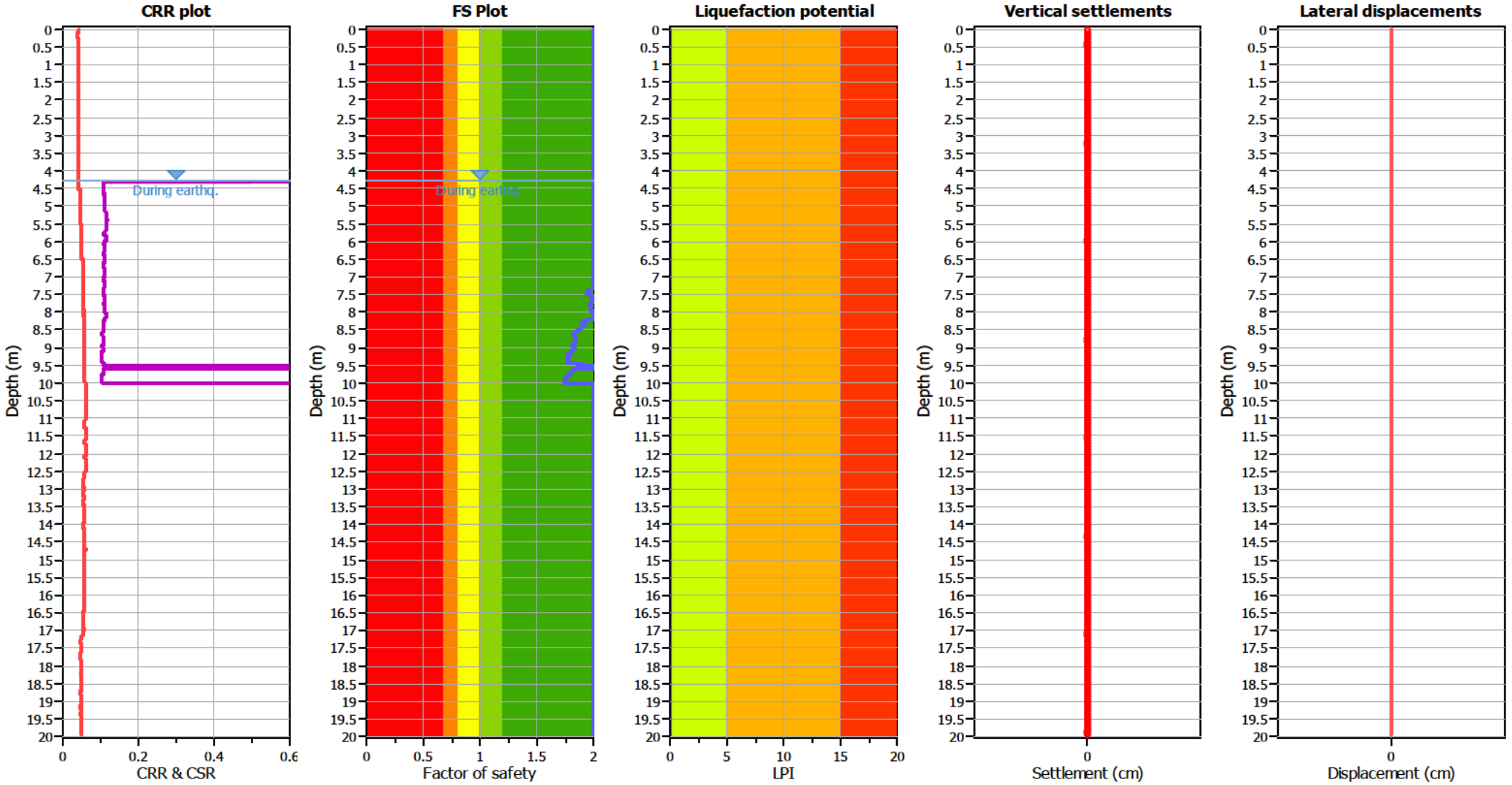

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.30 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.30 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

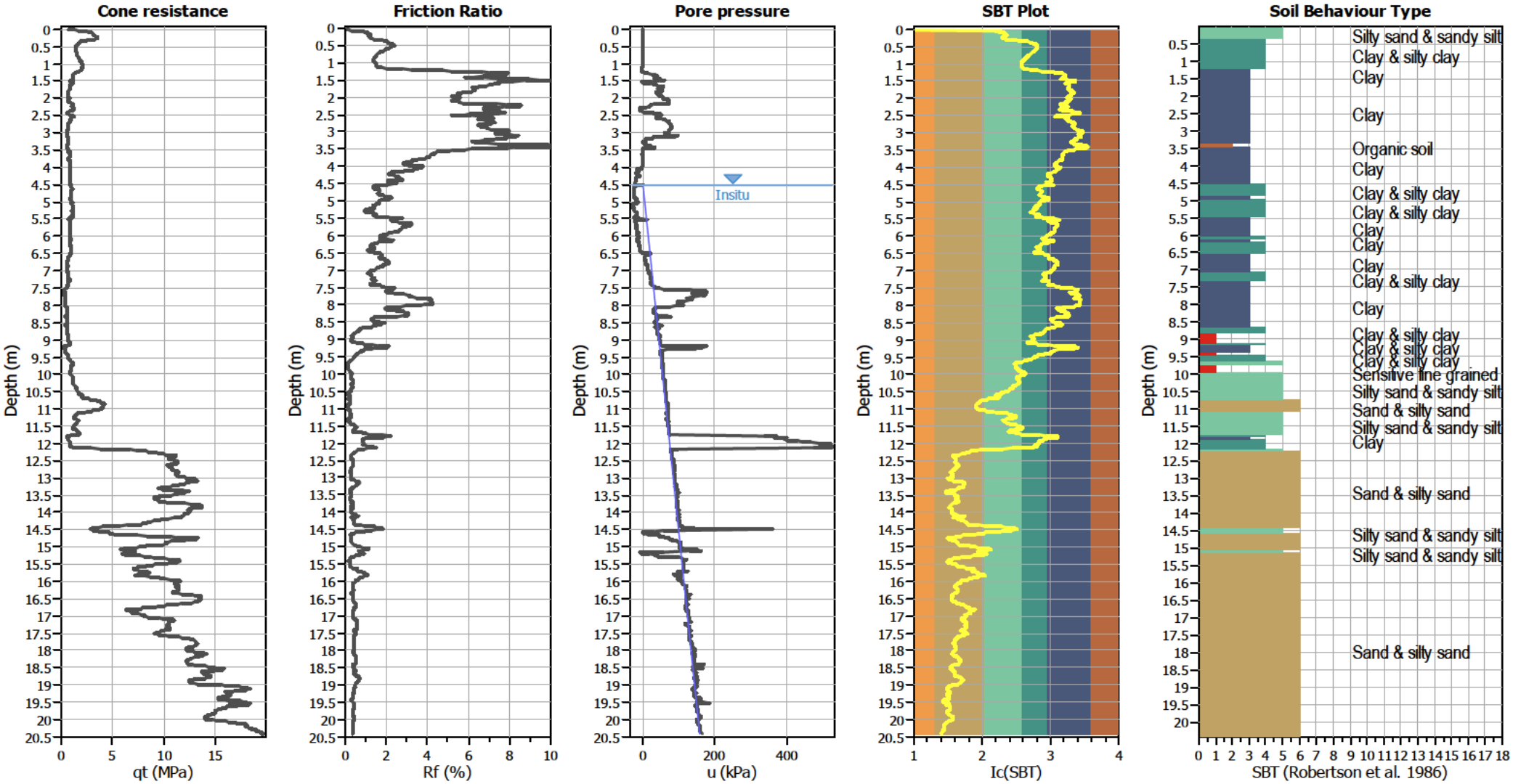
**F.S. color scheme**

- 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

## CPT basic interpretation plots



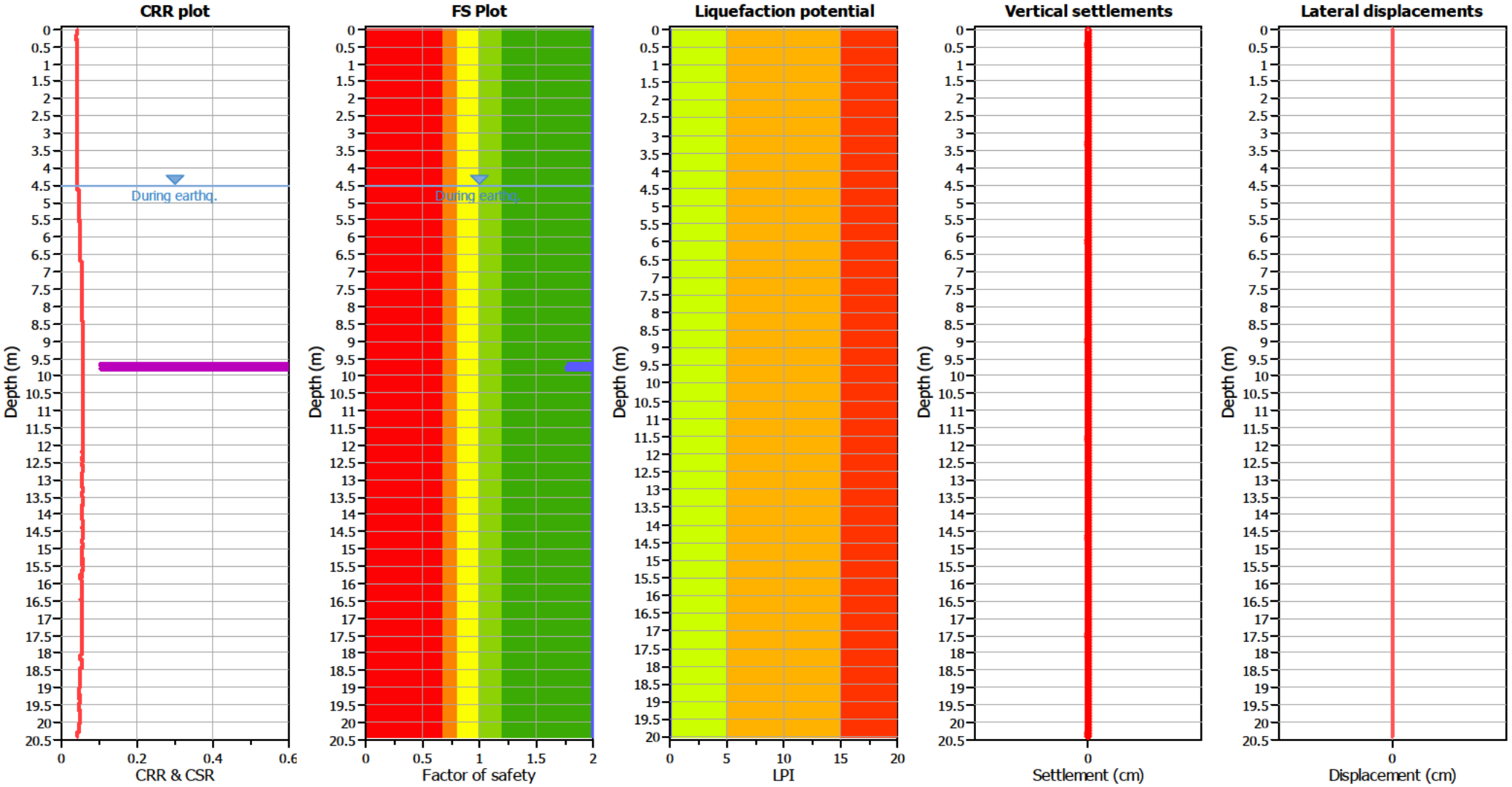

### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.50 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.08 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.50 m | Fill height: | N/A | Limit depth: | 10.00 m |

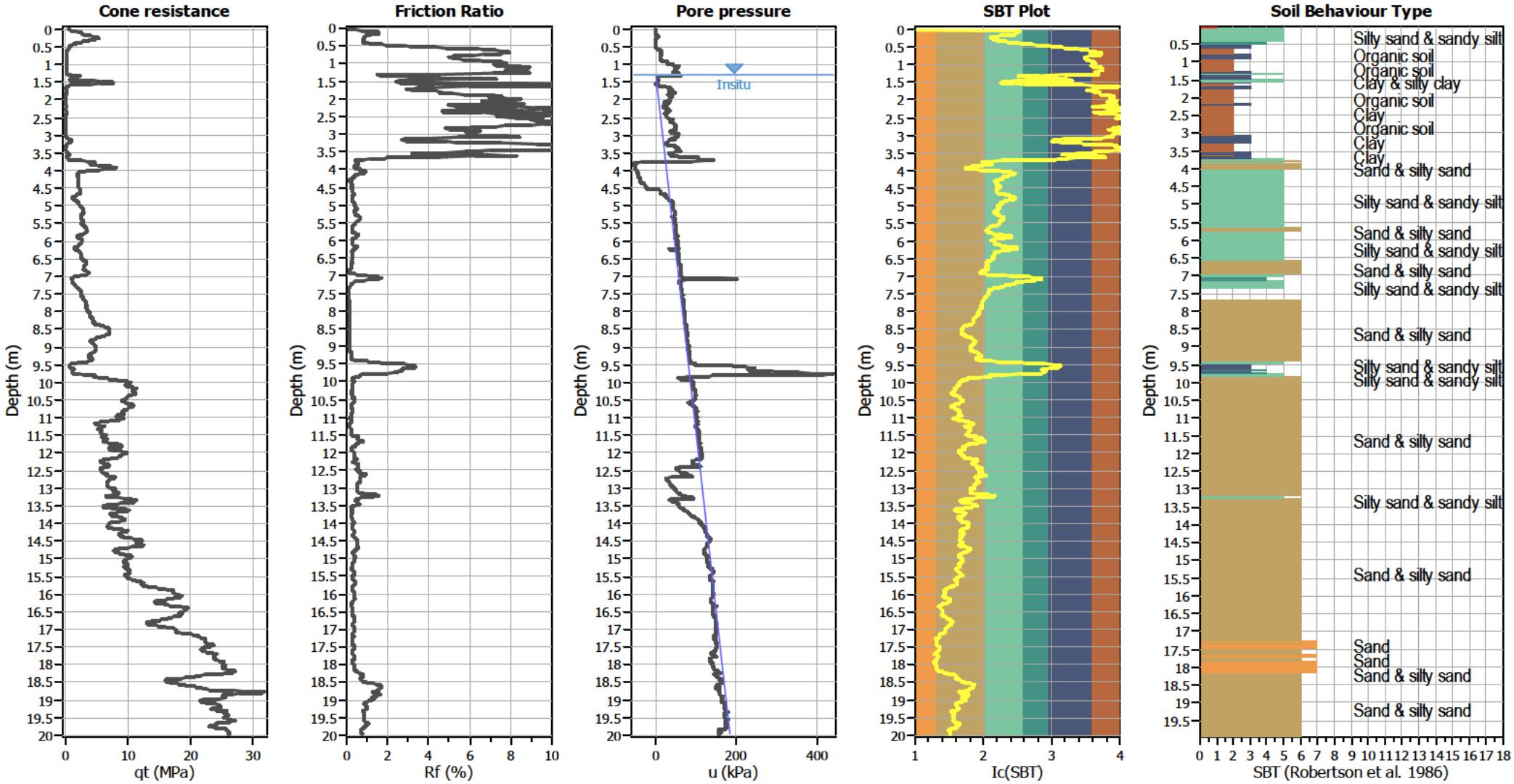
**F.S. color scheme**

- 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

# CPT basic interpretation plots



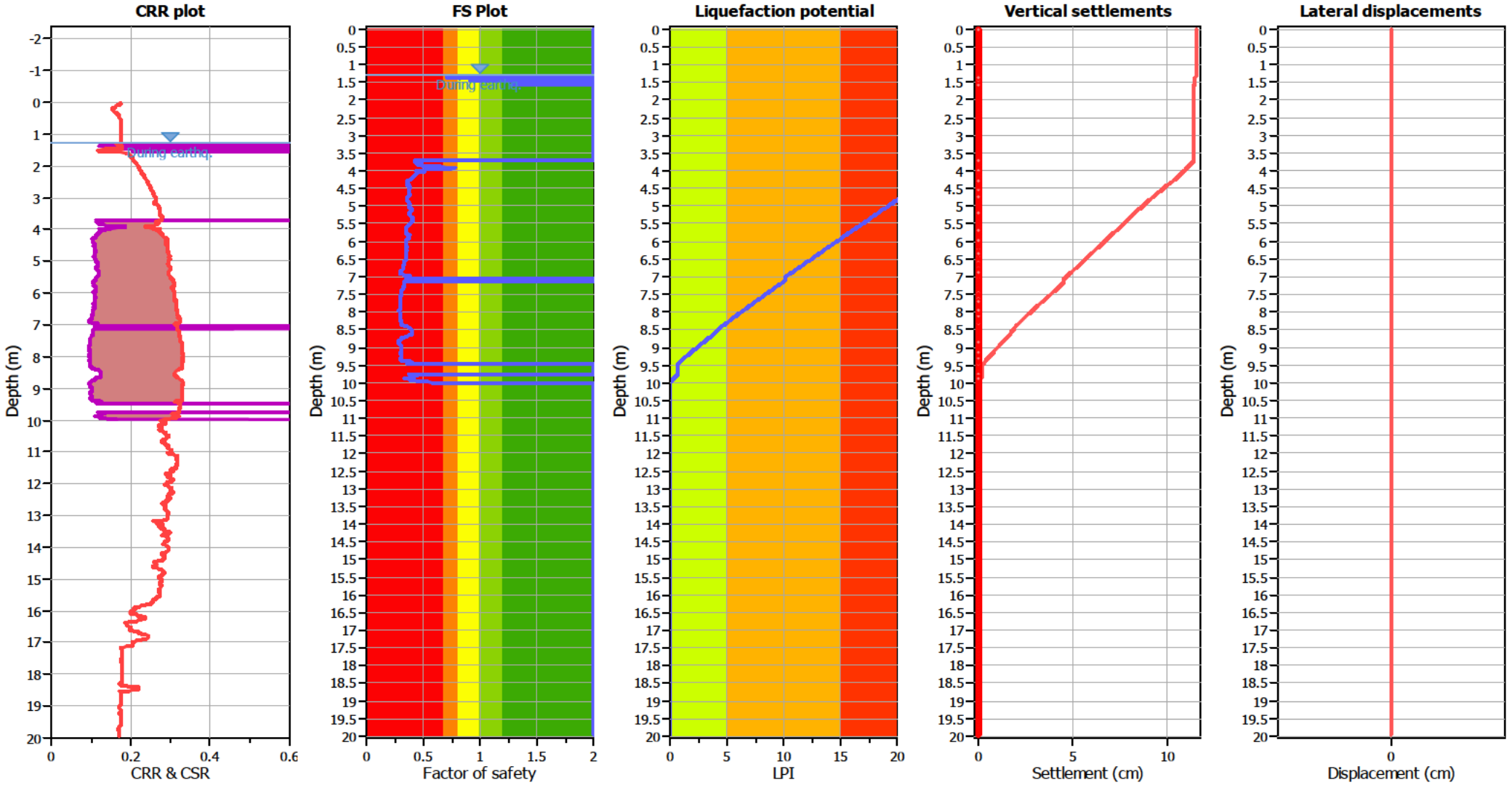

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.30 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

