

Preliminary Geotechnical Assessment Report

61 Hampton Downs Road, Hampton Downs



Prepared for National Green Steel Limited

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Client: National Green Steel Limited

Author: Lindsay Strachan, Senior Engineer, CMEngNZ, CPEng
lindsay.strachan@earthtech.co.nz

Reviewer: Aidan Nelson, Principal Geotechnical Engineer, CMEngNZ, CPEng

Earthtech Consulting Limited
47 West Street, PO Box 721, Pukekohe 2340
+64 9 238 3669
admin@earthtech.co.nz
www.earthtech.co.nz

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1. Background

National Green Steel Limited is a specialist steel and metals recovery and recycling company in New Zealand with plants located across the country in Manukau, Auckland and Christchurch. The company largely recovers metal resources from end-of-life vehicles (ELVs), most of which are sent offshore (e.g. India) for processing and upcycling into useable products. Circularity of these resources is not currently embedded in the country since no processing plants are available and/or there is no available capacity. New Zealand's Waste Strategy (MfE, March 2023) emphasises that the country moves towards a Circular Economy (CE), expressing that *"We need high-quality systems and infrastructure for the whole country that enable widespread circular management of products and materials, including reuse, repair and recycling."*

Aligned to a national vision to achieve a low-emissions, low-waste society, embedding circular economy principles by 2050 in New Zealand, National Green Steel Limited proposes to establish *in-country* processing of recovered metals to recycle ELVs.

The development of a steel smelter and processing facility is proposed at 61 Hampton Downs Road, a property that combines five (5) lots, as shown in Figure 2.1. The steel smelter and processing complex will require the construction of a large main building platform for the proposed arc furnace, mill areas, transformers and switches, stores and administration buildings, covering a combined area of some 21.2ha, as shown in Figures 2.1, 2.2 and Appendix A. The extent of the earthworks for the main platform is 32.7ha, and for the development overall, comprising the *main platform* and several proposed *perimeter platforms*, is approximately 48.7ha across the property area of 53.7ha, as shown in Figures 2.2, 2.3 and 2.4.

Earthtech Consulting Limited conducted site visits on 28 December 2023 and 9 January 2024. Site-specific field work consisting of ten CPTs (cone penetrometer test) and eight hand auger bore logs was undertaken from 25 to 26 January 2024. A piezometer was installed in CPT04. Field mapping was undertaken on 26 March 2024. Additionally, ten test pits were excavated and profiled on 23 April 2025 to directly observe the soil stratigraphy and evaluate soil characteristics for use as fill material in the proposed earthworks. This report provides a preliminary geotechnical assessment based on available information. Preliminary site development geometrics and details of estimated earthworks requirements are provided in this report. Provisional stormwater management and sediment controls have also been included.

2. Site Conditions

2.1 Site Location and Access

The site is located at 61 Hampton Downs Road, Hampton Downs, Waikato. Access is via State Highway 1 (SH1), turning west into Hampton Downs Road and entering the property from the northern side via a section of Harness Road and an existing tar-sealed road (turning south).

The Hampton Downs Motorsport Park is located immediately north of the property, and the operational Hampton Downs Landfill site is situated to the west (Figure A below) – both are accessed from Hampton Downs Road. The Hampton Downs Landfill site serves the solid waste disposal needs of the cities of Auckland and Hamilton, as well as several other areas of North Island. The Spring Hill Corrections Facility is situated to the south, as shown in Figure A below. A site location plan is presented in Figure 1.1.



Figure A: The site at 61 Hampton Downs Road, Hampton Downs, Waikato, viewing southwards from the hillside on the northern side of Harness Road.

2.2 Site Description

The property comprises five (5) lots: Lot 1 of DPS45893 and Lots 1 to 4 of DP310030. None of the five lots have been developed as rural living lots.

The northern portion of the site is defined by lower-lying flat ground at approximately RL3.5m, stepping up to higher ground in the central area varying in elevation from approximately RL7.5m to RL10m, then stepping up to an area of gently sloping ground varying in elevation from approximately RL12m to RL18m. The ground then rises moderately to the south, southeast and southwest at an approximate overall grade of 16° to 20°, forming a peripheral *horseshoe* ridge around the proposed development, as shown in Figures 2.1 and 3.1.

An existing farm race (horse track) is situated in the western portion of Lot 1, at an elevation of approximately RL3.5m. The proposed development area is located within an area on the northern and western side of the peripheral *horseshoe*-shaped ridge line (Figure 2.2). A historical aircraft

landing strip is situated on the northwest-facing spur line, on the boundary between Lots 4 and 5, in the southern portion of the site. High ground forming the southern perimeter of the *horseshoe* varies in elevation from approximately RL42m to RL51m.

Several existing flow paths originate from the ridgeline around the property, draining in a northerly direction. Additionally, several existing man-made farm drains transect the lower-lying ground in Lot 1. Outward-facing slopes from the property, i.e. southeast-facing in Lot 5 and south-facing in Lot 4, are steep with notable slip movement in parts.

2.3 Proposed Development

The proposed development comprises the construction of building platforms and linking embankments, as shown in the layout plan Figure 2.2, long section Figure PD5.1 and cross-sections Figure PD5.2. It is currently envisaged that a large single-level building platform (*main platform*) is to be constructed at the finished platform level of RL14m. Several *perimeter platforms* are to be constructed at provisionally proposed elevations RL14m, RL35m and RL45m, as shown in Figure 2.3, and the long section and cross sections in Figure PD5.1 and Figure PD5.2, respectively. Figures A, B and C below illustrate the proposed development area.



Figure A: Viewing southwards from Hampton Downs Road



Figure B: Viewing westwards from the peripheral access road



Figure C: Viewing eastwards from the hilltop in Lot 5

3. Geological Mapping and Ground Conditions

3.1 Published Geology

The New Zealand Geological Map (GNS Science, [Geology 2.0.0 \(gns.cri.nz\)](https://www.gns.cri.nz/Geology-2.0.0)) indicates only three units underlying the site (Figure 3.1):

- Q1a Taupo Pumice Alluvium – referred to as Young Alluvium. This unit underlies the very low-lying ground ($\leq \text{RL}4\text{m}$) and includes numerous open channel drains constructed for farm drainage purposes. The drains discharge to the Waipapa Stream, which is controlled by a pumped outlet into the Waikato River.
- eQa Rhyolitic Terrace Deposits – shown on the eastern side of the site and the eastern arm of the *horseshoe*.
- Mwa Amokura Formation underlies the balance of the site. This unit consists of alternating layers of siltstone and sandstone and is a sub-unit of the Waitemata Group rocks.

3.2 Geological Conditions Encountered at Nearby Sites

Earthtech Consulting Limited has direct experience with at least three sites in the vicinity, all of which have been mapped with similar geology. These are:

- i. The Hampton Downs Landfill to the west.
- ii. The Spring Hill Corrections Facility to the south.
- iii. The SH1 interchange to the northeast.

Site-specific investigations at all three sites indicated different conditions to the mapped units; therefore, the mapping needs to be reviewed upon completion of detailed site investigations.

3.3 Historical Photographs

Historical photographs, attached in Appendix C, provide useful information - interpreted as follows:

- 1942: Man-made farm drains constructed across the northern portion, outlet under Harness Road to the northeast, and a *herringbone spine*-like apparent drain conveying seepage waters from the central to southeastern areas of the property. Possibly a farm track running along the drain course. Vegetation along incised seepage lines is clearly visible. Intact steep slopes section close to the boundary in the northern-central portion. Farming activities and small structures are evident to the northeast.
- 1963: Farming buildings in the northeastern portion constructed with established row of trees (windbreak). Central *herringbone spine* drain slightly further extended into the site and additional farm drain in the northern portion. Access track constructed leading off Harness Road in the north and farm track accessing the southeastern area to the boundary (from the farm buildings). Access to the farm buildings from the east, i.e. from the current SH1. Apparent curved exposed crest line close to the southwestern boundary but no evidence of ground movement.
- 1977: Access farm track entering the site on the northeastern boundary and several exposed soil areas across the site where farm track access points have been seemingly located. Farm buildings are more established with small tree grove to the immediate southeast.
- 1986: Construction of large oval race and new buildings and track to the north, just outside the property to the north on the northeastern boundary. Established plant growth along farm drains. New access farm track constructed from farm buildings running along the crest along the southeastern and southern boundary. Airstrip established in southern portion orientated southeast-northwest. Established vegetation in low-lying drainage area in the northwestern portion of the property.
- 1991: New oval-shaped race constructed against the boundary in the northwestern portion and established farm track to Harness Road. Several contour terracettes (from cattle?) to the southwest. Peripheral access track extends further along the crest around the southeastern and southern boundaries. Cutting down of windbreak treeline apparent near farm buildings.
- 2013: Well-established vegetation in the northern portion of the property. Significant vegetation growth in the localised landslide northwest of the farm buildings. Peripheral access track extends further (along the crest around the southeastern and southern boundaries), accessing through the gully area to the southwest. Both previously mentioned races grassed over but still visible. Apparent borrow site to the west of the airstrip. Depression and ground cracking evident in this photo in the southwestern portion of the property. No immediately visible indication of ground movement along the southern portion of the site.

3.4 Ground Conditions Encountered on the Site

Analysis of the electronic cone penetrometer testing (CPT) data is included in Appendix B, together with the hand auger logs and test pit logs. Refusal of the CPT probe is expected to be on the surface of the weak Amokura rock. Borehole drilling is required to confirm this assumption and to prove piling depths to at least six pile diameters below the refusal depth.

Test pit excavations (Test Pits TP1A, TP2-2, TP2-5, TP2-6, TP5, TP7, TP8, TP9, TP11A and TP11B) provided valuable physical checks against CPT data (or signatures) as well as key findings on the in-situ characteristics of the soil types across the Green Steel site. By and large, a close correlation can be established with comparative CPT signatures, which can be applicable to any further CPT investigation. Several notes added to the test pit logs, e.g. *good fill material*, refer to the in-place characteristics of the soils encountered - applicable for potential use as cut-to-fill material. The information gained thus relates to soil characteristics, i.e. field moisture content, soil strength, plasticity and estimated conditioning requirements.

Ground conditions encountered comprise:

i. *Topsoil*

Allow for 0.2m to 0.4m depth.

ii. *Gully Alluvium*

All site gullies are expected to include weak alluvium, which consists of saturated, highly variable soft to firm silts and clays with organic matter (essentially slope wash re-deposited on top of vegetation by large storm events). Gully alluvium may require undercutting and placement in spoil heaps or landscape fill areas. The gullies are present within the *horseshoe* – approximately above RL5m.

iii. *Stream Alluvium (Q1a) – Young Alluvium*

The large low-lying area has been influenced by the ancestral Waikato River and is likely to be underlain by weak peat deposits and soft organic silts. The deposits are some 6m deep and prone to severe settlement if loaded. The *peat soils*, or mixed organic clayey soils identified in TP1A, typifies the stream alluvium soils encountered (Figures PD5.1 and PD5.2).

Roads may require reinforcement over such soils, e.g. by placement of geogrid reinforcing layers. No significant structures should be placed in these areas unless fully undercut, preloaded or piled. Stockpiles of materials could be located by placing geogrids directly on the surface crust, followed by construction of a hardfill platform up to 1m thick. Settlements of 500mm to 1,000mm are expected to occur over time.

iv. *Amokura Formation (Mwa)*

This is the “bedrock material” which is expected to underlie the entire area to depths of hundreds of metres thick, overlying greywacke at 500m⁺. The unit is very similar to the alternating sandstones and siltstones exposed as sea cliffs along Tamaki Drive in Auckland. Weathering depth is typically 3m to 10m, forming a highly plastic clay crust.

The unit underlies large areas of the Auckland Region, with the soil profile only workable during the summer months. The bedrock itself is easily worked as engineered fill. The unit (and any engineered fill) is suitable for light structures with a design allowable bearing capacity of 100kPa (ultimate bearing capacity of 300kPa).

No Amokura Formation has been identified on the site surface. The geological information suggests that the Amokura was eroded to low levels (below RL20m), followed by deposition of significant depths of alluvium – shown as Terrace Alluvium. At this stage of the investigation, there appears to be little to no Amokura material within the cut/fill profile shown. Mapping of the southeast area slopes outside of the *horseshoe* indicates large-scale and deep-seated instability due to erosion at the toe by the ancestral Waikato River. This zone is clear of the development site.

Highly loaded structures can be founded on bored piles which are typically socketed 2m to 6m into the bedrock. Piling in this unit is very common in the Auckland Region. The CPT refusal depth in all profiles has been interpreted as weak Amokura rock. This must be confirmed with borehole drilling.

v. *Kaawa Formation (Pk)*

This is a very sand-rich profile that was identified on the prison site. It is better suited to bulk earthworks than the weathered Amokura Formation.

The Kaawa Formation is not geologically mapped on or near the site but may be present in CPT11. Drilling is required to confirm this. Kaawa sands are exposed in the deep road cutting to the north of the site.

vi. *Rhyolitic Terrace Deposits (eQa) – Terrace Alluvium*

These appear to overlie the Amokura Formation in all areas above RL4m and consist of ancestral river terraces. Materials can be highly variable and prone to some settlement under high fill loads or high building loads. Further testing (i.e. soil laboratory analysis of test pit samples) is required ahead of detailed design.

vii. *Hamilton-Kauroa Ashes (H-K Ash)*

This has been identified as a 1m to 3m mantle over some of the higher ground. The material consists of stiff to very stiff sandy clay that reworks easily as engineered fill.

The unit is not mapped but was identified in some track cuttings and gully erosion areas.

viii. *Karapiro Formation (eQk)*

This is mapped 1km or more to the west but is easily confused with the Rhyolitic Terrace deposits (eQa). The material is generally a sensitive silt; cut to waste or use with caution.

ix. *Whangamarino Formation*

Not mapped but found on-site to the west, below the Karapiro Foundation. The material has a low pH and can affect concrete structures. Generally cut to waste and needs to be capped if exposed.

x. *Fill*

Fill has been identified in CPT07 on the old airstrip. There is also fill on the low-lying ground above RL4m.

Lowering the proposed building platform, possibly segmented into a series of stepped platforms, will increase some cut depths and reduce the volume of compacted fill required. Interpretation of the CPT data has been applied to the sections (Figures PD5.1 and PD5.2); however, these units may change with more detailed investigations.

Test pit excavations and profiling has allowed for direct observation and logging of soil stratigraphy, as well as the identification of in-situ soil characteristics in the upper 4 to 6m depth soil profile across the site. A tabulated summary of all test pits, including soil descriptions, consistency and engineering earthworks suitability, is presented in Table 1. Specific to test pit investigations, the following was encountered:

- *Topsoil* of 0.1m to 0.2m thickness is consistently present across all test pits.
- *Terrace Alluvium* forms the dominant soil type beneath the topsoil across the site. It consists primarily of clayey silts with minor sand of varying consistency/strength from firm to very stiff. This unit is moderately to highly plastic and good for cut-to-fill operations after minor drying.
- Ash soils (*H-K Ash*) at the TP2-5, TP2-6, and TP8 locations are very stiff to hard, and their properties (plasticity and remoulded strength characteristics) make them suitable for

engineered fill material. These soils will require short conditioning times for optimal placement.

- Organic and poor materials were observed in:
 - TP1A: organic clays and peat-like material encountered at shallow depths with high plasticity and moisture content, unsuitable for engineered fill material. Note: the existing surface was found to be firm in-situ, displaying very little penetration of the tracks of the 13t excavator. We suggest placing the fill material directly on this surface.
 - TP7: Soft clayey silt with organics (at 3m to 3.5m depth, i.e. approximately at RL11.5m to RL12m) of low undrained shear strength (S_u), which may require undercutting.
- Dense silty sands (TP5, TP9) represent good fill material. The presence of Kaawa Sands appeared to be the geology encountered at the TP5 and TP9 locations. This could be proven by core drilling.
- Groundwater and Moisture Observations:
 - Water ingress was noted at 1.2m depth (~RL2.6m) in TP1A and 4.5m depth (~RL9.7m) in TP7. Groundwater was not observed in other test pit locations.
- Geological Contacts
 - *Amokura Formation* was encountered at depth >3.5m in TP7, confirming earlier CPT interpretation.
- Probable *Kaawa Sands* at TP5 location – encountered at depth >4m.

Grab samples were taken at 1m depth intervals from all test pits and placed in core boxes, allowing for additional assessment. Soil sample “cores” are shown in photographs attached in Appendix B3.

Table 1: Test pit summary of soil types and characteristics across the Green Steel site.

Test Pit	Depth (m)	Soil description	Engineering Suitability Comment	Consistency
TP1A	3.5	Organic clays and peat. Hardened crust surface. Groundwater at 1.2m.	Unsuitable for engineered fill. Either undercut or leave in-situ and expect settlement under load.	Firm to very soft. Hardened crust surface.
TP2-2	4.0	Clayey silts. Groundwater not encountered.	Suitable for engineered fill, est. half-day conditioning required	Very stiff to hard
TP2-5	6.0	Ash soils (clayey silts) and clayey silts. Groundwater not encountered.	Good fill material – est. one-day drying required	Very stiff
TP2-6	5.0	Ash soils (clayey silts) and clayey silts. Groundwater not encountered.	Very good fill material, est. half-day to one-day drying required	Very stiff to hard
TP5	4.5	Clayey silts (up to 4m), silty sands (Kaawa Sands) from 4m. Groundwater not encountered.	Good fill material (in-situ) for direct cut-to-fill	Very stiff Medium-dense to dense sands
TP7	5.0	Clayey silts and some silty sands. Clayey silts with organics at 3m to 3.5m. Amokura silty sands >3.5m. Groundwater at 4.5m.	Good fill material to 3m depth, est. one-day drying.	Very stiff. Medium-dense to dense sands (>3.5m depth)
TP8	4.5	Ash soils (clayey silts) and clayey silts. Groundwater not encountered.	Good fill material, est. one-day drying required.	Very stiff to hard
TP9	5.0	Clayey silts (0.2m-2m), clayey sandy silts (2m-4m), silty sands (Kaawa Sands) >4m depth. Groundwater not encountered.	Good fill material throughout TP depth, est. half-day drying required.	Very stiff to hard. Medium-dense to dense sands.
TP11A	5.5	Clayey silts. Groundwater not encountered	Good fill material. Est. one-day drying required.	Very stiff to hard.
TP11B	6.0	Clayey silts. Groundwater not encountered	Good fill material - workable with minor drying. Below 4.4m, est. one-day drying required.	Very stiff.

3.5 Key Engineering Properties

- All organic soils, including peats to be cut to spoil or landscaping embankment fill, preloaded (requires specific design), or left in place where large settlements are acceptable.

- All terrace deposits are potentially compressible and need to be confirmed for strength and depth. The base of the ancestral Waikato River is approximately RL-5m, thus limiting the maximum depth to the terrace deposits.
- For bulk fill, target Amokura Formation (both weathered and unweathered) or Kaawa Formation if present. Neither of these have been positively identified within the cut profiles. Limited quantities of H-K Ash were present.
- Design preliminary cut and fill slopes at 1 on 3 unless retained. Note that there is obvious landslip movement on the outer slopes of the *horseshoe*. Detailed investigation of these areas may provide valuable information on the nature of the terrace deposits and possibly identify and confirm the Amokura bedrock.
- The Amokura Formation slopes are prone to gully failures, rotational failures, and, in some areas, deep-seated block slides controlled by very thin clay seams. The mapping walkover indicated large-scale instability on the southern and southwestern boundary of the site (i.e. clear of the inner *horseshoe* development area).
- All silts and clays are prone to shrink/swell movements.
- All gullies and drains will require undercutting and inclusion of subsoil drains.
- The liquefaction risk is low in these materials but cannot be ruled out entirely. Seismic design will need to be applied to all major structures, office buildings and workshop areas.

3.6 Geotechnical Design Parameters

A combination of site-specific sampling and laboratory testing, interpretation of in-situ test results (shear vane, CPT and SPT values), and published literature were used to derive shear strengths for the various materials and combinations of materials encountered on the nearby sites. Properties of the in-situ soils that are anticipated to be encountered on-site are provided in Table 2 below.

Table 2: Provisional Soil Properties of the 61 Hampton Downs Road Site

	Cohesion c'	Friction Angle ϕ'	Unit Weight γ
Stream Alluvium (Young Alluvium)	1kPa	25°	12kN/m ³
Rhyolitic Terrace Deposits (Old Alluvium)	4kPa	28°	18kN/m ³
Compacted Amokura Formation (Bulk Fill)	10kPa	36°	20kN/m ³
Compacted Kaawa Formation (Bulk Fill)	5kPa	36°	18kN/m ³
Compacted Hamilton-Kauroa (H-K) Ash	10kPa	30°	18kN/m ³

4. Seismic Design Considerations

The site is classified subsoil class C in terms of NZS1170:5, and seismic Importance Level 2 has been adopted for the proposed development with a 100-year design life – for ordinary consequences of failure presenting a low degree of hazard to life and other property.

