Attachment 5:

Geotechnical Assessment

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Project Number #19071.000.001

Geotechnical Investigation

Gabites Block, Upper Hutt

Submitted to:
Maymorn Developments Ltd
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Executive Summary

ENGEO Ltd was requested by Maymorn Developments Ltd to undertake a geotechnical investigation of the property referred to as Gabites Block, located to the east of Maymorn Road in Maymorn, Upper Hutt. The site has the legal description of Pt Sec 299 Hutt District and Lot 2 DP 356697. The purpose of our investigation was to assess the site's suitability for a rural residential plan change and subsequent subdivision, as indicated in the Gabites Block Development Area Structure Plan prepared by Envelope Engineering Ltd (Revision P3, dated 14 October 2021; project number 1594-01, drawing number PC-900).

Broadly the site morphology comprises relatively level ground across the western side, while the eastern side of the site is sloping hills, with a main ridgeline and associated side gully features.

To inform the geotechnical suitability of the proposed plan change and subsequent subdivision, we have undertaken a desktop study, site walkover, subsurface investigations and hazard assessment. Key geotechnical constraints to future development were identified as historical filling works, areas of historical and / or current slope instability and steeply sloping ground which has the potential for future instability.

Areas of fill (assumed to be non-engineered) were identified within an incised stream channel (up to approximately 6.5 m thick), old piggery effluent ponds (up to 3 m thick), and associated with the formation of a forestry road providing access to the hill areas of the site (unknown thickness but assumed to be greater than 1 m). We recommended at least partial remediation of the areas of uncontrolled fill to provide suitable building platforms.

A large scale slope instability was identified near the north-western extent of the hills while debris fans can be observed from the main gully channels on the western side of the hills extending towards the flat area of the site. In addition, bowed tree trunks suggest local instability in some areas of the sloping part of the site.

We have further considered the potential for liquefaction, lateral spreading, rock fall and debris flows and consider the risk from these hazards to be sufficiently low that specific mitigation works are not required in conjunction with the future subdivision works.

Our hazard assessment was then used to develop a constraints map, highlighting areas where future development will require varying levels of engineering input to form a suitable building platform. For the majority of the sites, we consider that a building platform can be readily developed which will be unlikely to accelerate or worsen the natural hazards affecting development. The exception to this is the areas identified in Appendix 4 as historical landslide or alluvial fans, which will require specific engineering design of stabilisation solutions in conjunction with subdivision works.

From a geotechnical perspective, we consider that the site is broadly appropriate for the proposed plan change, subject to the adoption of our recommendations around remediation of uncontrolled fill, earthworks and drainage.

1 Introduction

ENGEO Ltd was requested by Maymorn Developments Ltd to undertake a geotechnical investigation of the property referred to as Gabites Block, located to the east of Maymorn Road in Maymorn, Upper Hutt (herein referred to as 'the site'). The site has the legal description of Pt Sec 299 Hutt District and Lot 2 DP 356697 (Upper Hutt City Council, Xplorer (Public), Property Boundaries & Labels; retrieved October 2021). This work has been carried out in accordance with our signed agreement dated 9 July 2021 (ref P2021.001.495_03). We have been provided with the Gabites Block Development Area Structure Plan prepared by Envelope Engineering Ltd (Revision P3, dated 14 October 2021; project number 1594-01, drawing number PC-900).

The purpose of this geotechnical assessment is to assess the site's suitability for a rural residential plan change and subsequent subdivision, as indicated in the Gabites Block Development Area Structure Plan. Scope of Works

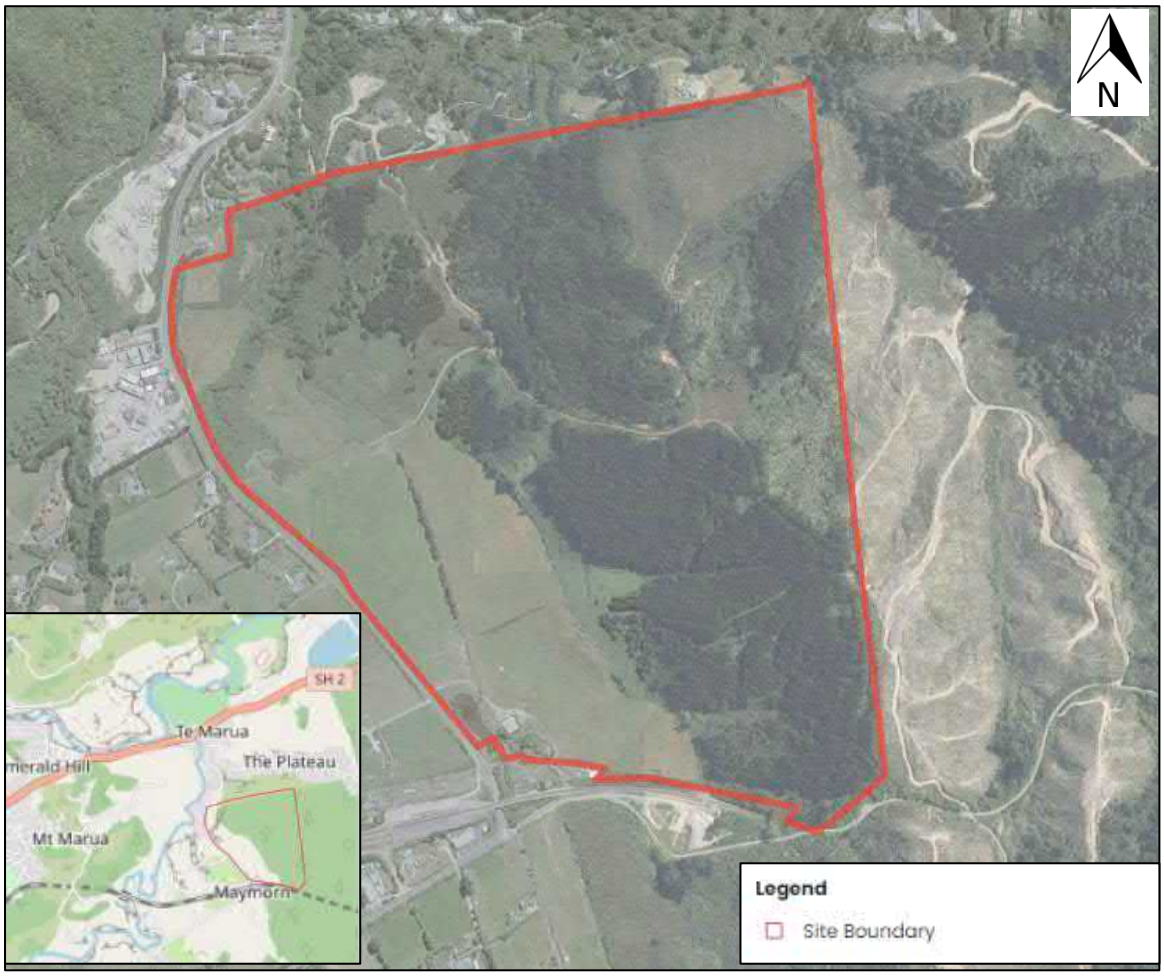
Our scope of works comprised:

- Undertaking a review of the available geotechnical and geological information relevant to the site.
- Site assessment of the hillside area including detailed geomorphological mapping and slope zoning based on steepness.
- Coordination with a local buried services location contractor.
- Coordination of a drilling contractor to complete 10 machine holes across the flat areas proposed for residential development.
- Coordination of a contractor to complete 10 Cone Penetration Tests (CPT) to a depth of 15 m also across the flat area proposed for residential development.
- An assessment of the liquefaction potential.
- Generate a conceptual geological ground model and geotechnical constraints map.
- An assessment of geotechnical risks that may affect the development.
- Production of this geotechnical report based on the findings of our enquiries, ground investigation and analyses, including recommendations for earthworks, cut and fill batter design and suitability of the final ground levels to support residential buildings. This report considers the geotechnical requirements of Section 106 of the Resource Management Act (RMA) and includes a statement of professional opinion in regard to the proposed site development.

2 Site Description

The proposed development site is located within Maymorn, Upper Hutt and covers an area of 74 ha (Upper Hutt City Council, Xplorer (Public), Property Boundaries & Labels; retrieved October 2021). It is bound by Maymorn Road to the west, the Wairarapa Rail Line and Rimutaka Tunnel to the south, forestry land to the east and residential properties to the north. A site location plan is presented in Figure 1.

Figure 1: Site Location Plan



Site location plan created using datanest, with aerial photograph from Land Information New Zealand (photography date not specified).

Broadly the western side of the site comprises relatively level ground, while the eastern side of the site is sloping, with a main ridgeline and associated side gully features.

The flat area on the western side of the site is largely grassed and used for cattle grazing, with a series of drainage channels which typically drain towards the north. The channels range from a steep sided natural meandering river in the north-western portion of the site, to modified linear drainage features which flow into the natural river channel and smaller drainage channels diverting water from the hills. A small pond feature is located near the southern corner of the site.

A shed is located adjacent to the pond near the southern corner of the site.

The sloping area is currently vegetated, predominantly with pine forest, and has been extensively modified by forestry works over time, including formation of a network of access tracks. Broadly the main ridgeline trends southeast to northwest but splays near the centre of the hill area with one part of the ridge extending to the northwest and the other extending to the northeast. Generally the ridgeline has a wide and relatively level crest. The adjacent slope angles typically up to 35°, with isolated gullies where slope angles locally reach approximately 50°. Further forestry tracks extend across the side slopes off the main ridgeline, with localised sub-vertical cuts associated with track formation. A drainage channel with flowing water was observed between the main ridge where it splays to the northwest and northeast.

3 Previous Site Investigations

NZET Ltd Consulting Engineers (NZET) previously completed a geotechnical investigation report for the western level portion of the site (dated 28 February 2021, no reference provided) with the purpose of assessing subdivision potential. Their reporting outlines the findings of a desktop study, subsurface investigations and provides recommendations for further testing.

Findings of note within their reporting included the identification of significant surface modifications to the flat area of the site, which included:

- Pond decommissioning associated with a previous piggery on-site; and
- Diversion of the main stream gully and backfilling.

The following subsurface investigations were completed by NZET:

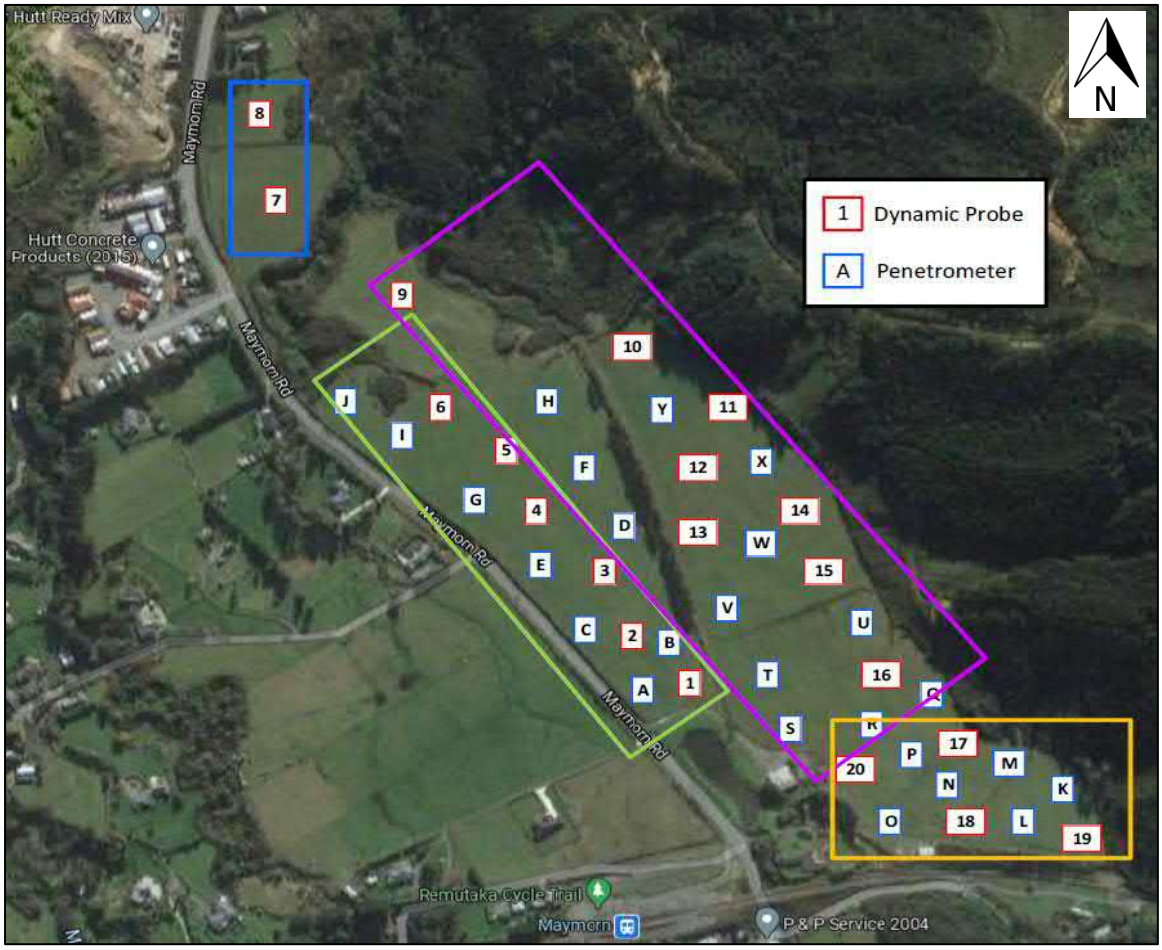
- 24 Scala tests were undertaken across the southern flat area of the site (completed in conjunction with the 2021 reporting).
- 20 Dynamic Penetration Heavy (DPH) tests were undertaken across the wider flat area of the site (completed in 2021).
- 24 test pit excavations across the southern flat area of the site (completed in 2013).

Raw Scala and DPH test results were not provided within the NZET reporting, however interpreted bearing capacity from each test is presented. Test results were grouped to reflect the different ground conditions across the flat area of the site, as shown in Figure 2, and summarised as follows:

- The flat area with the stream channel that was historically filled (NZET green tests).
- An area of un-modified original ground to the northwest (NZET blue tests).
- Backfilled ponds associated with the piggery (NZET purple tests).
- The area near the rail tunnel portal (NZET yellow tests).

Extracts of the NZET test location plan and interpreted results are presented in Appendix 1.

Figure 2: NZET Penetrometer and DP Test Locations



Extract from NZET 28 February 2121 report.

The NZET test pit investigations are reported to extend to depths of 1 to 1.5 m below ground level. No soil logs are provided within their reporting, however photographs of the test pits were included. These are presented in Appendix 1, along with the test pit location plan.

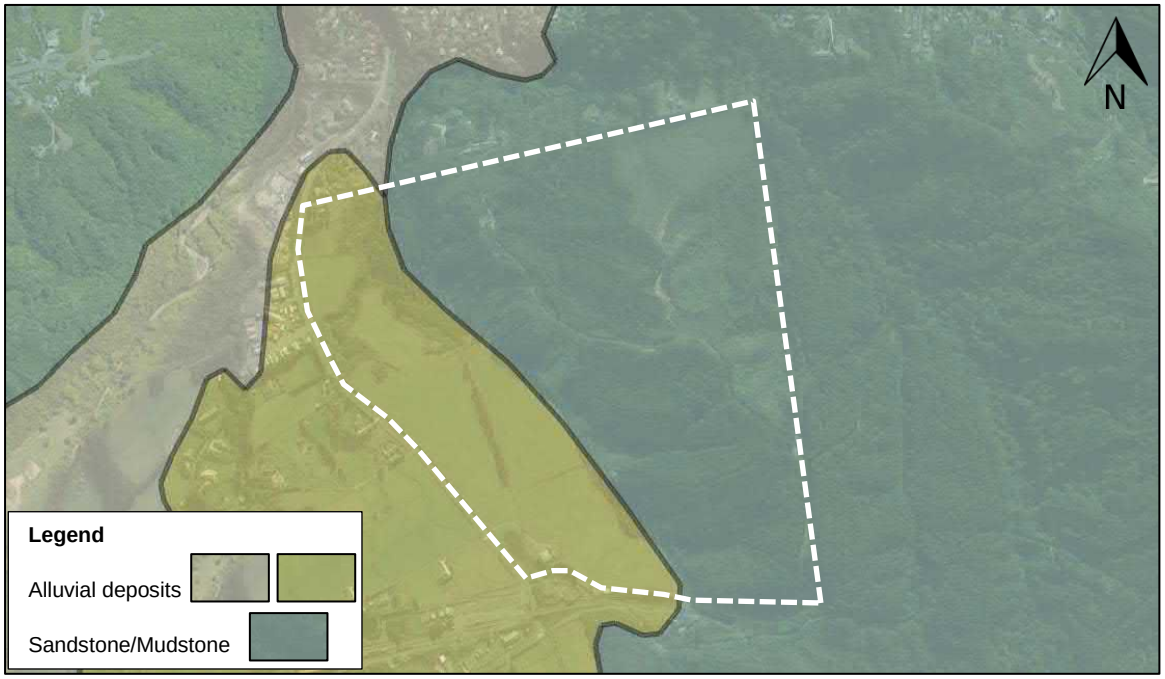
Overall NZET considered that the site appears generally suited to the proposed development, subject to further additional geotechnical investigation.

4 Desktop Study

4.1 Regional Geology

The site is mapped by GNS (Begg and Johnston, 2000) as being underlain by two geological units (Figure 3). The level western side of the site is underlain by alluvial gravel, described as late Pleistocene poorly to moderately sorted gravel with minor sand or silt. The hill area to the eastern side of the site is underlain by Rakaia Terrane. Commonly termed “Greywacke” the Rakaia Terrane comprises a sequence of grey sandstone-mudstone sequences and poorly bedded sandstone. Overlying the Greywacke typically is a sequence of sand silt and gravel Soil (Colluvium) which may reach several metres in thickness. To the northwest of the site is a younger (Holocene) alluvial gravel deposit.

Figure 3: Geological Mapping



Extract from Greater Wellington Regional Council GIS Maps.

4.2 Nearby Active Faults

The GNS Science New Zealand Active Faults Database website indicates that the site is located within 20 km of several active faults. Of the active faults within 20 km, only two are listed amongst the major faults in Table 3.6 of NZS1170.5, as follows:

- Wellington Fault – approximately 2 km from the site.
- Wairarapa Fault– approximately 11 km from the site.

Near fault factors, as per NZS1170.5, may therefore need to be taken into account during detailed design.

4.3 Earthquake Hazard Mapping

The Greater Wellington Regional Council presents a series of earthquake induced hazard maps (accessed through the GWRC Web Map Viewer), which indicates the following hazards at the site. These are summarised as follows for the subject site:

- Slope failure: low to moderate hazard across the hills increasing to a moderate to high hazard for the banks of the meandering stream channel.
- Liquefaction hazard: no hazard is identified.
- Ground shaking and combined hazard: the site is located beyond the mapped areas.

4.4 Proposed District Plan Hazard Mapping

Upper Hutt City Council are in the process of updating the district plan, to address the risk from natural hazards. Plan Change 47 includes a map of areas subject to high slope hazards. Figure 4 shows an excerpt from this mapping, which indicates that the majority of the hill areas of the site (including the banks of the stream channel) are considered to be within the high slope hazard area. Within these hazard areas, Upper Hutt City Council note that "new building platforms in this area have the potential to impact the stability of the hillside"'. Plan Change 47 indicates that specific geotechnical assessment and design will be required in conjunction with development of these areas.

Figure 4: UHCC Proposed District Plan High Slope Hazard Mapping

Excerpt from https://uhcc.maps.arcgis.com/apps/View/index.html?appid=0c4cc22a72504f93bae6626578945df8&extent=174.8969,-41.1890,175.2876,-41.0439, retrieved October 2021.

4.5 Historical Aerial Photographs

We have reviewed a range of aerial photographs of the site dating back to 1951 available through RetroLens and Google Earth imagery dating from 2002 to 2020. Excerpts of these photos covering the site area are presented in Appendix 2, and annotated to show key landform features and changes over time. In summary:

- Extensive logging works have been completed across the hills over the time of the aerial photographs. The site is of a large enough area that the hills have not been entirely clear at any one point in time, as a result of staggered clearance and replanting. Most of the hills were cleared for planting at the time of the 1977 aerial photograph, and again in 2003. Numerous access tracks and work platforms were formed in conjunction with these woks.

- No obvious evidence of large-scale hillslope instability is present in the aerial photographs. However, there is a possibility of smaller scale failures which would likely have been obscured by the vegetation cover and / or logging works across the hills.

- In the early photographs, the flat area of the site was cut by a large meandering stream channel which extended broadly parallel to the western site boundary, with smaller meandering channels to the east of the main stream. The smaller channels were progressively filled as the site was converted to pasture (by the time of the 1969 aerial photograph).

- Four ponds were formed between the time of the 1974 and 1977 aerial photographs, and we interpret these to be the effluent ponds discussed within the NZET report (Section 4). Both the effluent ponds and large meandering stream were infilled between the time of the 2003 and 2008 aerial photographs.

- The only structures evident on-site from the available aerial photographs have been clustered around the southern corner of the site. The initial structures at the southern corner of the site had a small floor area, which were then replaced with larger sheds that we anticipate were related to the piggery.

A summary map presenting historical features (specifically earthworks, developments and prior waterways) is presented in Appendix 3.

4.6 New Zealand Geotechnical Database

A review of the New Zealand Geotechnical Database indicates that the nearest subsurface investigation data is located approximately 1.7 km to the southwest. Owing to the potential for subsurface variability, we do not consider this to be representative of the site and have therefore not considered it further.

5 Site Investigation

5.1 Site Walkover Observations

ENGEO undertook a site walkover assessment on 11 August 2021, with observations used to inform the geomorphological map of the site conditions which is presented in Appendix 4. In summary, the following observations were made:

- The south-western side of the site is broadly flat ground that is grassed and used for cattle grazing (Figure 5 – Photo 1). A number of small drainage channels flow across this area, with a larger stream flowing in a linear south to north orientation from the pond at the south-western corner of the site through the middle of the paddocks (Figure 5 – Photo 2).

- Standing water and poor drainage with the growth of rushes was observed across much of the flat areas. Generally drier ground conditions were encountered to the west and north, moving away from the base of the hills.

- The flat area of the site is cut by two meandering stream channels which join to a single channel at the base of the hills. The banks of the western-most channel are vegetated (Figure 5 – Photo 3), while the banks of the eastern-most channel appear to have recently been cleared of vegetation. Both streams transition gradually from the broadly flat paddocks adjacently to a sub-vertical slope with the base of the channels incised approximately 5 m to 10 m below adjacent ground level (Figure 5 – Photo 4).

- The hillslopes on the eastern side of the site have a series of steeply sloping gullies and ridge features that have been extensively modified by forestry works.
    - Evidence of local instability is present in some areas as indicated by the bowing shape of isolated tree trunks (Figure 5 – Photo 5).
    - An area of recent instability was observed at the base of the hills (Figure 5 – Photo 6). The toe of the slope appears to have been previously cut and over-steepened. The cut-slope has recently failed with a headscarp located approximately 8 m above the adjacent paddocks, measuring approximately 4 m wide. The debris lobe at the toe of the slope extended approximately 12 m wide.
    - No further recent instability was observed across the accessible portions of the hill areas.
    - Variable rock and colluvium was observed to be outcropping across the slope areas, with colluvium thicknesses of up to 3 m within the forestry road cuts. We anticipate that colluvium thicknesses are likely to be greater near the base of the gullies.
    - At the highest area of the site is a cut platform (assumed to have been formed in conjunction with previous forestry works). Standing water was observed in localised areas across this platform, with a small pond present to the northwest of the platform. We understand from discussions with the client that this feature is sometimes completely dry.

Site photographs are presented in Figure 5, with the locations where they were taken and their orientation presented in Figure 6. We note that due to dense vegetation cover (specifically gorse and blackberry) our sloping ground observations were largely limited to that of the recently cleared ground and forestry tracks.

Figure 5: Site Photographs

Photo 1: Broadly flat paddocks across the western side of the site used for cattle grazing. Photograph taken facing northwest.

Photo 2: Drainage feature on western side of site. Photograph taken facing south.

Photo 3: Western branch of the meandering river channel.

Photo 4: Eastern branch of the meandering river channel.

Photo 5: Local instability indicated by bowed tree trunks.

Photo 6: Recent instability on a previously cut slope at the toe of the hills.

Figure 6: Location and Orientation of Site Photographs

Site plan created using datanest, with aerial photograph from Land Information New Zealand (photography date not specified).

5.2 Ground Investigation

ENGEO engaged Griffiths Drilling Ltd to undertake ten machine boreholes and seven CPT's across the flat area of the site, at the locations indicated in Figure 7. Further details of each of these investigations are presented in the following sections.

We understand that the MBIE / NZGS Guidance Module 2 Table 2.1 indicates that rural land is to have one deep investigation location per Lot, however, the density of the testing is considered to be adequate to characterise the subsurface conditions for the purposes of identifying the main hazards and constraints which could affect the proposed future residential development. Further subsurface investigations will be required to inform detailed design and building consent works on a lot by lot basis.

Figure 7: Subsurface Investigation Locations

Site plan created using datanest, with aerial photograph from Land Information New Zealand (photography date not specified).

5.2.1 Machine Boreholes

The machine boreholes were completed between 3 and 10 September 2021, and comprised a combination of continuous sonic core with Standard Penetration Tests (SPT) at 1.5 m intervals.

All of the machine boreholes extended to at least 19.5 m where a SPT was completed before the investigation was terminated. Not all of the SPTs extended for their full run length due to refusal in dense ground. The final SPTs at BH01, BH06, BH08, BH09 and BH10 were terminated in very dense gravel, while the remaining SPTs were all extended their full run length to terminate at 19.95 m depth.

Bedrock was not encountered in any of the investigations.

Groundwater dip tests were not completed in conjunction with these investigations However, we observed standing water at the ground surface across the flat area of the site near the base of the hills; and flowing water in the base of the drainage and stream channels. Accordingly, we anticipate that the depth to groundwater will be shallower near the base of the hills and then deepen towards the base of the stream channels (which extend to a maximum of 12 m deep near the northern side of the site).

Borehole logs are presented within Appendix 5 and are written in general accordance with the New Zealand Geotechnical Society field classification guidelines (NZGS, 2005).

5.2.2 Cone Penetration Tests (CPT)

Seven CPTs were completed at the site with all extending to refusal on material with high tip resistance. Termination depths ranged from 1.8 m to 10.49 m below ground level, reflecting variable ground conditions at the site. Plots of the CPT data are presented in Appendix 6.

Test locations were somewhat restricted by the presence of wet and very soft ground across the eastern side of the flat area of the site, in which the CPT rig was unable to traverse or gain sufficient anchoring for testing.

6 Ground Model

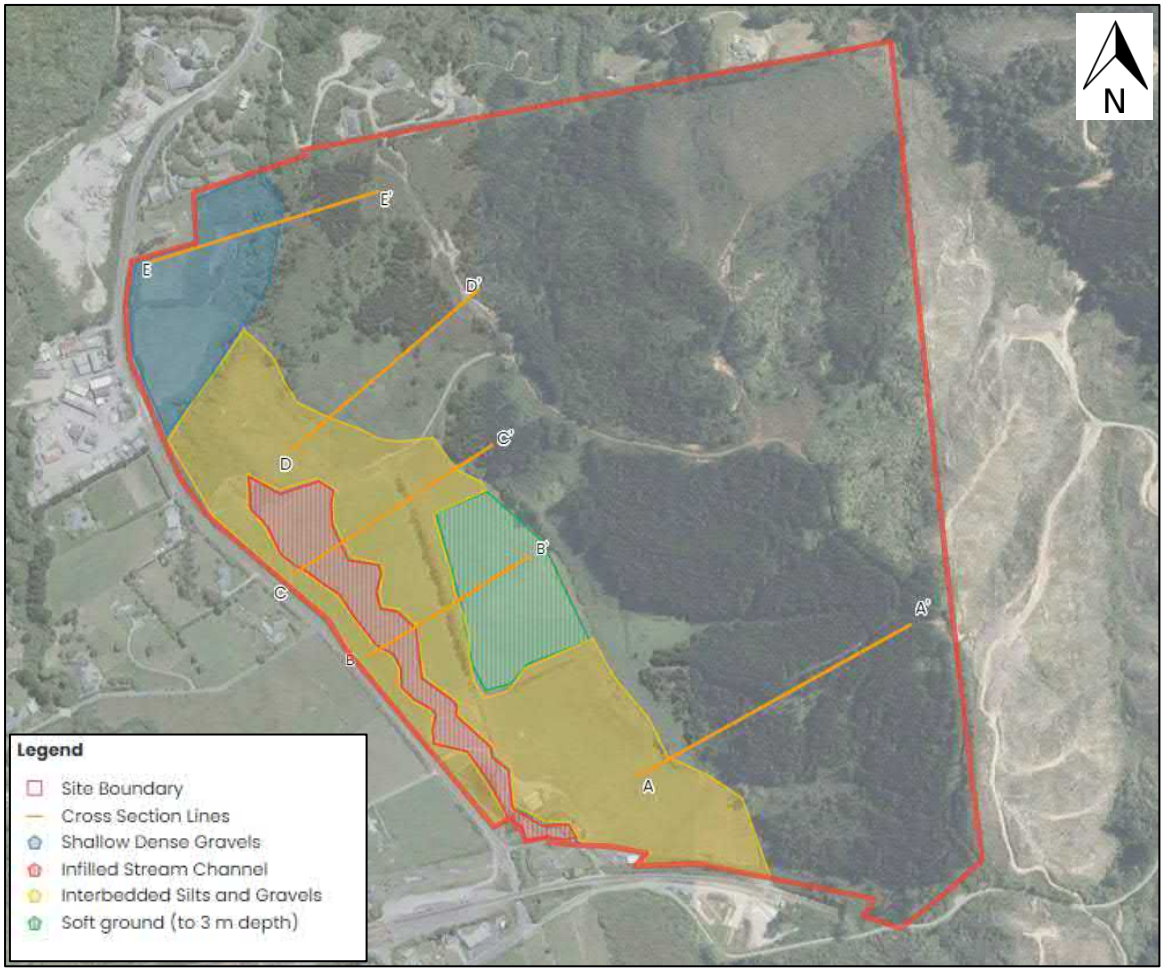
6.1 Summary of Flat Area Subsurface Conditions

Ground conditions across the flat area of the site are variable, however can be broadly be characterised into four distinct areas:

- North-western side of site: underlain by shallow dense gravels
- Infilled stream channel: underlain by variable fill deposits to approximately 6.5 m depth
- Zone of soft material (encountered to 3 m depth) in close proximity to historical effluent ponds
- Remainder of flat area site: underlain by interbedded silts and gravels of varying density

These areas are illustrated in Figure 8 below.

Figure 8: Subsurface Conditions across Flat Area of Site and Cross Section Lines



Site plan created using datanest, with aerial photograph from Land Information New Zealand (photography date not specified).

Only CPT investigations were completed within the location of the historical effluent ponds. The material behaviour type indicates clay and silty clay interbedded with layers of organic soil to at least 3 m below ground level, which is very soft. It is unclear from the material behaviour type and strength profile if this material is reflective of effluent pond infill, and if so, where the transition between backfill and natural soils occurs. Further investigation within this area will be required in conjunction with any future subdivision earthworks.

The above mapping provides a generalised summary of the subsurface conditions across the flat areas of the site. However, the ground profile comprises interbedded layers of material with varying silt, sand and gravel content that varies considerably between investigation locations. Included within Appendix 6 (final page) is a summary plot, with data from each of the individual test locations presented in a single plot for cone resistance, friction ratio, pore pressure ratio and soil behaviour type. This shows significant variation in the subsurface conditions encountered in the CPT locations, which is similar to the variability noted in the boreholes.

6.2 Summary of Hill Area Subsurface Conditions

While no subsurface investigations were undertaken across the hill areas of the site, there were numerous road cuttings and outcrops (from previous pine forestry operations) observed in conjunction with our site walkover that provided an indication to the subsurface conditions. For the purposes of characterising the hill area subsurface conditions, we have mapped six areas:

- Rock outcrops (sandstone).
- Rock inferred to be less than 3 m below ground surface (shallow sandstone).
- Colluvium soil cover (inferred depth to rock of more than 3 m below ground level).
- Alluvium soil cover (inferred depth to rock of more than 3 m below ground level).
- Fill material (inferred more than 1 m in thickness).
- Landslide debris (both recent and historical).

In summary, rock was generally observed to be outcropping in some locations along the ridgelines. Covering the rock is a layer of colluvium, which is expected to be thinnest (less than 0.5 m typically) along and in close proximity to the ridge crests The colluvium thickness is expected to generally increase to several metres towards the base of the slopes, however there will be some variation where forestry works have formed tracks and modified the slopes.

Based on the geomorphology of the site, alluvium is expected to infill the lower gully features where soils have been washed over time to form debris fans. These were predominantly observed to the west of the main ridgeline, however a smaller alluvial fan was observed between the northwest and north-eastern splays of the main ridgeline.

There is geomorphological evidence of a large landslide towards the north-western side of the site, as evidenced by hummocky terrain and the general surface morphology, however this does not appear to have experienced movement over the time frame of the available historical aerial imagery. A small recent landslide was observed at the toe of an alluvial fan, which had been previously cut forming an over-steepened slope that had partially collapsed.

Fill was noted in conjunction with the main forestry road that provides access up to the ridgeline. We anticipate this to be greater than 1 m thick based on the morphology of the access track and adjacent landform, however have not undertaken any subsurface investigation within this area to further assess this assumption.

6.3 Overall Geological Mapping and Cross Sections

A summary of our inferred ground conditions for the site (both flat and hill areas) is presented on the map provided in Appendix 7. To further illustrate the generalised subsurface conditions at the site, a series of schematic geotechnical cross section lines are presented in Appendix 8. The locations of the lines are indicated in Figure 8.