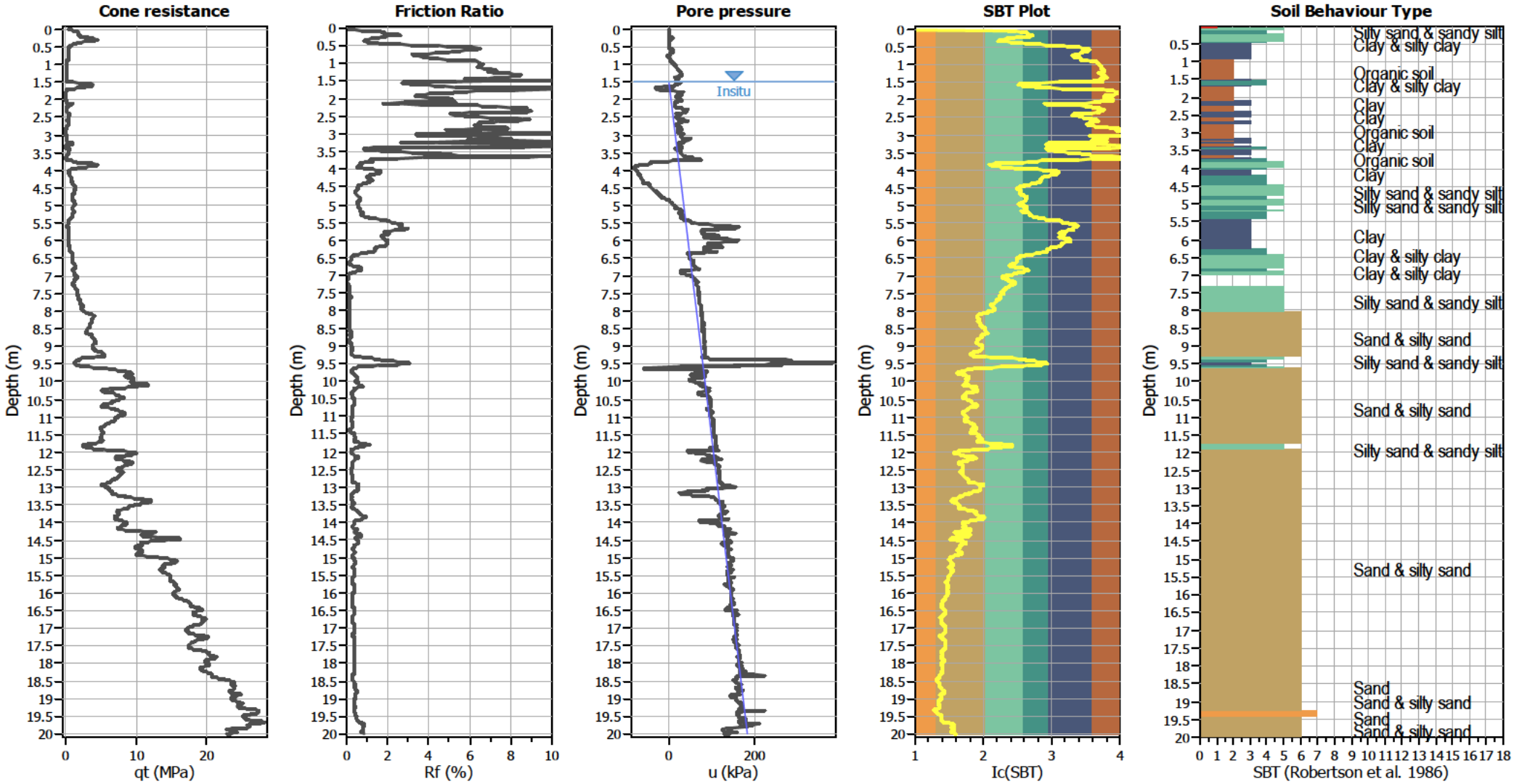
**F.S. color scheme**

- 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

# CPT basic interpretation plots



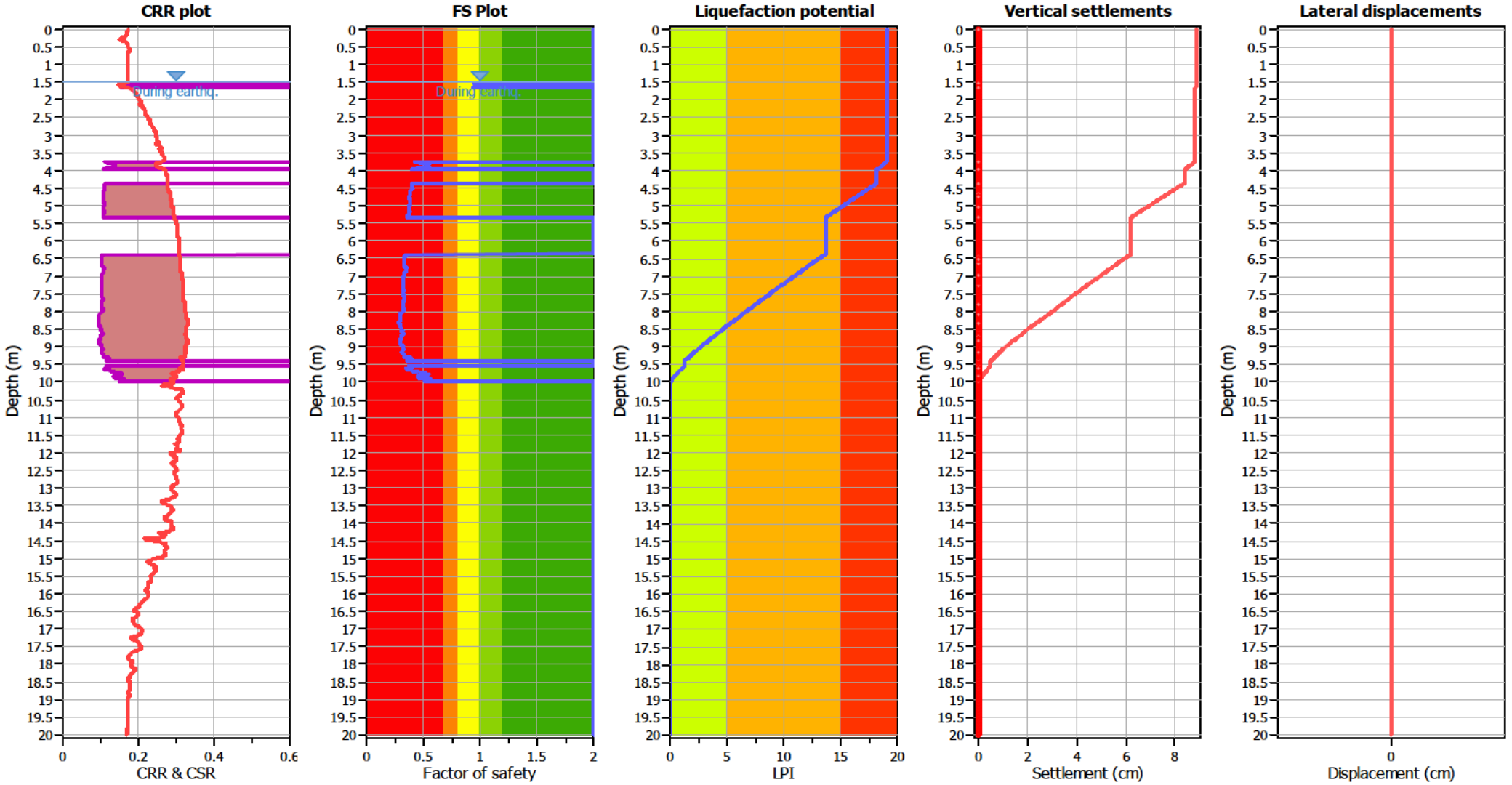

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.50 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.50 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.50 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.50 m | Fill height: | N/A | Limit depth: | 10.00 m |

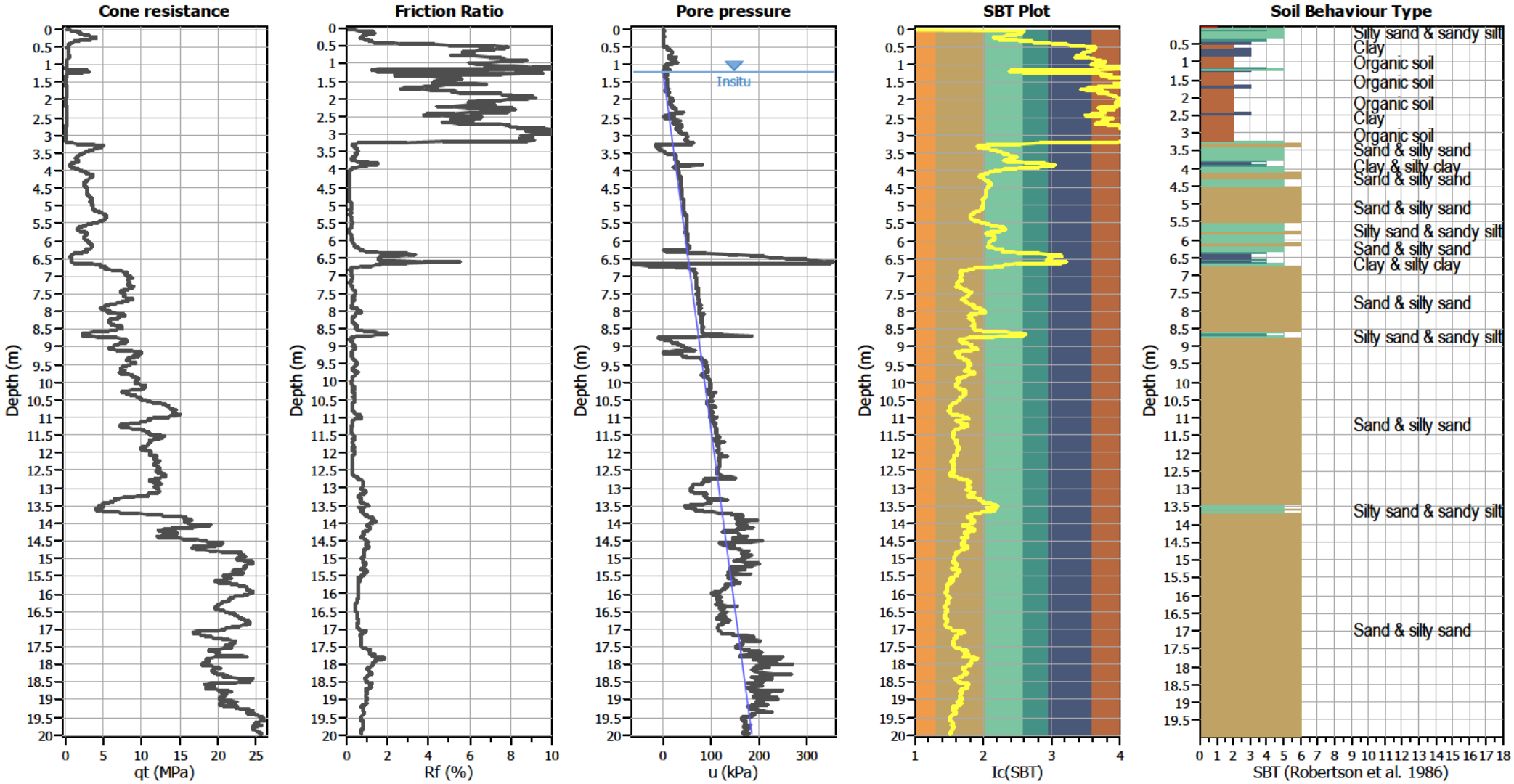
**F.S. color scheme**

- 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

## CPT basic interpretation plots



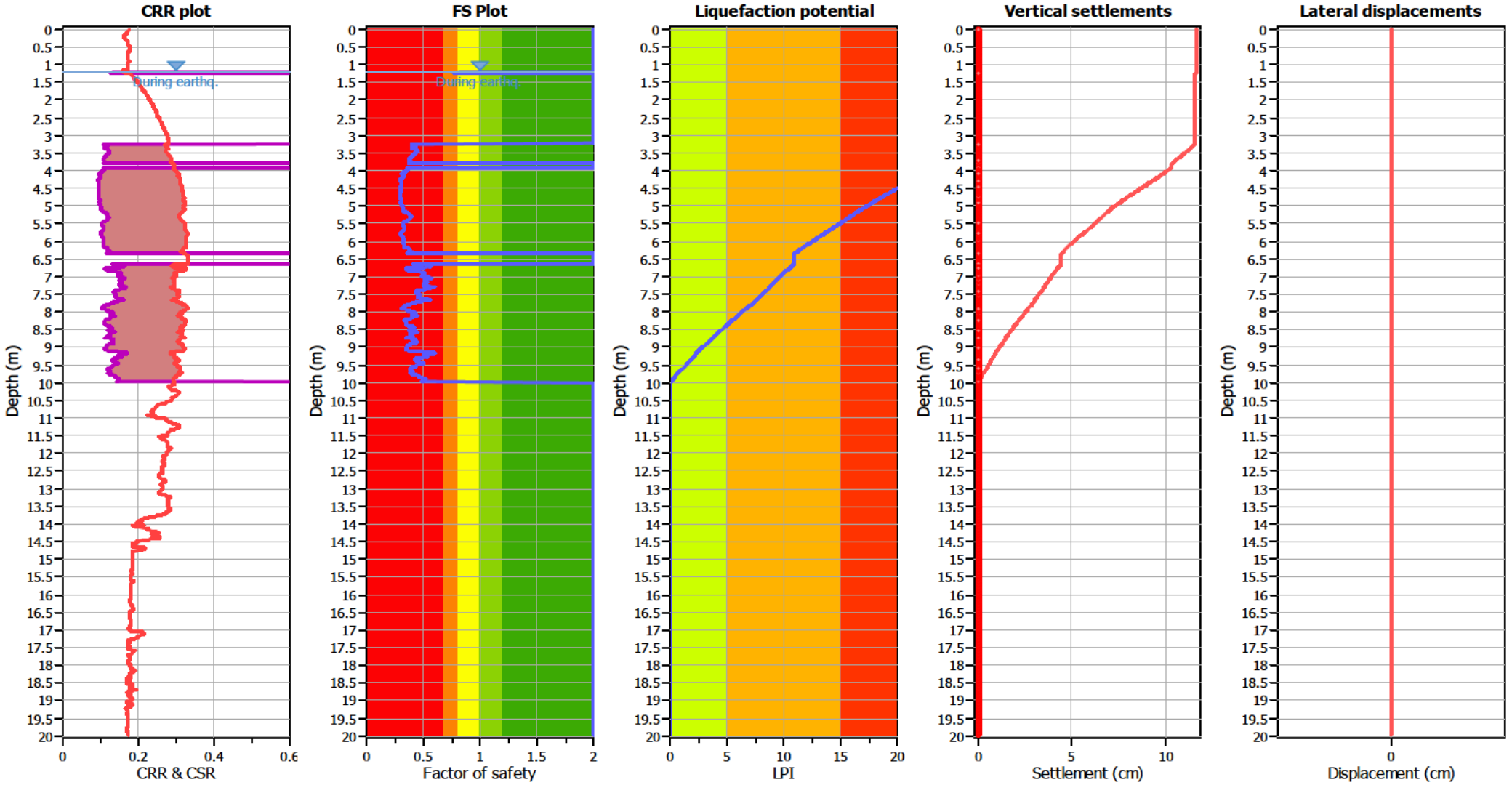

### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.20 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.20 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.20 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.20 m | Fill height: | N/A | Limit depth: | 10.00 m |