Peak Ground Accelerations (PGA's) and magnitudes for use in seismic design have been adopted from Earthquake Geotechnical Engineering Practice Module 1 (NZGS, 2021) for the Huntly area, this being the closest location (Table A1 of Appendix A, NZGS, 2021). This includes current guidance on PGA and magnitude values for use in geotechnical design with respect to recent updates to the New Zealand Seismic Hazard Model. There are no active fault lines running through the site or near the property. The seismic design parameters for the site are as follows:

Design Event	PGA	Magnitude
Serviceability Limit State, SLS (1/25yr)	0.06g	5.8
Ultimate Limit State, ULS (1/500yr)*	0.24g	5.8

* Governed by minimum design criteria.

5. Groundwater Regime

Groundwater was identified on the site on the lower terrace area to the north of the property at approximately 0.5m to 1m below existing ground level. Groundwater level was dipped (measured) in the CPT04 piezometer as 1.9m below ground level, translating to approximately RL4m. Groundwater level can, provisionally, be considered to be at approximately RL2.5m to RL4m. Several groundwater seepages were identified in the geotechnical mapping shown in Figure 2.1, found to emanate between approximately RL25m and RL35m inside the *horseshoe* (refer to Figures 2.1 and 3.1) area of the site.

Groundwater level can be expected to be perched upslope as indicated in CPT07, encountered at approximately 3m below existing ground level at this location (Figure 2.1). Boreholes will need to confirm the actual groundwater depth above RL4m areas.

Sandy soils below the groundwater table are potentially liquefiable but generally too old to be of concern.

6. Earthworks

6.1 Platform Layout

The smelter complex will require the construction of a single large main building platform for the proposed arc furnace, mill areas, stores and administration buildings, and an additional raised platform for transformers and switches, as shown in Figures 2.1, 2.2 and in the proposed provisional plant layout in Appendix A. The extent of the earthworks for the development, comprising the *main platform* and several proposed *perimeter platforms*, is shown in Figures 2.2, 2.3 and 2.4.

6.2 Cut and Fill Footprints

The main building platform (*main platform*) is to be constructed at finished platform level of RL14m, with a secondary *MRSS platform* elevated at RL19m situated in the southeastern corner for the MRSS equipment, i.e. transformer(s), switchgears, switches. Several *perimeter platforms* are to be constructed at provisionally proposed elevations RL14m and RL35m, as shown in Figure 2.2, and the long section and cross sections in Figure PD5.1 and Figure PD5.2, respectively.

Final proposed contours and extent of earthworks shown in Figures 2.2 and 2.3 show encroachment into the mapped area of large-scale instability. This area will require site-specific investigation and geotechnical design to establish suitable platform arrangements. Indicative cut and fill depths are illustrated in Figure 2.4. The balance of earthworks is provisionally some -17,120m³ (minor deficit) from 1,918,000m³ cut and 1,935,120m³ fill, i.e. ~1(cut):1(fill). Fills over the peat soils can be expected to settle by 2m and possibly more, and other probable undercuts may be required across the platform areas. This 'surplus' material is expected to be fully utilised.

As previously mentioned, the development area is situated within the *horseshoe* area on the northern and western side of an existing peripheral *horseshoe*-shaped ridge line. Earthworks involving large cuts and fills will be required to provide suitable platforms within the available area (Figure 2.4). Estimated volumes are provided in Table 3 below. Cut slopes not exceeding 1(v) on 3(h), i.e. 18.4°, are recommended around the platform areas at this stage, which have been adopted for the final contours in Figure 2.3. Possible retaining may be required along the platform intersect lines to suit the required fitment.

Undercuts of up to 1m to 2m may be required across the soils of the northern part of the main platform, and possibly 0.5m elsewhere could be anticipated. This is to be determined by further investigation. Our experience on neighbouring sites is that there could be a variance in geology across sections of the proposed development area, and unfavourable soils for engineered fill may be encountered. Allowance for such (spoil) volumes is provided in Table 3. The main platform area is 212,000m²; thus, an estimated 0.5m of undercut = 106,000m³. Estimated undercut across the *perimeter platforms* is 20,000m³.

Applying geosynthetic soil reinforcement materials, such as geogrids, may enhance geotechnical design requirements and potentially reduce the cost of earthworks and soil foundations. Extensive preloading was used on the adjacent Springhill Corrections Facility site to reduce predicted long-term settlements in some of the terrace alluvium areas.

Any earthworks surplus material, if encountered, will require either placement to a stockpile terrace, utilised for the construction of a screening embankment, used as landscaping material, or the platforms could be raised (or lowered) to accommodate this net volume difference. However, any surplus can be expected to be largely lost in the settlement of the required fills across the site and remaining material utilised for landscaping.

Table 3: Estimated Preliminary Cut and Fill Volumes

Platform	Cut (m ³)	Fill (m ³)	Possible Undercut and/or Unsuitable Material (m ³)
Main	1,033,800	878,700	Est. 106,000
Perimeter	254,100	215,800	Est. 20,000
Totals	1,287,900m ³	1,094,500m ³	126,000m ³
Monofills	504,100m ³	0m ³	
Adjusted fill (allowing for undercuts)	+126,000m ³	+126,000m ³	
Adjusted fill (allowing for use of excess fill material)	+0m ³	+714,620m ³	
Adjusted Totals	1,918,000m³	1,935,120m³	
Variance	-1%		

*Earthworks cut/fill balance overall is an estimated -17,120m³

7. Subsoil Drainage

Suitably engineered subsoil drainage is to be provided below or within the proposed building platforms. Subsoil drains are required to be constructed prior to the placement of compacted engineered fill of the embankments and building platforms to provide both appropriate drainage from the foundations and a secure and stable toe zone for the building platforms.

Subsoil drainage waters should be drained to inspection chambers to allow for functionality checks, possible flushing and quality monitoring where required.

8. Stormwater Drainage and Management

The proposed development is situated largely within a single catchment area, noted earlier as an inner *horseshoe* area, and stormwater flows can be suitably channelled around the site by strategically located contour drains. The final disposal and discharge of stormwater into and from the property will be determined at the detailed design stage. Attenuation ponds are likely to be required to reduce the impact of peak flows off roofs and paved areas. We understand the client's intention to capture and store rainwater runoff from roofed areas.

The nearest rainfall gauging station is located at Meremere, which provides rainfall data dating back to the 1960s. Preliminary design rainfall is as follows:

Allow: Ten minutes duration rainfall intensity (in mm/hr) for New Zealand shall be determined for ARIs of 10 years (10% AEP) and 50 years (2% AEP) using rainfall frequency duration information available from: the National Institute for Water and Atmospheric Research (NIWA) High Intensity Rainfall Design Systemu (HIRDS). [use: HIRDS V4 (Oct. 2023), <https://hirds.niwa.co.nz/>]

Design rainstorm event (50 years) = 24 hours 10% AEP storm of 99.7mm, i.e. **100mm** (depth in 24 hours).

The catchment area is 40ha; thus, several stormwater retention ponds (SRPs) for a 5ha design are to be provided, possibly along with stormwater buffering storage ponds. Existing farm drains can be appropriately utilised for stormwater and sediment controls. Preliminary stormwater and sediment controls are indicatively shown in Figure 6.1.

A combined Earthworks Management Plan and Erosion and Sediment Control Plan (ESCP) has been prepared to support a Resource Consent application for the proposed Green Steel Project development by Earthtech (2025a). The ESCP has been prepared in general accordance with the Waikato Regional Council Technical Report No. 2009/02 *Erosion and Sediment Control Guidelines for Soil Disturbing Activities*, January 2009 (TR2009/02), and supporting factsheets.

9. Erosion and Sediment Control

Earthworks will require careful engineering and management with the provision of strategically positioned stormwater retention and settlement/stilling pond(s). There will be a staging of erosion and sediment control measures, detailed in the ESCP (Earthtech, 2025a), as the construction of the main platform progresses from the cut earthworks from the southern areas. Synchronisation with the earthworks, construction and operation will be crucial. Figure 6.1 provides preliminary details for the enabling works that must be in place at ‘Day 1’, showing the placement of erosion and silt control infrastructure as well as stormwater sediment retention ponds (SRPs).

10. Stability

There are no identifiable concerns with instability within the *horseshoe* development area of the site. Areas of large-scale instability have been mapped on the geotechnical mapping plan (Figure 2.1). As previously mentioned, final proposed contours and extent of earthworks shown in Figures 2.2 and 2.3 indicate encroachment into the mapped area of large-scale instability. This area will require site-specific investigation and geotechnical design to establish suitable platform arrangements.

Ongoing erosion and creep can be expected along the steep slopes away from the *horseshoe*, i.e. along the southeastern, southern and southwestern boundaries. The localised landslide area to the northwest of the farm buildings has shown very little to no change in the last 80 years and lies outside the *main platform* area.

11. Conclusions and Recommendations

- i. The proposed development comprises the construction of a main building platform (*main platform*) at a provisional finished platform level of RL14m, with a secondary MRSS platform elevated at RL19m. The latter is to be situated in the southeastern corner for the transformer(s), switchgears and electrical switching. Several *perimeter platforms* are to be constructed at provisionally proposed elevations RL14m and RL35m.
- ii. Limited site investigations indicate the ground conditions as interpreted and shown in the sections. The difference between geological units is not easily identified by the CPTs and could be significant

in relation to earthworks parameters in particular. Several (10 No) test pits were excavated and profiled in April 2025, providing useful cross-checking interpretation of the CPT signatures. Investigations on neighbouring sites indicated different conditions to the mapped units. Hence, current site mapping (Figure 2.1) may require review with additional site investigation data.

- iii. It is recommended that the preliminary design of cut and fill slopes be at 1(v) on 3(h) unless retained.
- iv. For bulk fill material, the Amokura Formation should be targeted (both weathered and unweathered), but preliminary data indicates little cut in these materials. Limited quantities of H-K Ash are present, and Kaawa Sands were also encountered on the property, both representing suitable soil types for engineered fill.
- v. The Amokura Formation slopes are prone to potential gully failures, rotational failures, and in some areas (and encountered on nearby sites) to deep-seated block slides controlled by very thin clay seams. A preliminary walkover indicated large-scale instability effects on the western boundary of the site (i.e. clear of the inner *horseshoe* development area). Such instability would be overcome by excavation and lowering of the western/southwestern areas, as is intended by a proposed monofill site (Earthtech, 2025b).
- vi. All silts and clays are prone to shrink/swell movements, and further earthworks (laboratory) testing is required.
- vii. All gullies and drains will require undercutting and the inclusion of subsoil drains.
- viii. The site is subsoil class C in terms of NZS1170:5, and seismic Importance Level 2 has been currently adopted for the proposed development with a 100-year design life. Liquefaction risk is expected to be low to negligible in these materials.
- ix. The application of geosynthetic soil reinforcement materials, such as geogrids, can be considered to enhance geotechnical design requirements and potentially reduce the cost of earthworks and soil foundations.
- x. The proposed platform layout design translates to a required fill of some 1,033,800m³ and total cut volume of approximately 878,700m³. With consideration of possible undercuts, estimated cut and fill volumes are 1,287,900m³ and 1,094,500m³, respectively. It is recommended that the final geometrics of the platforms only be adjusted following site investigations to verify ground conditions and volumes of suitable material for engineered fill.

Fills over the peat soils can be expected to settle significantly, and any estimated 'surplus' (cut/fill balance) material is expected to be fully utilised.

- xi. A minimum design 24-hour rainstorm depth of 100mm is recommended.

- xii. Groundwater seepages encountered across the site can be suitably diverted and conveyed to discharge areas within the property boundary.
- xiii. Stormwater and sediment can be appropriately managed on this site with the application of recommended controls. Sediment control measures will require the strategic placement of stormwater retention ponds (SRPs) and silt/sediment control fences during the development phase of the proposed project.
- xiv. With application of appropriate engineering design, there is adequate available land to develop the proposed arc furnace project on this site and to suitably manage the diversions and discharges of stormwater and groundwater within the property boundary.
- xv. Geotechnically, we are confident that the site is suitable for the proposed development, provided engineering recommendations are followed, and further geotechnical investigations are conducted ahead of detailed design, as indicated in this report.

12. Next Steps

Some of the materials are highly sensitive and are generally not suited to compacted fill platforms. No significant quantity of Amokura Formation material has been identified in the cut areas. Given the scale of the proposed earthworks, further investigations should include:

1. Deep machine boreholes to recover full soil profiles for logging and laboratory testing (recommend eight boreholes).
2. Laboratory testing of test pit samples obtained to gain key geotechnical information on soil characteristics for cut materials, including Atterberg Limits and compaction curve testing.
3. The installation of standpipe piezometers will be used to identify the groundwater levels under the proposed building platforms (estimate four piezometers).
4. Note: the boreholes should be taken at least six pile diameters (say 6m) below the top of rock level (currently identified as CPT refusal depth).

13. Drawings Disclaimer

There are several drawings attached to this report, numbered as Figure 1.1 through 6.1, which are referred to in the technical content of this Preliminary Geotechnical Assessment Report. Certain details may differ slightly from similar drawings (Figures) appearing in other technical reports we have authored for the Green Steel project. This is primarily due to revision updates which are specific to the report. The Green Steel Project Development Drawings (PDDs), numbered PD5.1 and PD5.2, attached to this report, are consistent throughout our reports - current to the revision and date shown.

14. References

- Earthtech (2025a) *Earthworks Management and Erosion and Sediment Control Plan – Green Steel Project, 61 Hampton Downs Road, Hampton Downs, Waikato*. Ref. R4392-3, 23 May 2025.
- Earthtech (2025b) *Engineering Report – Green Steel Monofill, 61 Hampton Downs Road, Hampton Downs, Waikato*. Ref. R4424-2, 30 May 2025.
- GNS Science (Online) *Geological Map of New Zealand*. Scale 1:250,000. Retrieved from GNS Science, [Geology 2.0.0 \(gns.cri.nz\)](https://www.gns.cri.nz/Geology/2.0.0) on 12 January 2024.
- MBIE (2020) *Acceptable Solutions and Verification Methods: E1 Surface Water*. Ministry of Business, Innovation & Employment (MBIE).
- MfE (2023) *Te rautaki para / Waste strategy. Getting rid of waste for a circular Aotearoa New Zealand*. Wellington: Ministry for the Environment, New Zealand. March 2023.
- NZGS (2021) *Earthquake Geotechnical Engineering Practice in New Zealand*. New Zealand Geotechnical Society (NZGS) and Ministry of Business Innovation & Employment (MBIE). Rev 1, November 2021.
<https://www.building.govt.nz/assets/Uploads/building-code-compliance/b-stability/b1-structure/geotechnical-guidelines/module-1-overview-of-earthquake-geotechnical-engineering-practice-guidelines-version-1.pdf>
- Waikato Regional Council (2020) Waikato Regional Council Technical Report 2020/07. Updated version May 2020: *Waikato stormwater management guideline*. Erosion and sediment control guidelines for soil disturbing activities (TR2009/02).



FOR INFORMATION

Note: All drawings are to be approved (initialled) before final issue.



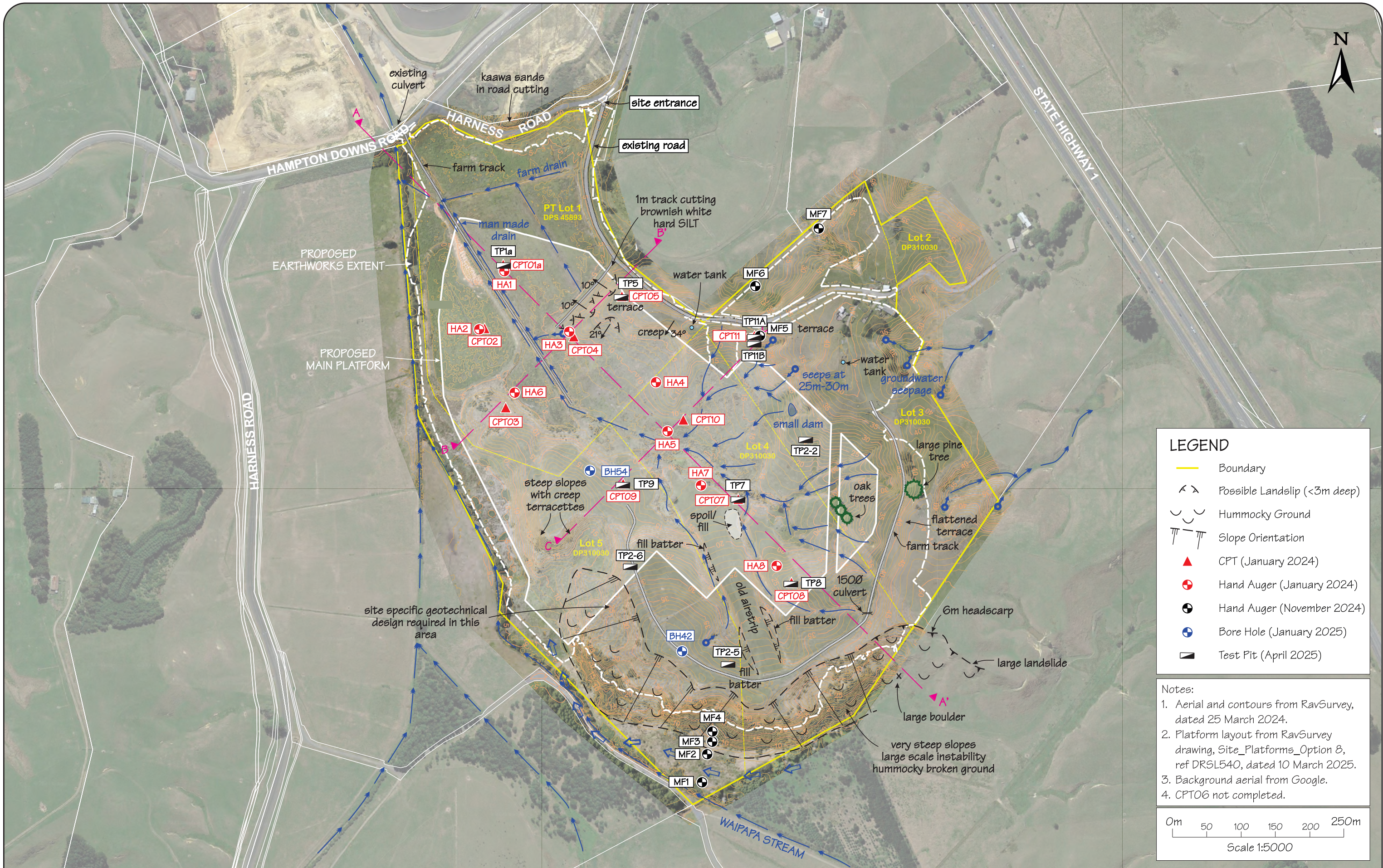
Earthtech Consulting Ltd.
P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

61 HAMPTON DOWNS ROAD
National Green Steel Limited

Site Location Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	12-01-24	FOR PRELIMINARY GEOTECHNICAL ASSESSMENT	L.S	A.N	S.SW	
B	15-04-24	CHANGE SCALE	L.S	A.N	S.SW	

DRAWING NO.:	FIG. 1.1
REF:	4392
SCALE:	1:15000
CRS:	NZTM
DATUM:	Moturiki 1953



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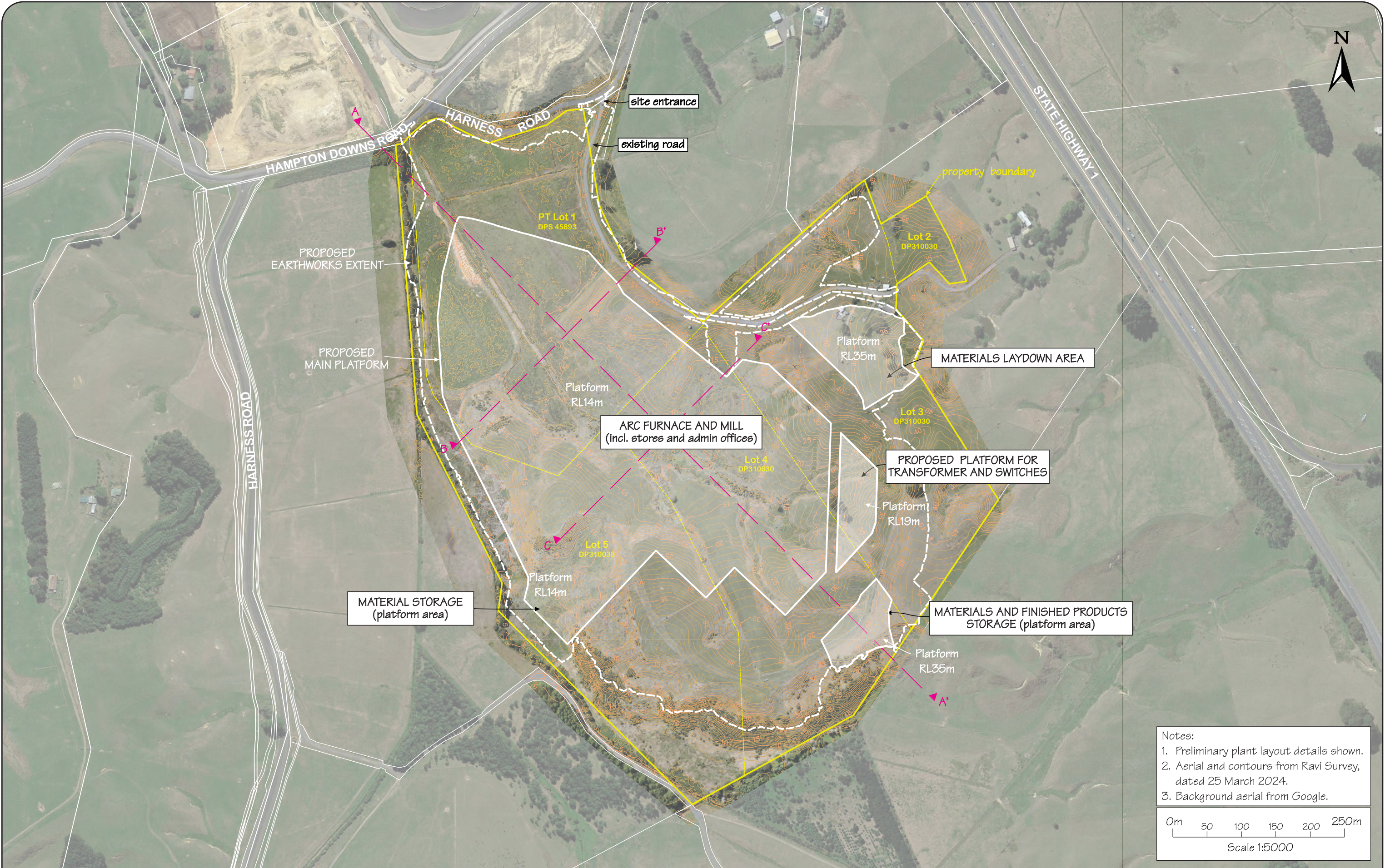
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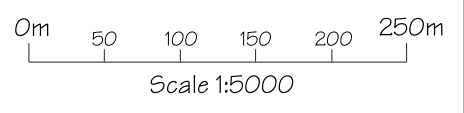
Site Investigation and Mapping Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	23-04-24	FOR REPORT R4392-2 REV A	L.S	A.N	S.SW	
B	29-04-24	FOR REPORT R4392-2 REV B	L.S	A.N	S.SW	
C	03-03-25	UPDATE PLATFORM	L.S	A.N	S.SW	
D	28-04-25	ADD TEST PITS	L.S	A.N	S.SW	
E	20-05-25	UPDATE EARTHWORKS EXTENT	L.S	A.N	S.SW	

DRAWING NO.:	FIG. 2.1
REF:	4392-R2
SCALE:	1:5000
CRS:	Mt Eden 2000
DATUM:	AVD46



- Notes:
1. Preliminary plant layout details shown.
 2. Aerial and contours from Ravi Survey, dated 25 March 2024.
 3. Background aerial from Google.