The interpreted cross sections present broad trends in the subsurface conditions, however we note that the ground conditions comprise relatively thinly interbedded layers of variable silts, sands and gravels. For specific ground conditions at each test location, we recommend referring to the individual boring logs and CPT plots.

7 Geotechnical Assessment

7.1 Soil Classification

Based on our interpretation of the ground conditions at the site, we consider that the site may be divided into three seismic soil classes in accordance with NZS 1170.5:2004 at the site, as follows:

- Class B – Rock (assumes up to 3 m coverage of soil or completely to highly weathered rock).
- Class C – Shallow Soil.
- Class D – Deep Soil.

These areas are presented in Appendix 9, and are based on the results of our subsurface investigations and site observations.

The hill site subsoil classes should be further refined by lot specific investigations to support foundation design and building consent works. Earthworks associated with subdivision formation on the hill sites are likely to include cut and fill works on each lot, and may therefore alter the site subsoil class from the current conditions.

It is possible that the flat areas of the site may be Class C – Shallow Soils, however as published site class maps are not available for this area and rock was not encountered within our subsurface investigations, we have conservatively adopted site Class D for this area. If the site class is critical to future development, further investigation and analysis should be undertaken to find the depth to rock and calculate the site period; however there is a distinct possibility with further works that the site class does not change and is confirmed as D – Deep Soils.

7.2 Seismic Design Considerations

For the purposes of characterising seismic design, we have assumed that any future subdivision will be developed with Importance Level 2 (IL2) structures only. Further analysis will be required if the development is to incorporate structures of higher importance levels.

According to NZS 1170.0:2002, Importance Level 2 (IL2) buildings should sustain little or no structural damage under a Serviceability Limit State (SLS) design load case, which is based on earthquake shaking with a 25 year return period. Further, IL2 buildings are required to be designed to resist earthquake shaking with an annual probability of exceedance of 1/500 (i.e. a 500 year return period). This is the Ultimate Limit State (ULS) design seismic loading.

For the assessment of liquefaction induced settlements, we have calculated the peak horizontal ground accelerations (a_{max}) for the flat area of the site (as the hill areas are not subject to liquefaction hazards). This was calculated in accordance with the Ministry of Business Innovation and Employment (MBIE) / NZGS Module 1 (2016) and the Bridge Manual 2018 updates, using the following formula:

$$a_{max} = C_{0,1000}\, R\, f / 1.3$$

where:

$C_{0,1000}$ = 0.45 for Upper Hutt assuming Class D soil as assumed across the entirety of the flat area of the site (Table C6.1 of the Bridge Manual Commentary 2018)

R = 0.25 for a 25 year return period event (in accordance with NZS 1170.5)

= 1.0 for a 500 year return period event (in accordance with NZS 1170.5)

F = 1.0 for Class D Soils

Accordingly, Table 1 presents the calculated peak ground acceleration for the design cases, along with the corresponding effective magnitude recommended within Table C6.1 of the Bridge Manual Commentary.

Table 1: Calculated Peak Ground Acceleration – Flat Western Area

Design Case	Moment Magnitude (M_w)	Acceleration (a_{max})
SLS	6.25	0.09
ULS	7.1	0.35

7.3 Liquefaction Analysis

The New Zealand Geotechnical Society (NZGS) and Ministry of Business, Innovation and Employment (MBIE) Geotechnical Guidance Module 3 (2016) provides recommendations for the assessment of liquefaction. This has been considered in our discussion below.

We have analysed the liquefaction potential of the flat area of the site utilising the CPT data. While the SPT data obtained from the machine boreholes can be for the purposes of liquefaction analysis, this is reliant on data points collected at 1.5 m centres. Accordingly, small changes in the subsurface profile can be missed and the analysis may over or under predict settlements. We have therefore chosen to only analyse the data from the CPTs for the purposes of characterising the liquefaction potential.

The following methods and parameters were utilised for the analysis:

- Liquefaction triggering method: Boulanger and Idriss (2014) as recommended by MBIE / NZGS.
- Two ground motions:
    - SLS Case: Mw 6.25, 0.09 g
    - ULS Case: Mw 7.1, 0.35 g
- A threshold probability of liquefaction (P_L) of 15%.
- Estimated fines content based on CPT data methods outlined by Robertson and Wride (1998).
- A soil behaviour type index (I_c) cut-off value of 2.6 to differentiate between susceptible and non-susceptible to liquefaction soils for the CPT analysis.
- The Zhang, Robertson, and Brachman (2002) procedure for estimating volumetric strain and vertical settlement for the CPT analysis.
- The Boulanger and Idriss relationship between fines content and I_c with a fitting parameter (C_{FC}) of 0.0 for the CPT analysis.

- Conservatively we have assumed earthquake groundwater levels at the surface, based on our observations of standing water across large areas of the site.

Full analysis results are presented in Appendix 10 and are summarised in Table 2.

Table 2: Summary of Liquefaction Analysis

CPT Identifier (Investigation depth)	Calculated Vertical Settlements (mm)[1]	
	SLS	ULS
CPT01 (7.16 m)	< 10	50
CPT02 (7.78 m)	10	50
CPT03 (6.46 m)	Negligible	20
CPT04 (10.49 m)	Negligible	80
CPT05 (7.19 m)	10	80
CPT06 (1.8 m)	Negligible	Negligible
CPT07 (10.17 m)	10	80

[1] Vertical free field settlements only. Settlements beneath buildings may be greater.

The analysis suggests very low levels of liquefaction induced settlements under SLS ground shaking conditions, with settlements due to thin lenses of potentially liquefiable material interspersed throughout the investigated soil profile (from near the ground surface through to 9.5 m depth). Under ULS ground shaking conditions, higher settlements of up to 80 mm are indicated by the analysis, with liquefiable layers up to 2 m thick.

7.4 Lateral Spreading Analysis

Lateral spreading occurs when there are continuous and uniform liquefiable layers that are able to move towards a ‘free face’.

No lateral spreading is anticipated under SLS ground shaking conditions due to the lack of continuous liquefiable layers of sufficient thickness in which to induce movement.

While more of the ground profile is potentially liquefiable under ULS ground shaking conditions, the ground conditions remain highly variable with no obvious evidence of continuous and uniform liquefiable layer in which to trigger spreading. Accordingly, we consider that the potential for lateral stretch across the future building platforms at the site is low.

7.5 Static Settlement

We consider that some of the flat areas of the site may be subject to static settlements under loads associated with further fill placement or the proposed residential developments. We anticipate that this may occur due to consolidation of historical fills within the old stream channel and soft soils within the vicinity of the historical effluent ponds. The observed fill material within the old stream channel was generally very soft to firm and loose to medium dense and contained variable detritus (such as glass, metal, wood). These factors suggest that the placed material was not cleanfill and was not placed to engineering standards (NZS4431). As such we cannot rule out the potential for future static settlement from consolidation of the fill material. Development works should therefore allow for solutions to mitigate or tolerate future static settlements should subdivision fill be required in these areas.

Prior to development of lots within the vicinity of the old effluent ponds, we recommend the completion of lot specific testing and consolidation to assess the likely settlements resulting from the soft soils within the upper 3 m.

7.6 Landslide Potential

From our site observations and knowledge of the failure mechanisms of the encountered subsurface materials, we consider that the most likely form of landsliding will be shallow sliding of the surface soils on the underlying rock surface. Owing to the relatively low nature of the hills and reasonably shallow expected depths to rock, we consider that these will typically be of a localised and shallow nature; however there is geomorphological evidence of at least one large scale failure near the north-western extent of the site as shown within Appendix 4. This landslide affects a part of the Hillside Area of the Structure Plan. The landslide does not appear to show any evidence of movement during the time frame of the available aerial photographs, but will need to be considered in greater detail in conjunction with the development of specific lots in this area.

As a preliminary step in the characterisation of landslide potential, we have utilised Greater Wellington Regional Council LiDAR data to group the sloping site into areas of similar gradient. For the purposes of this analysis we have adopted the following slope gradient categories:

- Instability unlikely where slope angles are less than 10°
- Instability unlikely where slope angles are between 10° and 17.5°
- Instability possible where slope angles are between 17.5° and 25°
- Instability unlikely under earthquake or rainfall events where slope angles are between 25° and 32.5°
- Instability likely where slope angles are between 32.5° and 37.5°
- Instability expected where slope angles are greater than 37.5°

Our resulting slope hazard mapping (based only from the slope angle data) is presented in Appendix 11. The resultant hazard mapping is limited by resolution of the LiDAR contour data that was used as an input for Constraint mapping and this should not be considered as the final slope hazard characterisation.

7.7 Rockfall Potential

As the rock exposures on-site were limited to that within formed accessways (forestry tracks and cuts) and at the base of stream channels, we consider the potential for rockfall at the site to be low. Further, the exposed rock comprised highly to completely weathered Greywacke sandstone which is highly fractured and more susceptible to localised frittering rather than large rock release which is required for significant rockfall.

7.8 Debris Flow Potential

The historical alluvial fans indicate potential for future debris flow which may affect the areas shown in Appendix 4 that should be considered on a lot specific basis when developing these.

We have considered the potential for future debris flow resulting from extreme rainfall events, considering morphometrical evidence. Initiation of debris movement and style of flow has been assessed by considering the Melton ratio (R). Broadly, catchment systems with high values of R and shorter stream lengths are mostly prone to debris flows, while those with lower values of R and longer stream lengths are mostly prone to floods (debris or clear water). R is defined as:

$$R = \frac{H_b}{\sqrt{A_b}}$$

Where H_b is the basin relief (the highest elevation in the catchment less the lowest elevation) and

A_b is the catchment area in plan.

Our assessed R for the three largest gully features with associated debris fans (suggesting past debris flows and potential for future debris flows), range between 0.3 and 0.4. As indicated in Welsh and Davies (2011), values of R greater than 0.5 typically indicated catchments showing signs of debris flow occurrence. As the calculated values are both less than 0.5, this suggests that the style of flow resulting from these catchments is likely to be a debris flood, which is defined as a very rapid flow of water, heavily charged with debris in a steep channel.

7.9 Stream Bank Retrogression

In addition to the potential for landsliding across the hill areas of the site, there is potential that the stream banks (where not filled) that cut across the flat area of the site may regress with time. To inform future development works, we recommend the use of a development set-back equal to a distance two times the height of the stream bank. This does not preclude development closer to the stream bank, however specific engineering assessment and design will be required to inform works.

As a preliminary indication, from our review of the contour data available through Land Information New Zealand (LINZ) stream bank heights vary from 3 m in the southeast to 12 m in the north. Accordingly, the corresponding development set-backs would range between 6 m and 24 m. For the purposes of defining the crest of the stream bank where there isn't an obvious slope break, we recommend that this is taken as the point at where the slope gradient exceeds 30°.

7.10 Development Constraints Mapping

To provide guidance for future development, we have prepared a constraints map outlining potential risk to the proposed subdivision by combining our knowledge of past and present site conditions to guide future works. The constraints map considers interactions between the following:

- Site geology (subsurface conditions, identified through our site observations and subsurface investigations).
- Geomorphological conditions (the locations of landslides and other features identified through our site observations and aerial photograph reviews).
- Topographical conditions (utilising Greater Wellington Regional Council LiDAR data to characterise areas of similar slope gradients).

Combining these factors we have developed the risk classes presented in Table 3. We have been advised that the proposed subdivision will be entirely of low density and rural residential development, and our assessment of risk has taken this into consideration when assessing vulnerability.

Table 3: Development Risk Classes

Development Risk Class	Flat Site Characteristics	Hill Slope Characteristics	Limitations to Development
1	Areas of natural ground Little to no liquefaction induced settlements	Low slope gradients (less than 17.5°) No obvious evidence of instability	Little to no limitations to residential development (subject to foundation suitability)
2	Areas of minor filling (up to 1 m thick) Liquefaction induced settlements of up to 25 mm under SLS conditions	Areas of moderate slope gradient (17.5° to 25°) Areas of minor filling (up to 1 m thick) May be evidence of instability following heavy rainfall or large earthquake events No obvious evidence of instability	May require shallow earthworks to form a suitable building platform
3	Areas of moderate filling (up to 3 m thick) Liquefaction induced settlements over 50 mm under SLS conditions.	Moderate to steep slope gradients (25° to 32.5°) Instability is likely under earthquake or rainfall events (includes potential for inundation from upslope) or Some evidence of small scale instability	Will likely require specific engineering design to form a suitable building platform
4	Areas of moderate to major filling (up to 8 m thick) Liquefaction induced settlements over 50 mm under SLS conditions.	Steep slope gradients (32.5° to 37.5°) Instability is likely under earthquake or rainfall events (includes potential for inundation from upslope) or Evidence of large-scale inactive or relict slope instability	Will require specific engineering design and substantial foundations and / or earthworks to form a suitable building platform
5	Areas where liquefaction induced settlements are likely to be over 100 mm under SLS conditions	Steep slope gradients (greater than 37.5° from horizontal) and indications of recent instability or Evidence of large-scale, active slope instability	Complex or large-scale engineering works required to develop. Consideration should be given to avoiding these other areas owing to severe physical limitations that are likely to be difficult to overcome

Note that these are based on the current site topography and assume only minimal earthworks to develop the site into residential lots. Should extensive earthworks be proposed (such as valley in-fills), the risk areas would need to be reassessed.

A site map presenting our interpreted development classes is presented in Appendix 12.

In some areas the map within Appendix 12 indicates higher development risk classes immediately adjacent to a lower risk category. In this instance, we recommend that that the lot specific geotechnical investigation takes into consideration risk posed by the adjacent area to appropriate mitigation solutions are incorporated into the development works.

8 Geotechnical Recommendations

We consider that the site is broadly appropriate for the proposed plan change as outlined in the Gabites Block Development Area Structure Plan prepared by Envelope Engineering Ltd (Revision P3, dated 14 October 2021; project number 1594-01, drawing number PC-900), subject to the following recommendations.

8.1 Remediation of Uncontrolled Fill

For lots identified to be underlain by uncontrolled fill, we recommend that at the time of subdivision development, further investigation is undertaken to determine appropriate remediation where necessary.

From our investigations to date, we recommend at least partial remediation in order to provide a suitable building platform per lot. Remediation works will likely include excavation of the fill material and replacement with engineered hardfill, in accordance with our earthworks recommendations below. Consideration could be given to other ground improvement solutions such as ridged inclusions (timber piles or stone columns)..

8.2 Earthworks

We recommend that permanent cuts are formed at no greater than 26° in soil and 55° in rock. Temporary cut batter angles may be formed up to 45° in soil and 63° in rock. If these angles cannot be accommodated within the layout of any proposed development, then retaining walls will be required.

Prior to placement of permanent fills, all vegetation, fill and topsoil should be stripped to expose the underlying native soils, which should then be benched to allow the placed fill to be adequately compacted. Filling works should be completed in accordance with NZS 4431:1989. Site won soils are likely to be suitable for re-use as fill (excluding the surficial topsoil and existing uncontrolled fill material), subject to testing.

To calculate maximum dry density of the placed fill, compaction testing will be required (for both site-won fill and imported fill). We recommend that this is considered prior to commencement of earthworks to avoid any delays to the program while awaiting these results.

In conjunction with detailed design, we recommend that consideration is given to control of stormwater runoff, and that this is diverted into a series of pipes and then into the stormwater system to minimise water flow across undeveloped areas of the site and associated erosion. Further, undeveloped sloping areas of the site should be vegetated where practicable to further improve the stability of the slope.

8.3 Site Drainage

Large areas of the flat part of the site are cut by drainage channels, with the adjacent ground very soft and wet. As such we recommend that drainage works are considered in conjunction with subdivision development, and an assessment of flood levels is undertaken. It is likely that areas of the flat part of the site will require filling to achieve required ground elevations and to minimise flooding potential.

9 Future Works

Prior to applying for subdivision resource consent, we recommend that ENGEO should be given the opportunity to review the proposed lot layout against the hazard constraints map (presented in Appendix 11), and check for suitable building platforms in accordance with Upper Hutt City Council (UHCC) Code of Practice for Civil Engineering Works. For Subdivision Consent, further geotechnical reporting will be required to outline the findings of our assessment of natural hazards in accordance with Section 106 of the Resource Management Act and to provide recommendations in line with New Zealand Standard NZS4404 for Land Development and Subdivision Infrastructure.

10 Sustainability

We encourage you to consider sustainability when assessing the options available for your project. Where suitable for the project, we recommend prioritising the sustainable use of resources, using locally sourced materials where available, and installing in an environmentally friendly way (e.g., reduced carbon emissions and minimal contamination). If you would like to discuss these options further, ENGEO staff are available to offer suggestions.

11 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Maymorn Developments Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ/ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (04) 472 0820 if you require any further information.

Report prepared by

Lauren Foote

Engineering Geologist

Report reviewed by

Richard Justice, CMEngNZ (PEngGeol)

Principal Engineering Geologist

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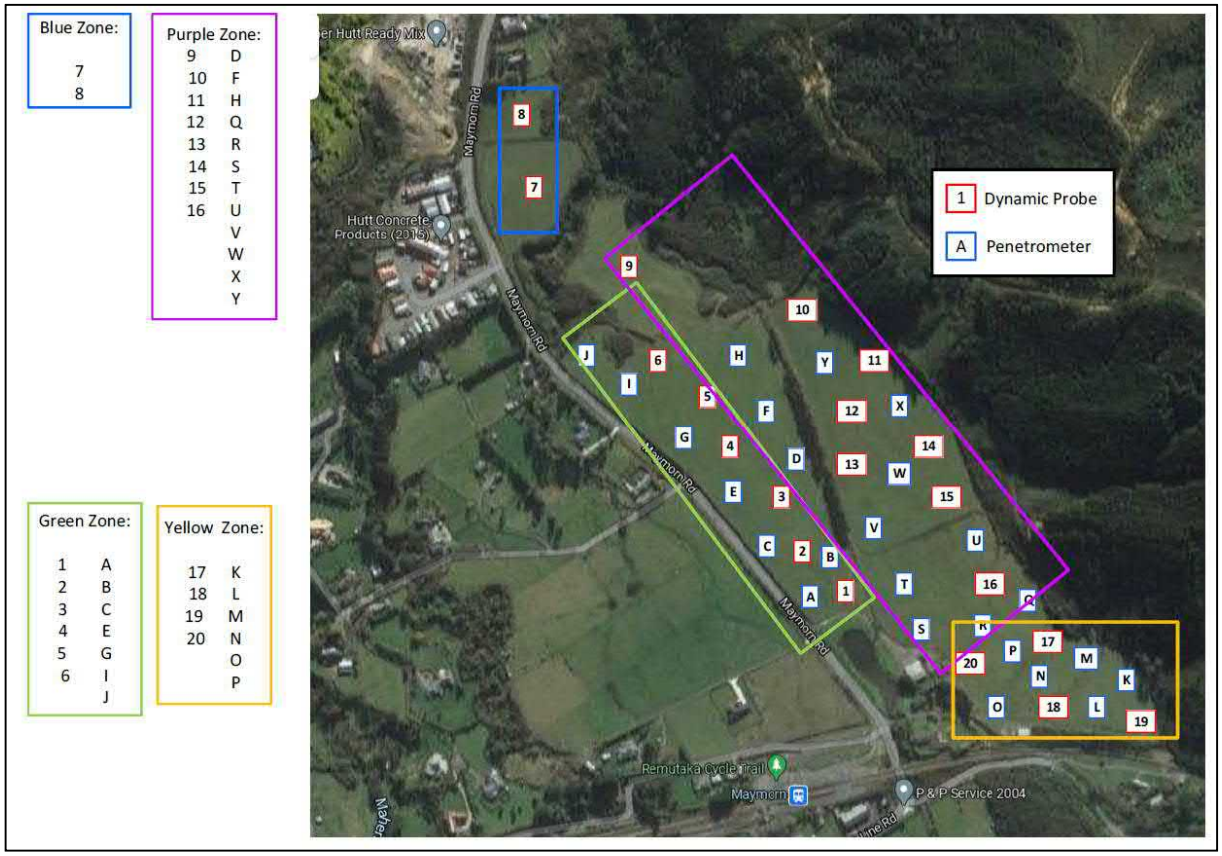
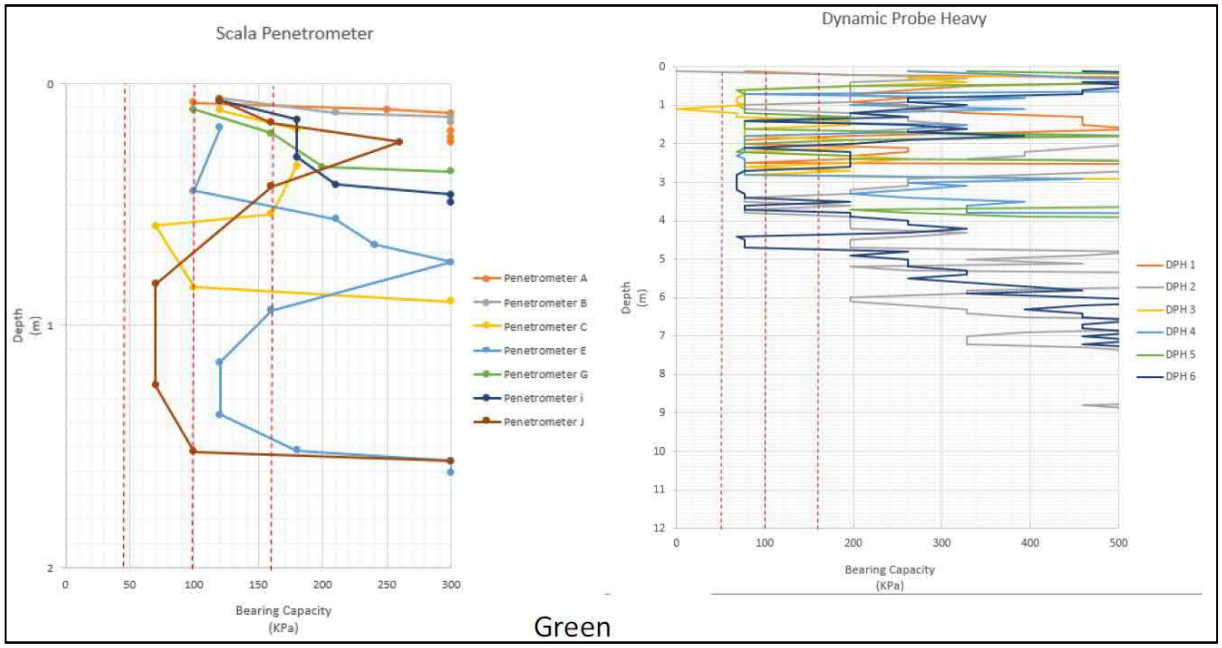
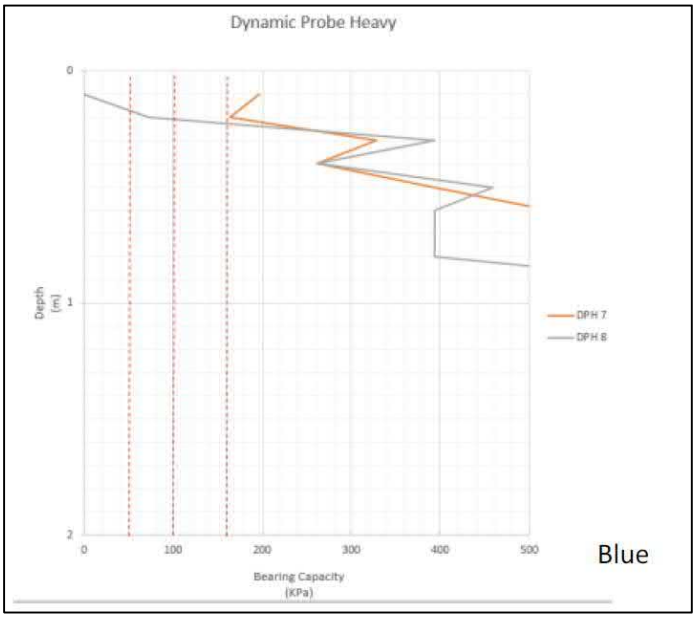
APPENDIX 1:

NZET Ltd Consulting Engineers Subsurface Investigations

NZET Scala Penetrometer and Dynamic Penetration Heavy Test Results






Dynamic Probe Heavy
Depth (m)
Bearing Capacity (KPa)
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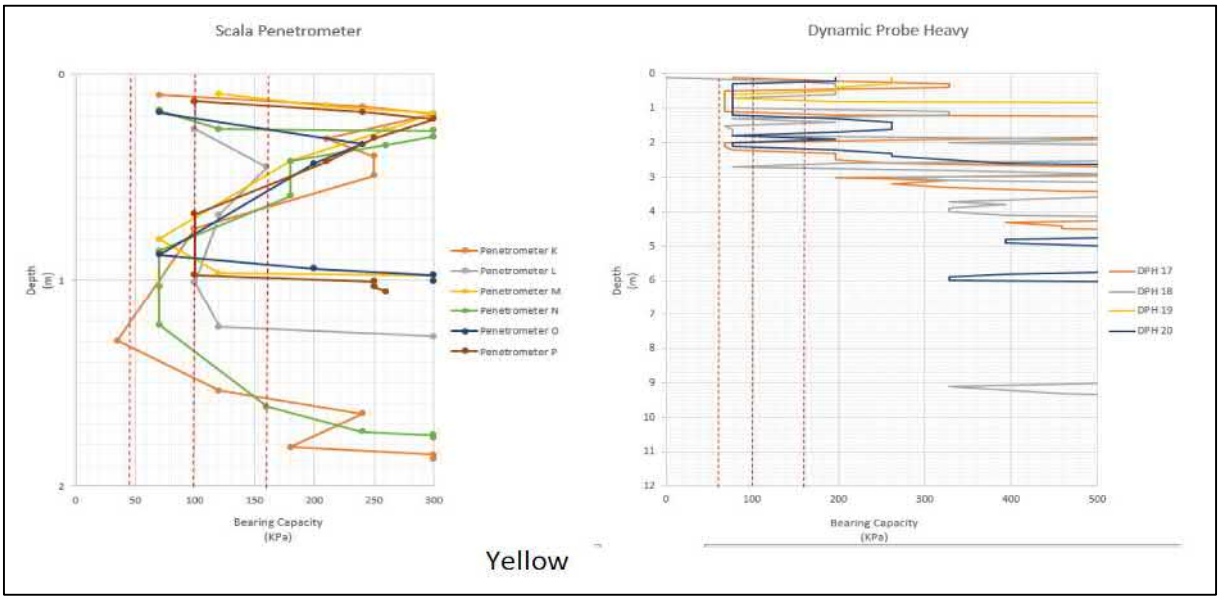
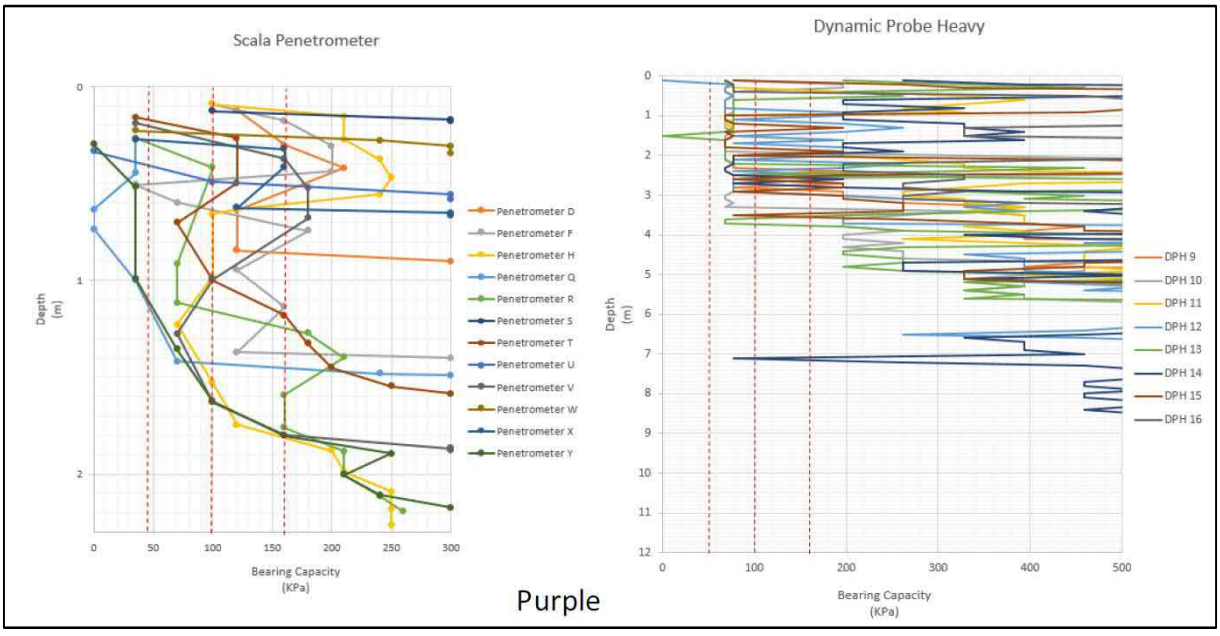
DPH 8
Blue


Scala Penetrometer
Depth (m)
Bearing Capacity (KPa)
Penetrometer K
Penetrometer L
Penetrometer M
Penetrometer N
Penetrometer O
Penetrometer P
Dynamic Probe Heavy
Depth (m)
Bearing Capacity (KPa)
DPH 17
DPH 18
DPH 19
DPH 20
Yellow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Depth (m)
Bearing Capacity (KPa)
Penetrometer D
Penetrometer F
Penetrometer H
Penetrometer Q
Penetrometer R
Penetrometer S
Penetrometer T
Penetrometer U
Penetrometer V
Penetrometer W
Penetrometer X
Penetrometer Y
Dynamic Probe Heavy
Depth (m)
Bearing Capacity (KPa)
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DPH 12
DPH 13
DPH 14
DPH 15
DPH 16
Purple

NZET Test Pits

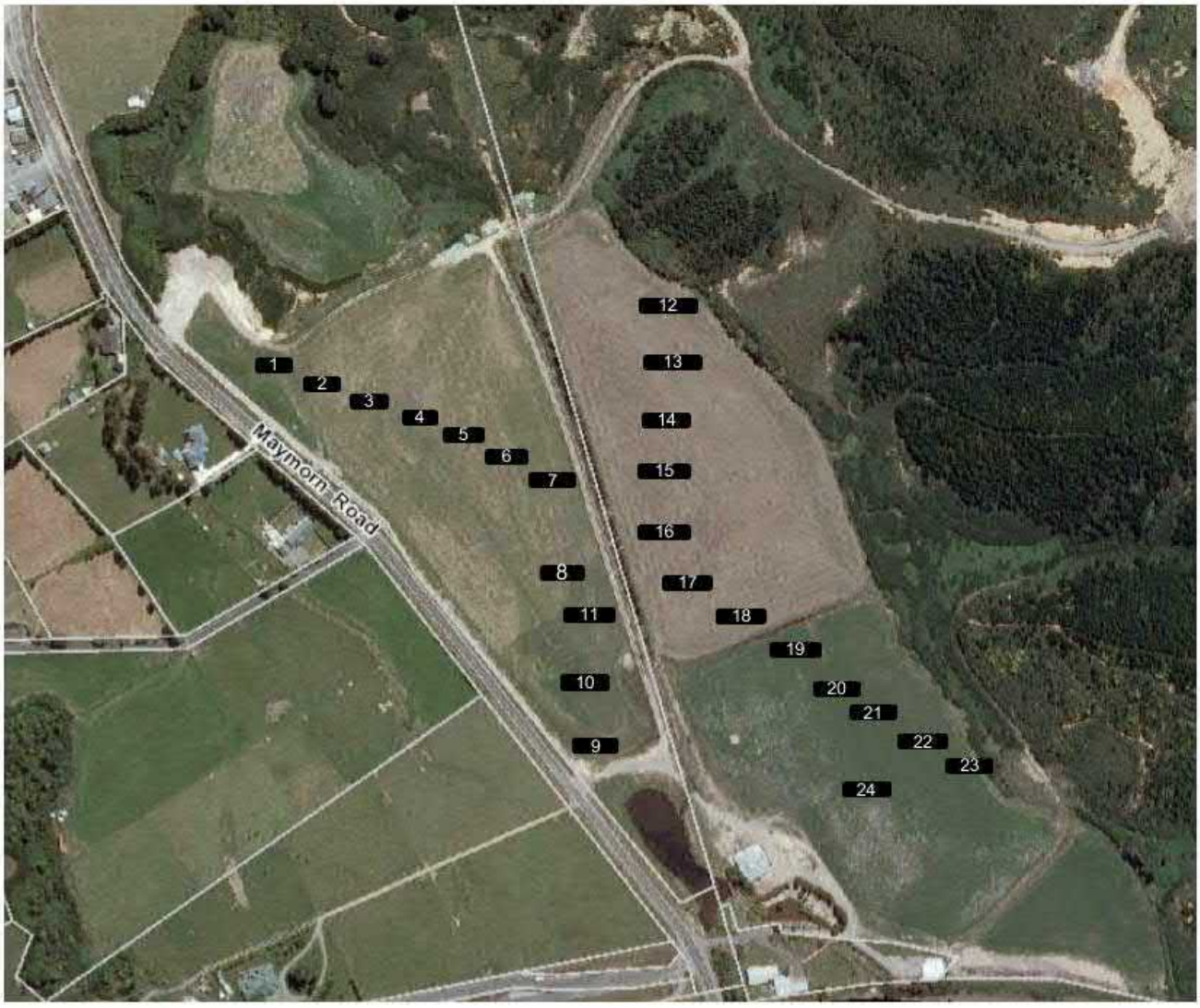


FIGURE 14. 2013 SHALLOW TEST PIT LOCATIONS

FIGURE 14. SHALLOW TEST PITS THROUGH LOWER FLATS 2013, HOLE NUMBERS SHOWN ON PHOTOS.