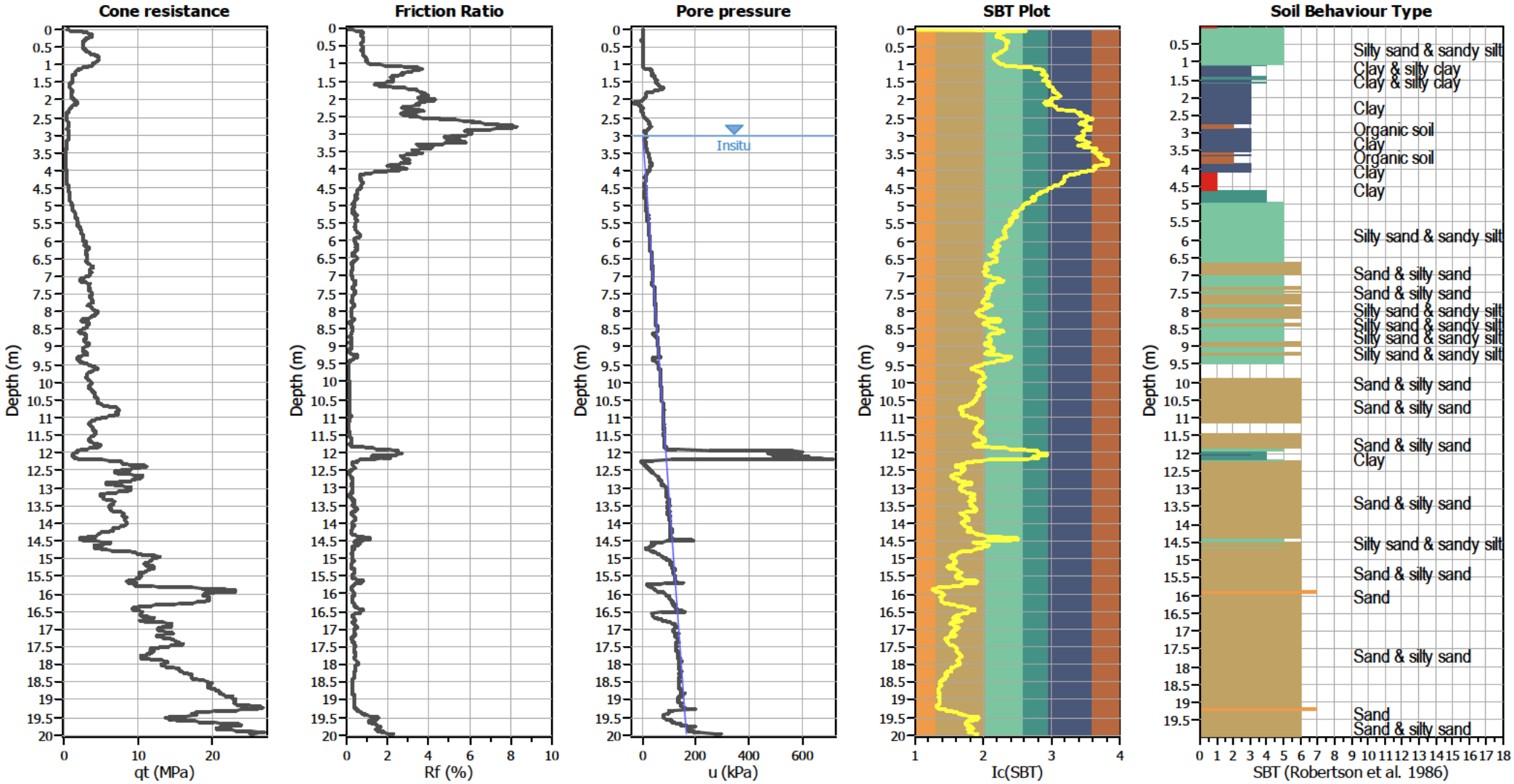
**F.S. color scheme**

- 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

# CPT basic interpretation plots



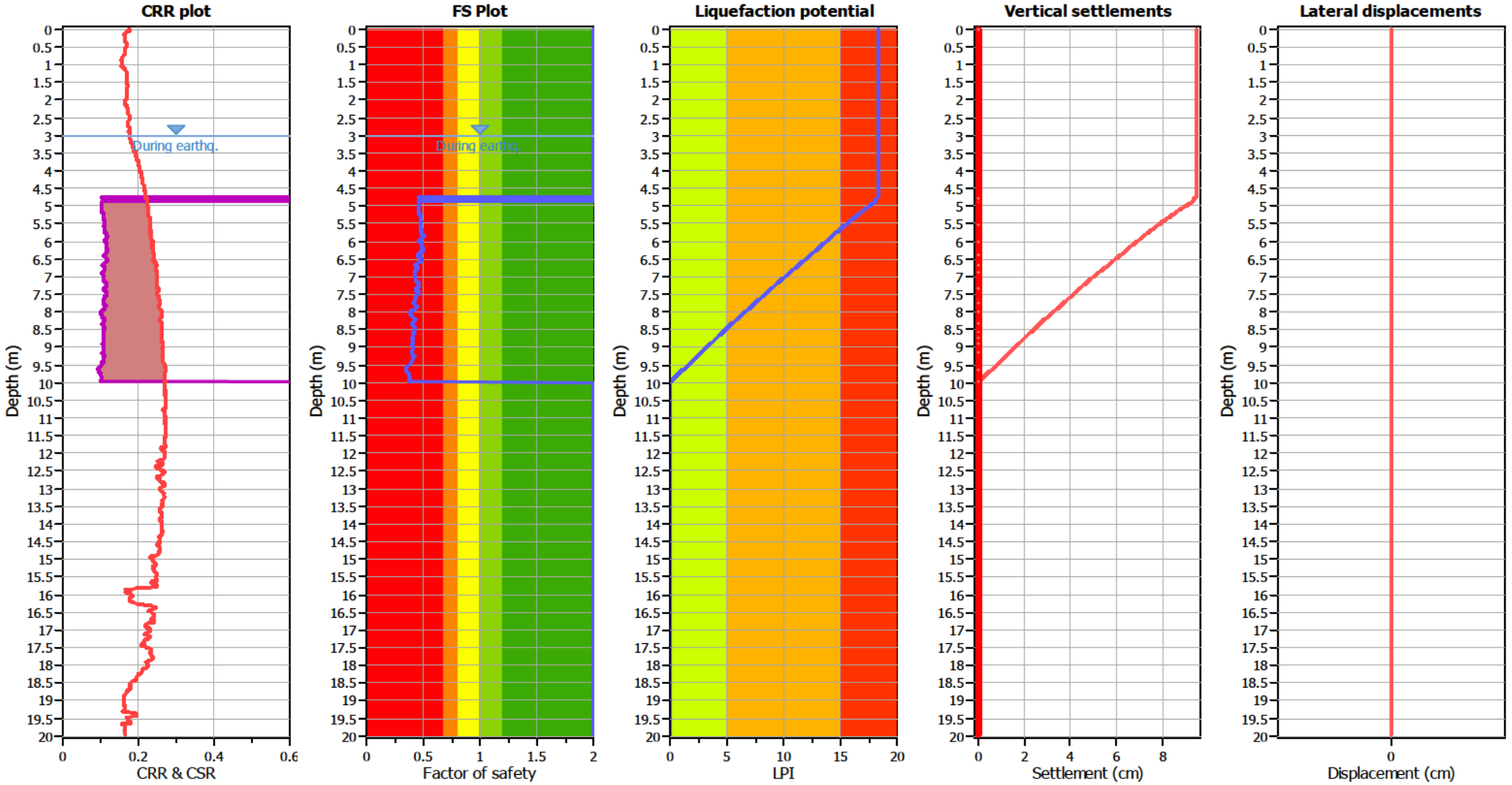

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 3.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 3.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 3.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 3.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

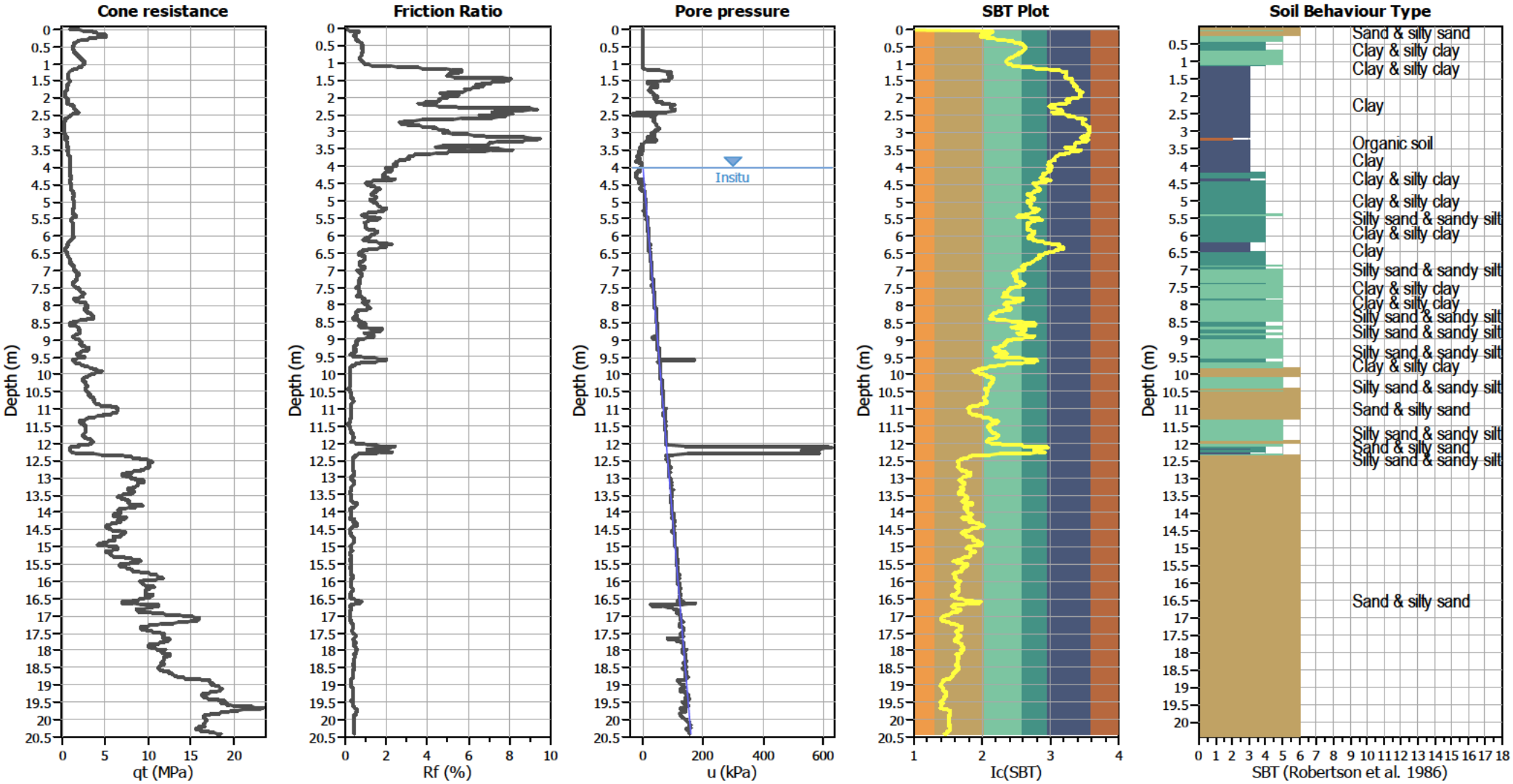
**F.S. color scheme**

- 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

## CPT basic interpretation plots



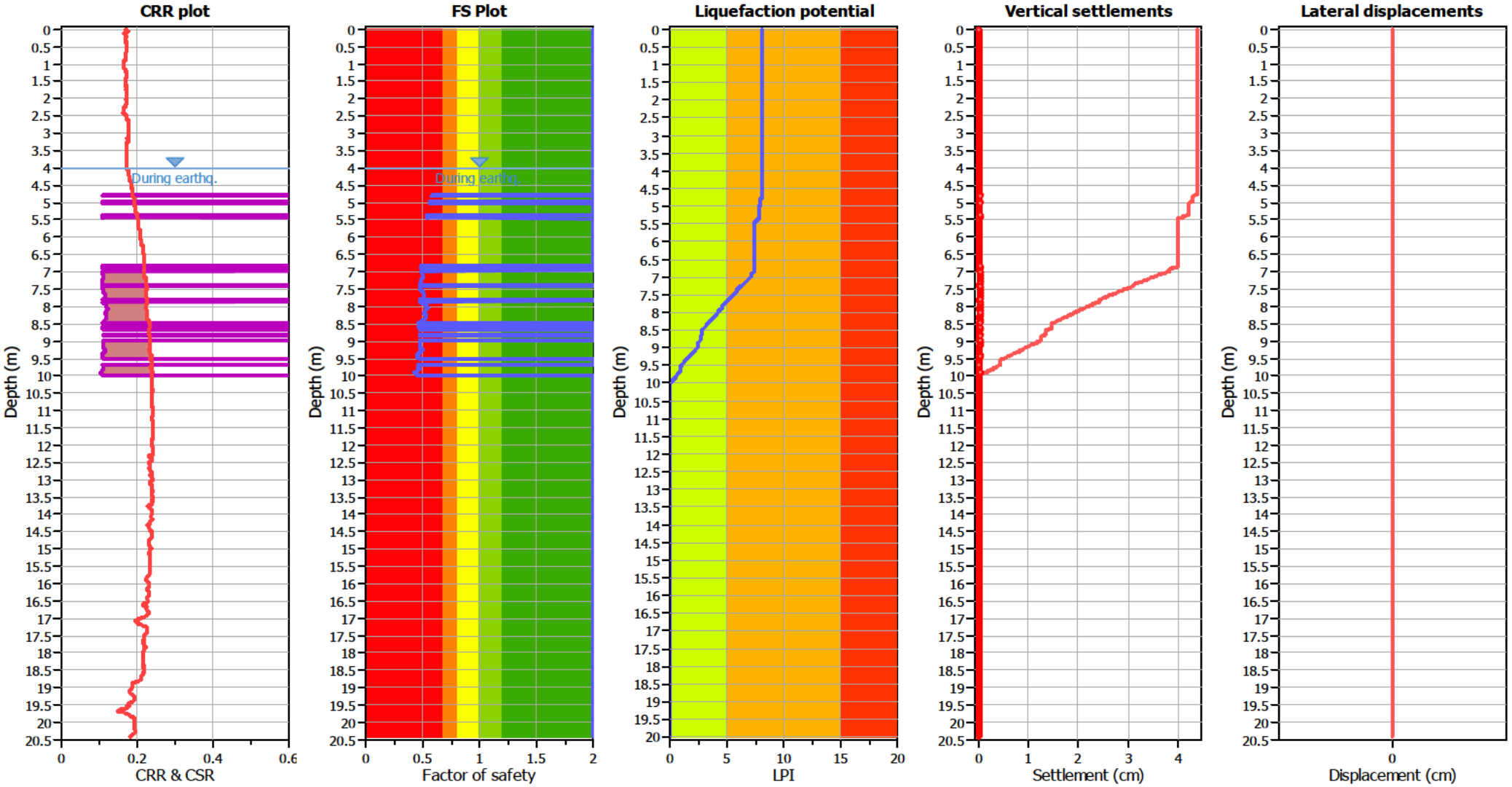

### Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

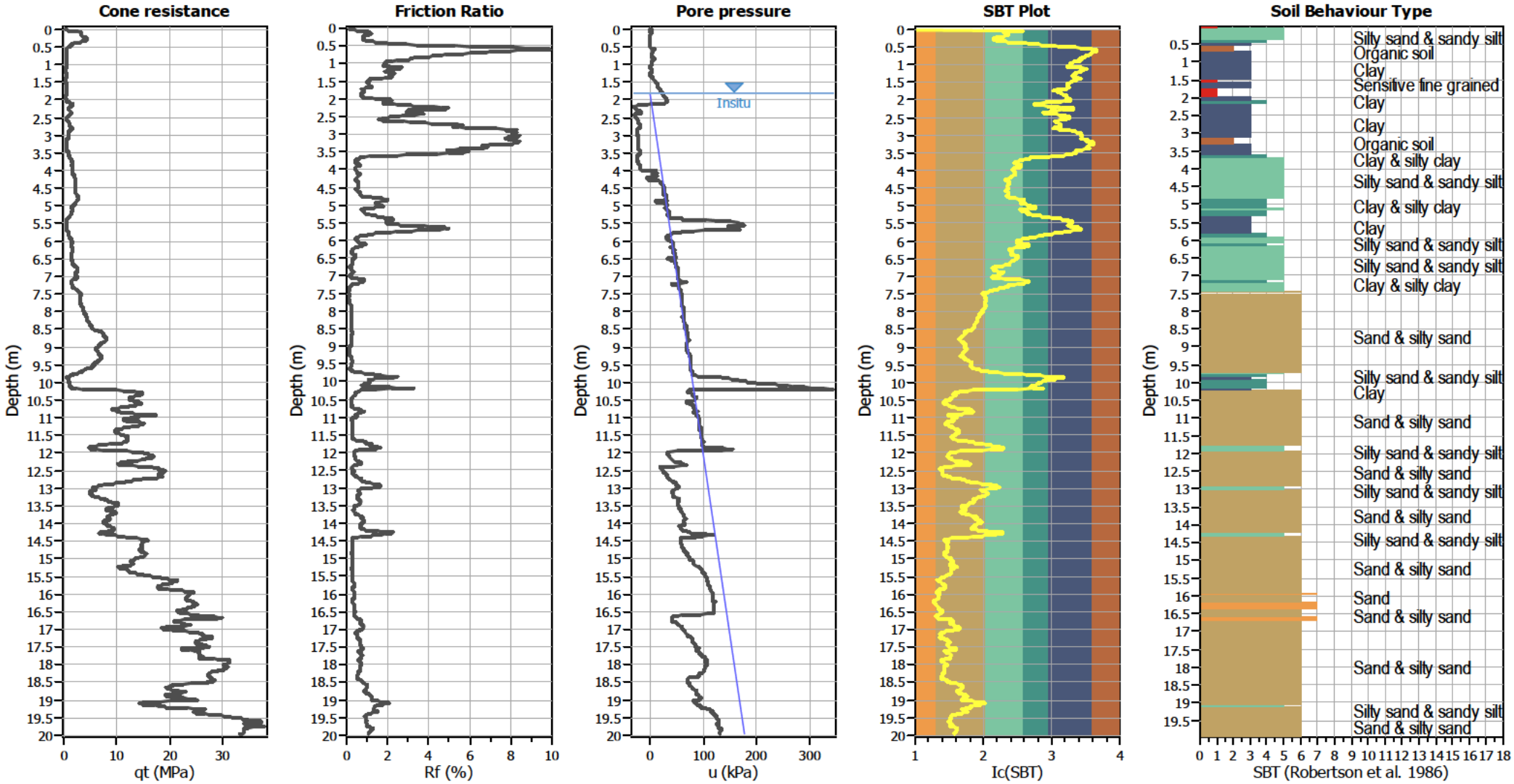
**F.S. color scheme**

- 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

# CPT basic interpretation plots



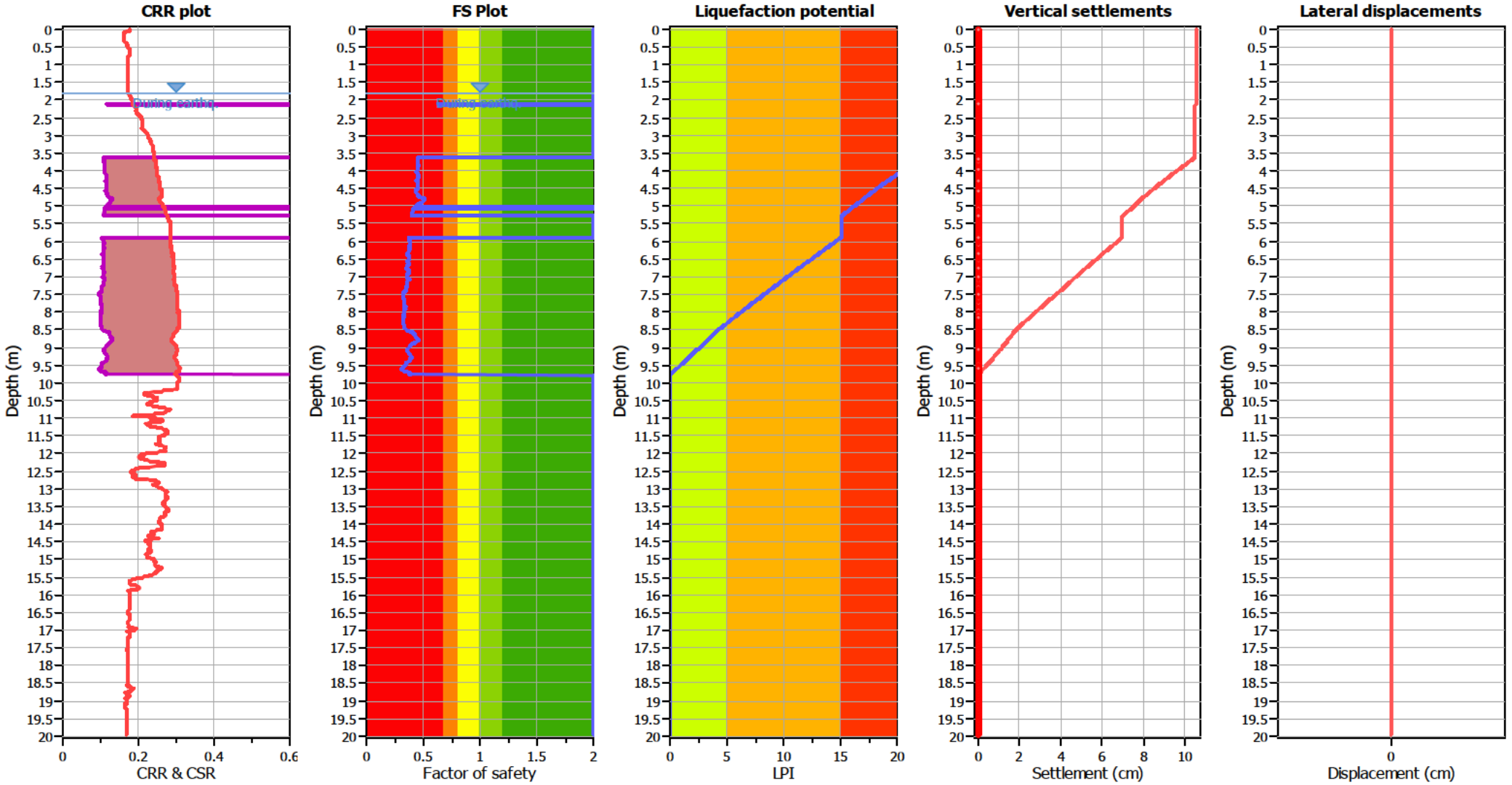

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.80 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.80 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.80 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.80 m | Fill height: | N/A | Limit depth: | 10.00 m |