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P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

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Site Layout Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	23-04-24	FOR REPORT R4392-2 REV A	L.S	A.N	S.SW	
B	29-04-24	FOR REPORT R4392-2 REV B	L.S	A.N	S.SW	
C	03-03-25	UPDATE PLATFORMS	L.S	A.N	S.SW	
D	20-05-25	UPDATE PLATFORMS	L.S	A.N	S.SW	

DRAWING NO.:
FIG. 2.2

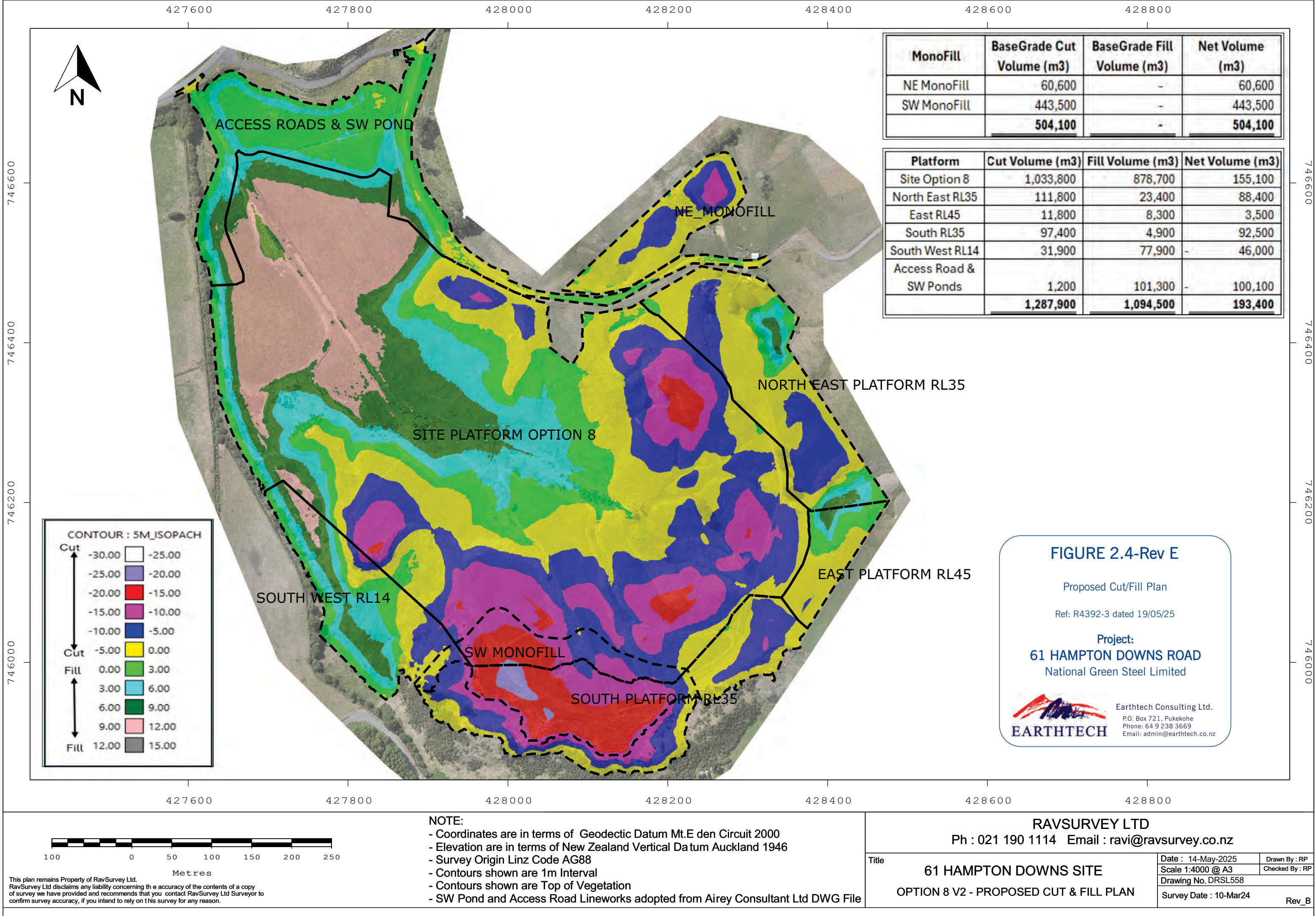
REF: 4392-R2

SCALE: 1:5000

CRS: NZTM

DATUM: Moturiki 1953





MonoFill	BaseGrade Cut Volume (m3)	BaseGrade Fill Volume (m3)	Net Volume (m3)
NE MonoFill	60,600	-	60,600
SW MonoFill	443,500	-	443,500
	504,100	-	504,100

Platform	Cut Volume (m3)	Fill Volume (m3)	Net Volume (m3)
Site Option 8	1,033,800	878,700	155,100
North East RL35	111,800	23,400	88,400
East RL45	11,800	8,300	3,500
South RL35	97,400	4,900	92,500
South West RL14	31,900	77,900	- 46,000
Access Road & SW Ponds	1,200	101,300	- 100,100
	1,287,900	1,094,500	193,400

CONTOUR : 5M_ISOPACH			
Cut	-30.00	-25.00	
	-25.00	-20.00	
	-20.00	-15.00	
	-15.00	-10.00	
	-10.00	-5.00	
Fill	-5.00	0.00	
	0.00	3.00	
	3.00	6.00	
	6.00	9.00	
	9.00	12.00	
	12.00	15.00	

FIGURE 2.4-Rev E


Proposed Cut/Fill Plan

Ref: R4392-3 dated 19/05/25

Project:
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P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz



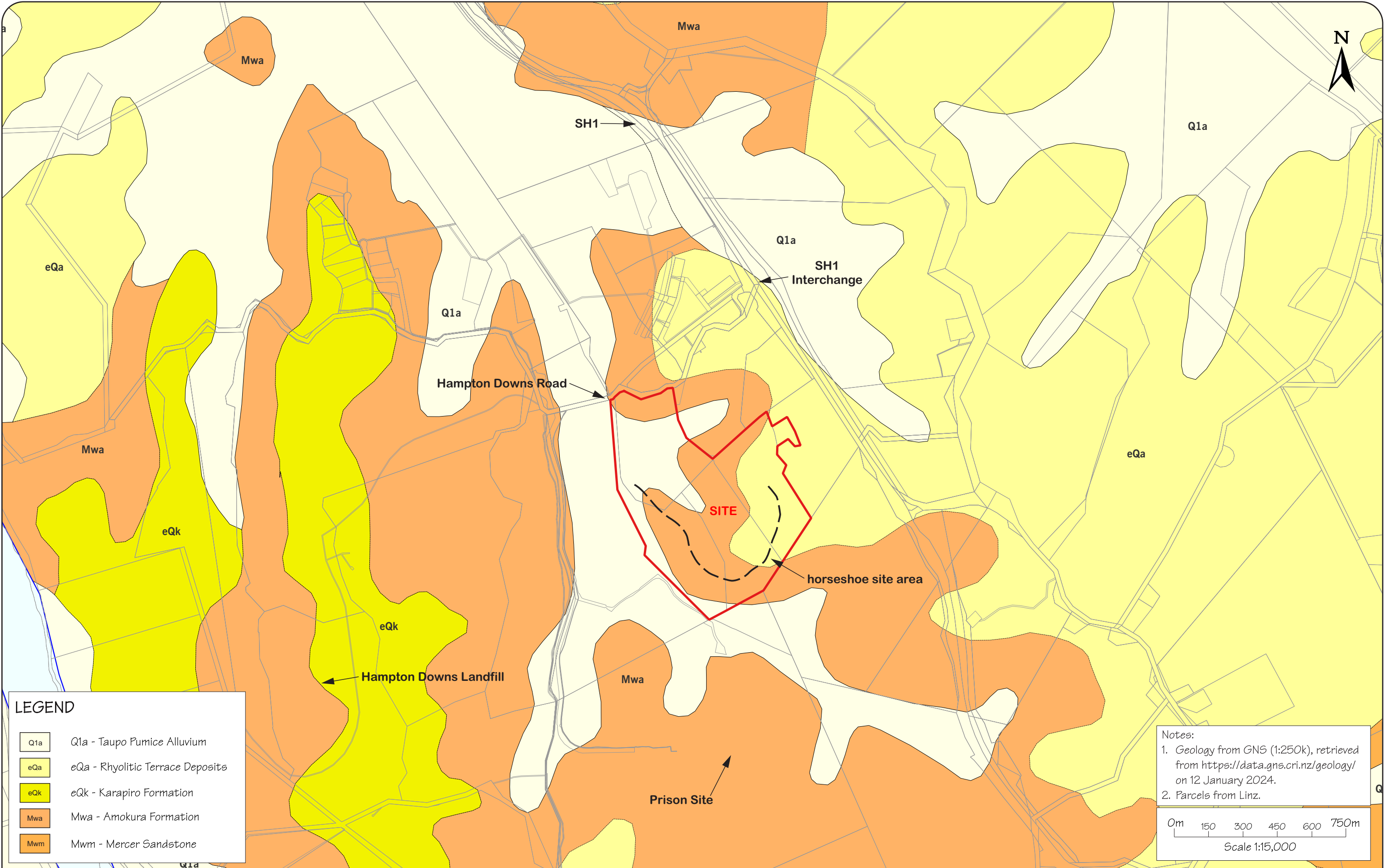
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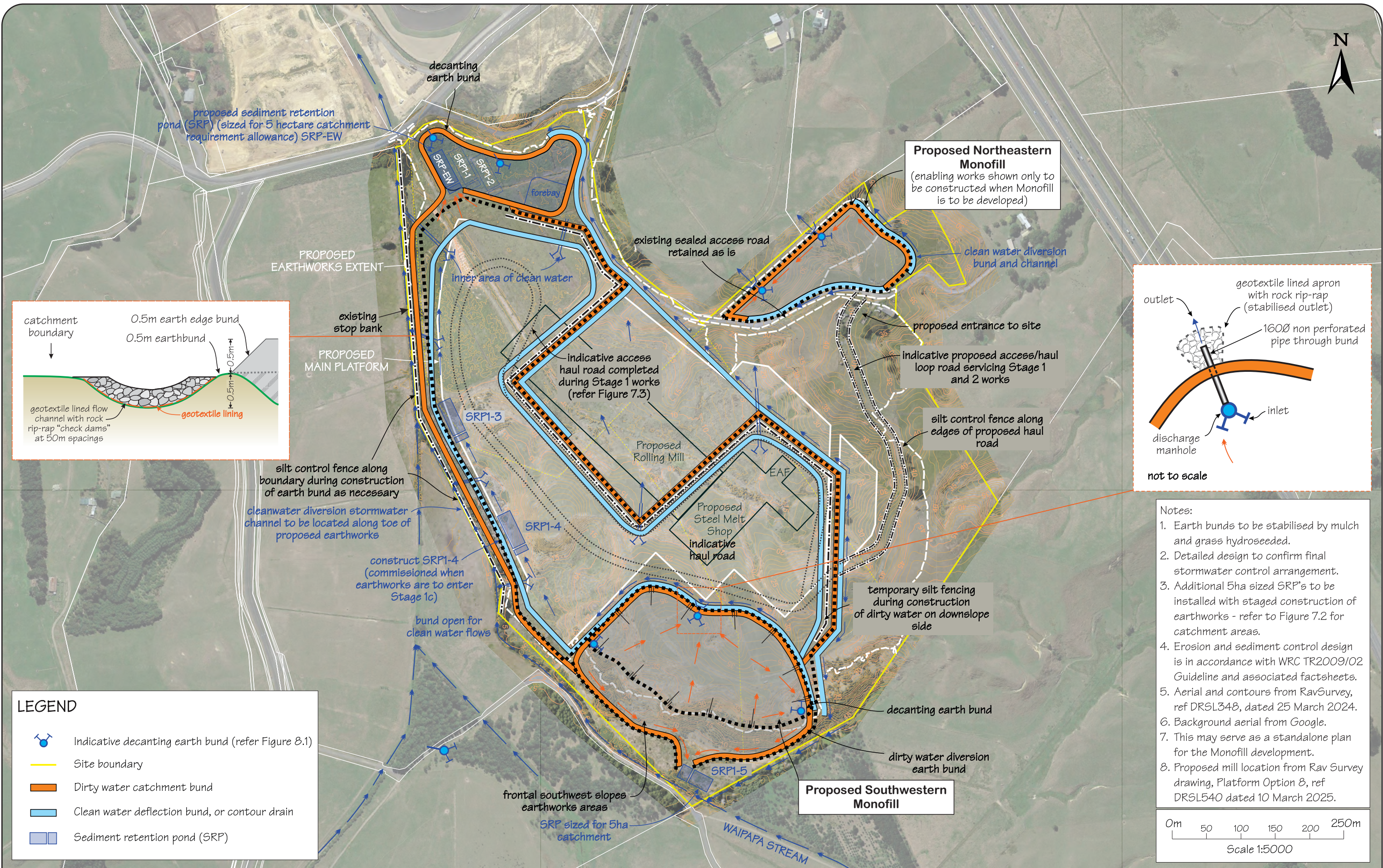
NOTE:

- Coordinates are in terms of Geodectic Datum Mt.E den Circuit 2000
- Elevation are in terms of New Zealand Vertical Datum Auckland 1946
- Survey Origin Linz Code AG88
- Contours shown are 1m Interval
- Contours shown are Top of Vegetation
- SW Pond and Access Road Lineworks adopted from Airey Consultant Ltd DWG File

RAVSURVEY LTD
Ph : 021 190 1114 Email : ravi@ravsurvey.co.nz

Title 61 HAMPTON DOWNS SITE OPTION 8 V2 - PROPOSED CUT & FILL PLAN	Date : 14-May-2025	Drawn By : RP
	Scale 1:4000 @ A3	Checked By : RP
	Drawing No. DRSL558	
	Survey Date : 10-Mar24	Rev_B





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P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

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Conceptual Stormwater Control Plan (Day 1 Plan)

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
B	29-04-24	FOR REPORT R4392-2 REV B	L.S.	A.N.	S.S.W.	
C	28-11-24	DRAFT FOR REPORT R4392-3	L.S.	A.N.	S.S.W.	
D	03-03-25	DRAFT FOR REPORT	L.S.	A.N.	S.S.W.	
E	30-04-25	UPDATE EARTHWORKS	L.S.	A.N.	S.S.W.	
F	23-05-25	UPDATE EARTHWORKS AND STAGING	L.S.	A.N.	S.S.W.	

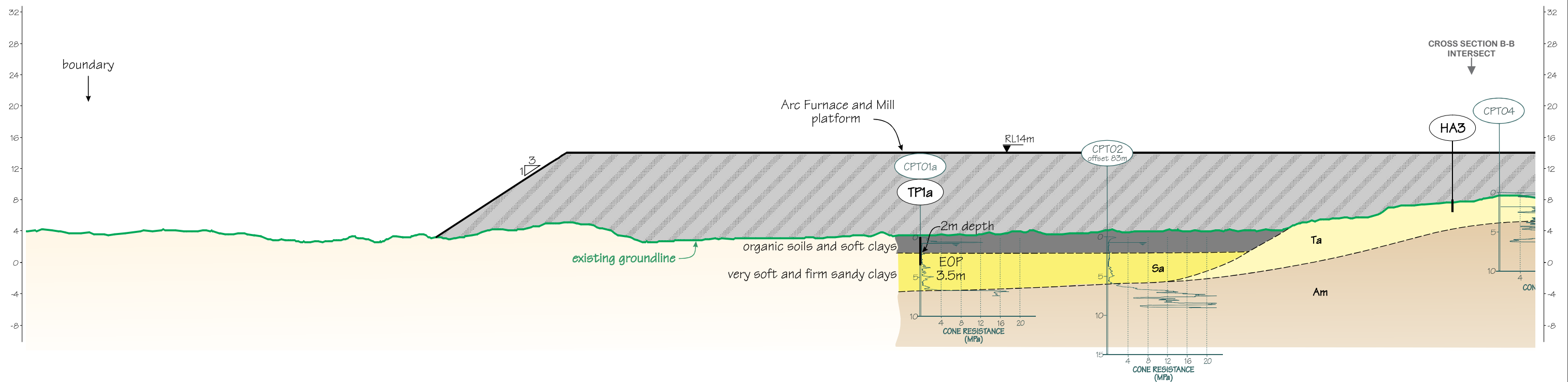
DRAWING NO.:

FIG. 6.1

REF: 4392

SCALE: 1:5000

CRS: Mt Eden 2000
DATUM: AVD46



LEGEND

	Organic soils and clays
	Stream Alluvium
	Terrace Alluvium
	H-K Ash
	Amokura Formation

Note:

- Geology shown is as mapped by GNS and needs to be proven by site investigations, which include test pits and deep boreholes.
- Groundline and design line from RavSurvey drawing DRSL371 Rev B, Long Section Line A, dated 10 March 24.