APPENDIX 2:

Historical Aerial Photographs

DATE PLOTTED: 31 August 2021 9:40:58 pm BY: rwilliams

1779000 1779500 1780000

5448000

MAYMORN ROAD

5447500

Large meandering stream channel

Smaller meandering stream channel

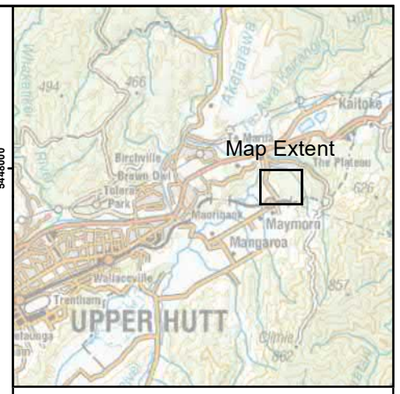
Earthworks at toe of slope, with associated construction

Small buildings

PARKES LINE ROAD

1779000 1779500 1780000

N



Legend

Site boundary

Aerial: RetroLens & LINZ. CC-BY-3.0.
Map image: Eagle Technology.
Historical Imagery: Approximate location only.

0 100 200
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

Wellington Office
Plimmer Towers, Level 18, 2-6 Gilmer Terrace
Wellington 6011
Tel: 04 472 0820, www.engeo.co.nz

Title:
Historic Imagery
1951

Client: Gillies Group Management Trust		Figure No:
Project: Gabites Block Maymorn Upper Hutt	Designed: LF Drawn: RW Checked: RJ Date: Aug 21	2A Size: A3
Proj No: 19071.000.001	Scale: 1:4,000	Revision: A

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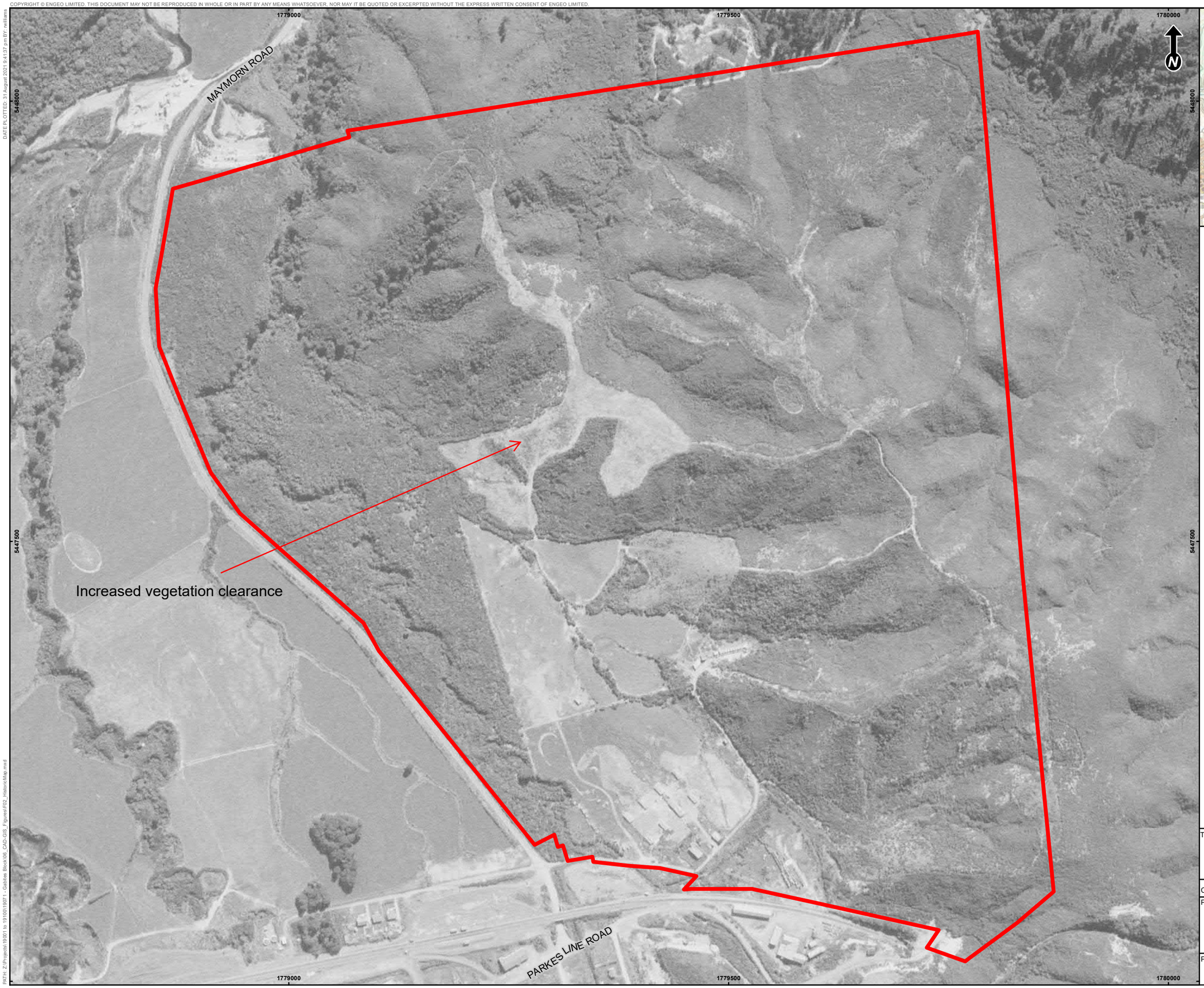

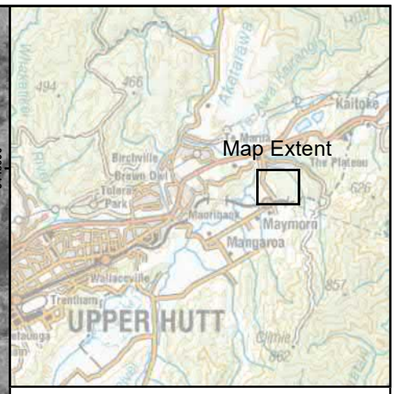

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Map image: Eagle Technology.
Historical Imagery: Approximate location only.

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Title:
Historic Imagery
1957

Client: Gillies Group Management Trust

Project:
Gabites Block
Maymorn
Upper Hutt

Designed: LF
Drawn: RW
Checked: RJ
Date: Aug 21

Figure No: **2B**
Size: A3

Proj No: 19071.000.001

Scale: 1:4,000

Revision: A

Overall page number 400

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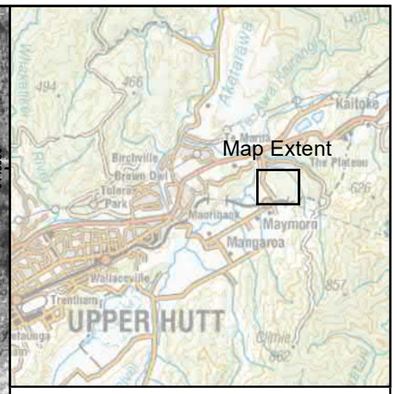

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Site boundary

Aerial: RetroLens & LINZ. CC-BY-3.0.
Map image: Eagle Technology.
Historical Imagery: Approximate location only.

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Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

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Title:
Historic Imagery
1966

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Size: A3

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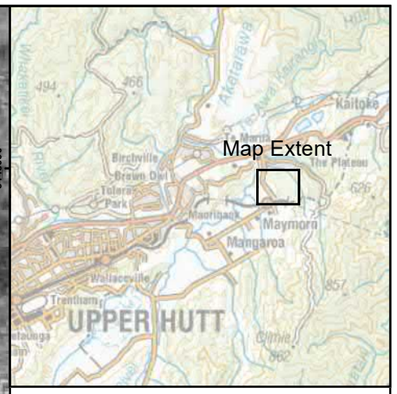

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Site boundary

Aerial: RetroLens & LINZ. CC-BY-3.0.
Map image: Eagle Technology.
Historical Imagery: Approximate location only.

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Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

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Title:
Historic Imagery
1969

Client: Gillies Group Management Trust

Project:
Gabites Block
Maymorn
Upper Hutt

Designed: LF
Drawn: RW
Checked: RJ
Date: Aug 21

Figure No: 2E
Size: A3

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Scale: 1:4,000

Revision: A

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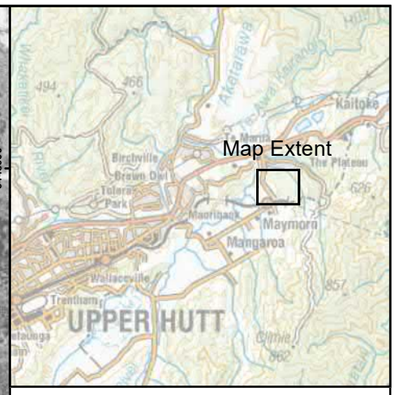

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Site boundary

Aerial: RetroLens & LINZ. CC-BY-3.0.
Map image: Eagle Technology.
Historical Imagery: Approximate location only.

0 100 200
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

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Title:
Historic Imagery
1974

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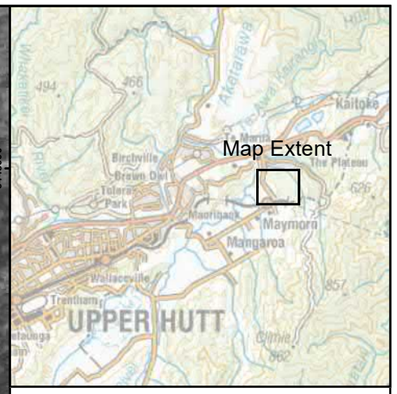

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Map image: Eagle Technology.
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Title:
Historic Imagery
1977

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Proj No: 19071.000.001	Scale: 1:4,000	Revision: A

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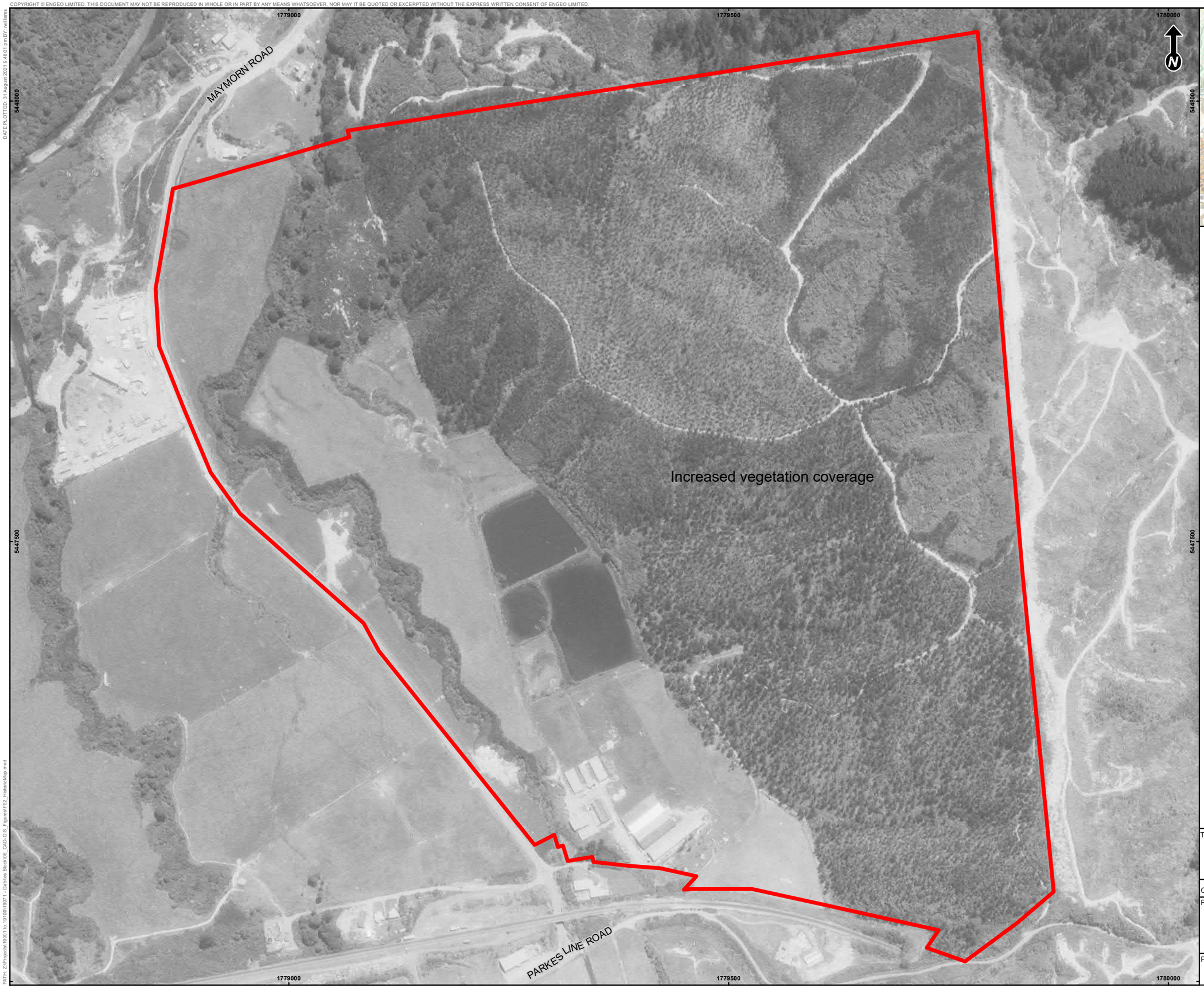
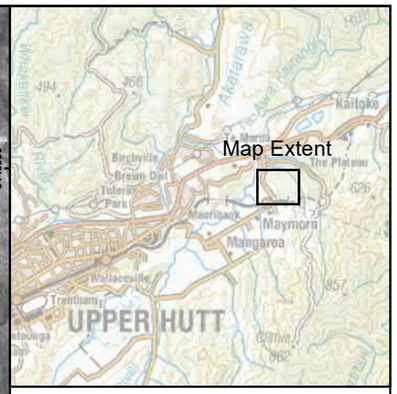
ORIGINAL FIGURE PRINTED IN COLOUR

DATE PLOTTED: 31 August 2021 9:48:01 pm BY: rwilliams





Legend

Site boundary

Aerial: RetroLens & LINZ. CC-BY-3.0.
Map image: Eagle Technology.
Historical Imagery: Approximate location only.

0 100 200
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

Wellington Office
Plimmer Towers, Level 18, 2-6 Gilmer Terrace
Wellington 6011
Tel: 04 472 0820, www.engeo.co.nz

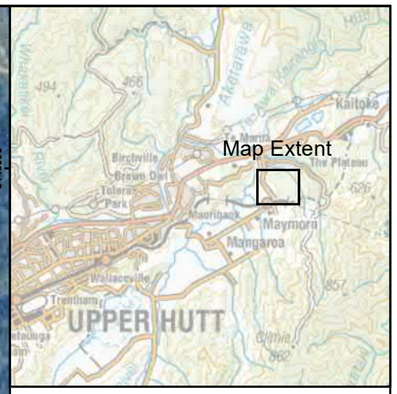
Title:
Historic Imagery
1988

Client: Gillies Group Management Trust		Figure No:
Project: Gabites Block Maymorn Upper Hutt	Designed: LF Drawn: RW Checked: RJ Date: Aug 21	2K Size: A3
Proj No: 19071.000.001	Scale: 1:4,000	Revision: A

PATH: Z:\Projects\19001 to 19100\19071 - Gabites Block\06_CAD-GIS_Figures\Fl2_HistoricMap.mxd

ORIGINAL FIGURE PRINTED IN COLOUR

DATE PLOTTED: 31 August 2021 9:51:05 pm BY: rwilliams



Legend

Site boundary

Aerial: RetroLens & LINZ. CC-BY-3.0.
Map image: Eagle Technology.
Historical Imagery: Approximate location only.

0 100 200
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Wellington Office
Plimmer Towers, Level 18, 2-6 Gilmer Terrace
Wellington 6011
Tel: 04 472 0820, www.engeo.co.nz

Title:
Historic Imagery
2003

Client: Gillies Group Management Trust

Project:
Gabites Block
Maymorn
Upper Hutt

Designed: LF
Drawn: RW
Checked: RJ
Date: Aug 21

Figure No: 20

Size: A3

Proj No: 19071.000.001

Scale: 1:1,000

Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: Z:\Projects\19001 to 19100\19071 - Gabites Block\06_CAD-GIS_Figures\Fig2_HistoricMap.mxd

DATE PLOTTED: 03 September 2021 12:17:34 pm BY: rwilliams

PATH: Z:\Projects\19001 to 19100\19071 - Gabites Block\06_CAD-GIS_Figures\F02_HistoricMap.mxd

1779000 1779500 1780000

5448000 5447500

MAYMORN ROAD

Earthworks forming large clearing

Hill areas largely replanted

Earthworks forming large clearing

Ponds have been filled

River channel has been filled

Pond fully formed

PARKES LINE ROAD

N

Map Extent

Legend

Site boundary

Aerial: Google Earth.
Map image: Eagle Technology.
Historical Imagery: Approximate location only.

0 100 200
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

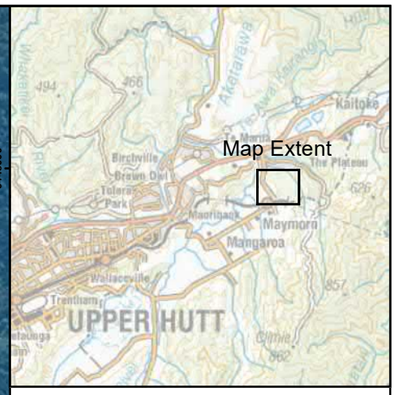
Wellington Office
Plimmer Towers, Level 18, 2-6 Gilmer Terrace
Wellington 6011
Tel: 04 472 0820, www.engeo.co.nz

Title: Historic Imagery 02/2008

Client: Gillies Group Management Trust		Figure No: 2P
Project: Gabites Block Maymorn Upper Hutt	Designed: LF Drawn: RW Checked: RJ Date: Sep 21	Size: A3
Proj No: 19071.000.001	Scale: 1:5,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

DATE PLOTTED: 03 September 2021 12:18:28 pm BY: rwilliams



Legend

Site boundary

Aerial: Google Earth.
Map image: Eagle Technology.
Historical Imagery: Approximate location only.

0 100 200
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Wellington Office
Plimmer Towers, Level 18, 2-6 Gilmer Terrace
Wellington 6011
Tel: 04 472 0820, www.engeo.co.nz

Title:

Historic Imagery
09/2012

Client: Gillies Group Management Trust

Project:
Gabites Block
Maymorn
Upper Hutt

Designed: LF
Drawn: RW
Checked: RJ
Date: Sep 21

Figure No: 2Q

Size: A3

Proj No: 19071.000.001

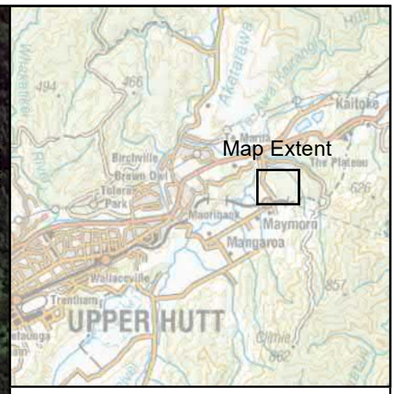
Scale: 1:4,000

Revision: A

PATH: Z:\Projects\19001 to 19100\19071 - Gabites Block\06 CAD-GIS Figures\F02_HistoricMap.mxd

ORIGINAL FIGURE PRINTED IN COLOUR

DATE PLOTTED: 03 September 2021 12:19:18 pm BY: rwilliams



Legend

Site boundary

Aerial: Google Earth.
Map image: Eagle Technology.
Historical Imagery: Approximate location only.

0 100 200
Metres

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

Wellington Office
Plimmer Towers, Level 18, 2-6 Gilmer Terrace
Wellington 6011
Tel: 04 472 0820, www.engeo.co.nz

Title:

Historic Imagery
01/2015

Client: Gillies Group Management Trust

Project:
Gabites Block
Maymorn
Upper Hutt

Designed: LF
Drawn: RW
Checked: RJ
Date: Sep 21

Figure No: **2R**

Size: A3

Proj No: 19071.000.001

Scale: 1:4,000

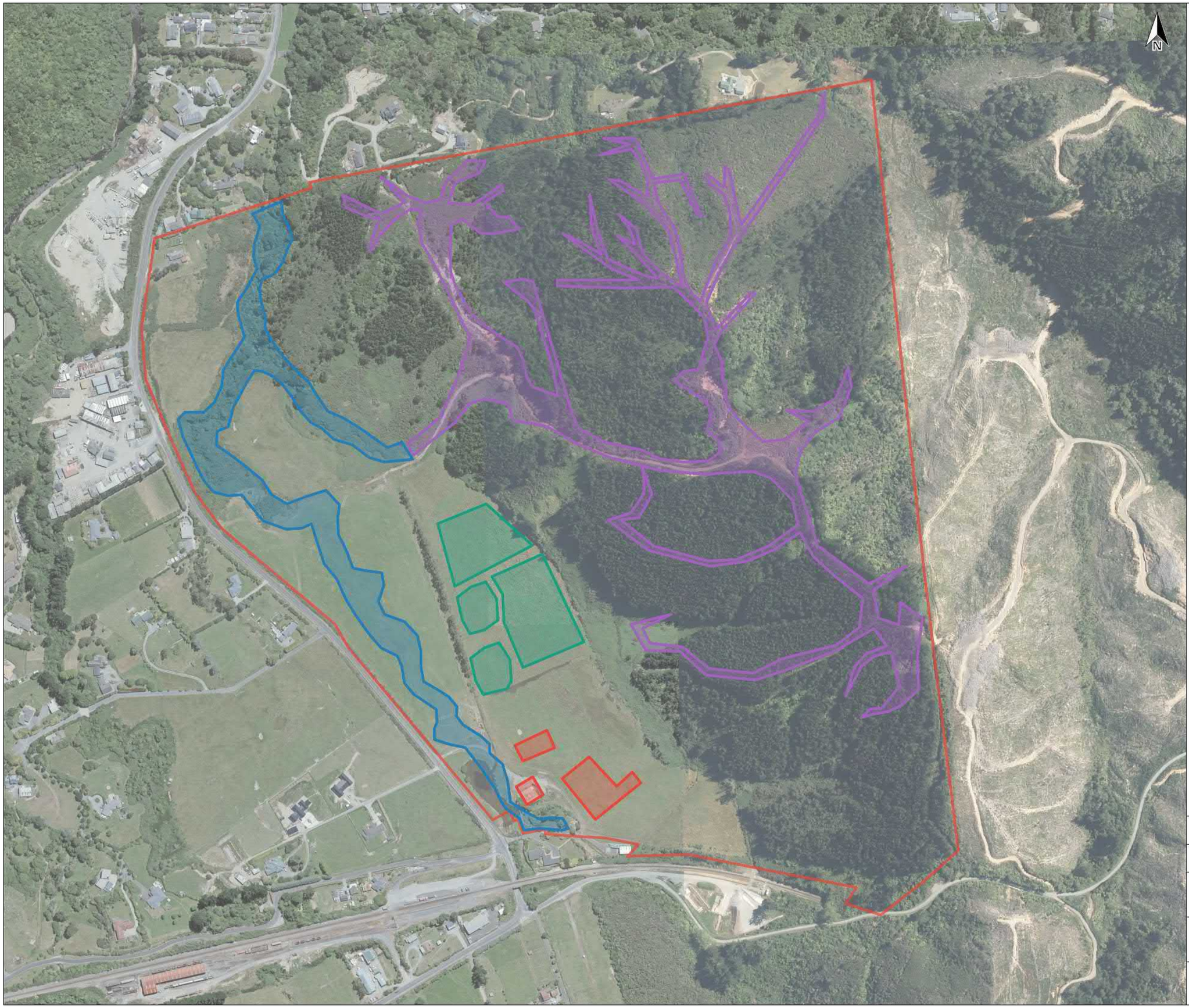
Revision: A

PATH: Z:\Projects\19001 to 19100\19071 - Gabites Block\06 CAD-GIS Figures\F02_HistoricMap.mxd

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 3:

Historical Features Mapping from Historical Aerial Photographs



Legend

- Previous River Channel
- Previous Effluent Pond
- Previous Building
- Forestry Tracks - 2003
- Site Boundary

0 50 m 100 m

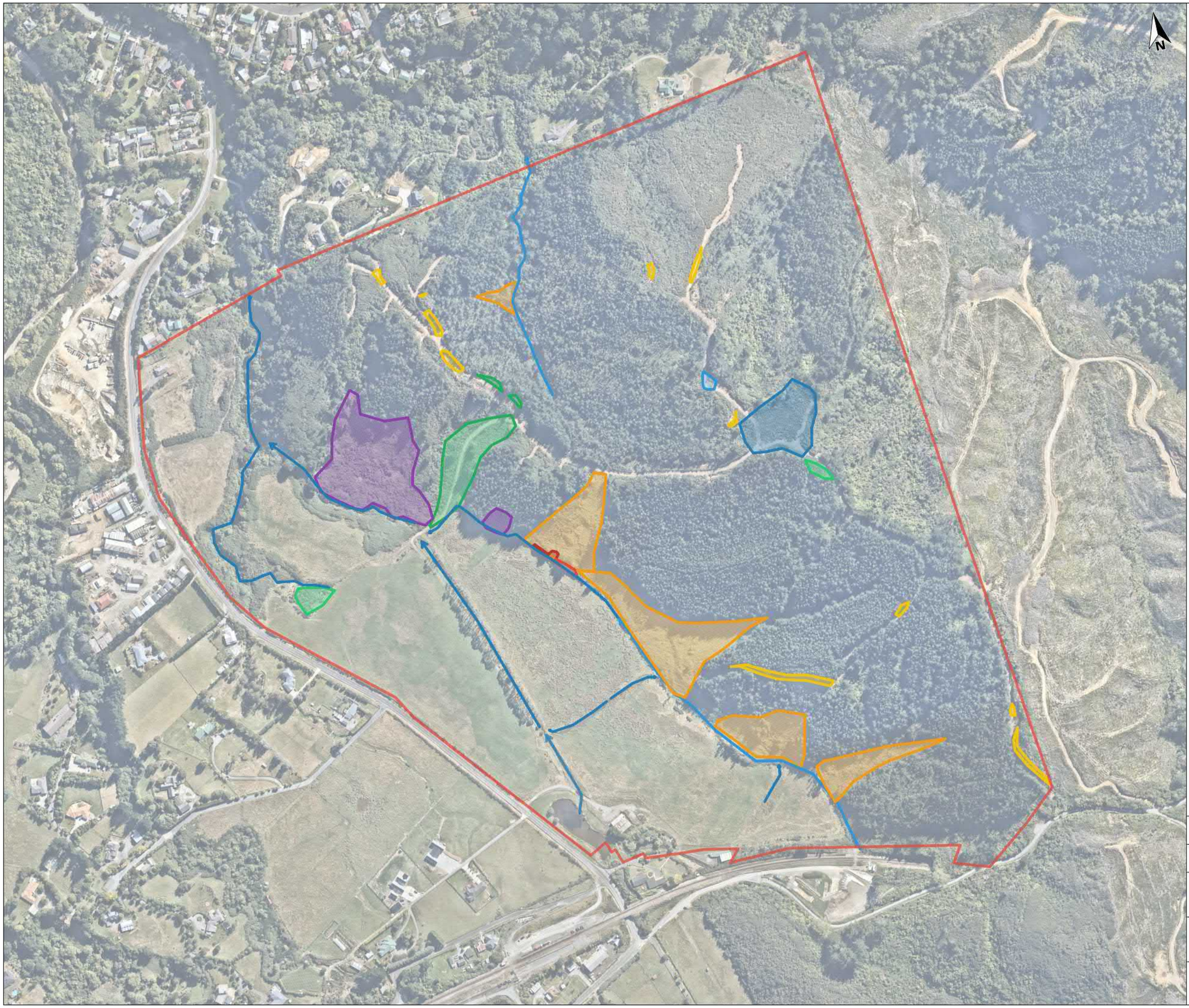
ENGEO

Produced by **Datanest.earth**

Title: Historical Features		
Client: Gillies Group Ltd		Figure No:
Project: Gabites Block, Upper Hutt	Drawn: LF	Size: A3
Date: 29-07-2021	Checked:	
Proj No: 19071.000.001	Scale: 1:6000	Version:

APPENDIX 4:

Geomorphological Map



Legend

- Site Boundary
- Alluvial Fan
- Rock outcrop
- Historical Landslide
- Pushover Fill
- Truncated slope / cut
- Recent Failure
- Cut Platform
- Pond

0 50 m 100 m

ENGEO

Produced by **Datanest.earth**

Title: Geomorphic Features		
Client: Gillies Group Ltd		
Project: Gabites Block, Upper Hutt	Drawn: LF	Figure No:
Date: 29-07-2021	Checked:	Size: A3
Proj No: 19071.000.001	Scale: 1:6000	Version:

APPENDIX 5:

Machine Borehole Logs

LOG OF BORING BH01

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.57 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Driling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.107395
Longitude : 175.138782

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	T		ML	[TOPSOIL] SILT with trace rootlets; light yellowish brown. Low plasticity.									
			ML	SILT; light yellowish brown. Low plasticity.					Firm*				
0.5			GP	Fine to medium GRAVEL with some silt and sand; light yellowish brown. Poorly graded, subangular to rounded, greywacke; sand is fine to coarse.					Loose*				
			ML	SILT with minor sand; light yellowish brown. Low plasticity; sand is fine.					Firm to Stiff*				
1.0			GP	Fine to medium GRAVEL with some silt and minor sand; light yellowish brown. Poorly graded, subangular to rounded, greywacke; sand is fine to coarse.					Loose	5/5//4/2/2/2 N=10			
1.5			ML	SILT; light yellowish brown with orange and grey mottles. Low plasticity.					Stiff				
2.0			GP	Fine to medium GRAVEL with some silt and minor sand; light yellowish brown. Poorly graded, subangular to rounded, greywacke; sand is fine to coarse.				M	Loose to Medium Dense*				
2.5													
3.0	ALLUVIUM/COLLUVIUM		GW	Fine to coarse GRAVEL with some silt and sand; light yellowish brown. Well graded, angular to subangular, greywacke; sand is fine to coarse.					Dense	5/8//8/8/6/8 N=30			
3.5													
4.0				4.1 m - Trace cobble with maximum dimension of 80 mm.									
4.5			GW	Fine to coarse GRAVEL with some silt and sand; grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.				M-W	Dense	8/7//6/8/10/12 N=36			
5.0													
5.5			ML	SILT with minor gravel; grey. Low plasticity; gravel is fine to medium, subangular to subrounded, greywacke.				M	Stiff to Hard*				
6.0			GM	Silty fine to coarse GRAVEL with minor sand; grey. Well graded, angular to rounded, greywacke; sand is fine to coarse.				D-M	Very Dense	35/15 for 15mm N=50+			
6.5													
7.0													

Machine borehole met target depth at 19.57 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH01

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.57 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Driling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.107395
Longitude : 175.138782

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
7.5	ALLUVIUM/COLLUVIUM		GM	Silty fine to coarse GRAVEL with minor sand; grey. Well graded, angular to rounded, greywacke; sand is fine to coarse.				D-M	Very Dense				
			ML	Clayey SILT with trace sand; grey. Low plasticity.					Stiff	2/3//3/4/3/4 N=14			
8.0			SM	Silty fine to coarse SAND with some gravel; light grey. Well graded; gravel is fine to medium, subangular to rounded, greywacke.					Loose to Medium Dense*				
8.5			ML	SILT with minor sand; light grey. Low plasticity; sand is fine.					Firm to Stiff*				
9.0			GP	Sandy fine to medium GRAVEL with some silt; grey. Poorly graded, angular to subangular, greywacke; sand is fine to coarse. 9.3 m - 100 mm thick lens of organic silt encountered.				M	Medium Dense	4/6//8/4/4/4 N=20			
10.0			ML	SILT; grey. Low plasticity.					Stiff to Very Stiff*				
10.5			GW	Fine to coarse GRAVEL with some sand and silt; grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.				M-W		16/34 for 75 mm N=50+			
11.5								D					
12.0									Dense to Very Dense	7/7//13/10/7/12 N=42			
12.5								M					
13.0								D					
13.5			GW	Fine to coarse GRAVEL with some silt and minor sand; brownish grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.				M	Very Dense	6/12//35/15 for 75 mm N=50+			
14.0													

Machine borehole met target depth at 19.57 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH01

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.57 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Driling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.107395
Longitude : 175.138782

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
14.5	ALLUVIUM/COLLUVIUM		GW	Fine to coarse GRAVEL with some silt and minor sand; brownish grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.				M		12/15//28/22 N=50+			
15.0													
15.5													
16.0			GM	Silty fine to coarse GRAVEL with minor sand; brown. Well graded, angular to subangular, greywacke; sand is fine to coarse.				D	Very Dense	18/32 for 70 mm N=50+			
16.5								M					
17.0													
17.5								D					
18.0										5/10//15/25/10 for 5 mm N=50+			
18.5								M					
19.0			ML	Gravelly SILT with minor sand; brown. Low plasticity; gravel is fine to medium, angular to subangular, greywacke; sand is fine to coarse.					Very Stiff				
19.5				No recovery within SPT.	NR				-	50 for 70 mm N=50+			

End of Hole Depth: 19.57 m
Termination: Target depth

Machine borehole met target depth at 19.57 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH02

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 07/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Driling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.106307
Longitude : 175.13709