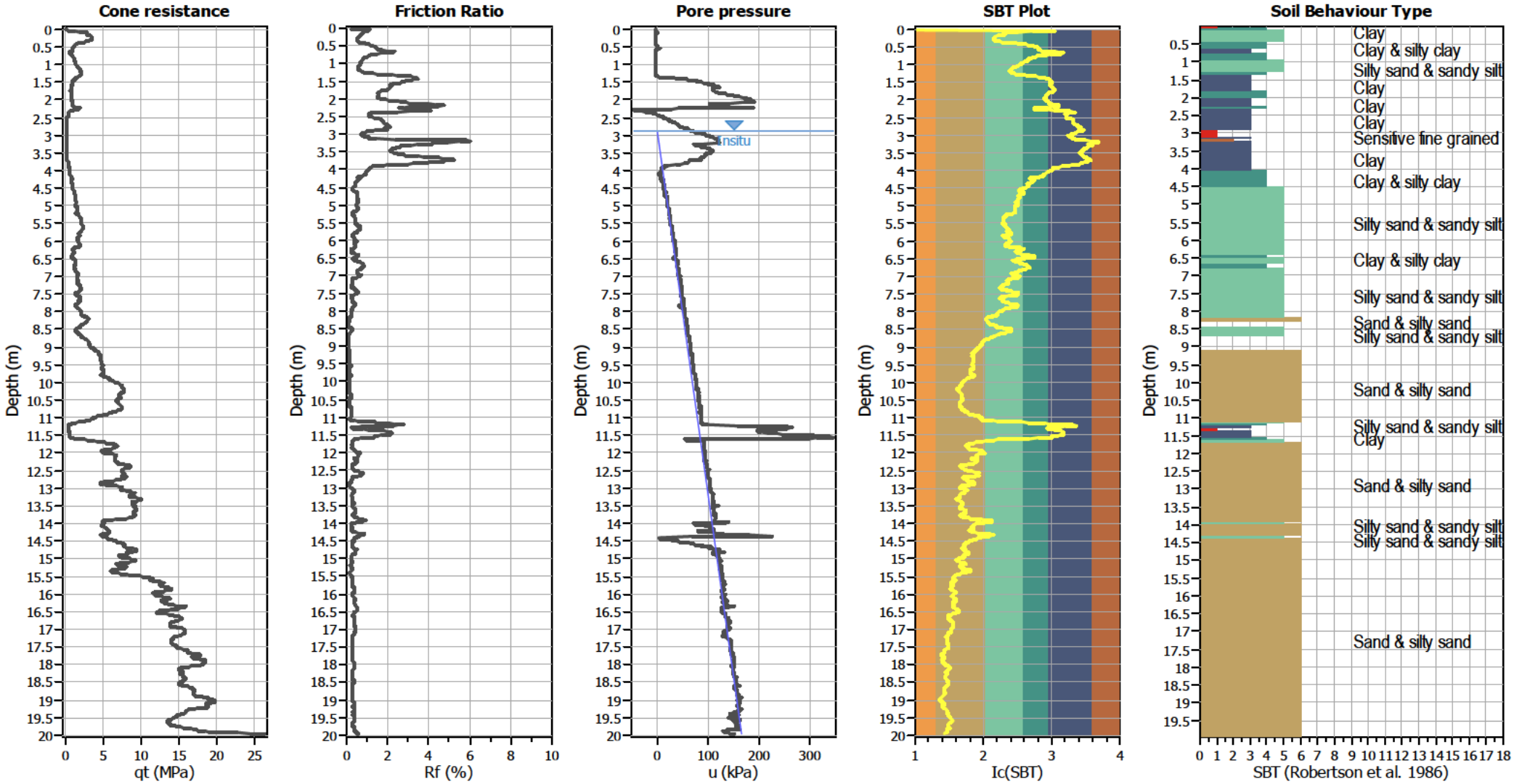
**F.S. color scheme**

- 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

# CPT basic interpretation plots



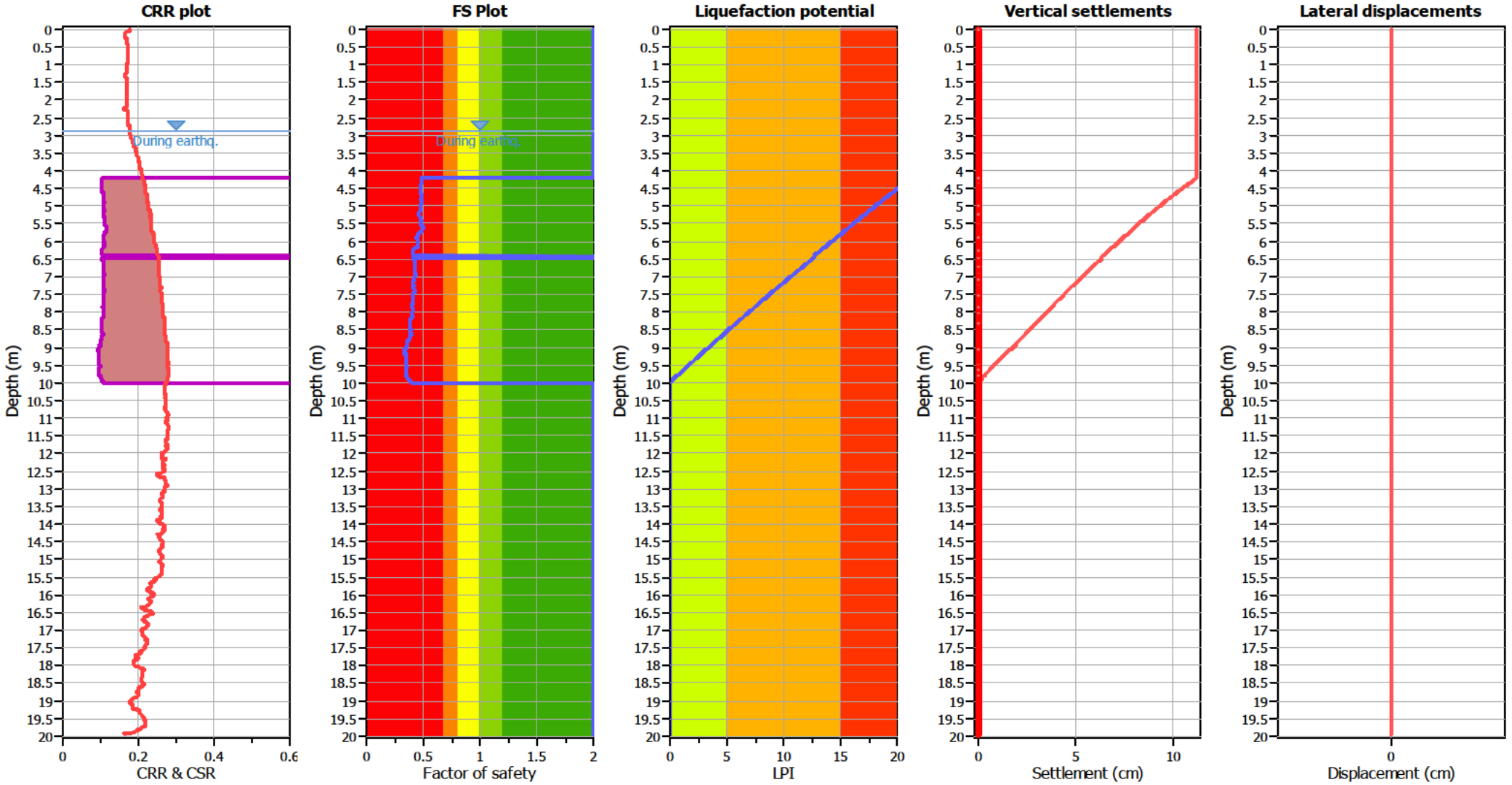

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 2.90 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 2.90 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 2.90 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 2.90 m | Fill height: | N/A | Limit depth: | 10.00 m |

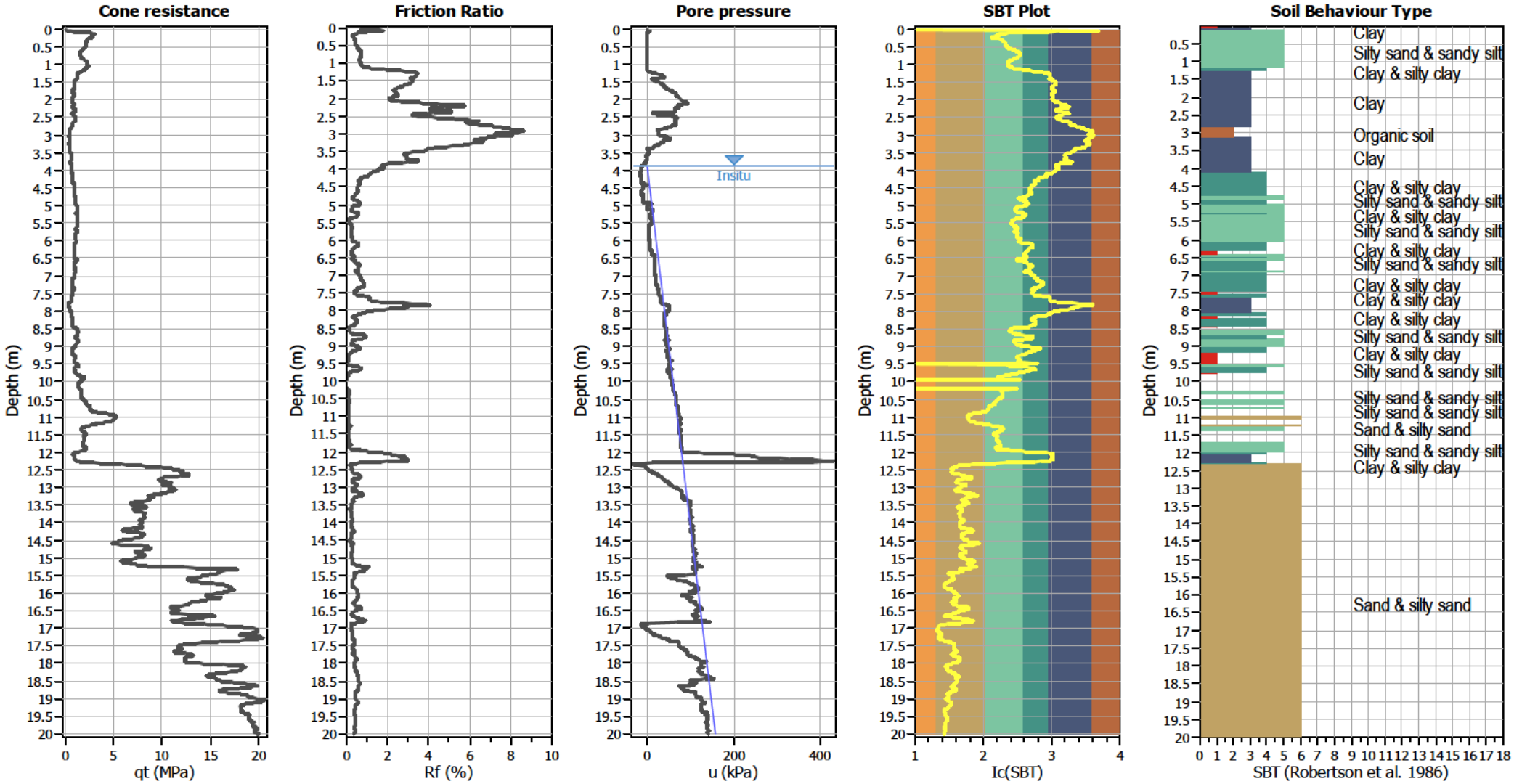
**F.S. color scheme**

- 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

# CPT basic interpretation plots



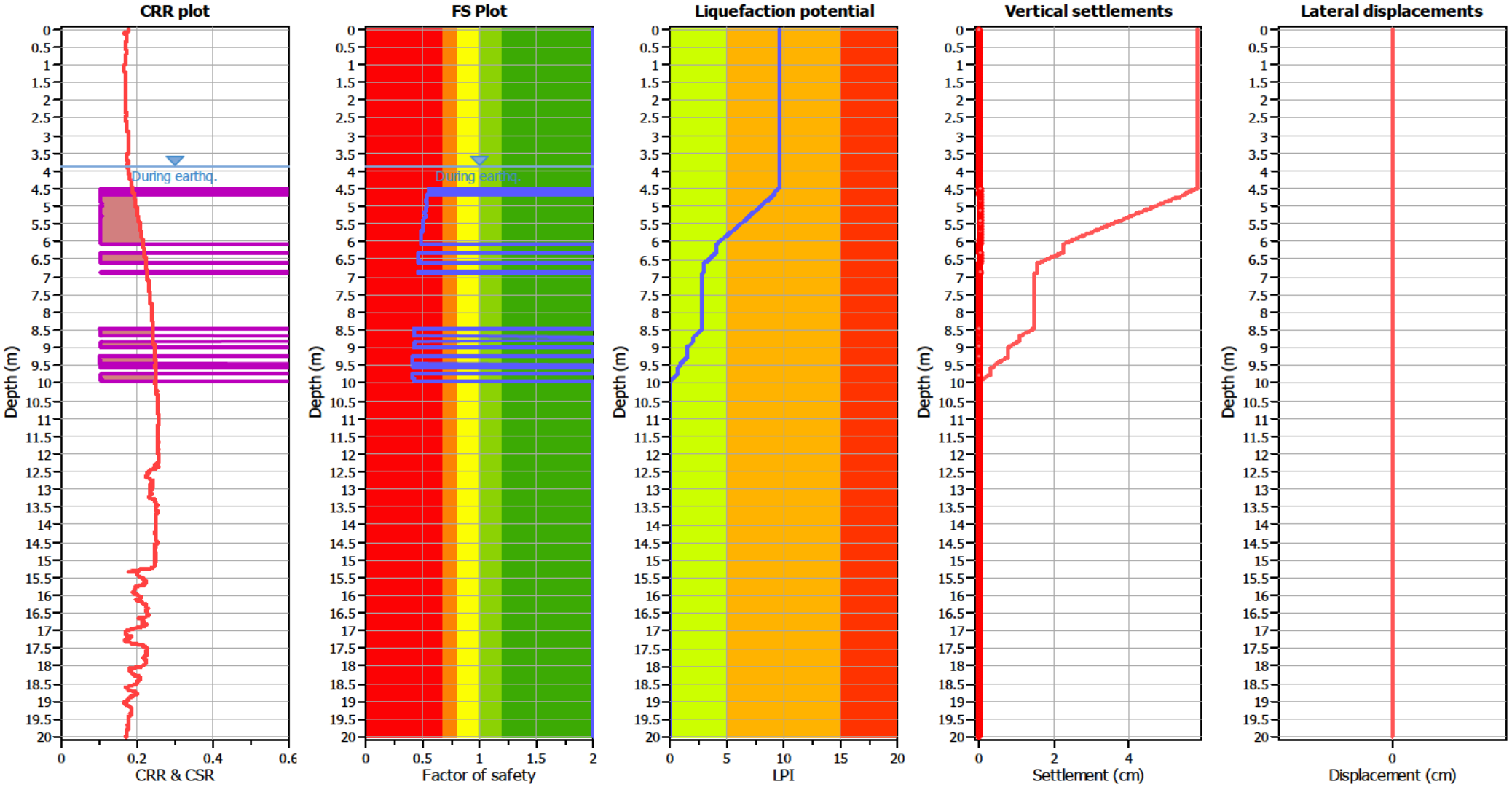

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 3.90 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 3.90 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 3.90 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 3.90 m | Fill height: | N/A | Limit depth: | 10.00 m |