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P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

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Long Section A-A - Page 1 of 3

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	26-04-24	FOR REPORT R4392-2 REV A	L.S	A.N	S.SW	
B	29-04-24	FOR REPORT R4392-2 REV B	L.S	A.N	S.SW	
C	30-04-25	ADD TEST PITS	L.S	A.N	C.F	

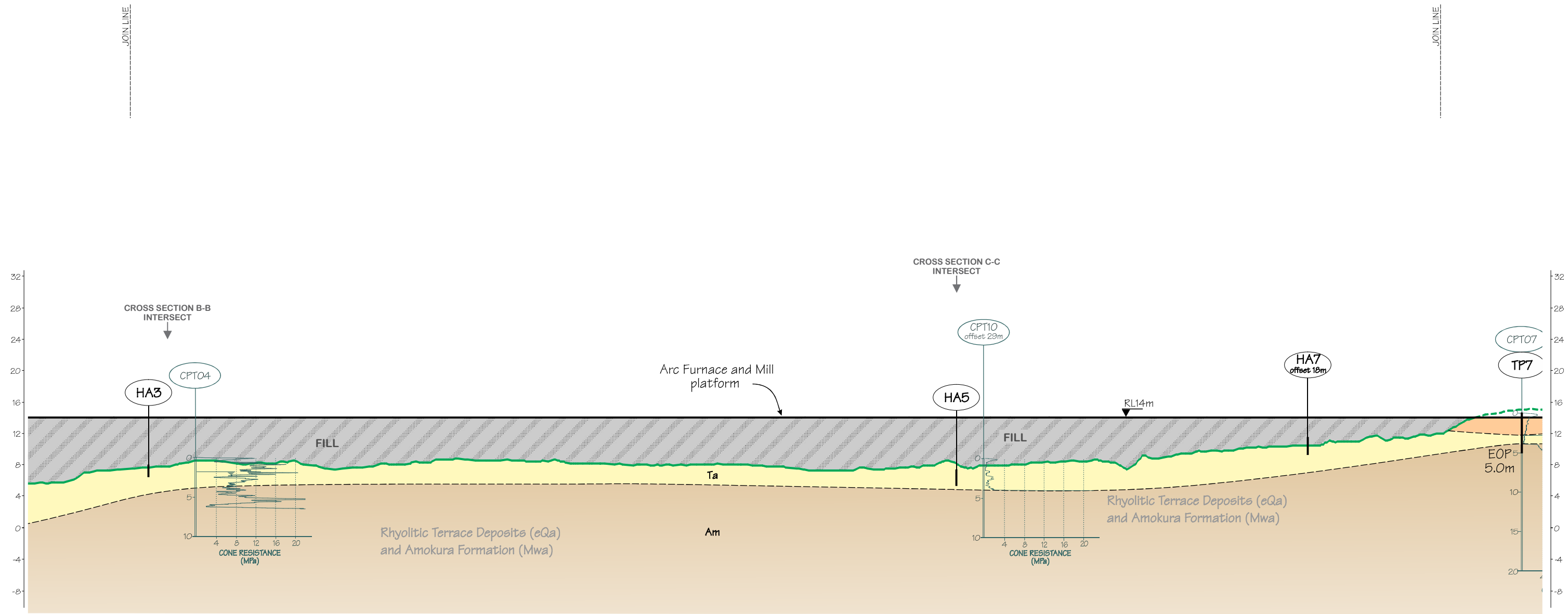
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FIG. PD5.1/1

REF: 4392

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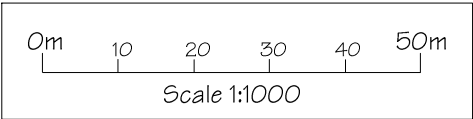
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DATUM: AVD46



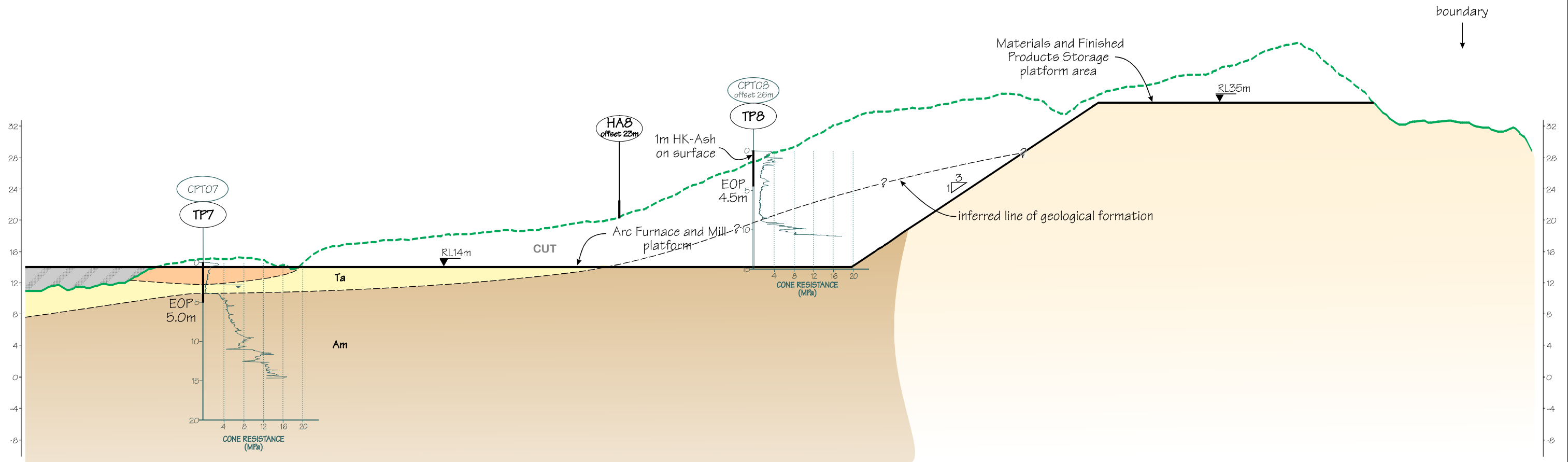
- LEGEND**
- Organic soils and clays
 - Sa Stream Alluvium
 - Ta Terrace Alluvium
 - HK-A H-K Ash
 - Am Amokura Formation

Note:

- Geology shown is as mapped by GNS and needs to be proven by site investigations, which include test pits and deep boreholes.
- Groundline and design line from RavSurvey drawing DRSL371 Rev B, Long Section Line A, dated 10 March 24.



JOIN LINE

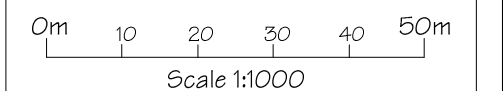


LEGEND

	Organic soils and clays
	Stream Alluvium
	Terrace Alluvium
	H-K Ash
	Amokura Formation

Note:

- Geology shown is as mapped by GNS and needs to be proven by site investigations, which include test pits and deep boreholes.
- Groundline and design line from RavSurvey drawing DRSL371 Rev B, Long Section Line A, dated 10 March 24.



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P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

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Long Section A-A - Page 3 of 3

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	26-04-24	FOR REPORT R4392-2 REV A	L.S	A.N	S.SW	
B	29-04-24	FOR REPORT R4392-2 REV B	L.S	A.N	S.SW	
C	30-04-25	ADD TEST PITS	L.S	A.N	C.F	

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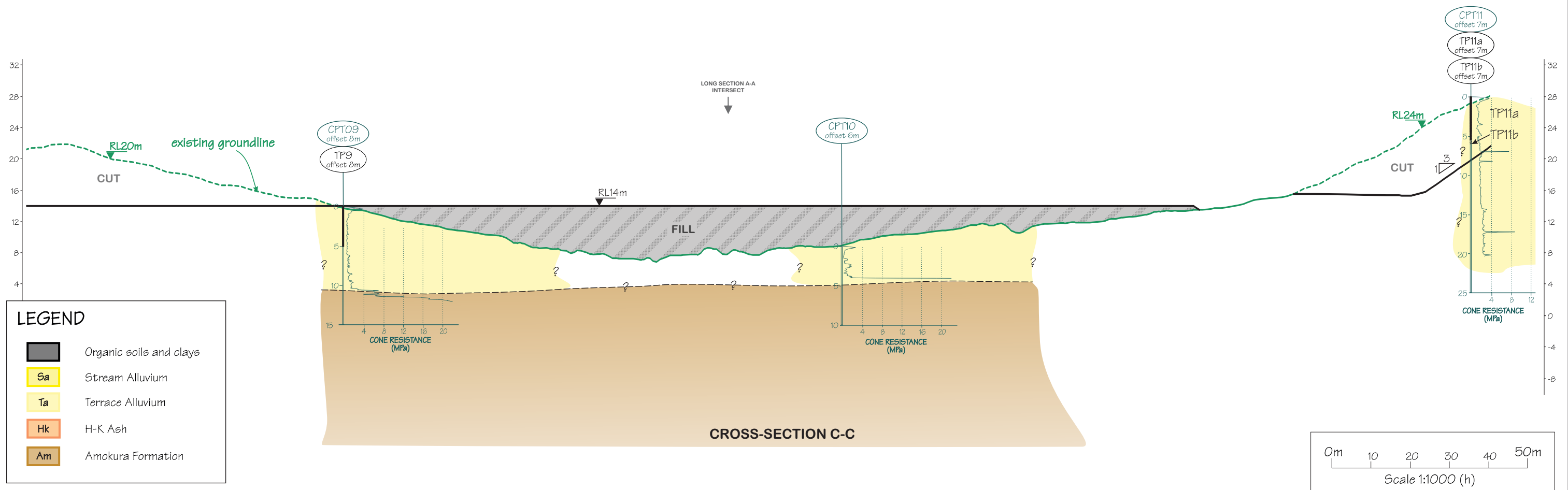
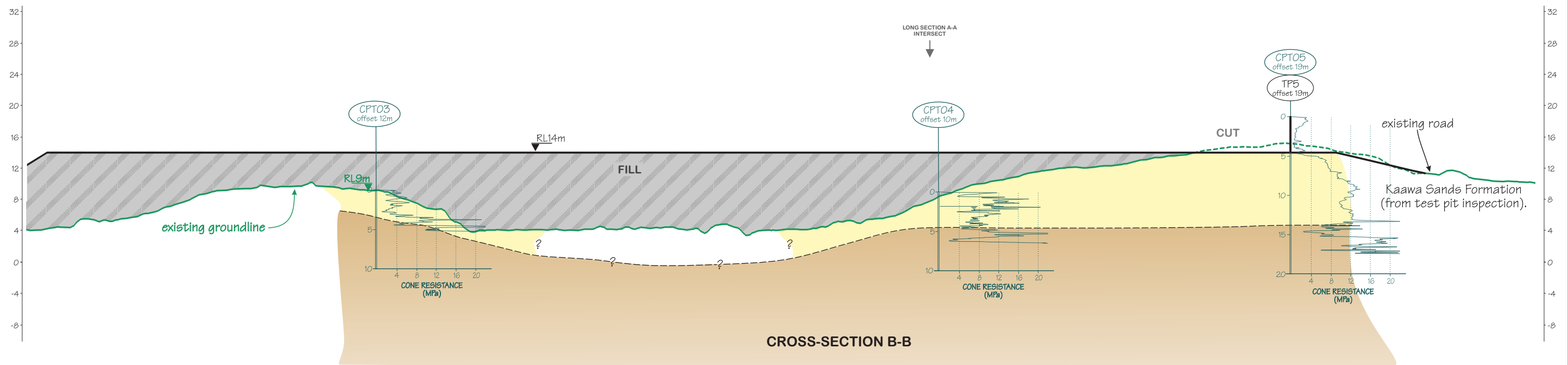
FIG. PD5.1/3

REF: 4392

SCALE: 1:1000(h) 1:500(v)

CRS: Mt Eden 2000
DATUM: AVD46

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LEGEND	
	Organic soils and clays
	Stream Alluvium
	Terrace Alluvium
	H-K Ash
	Amokura Formation

FOR INFORMATION Notes: Groundline and design line from Ravsurvey Drawing DRSL372 Rev B, Long Section Line B-C, dated 10 Mar 24.

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Earthtech Consulting Ltd.
P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

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Cross-Section B-B and C-C

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	24-04-24	FOR REPORT R4392-2 REV A	L.S	A.N	S.SW	
B	29-04-24	FOR REPORT R4392-2 REV B	L.S	A.N	S.SW	
C	02-05-25	ADD TEST PITS	L.S	A.N	C.F	

DRAWING NO.:
FIG. PD5.2

REF: 4392

SCALE: 1:1000(h) 1:500(v)

CRS: Mt Eden 2000

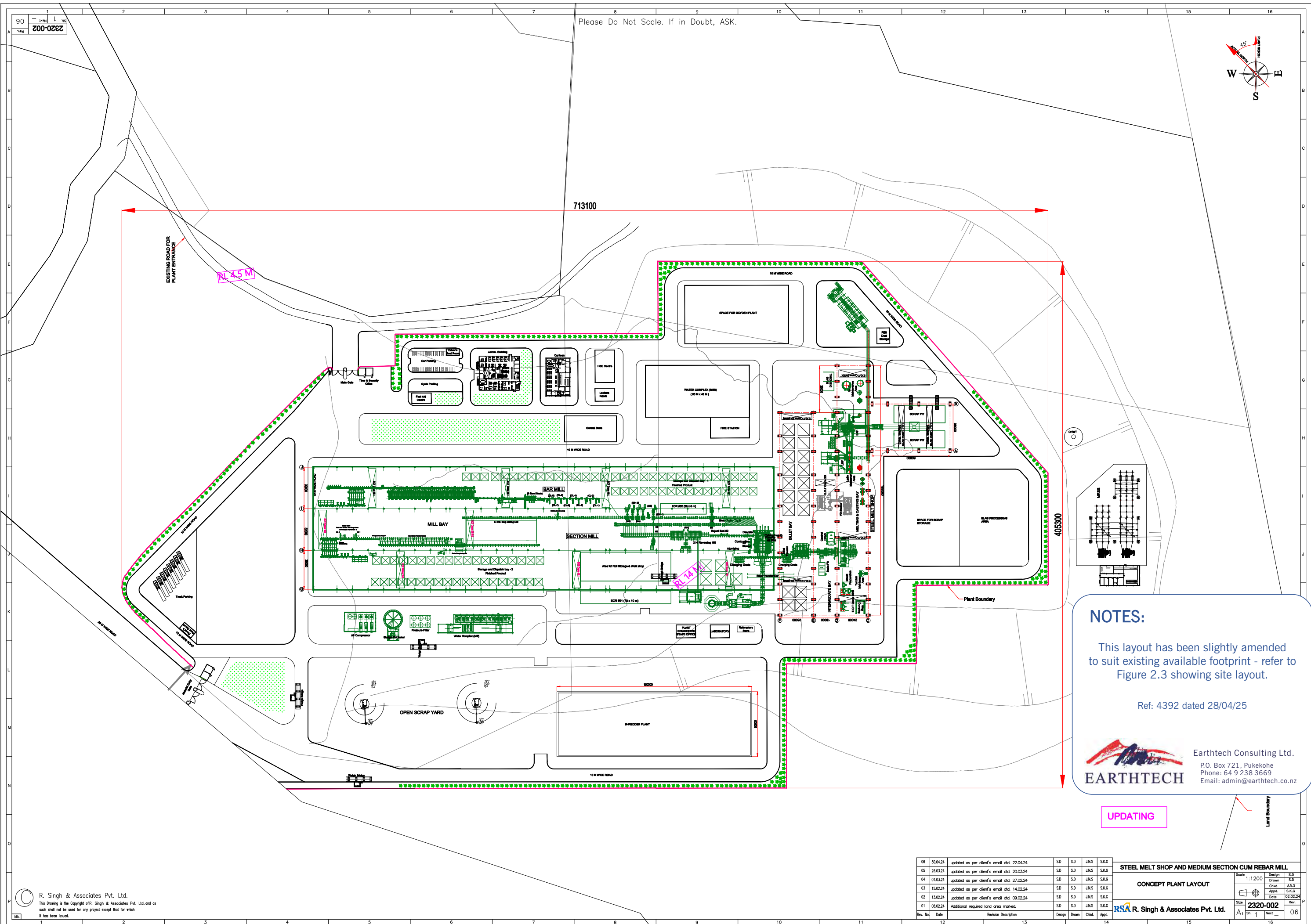
DATUM: AVD46

Preliminary Geotechnical Assessment Report

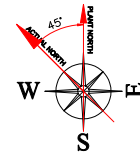
61 Hampton Downs Road, Hampton Downs

Appendix A

Concept Plant Layout



Please Do Not Scale. If in Doubt, ASK.



NOTES:

This layout has been slightly amended to suit existing available footprint - refer to Figure 2.3 showing site layout.

Ref: 4392 dated 28/04/25




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P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

UPDATING

Rev. No.	Date	Revision Description	Design	Drawn	Chkd.	Appd.
06	30.04.24	updated as per client's email dtd. 22.04.24	S.D	S.D	J.N.S	S.K.G
05	26.03.24	updated as per client's email dtd. 20.03.24	S.D	S.D	J.N.S	S.K.G
04	01.03.24	updated as per client's email dtd. 27.02.24	S.D	S.D	J.N.S	S.K.G
03	15.02.24	updated as per client's email dtd. 14.02.24	S.D	S.D	J.N.S	S.K.G
02	13.02.24	updated as per client's email dtd. 09.02.24	S.D	S.D	J.N.S	S.K.G
01	08.02.24	Additional required land area marked.	S.D	S.D	J.N.S	S.K.G

STEEL MELT SHOP AND MEDIUM SECTION CUM REBAR MILL

CONCEPT PLANT LAYOUT

CONCEPT PLANT LAYOUT		Scale	1:1200	Design	Drawn
				Chkd.	
			Appd.		
			Date		
		Size	2320-002		
R. Singh & Associates Pvt. Ltd.		A1	Sh.	Next	

RSA R. Singh & Associates Pvt. Ltd.

Preliminary Geotechnical Assessment Report

61 Hampton Downs Road, Hampton Downs

Appendix B

Site Investigation Data

- B1) CPT's – CPT01a to CPT05, CPT07 to CPT11
- B2) Hand Augers – HA1 to HA8
- B3) Test Pits – TP1A, TP2-2, TP2-5, TP2-6, TP5, TP7, TP8, TP9, TP11A and TP11B
Test Pit Grab-Samples Photographs