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	T		ML	[TOPSOIL] SILT with some organics, trace sand and gravel; dark brown. Low plasticity; sand is fine to coarse; gravel is fine, subrounded to rounded, greywacke.					Soft to Firm*				
0.5	ALLUVIUM/COLLUVIUM		ML	SILT; yellowish brown with grey and orange mottles. Low plasticity.					Soft to Firm*				
1.0			ML	Sandy SILT; light grey. Low plasticity; sand is fine.					Soft to Firm*				
1.5			GW	Sandy fine to coarse GRAVEL with some silt and trace cobble; brown. Well graded, subangular to rounded, greywacke; sand is fine to coarse; cobble is subrounded, greywacke. Maximum cobble dimension is 70 mm.				M	Medium Dense	9/15//8/4/4/4 N=20			
2.0			ML	Sandy SILT with minor gravel; orange brown. Low plasticity; sand is fine to coarse; gravel is fine to medium, subangular to rounded, greywacke.					Stiff*				
2.5			ML	Gravelly SILT with minor sand; brown. Low plasticity; gravel is fine to coarse, angular to subangular, greywacke; sand is fine to coarse.				D					
3.0				3.0 m - Gravel becomes subangular to rounded.					Very Stiff	2/1//1/3/8/8 N=20			
3.5			ML	SILT; brown. Low plasticity.									
4.0			GM	Silty fine to coarse GRAVEL with some sand; brown. Well graded, subangular to subrounded, greywacke; sand is fine to coarse. 4.3 m - Sand becomes minor. Colour becomes dark brown.					Loose to Medium Dense*				
4.5			ML	Sandy SILT; brown. Low plasticity; sand is fine.					Soft to Firm	1/1//1/1/1/2 N=5			
5.0			SM	Silty fine SAND; grey. Poorly graded.				M	Very Loose to Loose				
5.5			ML	Sandy SILT; brown. Low plasticity; sand is fine.					Soft to Firm*				
6.0			GW	Sandy fine to coarse GRAVEL; grey. Well graded, subangular to subrounded; sand is fine to coarse.					Loose	4/3//1/1/2/2 N=6			
			ML	Sandy SILT; grey. Low plasticity; sand is fine.					Soft				
6.5			SM	Silty fine to coarse SAND; grey. Well graded.									
7.0			GP	Sandy fine GRAVEL; grey. Poorly graded, subangular to subrounded, greywacke; sand is					Loose*				

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH02

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 07/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Driling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.106307
Longitude : 175.13709

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
7.5	ALLUVIUM/COLLUVIUM		ML	fine to coarse. Sandy SILT with minor gravel; bluish grey. Low plasticity; sand is fine; gravel is fine to medium, subrounded to rounded, greywacke.				M	Firm to Stiff	1/1//1/3/3/4 N=11			
8.0			GP	Sandy fine to medium GRAVEL; bluish grey. Poorly graded, subangular to rounded, greywacke; sand is fine to coarse.				W	Loose*				
			ML	Sandy SILT; bluish grey. Low plasticity; sand is fine.				M	Firm to Stiff*				
9.0			GW	Fine to coarse GRAVEL with minor silt and sand; dark bluish grey. Well graded, angular to subangular, greywacke; sand is fine to coarse.				W	Loose to Medium Dense*	4/6//2/4/3/2 N=11			
9.5			GW	Sandy fine to coarse GRAVEL with minor silt; grey. Well graded, angular, greywacke; sand is fine to coarse.					Medium Dense				
			ML	SILT; light bluish grey. Low plasticity.					Stiff				
10.0			SM	Silty fine to coarse SAND with trace gravel; light bluish grey. Well graded; gravel is fine to medum, angular to subrounded, greywacke.					Medium Dense*				
10.5			ML	SILT; light brown. Low plasticity.					Stiff*				
			SW	Fine to coarse SAND with minor silt; grey. Well graded.					Medium Dense	2/2//3/4/5/5 N=17			
11.0			ML	SILT; dark greyish brown. Low plasticity.					Stiff*				
11.5			SM	Silty fine to coarse SAND with trace gravel; bluish grey. Well graded; gravel is fine to medium, subrounded, greywacke.				M	Medium Dense*				
			ML	SILT; dark greyish brown. Low plasticity.					Stiff*				
12.0			ML	Sandy SILT; grey. Low plasticity; sand is fine.					Hard	1/7//8/22/20 for 60 mm N=50+			
			GW	Fine to coarse GRAVEL with minor silt and sand; grey. Well graded, angular, greywacke; sand is fine to coarse.					Very Dense				
12.5			ML	SILT; light greyish brown. Low plasticity.					Hard*				
13.0			ML	Sandy SILT; light greyish brown. Low plasticity; sand is fine.									
13.5			SM	Silty fine to coarse SAND with trace gravel; grey. Well graded; gravel is fine to coarse, angular to subangular, greywacke.					Medium Dense	2/2//4/2/3/4 N=13			
14.0			ML						Stiff				

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH02

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 07/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Driling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.106307
Longitude : 175.13709

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
14.5	ALLUVIUM/COLLUVIUM		ML	SILT with organic lenses; greyish brown. Low plasticity.					Stiff				
			SW	Fine to coarse SAND with some gravel; grey with yellowish brown mottles. Well graded; gravel is fine to coarse, angular to subangular, greywacke.					Loose to Medium Dense*				
			ML	Sandy SILT; light greyish brown. Low plasticity; sand is fine.					Stiff*				
15.0			GW	Sandy fine to coarse GRAVEL with some silt; grey. Well graded, angular to subangular, greywacke; sand is fine to coarse.					Very Dense	3/5//15/35 for 70 mm N=50+			
16.5								M		5/7//9/10/14/17 for 60 mm N=50+			
17.0			SM	Silty fine to coarse SAND with trace gravel; light grey. Well graded; gravel is fine to coarse, subangular to rounded, greywacke.					Very Dense*				
17.5			GM	Silty fine to coarse GRAVEL; grey. Well graded, angular, greywacke.					Very Dense	50 for 65 mm N=50+			
18.0			GP	Fine to medium GRAVEL with some sand and silt; bluish grey. Poorly, angular to rounded, greywacke; sand is fine to coarse.									
18.5			ML	Sandy SILT; bluish grey. Low plasticity; sand is fine.					Hard*				
19.0			ML	SILT; greyish brown. Low plasticity.									
			SM	Silty fine SAND with trace organics; greyish brown. Poorly graded.					Medium Dense to Dense*				
19.5			ML	SILT; greyish brown. Low plasticity.									
			-	No recovery	NR			-	Very Stiff to Hard*	7/6//5/7/6/6 N=24			

End of Hole Depth: 19.95 m
Termination: Target depth

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH03

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.105972
Longitude : 175.134408

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	T		ML	[TOPSOIL] SILT with some sand and trace gravel; brown. Low plasticity; sand is fine to coarse; gravel is fine, angular, greywacke.									
0.5	FILL		ML	[FILL] SILT with minor sand, gravel and trace charcoal; light yellowish brown with yellowish white and grey bands. Low plasticity; sand is fine to coarse; gravel is fine to coarse, subangular to subrounded, greywacke.					Soft to Firm*				
1.0			ML										
1.5			GW	[FILL] SILT with minor gravel, trace sand, wood, rootlets and charcoal; grey. Low plasticity; gravel is fine to coarse, angular, greywacke; sand is fine to coarse.									
			GM	[FILL] Sandy fine to coarse GRAVEL with minor silt, trace asphalt and concrete; grey. Well graded, angular, greywacke; sand is fine to coarse.						20/15//3/4/3/3 N=13			
2.0				[FILL] Silty fine to coarse GRAVEL with minor sand and trace charcoal; grey. Well graded, angular to subrounded, greywacke; sand is fine to coarse.					Medium Dense				
2.5													
2.8				[FILL] Fibre board.					N/A				
3.0			ML	[FILL] SILT with minor gravel, trace sand, trace glass and charcoal; brownish grey. Low plasticity; gravel is fine to coarse, subangular to rounded; sand is fine to coarse.						1/1//1/1/1/1 N=4			
3.5								M	Soft to Firm				
4.0			GW	[FILL] Sandy fine to coarse GRAVEL with minor silt; light grey. Well graded, angular to rounded, greywacke and concrete; sand is fine to coarse.									
4.5			GW	[FILL] Silty fine to coarse GRAVEL with some sand, trace rubber, fibre board, wood and brick; light grey. Well graded, angular to subrounded, greywacke; sand is fine to coarse.						4/3//1/1/1/1 N=4			
5.0									Loose				
5.5													
6.0			OL	[FILL] Organic SILT with some gravel, sand and trace brick; greyish brown. Low plasticity; gravel is fine to coarse, angular to subrounded, greywacke; sand is fine to coarse.					Firm	0/0//1/1/2/3 N=7			
6.5	A/C		ML	Sandy SILT; grey. Low plasticity; sand is fine.					Firm*				
7.0													

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL
A/C = ALLVUIUM/COLLVUIUM

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH03

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.105972
Longitude : 175.134408

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
7.0	ALLUVIUM/COLLUVIUM		SM	Silty fine to medium SAND; grey. Poorly graded.					Loose*				
			ML	Sandy SILT; light brownish grey with grey mottles. Low plasticity; sand is fine.					Firm*				
7.5			GP	Sandy fine to medium GRAVEL; grey. Poorly graded, angular to subrounded, greywacke; sand is fine to coarse.					Loose to Medium Dense	2/4//4/3/2/1 N=10			
			ML	SILT with minor sand; grey. Low plasticity; sand is fine.					Firm				
8.0			GW	Sandy fine to coarse GRAVEL with some silt; grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.					Loose*				
8.5			ML	SILT with minor sand; grey. Low plasticity; sand is fine.					Firm*				
			SW	Fine to coarse SAND with minor silt; grey. Well graded.				M	Loose*				
9.0			ML	Sandy SILT; grey. Low plasticity; sand is fine to coarse.					Stiff	2/1//3/3/2/2 N=10			
9.5			GM	Silty fine to medium GRAVEL with some sand; grey. Poorly graded, subangular to rounded, greywacke; sand is fine to coarse.					Medium Dense*				
10.0			ML	Sandy SILT; grey. Low plasticity; sand is fine.					Stiff to Very Stiff*				
10.5			GP	Fine to medium GRAVEL with some silt; grey. Poorly graded, subangular, greywacke.					Dense	8/8//10/10/12/15 N=47			
			GP	Fine to medium GRAVEL with minor silt and sand; yellowish brown. Poorly graded, subangular, greywacke; sand is fine to coarse.					Medium Dense to Dense				
11.0													
11.5													
12.0				12.1m - Colour changes to grey.				M-W		3/5//3/6/7/5 N=21			
12.5													
13.0			ML	SILT with minor sand; brownish grey. Low plasticity; sand is fine.					Very Stiff to Hard*				
13.5			GM	Silty fine to coarse GRAVEL with some sand; grey. Well graded, angular to subangular, greywacke; sand is fine to coarse.				W	Very Dense	4/15//28/22/1 for 45 mm N=50+			
14.0													

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL
A/C = ALLVUIUM/COLLVUIUM

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH03

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.105972
Longitude : 175.134408

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
14.5	ALLUVIUM/COLLUVIUM		GM	Silty fine to coarse GRAVEL with some sand; grey. Well graded, angular to subangular, greywacke; sand is fine to coarse.				W	Very Dense	15/35 for 75 mm N=50+		25 50 75	
15.0													
15.5													
16.0				16.3 m - Colour changes to brownish grey.									
16.5			SM	Silty fine to coarse SAND with some gravel and trace cobbles; grey banded with reddish brown. Well graded; gravel is fine to coarse, angular to subangular, greywacke; cobbles are angular to subrounded, greywacke, maximum dimension 80 mm.						14/36 for 75 mm N=50+			
17.0									Very Dense				
17.5													
18.0			GM	Silty fine to medium GRAVEL with some sand; grey. Poorly graded, angular to subangular, greywacke; sand is fine to coarse.				M	Dense	12/15//9/10/10/11 N=40			
18.5			ML	SILT; grey. Low plasticity.					Stiff				
19.0													
19.5										2/2//3/2/3/3 N=11			

End of Hole Depth: 19.95 m
Termination: Target depth

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

A/C = ALLVUIUM/COLLVUIUM

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH04

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.104721
Longitude : 175.133335

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	TS		OL	[TOPSOIL] Organic SILT with minor sand and trace gravel; brown. Low plasticity; sand is fine to coarse; gravel is fine to medium, angular to subangular, greywacke.					Very Soft*				
0.5	FILL		ML	[FILL] SILT with minor gravel and sand; light yellowish brown. Low plasticity; gravel is fine to medium, angular to subrounded, greywacke; sand is fine to coarse.					Very Soft*				
1.0			ML	[FILL] SILT with some gravel and sand; yellowish brown. Low plasticity; gravel is fine to coarse, angular, greywacke; sand is fine to coarse.									
1.5			ML	[FILL] SILT with minor sand, trace gravel and wood; light yellowish grey. Low plasticity; sand is fine to coarse; gravel is fine, subangular to subrounded, greywacke.					Firm	2/2//2/2/2/1 N=7			
2.0			ML	[FILL] SILT with trace gravel and sand; grey. Low plasticity; gravel is fine to coarse, subrounded to subangular, greywacke; sand is fine to coarse.					Soft to Firm*				
2.5			ML	[FILL] SILT with some gravel and minor sand; brownish grey. Low plasticity; gravel is fine to coarse, angular, greywacke; sand is fine to coarse.				M-W		0/1//1/1/1/1 N=4			
3.0													
3.5				4.0 m - Trace metal.					Soft to Firm				
4.0										1/0//1/0/0/3 N=4			
4.5				5.0-5.8 m - Trace brick.									
5.0													
5.5	ALLUVIUM/COLLUVIUM		ML	SILT with minor gravel; grey. Low plasticity; gravel is fine to coarse, angular to subrounded, greywacke.					Firm	2/1//1/1/3/2 N=7			
6.0			GW	Fine to coarse GRAVEL with minor silt and sand; grey. Well graded, angular, greywacke; sand is fine to coarse.				D	Loose*				
6.5			SW	Fine to coarse SAND with some gravel and minor silt; grey. Well graded; gravel is fine to coarse,									
7.0													

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
TS = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH04

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.104721
Longitude : 175.133335

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
			ML	angular to subrounded, greywacke.									
			ML	SILT with trace sand; grey. Low plasticity; sand is fine to coarse.					Firm to Stiff*				
7.5				7.4 m - Organic lenses.									
			SM	Silty fine to coarse SAND with some gravel; grey. Well graded; gravel is fine to medium, angular, greywacke.						5/5//4/7/10/8 N=29			
			SP	Fine SAND with some silt; grey. Poorly graded.					Medium Dense				
8.0													
			ML	SILT with trace sand; grey. Low plasticity; sand is fine to coarse.					Stiff to Very Stiff*				
8.5			SM	8.4 m - Organic lenses.									
				Silty fine SAND with trace gravel; grey. Poorly graded; gravel is fine, angular, greywacke.									
9.0			SW	Fine to coarse SAND with some gravel; grey. Well graded; gravel is fine to coarse, angular, greywacke.					Medium Dense	1/3//3/4/5/5 N=17			
9.5													
			ML	Sandy SILT; grey. Low plasticity; sand is fine.					Stiff to Very Stiff*				
10.0			ML	SILT with trace sand; brownish grey. Low plasticity, sand is fine to coarse.									
	ALLUVIUM/COLLUVIUM		GW	Fine to coarse GRAVEL with minor sand and silt; grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.				M-W	Medium Dense	2/4//5/4/7/5 N=21			
10.5													
			ML	SILT with minor sand; grey. Low plasticity; sand is fine.					Stiff to Very Stiff*				
11.0			GP	Fine to medium GRAVEL with some sand and silt; grey. Poorly graded, angular to subrounded, greywacke; sand is fine to coarse.					Medium Dense*				
			ML										
11.5			ML	Sandy SILT with organic lenses; grey. Low plasticity; sand is fine.					Very Stiff to Hard*				
			GP	SILT; grey. Low plasticity.									
12.0				Sandy fine to medium GRAVEL with some silt; grey mixed with reddish brown. Poorly graded, angular to subrounded, greywacke; sand is fine to coarse.					Dense	4/12//10/12/6/5 N=33			
12.5													
			ML	SILT with trace sand; grey. Low plasticity; sand is fine to coarse.					Very Stiff to Hard*				
			GP	Sandy fine to medium GRAVEL with some silt; grey with reddish brown and greyish green mottles. Poorly graded, angular, greywacke and chert; sand is fine to coarse.					Dense to Very Dense*				
13.0			SW										
				Fine to coarse SAND with some gravel and minor silt; grey with reddish brown and greyish green mottles. Well graded; gravel is fine to medium, angular, greywacke.					Very Dense	8/10//15/18/17 for 40 mm N=50+			
13.5													
14.0													

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
TS = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH04

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.104721
Longitude : 175.133335

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
14.5	ALLUVIUM/COLLUVIUM		SW	Fine to coarse SAND with some gravel and minor silt; grey with reddish brown and greyish green mottles. Well graded; gravel is fine to medium, angular, greywacke.				M-W	Very Dense				
15.0			ML	SILT with minor sand; grey. Low plasticity; sand is fine.					Very Stiff	2/7//4/10/3/5 N=22			
15.5			SM	Silty fine to coarse SAND; grey. Well graded.					Medium Dense to Dense*				
16.0			SW	Fine to coarse SAND with minor gravel and silt; grey. Well graded; gravel is fine, angular to subrounded, greywacke.				W	Dense	1/8//10/10/6/6 N=32			
16.5													
17.0			SM	Silty fine to coarse SAND; grey. Well graded. 17.2 m - Minor gravel noted; fine to medium, angular, greywacke.					Dense*				
17.5			ML	SILT with some sand; grey. Low plasticity; sand is fine.					Stiff				
18.0										2/2//2/3/3/4 N=12			
18.5			OL	Organic SILT; dark brown. Low plasticity.				M-W	Stiff				
19.0			SW	Fine to coarse SAND with some gravel and silt; grey. Well graded; gravel is fine to coarse, angular to subrounded, greywacke.					Medium Dense*				
19.5			SM SW	Silty fine to coarse SAND with minor gravel; light reddish grey. Well graded; gravel is fine to medium, angular to subrounded, greywacke.									
			ML	Fine to coarse SAND with some silt and minor gravel; light bluish grey banded with yellow and green. Well graded; gravel is fine to medium, angular to subangular, greywacke and chert.					Stiff	0/0//2/3/3/3 N=11			
				SILT with trace sand; light yellowish brown. Low plasticity; sand is fine to coarse.									
				End of Hole Depth: 19.95 m Termination: Target depth									

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
TS = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH05

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.104223
Longitude : 175.132025

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	T		ML	[TOPSOIL] SILT with minor rootlets; brown. Low plasticity.					Stiff to Very Stiff*				
0.5	FILL		ML	[FILL] SILT with some gravel; yellowish brown. Low plasticity; gravel is fine, subrounded to rounded, greywacke. 0.8 m - Orange mottles present.					Stiff to Very Stiff*				
1.0			ML	[FILL] SILT; grey with orange mottles. Low plasticity.									
1.5			GM	[FILL] Silty fine to coarse GRAVEL with minor sand; brownish grey. Well graded, subangular to rounded, greywacke; sand is fine to coarse.						5/5//9/7/4/3 N=23			
2.0									Medium Dense				
2.5			GM	[FILL] Silty fine to medium GRAVEL with some sand; grey. Poorly graded; subangular to subrounded, greywacke; sand is fine to coarse.									
			ML						Firm to Stiff*				
3.0			SM	[FILL] SILT; grey. Low plasticity.									
				[FILL] Silty fine to coarse SAND with some gravel; grey. Well graded; gravel is fine, subangular to rounded, greywacke.					Loose	6/3//3/2/2/1 N=8			
3.5			ML	[FILL] SILT with some sand; grey. Low plasticity; sand is fine.				M	Firm to Stiff*				
4.0			SW	[FILL] SAND with some silt and gravel; grey with orange mottles. Well graded; gravel is fine, subangular to rounded, greywacke.					Loose*				
4.5	ALLUVIUM/COLLUVIUM		ML	SILT with minor sand; grey speckled with white. Low plasticity; sand is fine.						1/3//2/2/2/4 N=10			
5.0													
5.5									Stiff				
6.0										1/3//2/4/3/5 N=14			
6.5													
7.0			SM	Silty fine SAND; grey. Poorly graded.					Loose to				

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH05

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.104223
Longitude : 175.132025

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
7.5	ALLUVIUM/COLLUVIUM		SW	Fine to coarse SAND with minor silt and minor gravel; grey. Well graded; gravel is fine to coarse, subangular to subrounded, greywacke.				M	Medium Dense* Dense	3/12//11/28/11 for 30 mm N=50+			
8.0			GW	Fine to coarse GRAVEL with some sand and minor silt; grey. Well graded, subangular to rounded, greywacke; sand is fine to coarse.				M-W	Very Dense				
9.0			SW	Fine to coarse SAND with some silt and gravel; grey. Well graded; gravel is fine to coarse, subangular to rounded, greywacke.					Medium Dense	5/3//3/3/4/6 N=16			
10.0			SW	Fine to coarse SAND with some silt and minor gravel; grey. Well graded, gravel is fine, subangular to subrounded, greywacke. 10.9 m - Colour changes to dark greenish grey.					Dense	2/5//6/6/10/15 N=37			
11.5			ML	SILT with trace sand; grey. Low plasticity; sand is fine.				M	Stiff to Very Stiff*				
12.0			ML	Sandy SILT; greenish grey banded with orange. Low plasticity; sand is fine.									
12.5			ML	SILT; grey banded with orange. Low plasticity.					Very Stiff	5/4//5/5/7/7 N=24			
13.0			SW	Fine to coarse SAND with some gravel and silt; dark grey with reddish brown bands. Well graded; gravel is fine to coarse, subangular to rounded, greywacke.					Very Dense	4/7//8/11/31 for 75 mm N=50+			
14.0													

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH05

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 03/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.104223
Longitude : 175.132025

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
14.5	ALLUVIUM/COLLUVIUM		SW	Fine to coarse SAND with some gravel and silt; dark grey with reddish brown bands. Well graded; gravel is fine to coarse, subangular to rounded, greywacke.					Very Dense				
15.0			ML	SILT; brown. Low plasticity.				M	Stiff	1/1//2/4/4/4 N=14			
16.5			GP GW	Sandy fine to medium GRAVEL with minor silt; dark grey with green and red mottles. Poorly graded, subangular to rounded, greywacke and chert; sand is fine to coarse.						10/16//50 for 75 mm N=50+			
17.0				Fine to coarse GRAVEL with some sand and silt; brown. Well graded, angular to subrounded, greywacke; sand is fine to coarse.				W	Very Dense				
18.0			SM	Silty fine to coarse SAND with some gravel; brown. Well graded; gravel is fine to coarse, angular to subrounded, greywacke.						8/24//40/10 for 5mm N=50+			
19.0								M-W	Dense to Very Dense				
19.5										5/7//5/8/13/22 N=48			

End of Hole Depth: 19.95 m
Termination: Target depth

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH06

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 07/09/21
Hole Depth : 19.675 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.103291
Longitude : 175.134098

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	FILL		ML	[FILL] SILT with some gravel, minor sand, trace wood; yellowish brown. Low plasticity; gravel is fine to coarse, angular to rounded, greywacke;					Firm*				
			GW	sand is fine to coarse.					Loose*				
0.5			ML	[FILL] Fine to coarse GRAVEL with minor silt and minor sand; yellowish brown. Well graded, angular to rounded, greywacke; sand is fine to coarse.									
1.0				SILT with minor sand and trace gravel; yellowish brown with orange and grey mottles. Low plasticity; sand is fine; gravel is fine to medium, subangular to subrounded, greywacke.					Firm to Stiff				
1.5										3/3//3/3/2/2 N=10			
2.0	ALLUVIUM/COLLUVIUM		GM	Silty fine to coarse GRAVEL with some sand; yellowish brown. Well graded, angular to subangular, greywacke; sand is fine to coarse.					Loose				
2.5													
3.0										1/1//1/2/2/2 N=7			
3.5			ML	SILT; brown. Low plasticity.					Firm				
			GP	Sandy fine GRAVEL with minor silt; dark orange brown. Poorly graded, angular to subrounded,				M	Loose*				
			ML	greywacke; sand is fine to coarse.					Firm*				
4.0			GW	SILT with some sand; greyish brown. Low plasticity; sand is fine.					Loose*				
			ML	Fine to coarse GRAVEL with some silt and some sand; dark greyish brown. Well graded, angular to subrounded, greywacke; sand is fine to coarse.					Firm*				
4.5				SILT; light grey. Low plasticity.									
			GP	Fine GRAVEL with minor silt and sand; bluish grey. Poorly graded, angular, greywacke; sand is fine to coarse.					Loose	2/1//2/2/2/1 N=7			
5.0			ML	SILT; light grey. Low plasticity.					Firm*				
5.5													
6.0			GP	Fine to medium GRAVEL with some sand and minor silt; light grey. Poorly graded, angular, greywacke; sand is fine to coarse.					Dense to Very Dense	8/12//12/24/14 for 30 mm N=50+			
6.5			GW	Fine to coarse GRAVEL with some sand and minor silt; light grey. Well graded, angular, greywacke; sand is fine to coarse.									
7.0			SP						Medium				

Machine borehole met target depth at 19.675 m.
*Inferred based on diagnostic properties.

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH06

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 07/09/21
Hole Depth : 19.675 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.103291
Longitude : 175.134098

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
7.5	ALLUVIUM/COLLUVIUM		SP	Fine to medium SAND with minor silt and trace gravel; grey. Poorly graded; gravel is fine to medium, rounded, greywacke.				M	Dense Medium Dense	0/1//2/6/8/11 N=27			
8.0			GW	Sandy fine to coarse GRAVEL with minor silt; dark grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.				M-W	Medium Dense				
9.0			-	Core loss - no recovery.	NR				-	5/4//2/2/3/4 N=11			
9.5			SM	Silty fine SAND; light bluish grey with reddish brown and yellowish brown mottles. Poorly graded.					Loose to Medium Dense*				
10.0			ML	SILT; light bluish grey. Low plasticity.									
10.5			ML	Sandy SILT with trace gravel; light bluish grey. Low plasticity; sand is fine; gravel is fine to coarse, angular, greywacke.					Very Stiff	2/4//5/7/6/6 N=24			
11.0			ML	SILT; grey. Low plasticity.									
11.5			ML	Sandy SILT with minor gravel; light grey. Low plasticity; sand is fine; gravel is fine to medium, subangular to subrounded, greywacke.				M	Very Stiff	2/3//3/5/5/3 N=19			
12.0			ML	SILT with minor sand; light bluish grey. Low plasticity; sand is fine.									
12.5			ML	SILT with minor sand and gravel; light bluish grey speckled with white. Low plasticity; sand is fine.					Stiff to Very Stiff*				
13.0			ML	SILT; light bluish grey. Low plasticity.									
13.5			ML	SILT with minor sand and gravel; light bluish grey. Low plasticity; sand is fine to coarse; gravel is fine to medium, subangular to subrounded, greywacke.					Stiff	1/1//3/4/4/4 N=15			
14.0													

Machine borehole met target depth at 19.675 m.
*Inferred based on diagnostic properties.

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH06

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 07/09/21
Hole Depth : 19.675 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.103291
Longitude : 175.134098

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
14.5	ALLUVIUM/COLLUVIUM		ML	Sandy SILT; light bluish greyish brown. Low plasticity; sand is fine.					Stiff				
			ML	SILT; light brown. Low plasticity.									
			ML	SILT with minor sand and gravel; light bluish grey. Low plasticity; sand is fine to coarse; gravel is fine, subangular to subrounded, greywacke.					Loose to Medium Dense				
			SM										
			ML										
15.0				Silty fine to coarse SAND with some gravel; bluish grey. Well graded; gravel is fine to medium, angular to subrounded, greywacke.									
				SILT; grey. Low plasticity.					Stiff	0/2//2/4/4/3 N=13			
15.5													
			ML	SILT; brown. Low plasticity.									
16.0			ML	Sandy SILT with minor gravel; light grey. Low plasticity; sand is fine to coarse; gravel is fine, subangular, greywacke.					*				
			ML	SILT with some sand; grey. Low plasticity; sand is fine.									
16.5			ML	SILT with some sand and gravel; grey. Low plasticity; sand is fine to coarse; gravel is fine to medium, subangular, greywacke.				M		2/3//4/4/5/4 N=17			
17.0													
17.5									Stiff to Very Stiff				
18.0										3/5//6/4/4/2 N=20			
18.5													
19.0			ML	Gravelly SILT; grey. Low plasticity; gravel is fine to medium, angular to subangular, greywacke.					Hard				
19.5										5/28//50 for 25 mm N=50+			

End of Hole Depth: 19.675 m
Termination: Target depth

Machine borehole met target depth at 19.675 m.
*Inferred based on diagnostic properties.

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH07

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 08/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.103244
Longitude : 175.132242

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	TS		ML	[TOPSOIL] SILT with trace gravel and rootlets; brown. Low plasticity; gravel is fine, subrounded to rounded, greywacke.									
	F		ML						Soft to Firm*				
0.5	BTS		ML	[FILL] SILT; light brown with orange mottles. Low plasticity.									
	ALLUVIUM/COLLUVIUM		ML	[BURIED TOPSOIL] Organic SILT with minor sand; dark brown. Low plasticity; sand is fine.									
1.0				SILT; light yellowish brown with orange mottles. Low plasticity.					Soft to Firm				
1.5			GP	Sandy fine to medium GRAVEL with minor silt; brownish grey. Poorly graded, angular to subangular, greywacke; sand is fine to coarse.						1/1//1/3/3/3 N=10			
2.0									Loose				
2.5													
3.0				2.9 m - Orange brown mottles.									
			ML	SILT; grey. Low plasticity.						3/5//1/2/1/2 N=6			
3.5				3.7 to 3.8 m - Trace organics/amorphous peat lenses.				M	Firm				
4.0			SM	Silty fine SAND; grey. Poorly graded.					Loose*				
			ML	Sandy SILT; grey speckled with white. Low plasticity; sand is fine.					Firm				
4.5			GP	Sandy fine to medium GRAVEL with some silt; dark grey. Poorly graded, angular to subangular, greywacke; sand is fine.						2/5//7/5/4/4 N=20			
5.0									Medium Dense				
			ML	SILT with some sand and trace organics; grey with dark brown veins. Low plasticity.									
5.5				5.7 m - 10 mm thick lens of fine to coarse SAND; grey. Well graded.					Loose to Medium Dense*				
6.0			GP	Fine to medium GRAVEL with some sand; grey. Poorly graded, subangular to subrounded, greywacke; sand is coarse.					Medium Dense	1/1//6/8/9/5 N=28			
			ML										
6.5				SILT; grey speckled with white. Low plasticity.					Stiff to Very Stiff				
7.0													

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL
F = FILL
BTS = BURIED TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH07

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 08/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.103244
Longitude : 175.132242

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
7.5	ALLUVIUM/COLLUVIUM		ML	SILT; grey speckled with white. Low plasticity. 7.3 m - Trace organics encountered.					Stiff to Very Stiff	2/5//3/2/2/3 N=10			
8.0			GM	Silty fine to medium GRAVEL with some sand; bluish grey. Poorly graded, angular to subrounded, greywacke; sand is fine to coarse.					Loose to Medium Dense				
8.5			ML	SILT; bluish grey. Low plasticity. 8.6 m - 10 mm thick organic silt lens.					Firm to Stiff*				
9.0			ML	Sandy SILT; bluish grey. Low plasticity; sand is fine.					Very Stiff	9/12//12/16/14/8 for 40 mm N=50+			
9.5			SW	Gravelly fine to coarse SAND; bluish grey. Well graded; gravel is fine to medium, subangular to subrounded, greywacke.					Dense to Very Dense				
10.0			GM	Silty sandy fine to medium GRAVEL; grey. Poorly graded, angular to subrounded, greywacke; sand is fine to coarse.					Dense				
10.5								M		6/13//12/13/8/7 N=40			
11.0			ML	SILT; grey. Low plasticity.					Very Stiff to Hard				
11.5			OL SW	Organic SILT with some sand and trace gravel; brownish grey. Low plasticity; sand is fine to coarse; gravel is fine to medium, subangular to subrounded, greywacke. Gravelly fine to coarse SAND with some silt; grey. Well graded. Gravel is fine to medium, subangular to subrounded.					Medium Dense*				
12.0			SM	Silty fine SAND; grey. Poorly graded.					Medium Dense	1/2//3/4/5/8 N=20			
12.5			GM	Silty fine to medium GRAVEL with some sand; grey. Poorly graded, angular to subrounded, greywacke; sand is fine to coarse.									
13.0									Medium Dense*				
13.5			ML	SILT with some sand; grey speckled with white. Low plasticity; sand is fine.					Hard	6/8//9/10/8/6 N=33			
14.0													

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

F = FILL
BTS = BURIED TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH07

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 08/09/21
Hole Depth : 19.95 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.103244
Longitude : 175.132242

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
14.5	ALLUVIUM/COLLUVIUM		ML	SILT with some sand; grey speckled with white. Low plasticity; sand is fine.					Hard				
15.0			ML	Sandy SILT; grey. Low plasticity; sand is fine.					Hard	12/38 for 70 mm N=50+			
15.5			GM	Silty fine to medium GRAVEL with some sand; grey with red and greenish grey mottles. Poorly graded, angular to subangular, greywacke; sand is fine to coarse.					Very Dense				
16.0													
16.5										18/32 for 75 mm N=50+			
17.0			ML	SILT brownish grey. Low plasticity.				M	Very Stiff to Hard*				
17.5			GW	Fine to coarse GRAVEL with some silt and sand; brownish grey. Well graded, angular to subrounded; sand is fine to coarse.					Dense*				
18.0			ML	Sandy SILT; brownish grey. Low plasticity; sand is fine to coarse.					Very Stiff	10/8//5/6/5/7 N=23			
18.5			ML	SILT; brownish grey. Low plasticity.									
19.0			SM	SILT with some gravel and sand; brownish grey. Low plasticity; gravel is fine to medium, angular to subrounded, greywacke; sand is fine to coarse.					Medium Dense*				
19.5			ML	SILT with trace sand; grey. Low plasticity; sand is fine to coarse.					Very Stiff	1/1//3/6/5/15 N=29			
				Silty fine to coarse SAND with some gravel; grey. Well graded; gravel is fine to medium, subangular to subrounded, greywacke and chert.									
				SILT with trace sand; grey. Low plasticity; sand is fine to medium.									