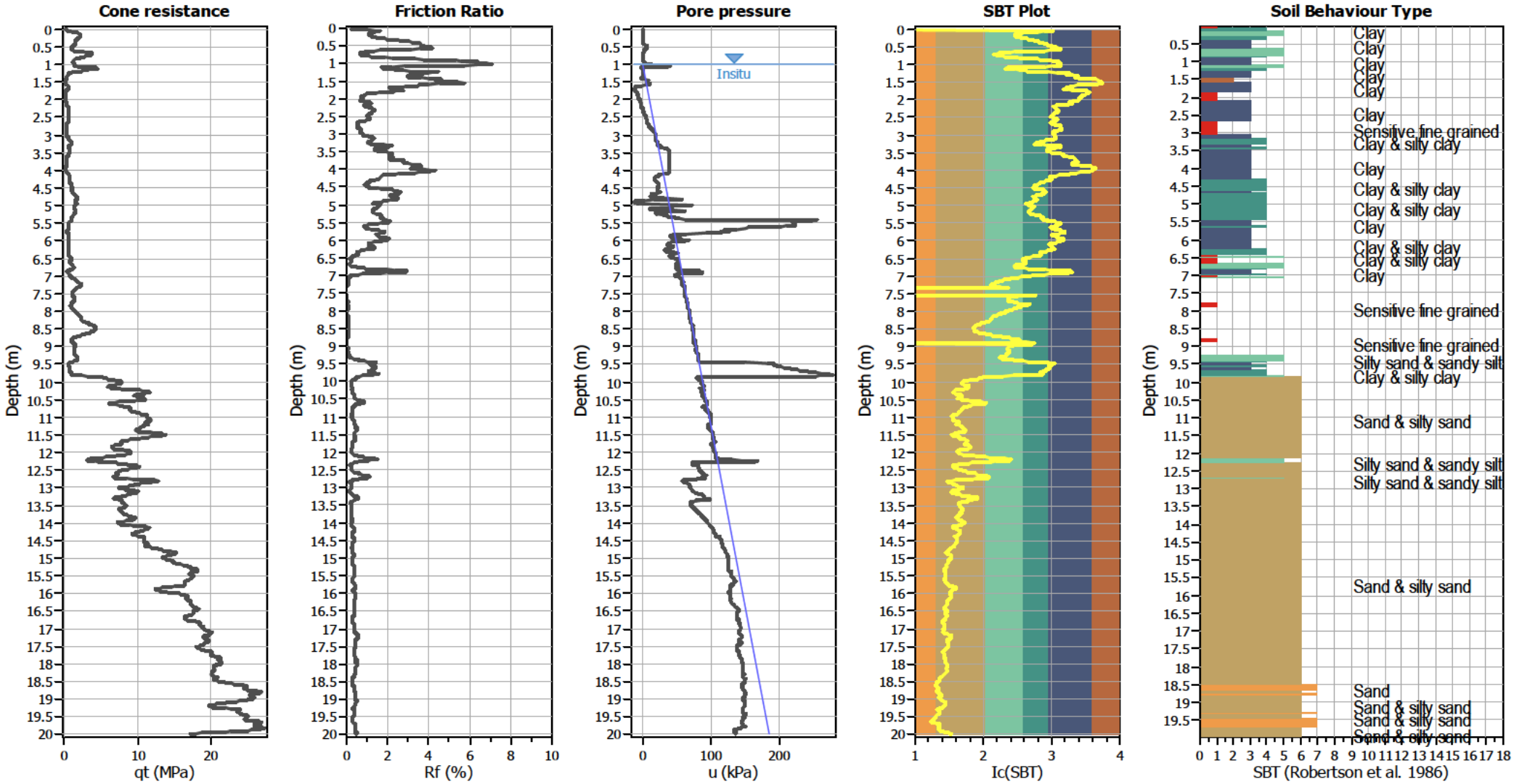
**F.S. color scheme**

- 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

# CPT basic interpretation plots



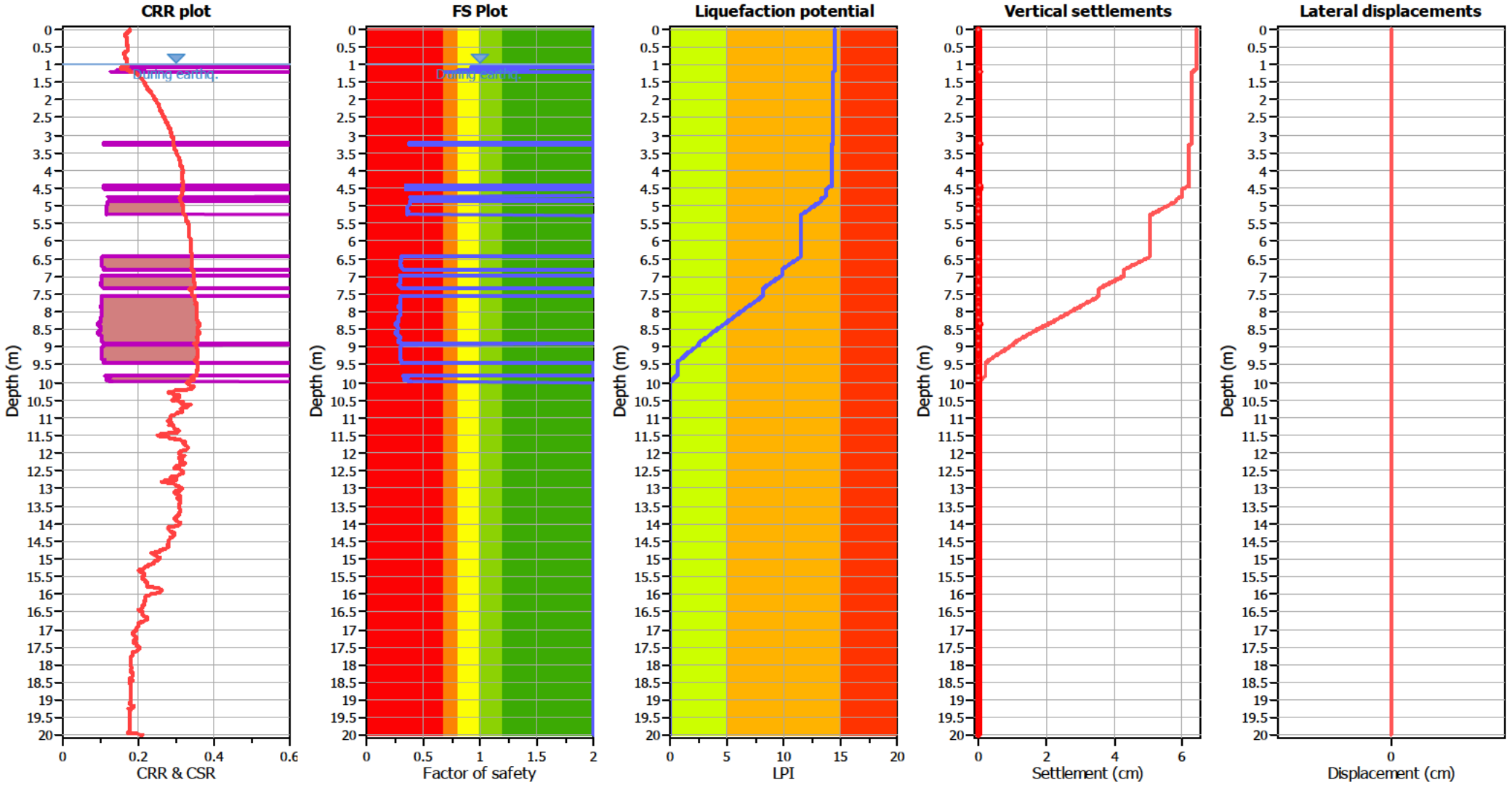

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 1.00 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 1.00 m | Fill height: | N/A | Limit depth: | 10.00 m |

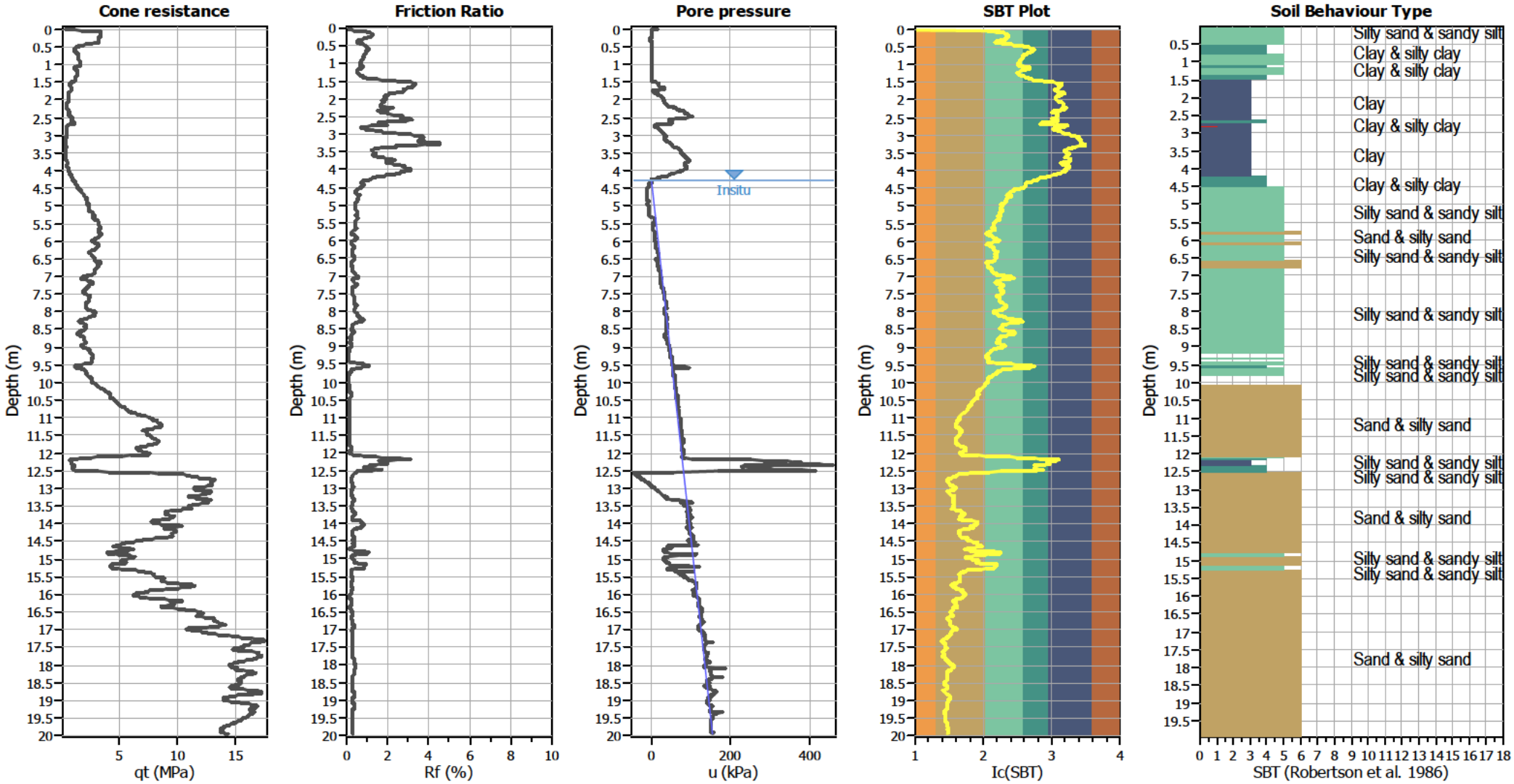
**F.S. color scheme**

- 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

# CPT basic interpretation plots



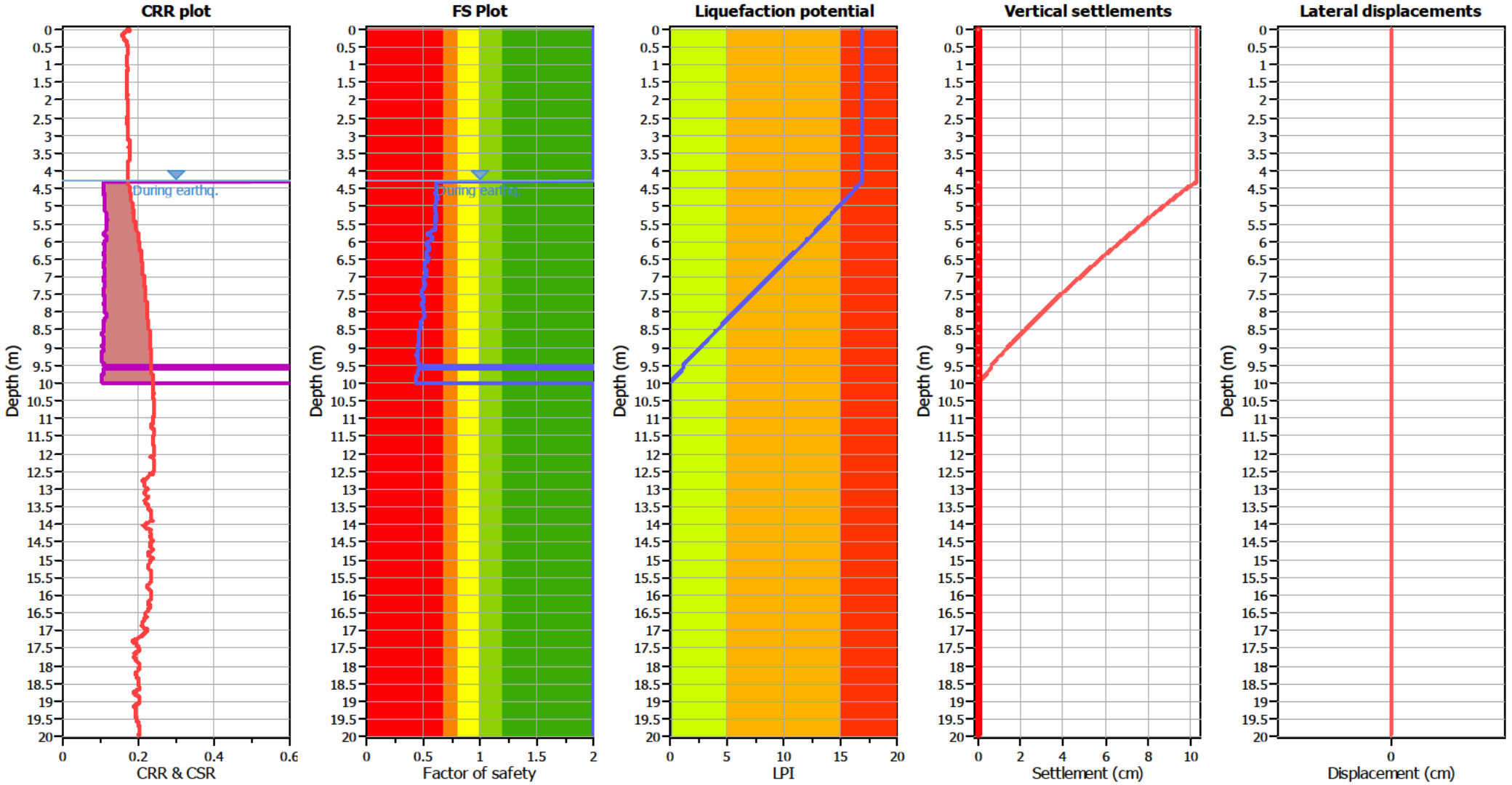

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.30 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.30 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.30 m | Fill height: | N/A | Limit depth: | 10.00 m |