Preliminary Geotechnical Assessment Report

61 Hampton Downs Road, Hampton Downs

Appendix B1

CPT Data

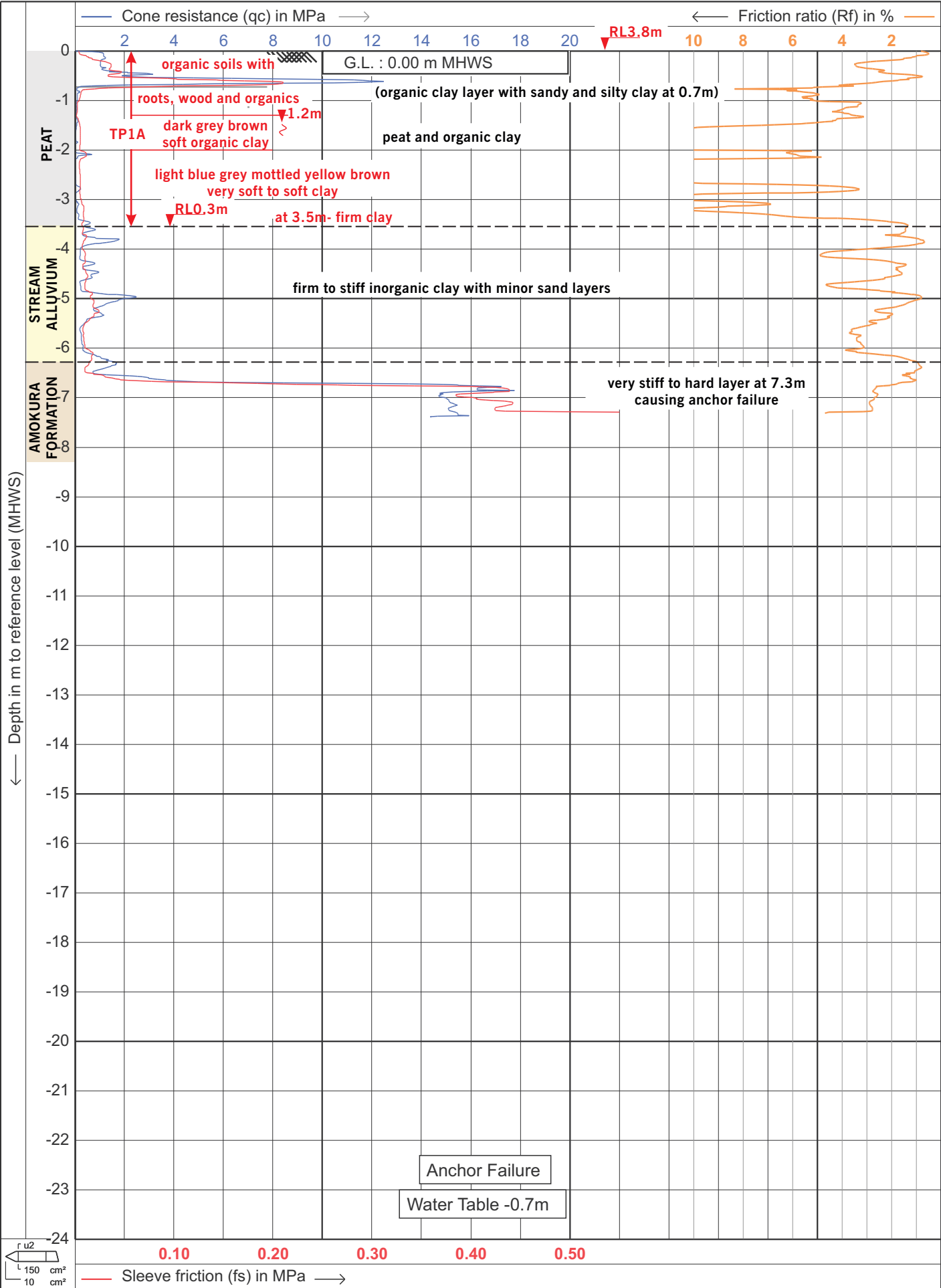
CPT01a to CPT05, CPT07 to CPT11

APPENDIX B1

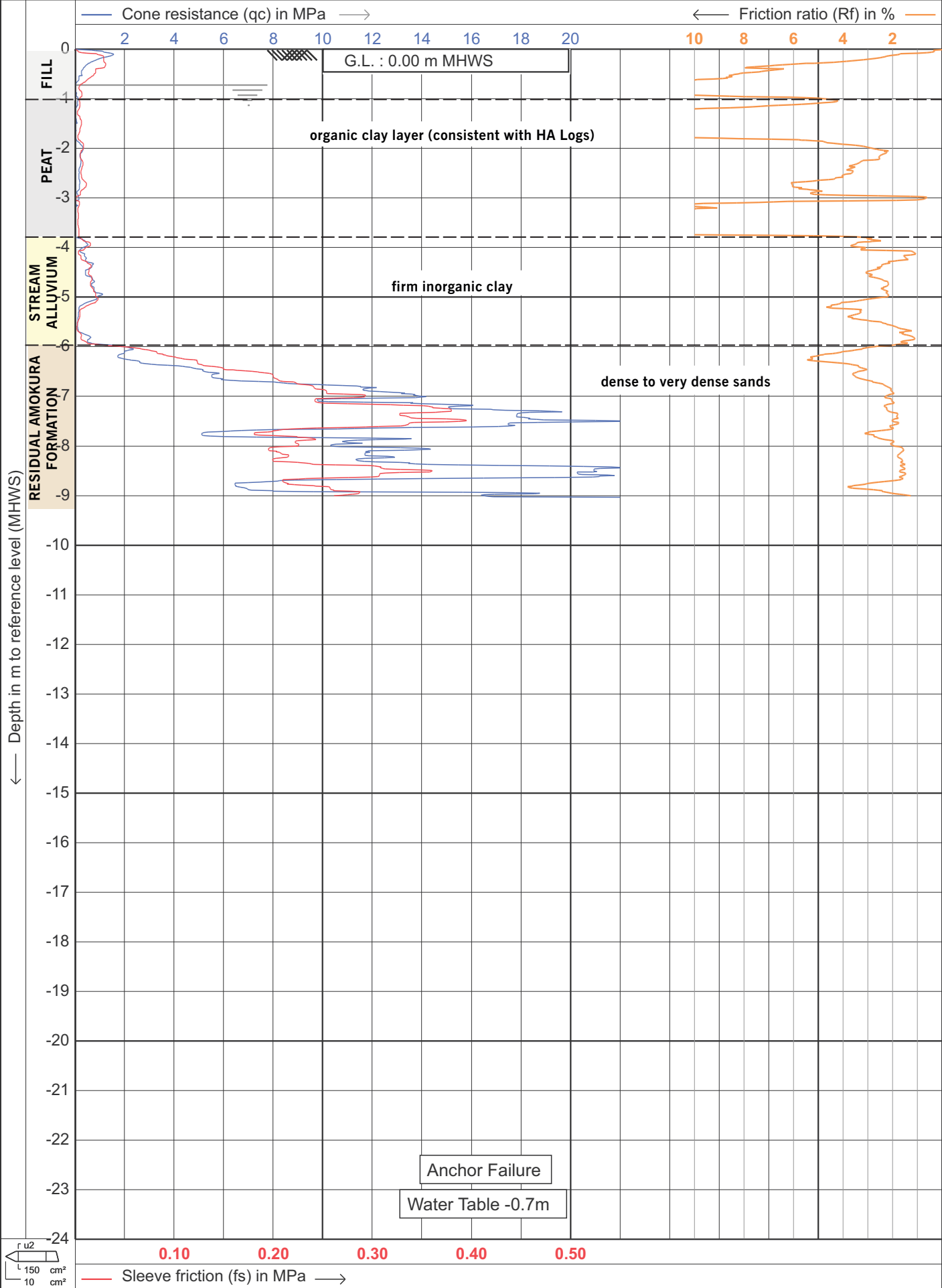
CPT DATA - 2024 TESTING


CPT Number	Cone Reference Number	Depth	RL	NZTM Co-ordinates	
				Northing	Easting
CPT01A	C10CFIIP.C21103	7.39m	3.8m	5863038.786	1783976.611
CPT02	C10CFIIP.C21103	9.08m	4m	5862945.575	1783949.571
CPT03	C10CFIIP.C21103	5.27m	9m	5862829.562	1783979.980
CPT04	C10CFIIP.C21103	6.54m	9m	5862932.836	1784079.371
CPT05	C10CFIIP.C21103	17.38m	18.5m	5862992.340	1784149.887
CPT07	C10CFIIP.C21103	14.59m	14.2m	5862695.752	1784319.328
CPT08	C10CFIIP.C21103	10.8m	29m	5862574.930	1784396.587
CPT09	C10CFIIP.C21103	12.13m	14m	5862718.441	1784151.206
CPT10	C10CFIIP.C21103	4.05m	9m	5862811.975	1784239.130
CPT11	C10CFIIP.C21103	20.2m	28m	5862934.570	1784343.204

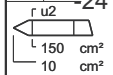
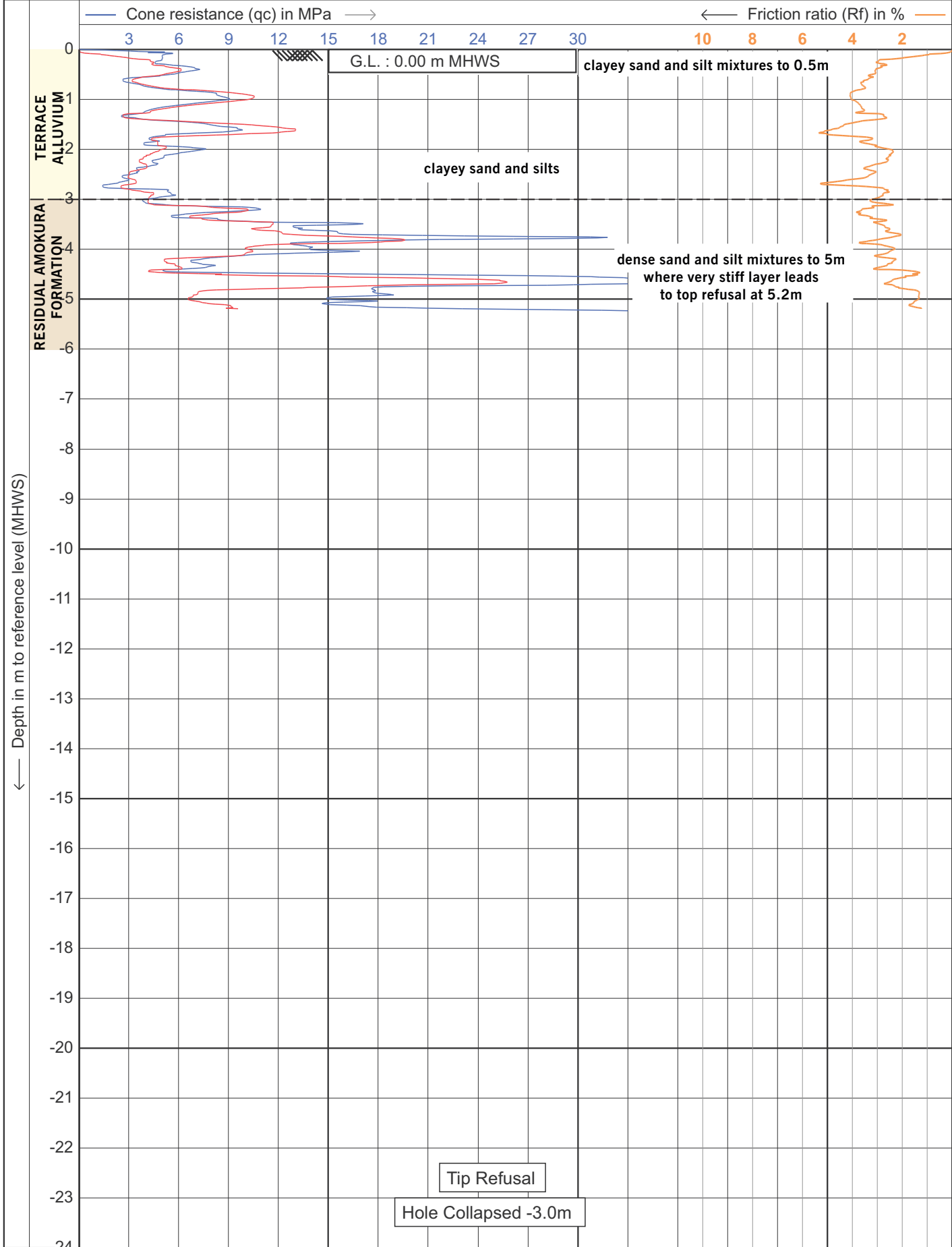
NOTE: TEST PIT MARKUP IS SHOWN IN RED



 TEST RIGHT • BUILD RIGHT NORTHLAND • WELLINGTON • CANTERBURY • OTAGO	Test performed in accordance with ASTM D5778-12		Date : 25-1-2024
	Project : EARTHTECH		Cone no. : C10CFIIP.C21103
	Location: Hampton Downs		Project no. : 8736-010
	Position : 175.077455, -37.361146 WGS84		CPT no. : CPT01a 1/4



 TEST RIGHT • BUILD RIGHT NORTHLAND • WELLINGTON • CANTERBURY • OTAGO	Test performed in accordance with ASTM D5778-12		Date : 25-1-2024
	Project : EARTHTECH		Cone no. : C10CFIIP.C21098
	Location: Hampton Downs		Project no. : 8736-010
	Position : 175.077173, -37.361991 WGS84		CPT no. : CPT02 1/4



TEST RIGHT • BUILD RIGHT

NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Test performed in accordance with ASTM D5778-12

Project : **EARTHTECH**

Location: **Hampton Downs**

Position : **175.077545, -37.36303 WGS84**

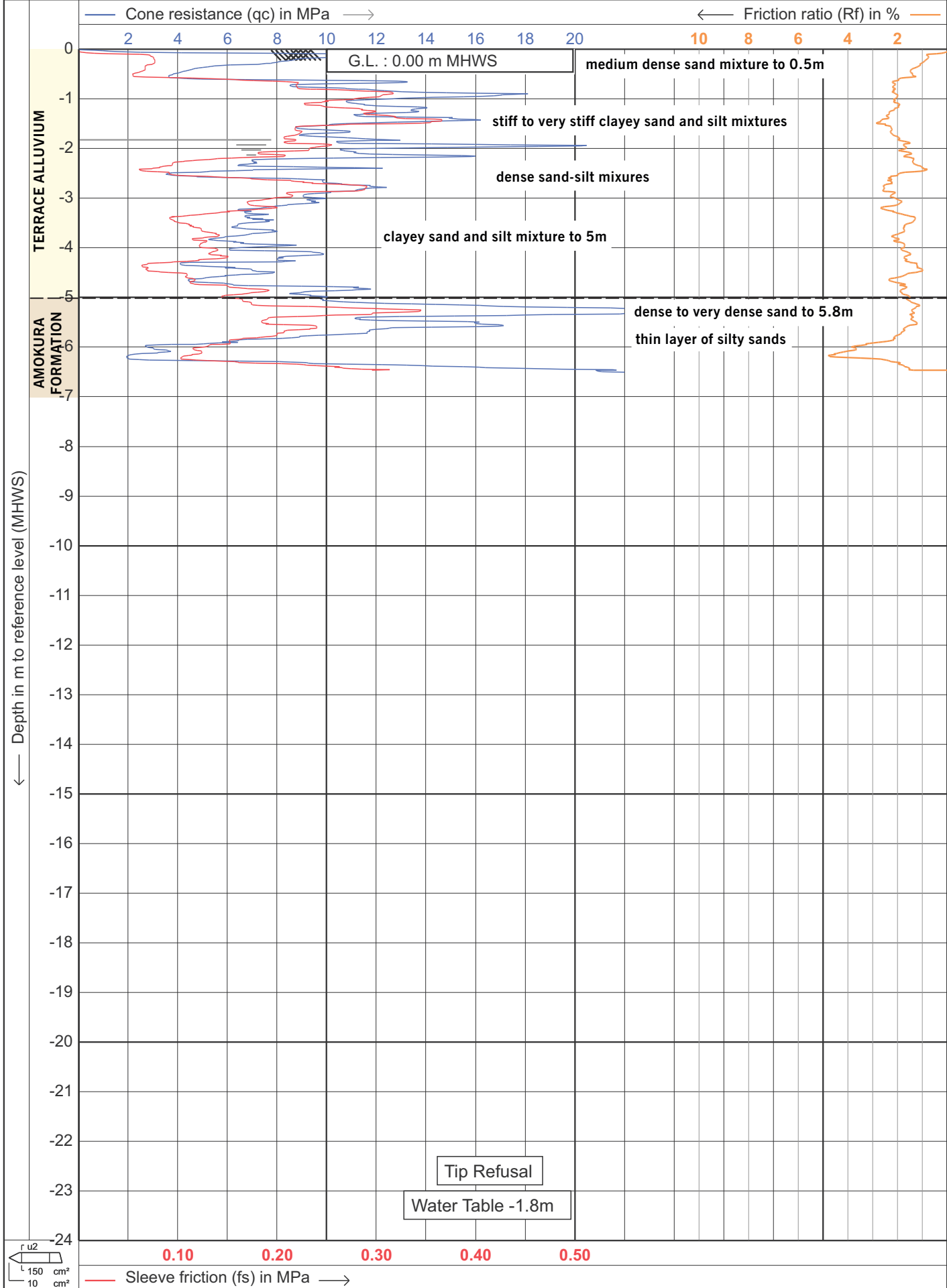
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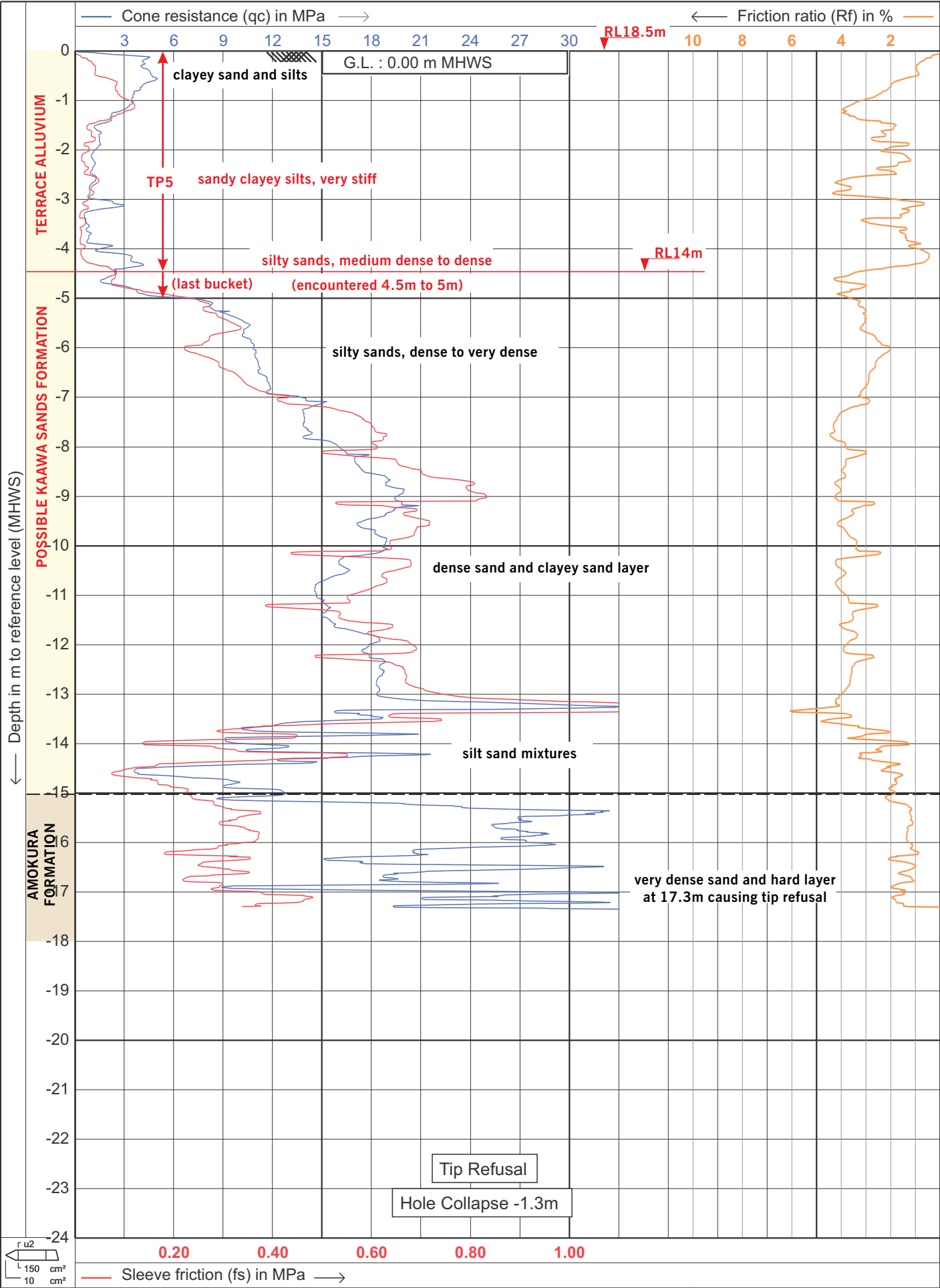
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CPT no. : **CPT03**

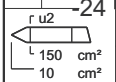
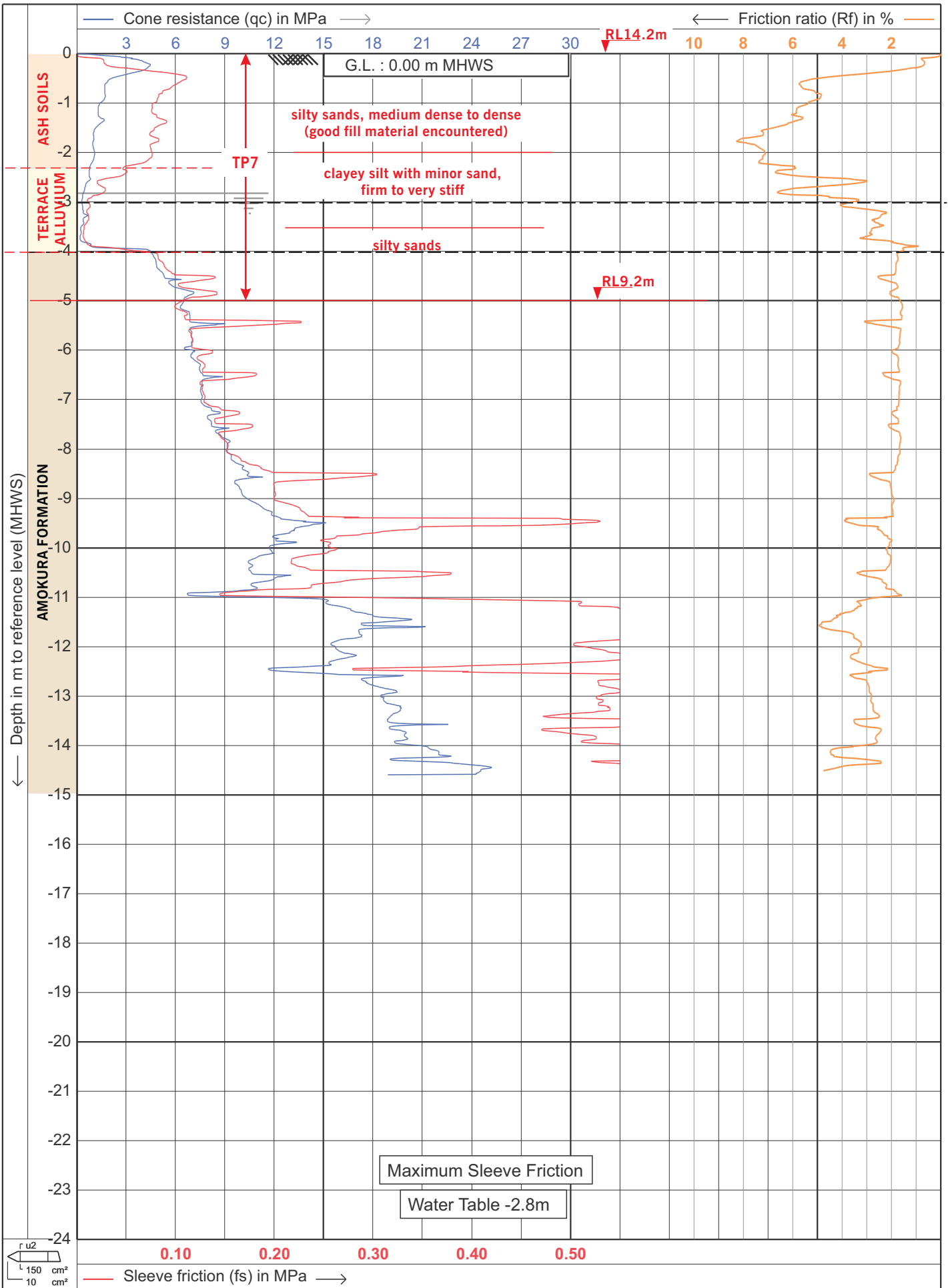
1/4