End of Hole Depth: 19.95 m
Termination: Target depth

Machine borehole met target depth at 19.95 m.
*Inferred based on diagnostic properties.
T = TOPSOIL

F = FILL
BTS = BURIED TOPSOIL

GEOTECH MACHINE BORING BH LOGS BH01 - BH07 - FINAL.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH08

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 08/09/21
Hole Depth : 19.54 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF+MR / CM
Latitude : -41.102647
Longitude : 175.130689

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	T		ML	[TOPSOIL] SILT with trace sand and rootlets; light greyish brown. Low plasticity; sand is fine.					Soft*				
	ALLUVIUM/COLLUVIUM		ML	SILT with trace gravel and rootlets; light brown. Low plasticity; gravel is fine to medium, angular, greywacke. 0.65 m - Rootlets cease.					Soft*				
1.0			ML	SILT with trace sand; light brownish grey. Low plasticity; sand is fine.					Firm to Stiff	0/2//1/3/3/3 N=10			
3.0								M		0/0//1/1/2/2 N=6			
3.5			ML	Sandy SILT; greyish brown.Low plasticity; sand is fine.					Stiff*				
4.0			SP	Fine to medium SAND with some silt; dark grey. Poorly graded.					Loose to Medium Dense*				
4.5			ML	SILT with some sand; grey. Low plasticity; sand is fine.					Stiff	1/2//2/3/3/3 N=11			
5.0			GP	Sandy fine to medium GRAVEL with trace silt; grey. Poorly graded, angular to subangular, greywacke; sand is fine.					Loose*				
			ML						Stiff*				
5.5			GP						Loose*				
			ML	Sandy SILT; grey. Low plasticity; sand is fine. Sandy fine to medium GRAVEL with trace silt; dark grey. Poorly graded, subangular to subrounded, greywacke; sand is fine to coarse.					Stiff*				
6.0			GP	Sandy SILT with trace gravel; grey. Low plasticity; sand is fine; gravel is fine to coarse, angular, greywacke.					Medium Dense	1/2//2/3/3/3 N=11			
6.5				Sandy medium to coarse GRAVEL; brownish orange. Poorly graded, angular to subrounded, greywacke; sand is fine to coarse.				D					
			SW						Medium Dense*				
7.0													

Machine borehole met target depth at 19.54 m.
T = TOPSOIL.
* Inferred from diagnostic properties.

GEOTECH MACHINE BORING BH LOGS - BH08 - BH10.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH08

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 08/09/21
Hole Depth : 19.54 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF+MR / CM
Latitude : -41.102647
Longitude : 175.130689

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
7.5	ALLUVIUM/COLLUVIUM		SW	Gravelly fine to coarse SAND with trace silt; light brown. Well graded; gravel is fine to coarse, angular to subangular, greywacke.				D	Medium Dense*	10/40 for 70 mm N=50			
			GP	Sandy medium to coarse GRAVEL with trace silt; light brown. Poorly graded, subangular to subrounded, greywacke; sand is fine to coarse.					Very Dense				
8.0			SP	Gravelly medium to coarse SAND with some silt; light brown. Poorly graded; gravel is fine to medium, angular to subangular, greywacke.				M	Very Dense*				
9.0			GW	Sandy fine to coarse GRAVEL with some silt; light brown speckled with white. Well graded, angular to subangular, greywacke; sand is medium to coarse.				D	Very Dense	9/13//7/13/30 for 75mm N=50+			
10.0			SW	Gravelly fine to coarse SAND with some silt; light brown speckled with white. Well graded; gravel is fine to medium, angular to subangular, greywacke.					Dense to Very Dense*				
10.5			ML	SILT with trace sand; brownish orange. Low plasticity; sand is fine.				M	Stiff	1/5//4/3/3/4 N=14			
11.0			SM	Silty fine SAND; light grey. Poorly graded.					Medium Dense*				
11.5			SM	Silty fine to coarse SAND with trace gravel; grey. Well graded; gravel is fine to medium, angular to subangular, greywacke.									
12.0			SP										
			GW	Fine to medium SAND with some silt and gravel; grey. Poorly graded; gravel is fine to coarse, subrounded to rounded, greywacke.					Very Dense	7/12//14/16/20 for 65mm N=50+			
12.5			GM	Fine to coarse GRAVEL with some silt and sand; grey. Well graded, angular to subrounded, greywacke; sand is fine to coarse.									
13.0				Silty fine to medium GRAVEL with some sand; grey. Poorly graded, angular to subangular, greywacke; sand is fine to coarse.				M-W	Very Dense*				
13.5			GW	Fine to coarse GRAVEL with some sand and silt; grey. Well graded, angular to subrounded, greywacke; sand is fine to coarse.					Very Dense	5/14//18/32 for 70mm N=50+			
14.0													

Machine borehole met target depth at 19.54 m.
T = TOPSOIL.
* Inferred from diagnostic properties.

GEOTECH MACHINE BORING BH LOGS - BH08 - BH10.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH08

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 08/09/21
Hole Depth : 19.54 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF+MR / CM
Latitude : -41.102647
Longitude : 175.130689

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
14.5	ALLUVIUM/COLLUVIUM		SW	Fine to coarse SAND with some gravel and silt; grey. Well graded, gravel is fine to coarse, subangular to rounded, greywacke.				M-W	Very Dense*				
			GM	Silty fine to medium GRAVEL with minor sand; grey. Poorly graded, angular to aubangular, greywacke and chert; sand is fine to coarse.				D-M	Very Dense*				
15.0			GW	Sandy fine to coarse GRAVEL with minor silt; grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.					Very Dense	16/34 for 65mm N=50+			
15.5			ML	SILT with some gravel; grey. Low plasticity; gravel is fine to medium, subangular to rounded, greywacke.					Hard*				
			GP						Very Dense*				
16.0			ML	Fine to medium GRAVEL with minor sand and silt; grey. Poorly graded; subrounded to rounded, greywacke; sand is medium to coarse.				M-W	Hard*				
16.5			ML	SILT with some gravel and minor sand; grey. Low plasticity; gravel is fine to coarse, subangular to rounded, greywacke; sand is fine to coarse.						6/8//12/12/26 for 60mm N=50+			
			GW	Fine to coarse GRAVEL with some silt and sand; grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.					Very Dense				
17.0			ML	SILT with minor gravel and trace sand; brown. Low plasticity; gravel is fine to medium, subangular to subrounded; greywacke and chert.									
17.5			ML	SILT with some gravel and minor sand; grey. Low plasticity; gravel is fine to medium, angular to subrounded, greywacke; sand is fine to coarse.				M	Hard*				
			GW	Fine to coarse GRAVEL with minor silt and sand; grey. Well graded, angular to subrounded, greywacke; sand is fine to coarse.				W	Very Dense	9/12//50 for 75mm N=50+			
18.0			ML	SILT with some sand and minor gravel; grey. Low plasticity; gravel is fine to coarse, angular to subrounded, greywacke; sand is fine to coarse.									
18.5								M	Hard				
19.0													
19.5			-	No recovery in SPT.					-	50 for 40mm N=50+			
				End of Hole Depth: 19.54 m Termination: Target depth									

Machine borehole met target depth at 19.54 m.
T = TOPSOIL.
* Inferred from diagnostic properties.

GEOTECH MACHINE BORING BH LOGS - BH08 - BH10.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH09

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 10/09/21
Hole Depth : 19.55 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : MR / CM
Latitude : -41.101653
Longitude : 175.130045

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	T		ML	[TOPSOIL] SILT with some gravel and organics; dark brown. Low plasticity; gravel is fine to coarse, angular to subrounded, greywacke.					Firm to Stiff*				
			ML	SILT with some gravel; brownish orange. Low plasticity; gravel is fine to coarse, angular to subrounded; greywacke.				M	Stiff*				
0.5			ML	Sandy SILT with some gravel; brownish orange. Low plasticity; sand is fine to medium; gravel is fine to coarse, subangular to subrounded, greywacke.									
1.0			GM	Silty fine to coarse GRAVEL with some sand; light brown. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.					Dense*				
1.5	ALLUVIUM/COLLUVIUM							M-W	Very Dense	7/10//28/22 for 35mm N=50+			
2.0			GW	Sandy fine to coarse GRAVEL with minor silt; light brownish grey. Well graded, subangular to subrounded, greywacke; sand is fine to coarse.									
2.5			GP	Sandy medium to coarse GRAVEL with trace silt; light brownish grey. Poorly graded, subangular to subrounded, greywacke; sand is fine to coarse.					Very Dense	6/8//12/20/18 for 50mm N=50+			
3.0													
3.5			SW	Gravelly fine to coarse SAND with trace silt; light brownish grey. Well graded; gravel is fine to coarse, subangular to subrounded, greywacke.				M	Very Dense*				
4.0													
4.5			GW	Sandy fine to coarse GRAVEL with minor silt; light grey. Well graded, subangular to subrounded, greywacke; sand is medium to coarse.						4/8//12/20/14/4 for 75mm N=50+			
5.0													
5.5								M-W	Very Dense				
6.0										6/7//8/34/8 for 10mm N=50+			
6.5													
7.0													

Machine borehole met target depth at 19.55 m.
T = TOPSOIL.
* Inferred from diagnostic properties.

GEOTECH MACHINE BORING BH LOGS - BH08 - BH10.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH09

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 10/09/21
Hole Depth : 19.55 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : MR / CM
Latitude : -41.101653
Longitude : 175.130045

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
7.5	ALLUVIUM/COLLUVIUM		GW	Sandy fine to coarse GRAVEL with minor silt; light grey. Well graded, subangular to subrounded, greywacke; sand is medium to coarse.				M-W	Very Dense	9/41 for 75mm N=50+			
8.0			GW	Sandy fine to coarse GRAVELwith trace silt; light brownish grey. Well graded, angular to subrounded, greywacke; sand is medium to coarse.				S					
8.5								M					
9.0										11/28//37/13 for 20mm N=50+			
9.5									Very Dense				
10.0								W-S					
10.5										13/26//27/23 for 50mm N=50+			
11.0													
11.5			GW	Sandy fine to coarse GRAVEL with some silt; light brown. Well graded, angualr to subrounded, greywacke; sand is fine to coarse.					Very Dense*				
12.0			GW	Sandy fine to coarse GRAVEL with trace silt; light greyish brown. Well graded, angular to subrounded, greywacke; sand is medium to coarse.						10/15//21/29 for 75mm N=50+			
12.5								M	Very Dense				
13.0													
13.5								M-W		16/22//20/30 for 70mm N=50+			
14.0													

Machine borehole met target depth at 19.55 m.
T = TOPSOIL.
* Inferred from diagnostic properties.

GEOTECH MACHINE BORING BH LOGS - BH08 - BH10.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH09

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 10/09/21
Hole Depth : 19.55 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : MR / CM
Latitude : -41.101653
Longitude : 175.130045

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
14.5	ALLUVIUM/COLLUVIUM		SP	Gravelly medium to coarse SAND with some silt; light brownish grey. Poorly graded; gravel is fine to coarse, angular to subangular, greywacke.				M-W	Very Dense	11/13//20/28/2 for 5mm N=50+			
15.0													
15.5								M					
16.0													
16.5			GW	Sandy fine to coarse GRAVEL with trace silt; dark brownish grey. Well graded, subangular to subrounded, greywacke; sand is medium to coarse.						24/26 for 60mm N=50+			
17.0								M-W	Very Dense				
17.5													
18.0			SW	Fine to coarse SAND with some silt; light brown. Well graded.						25/25 for 70mm N=50+			
			GW	Sandy fine to coarse GRAVEL with trace silt; brownish grey. Well graded, subangular to subrounded, greywacke; sand is medium to coarse.				M	Very Dense				
19.0			SP	Gravelly medium to coarse SAND with trace silt; dark brownish grey. Poorly graded; gravel is fine to coarse, angular to subangular, greywacke.					Very Dense				
19.5			-	No recovery in SPT.	N R					50 for 50mm N=50+			
				End of Hole Depth: 19.55 m Termination: Target depth									

Machine borehole met target depth at 19.55 m.
T = TOPSOIL.
* Inferred from diagnostic properties.

GEOTECH MACHINE BORING BH LOGS - BH08 - BH10.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH10

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 09/09/21
Hole Depth : 19.522 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.100448
Longitude : 175.131075

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%)	Notes
0.0	T		ML	[TOPSOIL] SILT with some gravel and rootlets; dark brown. Low plasticity; gravel is fine to coarse, angular to subrounded, greywacke.					Firm to Stiff*				
	ALLUVIUM/COLLUVIUM		ML	SILT with some gravel and trace cobble; yellowish brown. Low plasticity; gravel is fine to coarse, angular to rounded, greywacke; cobble is subrounded with maximum dimension of 80 mm.					Stiff*				
1.0			GW	Fine to coarse GRAVEL with some sand and silt; brown. Well graded, angular to rounded, greywacke; sand is fine to coarse.				M	Very Dense	9/18//28/22 for 55mm N=50+			
2.5								D					
3.0			GW	Fine to coarse GRAVEL with minor silt and sand; brown. Well graded, angular, greywacke; sand is fine to coarse.				M	Dense to Very Dense	5/5//8/12/30 for 75mm N=50+			
4.5										7/7//3/7/3/22 N=45			
5.0			GM	Silty fine to coarse GRAVEL with some sand; brown. Well graded, subangular to rounded, greywacke; sand is fine to coarse.									
			GW	Fine to coarse GRAVEL with some silt and sand; brown. Well graded, angular, greywacke; sand is fine to coarse.				D	Very Dense	8/10//16/34 for 70mm N=50+			
6.5				6.7 - 6.9 m - Colour becomes dark brown.									
7.0													

Machine borehole met target depth at 19.522 m.
T = TOPSOIL.
* Inferred from diagnostic properties.

GEOTECH MACHINE BORING BH LOGS - BH08 - BH10.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH10

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 09/09/21
Hole Depth : 19.522 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.100448
Longitude : 175.131075

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
7.5	ALLUVIUM/COLLUVIUM		GW	Fine to coarse GRAVEL with some silt and sand; brown. Well graded, angular, greywacke; sand is fine to coarse. 7.1 m - Black coating on gravel clasts. 7.5 m - Colour becomes dark brownish orange.				D					
								M		8/42 for 75mm N=50+			
8.0													
8.5													
9.0								D		8/11//12/18/20 for 65mm N=50+			
9.5													
10.0									Very Dense				
10.5										8/10//13/21/16 for 40mm N=50+			
11.0													
11.5													
12.0								D-M		12/20//32/18 for 20mm N=50+			
12.5													
13.0													
13.5										28/22 for 50mm N=50+			
14.0			GW	Sandy fine to coarse GRAVEL with minor silt; brown. Well graded, subrounded to rounded, greywacke; sand is fine to coarse.				M	Very Dense				

Machine borehole met target depth at 19.522 m.
T = TOPSOIL.
* Inferred from diagnostic properties.

GEOTECH MACHINE BORING BH LOGS - BH08 - BH10.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

LOG OF BORING BH10

Gabites Block
Maymorn Road
Maymorn
19071.000.001

Client : Gillies Group Limited
Date : 09/09/21
Hole Depth : 19.522 m
Drilling Method : Rotosonic
Drilling Contractor : Griffiths Drilling Ltd

Core Diameter : 83 mm
Energy Transfer Ratio : 89 %
Logged By/Reviewed By : LF / CM
Latitude : -41.100448
Longitude : 175.131075

Depth (m BGL)	Material	Sample Type	USCS Symbol	DESCRIPTION	Log Symbol	Elevation (mRL)	Water Level	Moisture	Consistency/ Density Index	SPT N-Value	Torvane Shear (kPa)	Total Core Recovery (%) 25 50 75	Notes
14.5	ALLUVIUM/COLLUVIUM		GW	Sandy fine to coarse GRAVEL with minor silt; brown. Well graded, subrounded to rounded, greywacke; sand is fine to coarse.					Very Dense				
15.0			GW	Fine to coarse GRAVEL with some silt and sand; brown. Well graded, angular to subangular, greywacke; sand is fine to coarse.						9/24//33/27 for 75mm N=50+			
15.5				15.6 m - Becomes mottled with light and dark orange brown.					Very Dense				
16.0													
16.5			GW	Fine to coarse GRAVEL with minor sand; brown. Well graded, subangular to rounded, greywacke; sand is coarse.				M		25/25 for 65mm N=50+			
17.0									Very Dense				
17.5			GW	17.3 m - Trace cobble encountered. Maximum cobble dimension is 70 mm.									
				Fine to coarse GRAVEL with minor sand and silt; brown. Well graded, angular to rounded, greywacke; sand is fine to coarse.					Very Dense*				
18.0			GW	Fine to coarse GRAVEL with minor sand; brown. Well graded, angular to rounded, greywacke; sand is fine to coarse.						28/22 for 30mm N=50+			
18.5									Very Dense				
19.0			GW	Fine to coarse GRAVEL with some silt and minor sand; brown. Well graded, angular to rounded, greywacke; sand is fine to coarse.					Very Dense				
19.5			-	No recovery in SPT.					-	50 for 25mm N=50+			
				End of Hole Depth: 19.522 m									
				Termination: Target depth									

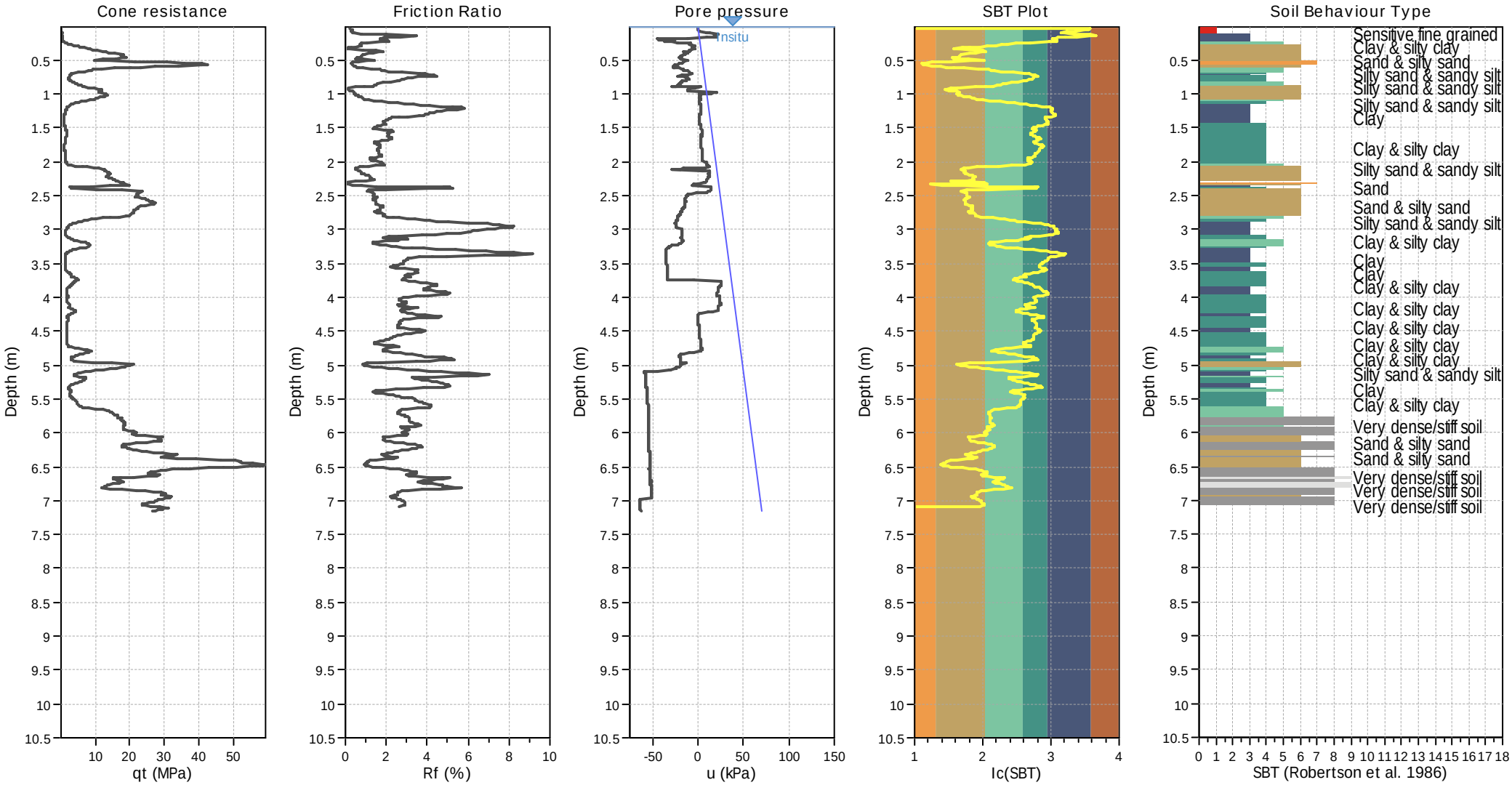
Machine borehole met target depth at 19.522 m.
T = TOPSOIL.
* Inferred from diagnostic properties.

GEOTECH MACHINE BORING BH LOGS - BH08 - BH10.GPJ NZ DATA TEMPLATE 2.GDT 19/10/21

APPENDIX 6:

Cone Penetration Test Plots

CPT basic interpretation plots



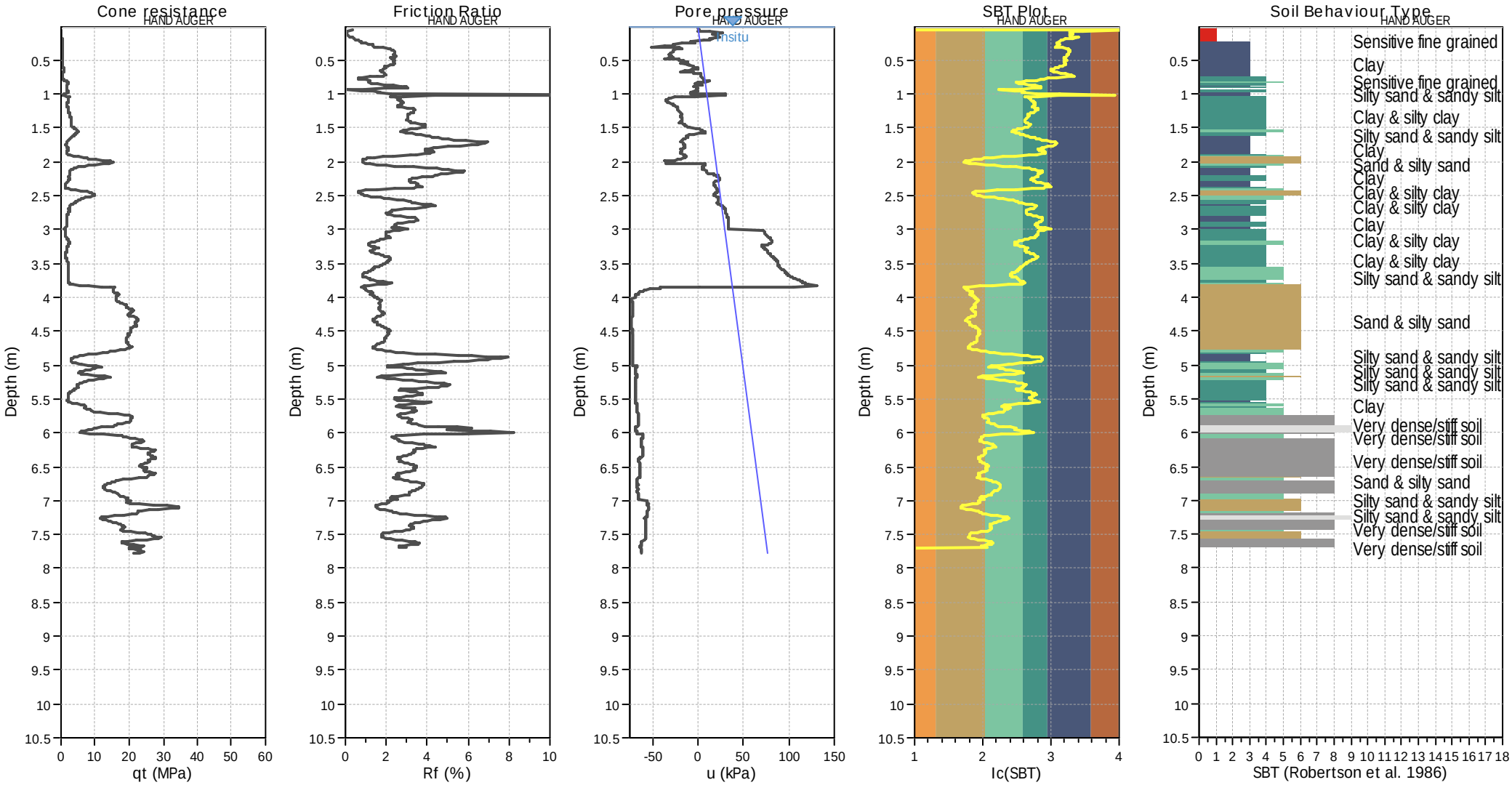
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

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

CPT basic interpretation plots



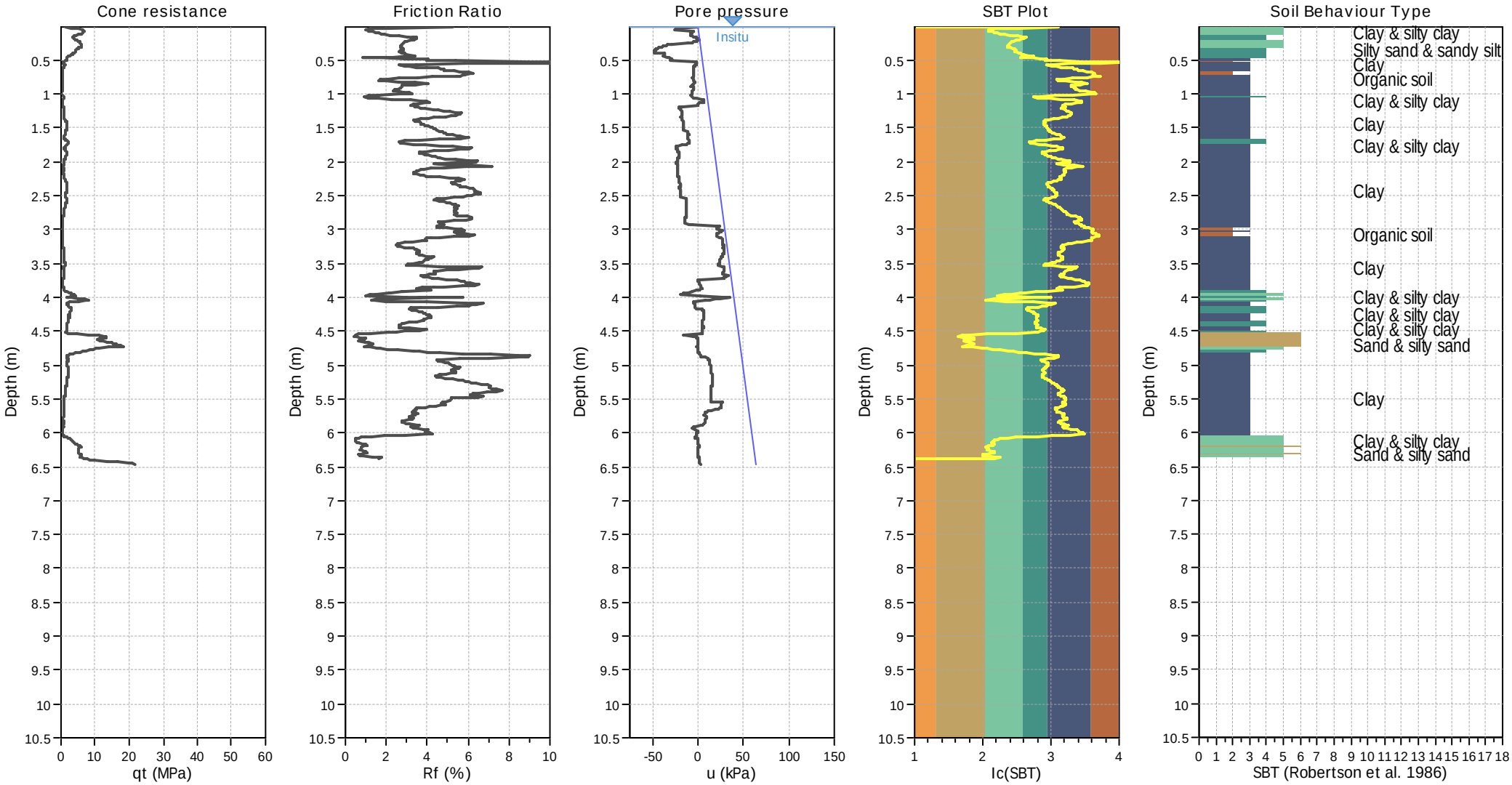
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

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

CPT basic interpretation plots



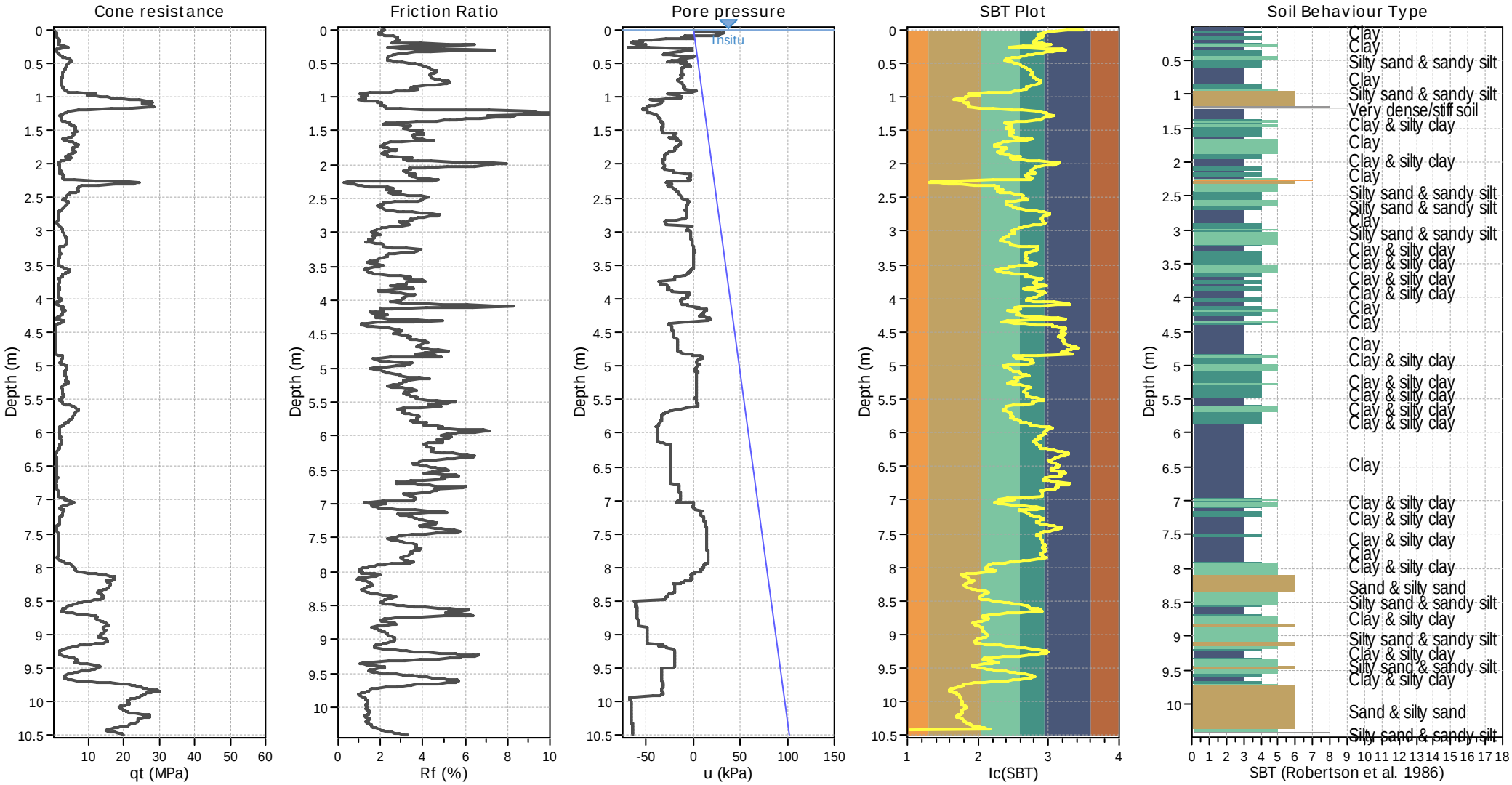
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

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

CPT basic interpretation plots



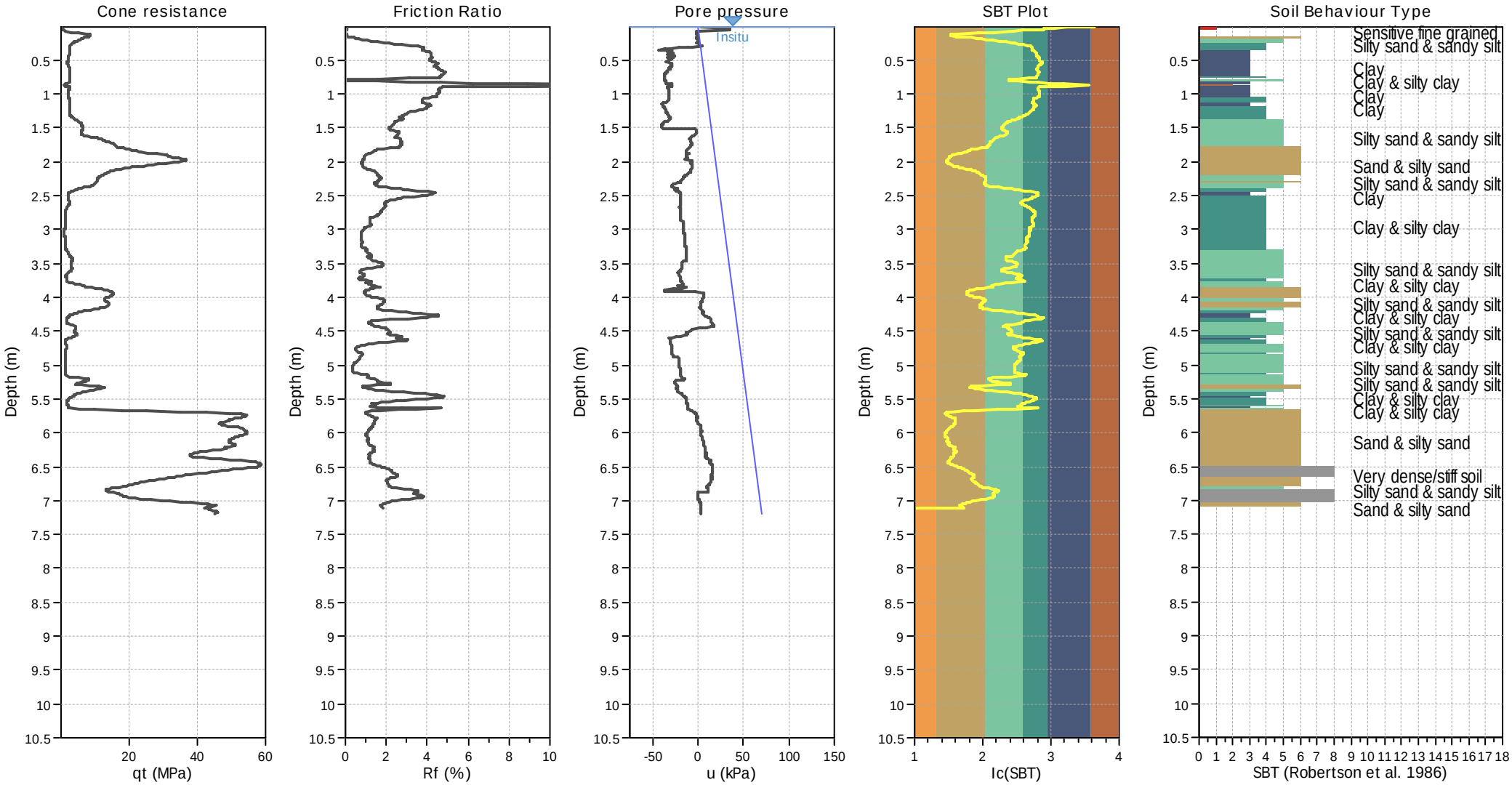
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

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

CPT basic interpretation plots



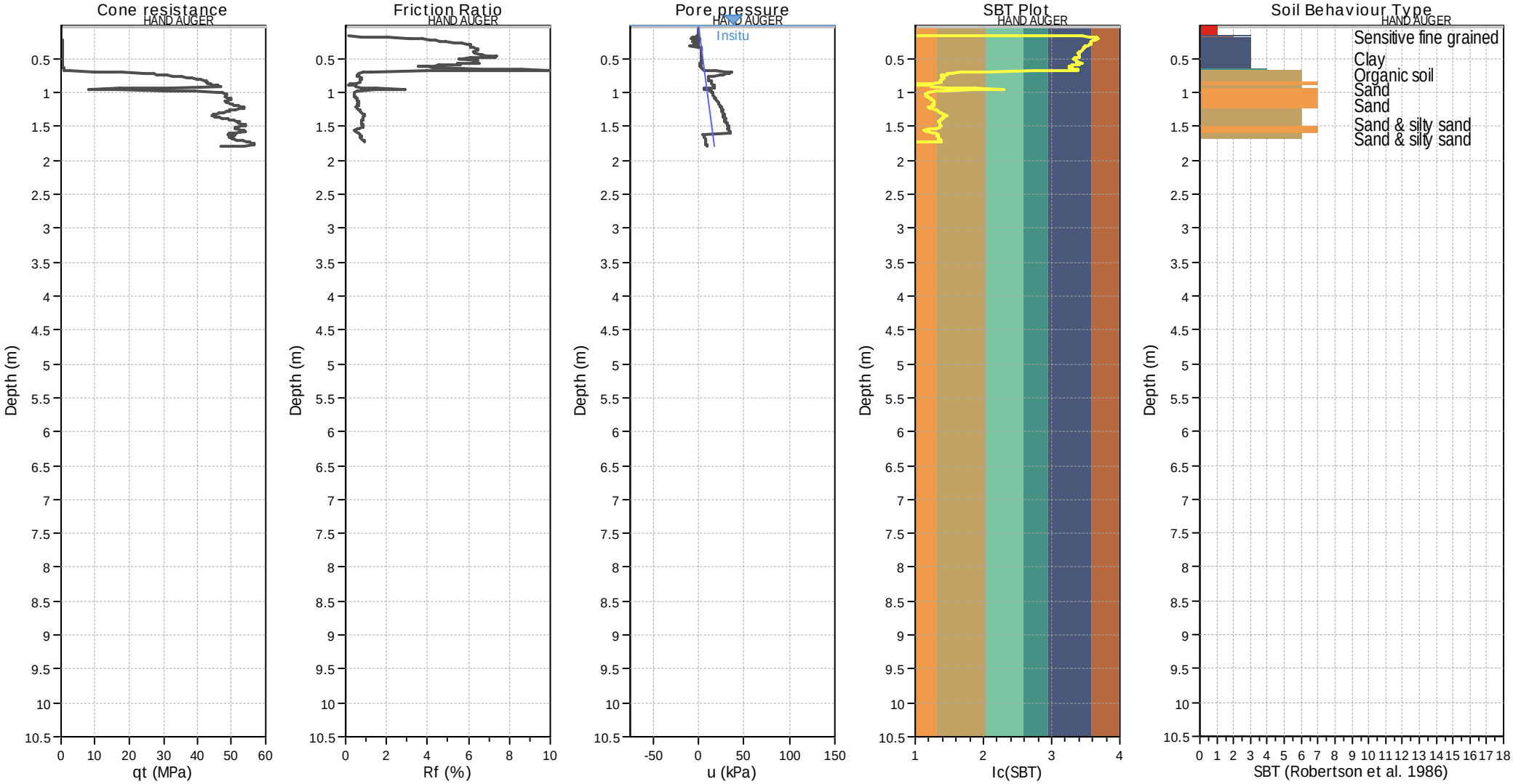
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

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

CPT basic interpretation plots



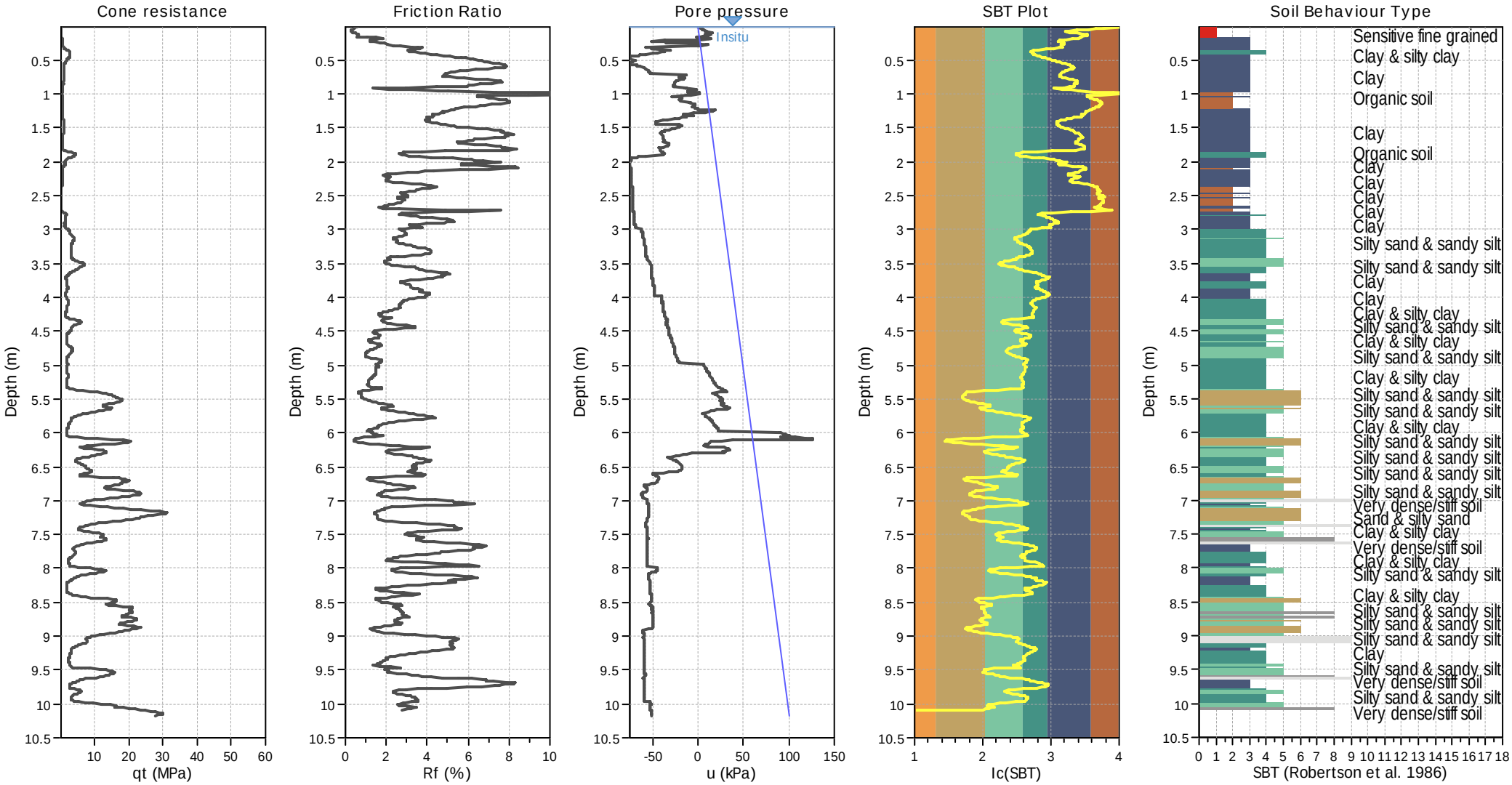
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

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

CPT basic interpretation plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

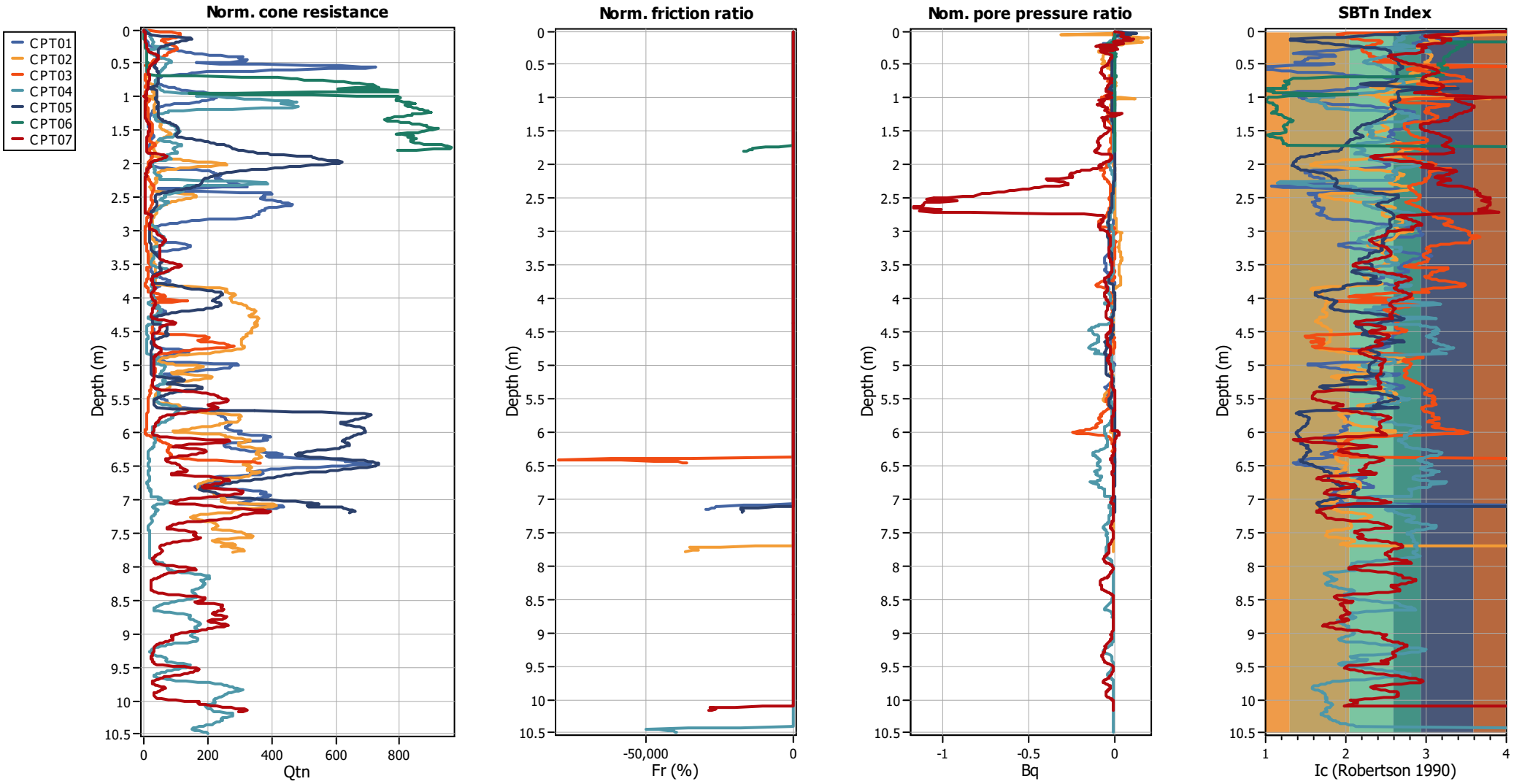
SBT legend

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

ENGEO Ltd
Level 18, Plimmer Tower
2-6 Gilmer Terrace
Wellington 6011

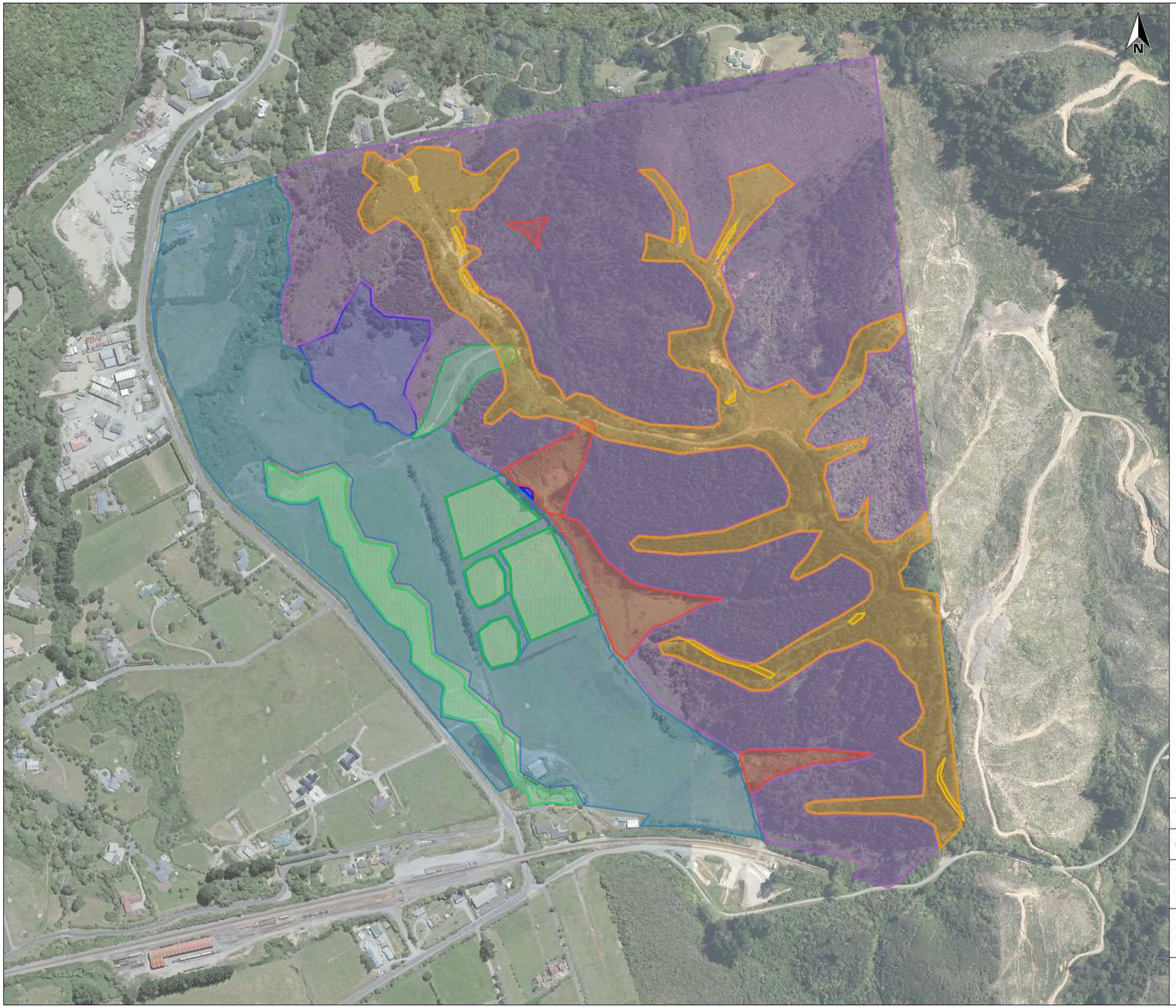
Project: Geotechnical Assessment

Overlay Normalized Plots



APPENDIX 7:

Site Specific Geological Map



Legend

- Sandstone (Greywacke)
- Shallow Sandstone (less than 3 m to rock)
- Alluvium
- Colluvium (rock more than 3 m from surface)
- Fill (more than 1 m thick)
- Variable Colluvium / Alluvium
- Landslide Debris

0 50 m 100 m

ENGEO

Produced by **Datanest.earth**

Title: Site Specific Geological Mapping		
Client: Gillies Group Ltd		Figure No: Size: A3
Project: Gabites Block, Upper Hutt	Drawn: LF	
Date: 29-07-2021	Checked:	
Proj No: 19071.000.001	Scale: 1:6000	Version:

APPENDIX 8:

Geological Cross Sections

GEOLOGICAL CROSS SECTION A-A'

A (Southwest)

A' (Northeast)

ELEVATION (m)

GREYWACKE SANDSTONE

COLLUVIUM

BH02

COLLUVIUM

COLLUVIUM

ALLUVIUM

SPT (N) VALUE VS DEPTH

KEY

INFERRED GROUNDWATER

SILT

GRAVEL/SAND

COLLUVIUM

GREYWACKE SANDSTONE

?—?—? INFERRED GEOLOGICAL BOUNDARY

0 5 10 15 20(m) 1:500@A3 (Vertical

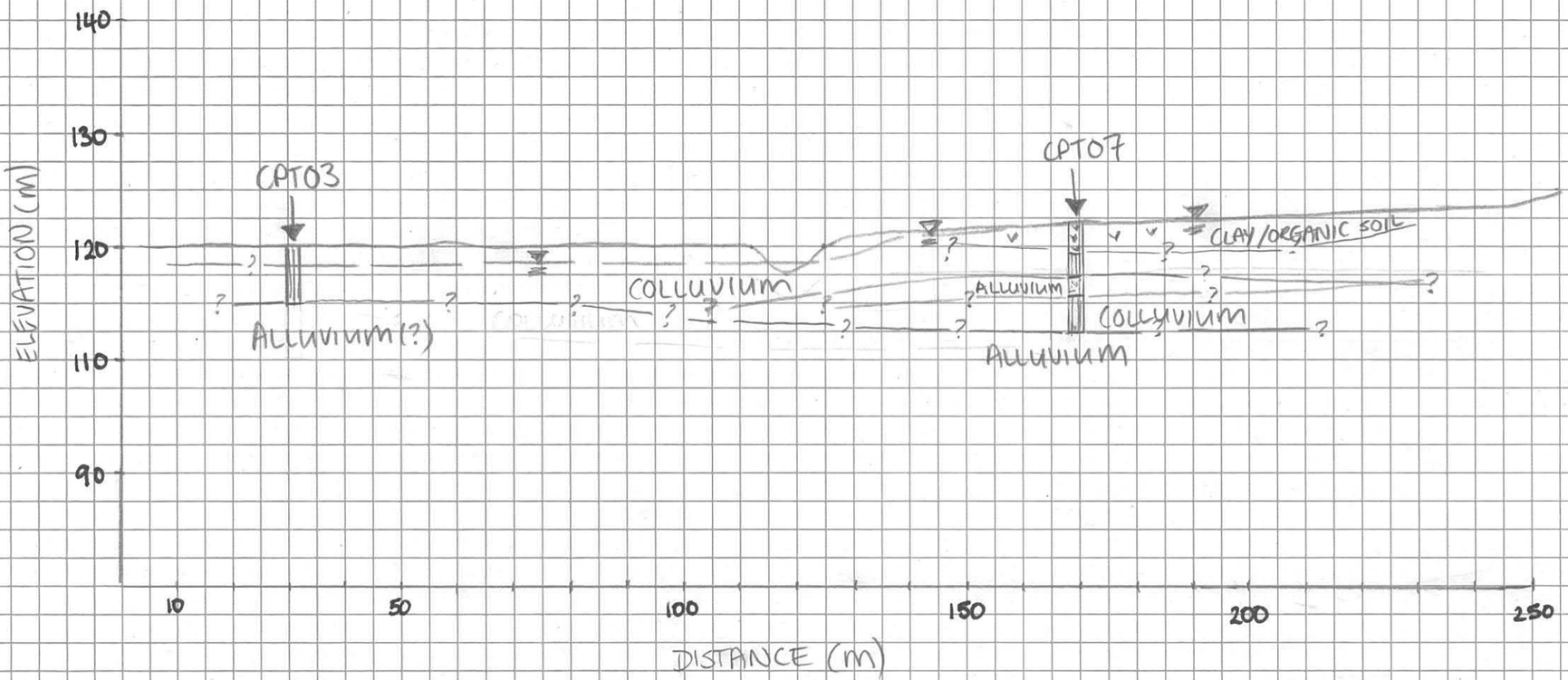
0 10 20 30 40 50(m) 1:1000@A3 (Horizontal)

DISTANCE (m)

GEOLOGICAL CROSS SECTION B-B'

B (Southwest)

B' (Northeast)



KEY

INFERRED GROUNDWATER

CLAY/ORGANIC SOIL

SILT/CLAY

INFERRED GEOLOGICAL BOUNDARY

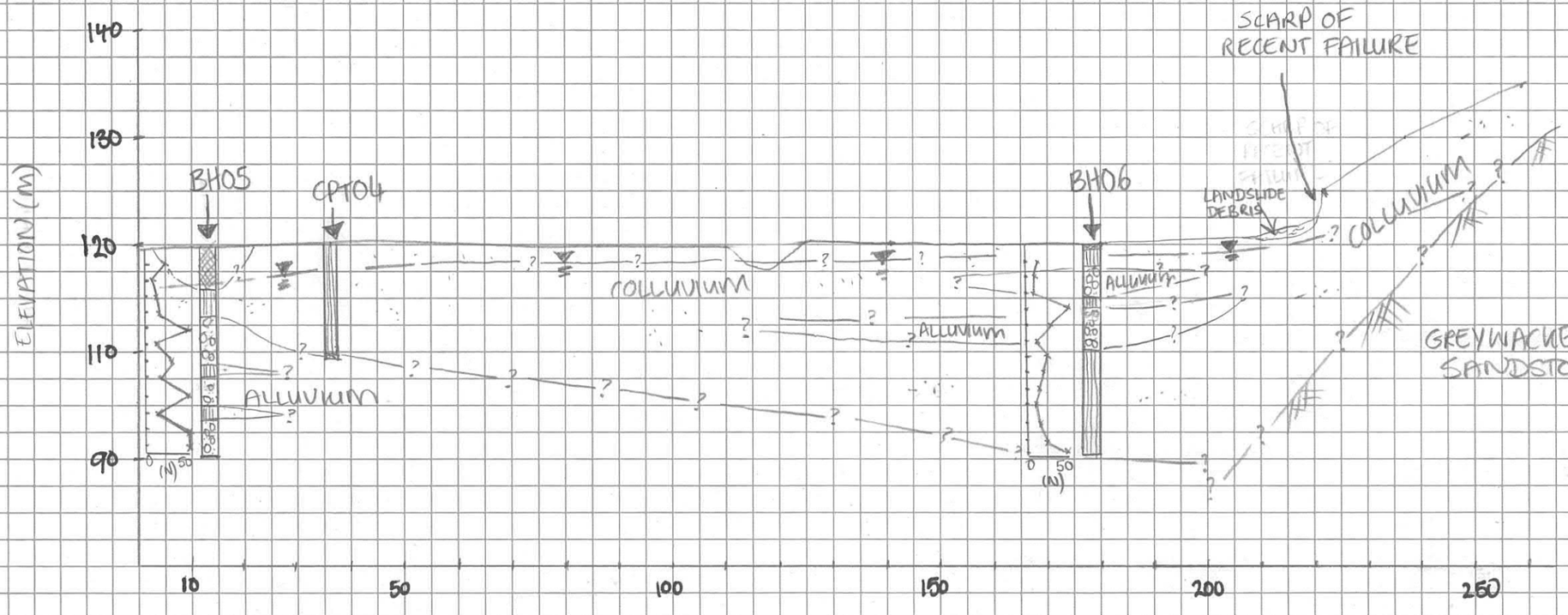
0 5 10 15 20 (m) 1:500@A3 (Vertical)

0 10 20 30 40 50 (m) 1:1000@A3 (Horizontal)

GEOLOGICAL CROSS SECTION C–C'

C (Southwest)

C' (Northeast)



KEY

SPT (N) VALUE VS DEPTH

0 50

- FILL
- SILT/CLAY
- GRAVEL/SAND
- COLLUVIUM
- ALLUVIUM
- GREYWACKE SANDSTONE

INFERRED GROUNDWATER

—?— INFERRED GEOLOGICAL BOUNDARY

LANDSLIDE DEBRIS

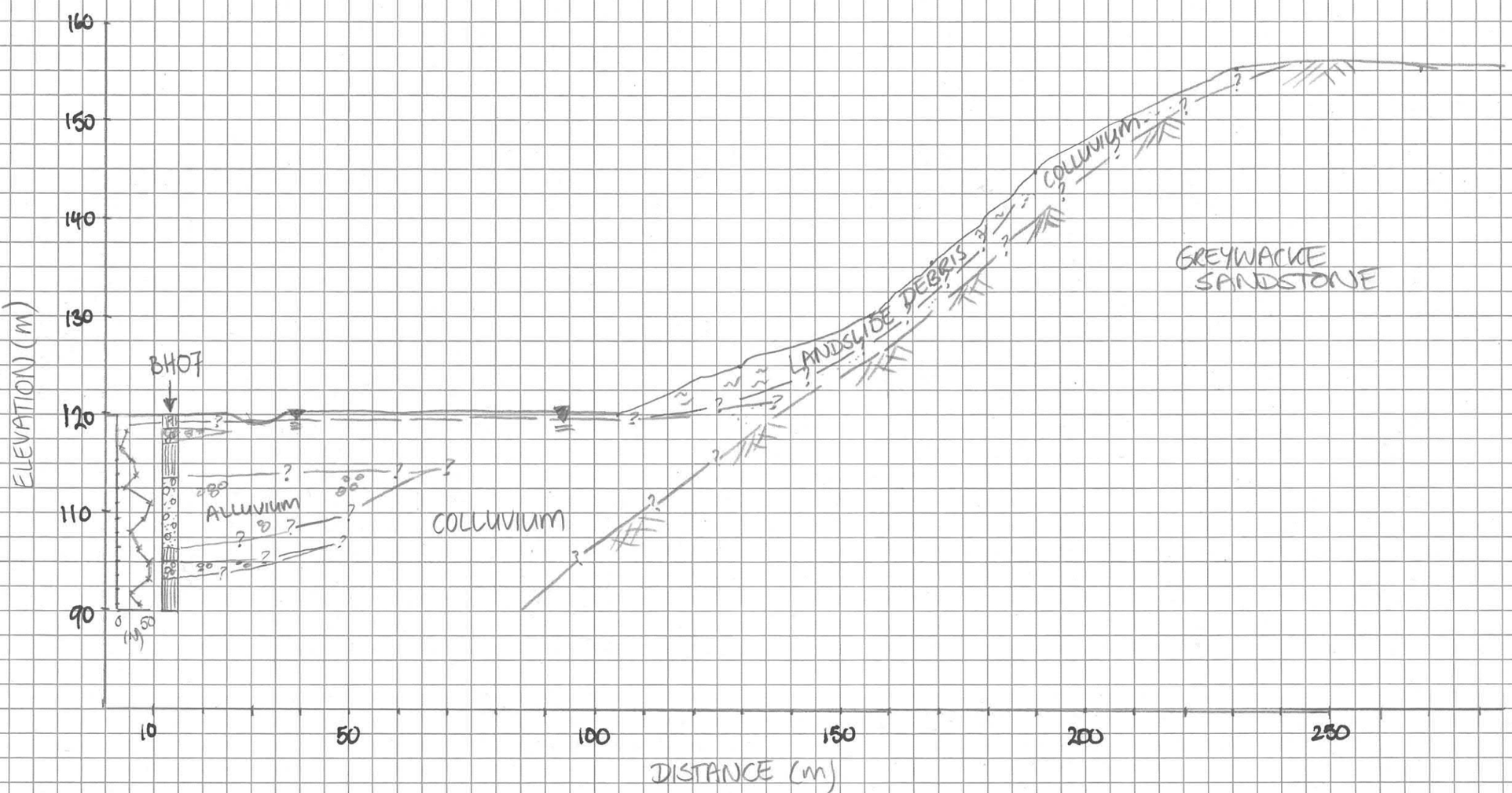
0 5 10 20 30 (m) 1:500 @ A3 (Vertical)

0 10 20 30 40 50 (m) 1:1000 @ A3 (Horizontal)

GEOLOGICAL CROSS SECTION D-D'

D (Southeast)

D' (Northeast)



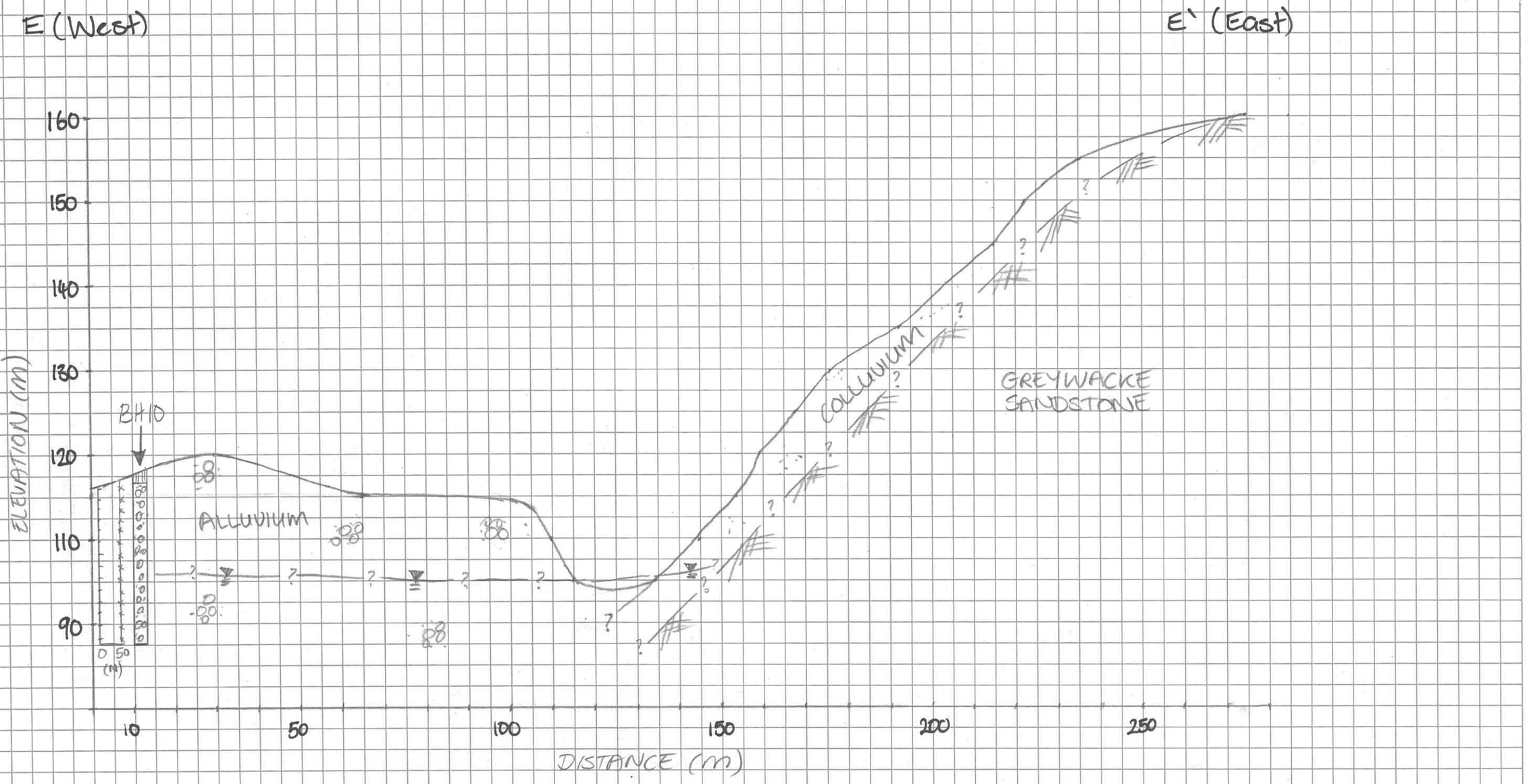
KEY

- SILT
- GRAVEL/SAND
- COLLUVIUM
- ALLUVIUM
- LANDSLIDE DEBRIS
- GREYWACKE SANDSTONE
- INFERRED GROUNDWATER
- ?—?—? INFERRED GEOLOGICAL BOUNDARY

0 5 10 20 30 (m) 1:500@A3 (Vertical)

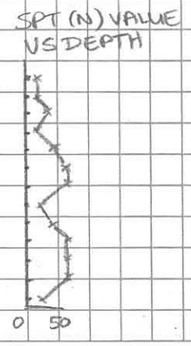
0 10 20 30 40 50(m) 1:1000@A3 (Horizontal)

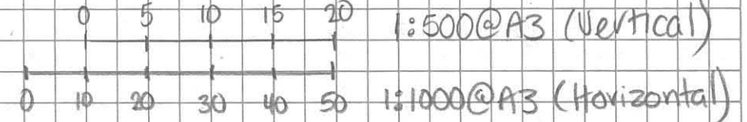
GEOLOGICAL CROSS SECTION E-E`



KEY

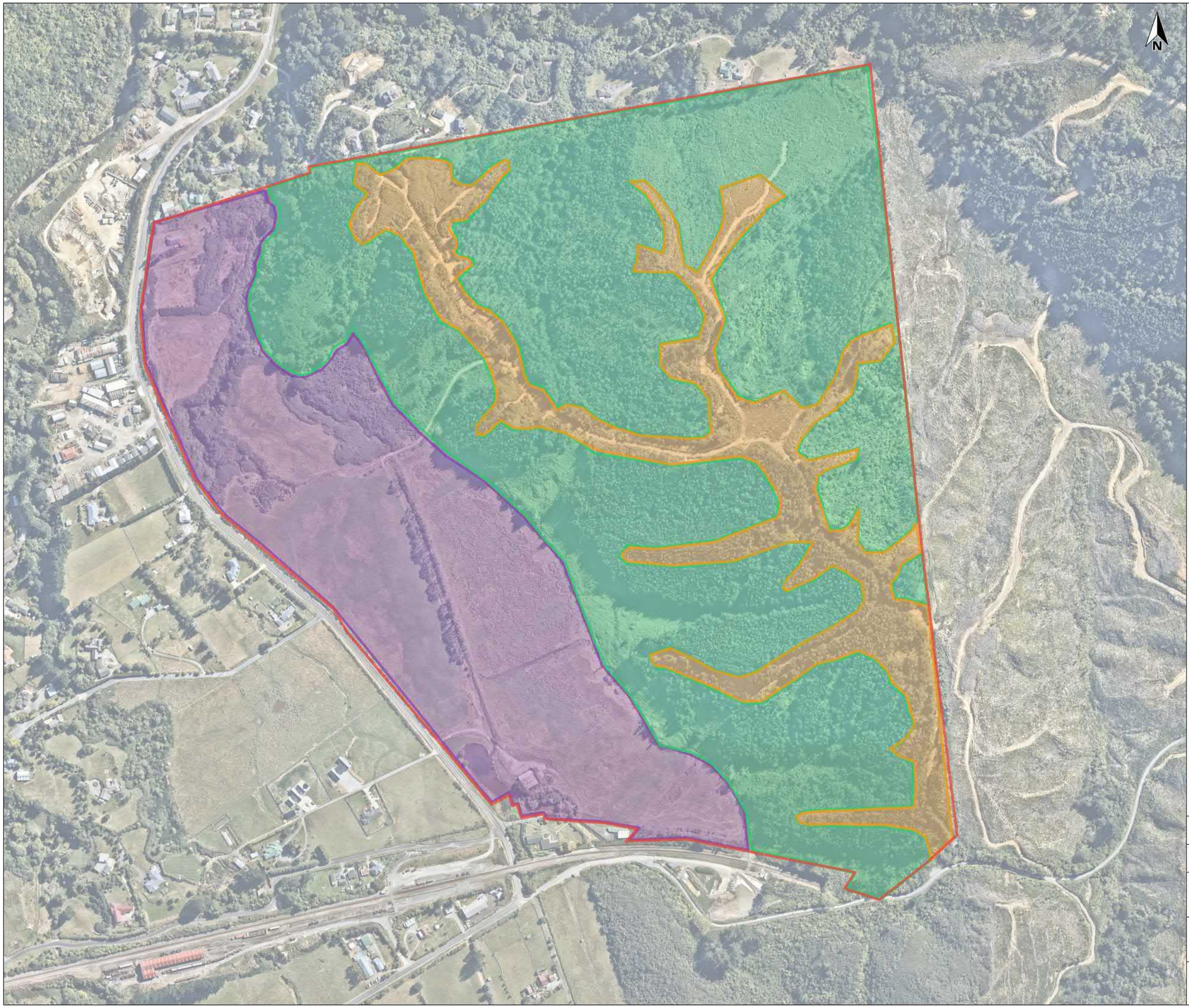
- SILT
- GRAVEL/SAND
- COLLUVIUM
- ALLUVIUM
- INFERRED GROUNDWATER
- ?—?—? INFERRED GEOLOGICAL BOUNDARY





APPENDIX 9:

Site Subsoil Class Map



Legend

- Site Boundary
- Inferred Class B - Rock
- Inferred Class C - Shallow Soil
- Inferred Class D - Deep Soil

0 50 m 100 m

ENGEO

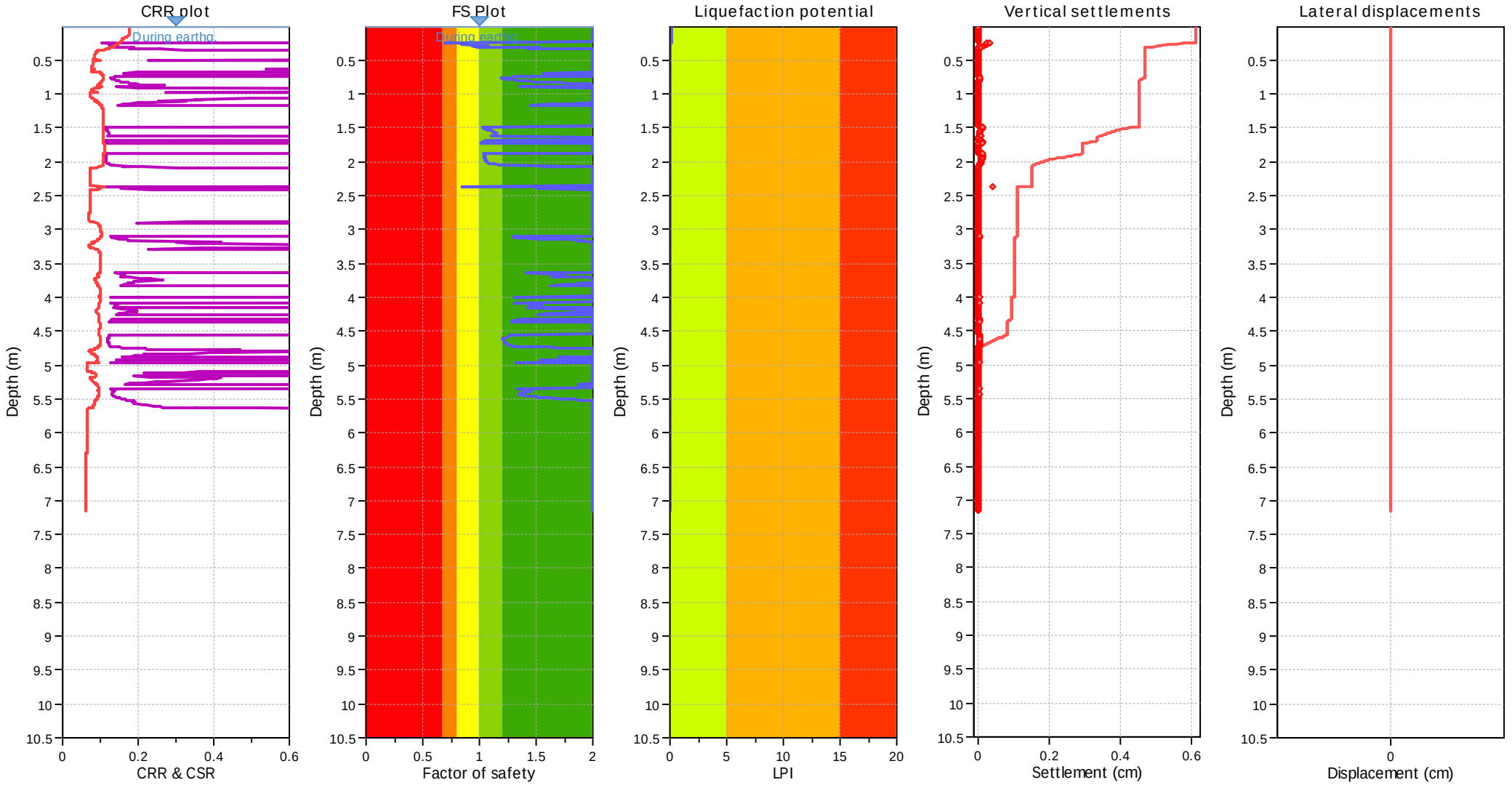
Produced by **Datanest.earth**

Title: Seismic Site Subsoil Class		
Client: Gillies Group Ltd		Figure No:
Project: Gabites Block, Upper Hutt	Drawn: LF	Size: A3
Date: 29-07-2021	Checked:	
Proj No: 19071.000.001	Scale: 1:6000	Version:

APPENDIX 10:

Liquefaction Analysis Results

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	6.25	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.09	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

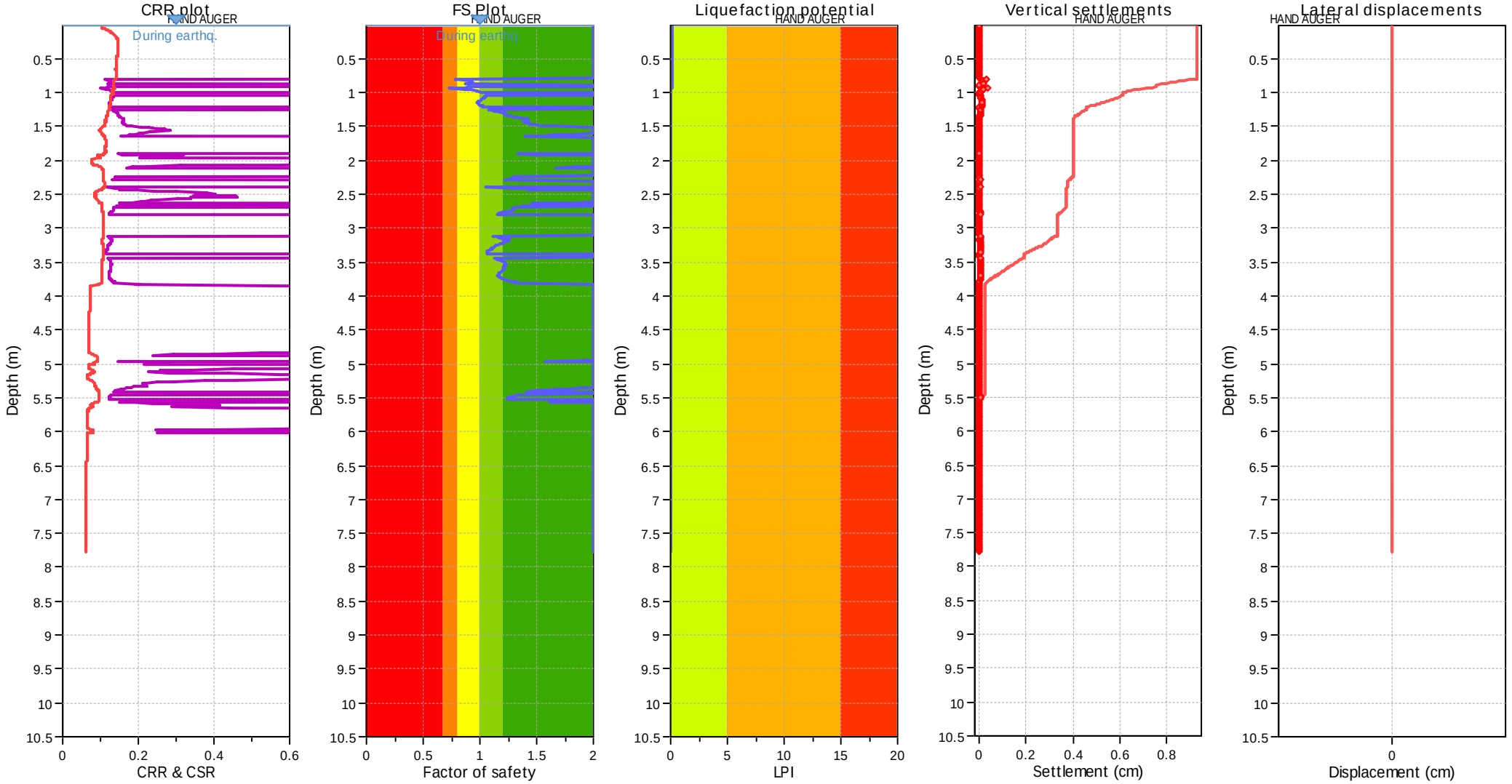
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
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LPI color scheme

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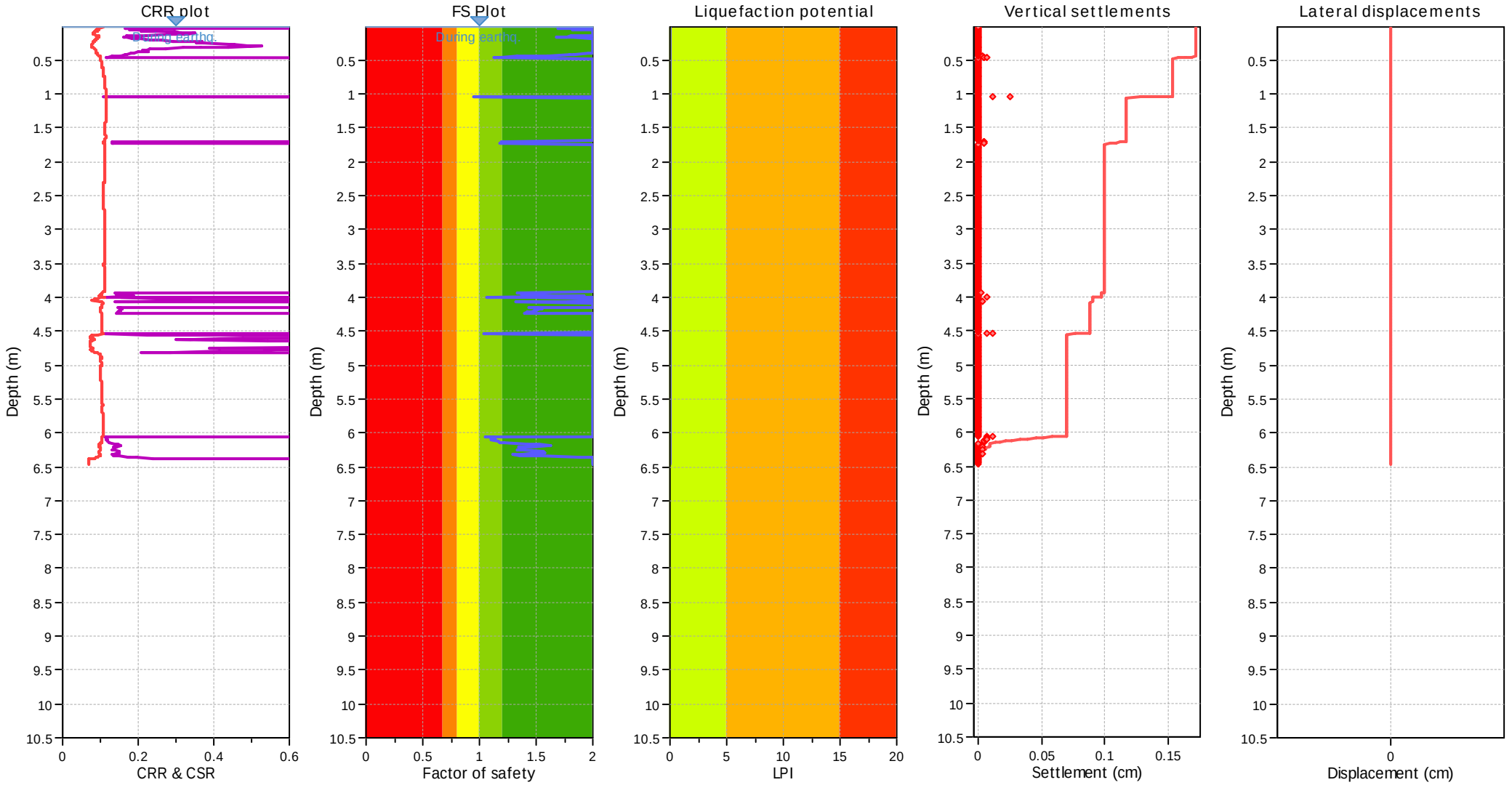
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	6.25	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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LPI color scheme

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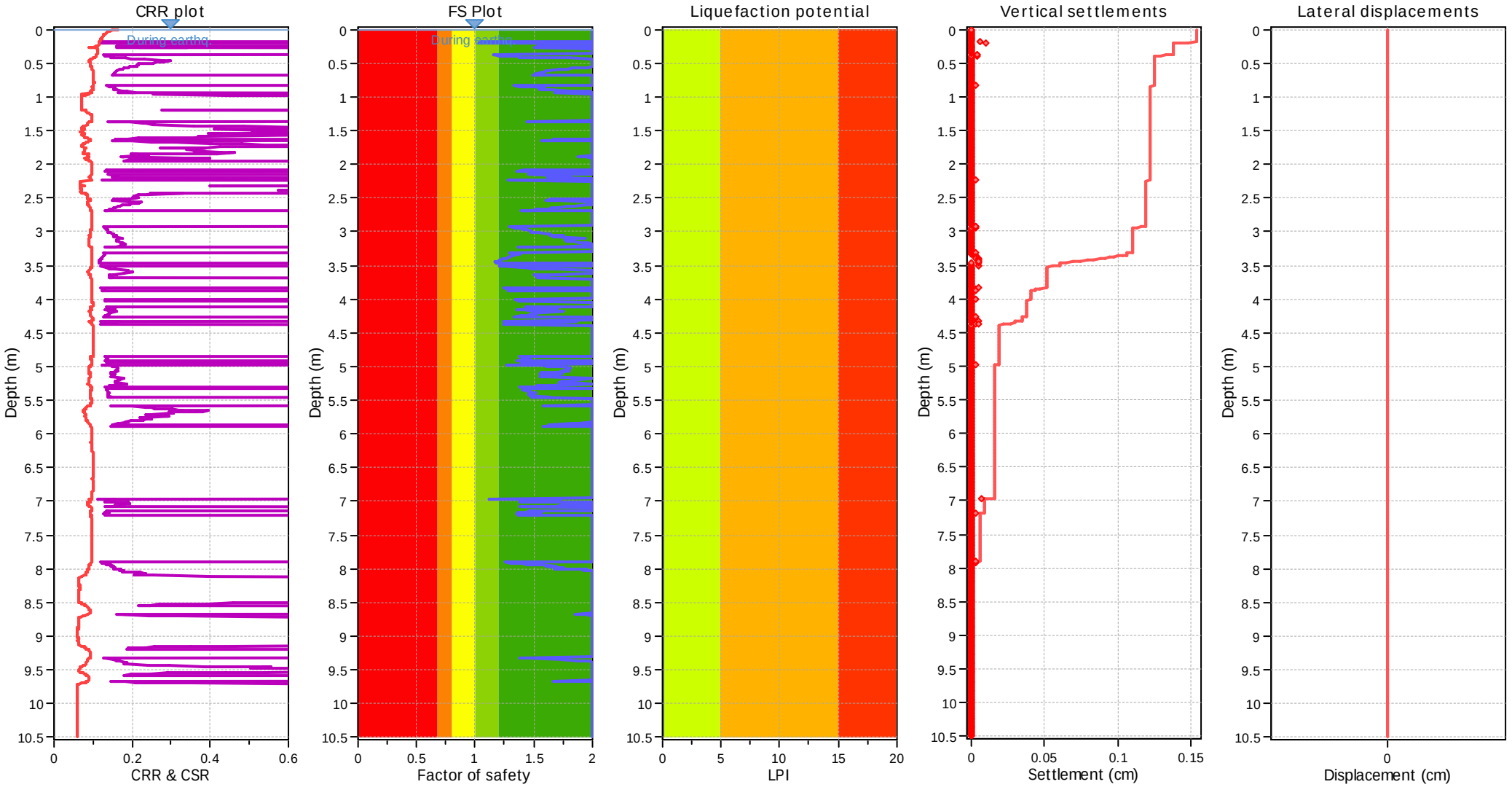
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	6.25	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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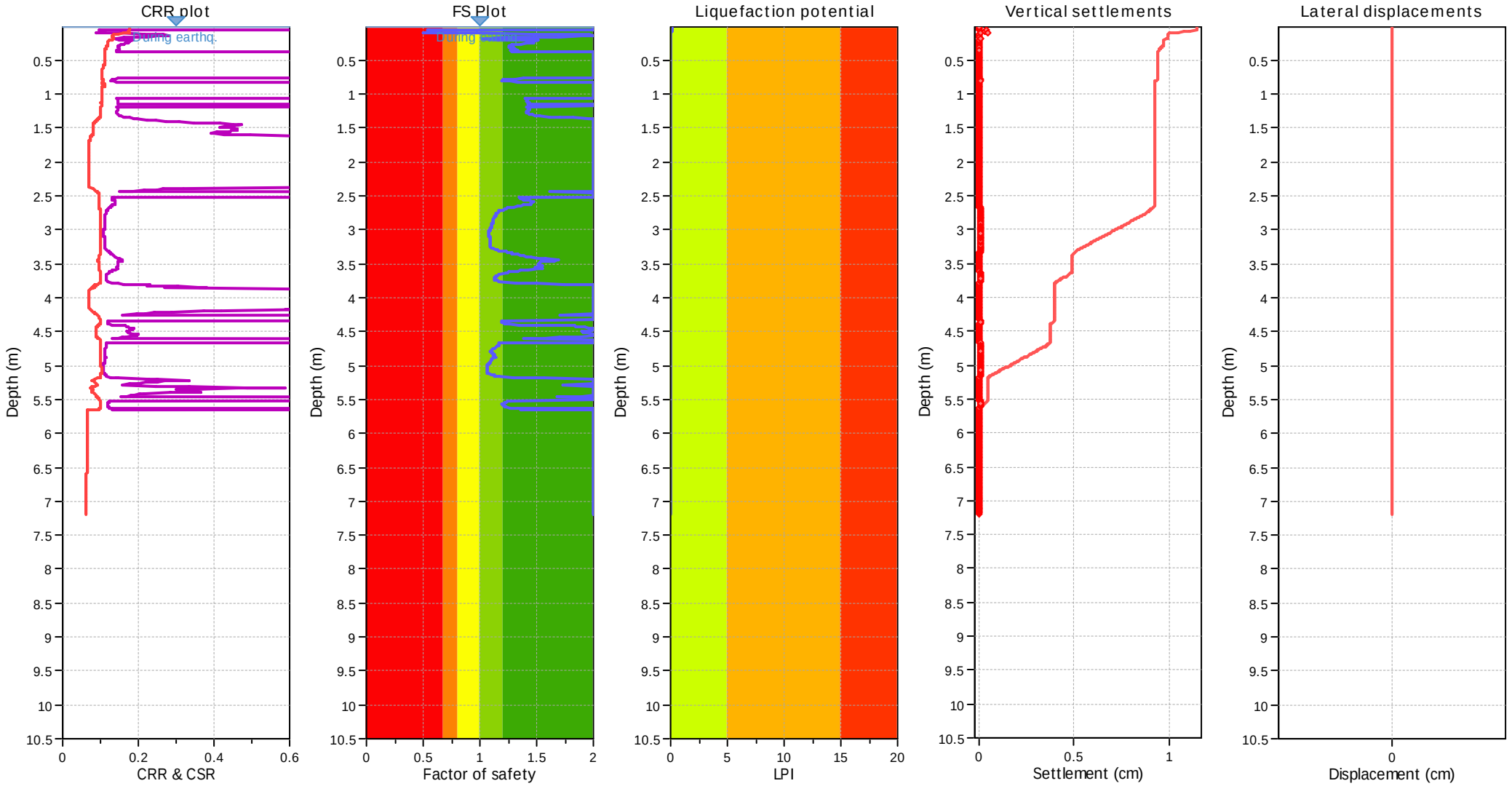
LPI color scheme
- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	6.25	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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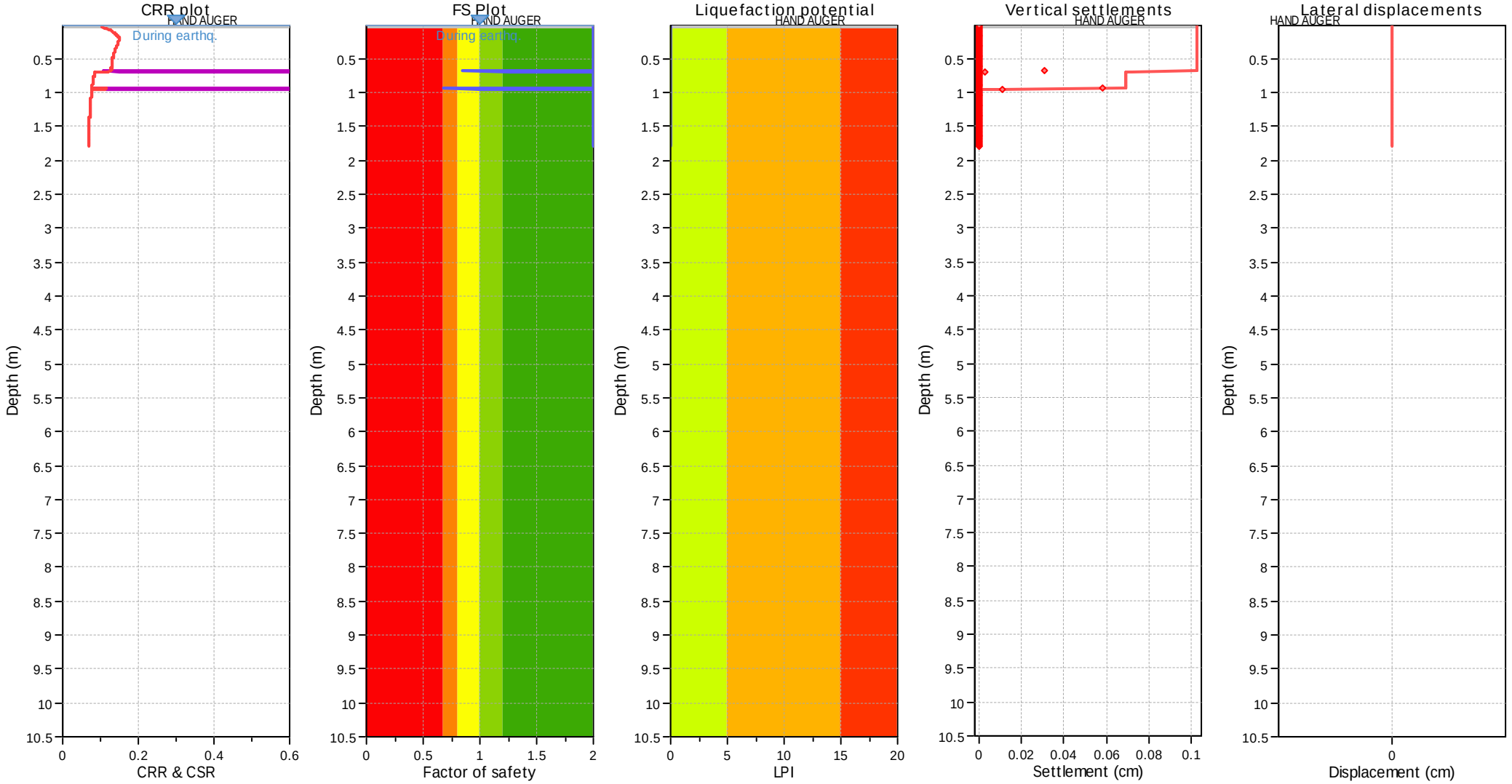
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
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Earthquake magnitude M_w:	6.25	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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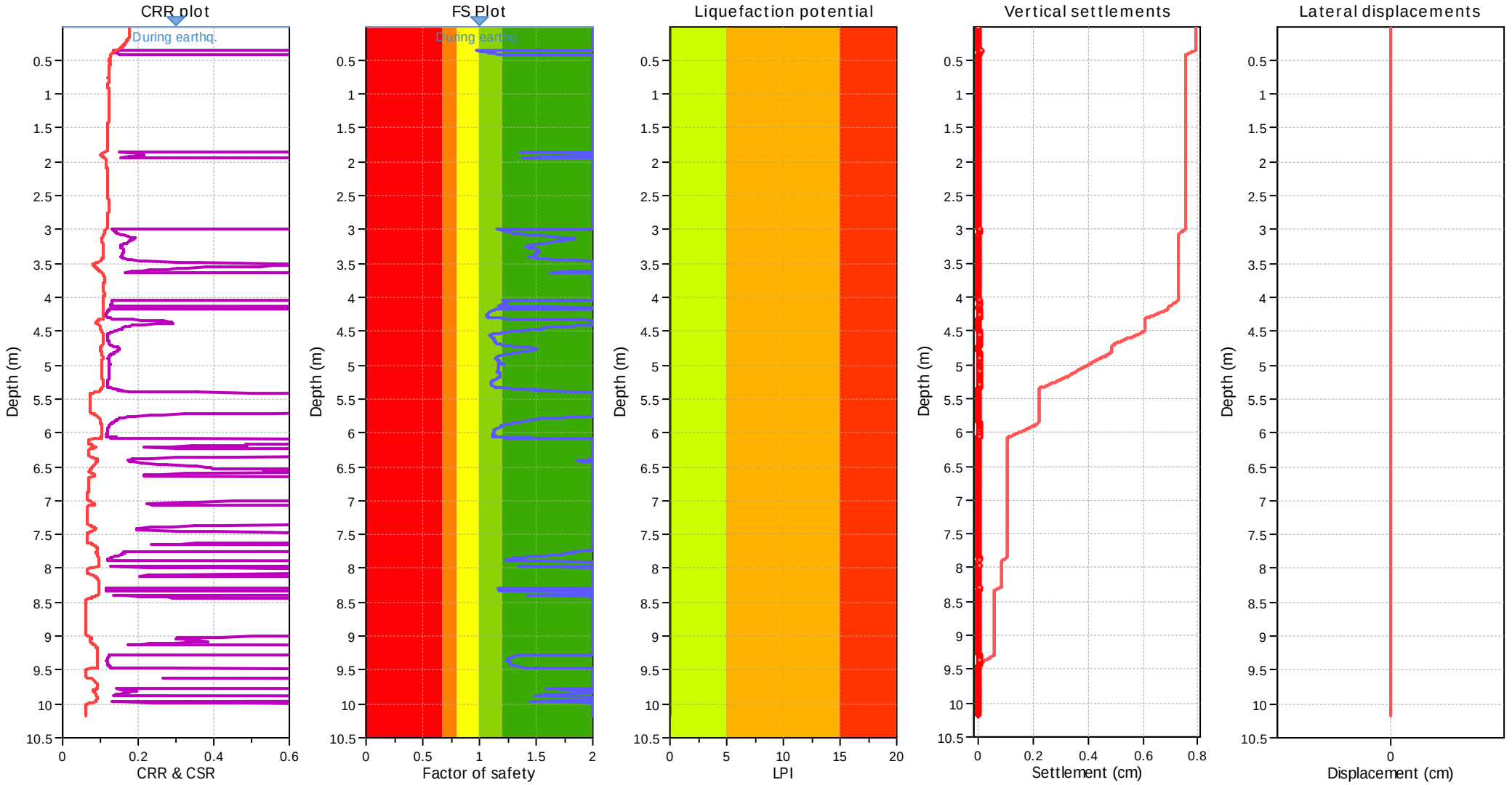
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	6.25	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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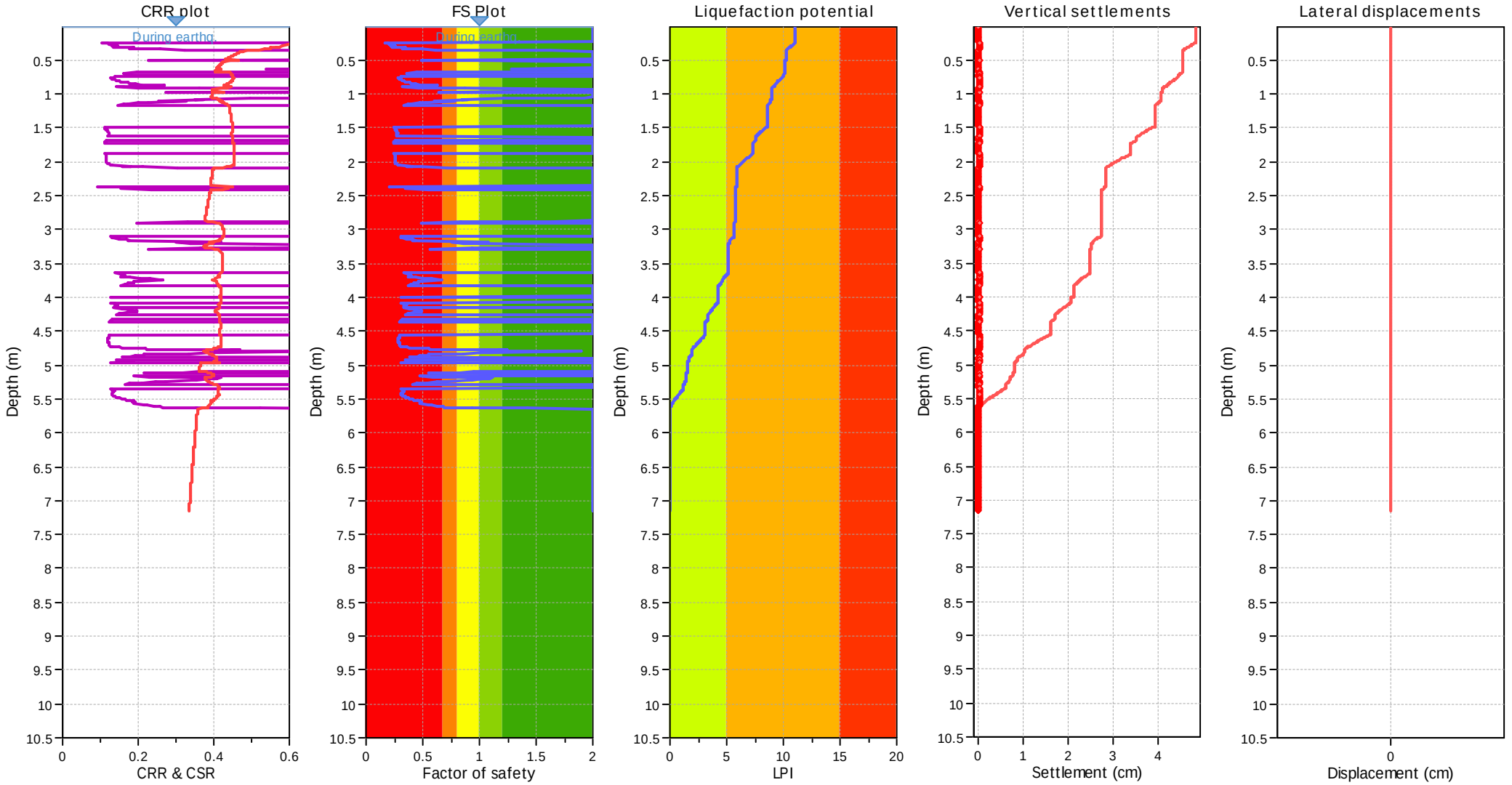
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
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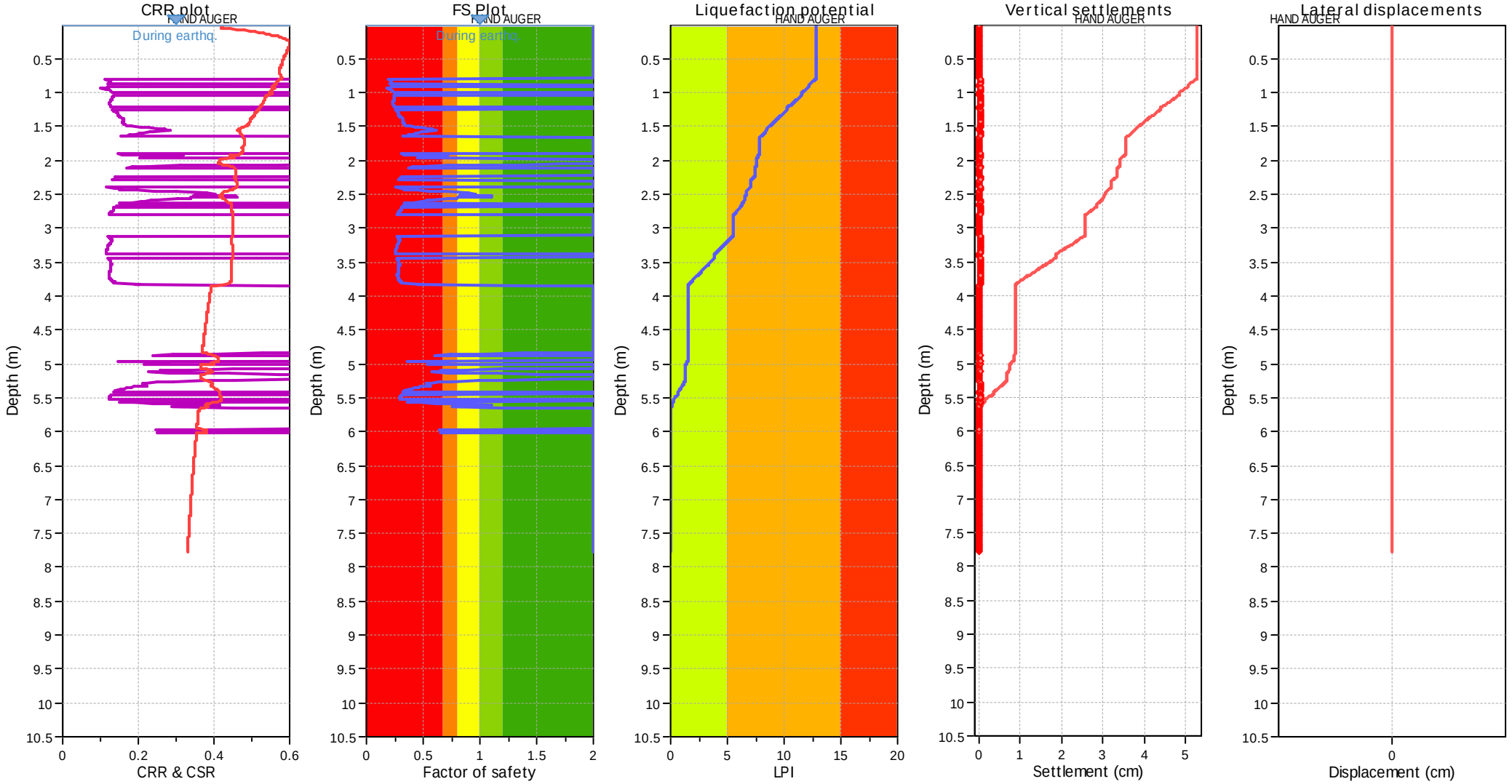
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
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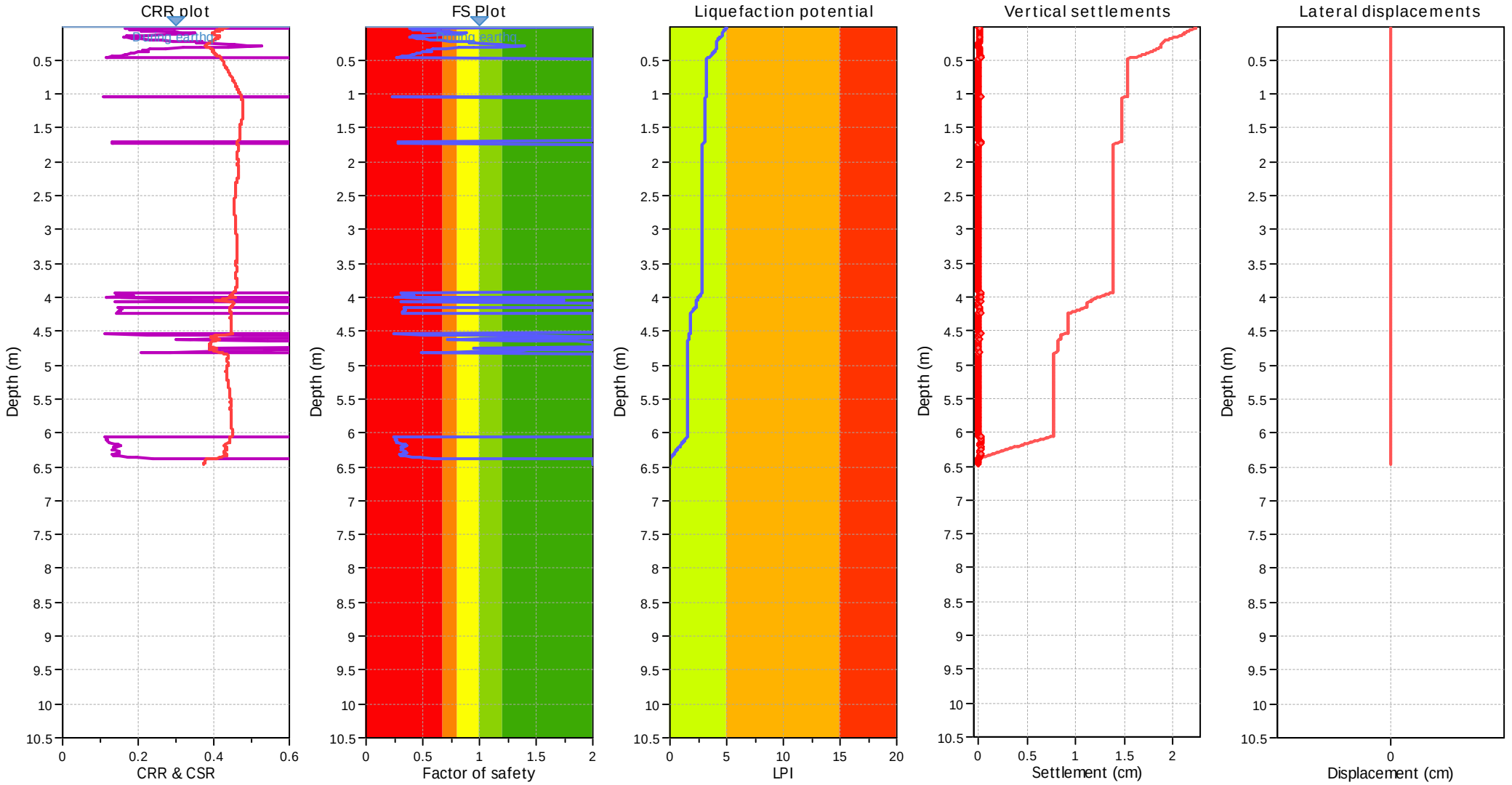

Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

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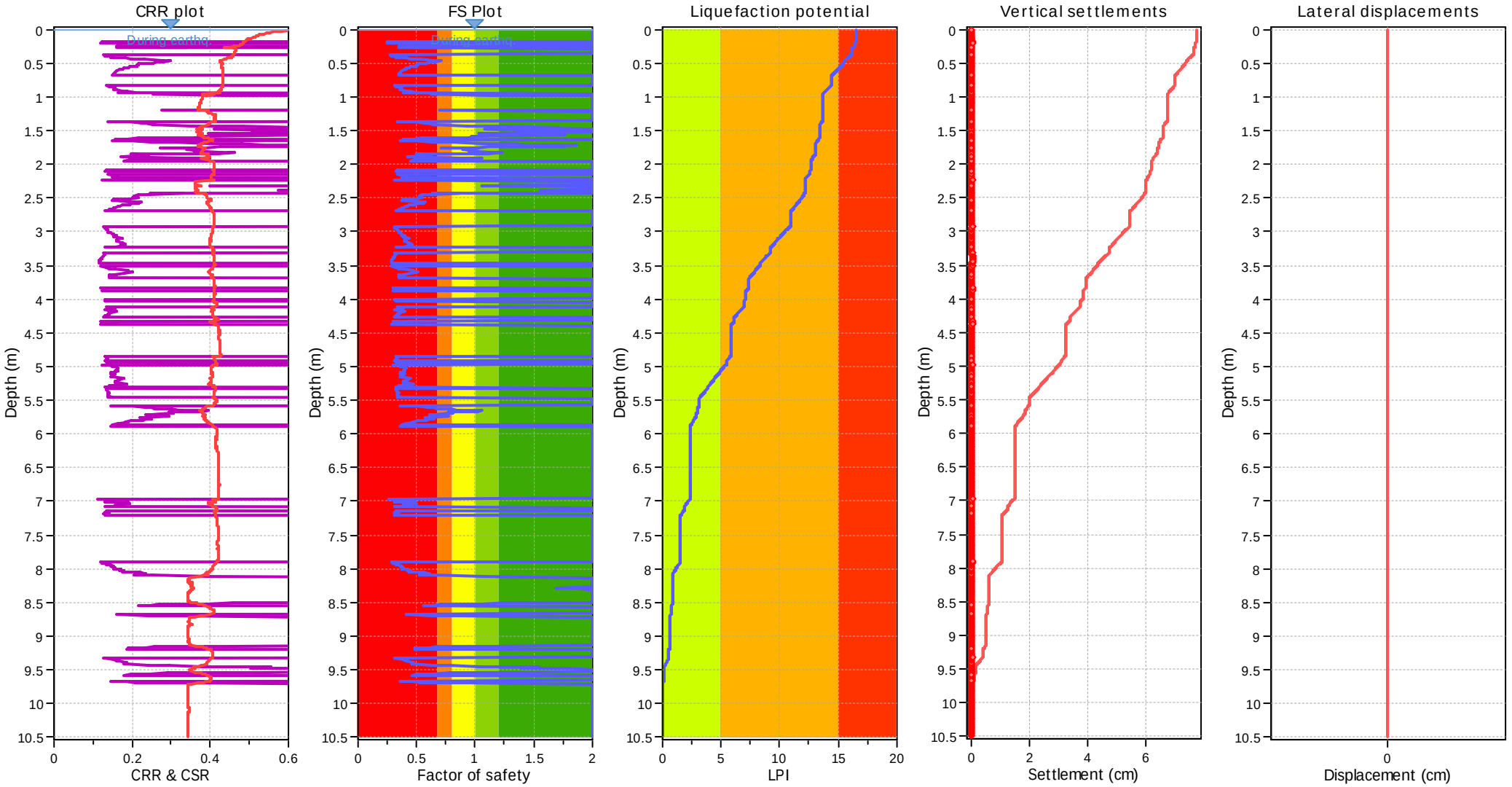
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

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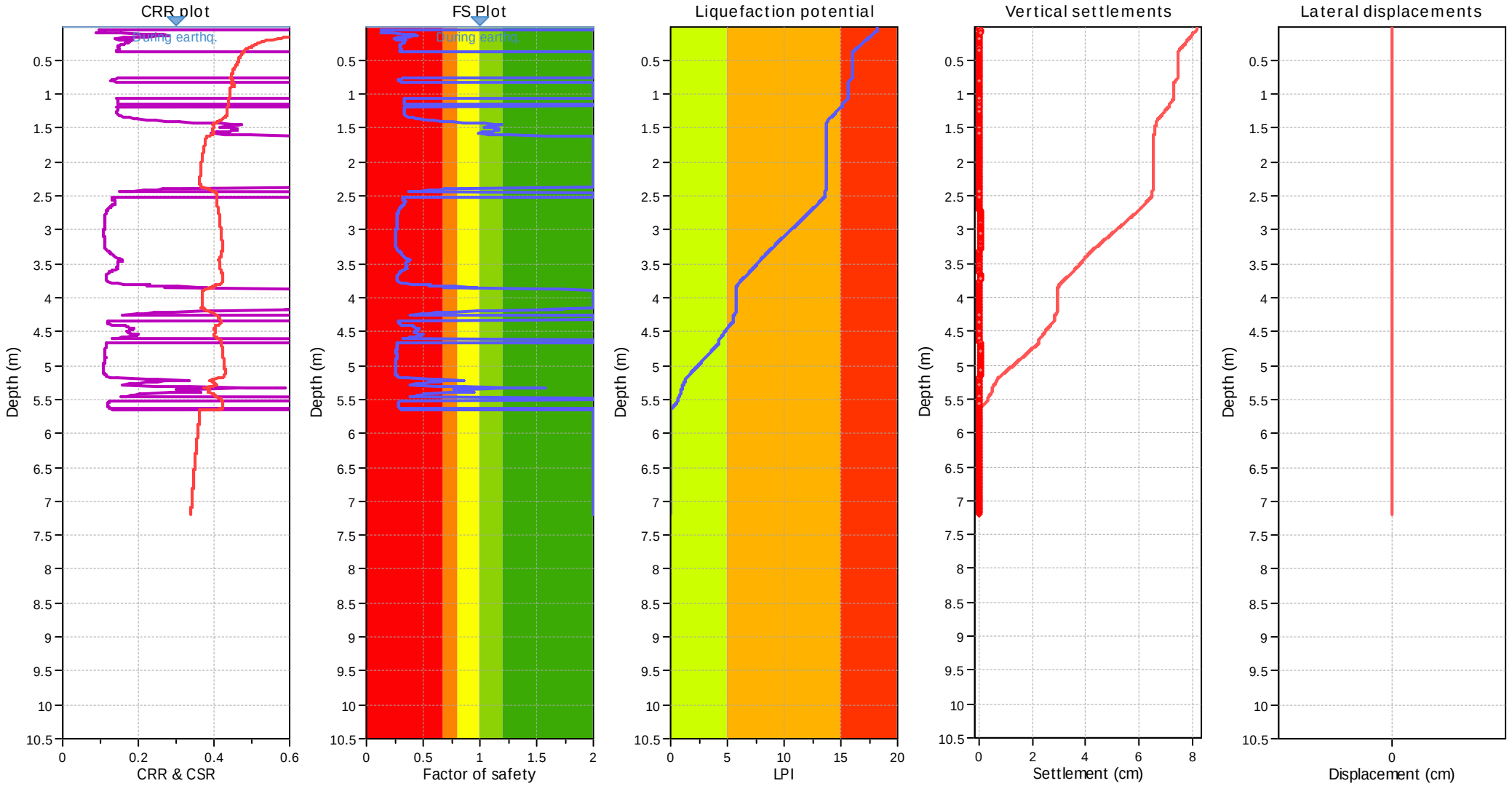
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	0.00 m	Fill height:	N/A	Limit depth:	N/A

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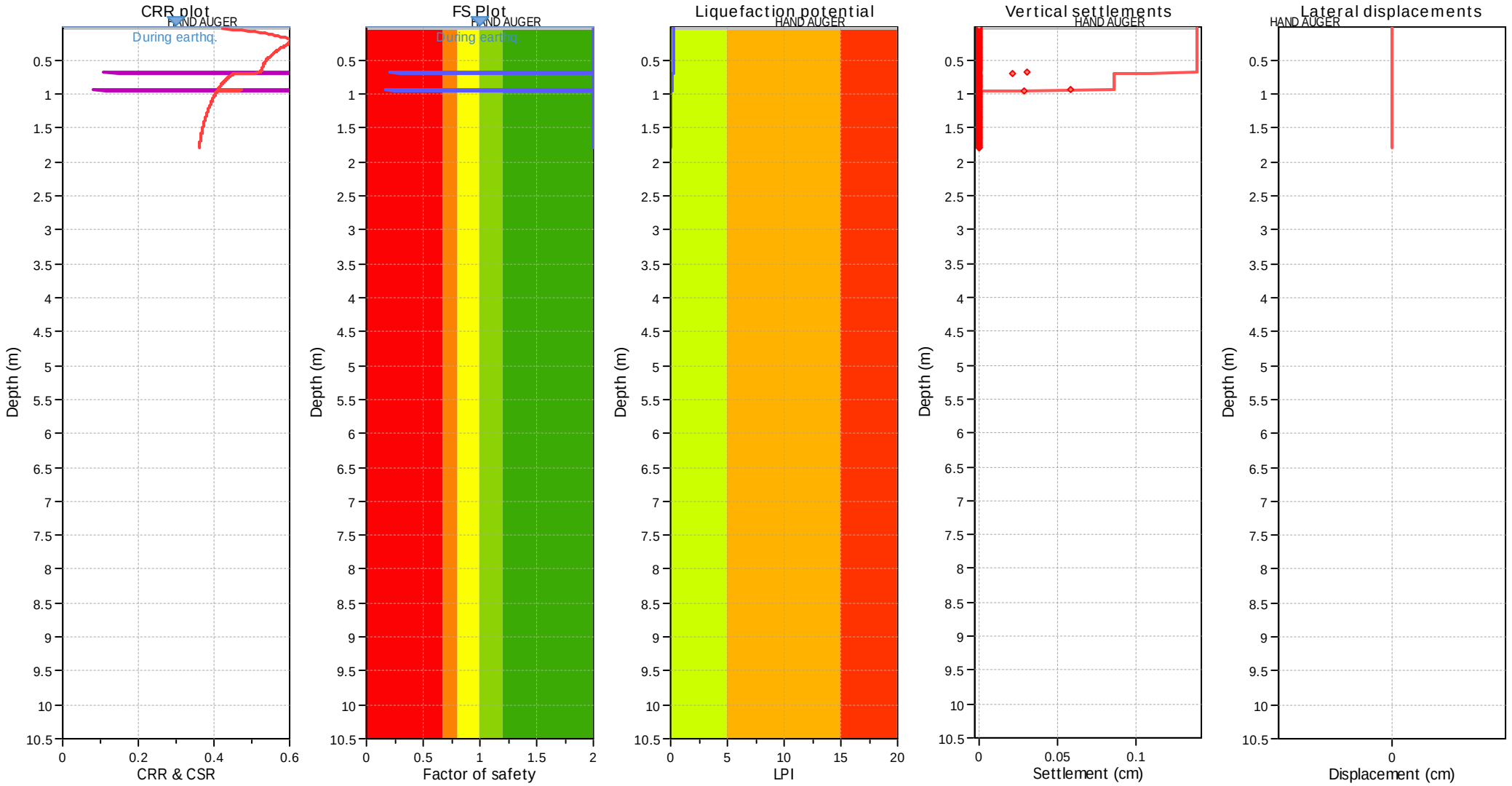
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
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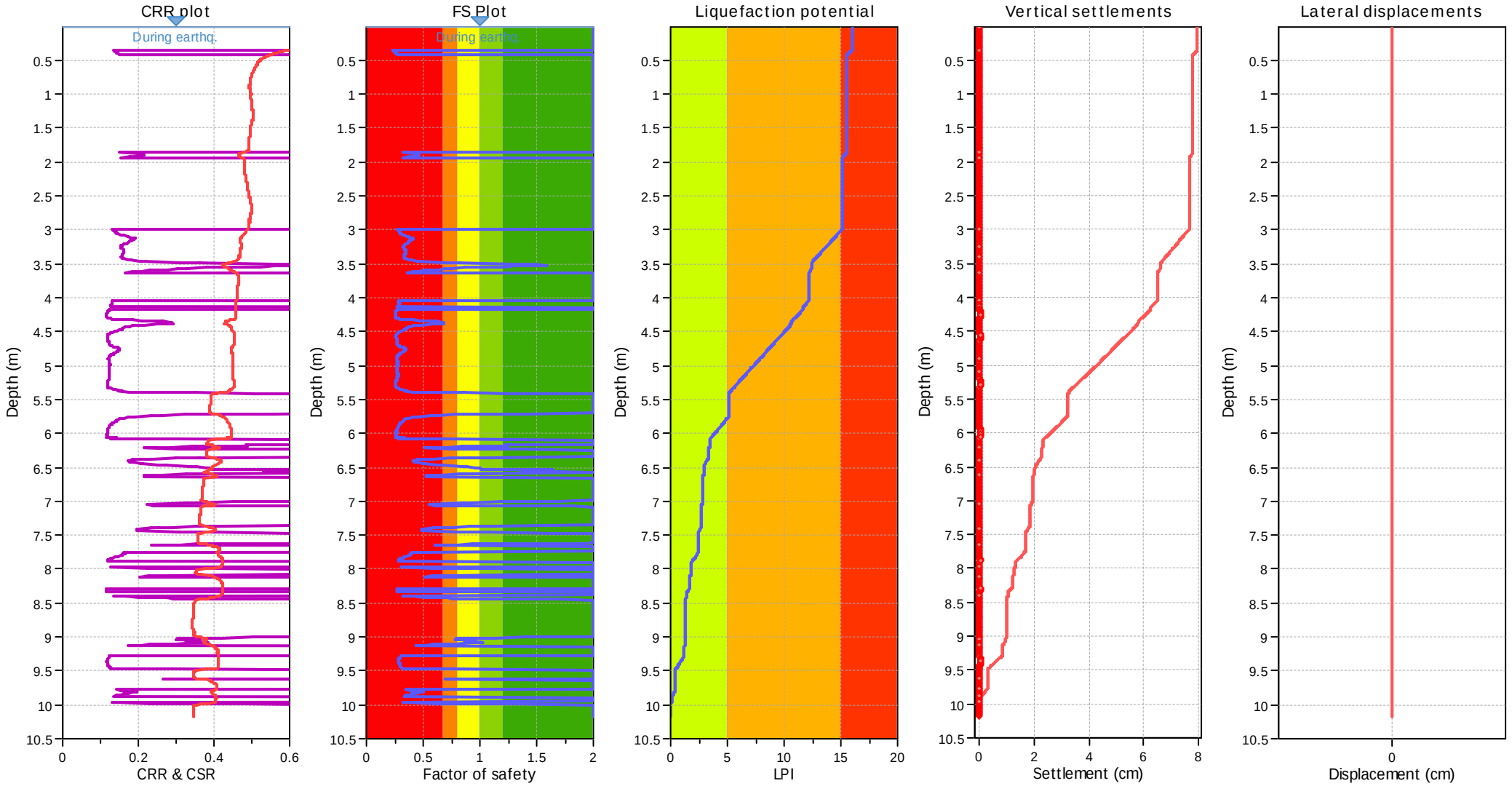

Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	0.00 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_σ applied:	Yes
Earthquake magnitude M_w:	7.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
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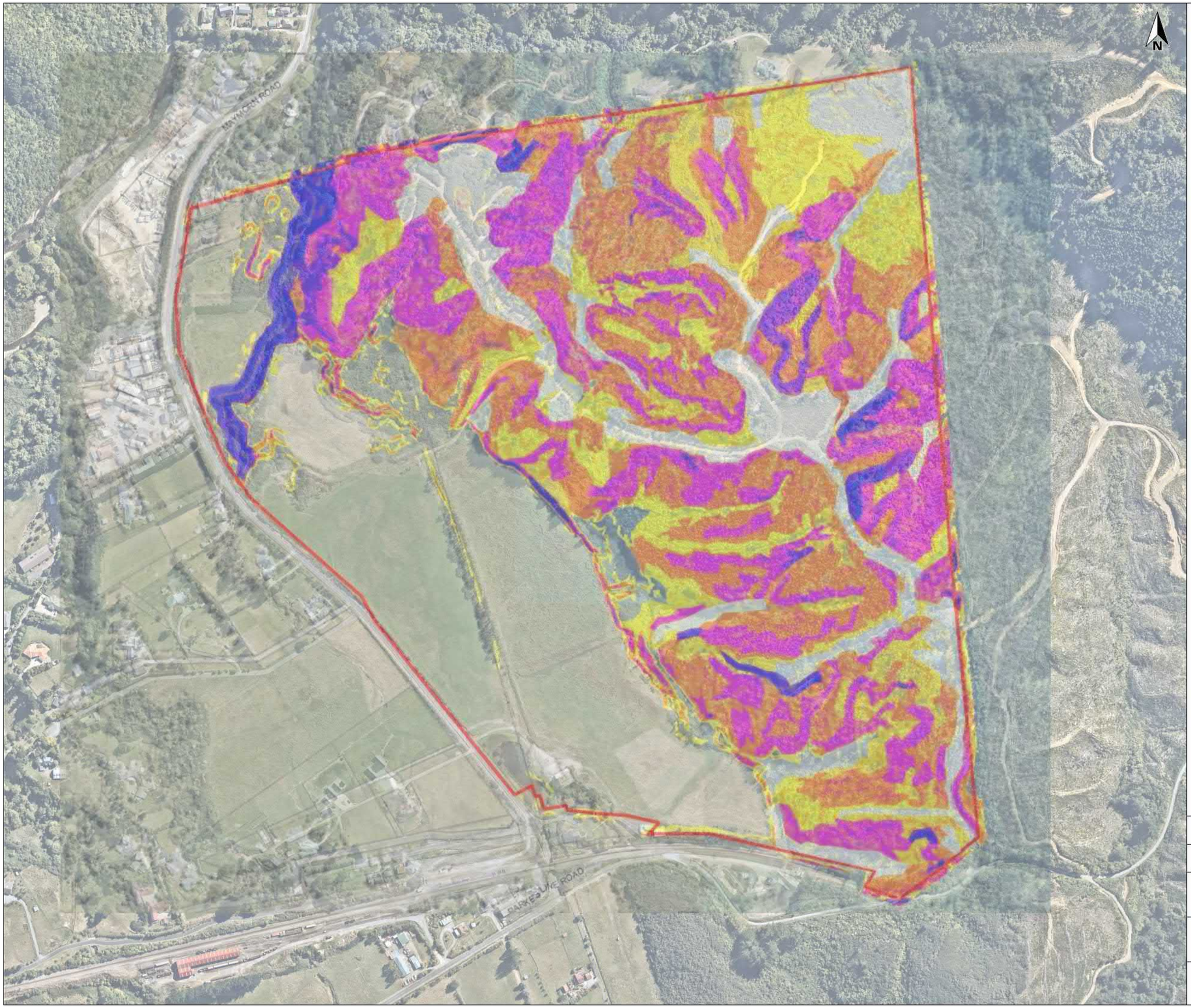
APPENDIX 11:

Slope Hazard Map



Legend

Slope (deg)

- <10 degrees – slope instability very unlikely
- 10 – 17.5 degrees – slope instability unlikely
- 17.5 – 25 degrees – slope instability possible
- 25 – 32.5 degrees – slope instability likely under eq/rainfall
- 32.5 – 37.5 degrees - slope instability likely
- >37.5 deg – slope instability almost certain

0 50 m 100 m

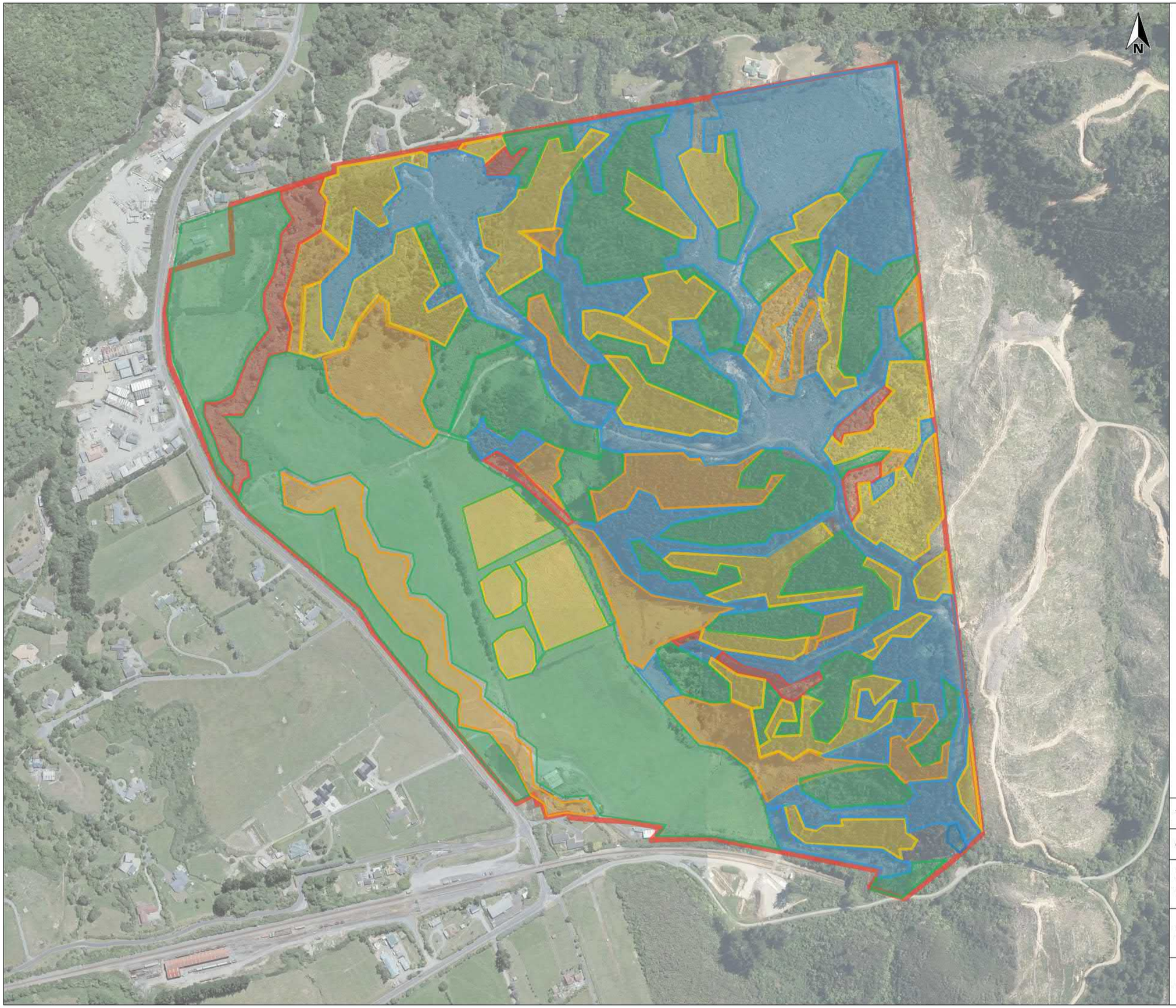
ENGEO

Produced by **Datanest.earth**

Title: Slope Hazard Model		
Client: Gillies Group Ltd		Figure No:
Project: Gabites Block, Upper Hutt	Drawn: LF	Size: A3
Date: 29-07-2021	Checked:	
Proj No: 19071.000.001	Scale: 1:6000	Version:

APPENDIX 12:

Hazard Risk Class Map



Legend

- Development Risk Class 1
- Development Risk Class 2
- Development Risk Class 3
- Development Risk Class 4
- Development Risk Class 5
- Site Boundary

0 50 m 100 m

ENGEO

Produced by **Datanest.earth**

Title: Development Risk Classes		
Client: Gillies Group Ltd		
Project: Gabites Block, Upper Hutt	Drawn: LF	Figure No: 11 Size: A3
Date: 03-11-2021	Checked: RJ	
Proj No: 19071.000.001	Scale: 1:6000	Version: 2