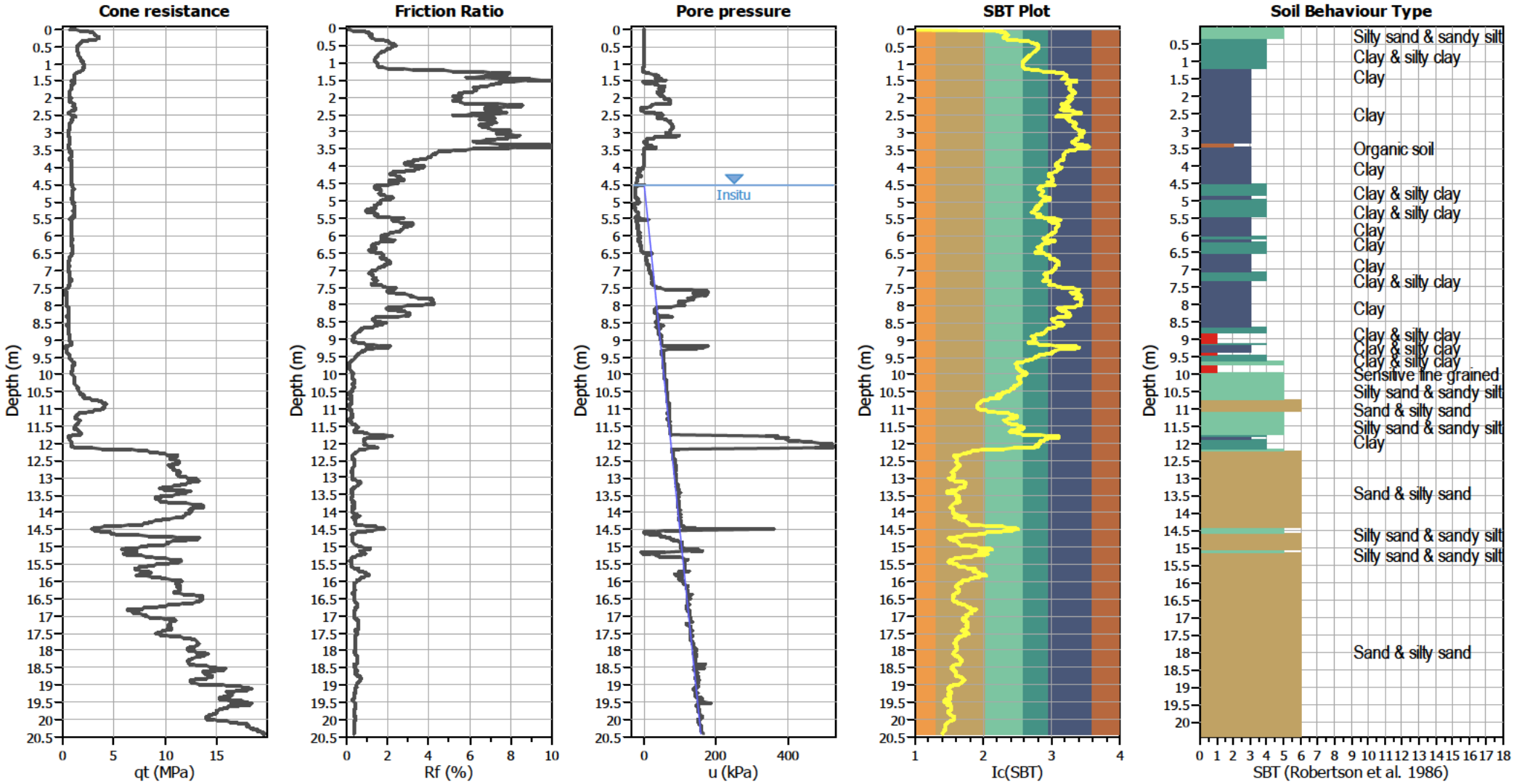
**F.S. color scheme**

- 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

# CPT basic interpretation plots



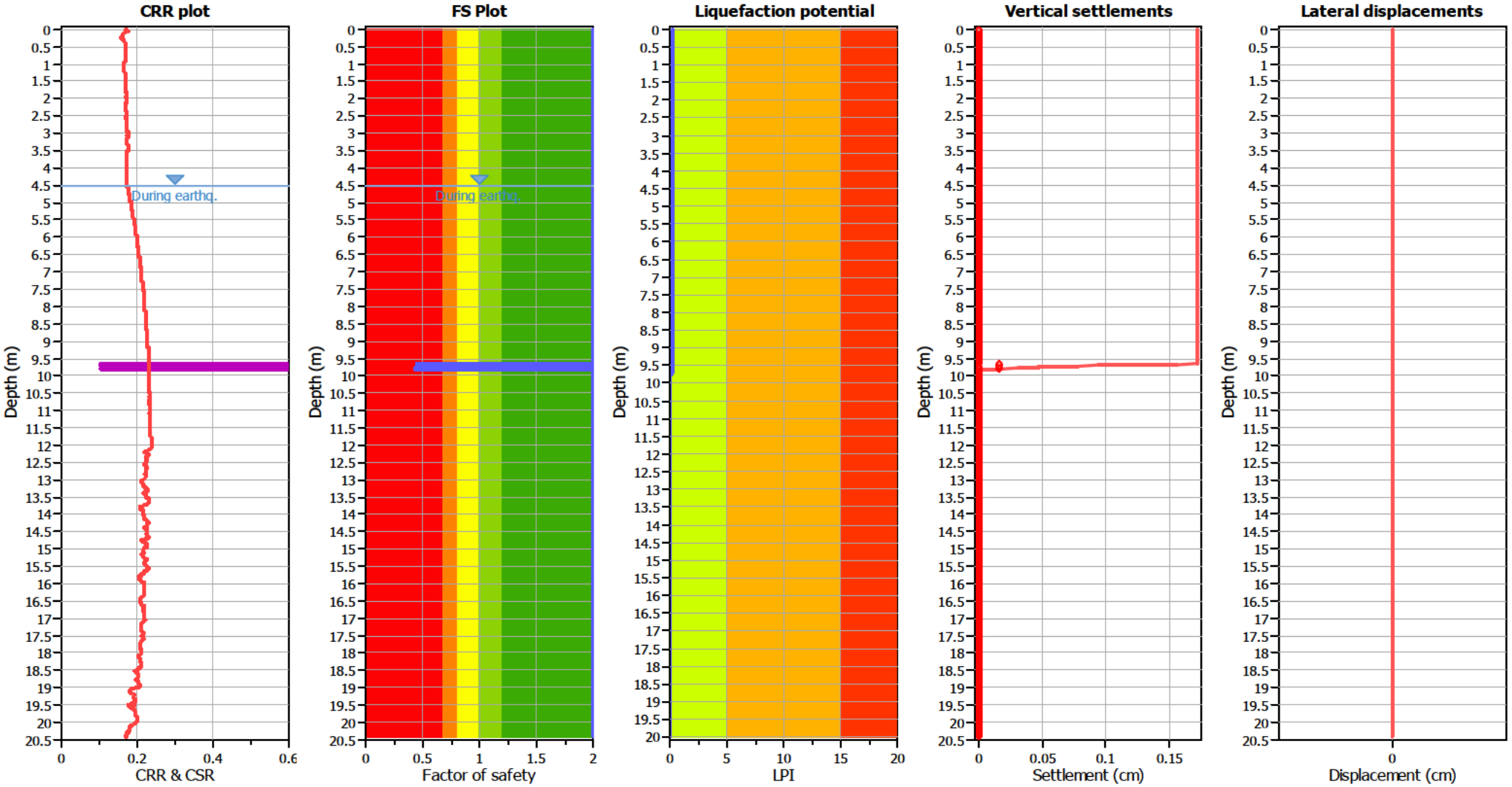

## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.50 m | Fill height: | N/A | Limit depth: | 10.00 m |

**SBT legend**

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

# Liquefaction analysis overall plots




## Input parameters and analysis data

| | | | | | |
|---|---|---|---|---|---|
| Analysis method: | B&I (2014) | Depth to GWT (erthq.): | 4.50 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 | $K_\sigma$ applied: | Yes |
| Earthquake magnitude $M_w$: | 6.00 | Unit weight calculation: | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration: | 0.32 | Use fill: | No | Limit depth applied: | Yes |
| Depth to water table (insitu): | 4.50 m | Fill height: | N/A | Limit depth: | 10.00 m |

**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

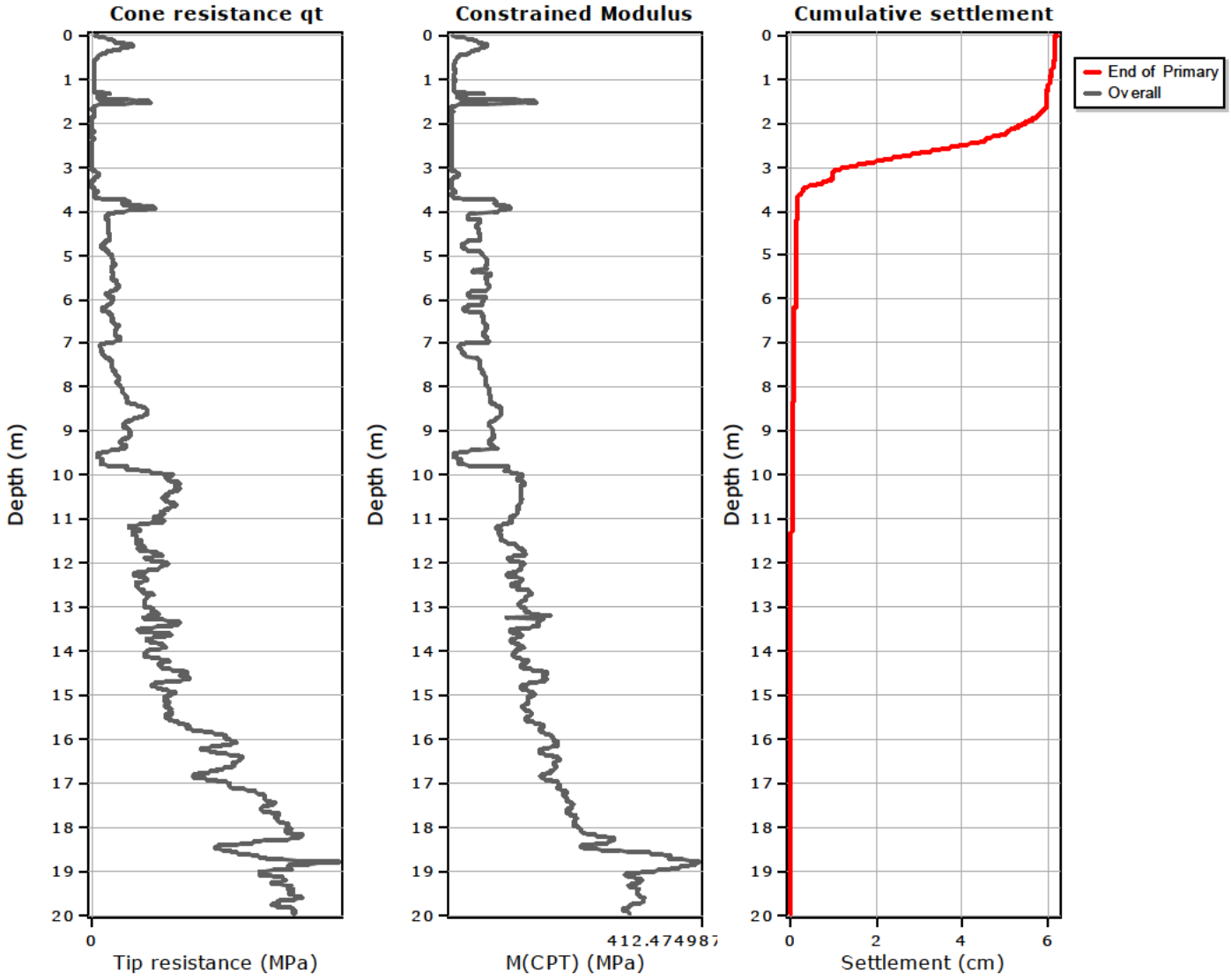
# Appendix E: Settlement Analyses

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

**CPT: CPT01**
Total depth: 19.96 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

**GeoLogismiki**
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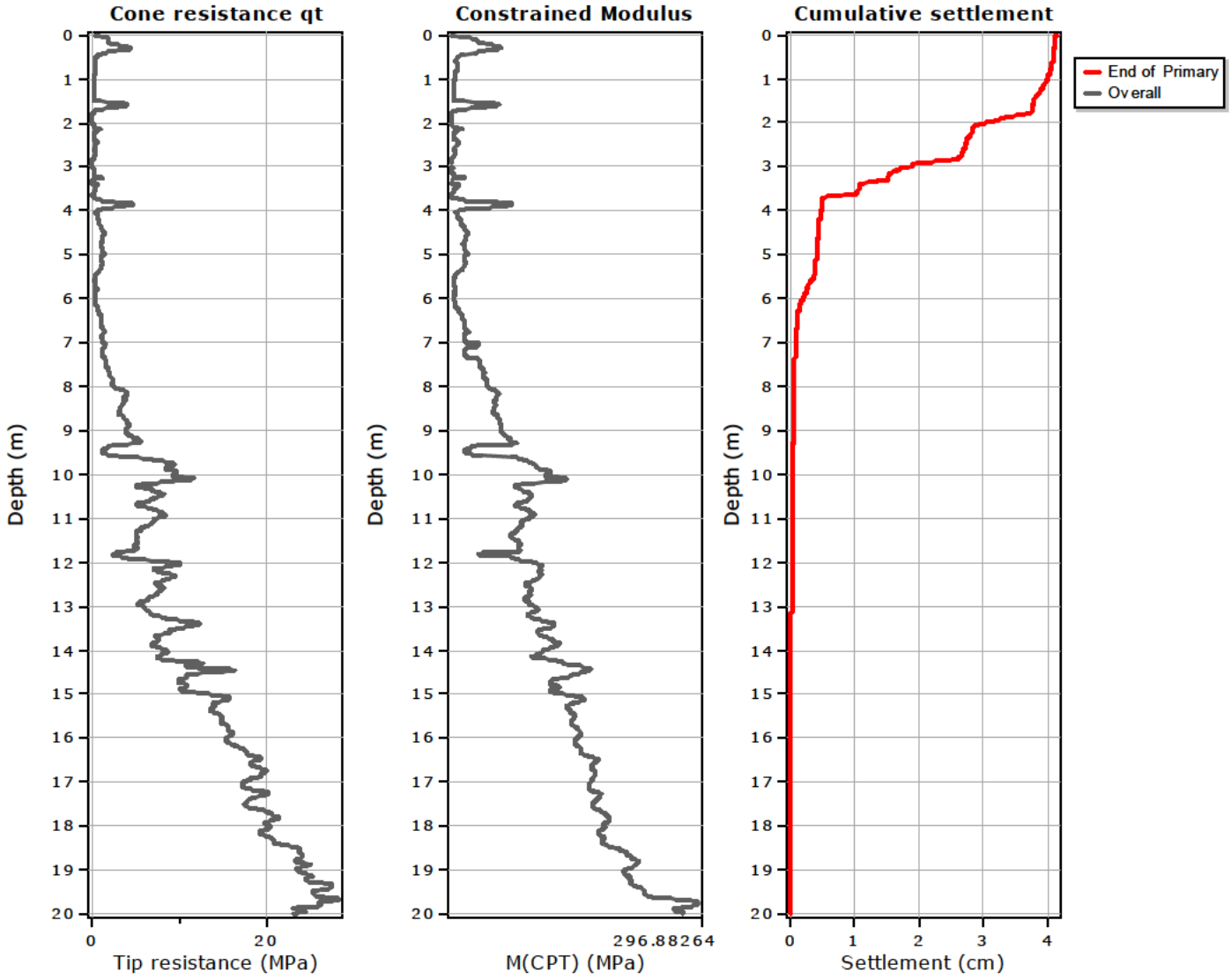
**CPT: CPT02**
Total depth: 20.00 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

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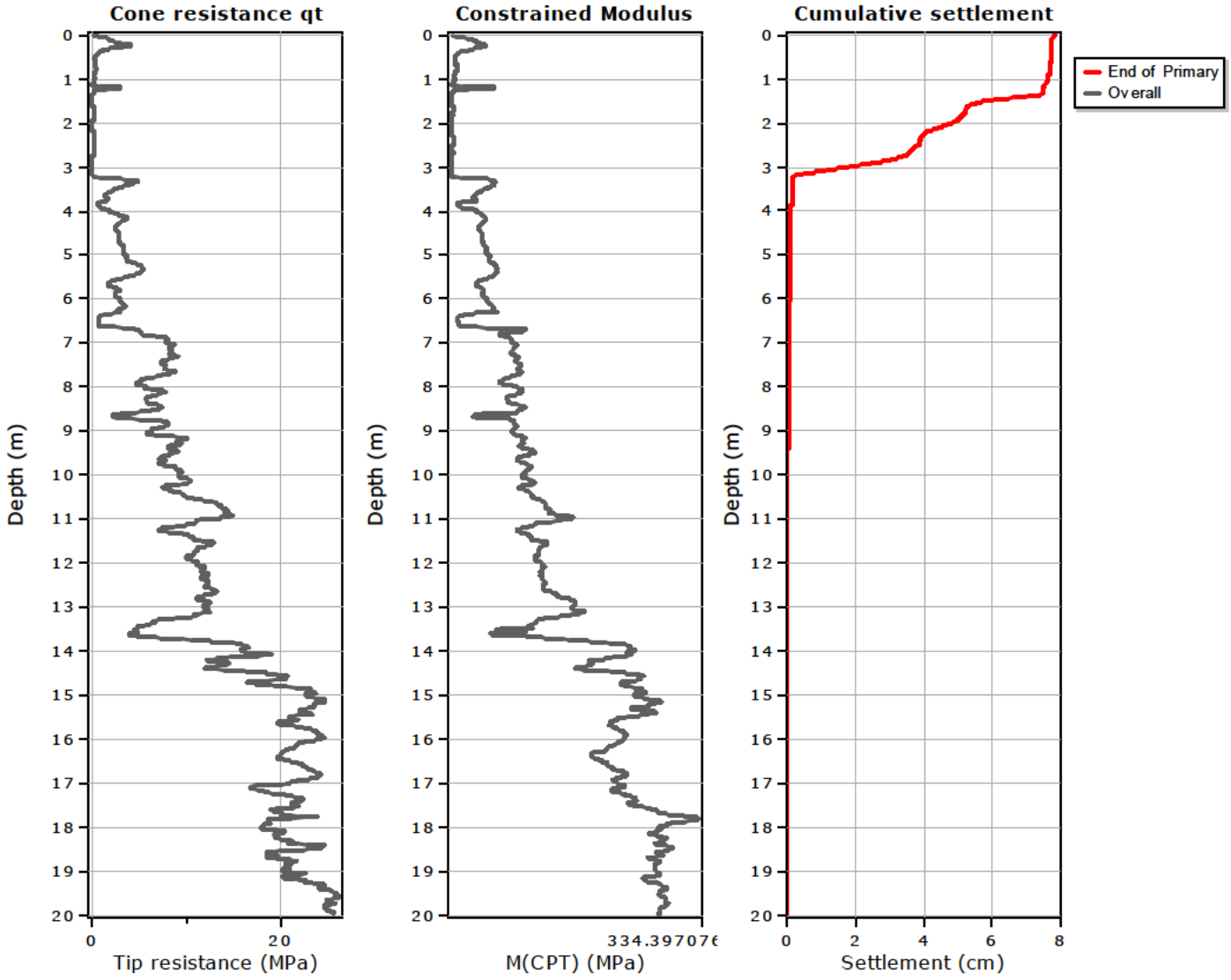
**CPT: CPT03**
Total depth: 19.97 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.00 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

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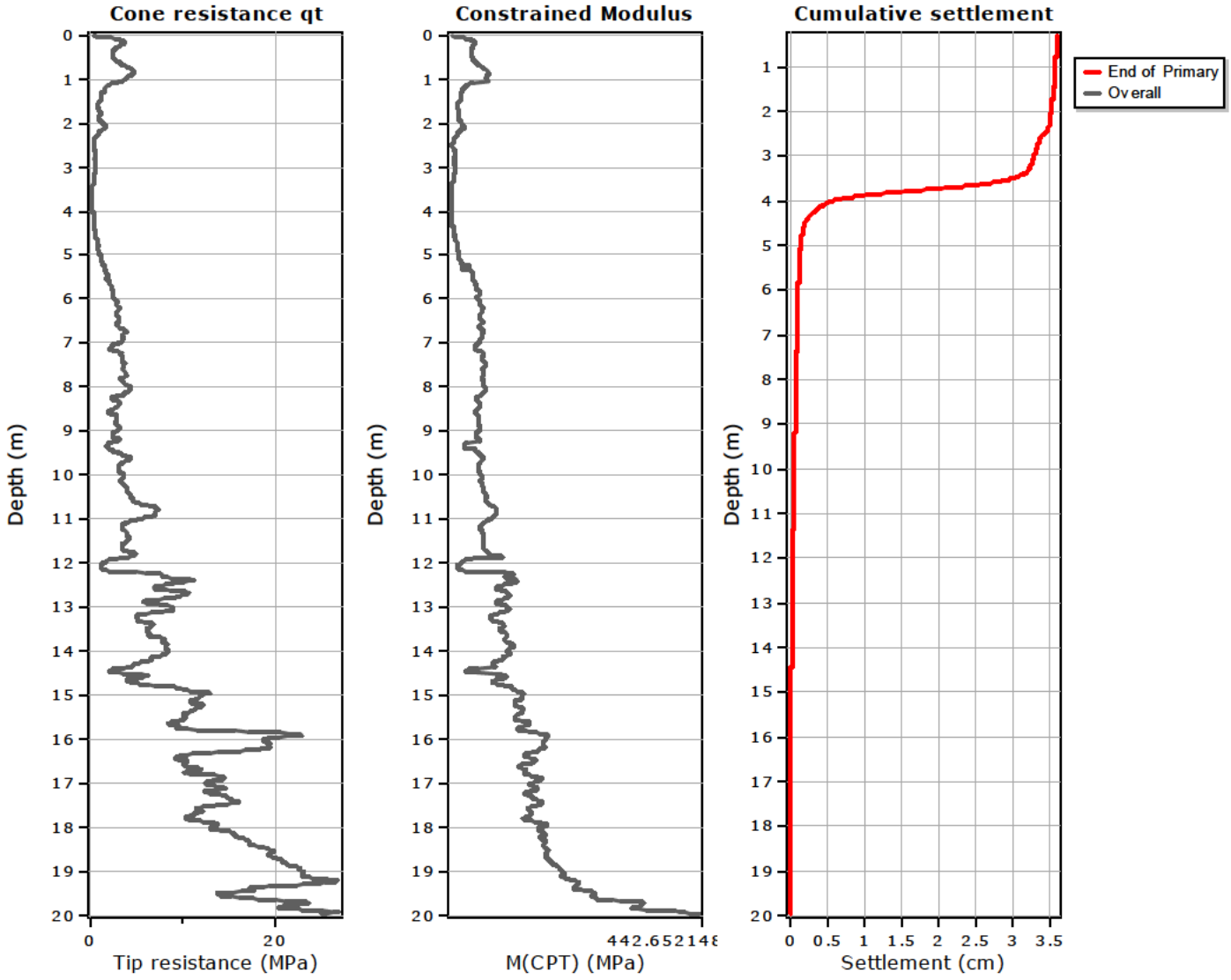
**CPT: CPT04**
Total depth: 19.97 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.30 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