NOTE: TEST PIT MARKUP IS SHOWN IN RED



NOTE: TEST PIT MARKUP IS SHOWN IN RED



— Sleeve friction (fs) in MPa →



TEST RIGHT • BUILD RIGHT

NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Test performed in accordance with ASTM D5778-12

Project : **EARTHTECH**

Location: **Hampton Downs**

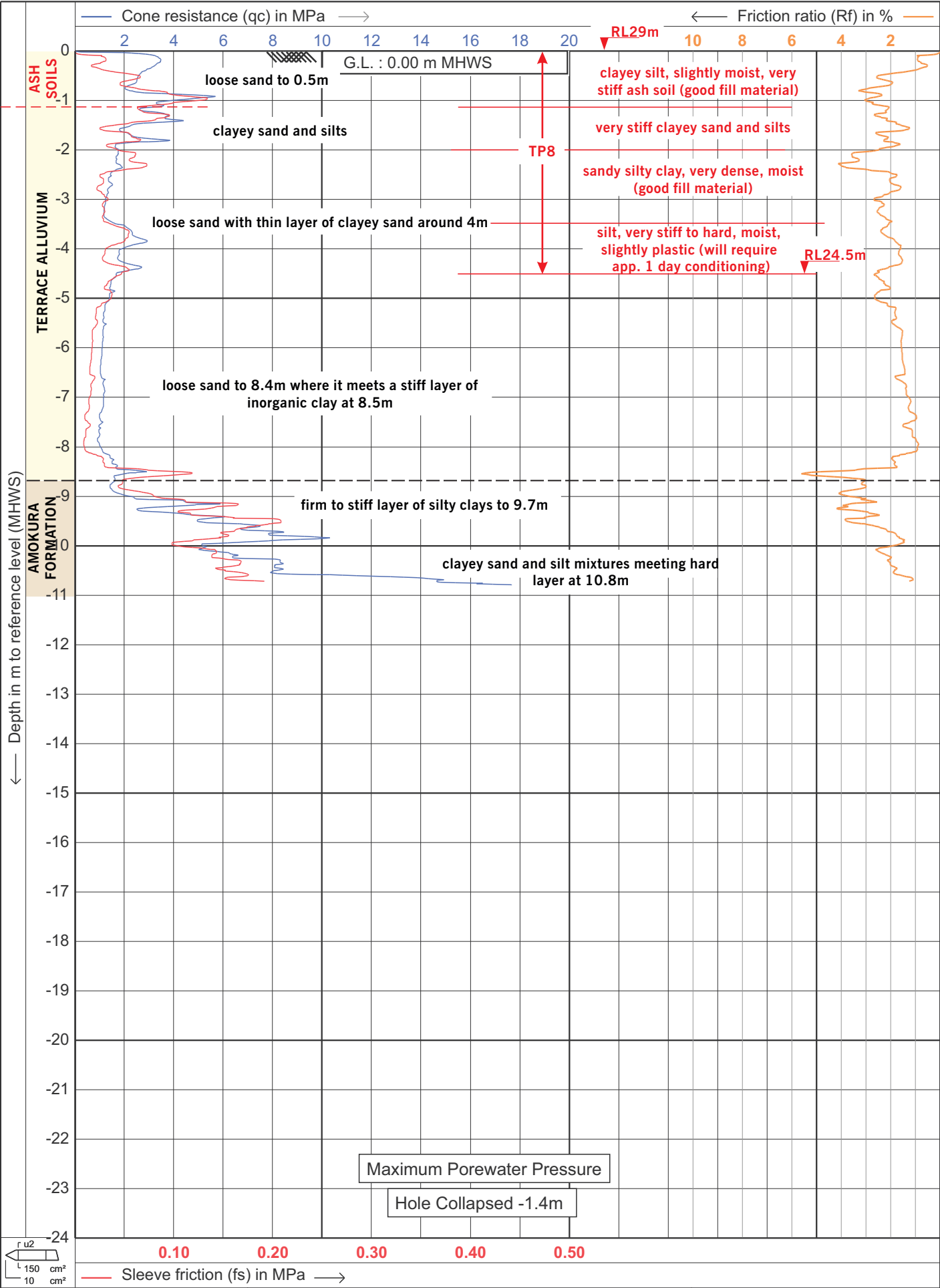
Position : 175.081408, -37.364168 WGS84

Date	: 26-1-2024
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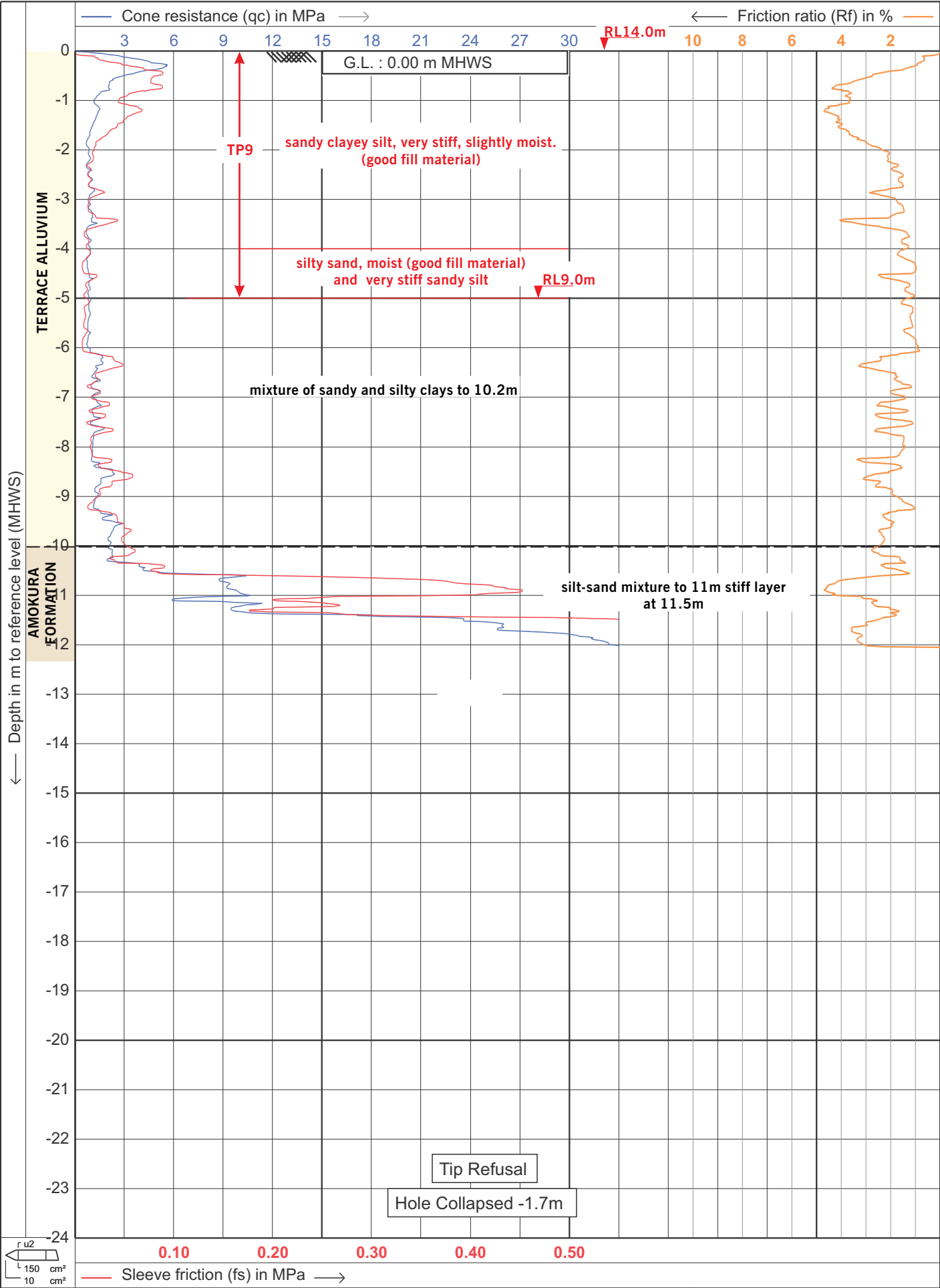
Cone no.	: C10CFIIP.C21103
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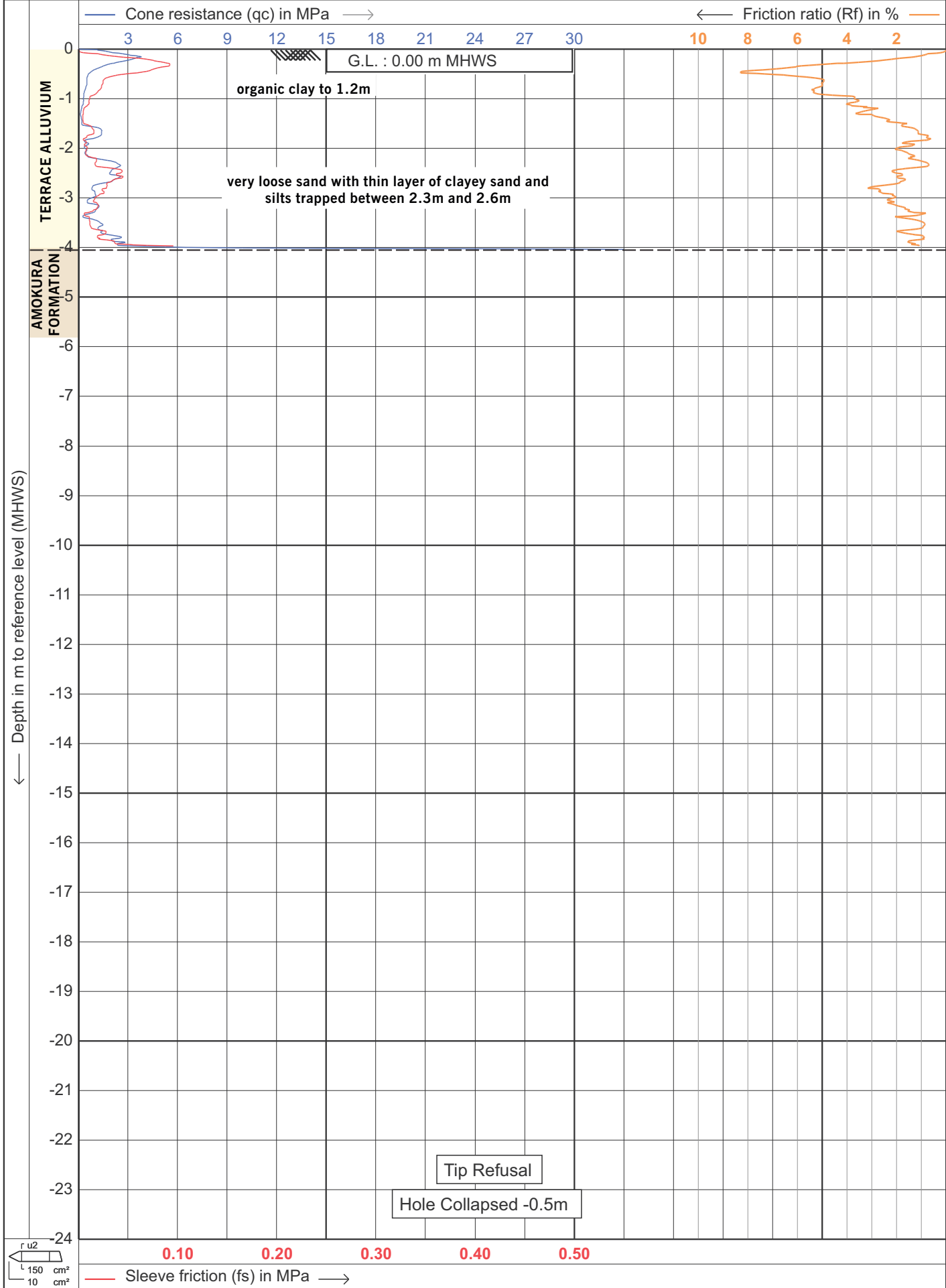
Project no. : **8736-010**CPT no. : **CPT07** $\frac{1}{4}$


NOTE: TEST PIT MARKUP IS SHOWN IN RED



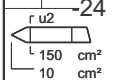
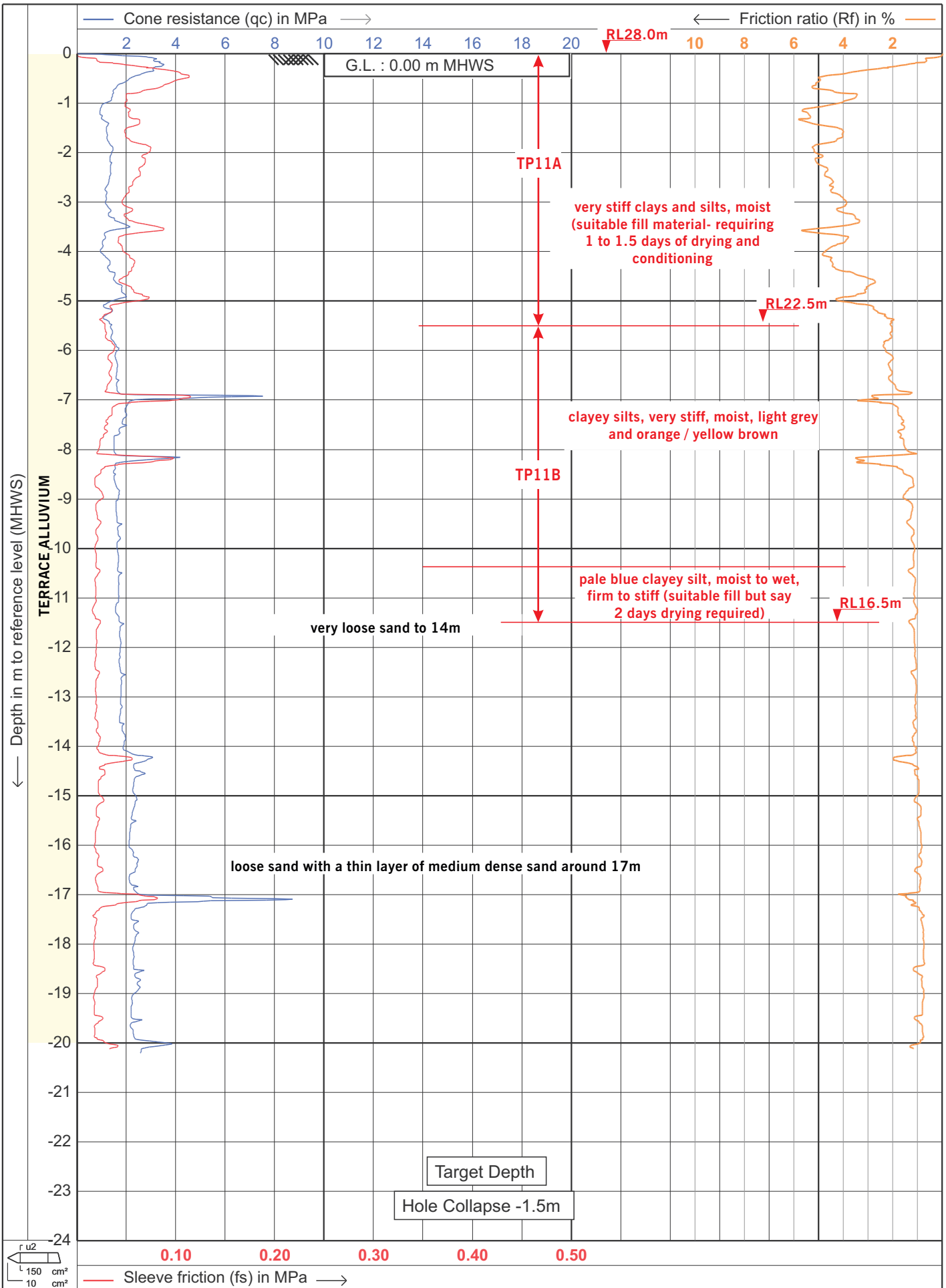
NOTE: TEST PIT MARKUP IS SHOWN IN RED





 TEST RIGHT • BUILD RIGHT NORTHLAND - WELLINGTON - CANTERBURY - OTAGO	Test performed in accordance with ASTM D5778-12		Date : 26-1-2024
	Project : EARTHTECH		Cone no. : C10CFIIP.C21103
	Location: Hampton Downs		Project no. : 8736-010
	Position : 175.080474, -37.363137 WGS84		CPT no. : CPT10 1/4

NOTE: TEST PIT MARKUP IS SHOWN IN RED



TEST RIGHT • BUILD RIGHT

NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Test performed in accordance with ASTM D5778-12

Project : **EARTHTECH**

Location: **Hampton Downs**

Position: **175.081618, -37.362012 WGS84**

Date : **26-1-2024**

Cone no. : **C10CFIIP.C21103**

Project no. : **8736-010**

CPT no. : **CPT11**

1/4

Preliminary Geotechnical Assessment Report

61 Hampton Downs Road, Hampton Downs

Appendix B2

Hand Auger Data

HA1 to HA8

APPENDIX B2

HA DATA - 2024 TESTING

HA Number	Depth	RL	NZTM Co-ordinates	
			Northing	Easting
HA1	1.0m	3.8m	5863025.816	1783978.131
HA2	3m	4m	5862945.594	1783940.621
HA3	1.5m	8m	5862942.253	1784071.196
HA4	1.5m	12m	5862867.858	1784198.241
HA5	2.0m	7.5m	5862795.822	1784215.100
HA6	1.5m	4m	5862853.011	1783991.806
HA7	2.2m	12.5m	5862716.952	1784265.840
HA8	2.2m	23m	5862598.677	1784375.061



Bore No.: HA1
Project No.: 4392
Sheet: 1 of 1

Client:	National Steel
Project:	Steel Smelter
Location:	61 Hampton Downs Road, Hampton Downs
Test Location:	Near CPT01a

Coordinates:
CRS:
Elevation:
Located by: Map

Test Date: 18/01/2024
 Logged by: CF
 Prepared by: SS
 Checked by: AN/LS

Depth (m)	Geology	Soil Symbol	Soil Description	Water Level	Undrained Shear Strength (kPa)	Scala Penetrometer
					0100200	Blows/100mm 012345678910111213
0.5	PEAT		Peat, large tree roots and organic material with minor silt; black brown with light grey deposits. Loose; moist to wet; non-plastic.			
1.0						
1.5						
2.0						
2.5						
3.0						
3.5						
4.0						
4.5						
5.0						
						Inferred CBR 10% 02468101316182023262830

Hole Depth: 1.0m	Termination: Refusal on buried tree.
------------------	--------------------------------------



Remarks: Groundwater encountered at 0.6m.
Logged excavated drain approximately 10m from pegged location.

Soil is described in general accordance with NZGS 'Field Description of Soil and Rock' (2005). No correlation is implied between shear vane and scala penetrometer values.