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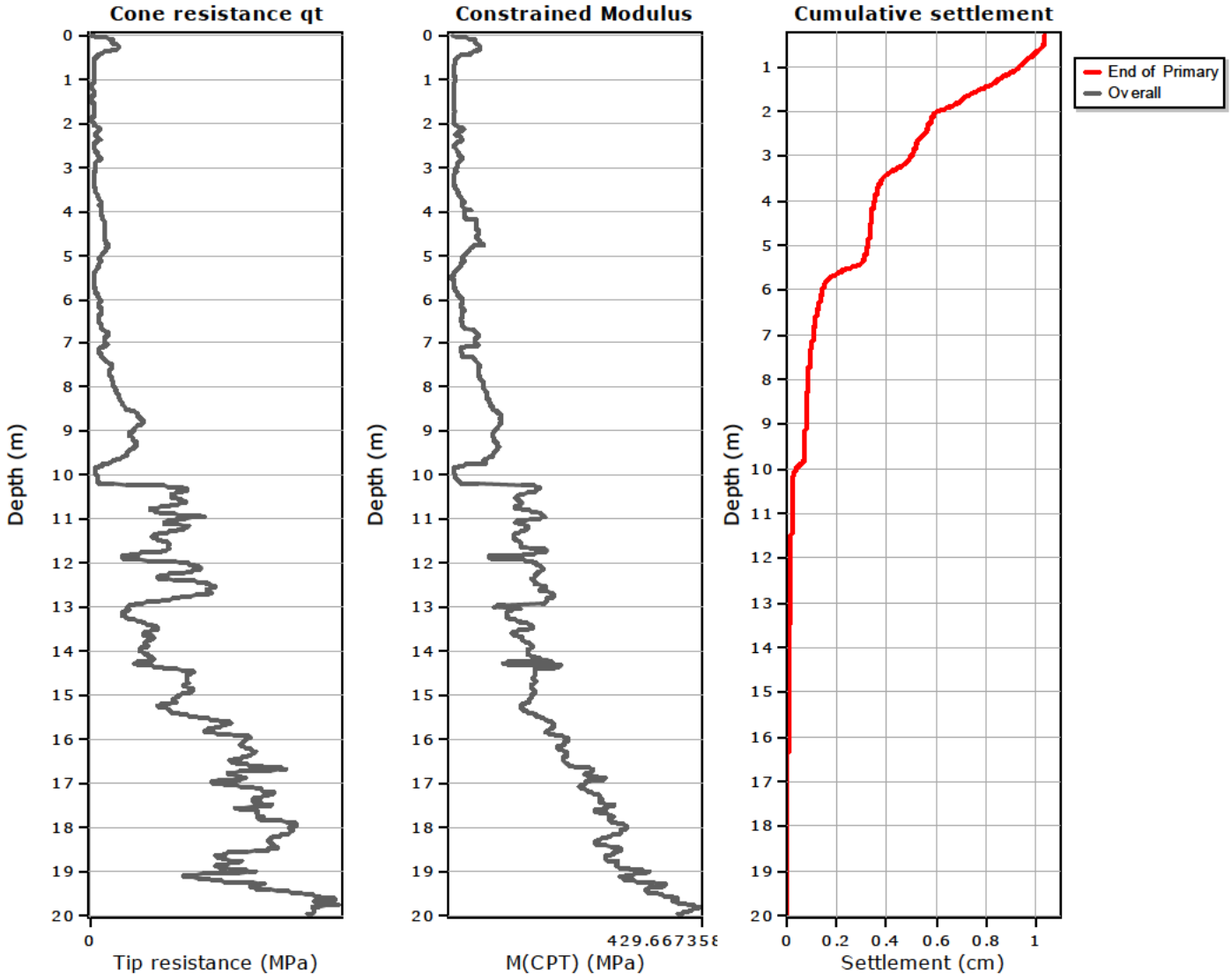
**CPT: CPT06**
Total depth: 19.96 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.30 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

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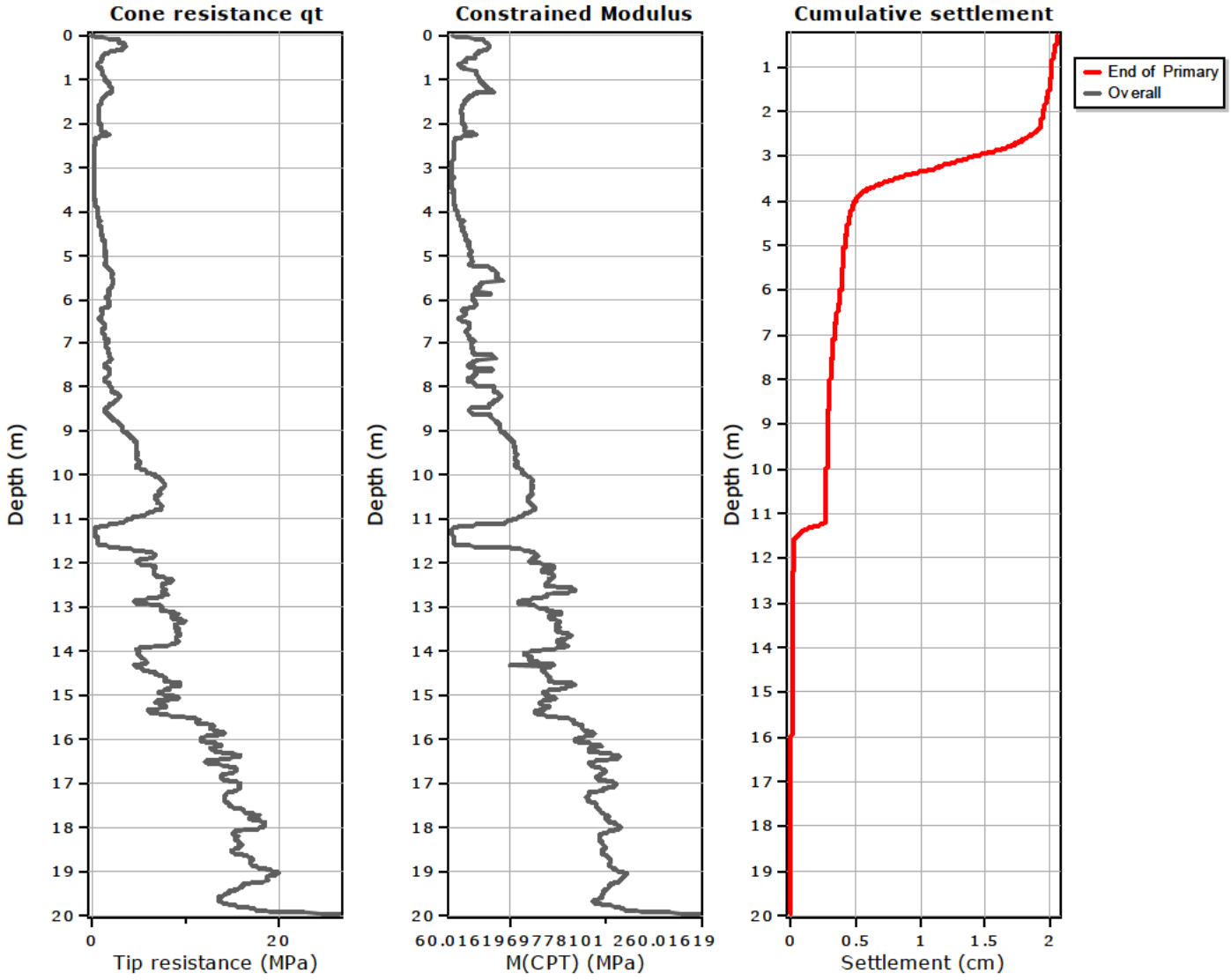
**CPT: CPT07**
Total depth: 19.96 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.30 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

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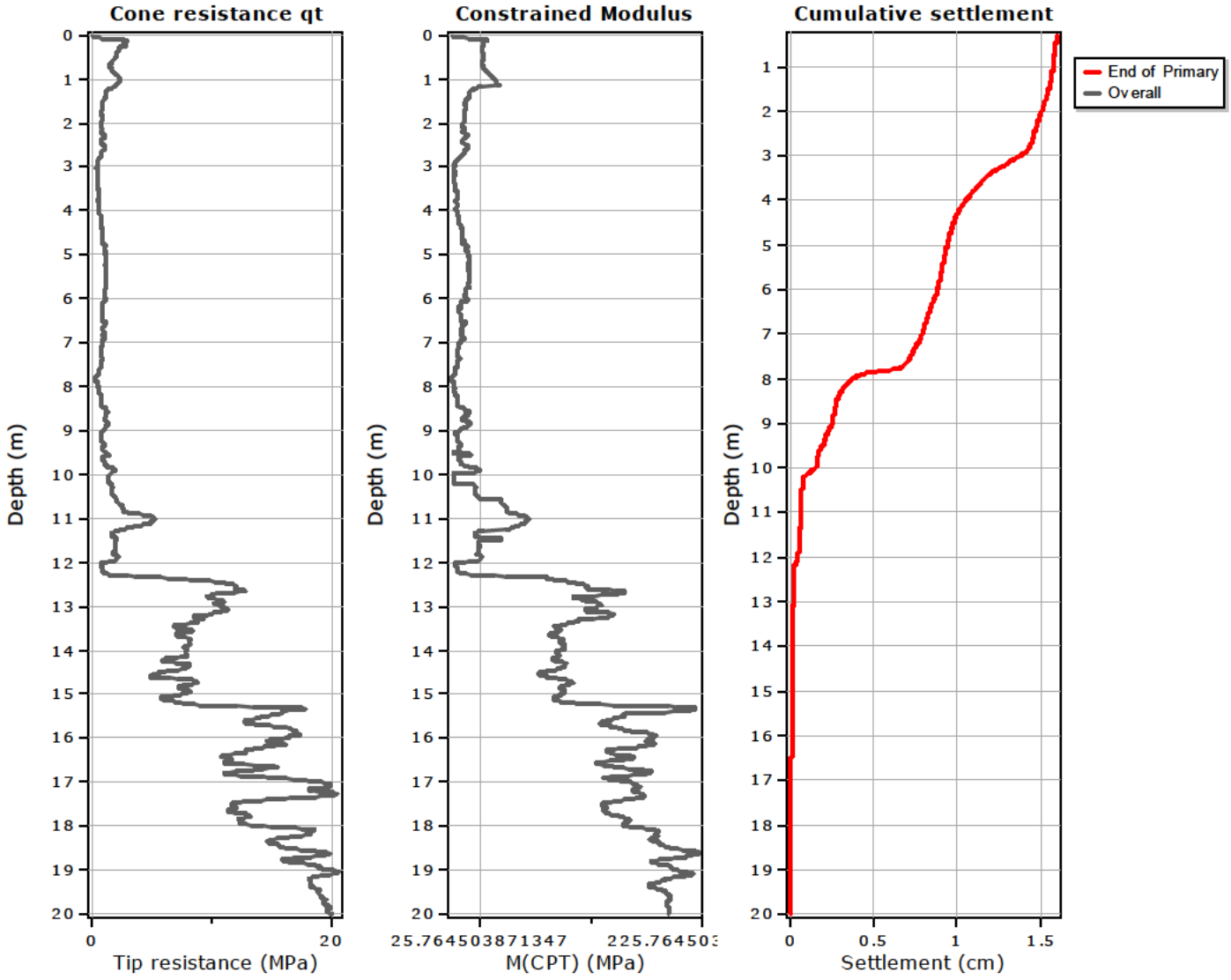
**CPT: CPT08**
Total depth: 20.00 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.30 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

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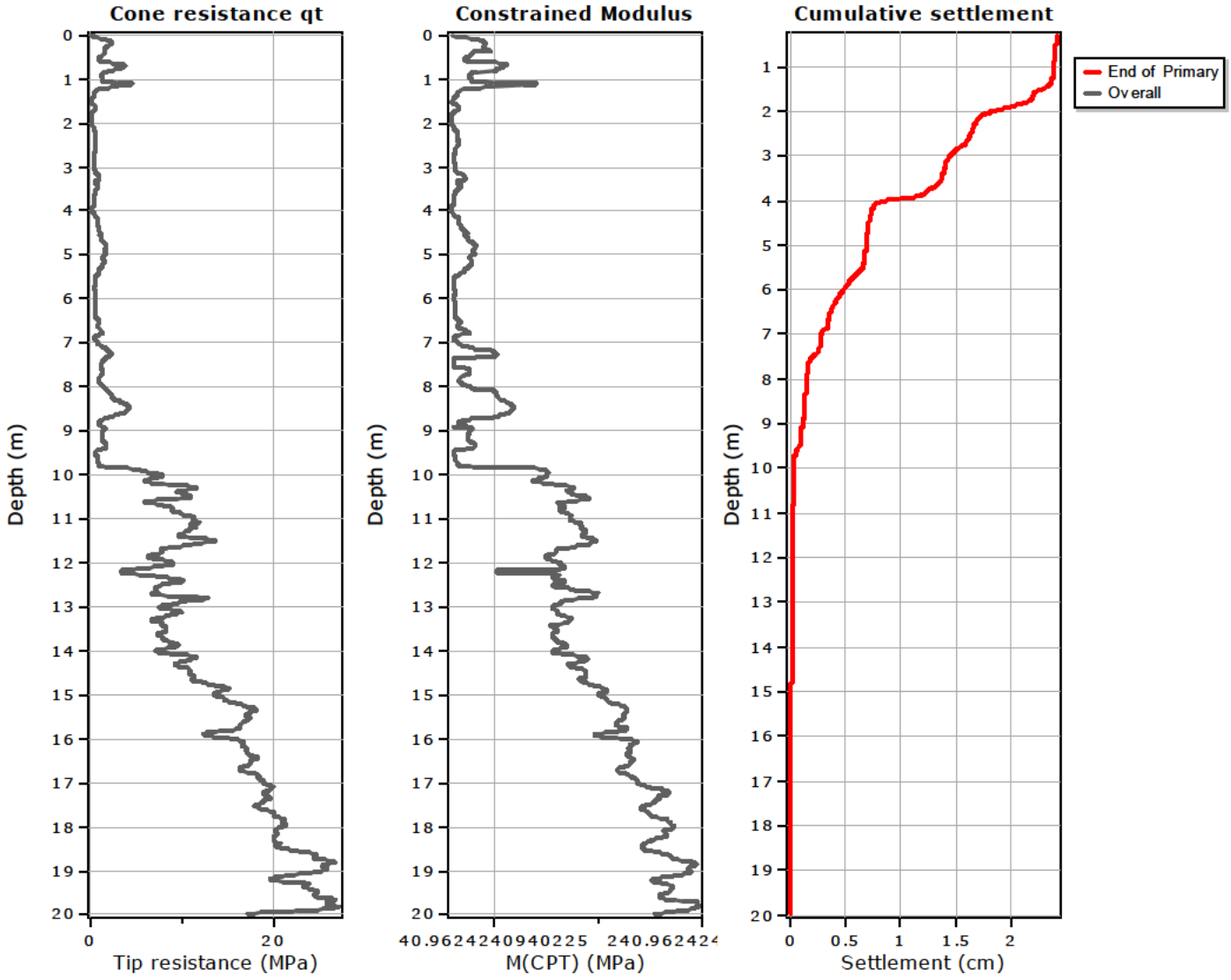
**CPT: CPT10**
Total depth: 19.98 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.30 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

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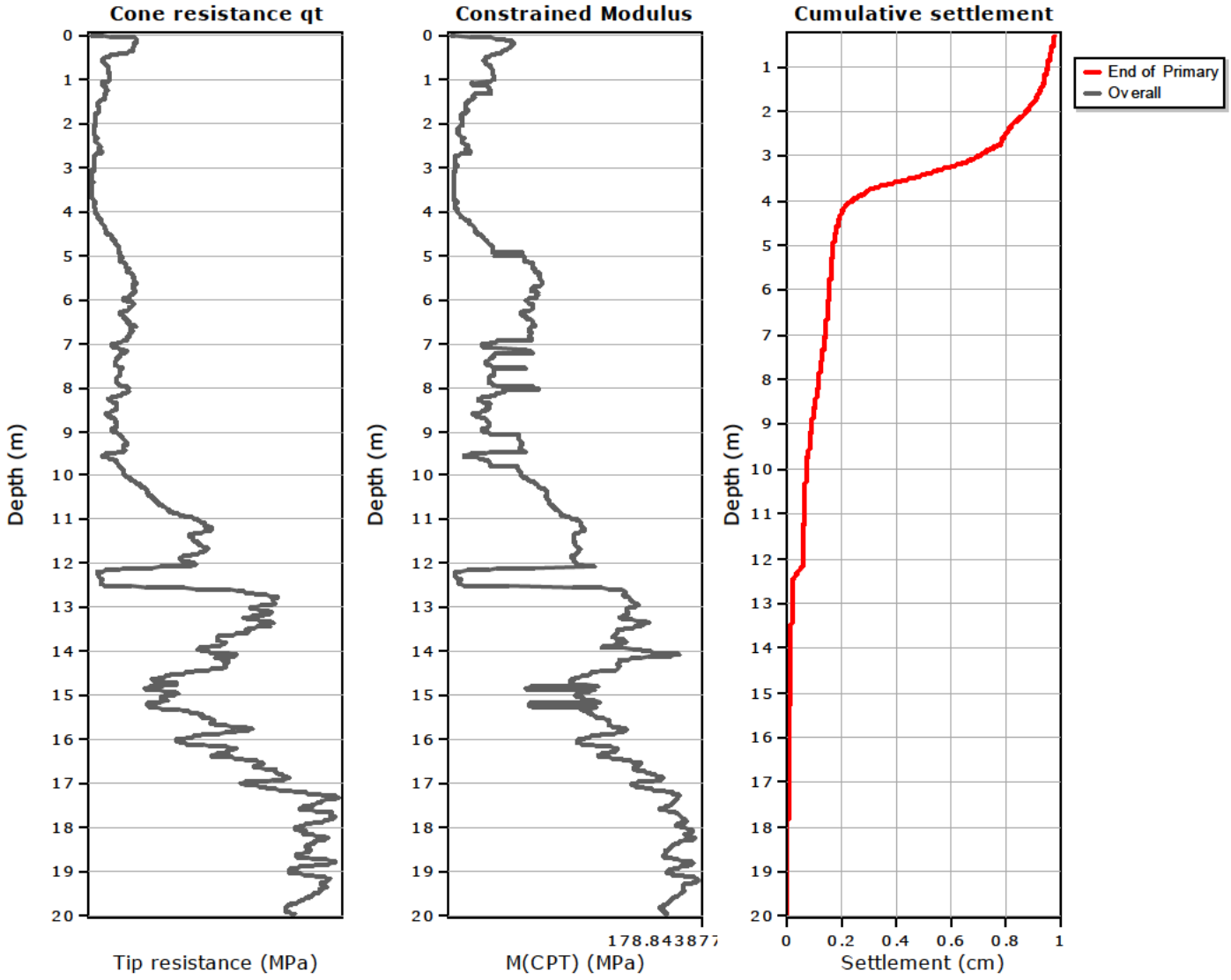
**CPT: CPT11**
Total depth: 19.95 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.30 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

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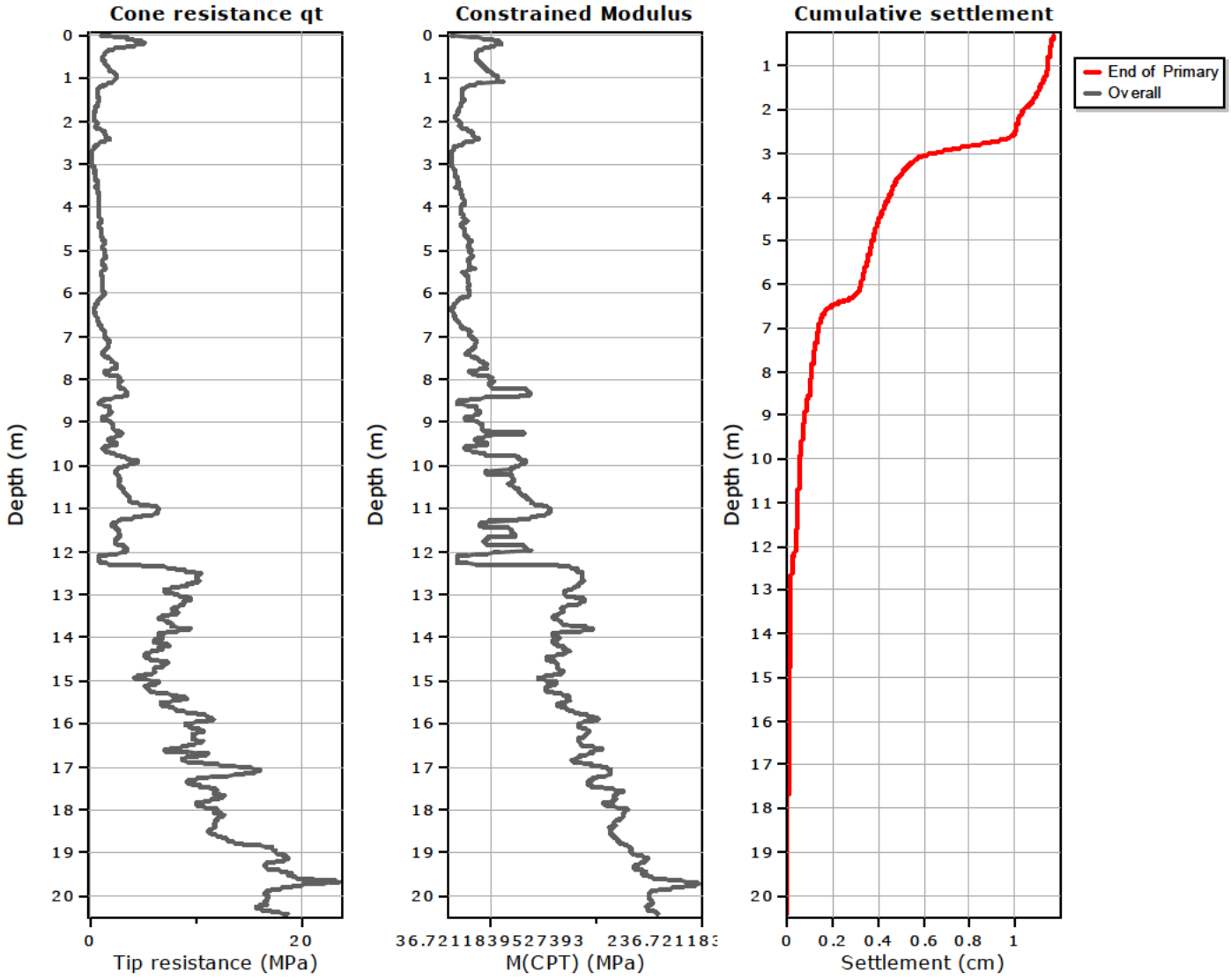
**CPT: sCPT05**
Total depth: 20.42 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




## Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.30 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

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

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

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

where $t_p$ is the duration of primary consolidation

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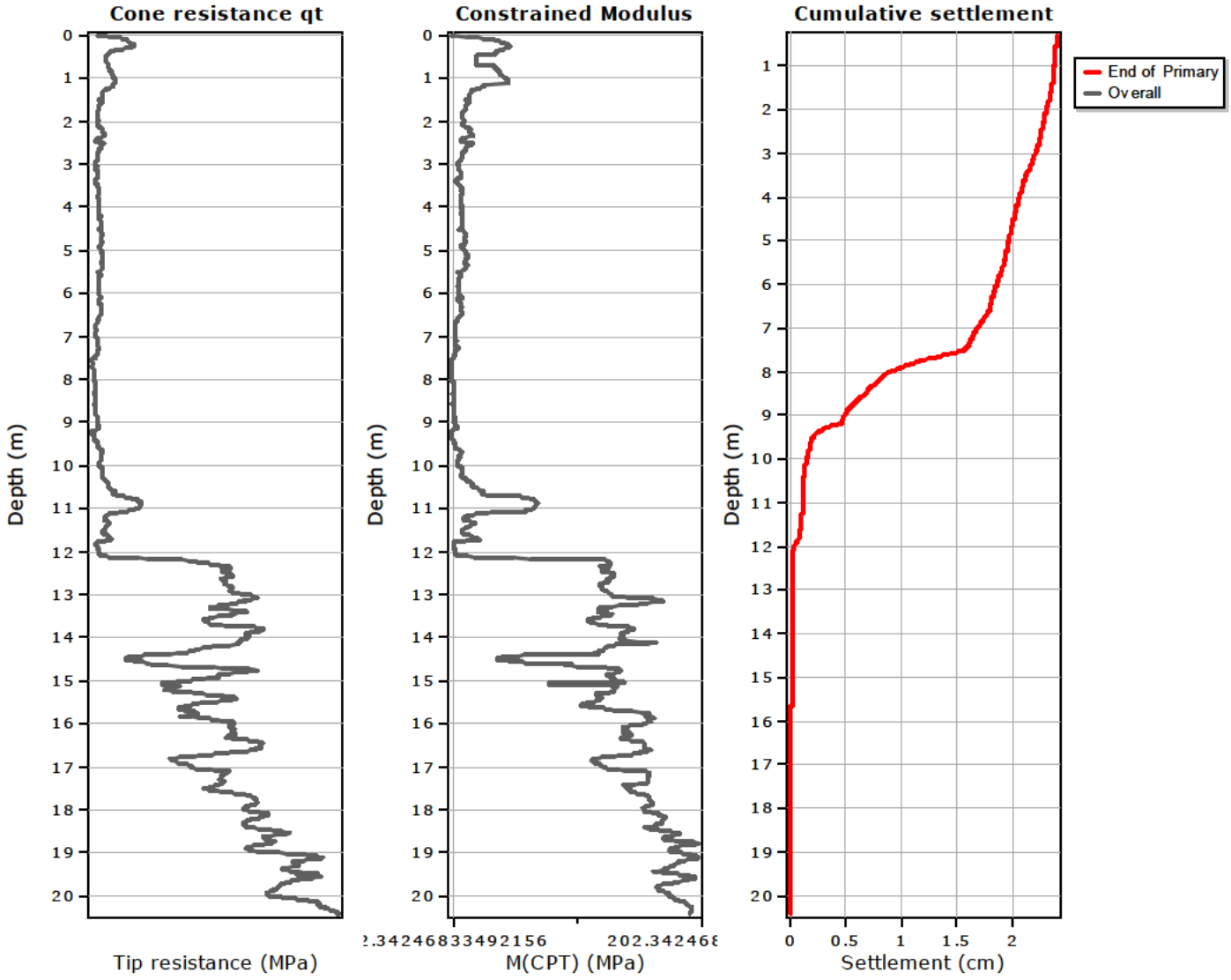
Geotechnical Engineers
Merarhias 56
http://www.geologismiki.gr

**CPT: sCPT12**
Total depth: 20.42 m, Date: 24/01/2022
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type:
Cone Operator:

**Project:**
**Location:**

## Settlements calculation according to theory of elasticity*




### Calculation properties

Footing type: Rectangular
Footing width: 15.00 (m)
L/B: 1.0
Footing pressure: 10.00 (kPa)
Embedment depth: 0.30 (m)
Footing is rigid: No
Remove excavation load: No
Apply 20% rule: No
Calculate secondary settlements: No
Time period for primary consolidation: N/A
Time period for second. settlements: N/A

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

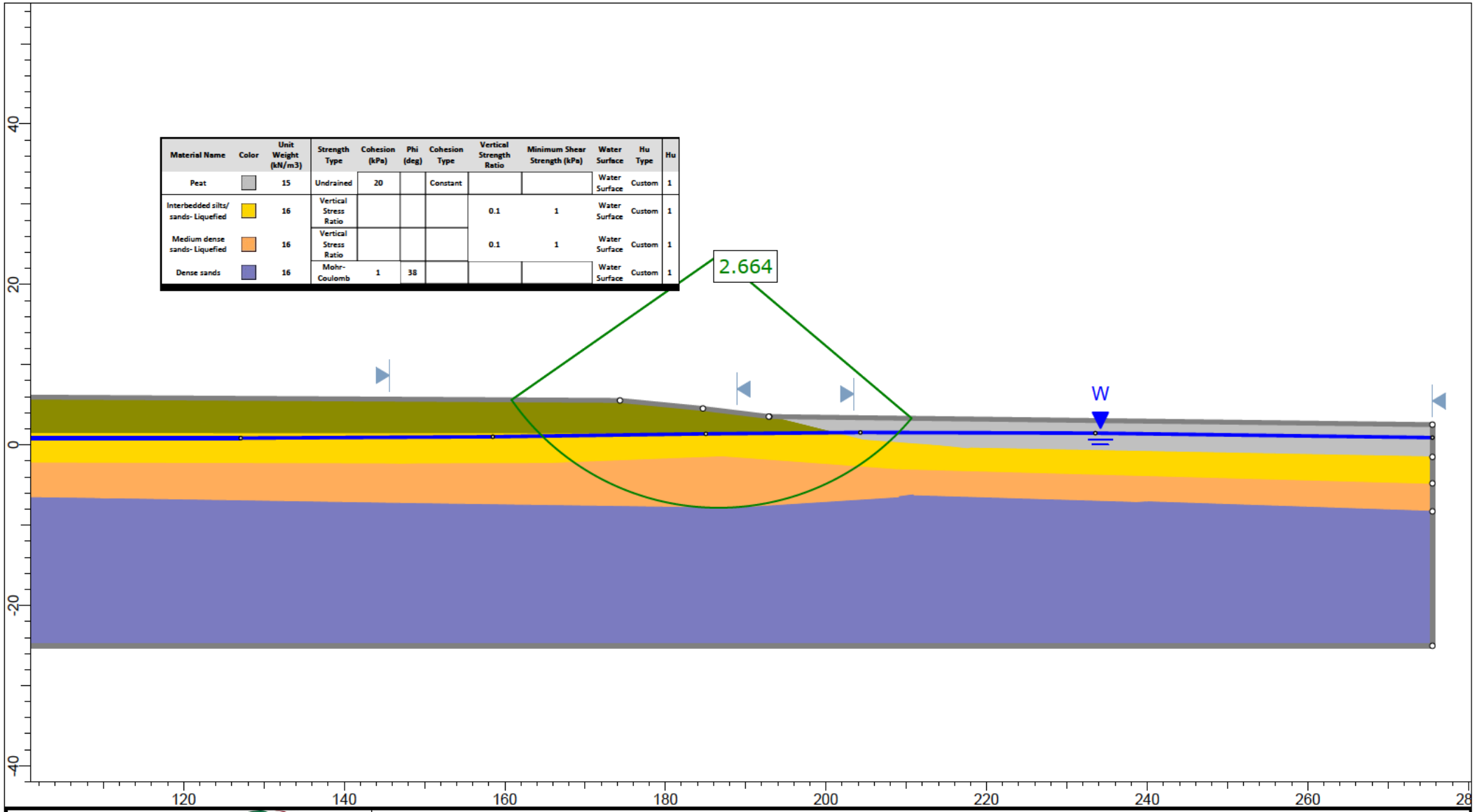
$$S = \sum \frac{\Delta \sigma_v}{M_{CPT}} \Delta z$$

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

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

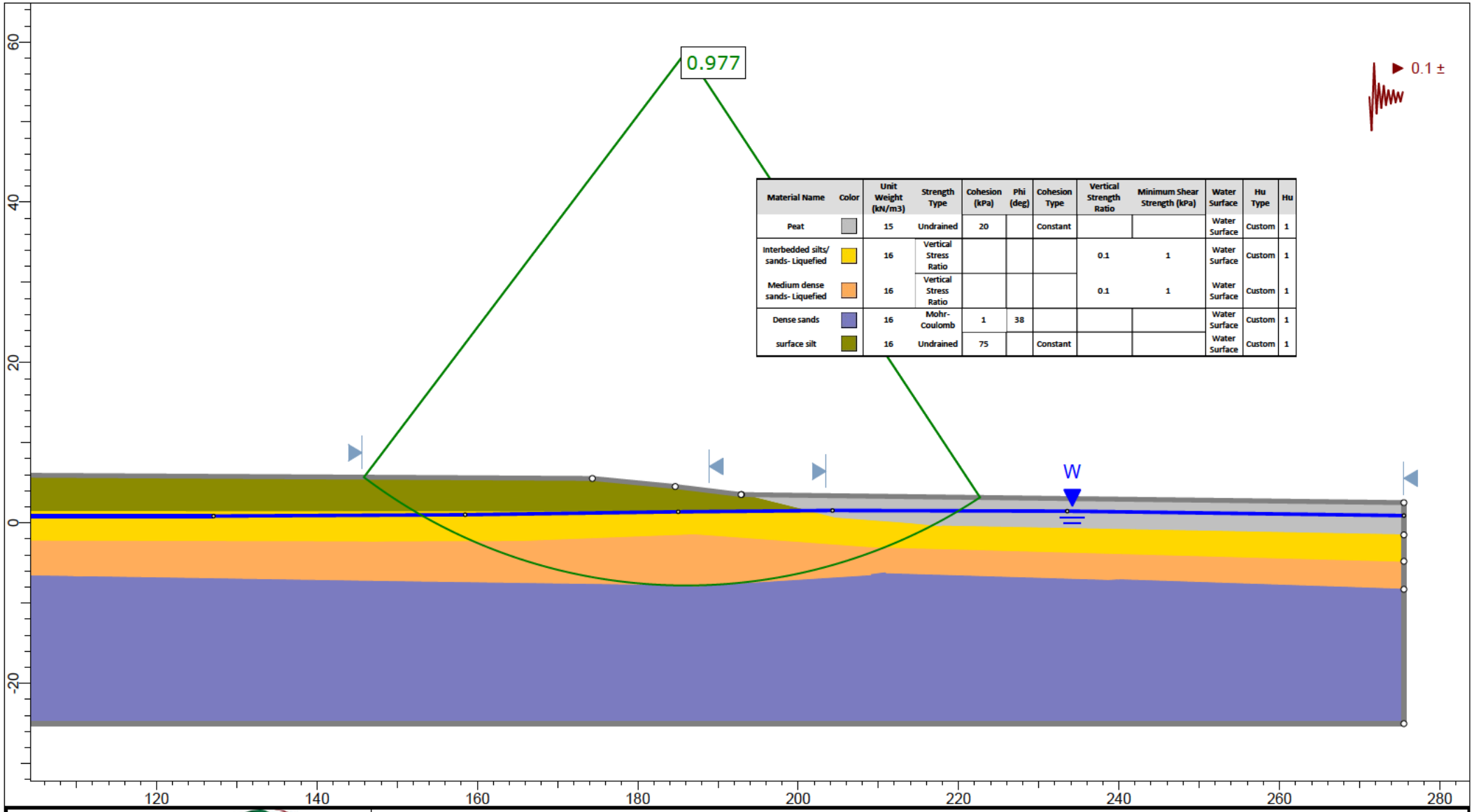
where $t_p$ is the duration of primary consolidation

# Appendix F: Lateral Spread Analyses




| | | | |
|---|---|---|---|
| CMW Geosciences | *Project* | Pencarrow Estate<br>Section A - Flow Failure | |
| | *Group* | | *Scenario* Lateral Spread |
| | *Drawn By* | LGL | *Client* Marsh |
| | *Date* | 01/02/22 | *File Name* A-A - test.slmd |

SLIDEIN... 9.001




| Material Name | Color | Unit Weight (kN/m3) | Strength Type | Cohesion (kPa) | Phi (deg) | Cohesion Type | Vertical Strength Ratio | Minimum Shear Strength (kPa) | Water Surface | Hu Type | Hu |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Peat | | 15 | Undrained | 20 | | Constant | | | Water Surface | Custom | 1 |
| Interbedded silts/ sands- Liquefied | | 16 | Vertical Stress Ratio | | | | 0.1 | 1 | Water Surface | Custom | 1 |
| Medium dense sands- Liquefied | | 16 | Vertical Stress Ratio | | | | 0.1 | 1 | Water Surface | Custom | 1 |
| Dense sands | | 16 | Mohr-Coulomb | 1 | 38 | | | | Water Surface | Custom | 1 |
| surface silt | | 16 | Undrained | 75 | | Constant | | | Water Surface | Custom | 1 |

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SLIDEINTERPRET 9.001

| | | | |
|---|---|---|---|
| *Project* | Pencarrow Estate<br>Section A - Yield Acceleration | | |
| *Group* | | *Scenario* | Lateral Spread |
| *Drawn By* | LGL | *Client* | Marsh |
| *Date* | 01/02/22 | *File Name* | A-A - test.slmd |