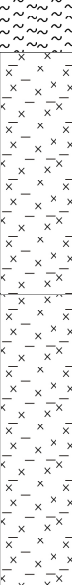





Shear vane ID: Shear vane 3
serial No. 3922








UTP = unable to penetrate

HAND AUGER LOG



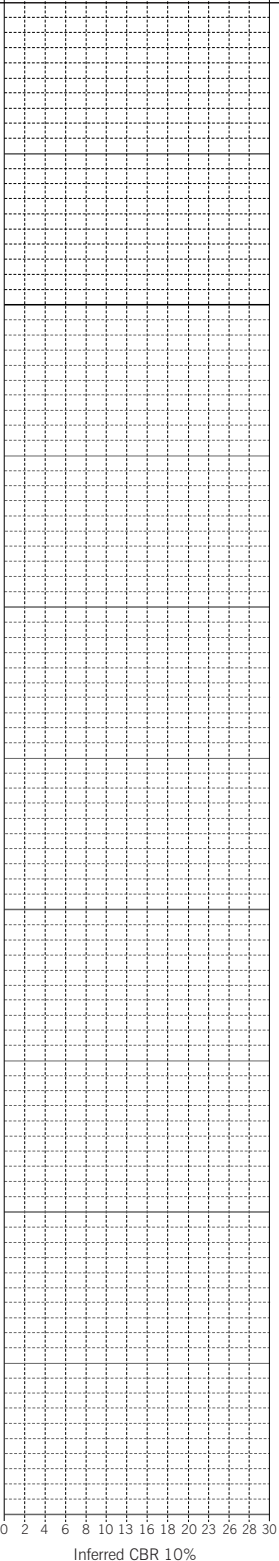
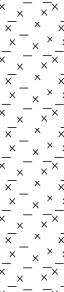
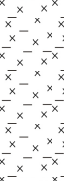
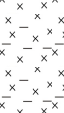
			<h1>HAND AUGER LOG</h1>			Bore No.: HA 4 Project No.: 4392 Sheet: 1 of 1																
Client: National Steel Project: Steel Smelter Location: 61 Hampton Downs Road, Hampton Downs Test Location:			Coordinates: CRS: Elevation: Located by: Map			Test Date: 26/01/2024 Logged by: LS Prepared by: SS Checked by: AN/LS																
Depth (m)	Geology	Soil Symbol	Soil Description	Water Level	Undrained Shear Strength (kPa)			Scala Penetrometer														
								Blows/100mm														
					0	100	200	0	1	2	3	4	5	6	7	8	9	10	11	12	13	
	TOP SOIL		TOPSOIL; black brown. Stiff; dry; non plastic																			
0.5			Clayey SILT and some fine and medium coarse pumiceous sand; yellow brown with beige and brown mottling. Very stiff; dry; slightly plastic to non plastic.																			
1.0			Clayey SILT and some fine and medium coarse pumiceous sand; yellow brown with beige and brown mottling. Very stiff; slightly moist; non plastic.																			
1.5																						
2.0																						
2.5																						
3.0																						
3.5																						
4.0																						
4.5																						
5.0																						
Hole Depth: 1.5m			Termination: Target depth reached.			Shear vane ID: Shear vane 3 serial No. 3922																
Remarks: Groundwater not encountered.																						
Soil is described in general accordance with NZGS 'Field Description of Soil and Rock' (2005). No correlation is implied between shear vane and scala penetrometer values.																						
						UTP = unable to penetrate																

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			<h1>HAND AUGER LOG</h1>			Bore No.: HA 5 Project No.: 4392 Sheet: 1 of 1	
Client: National Steel Project: Steel Smelter Location: 61 Hampton Downs Road, Hampton Downs Test Location:			Coordinates: CRS: Elevation: Located by: Map			Test Date: 26/01/2024 Logged by: LS/CF Prepared by: SS Checked by: AN/LS	
Depth (m)	Geology	Soil Symbol	Soil Description	Water Level	Undrained Shear Strength (kPa)		Scala Penetrometer
					0100200	Blows/100mm 012345678910111213	
0.5	TOP SOIL		TOPSOIL; black brown. Loose; dry; non plastic.			93/62kPa	
			Clayey SILT; dark yellow orange. Stiff to very stiff; moist; plastic. H-K Ash soil.			75/70kPa	
			Silty CLAY; dark yellow orange. Very stiff; moist; highly plastic. (Apparent H-K Ash soil, possibly hill wash deposits?)			102/70kPa	
1.0						102/78kPa	
1.5						134/105kPa	
2.0							
2.5							
3.0							
3.5							
4.0							
4.5							
5.0							
Hole Depth: 2.0m			Termination: Target depth reached.			Shear vane ID: Shear vane 3 serial No. 3922 UTP = unable to penetrate	
Remarks: Groundwater not encountered.							
Soil is described in general accordance with NZGS 'Field Description of Soil and Rock' (2005). No correlation is implied between shear vane and scala penetrometer values.							

			<h1>HAND AUGER LOG</h1>			Bore No.: HA 6 Project No.: 4392 Sheet: 1 of 1															
Client: National Steel Project: Steel Smelter Location: 61Hampton Downs Road, Hampton Downs Test Location:			Coordinates: CRS: Elevation: Located by: Map			Test Date: 26/01/2024 Logged by: SS Prepared by: SS Checked by: AN/LS															
Depth (m)	Geology	Soil Symbol	Soil Description	Water Level	Undrained Shear Strength (kPa)			Scala Penetrometer													
								Blows/100mm													
					0	100	200	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	TOP SOIL		TOPSOIL; dark brown. Loose; dry.																		
0.5			Clayey SILT; dark brown and yellow brown. Stiff; slightly moist; low plasticity.					203kPa													
								203kPa													
1.0			Clayey SILT with H-K Ash; grey brown with orange tint. Stiff; slightly moist; low plasticity.					177/108kPa													
								203kPa													
1.5			1.4m: Colour changed to dark yellow brown.					203kPa													
2.0																					
2.5																					
3.0																					
3.5																					
4.0																					
4.5																					
5.0																					
Hole Depth: 1.5m			Termination: Target depth reached.			Shear vane ID: Shear vane 3 serial No. 3922															
Remarks: Groundwater not encountered.																					
Soil is described in general accordance with NZGS 'Field Description of Soil and Rock' (2005). No correlation is implied between shear vane and scala penetrometer values.																					
						UTP = unable to penetrate															

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			<h1>HAND AUGER LOG</h1>			Bore No.: HA 8 Project No.: 4392 Sheet: 1 of 1				
Client: National Steel Project: Steel Smelter Location: 61 Hampton Downs Road, Hampton Downs Test Location: Near CPT08			Coordinates: CRS: Elevation: Located by: Map			Test Date: 26/02/2024 Logged by: LS/CF Prepared by: SS Checked by: AN/LS				
Depth (m)	Geology	Soil Symbol	Soil Description	Water Level	Undrained Shear Strength (kPa)			Scala Penetrometer		
					0 100 200			Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13		
0.5	TOP SOIL		Silty sandy TOPSOIL with organics; dark brown. Loose; dry.		172/94kPa					
			110/41kPa							
			99/35kPa							
1.0	FILL		Clayey SILT, H-K ash type soil; orange brown with dark orange mottling, dark brown particles and light grey occasional mottling. Stiff to very stiff; moist. 0.5m: Very stiff; slightly plastic.	203/146kPa						
			200/174kPa							
			203kPa							
1.5			Clayey SILT with apparent pumice; beige brown and light grey with dark black brown mottling and occasional dark brown coarse grains. Very stiff; moist; slightly plastic.	203kPa						
			203kPa							
			203kPa							
2.0			Clayey SILT; beige brown with dark orange mottling. Very stiff; moist; highly plastic.	203kPa						
			203kPa							
			203kPa							
2.5					203kPa					
3.0										
3.5										
4.0										
4.5										
5.0										
Hole Depth: 2.2m			Termination: Target depth reached.			Shear vane ID: Shear vane 3 serial No. 3922 UTP = unable to penetrate				
Remarks: Groundwater not encountered.										
Soil is described in general accordance with NZGS 'Field Description of Soil and Rock' (2005). No correlation is implied between shear vane and scala penetrometer values.										
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Preliminary Geotechnical Assessment Report

61 Hampton Downs Road, Hampton Downs

Appendix B3



Test Pit Data

TP1A, TP2-2, TP2-5, TP2-6, TP5, TP7, TP8, TP9, TP11A and TP11B
Test Pit Grab-Samples Photographs

APPENDIX B3

TEST PIT DATA - 2025 TESTING

TP Number	Depth	RL	NZTM	
			Co-ordinates	
			Northing	Easting
TP1A	3.5m	3.8m	5863038.786	1783976.611
TP5	4.5m	18.5m	5862992.340	1784149.887
TP7	5m	14.2m	5862695.752	1784319.328
TP8	4.5m	29m	5862574.930	1784396.587
TP9	5m	14m	5862718.441	1784151.206
TP11A	5.5m	28m	5862934.570	1784343.204
TP11B	6m	22.5m	5862934.570	1784343.204
TP2-2	4m	25m	5862784.036	1784417.537
TP2-5	6m	36.5m	5862454.328	1784295.24
TP2-6	5m	27m	5862599.255	1784162.211

<div></div> <div>TEST PIT LOG</div>					Test Pit No.: TP1A Project No.: 4392 Sheet: 1 of 1	
Client: National Green Steel Project: Green Steel Location: 61 Hampton Downs Road Test Location:			Coordinates: CRS: Elevation: ~3.8m Located by: GIS/Web Map		Test Date: 23/04/2025 Logged by: LS Prepared by: SSW/SP Checked by: AN	
Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
						Blows/100mm
TOP SOIL	TOPSOIL.					
PEAT	Mixed ORGANIC clayey soils with wood, roots and organic matter; dark brown-black. Soft to firm; moist. (firm crust surface, very little penetration of 13t excavator)		0.5			
	1.2m: Water ingress.		1.0			
	CLAY; dark brown grey. Soft; saturated; highly plastic. Pockets of organic clays.		1.5		25/19kPa	
	2.0m: CLAY; light blue grey with yellow brown staining. Soft to firm; saturated; highly plastic.		2.0			
			2.5			
			3.0		29/22kPa	
			3.5			
			4.0			
<div>EXCAVATOR TYPE: 13t</div> <div>OPERATOR: Grant Fitzgerald</div> <div>TEST PIT TERMINATED AT: 3.5m</div> <div>Target Depth <input checked="" type="checkbox"/> Refusal <input type="checkbox"/></div> <div>Near Refusal <input type="checkbox"/> Flooding <input type="checkbox"/></div> <div>SAMPLE TYPE:</div> <div>bulk sample <input type="checkbox"/> Shear vane <input checked="" type="checkbox"/></div> <div>tube sample <input type="checkbox"/> Hand penetrometer <input type="checkbox"/></div> <div>disturbed profile sample <input checked="" type="checkbox"/> Estimate only <input type="checkbox"/></div> <div>FIELD SHEAR STRENGTH:</div> <div>Remarks: This TP log has been profiled with focus on earthworks for the Green Steel Project. As such, notes are provided here in regard to soil material quality for potential use as engineered fill or as general landscaping fill, or to be spoiled.</div>					<div>TEST PIT PHOTO</div> <div>SCALE: NTS</div> <div></div>	

TEST PIT LOG

Test Pit No.: TP2-2
Project No.: 4392
Sheet: 1 of 1

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location:

Coordinates:
CRS:
Elevation: ~26m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
TOP SOIL	TOPSOIL.				0 100 200	Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
TERRACE ALLUVIUM	Clayey SILT with minor sand; light grey and dark yellow. Very stiff; slightly moist; slightly plastic. (Good fill material.)		0.5			
	Clayey SILT; light grey and dark yellow. Very stiff; slightly moist; slightly plastic.		1.0		204/70kPa	
	Sandy SILT; dark yellow brown with light grey layers. Very stiff to hard; slightly moist.		2.0		UTP	
	Clayey SILT with fine sand grains; light grey with dark yellow layers. Hard; moist; plastic. Friable.		3.0		UTP	
			4.0			Inferred CBR 10% 0 2 4 6 8 10 13 16 18 20 23 26 28 30

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 4m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:








bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐

Remarks: Workable - cut to fill. Half day conditioning required.
Good fill encountered throughout TP depth.
Refer TP1A note.
UTP- Unable to penetrate

TEST PIT PHOTO

SCALE: NTS



<div></div> <div>TEST PIT LOG</div>					Test Pit No.: TP2-5 Project No.: 4392 Sheet: 1 of 2	
Client: National Green Steel Project: Green Steel Location: 61 Hampton Downs Road Test Location:			Coordinates: CRS: Elevation: ~38m Located by: GIS/Web Map		Test Date: 23/04/2025 Logged by: LS Prepared by: SSW/SP Checked by: AN	
Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer (Blows/100mm)
TOP SOIL	TOPSOIL; dark brown.		0			
ASH SOIL	Clayey SILT with fine sand; dark orange brown. Very stiff to hard; moist. (Good fill material.)		0.5			
TERRACE ALLUVIUM	Clayey SILT; dark orange brown with black mottling. Very stiff; moist; plastic.		1.0		220/83kPa	
			1.5			
	2.0m to 3.7m: Clayey SILT with minor coarse and fine sand; dark orange brown with minor black mottling. Stiff; moist to wet; plastic.		2.0		108/73kPa	
			2.5			
			3.0		156/76kPa	
			3.5			
	3.7m: Clayey SILT; light grey mottled dark yellow and black with dark orange staining. Very stiff to hard; moist; friable. (Good fill material.)		4.0			
EXCAVATOR TYPE: 13t OPERATOR: Grant Fitzgerald TEST PIT TERMINATED AT: 6m Target Depth <input checked="" type="checkbox"/> Refusal <input type="checkbox"/> Near Refusal <input type="checkbox"/> Flooding <input type="checkbox"/> SAMPLE TYPE: FIELD SHEAR STRENGTH: bulk sample <input type="checkbox"/> Shear vane <input checked="" type="checkbox"/> tube sample <input type="checkbox"/> Hand penetrometer <input type="checkbox"/> disturbed profile sample <input checked="" type="checkbox"/> Estimate only <input type="checkbox"/> Remarks: 2m to 3.7m: One day drying required. Refer TP1A note.			TEST PIT PHOTO 			SCALE: NTS

TEST PIT LOG

Test Pit No.: TP2-5
Project No.: 4392
Sheet: 2 of 2

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location:

Coordinates:
CRS:
Elevation: ~38m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
					0 100 200	Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13 Inferred CBR 10% 0 2 4 6 8 10 13 16 18 20 23 26 28 30
TERRACE ALLUVIUM	Clayey SILT; light grey mottled dark yellow and black with dark orange staining. Very stiff to hard; moist; friable. (Good fill material.)		4.5			
	5.5m: Clayey SILT; light grey mottled dark yellow and black with dark orange staining, yellow brown layering. Very stiff to hard; moist; friable. (Good fill material.)		5.0			
			5.5			
			6.0			
			6.5			
			7.0			
			7.5			
			8.0			

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 6m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:












bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐

Remarks: 2m to 3.7m: One day drying required.
Refer TP1A note.

TEST PIT PHOTO

SCALE: NTS



		<h1>TEST PIT LOG</h1>			Test Pit No.: TP2-6 Project No.: 4392 Sheet: 1 of 2	
Client: National Green Steel Project: Green Steel Location: 61 Hampton Downs Road Test Location:		Coordinates: CRS: Elevation: ~28m Located by: GIS/Web Map			Test Date: 23/04/2025 Logged by: LS Prepared by: SSW/SP Checked by: AN	
Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
TOP SOIL	TOPSOIL; dark brown.		0		0 100 200	Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
ASH SOIL	Clayey SILT with some fine sand; orange brown and dark yellow brown. Hard; slightly moist; slight plastic. (Very good fill material.)		0.5			
TERRACE ALLUVIUM	Clayey SILT; light grey with dark yellow mottling and dark orange pink staining. Very stiff to hard; slightly moist; slightly plastic. (Good fill material.)		1.0		UTP	
			1.5			
			2.0		220/48kPa	
			2.5			
	3.0m to 4.0m: clayey SILT with some sand; dark yellow with light grey striations. Very stiff to hard; moist; plastic.		3.0		191/96kPa	
			3.5			
			4.0			
EXCAVATOR TYPE: 13t OPERATOR: Grant Fitzgerald TEST PIT TERMINATED AT: 5m Target Depth <input checked="" type="checkbox"/> Refusal <input type="checkbox"/> Near Refusal <input type="checkbox"/> Flooding <input type="checkbox"/> SAMPLE TYPE: FIELD SHEAR STRENGTH: bulk sample <input type="checkbox"/> Shear vane <input checked="" type="checkbox"/> tube sample <input type="checkbox"/> Hand penetrometer <input type="checkbox"/> disturbed profile sample <input checked="" type="checkbox"/> Estimate only <input type="checkbox"/> Remarks: 3m to 4m: Half day drying required. Refer TP1A note. UTP- Unable to penetrate		TEST PIT PHOTO SCALE: NTS 				



Test Pit No.: TP2-6
Project No.: 4392
Sheet: 2 of 2

Client:	National Green Steel
Project:	Green Steel
Location:	61 Hampton Downs Road
Test Location:	

Coordinates:
CRS:
Elevation: ~28m
Located by: GIS/Web Map

Test Date: 23/04/2025
 Logged by: LS
 Prepared by: SSW/SP
 Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer Blows/100mm
TERRACE ALLUVIUM	Sandy clayey SILT; dark yellow brown with light grey mottling. Very stiff; moist; plastic. (Good for direct fill.)		4.5			
			5.0			
			5.5			
			6.0			
			6.5			
			7.0			
			7.5			
			8.0			

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 5m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:

bulk sample	<input type="checkbox"/>	Shear vane	<input checked="" type="checkbox"/>
tube sample	<input type="checkbox"/>	Hand penetrometer	<input type="checkbox"/>
disturbed profile sample	<input checked="" type="checkbox"/>	Estimate only	<input type="checkbox"/>

Remarks: 3m to 4m: Half day drying required.
Refer TP1A note.
UTP- Unable to penetrate

TEST PIT PHOTO

SCALE: NTS



TEST PIT LOG

Test Pit No.: TP5
Project No.: 4392
Sheet: 1 of 2

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: At CPT5 location

Coordinates:
CRS:
Elevation: ~19m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
TOP SOIL	TOPSOIL; dark brown.					
TERRACE ALLUVIUM	Clayey SILT; light grey mottled dark yellow. Very stiff; slightly moist; plastic.		0.5			
	Clayey SILT; light grey mottled dark yellow and dark orange. Very stiff; moist; plastic. (Suitable fill material with little drying conditioning required.)		1.0		191/102kPa	
	2.0m to 3.0m: clayey SILT with minor coarse and fine sand; beige with dark yellow layering. very stiff; moist; plastic.		2.0		150/121kPa	
	3.0m to 3.5m: same material characteristics but changes to clayey SILT; dark yellow and light grey.		3.0		166/57kPa	
	3.5m: Clayey SILT with sand particles; light grey with dark yellow and orange layering. Very stiff; moist; plastic. Very good fill material.		3.5			
			4.0			

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 4.5m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:

bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐

Remarks: 2m to 3.0m: Half day conditioning required. Cut to fill
Refer TP1A note.

TEST PIT PHOTO

SCALE: NTS




TEST PIT LOG

Test Pit No.: TP5
Project No.: 4392
Sheet: 2 of 2

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: At CPT5 location

Coordinates:
CRS:
Elevation: ~19m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
KAWA SANDS	Silty SAND; yellow brown with dark orange mottling. Medium dense to dense; moist; non plastic.		0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0		0 100 200	Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13 Inferred CBR 10% 0 2 4 6 8 10 13 16 18 20 23 26 28 30

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 4.5m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:

bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐

Remarks: 2m to 3.0m: Half day conditioning required. Cut to fill
Refer TP1A note.

TEST PIT PHOTO

SCALE: NTS



TEST PIT LOG

Test Pit No.: TP7
Project No.: 4392
Sheet: 1 of 2

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: At CPT7 location

Coordinates:
CRS:
Elevation: ~15m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
TOP SOIL	TOPSOIL; dark brown.		0		0	0
TERRACE ALLUVIUM	Silty SAND; light grey with yellow brown staining. Very dense; moist; non plastic. (Good fill material.)		0.5			
	Clayey SILT with some fine sand; light grey with yellow brown staining. Very stiff to hard; moist to hard; plastic.		1.0		UTP	
	2m to 3.0m: Clayey SILT with minor fine sand; light grey mottled dark yellow brown. Firm to very stiff; moist to wet; highly plastic.		2.0		118/64kPa	
	3.0m to 3.5m: Clayey SILT with organics; blue with mixed dark brown and dark grey. Soft; wet; highly plastic. Smell. (Poor fill material, undercut required.)		3.0			
			3.5		92/39kPa	
AMOKURA	Silty SAND; blue grey. Medium dense to dense; moist to wet. (Good fill material.)		4.0			

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 5m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:



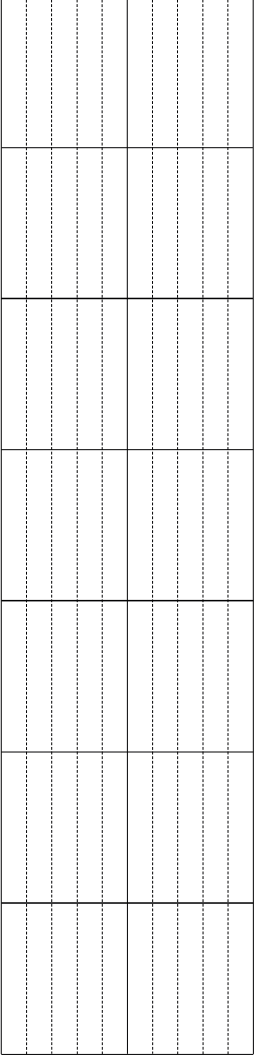
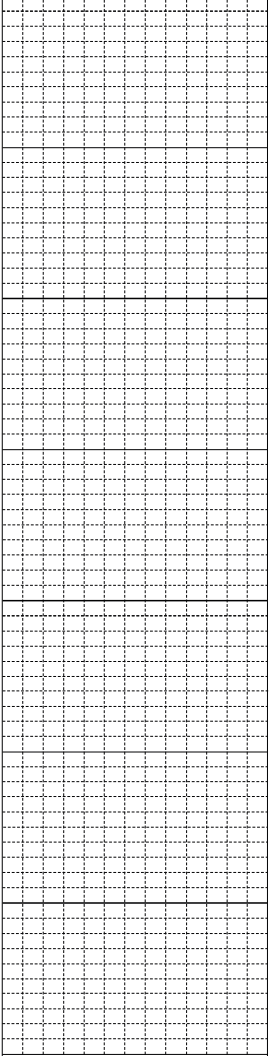

bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐



Remarks: Refer TP1A note.

TEST PIT PHOTO

SCALE: NTS



		<h1>TEST PIT LOG</h1>			Test Pit No.: TP7 Project No.: 4392 Sheet: 2 of 2				
Client: National Green Steel Project: Green Steel Location: 61 Hampton Downs Road Test Location: At CPT7 location			Coordinates: CRS: Elevation: ~15m Located by: GIS/Web Map			Test Date: 23/04/2025 Logged by: LS Prepared by: SSW/SP Checked by: AN			
Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength			Scala Penetrometer	
					(kPa) 0 100 200			Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13	
AMOKURA	Silty SAND; blue grey. Medium dense to dense; moist to wet. (Good fill material.)		4.5						
			5.0						
			5.5						
			6.0						
			6.5						
			7.0						
			7.5						
			8.0						
EXCAVATOR TYPE: 13t OPERATOR: Grant Fitzgerald TEST PIT TERMINATED AT: 5m Target Depth <input checked="" type="checkbox"/> Refusal <input type="checkbox"/> Near Refusal <input type="checkbox"/> Flooding <input type="checkbox"/> SAMPLE TYPE: bulk sample <input type="checkbox"/> Shear vane <input checked="" type="checkbox"/> tube sample <input type="checkbox"/> Hand penetrometer <input type="checkbox"/> disturbed profile sample <input checked="" type="checkbox"/> Estimate only <input type="checkbox"/> Remarks: Refer TP1A note.				TEST PIT PHOTO  SCALE: NTS					

 <h1 style="margin: 0;">TEST PIT LOG</h1>						Test Pit No.: TP8 Project No.: 4392 Sheet: 1 of 2	
Client: National Green Steel Project: Green Steel Location: 61 Hampton Downs Road Test Location: At CPT8 location			Coordinates: CRS: Elevation: ~29m Located by: GIS/Web Map			Test Date: 23/04/2025 Logged by: LS Prepared by: SSW/SP Checked by: AN	
Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer	
TOP SOIL	TOPSOIL; dark brown.	~	0		0 100 200	Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13	
ASH SOIL	Clayey SILT with minor fine sand; pinkish light grey and dark yellow. Very stiff to hard; slightly moist; Plastic. Possible ash soil. (Good fill material.)	x	0.5				
TERRACE ALLUVIUM	Clayey SILT "sugary" with some fine sand; light grey and dark yellow. Very stiff to hard; moist; friable; plastic.	x	1.0		223/127kPa		
		x	1.5				
	Clayey SILT with some fine and coarse sand; light grey mottled dark brown and yellow. Hard; moist; friable. (Good fill material.)	x	2.0		207/70kPa		
		x	2.5				
		x	3.0		UTP		
	3.5m: becomes beige brown mottled yellow SILT. Very stiff to hard; moist to wet; plastic. (will require ~1 day of drying conditioning.)	x	3.5			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%	
		x	4.0				
EXCAVATOR TYPE: 13t OPERATOR: Grant Fitzgerald TEST PIT TERMINATED AT: 4.5m Target Depth <input checked="" type="checkbox"/> Refusal <input type="checkbox"/> Near Refusal <input type="checkbox"/> Flooding <input type="checkbox"/> SAMPLE TYPE: FIELD SHEAR STRENGTH: bulk sample <input type="checkbox"/> Shear vane <input checked="" type="checkbox"/> V tube sample <input type="checkbox"/> Hand penetrometer <input type="checkbox"/> P disturbed profile sample <input checked="" type="checkbox"/> Estimate only <input type="checkbox"/> E					TEST PIT PHOTO SCALE: NTS <div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; width: 100px; height: 100px; margin-right: 10px;"></div>  <div style="border: 1px solid black; width: 100px; height: 100px; margin-left: 10px;"></div> </div>		

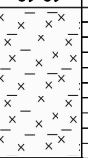
TEST PIT LOG

Test Pit No.: TP8
Project No.: 4392
Sheet: 2 of 2

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: At CPT8 location

Coordinates:
CRS:
Elevation: ~29m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
TERRACE ALLUVIUM	4.0m: changes to beige brown mottled reddish pink. Moist to wet.		0		0	0
			4.5			
			5.0			
			5.5			
			6.0			
			6.5			
			7.0			
			7.5			
			8.0			

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 4.5m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:












bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐

Remarks: Sample at 4m.
From 3m: workable with 1 day drying.
Refer TP1A note.
UTP- Unable to penetrate.

TEST PIT SECTION

SCALE: NTS



<div></div> <div>TEST PIT LOG</div>					Test Pit No.: TP9 Project No.: 4392 Sheet: 1 of 2	
Client: National Green Steel Project: Green Steel Location: 61 Hampton Downs Road Test Location: At CPT9 location			Coordinates: CRS: Elevation: ~14.5m Located by: GIS/Web Map		Test Date: 23/04/2025 Logged by: LS Prepared by: SSW/SP Checked by: AN	
Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
TOP SOIL	TOPSOIL; dark brown.		0		0 100 200	Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
TERRACE ALLUVIUM	Clayey SILT with some fine sand; light grey with dark yellow layering. very stiff to hard; slightly moist; slightly plastic. Ash like soil.		0.5			
			1.0		220/131kPa	
			1.5			
	Sandy clayey SILT; light beige with dark yellow staining. Hard; slightly moist. Good fill material.		2.0		UTP	
			2.5			
			3.0		>223kPa	
	3.0m: Sandy clayey SILT; light grey with dark yellow staining (layers). Very stiff to hard; slightly moist to moist; slightly plastic. Good fill material.		3.5		>223kPa	
			4.0			
EXCAVATOR TYPE: 13t OPERATOR: Grant Fitzgerald TEST PIT TERMINATED AT: 5m Target Depth <input checked="" type="checkbox"/> Refusal <input type="checkbox"/> Near Refusal <input type="checkbox"/> Flooding <input type="checkbox"/> SAMPLE TYPE: FIELD SHEAR STRENGTH: bulk sample <input type="checkbox"/> Shear vane <input checked="" type="checkbox"/> tube sample <input type="checkbox"/> Hand penetrometer <input type="checkbox"/> disturbed profile sample <input checked="" type="checkbox"/> Estimate only <input type="checkbox"/> Remarks: 3m to 5m: Half day drying required. Close to optimum moisture content. Refer TP1A note. UTP- Unable to penetrate.			TEST PIT SECTION SCALE: NTS 			

TEST PIT LOG

Test Pit No.: TP11A
Project No.: 4392
Sheet: 1 of 2

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location:

Coordinates:
CRS:
Elevation: ~28m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer
TERRACE ALLUVIUM	Clayey SILT with minor sand; light grey and dark yellow. Very stiff; moist; highly plastic.	[Symbol]	0.5			
	Clayey SILT with minor sand; mid pinkish grey. Very stiff; moist; highly plastic. (Suitable fill material with minor drying.)		1.0		207/103kPa	
	1m-1.5m: shrink swell occurring.		1.5			
	Clayey SILT with minor sand and fine gravels; dark yellow mottled light grey. Very stiff; moist; plastic.		2.0		191/103kPa	
			2.5			
			3.0		191/103kPa	
			3.5			
			4.0			

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 5.5m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:

bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐

Remarks: Mixed sample 3-5m and from 5m.
0m-5m: soil workable with minor drying.
Below 5m: moist silt, may require 1 day drying.
Refer TP1A note.

TEST PIT PHOTO

SCALE: NTS



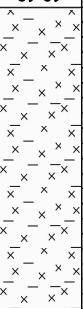
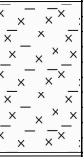
TEST PIT LOG

Test Pit No.: TP11A
Project No.: 4392
Sheet: 2 of 2

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location:

Coordinates:
CRS:
Elevation: ~28m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer (Blows/100mm)
TERRACE ALLUVIUM	Clayey SILT with minor sand; light white-grey with occasional pink striations/layering. Very stiff; slightly moist; plastic.		0		0	0
			4.5			
	Clayey SILT with minor fine sand and gravels; thinly layered grey/pink/white. Very stiff; slightly moist; slightly plastic.		5.0			
	5.5m: Clayey SILT with minor fine sand and gravels; light grey/white grey. Very stiff; moist; slightly plastic.		5.5			
			6.0			
			6.5			
			7.0			
			7.5			
			8.0			

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 5.5m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:

bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐

Remarks: Mixed sample 3-5m and from 5m.
0m-5m: soil workable with minor drying.
Below 5m: moist silt, may require 1 day drying.
Refer TP1A note.

TEST PIT PHOTO

SCALE: NTS



TEST PIT LOG

Test Pit No.: TP11B
Project No.: 4392
Sheet: 1 of 2

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: Downslope of TP11A

Coordinates:
CRS:
Elevation: ~22.5m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer (Blows/100mm)
TOP SOIL	TOPSOIL.					
TERRACE ALLUVIUM	Clayey SILT with minor sand and organics; mottled orange and white. Stiff; moist; highly plastic.		0.5			
	Clayey SILT; orange yellow with mottled light grey. Very stiff; moist; plastic.		1.0		127/76kPa	
	Clayey SILT; dark orange with mottled yellow and dark brown. Very stiff; moist; plastic. Staining on fissures.		2.0		151/86kPa	
	Clayey SILT; yellow (thinly layered yellow and white). Very stiff; moist; plastic.		3.0		150/73kPa	
			4.0			

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 6m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:

bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐

Remarks: 0m-4.4m: soil workable with minor drying.
Below 4.4m: may require 1 day drying.
Refer TP1A note.

TEST PIT PHOTO

SCALE: NTS





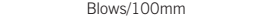

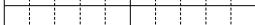

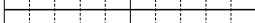



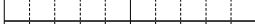





TEST PIT LOG

Test Pit No.: TP11B
Project No.: 4392
Sheet: 2 of 2

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: Downslope of TP11A

Coordinates:
CRS:
Elevation: ~22.5m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Soil Symbol	Depth (m)	Sample Type	Undrained Shear Strength (kPa)	Scala Penetrometer (Blows/100mm)
TERRACE ALLUVIUM	Clayey SILT; yellow (thinly layered yellow and white). Very stiff; moist; plastic.		0			
	4.4m: Clayey SILT; pale blue with minor orange stained fissures. Firm to stiff; moist to wet; plastic.					
	Clayey SILT with minor sand; pale blue. Very stiff; moist to wet; plastic.		5.5			
			6.0			
			6.5			
			7.0			
			7.5			
			8.0			

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 6m

Target Depth ☒ Refusal ☐
Near Refusal ☐ Flooding ☐

SAMPLE TYPE: FIELD SHEAR STRENGTH:

bulk sample ☐ Shear vane ☒
tube sample ☐ Hand penetrometer ☐
disturbed profile sample ☒ Estimate only ☐

Remarks: 0m-4.4m: soil workable with minor drying.
Below 4.4m: may require 1 day drying.
Refer TP1A note.

TEST PIT PHOTO

SCALE: NTS



CORE PHOTOGRAPHS

Test Pit No.: TP 2-2
 Project No.: 4392
 Sheet: 1 of 1
 Test Date: 23/04/2025
 Logged by: LS
 Prepared by: SP
 Checked by: LS

Client: National Green Steel
 Project: Green Steel
 Location: 61 Hampton Downs Road
 Test Location:

Coordinates:
 CRS:
 Elevation: ~26m
 Located by: GIS/Web Map



0.0m-4.0m

CORE PHOTOGRAPHS

Test Pit No.: TP 2-5
 Project No.: 4392
 Sheet: 1 of 1
 Test Date: 23/04/2025
 Logged by: LS
 Prepared by: SP
 Checked by: LS

Client: National Green Steel
 Project: Green Steel
 Location: 61 Hampton Downs Road
 Test Location:

Coordinates:
 CRS:
 Elevation: ~38m
 Located by: GIS/Web Map



0.0m-6.0m

CORE PHOTOGRAPHS

Test Pit No.: TP 2-6
 Project No.: 4392
 Sheet: 1 of 1
 Test Date: 23/04/2025
 Logged by: LS
 Prepared by: SP
 Checked by: LS

Client: National Green Steel
 Project: Green Steel
 Location: 61 Hampton Downs Road
 Test Location:

Coordinates:
 CRS:
 Elevation: ~28m
 Located by: GIS/Web Map



0.0m-5.0m

CORE PHOTOGRAPHS

Test Pit No.: TP 5

Project No.: 4392

Sheet: 1 of 1

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: At CPT5 location

Coordinates:
CRS:
Elevation: ~19m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SP
Checked by: LS



0.0m-4.5m

CORE PHOTOGRAPHS

Test Pit No.: TP 7

Project No.: 4392

Sheet: 1 of 1

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: At CPT7 location

Coordinates:
CRS:
Elevation: ~15m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SP
Checked by: LS



0.0m-5.0m

CORE PHOTOGRAPHS

Test Pit No.: TP 8

Project No.: 4392

Sheet: 1 of 1

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: At CPT8 location

Coordinates:
CRS:
Elevation: ~29m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SP
Checked by: LS



0.0m-4.5m

CORE PHOTOGRAPHS

Test Pit No.: TP 9

Project No.: 4392

Sheet: 1 of 1

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: At CPT9 location

Coordinates:
CRS:
Elevation: ~14.5m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SP
Checked by: LS



0.0m-5.0m

CORE PHOTOGRAPHS

Test Pit No.: TP 11A

Project No.: 4392

Sheet: 1 of 1

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location:

Coordinates:
CRS:
Elevation: ~28m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SP
Checked by: LS



0.0m-5.5m

CORE PHOTOGRAPHS

Test Pit No.: TP 11B

Project No.: 4392

Sheet: 1 of 1

Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: Downslope of TP11A

Coordinates:
CRS:
Elevation: ~23m
Located by: GIS/Web Map

Test Date: 23/04/2025
Logged by: LS
Prepared by: SP
Checked by: LS



0.0m-6.0m

Preliminary Geotechnical Assessment Report

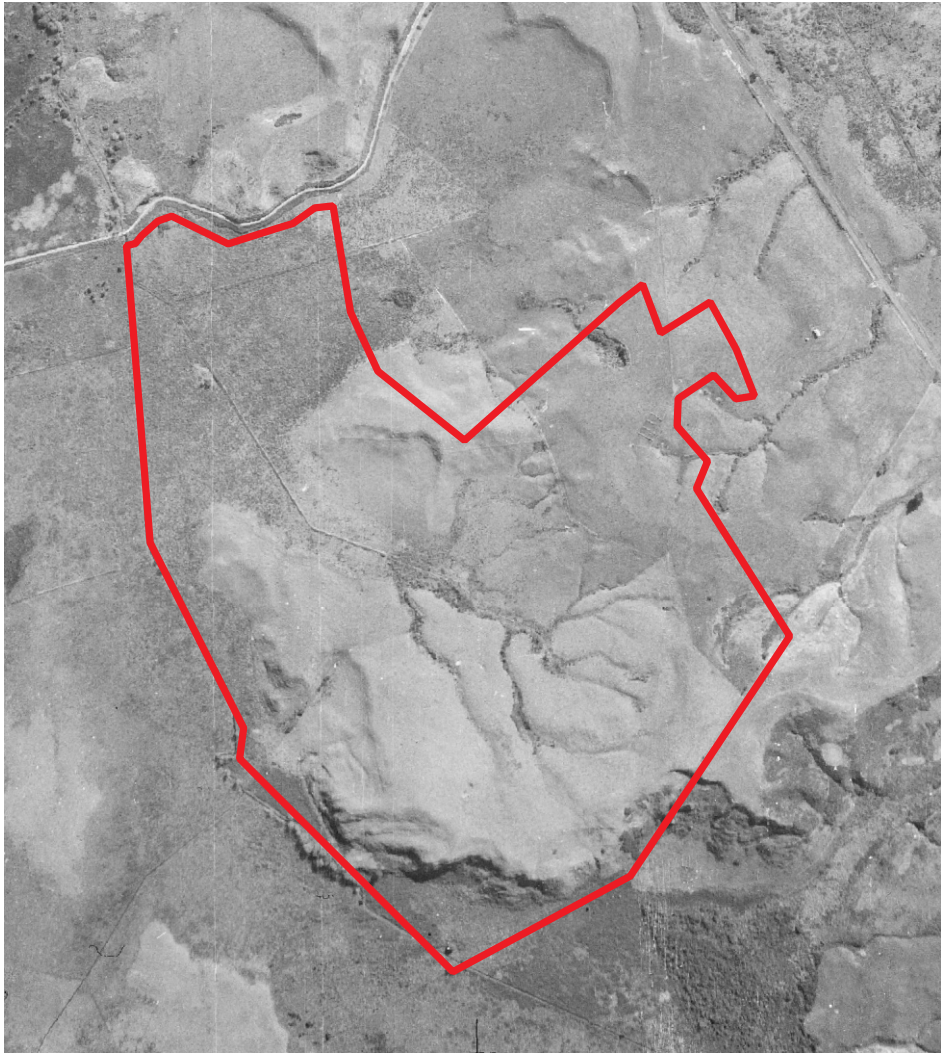
61 Hampton Downs Road, Hampton Downs

Appendix C

Historic Aerial Photographs

Figure C1 – 1942 to 1977

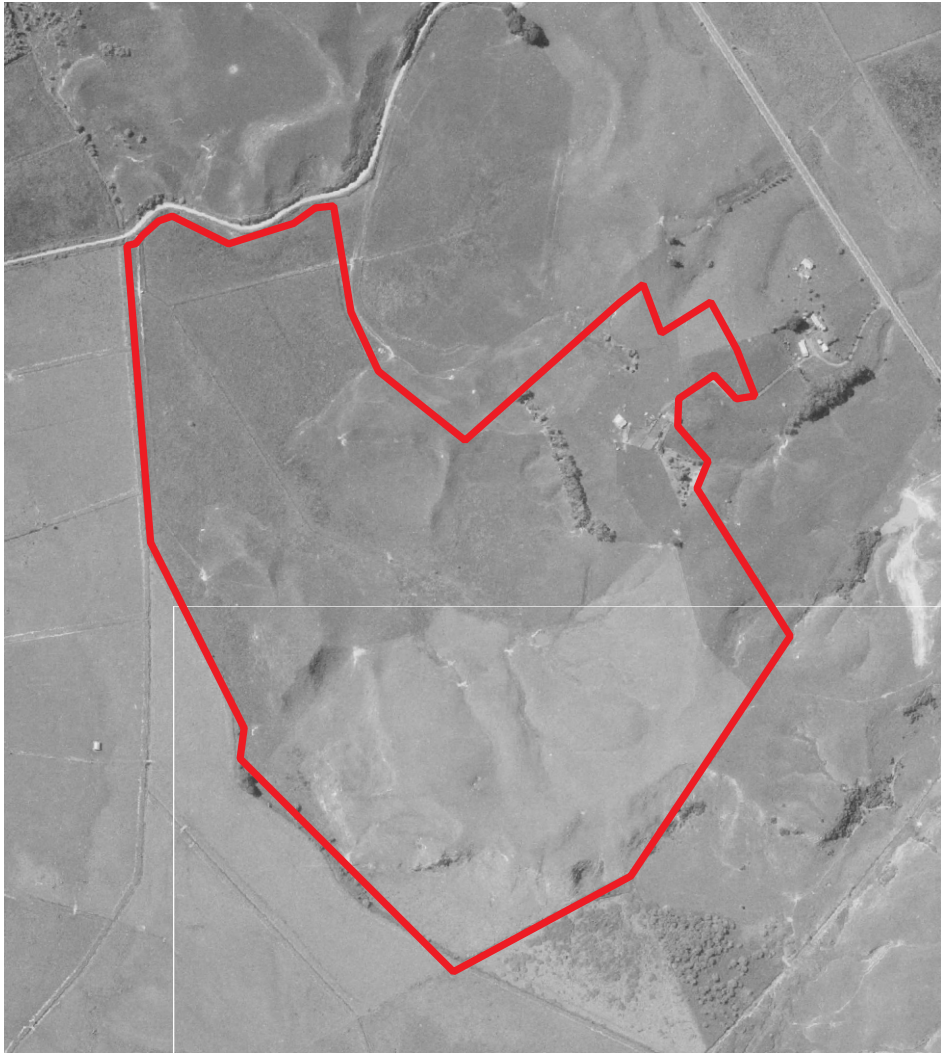
Figure C2 – 1986 to 2013



1942



1963



1977

FOR INFORMATION

Note: All drawings are to be approved (initialled) before final issue.



Earthtech Consulting Ltd.
P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

61 HAMPTON DOWNS ROAD
National Steel

Historic Aerial Photographs 1942 to 1977

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	23-04-24	FOR REPORT R4392-2 REV A	L.S	A.N	S.SW	

DRAWING NO.:
FIG. C1
REF: 4392
SCALE: 1:10000 (approx)
CRS:
DATUM:



1986



1991



2013

FOR INFORMATION

Note: All drawings are to be approved (initialled) before final issue.



Earthtech Consulting Ltd.
P.O. Box 721, Pukekohe
Phone: 64 9 238 3669
Email: admin@earthtech.co.nz

61 HAMPTON DOWNS ROAD
National Steel

Historic Aerial Photographs 1986 to 2013

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	23-04-24	FOR REPORT R4392-2 REV A	L.S	A.N	S.SW	

DRAWING NO.:
FIG. C2
REF: 4392
SCALE: 1:10000 (approx)
CRS:
DATUM: