Report

Engineering Report

Green Steel Monofill, Hampton Downs

61 Hampton Downs Road, Hampton Downs, Waikato

VOLUME 2 – APPENDICES

Prepared for National Green Steel Limited

Prepared by Earthtech Consulting Limited

30 May 2025
Reference: R4424-2

EARTHTECH

Document Control

Engineering Report

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

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Appendices

Engineering Report

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Appendix A

Green Steel Project Development Drawings

FOR INFORMATION

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

EARTHTECH

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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. PD1

REF: 4392

SCALE: 1:15000

CRS: NZTM

DATUM: Moturiki 1953

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

0m 50 100 150 200 250m

Scale 1:5000

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Site Plan with Existing Contours

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	19-02-25	UPDATE PLATFORMS	L.S	A.N	S.SW	
D	02-05-25	FOR REPORT R4392-3	L.S	A.N	S.SW	
E	20-05-25	UPDATE PLATFORMS	L.S	A.N	S.SW	

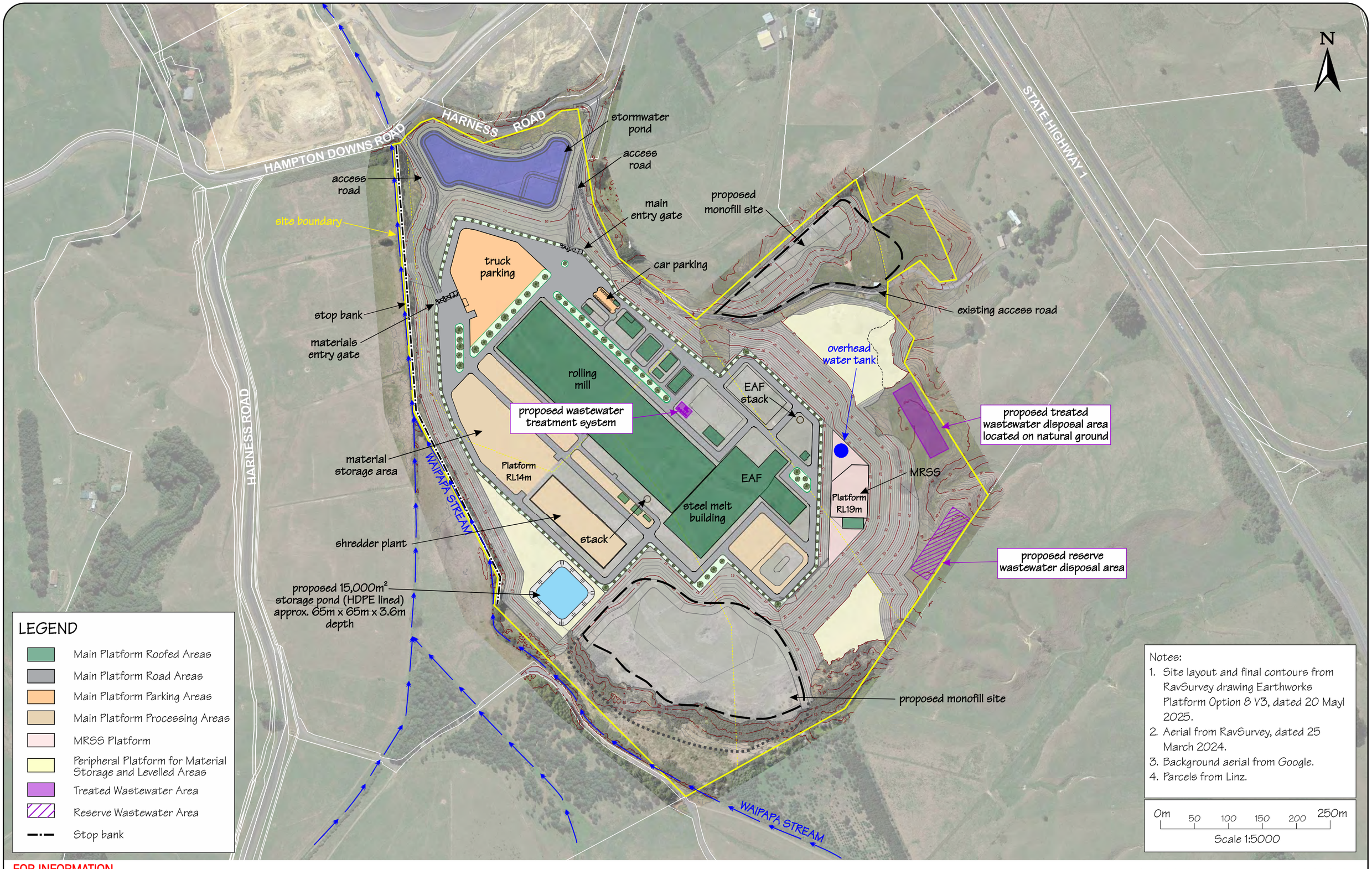
DRAWING NO.: FIG. PD2

REF: 4392

SCALE: 1:5000

CRS: NZTM

DATUM: Moturiki 1953



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61 HAMPTON DOWNS ROAD

National Green Steel Limited

Site Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	05-12-24	DRAFT FOR DISCUSSION	L.S	A.N	S.SW	
B	18-02-25	UPDATE PLATFORMS AND CONTOURS	L.S	A.N	S.SW	
C	16-04-25	UPDATE STORMWATER POND	L.S	A.N	S.SW	
D	20-05-25	UPDATE WASTEWATER AREA	L.S	A.N	S.SW	

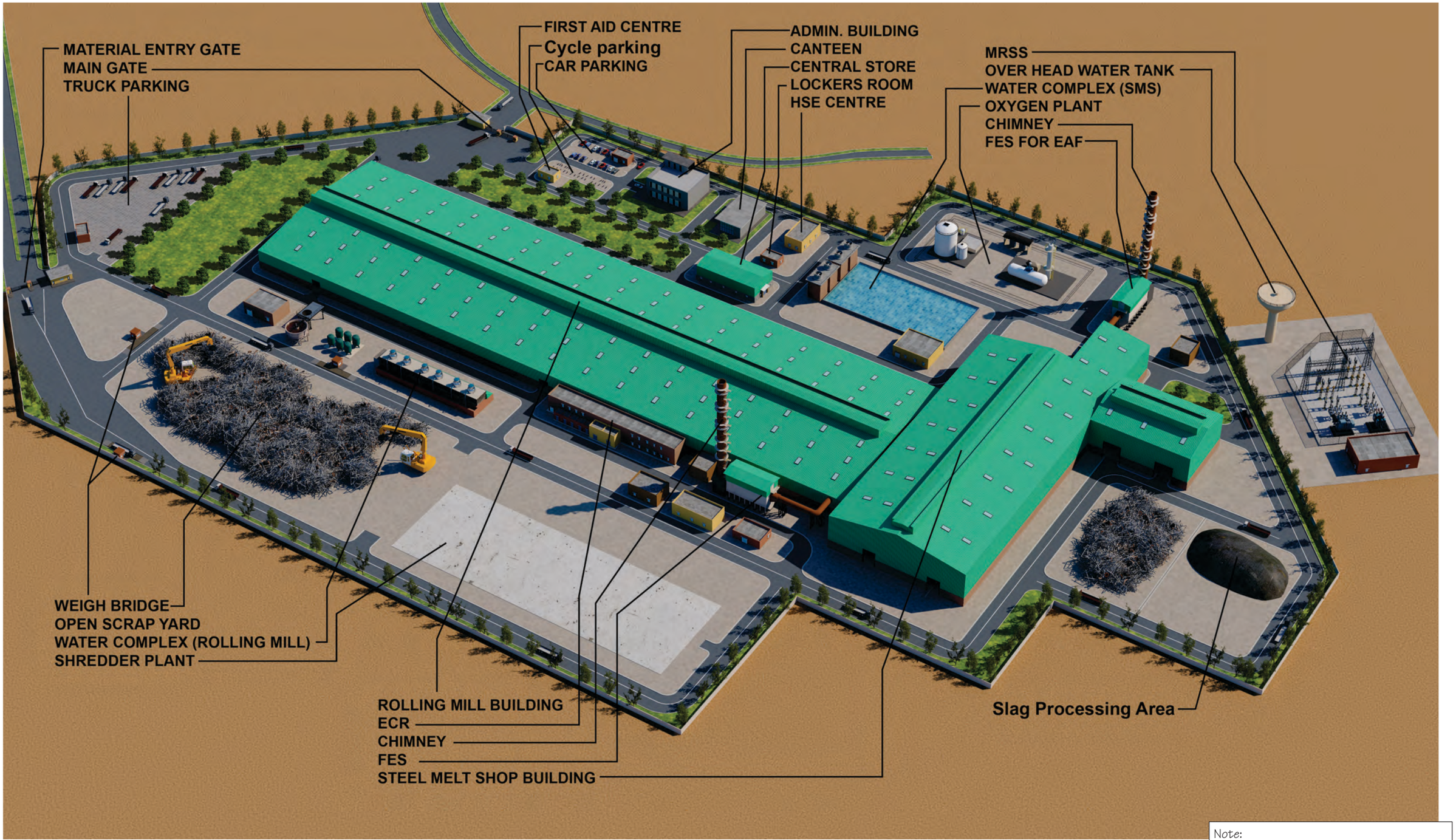
DRAWING NO.: FIG. PD3

REF: 4392

SCALE: 1:5000

CRS: Mt Eden 2000

DATUM: AVD46



Note:
1. Layout drawing received from R. Singh & Associates Pvt. Limited. Ref 2320-002sh1r7y24. Received 29 August 2024.

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61 HAMPTON DOWNS ROAD

National Green Steel Limited

Aerial View

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	04-12-24	DRAFT FOR DISCUSSION	L.S	A.N	S.SW	

DRAWING NO.: FIG. PD4

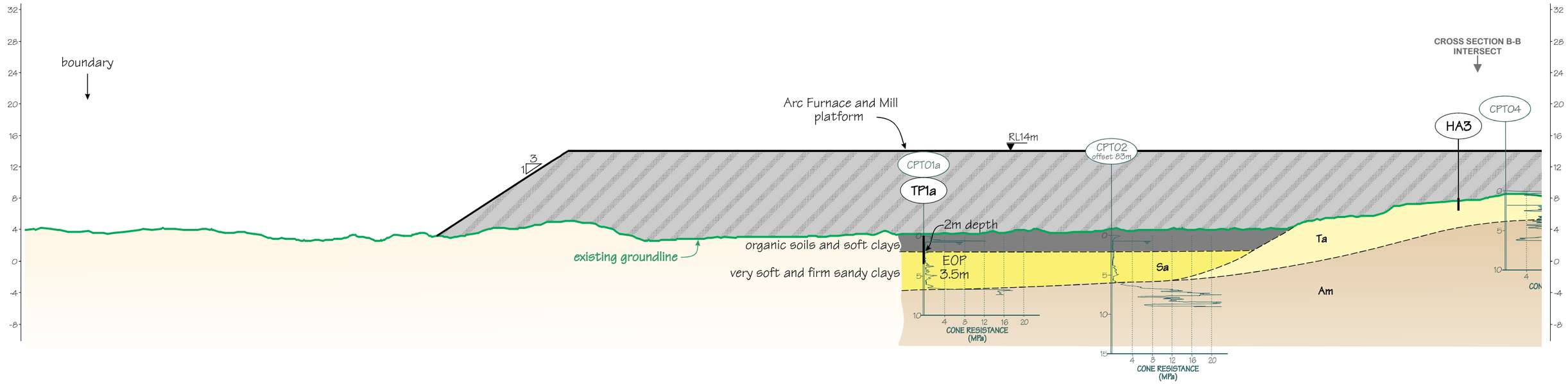
REF: 4392

SCALE: nts

CRS:

DATUM:

JOIN LINE



LEGEND

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

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

0m 10 20 30 40 50m

Scale 1:1000

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61 HAMPTON DOWNS ROAD

National Green Steel Limited

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	

DRAWING NO.: FIG. PD5.1/1

REF: 4392

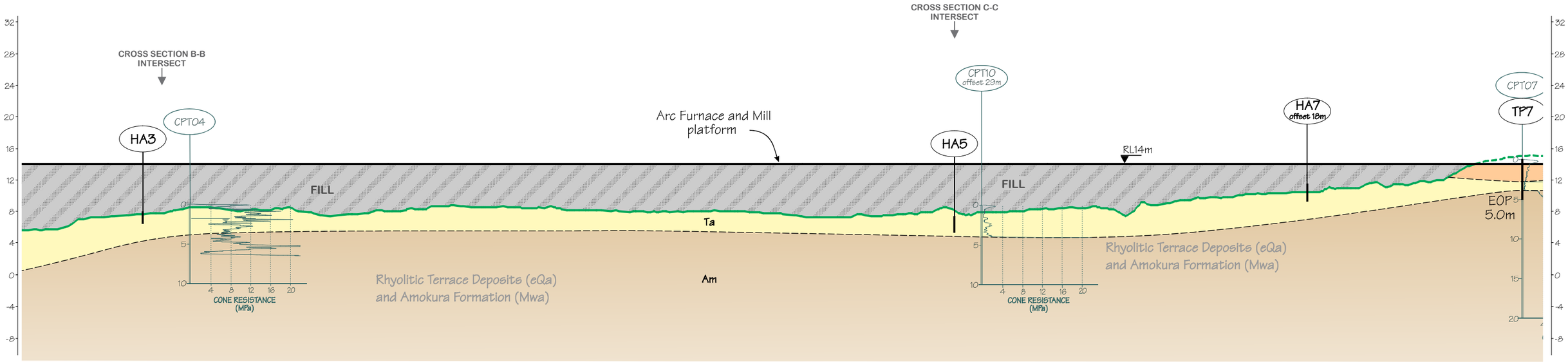
SCALE: 1:1000(h) 1:500(v)

CRS: Mt Eden 2000

DATUM: AVD46

JOIN LINE

JOIN LINE



LEGEND

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

Note:

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

0m 10 20 30 40 50m

Scale 1:1000

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61 HAMPTON DOWNS ROAD

National Green SteelLimited

Long Section A-A - Page 2 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	

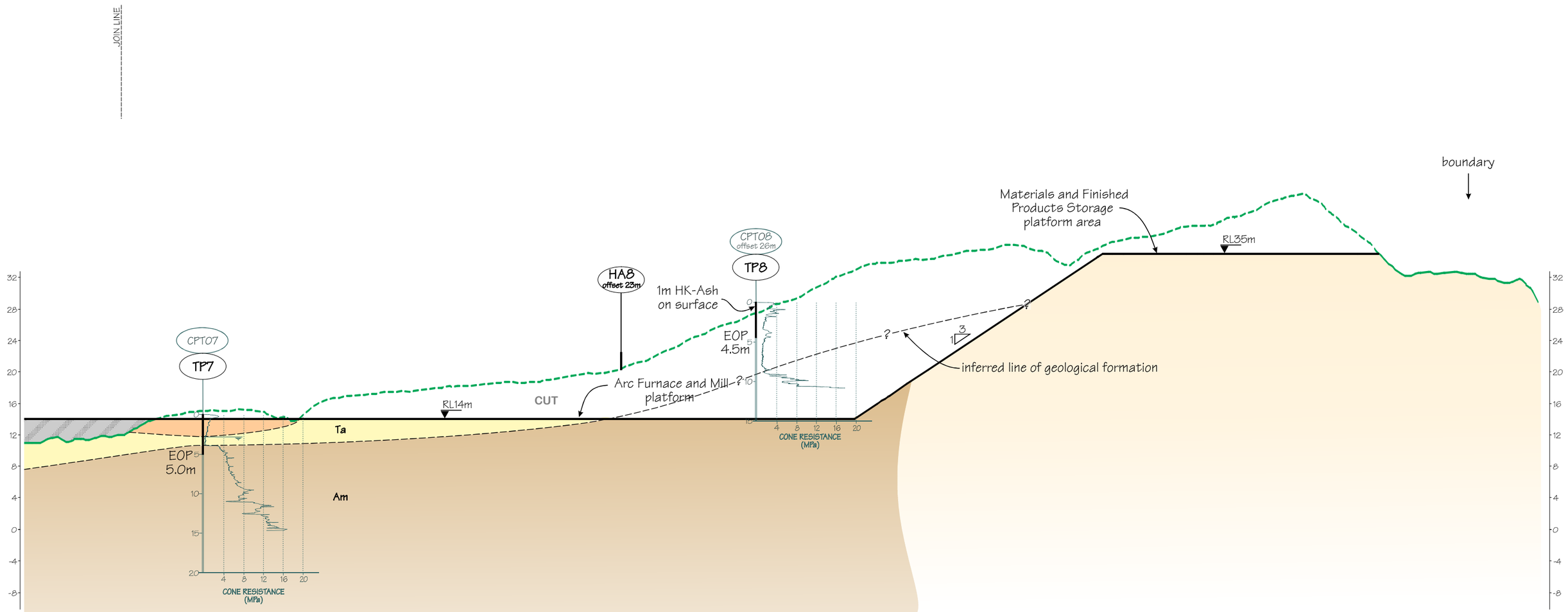
DRAWING NO.: FIG. PD5.1/2

REF: 4392

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

CRS: Mt Eden 2000

DATUM: AVD46



LEGEND

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

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

0m 10 20 30 40 50m
Scale 1:1000

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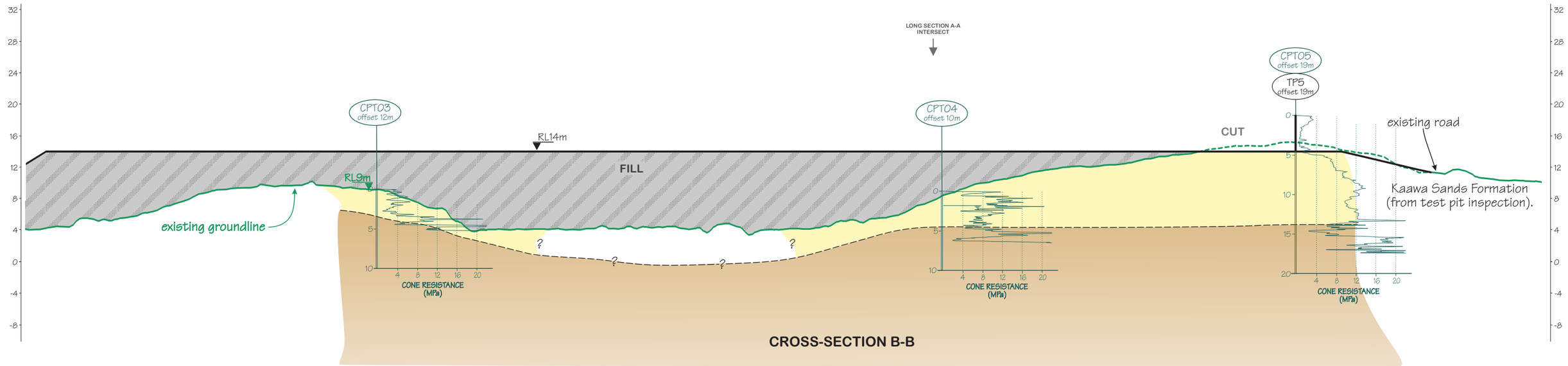
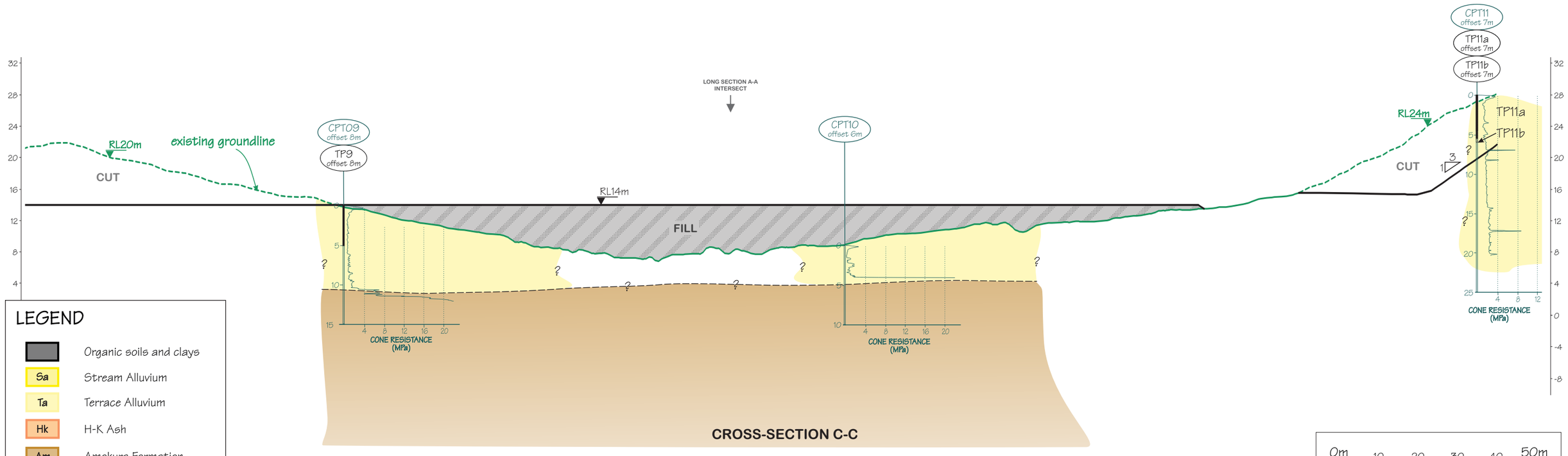
Long Section A-A - Page 3 of 3

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	

DRAWING NO.: FIG. PD5.1/3
REF: 4392
SCALE: 1:1000(h) 1:500(v)
CRS: Mt Eden 2000
DATUM: AVD46





LEGEND

	Organic soils and clays
Sa	Stream Alluvium
Ta	Terrace Alluvium
Hk	H-K Ash
Am	Amokura Formation

0m 10 20 30 40 50m

Scale 1:1000 (h)

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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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

Engineering Report

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Appendix B

Preliminary Geotechnical Assessment Report

R4424-1, 29 May 2025

Report

Preliminary Geotechnical Assessment

Green Steel Monofill, Hampton Downs

61 Hampton Downs Road, Hampton Downs, Waikato

Prepared for National Green Steel Limited

Prepared by Earthtech Consulting Limited

29 May 2025
Reference: R4424-1

EARTHTECH

Document Control

Preliminary Geotechnical Assessment

Green Steel Monofill

Client: National Green Steel Limited

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

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Preliminary Geotechnical Assessment

Green Steel Monofill, Hampton Downs

1. Introduction

National Green Steel Limited is a specialist New Zealand steel and metal recovery and recycling company with plants located across the country in Manukau, Auckland and Christchurch. The company primarily 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. The 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 with 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 facility is proposed at 61 Hampton Downs Road (Figures PD1 through PD4). The smelter 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 approximately 21.2*ha*. The extent of the earthworks for the main platform is 32.7*ha*, and for the overall development, comprising the main platform and several proposed perimeter platforms, it is approximately 48.7*ha* across the property area of 53.7*ha*.

In addition to the metal recycling and recovery plant, Green Steel intends to store the waste floc for future use in two monofills located southwest and northeast of the arc furnace facilities (Figure PD2).

Currently, the waste "floc" produced is disposed to landfill. A volume of up to some 200m^3 of floc is produced daily from the Manukau Plant, which, at a general bulk density of 0.5t/m^3, equates to some 100 tons per day, 3,000 tons per month and approximately 36,000 tons annually.

To achieve a full circular economy and avoid landfill disposal, National Steel proposes that two monofill sites be developed and operated on the arc furnace site. The term "monofill" is used since only this waste stream will be disposed to these sites. Available (clean) technologies for the conversion of such floc wastes to other uses, such as alternative fuel energy recovery from refuse-derived fuel (RDF) or solid refuse fuel

(SRF), are still to be explored in New Zealand. Hence, the monofill sites provide for the effective "storage" of this resource material until such time as it can be used effectively.

The Waste Minimisation Act of 2008 (WMA, 2008) is designed to encourage waste diversion from landfills, as well as the minimisation and reduction in the quantities of waste disposed. The Act requires industry to consider the following waste hierarchal steps (in order of importance):

• reduction; • reuse; • recycling; • recovery; • treatment; and lastly • disposal

It is widely accepted internationally that "recovery" includes the recovery of energy.

National Steel is a 2019 Sustainable Business Network award winner with a "Zero Waste" ethos. The proposed monofills provide an undertaking aimed at possible resource recovery and reuse of the floc material when (and if) viable technologies arise in the future. Notwithstanding this, the sites are to be engineered for the safe disposal of the floc material for the foreseeable future.

This report provides a preliminary geotechnical assessment for the two monofill sites. Associated reports on the development of the monofill sites include the Earthworks Management and Erosion and Sediment Control Plan (Earthtech, 2025a), the Engineering Report (Earthtech, 2025b), the Preliminary Geotechnical Assessment Report (Earthtech, 2025c) and the monofill Monitoring Plan (Earthtech, 2025d).

The Preliminary Geotechnical Assessment Report (Earthtech, 2025c) covers the entirety of the Green Steel project site. The geotechnical information and assessment of ground conditions provided in this report specifically refer to the monofill sites with the Green Steel site only. Further proving of ground conditions is required ahead of detailed design through intrusive site investigations, i.e. drilling of boreholes with core recovery.

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 – 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 the North Island. The Spring Hill Corrections Facility is situated to the south. A site location plan is presented in Figure PD1.

2.2 Site Description

A detailed description of the arc furnace site is provided in Earthtech (2025c).

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 (Figures PD1 and PD2). The proposed arc furnace development area is located within a *horseshoe*-shaped ridge line (Figure M3.1). The two monofill sites are located in the northeast and southwest areas of the site.

Several existing flow paths originate from the ridgeline around the property, draining in a northerly direction. Man-made farm drains transect the lower-lying ground to the north. Both monofill sites are drained by local catchments to the northeast and southwest, respectively, i.e. they are self-contained and isolated from the main horseshoe perimeter catchment.

2.3 Proposed Monofill Developments

2.3.1. Southwest (SW) Monofill

The site is located on the southwest side of the horseshoe ridge. Extensive earthworks are proposed to accommodate the monofill on a safe and stable site that is suitable for the construction of a Class 1 landfill liner.

Existing site contours and the southwest monofill footprint area are shown in Figure M2.1, together with cross-sections D-D1 and J-J1 in Figures M4.1 and M4.2. Note that cutting the subgrade to a deeper level (say RL12*m* instead of RL22*m*) will provide a larger, stable lining area and a significant increase in the monofil volume. This option may be explored further and will largely remove the need for stability remedial works on the southwestern slopes.

The steep southwest-facing slopes (Sections J-J1 and Y-Y1) have been mapped as unstable ground up to 6*m* depth. Note: Section Y-Y1 was identified as a key cross-section adopted for stability analysis (refer to Appendix C1). These will be cut away and stabilised with compacted fill or stabilised with a buttress fill.

The monofill floor liner is graded at a basegrade slope of 1 in 100 (1%) (up to 1 in 40 (2.5%), dependent on final geometric design arrangements) towards the arc furnace site. Finished monofill side slopes are expected to vary from a maximum of 1 on 2 to a gently domed cap at RL38*m*.

2.3.2. Northeast (NE) Monofill

The site is located on the northeast side of the horseshoe ridge. Extensive earthworks are proposed to accommodate the monofill on a safe and stable site that is suitable for the construction of a Class 1 landfill liner.

Existing site contours and the northeast monofill footprint area are shown in Figure M2.2, together with cross-sections G-G1 and H-H1 in Figures M4.4 and M4.5, respectively.

The existing shared accessway is to remain in place in the short term. Stage 1 of the monofill is limited to the area to the north of the accessway. A possible Stage 2 area is indicated to the south, as shown in the site plan (Figure M2.2). If the accessway is relocated to the south, Stages 1 and 2 could be merged into a single larger monofill.

The steep slopes in the two gullies will be cut away to flatter grades, and a compacted fill toe buttress will be constructed along the northern boundary.

The monofill liner is graded at 1 in 50 to the north. Finished monofill side slopes are expected to vary from a maximum of 1 on 2 to a gently domed cap at RL38*m*.

3. Geological Mapping and Ground Conditions

3.1 Published Geology

The New Zealand Geological Map (GNS Science, Geology 2.0.0 (gns.cri.nz)) indicates only three units underlying the site (Figure M3.1):

Q1a Taupo Pumice Alluvium – referred to as Young Alluvium. This unit underlies the very low-lying ground (≤RL4*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.

Underlying soils, based on preliminary geotechnical investigations, are shown in long-section A-A (PD5.1) and cross-sections B-B and C-C (PD5.2), attached in Appendix A.

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, site mapping needs to be reviewed upon completion of detailed site investigations. Geotechnical mapping of the site is shown in Figure M1.1.

3.3 Historical Photographs

Aerial photographs from 1942 and 2013 in Figure M3.2 indicate site conditions at earlier times. Little has changed from 2013 to the current site conditions.

3.4 Ground Conditions Encountered on the Monofill Sites

Several geotechnical investigations have been undertaken on the overall site. These include:

- Walkover surveys.
- Eight (x8) hand auger bores (HA1 to HA8).
- Ten (x10) cone penetrometer profiles (CPT01a to CPT05, CPT07 to CPT11).
- Ten (x10) test pit excavations (TP1A, TP2-2, TP2-5, TP2-6, TP5, TP7, TP8, TP9, TP11A and TP11B). Test pits TP2-5, TP2-6 and TP8 were conducted within, and immediately adjacent to, the SW Monofill site; and TP11A and TP11B adjacent to the NE Monofill site.

Site-specific investigations on the monofill sites include hand auger bores and test pits conducted at key locations, with undrained shear strength measurements. Investigation logs are provided in Appendix B.

Interpretation of the topographical and engineering geological mapping data, along with the CPT and hand auger data (Appendix B), has been undertaken with knowledge from the three adjacent sites to provide the likely and worst-case interpretation for each monofill site.

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. Test pit excavations have provided valuable physical checks against CPT data (or signatures). By and large, a close correlation can be established with comparative CPT signatures, which can be applicable to any further CPT investigation.

Several soil material types are described in the Preliminary Geotechnical Report (Earthtech, 2025c). No acid-sulphate-type soils were encountered during the geotechnical investigations, but they cannot be ruled out. Where encountered, such soils may be required to be removed and relocated to appropriately selected spoil areas, suitably separated and contained (capped) to prevent leaching into the surrounding receiving environment. A management approach is provided in the Earthworks Management and Erosion and Sediment Control Plan (Earthtech, 2025a) for dealing with acid sulphate soils, if or where encountered. Additionally, areas of the site have been mapped, indicating the potential presence of acid sulphate soils (Earthtech, 2025a).

Materials encountered and expected to be on the monofill sites include:

i. *Topsoil*

Allow for 0.2*m* to 0.4*m* 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). All gully alluvium will need to be undercut and placed in spoil heaps or landscape fill areas. The gullies are present within the *horseshoe* above RL5*m*. The northeast monofill includes two gully alluvium areas. Slope wash at the foot of the southwesterly facing slopes is expected on the southwestern monofill site.

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

The ancestral Waikato River has influenced the large low-lying area and is likely to be underlain by weak peat deposits and soft organic silts. The deposits are typically 6*m* deep and prone to severe settlement if loaded. Roads will require 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 1*m* thick. Settlements of 500*mm* to 1,000*mm* are expected to occur over time. Only minor areas of stream alluvium are anticipated on the southwestern monofill site with none on the northeastern site.

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 3*m* to 10*m*, 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 100*kPa* (ultimate bearing capacity of 300*kPa*).

Amokura Formation has been identified on the surface of the southwestern monofill slopes between RL7*m* and RL25*m*. The geological information suggests that the Amokura was eroded to low levels (below RL25*m*), followed by deposition of significant depths of alluvium, shown as Terrace Alluvium.

Mapping of the southwest 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 but borders the southwest monofill site.

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. Kaawa sands are expected on the northeastern monofill site.

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

These appear to overlie the Amokura Formation in all areas above RL4*m* 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 testing) is required.

Terrace alluvium is expected on both monofill sites.

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

This has been identified as a 1*m* to 3*m* 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. It is expected to be found on the surface of both sites.

viii. *Karapiro Formation (eQk)*

This is mapped 1*km* 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 used 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 RL4*m* and minor zones of fill associated with farm tracks and cuttings.

In summary, the CPT data has not conclusively identified the alluvial materials on the site. Additional testing is required for the proposed compacted-fill earthworks.

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*m* to 6*m* depth soil profile across the monofill site. A tabulated summary of relevant test pits, including soil descriptions, consistency and comment on engineering earthworks suitability, is presented in Table 1 below. Grab samples were taken at 1*m* depth intervals and placed in core boxes, allowing for additional assessment. Soil sample "cores" are shown in photographs attached in Appendix B.

Table 1: Test pit summary of soil types encountered – Green Steel Monofill Sites.

Test Pit	Depth (m)	Soil description	Engineering Suitability Comment	Consistency
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
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
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 4.4*m*, est. one-day drying required.	Very stiff.

3.5 Southwest Monofill Site

Ground conditions below the liner level are expected to be either residual Amokura soils and/or Amokura bedrock. Section J-J1 (Figure M4.2) indicates the intention to place the liner footprint on competent and stable ground.

3.6 Northeast Monofill Site

Ground conditions below the liner are expected to be either Kaawa sands, residual Amokura soils and/or Amokura bedrock. Sections G-G1 and H-H1 (Figures M4.4 and M4.5) indicate the intention to place the liner footprint on competent and stable ground. A 1 on 2 cut slope is proposed to retain the existing shared accessway.

3.7 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 from the adjacent site 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	Undrained Shear Strength Su
Stream Alluvium (Young Alluvium) – Peat soils	3*kPa*	22°	14kN/m^3	25-50*kPa*
Young Alluvium – Silts, clays and minor sands	5*kPa*	28°	18kN/m^3	60-80*kPa*
Rhyolitic Terrace Deposits (Old Alluvium)	4*kPa*	28°	18kN/m^3	>140*kPa*
Compacted Amokura Formation (Bulk Fill)	10*kPa*	36°	20kN/m^3	n/a
Compacted Kaawa Formation (Bulk Fill)	5*kPa*	36°	18kN/m^3	>140*kPa*
Compacted Hamilton-Kauroa (H-K) Ash	10*kPa*	30°	18kN/m^3	>80*kPa*

3.8 Key Engineering Properties and Proposed Use of Site Materials

- All organic soils, including peats to be cut to spoil, 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-5*m*, thus limiting the maximum depth to the terrace deposits.

- For compacted 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 are present and suitable for compacted fill.

- 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. Amokura bedrock has been identified on these slopes between RL7*m* and RL20*m*.

- 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 but directly adjacent to the southwest monofill site. Regional bedding of the Amokura bedrock is northwest, which is neutral in regard to monofill stability.

- All silts and clays are prone to shrink/swell movements.

- All gullies and drains will require undercutting and the 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, workshop areas and the two monofill sites.

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 (1/25*yr*)	0.06*g*	5.8
Ultimate Limit State, ULS (1/500*yr*)*	0.24*g*	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 0.5*m* to 1*m* below existing ground level. Groundwater rises to the surface under very wet winter conditions and extreme flood events when the lowest terrace area is flooded.

Several groundwater seepages were identified in the geotechnical mapping shown in Figure M1.1, found to emanate between approximately RL25*m* and RL35*m* inside the *horseshoe* area of the site.

Groundwater levels beneath the monofill sites are expected to be at or just below liner level. Subsoil drains will need to be included below the liner.

Sandy soils of the Kaawa Formation, below the groundwater table, are potentially liquefiable but too old to be of any concern.

6. Earthworks

6.1 Southwest Monofill Site

Earthworks will be required to prepare the site in two stages. These works will be undertaken in conjunction with the main site preparation works.

Topsoil will be removed and stockpiled for reuse.

A large cut will be required to remove the ridge line from RL35*m* to the liner level at RL22*m*. This may be lowered further with further design consideration which is covered in the Engineering Report. This cut material is expected to provide good fill materials for the arc furnace main platform. Bulk excavation can continue to within 1*m* of the subgrade levels, followed by careful trimming to subgrade level to avoid any machine disturbance to the monofill floor.

The full extent of the liner area is to be excavated down to stable ground. This is particularly important along the southwest-facing slopes where the existing instability is to be:

a. Removed and replaced with compacted fill (Option 1),
b. Left as is with an adequate setback (Option 2), or
c. Stabilised from the bottom up with a large buttress fill with a final overall slope of 1 on 4 (Option 3). The toe zone of the buttress fill includes weaker soil materials (MF1 and MF2) which may require undercutting or excavation and replacement with good fill. Investigations to date have not identified any significant peat deposits in the buttress fill area.

Options 1 and 3 are the most likely, as Option 2 will result in a significant loss of monofill volume. Preliminary design details indicate a combination of Options 1 and 3 to stabilise the slopes.

6.2 Northeast Monofill Site

Topsoil will be removed to stockpiles for reuse. All unstable materials in the two gullies will be removed to spoil stockpiles. Significant cut depths will be undertaken to prepare the liner subgrade and the 1 on 2 cut slopes to the north of the shared accessway.

A toe buttress approximately 3*m* high will be keyed into the ground along the northern boundary.

Subsoil drains are likely to be placed beneath the gully alignments and in any other groundwater seepage areas.

7. Monofill Stability Analyses

7.1 Methodology

Stability of the key cross-sections has been analysed using the SLOPE/W module of GeoStudio (2024) software. This calculates the Factor of Safety (FoS) under various loading and groundwater conditions. The analysis employed the Morgenstern-Price method with the entry-exit slip surface option to evaluate the stability under both static and seismic conditions. The monofill was modelled to a 1:3 gradient. Analytical results showing Slope/W outputs are attached in Appendix C.

7.2 Material Properties

The soil strength parameters obtained (estimated from field investigations and mapping) are presented in Table 3. The water table depth has been considered at the surface of the existing slope as a conservative approach. (In practice, groundwater drains will be included at all seeps and gully areas.)

Table 3: Soil Strength Parameters Used for Stability Analysis

Name	Unit Weight (γ) (kPa)	Cohesion (c') (kPa)	Internal Friction Angle (ϕ') (degrees)	Undrained Shear Strength (S_u) (kPa)
Bedrock	19	10	36	500
Buttress fill	16	2	25	60
Colluvium	17	2	27	70
Compacted Fill	18	5	33	120
Monofill	12	5	30	50
Residual soils	17	5	30	100
Rhyolitic Terrace Deposits	18	4	28	150
Toe Bund	16	5	36	120
Young alluvium – silts, clays, minor sands	18	5	28	80

7.3 Seismic Analysis Details

The site is classified as subsoil class C according to NZS 1170.5, with a seismic importance level (IL) of 2. The design working life of the structure is considered 50 years for IL 2, using NZS 1170.0.

Seismic design parameters have been provided in section 4 above.

7.3.1.

7.3.1. Southwest Monofill

A) Static Analysis Results

The FoS obtained for the static case is shown in Table 4, and the outputs are attached in Appendix C1.

Table 4: FoS Against Sliding Under Static Conditions

Case	Method	FOS
Existing slope	Entry-Exit	0.88
Recompacted fill (option 1)		1.69
With buttress fill (option 3)		2.04

B) Seismic Analysis Results

The monofill, modelled on top of high-strength bedrock, is seismically stable, and any slip surface passing through the monofill and colluvium/residual soils yields a higher FOS. The results for all sections are presented in Tables 5 and 6.

Table 5: FoS Against Sliding Under Seismic Conditions (Slip Surface Not Affecting Monofill)

Case	Design Event	Method	FOS
Existing slope	SLS	Entry-Exit	2.55
	ULS		1.79
Recompacted fill (option 1)	SLS	Entry-Exit	4.00
	ULS		2.72
With buttress fill (option 3)	SLS	Entry-Exit	2.13
	ULS		1.46

Table 6: FoS Against Sliding Under Seismic Conditions (Slip Surface Passing Through Monofill)

Case	Design Event	Method	FOS
Existing slope	SLS	Entry-Exit	2.97
	ULS		2.11
Recompacted fill (option 1)	SLS	Entry-Exit	4.79
	ULS		3.18
With buttress fill (option 3)	SLS	Entry-Exit	3.39
	ULS		2.41

With the FoS for ULS and SLS events being greater than 1, no slope movement affecting the monofill is anticipated during seismic events.

C) Conclusions

Slope stability analysis results indicate that the placement of buttress fill on the existing southwestern slopes is an effective way of preventing any slope failure under static and seismic conditions. Removal and replacement with compacted fill is also an option, as shown in Figure A.

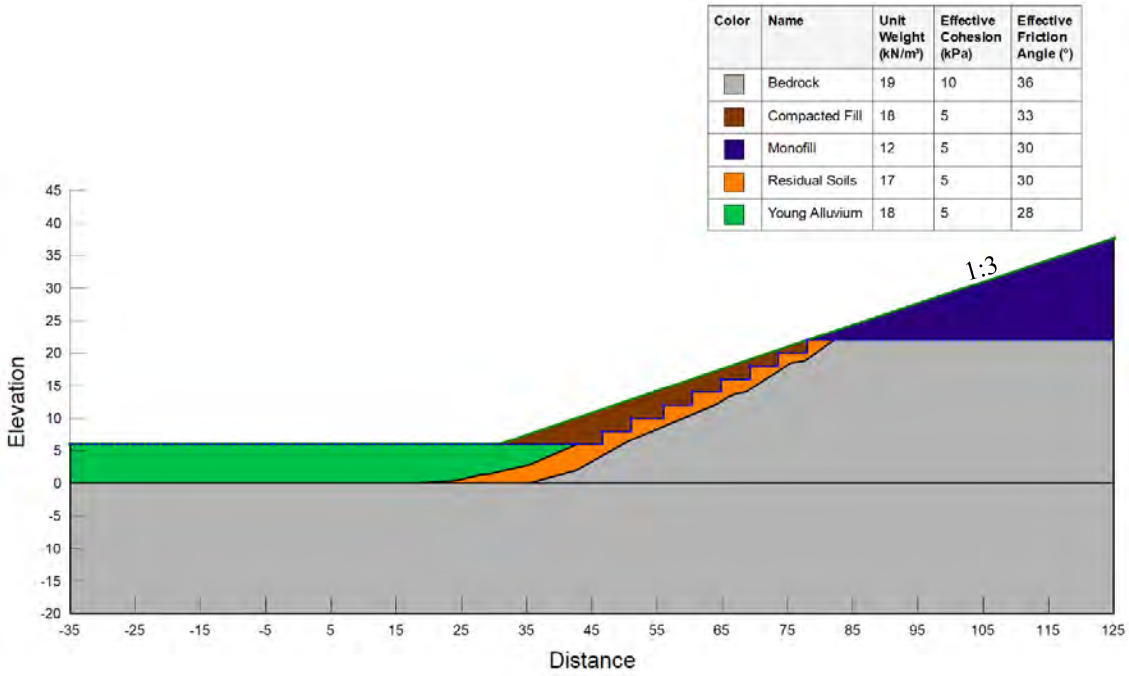

Figure A: SLOPE/W model for SW monofill (benched with compacted fill – Option 1)

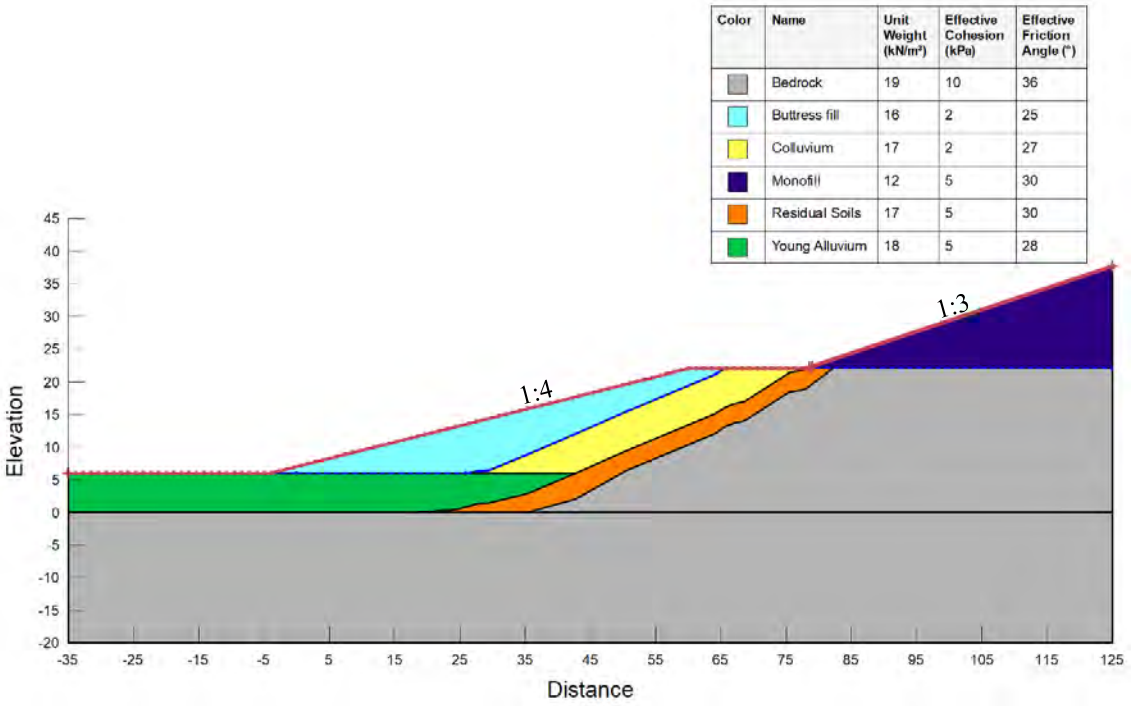

Figure B: SLOPE/W model for SW monofill (with buttress fill – Option 3)

7.3.2 Northeast Monofill

A) Static Analysis Results

The FoS obtained for the static case is 1.83, and the output is attached in Appendix C2.

B) Seismic Analysis Results

The results for the seismic analysis are presented in Table 7.

Table 7: FoS Against Sliding Under Seismic Conditions

Case	Design Event	Method	FOS
NE slope with monofill	SLS	Entry-Exit	1.99
	ULS		1.2

C) Conclusions

The northeast monofill modelled on 1:2 cut slope from the shared accessway is statically and seismically stable.

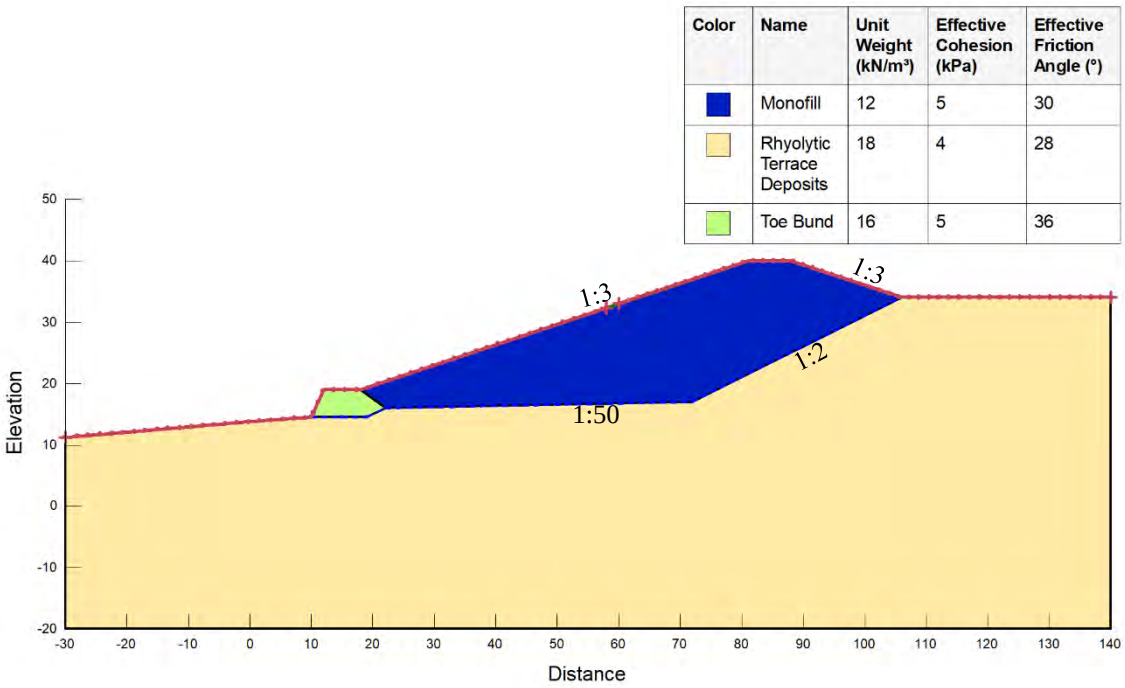

Figure C: SLOPE/W model for NE monofill

8. Subsoil Drainage

Subsoil drains will be installed below the monofill liners, along with inspection chambers, to facilitate water quality sampling and potential flushing as needed. Subsoil drains will also be included beneath the buttress fill. Design details are provided in the monofill Engineering Report (Earthtech, 2025b).

9. Stormwater Drainage and Sediment Controls

The proposed monofill development sites are both situated within independent catchment areas, akin to a *bathtub*, and stormwater flows can be suitably channelled around the site by strategically located stormwater (*dirty* and *clean water* type) contour drains. Stormwater management and treatment (primarily by sediment controls) details are provided in the Earthworks Management Plan and Erosion and Sediment Control Plan (ESCP) (Earthtech, 2025a). A site-specific erosion and sediment control plan component has been prepared for each monofill site in this (latter) report. Stormwater attenuation ponds and/or weirs with decanting, formed by earth bunds (with erosion protection), will be required to reduce the impact of peak flows across areas of the monofill – during development. Monofill development staging details are provided in the Engineering Report (Earthtech, 2025b).

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.

Both monofills will be treated as separate catchment areas with clean diversion drains around the site, and any sediment-laden water will be collected and treated via local sediment retention ponds. On completion of filling, the sites will be grassed or planted with native shrubs.

10. Conclusions and Recommendations

a. Two areas of the overall site have been identified as being suitable for the construction of a fully lined monofill to store the waste floc materials for future use.

b. The monofill sites need to be located on stable ground and will include:

- Subsoil drains below the liner to control groundwater seepage and act as leak detention drains.
- A full Class 1 landfill liner consisting of:
  - Prepared subgrade
  - Composite GCL/HDPE liner
  - Full leachate collection systems
  - Floc layers up to 3*m* deep with 300*mm* soil cover placed as daily cover
  - A final capping layer, domed to shed rainwater and protected from erosion.

c. Site investigations indicate the ground conditions as interpreted and shown in the sections attached (PD5.1 and PD5.2). The difference between geological units is not easily identified by the CPTs and could be significant in relation to earthworks parameters in particular. Several 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.

d. It is recommended that the preliminary design of cut and fill slopes be at 1(v) on 3(h) unless retained.

e. All silts and clays are prone to shrink/swell movements, and further earthworks (laboratory) testing is required.

f. 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.

g. The southwest monofill site will require significant earthworks to prepare the platform and to stabilise the existing natural slopes. The cut material can be expected to good, requiring little conditioning (primarily drying) - thus suitable for use as engineered fill material for the construction of the main building platform for the Green Steel project development.

h. The northeast monofill site is a valley site which will require large cut volumes to allow increased volumes of floc. The existing shared road is to be partially used to gain access to the site. This could be widened or, alternatively, rerouted in the future.

i. Groundwater seepages encountered within the monofill sites can be suitably diverted and conveyed to discharge areas within the monofill site and later conveyed by purpose-engineered subsoil drains.

j. The proposed monofill development sites are both situated within independent catchment areas, similar to a *bathtub*, and stormwater flows can be suitably channelled around the site by strategically located stormwater (*dirty* and *clean water* type) contour drains. A site-specific erosion and sediment control plan component has been prepared for each monofill site in the Earthworks Management Plan and Erosion and Sediment Control Plan (ESCP) (Earthtech, 2025a).

k. Detailed site-specific investigations will be required on both sites prior to preparation of detailed design plans and specifications. We would recommend deep machine boreholes to recover full soil profiles for logging and laboratory testing. This could be synchronised with the drilling of the required monitoring boreholes described in the Engineering Report (Earthtech, 2025b).

l. No acid-sulphate-type soils were encountered during the geotechnical investigations, but they cannot be ruled out. A management approach is provided in the Earthworks Management and Erosion and Sediment Control Plan (Earthtech, 2025a) for dealing with acid sulphate soils, if or where, encountered. Also, areas of the site have been mapped, showing the potential probability of acid sulphate soils (Earthtech, 2025a).

m. A draft monofill management plan will also be required to provide details of how the monofills will be operated and managed.

n. Preliminary investigations and a conservative stability assessment of each site indicate that both sites will be suitable for the intended monofill development and long-term operation.

11. Drawings Disclaimer

The are several drawings attached to this report, numbered as Figure M1.1 through M4.5, 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 PD1 through PD5.2, attached to this report, are consistent throughout our reports - current to the revision and date shown.

12. 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.

Earthtech (2025c) — *Preliminary Geotechnical Assessment Report. 61 Hampton Downs Road, Hampton Downs.* Prepared for National Green Steel Limited. Ref R4392-2, Rev D, dated 28 May 2028.

Earthtech (2025d) — *Monitoring Plan and Evaluation of Surface and Groundwater Effects. – Green Steel Monofill, 61 Hampton Downs Road, Hampton Downs, Waikato*. Ref. R4424-6, 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) on 12 January 2024.

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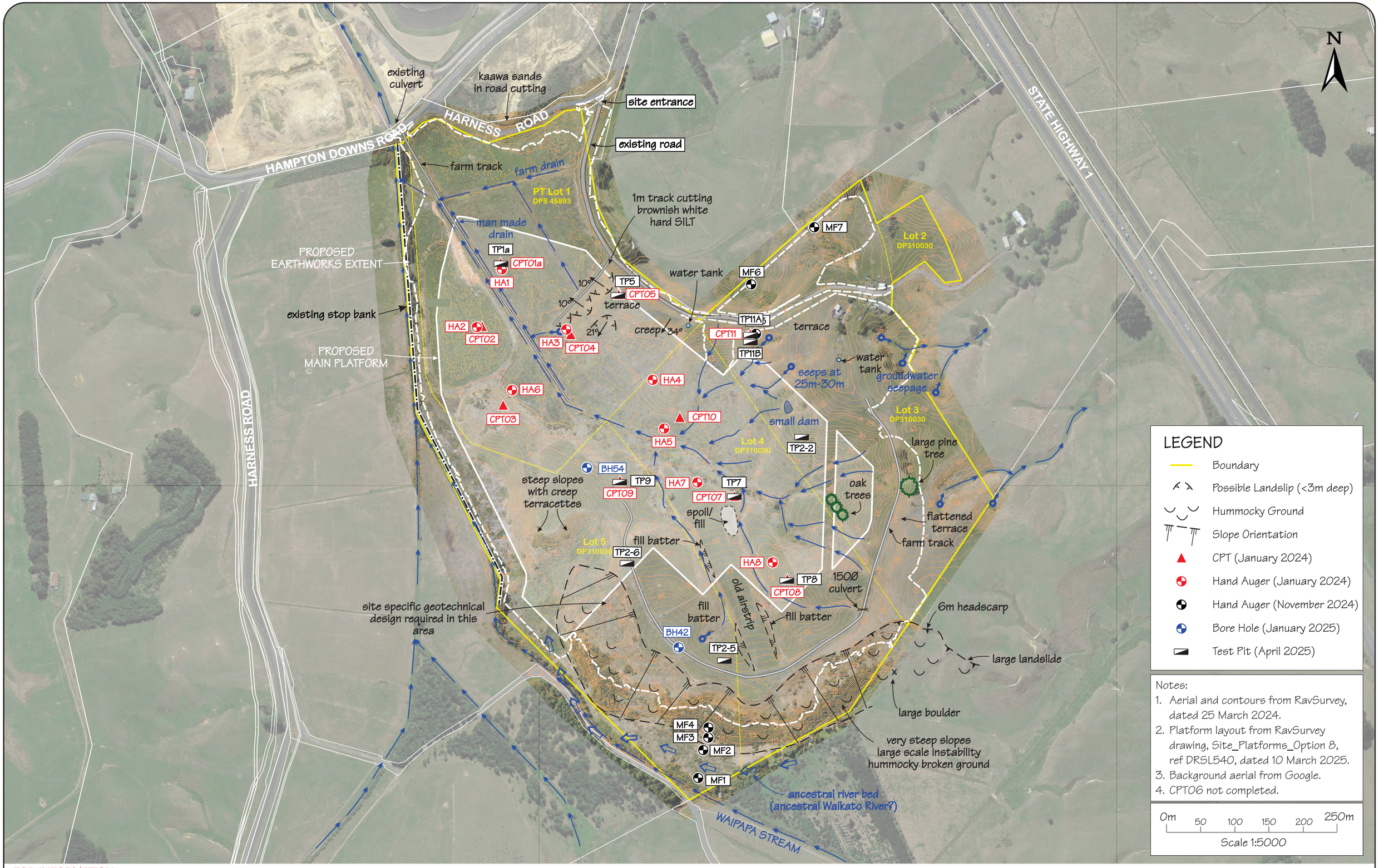
NZGS (2021) — *Earthquake Geotechnical Engineering Practice in New Zealand*. New Zealand Geotechnical Society (NZGS) and Ministry of Business Innovation & Employment (MBIE). Rev 1, November 2021. https://www.building.govt.nz/assets/Uploads/building-code-compliance/b-stability/b1-structure/geotechnical-guidelines/module-1-overview-of-earthquake-geotechnical-engineering-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).



LEGEND

- Boundary
- Possible Landslip (<3m deep)
- Hummocky Ground
- Slope Orientation
- CPT (January 2024)
- Hand Auger (January 2024)
- Hand Auger (November 2024)
- Bore Hole (January 2025)
- Test Pit (April 2025)

Notes:

1. Aerial and contours from RavSurvey, dated 25 March 2024.
2. Platform layout from RavSurvey drawing, Site_Platforms_Option 8, ref DRSL540, dated 10 March 2025.
3. Background aerial from Google.
4. CPT06 not completed.

0m 50 100 150 200 250m

Scale 1:5000

FOR INFORMATION

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

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MONOFILL ENGINEERING REPORT

THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

National Green Steel Limited

Site Investigation and Mapping Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	06-12-24	FOR REPORT R4424-1	L.S	A.N	S.SW	
B	18-02-25	BORES ADDED	L.S	A.N	S.SW	
C	29-05-25	TEST PITS ADDED	L.S	A.N	S.SW	

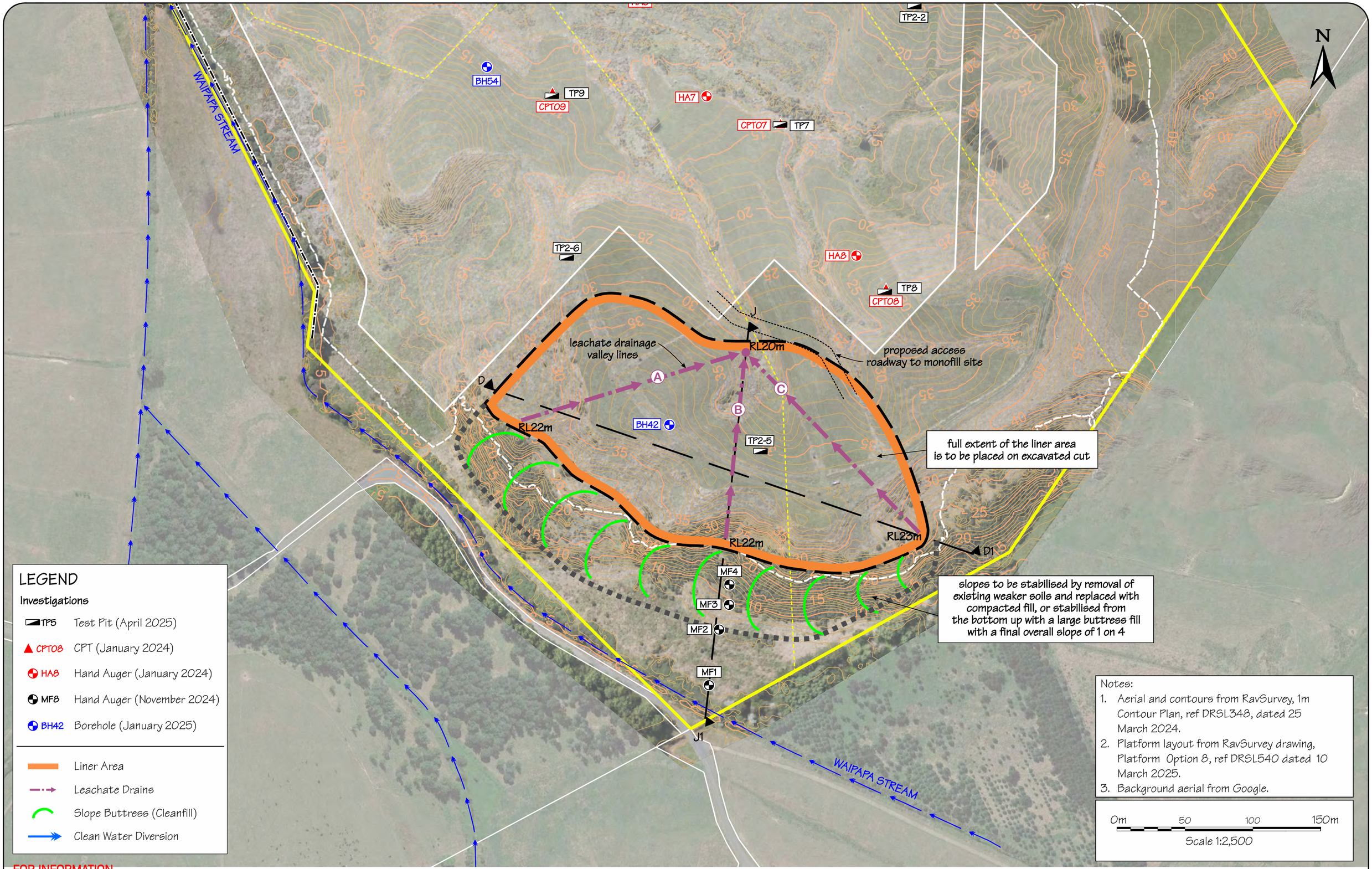
DRAWING NO.: FIG. M1.1

REF: 4424

SCALE: 1:5000

CRS: Mt Eden 2000

DATUM: AVD46



LEGEND

Investigations

- TP5 — Test Pit (April 2025)
- CPT08 — CPT (January 2024)
- HA8 — Hand Auger (January 2024)
- MF8 — Hand Auger (November 2024)
- BH42 — Borehole (January 2025)

- Liner Area
- Leachate Drains
- Slope Buttress (Cleanfill)
- Clean Water Diversion

Notes:

1. Aerial and contours from RavSurvey, 1m Contour Plan, ref DRSL348, dated 25 March 2024.
2. Platform layout from RavSurvey drawing, Platform Option 8, ref DRSL540 dated 10 March 2025.
3. Background aerial from Google.

0m 50 100 150m

Scale 1:2,500

FOR INFORMATION

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MONOFILL ENGINEERING REPORT

THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

National Green Steel Limited

Site Layout Plan for Southwest Monofill

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	06-12-24	DRAFT FOR COMMENT	A.N	A.N	S.SW	
B	28-02-25	UPDATE PLATFORMS	L.S	A.N	S.SW	
C	29-05-25	ADD TEST PITS	L.S	A.N	S.SW	

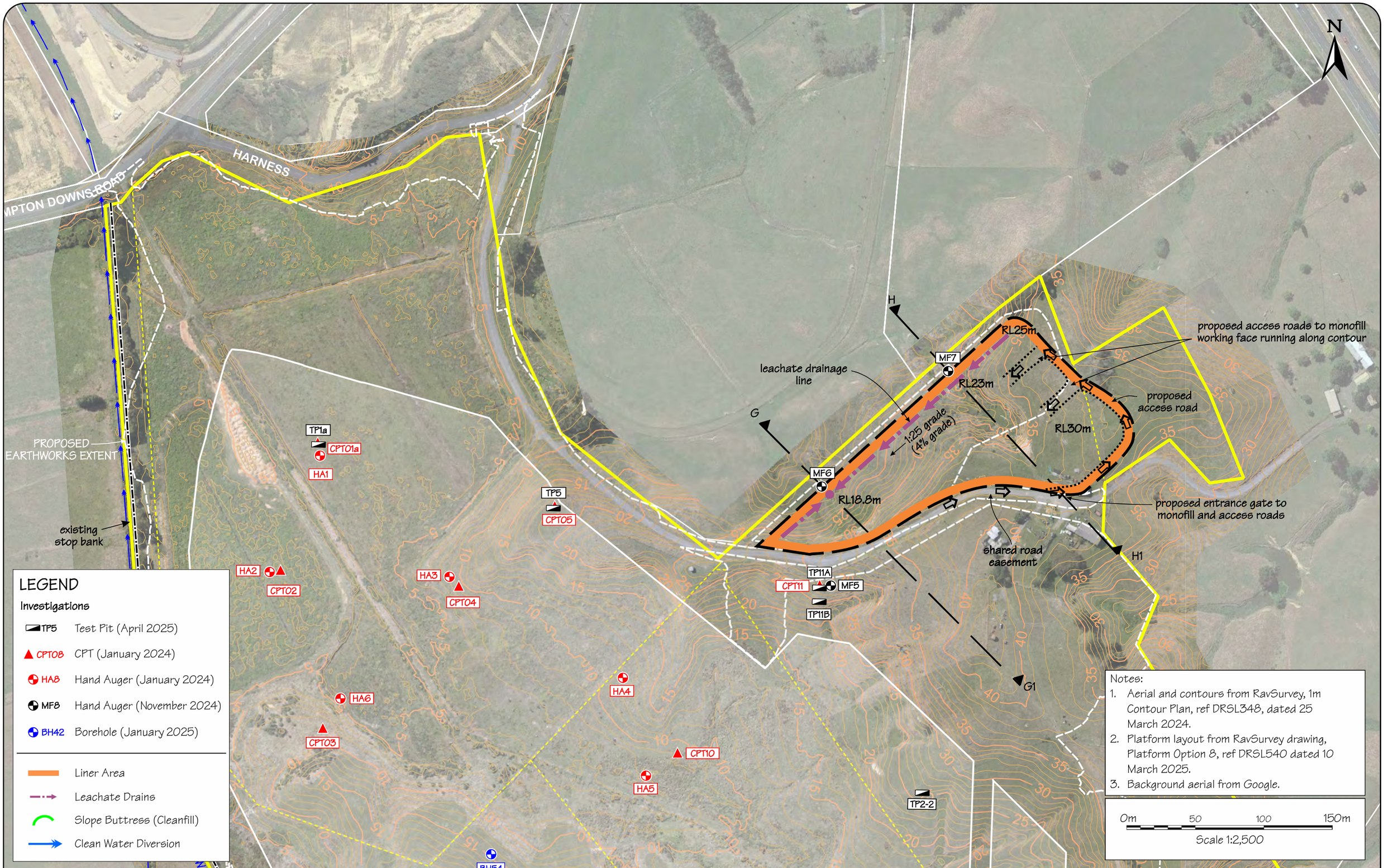
DRAWING NO.: FIG. M2.1

REF: 4424

SCALE: 1:2500

CRS: Mt Eden 2000

DATUM: AVD46



LEGEND

Investigations

- TP5 — Test Pit (April 2025)
- CPT08 — CPT (January 2024)
- HA8 — Hand Auger (January 2024)
- MF8 — Hand Auger (November 2024)
- BH42 — Borehole (January 2025)

- Liner Area
- Leachate Drains
- Slope Buttress (Cleanfill)
- Clean Water Diversion

Notes:
1. Aerial and contours from RavSurvey, 1m Contour Plan, ref DRSL348, dated 25 March 2024.
2. Platform layout from RavSurvey drawing, Platform Option 8, ref DRSL540 dated 10 March 2025.
3. Background aerial from Google.

0m 50 100 150m

Scale 1:2,500

FOR INFORMATION

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

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MONOFILL ENGINEERING REPORT

THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

National Green Steel Limited

Site Layout Plan for Northeast Monofill

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	06-12-24	DRAFT FOR COMMENT FOR R4424-1	A.N	A.N	S.SW	
B	28-02-25	UPDATE PLATFORMS	L.S	A.N	S.SW	
C	14-03-25	UPDATE SECTIONS	L.S	A.N	S.SW	
D	29-05-25	ADD TEST PITS	L.S	A.N	S.SW	

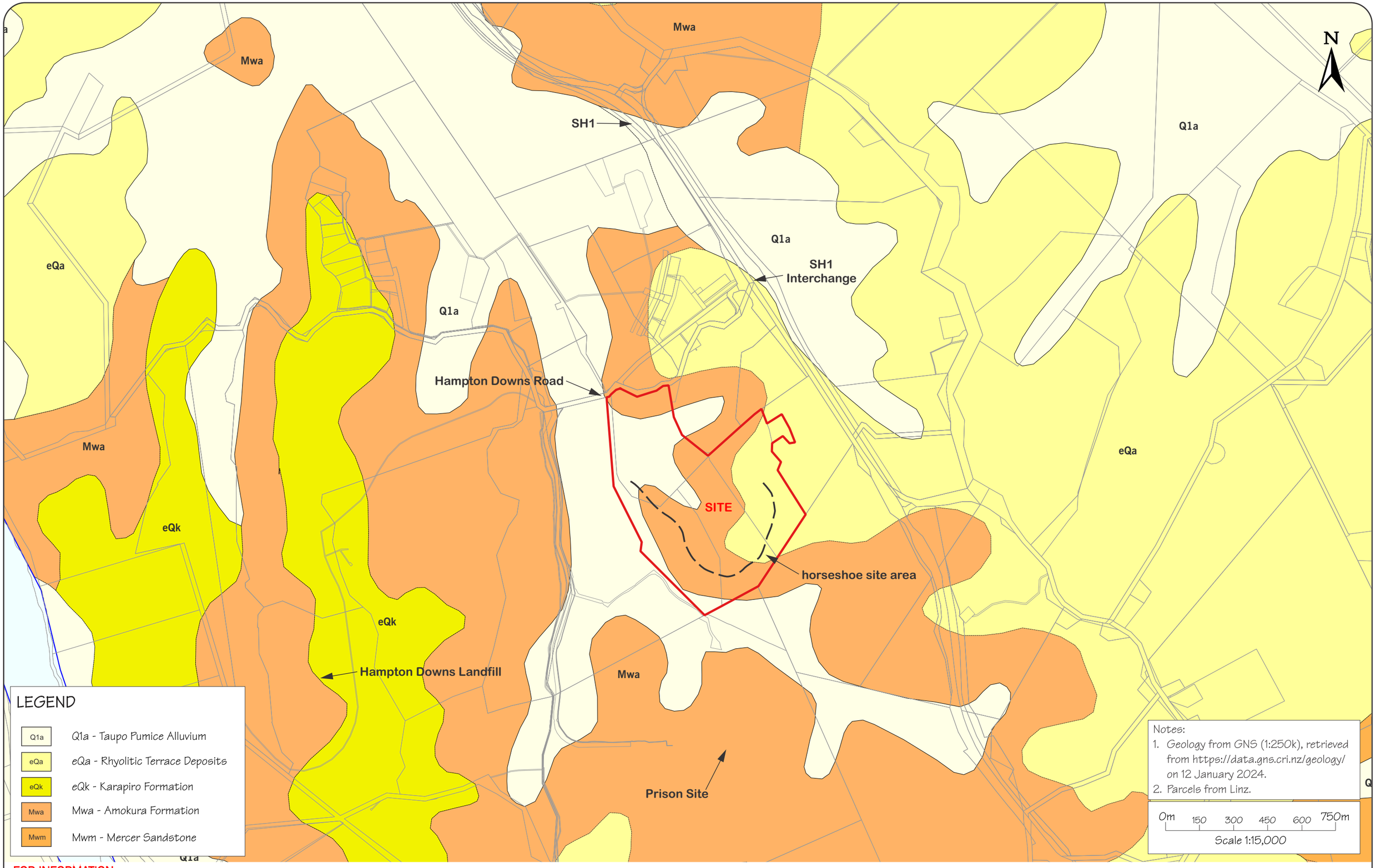
DRAWING NO.: FIG. M2.2

REF: 4424

SCALE: 1:2500

CRS: Mt Eden 2000

DATUM: AVD46



FOR INFORMATION

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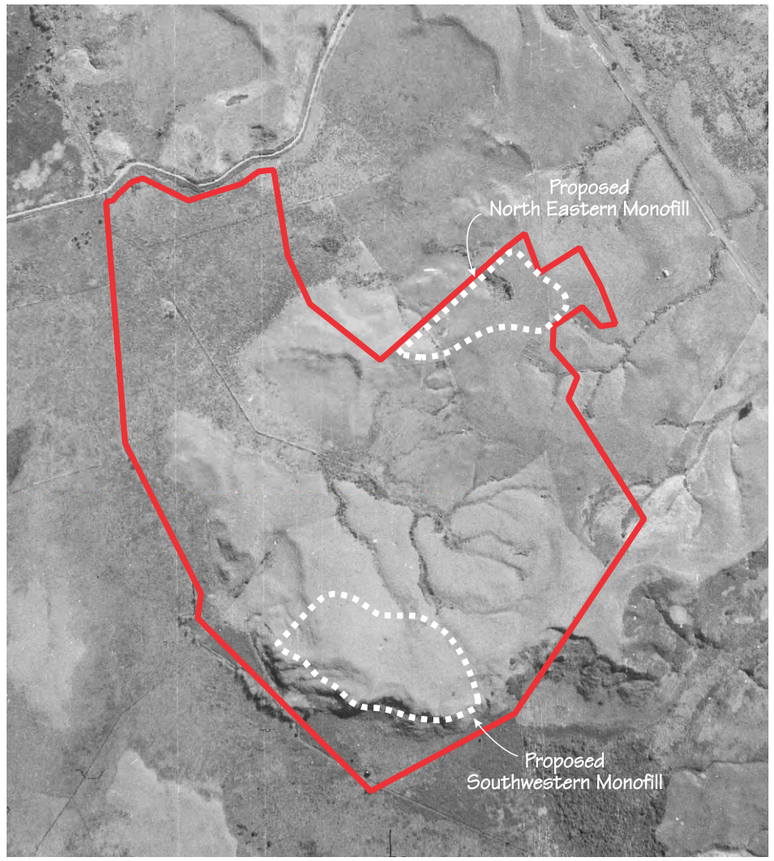
THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD
National Green Steel Limited

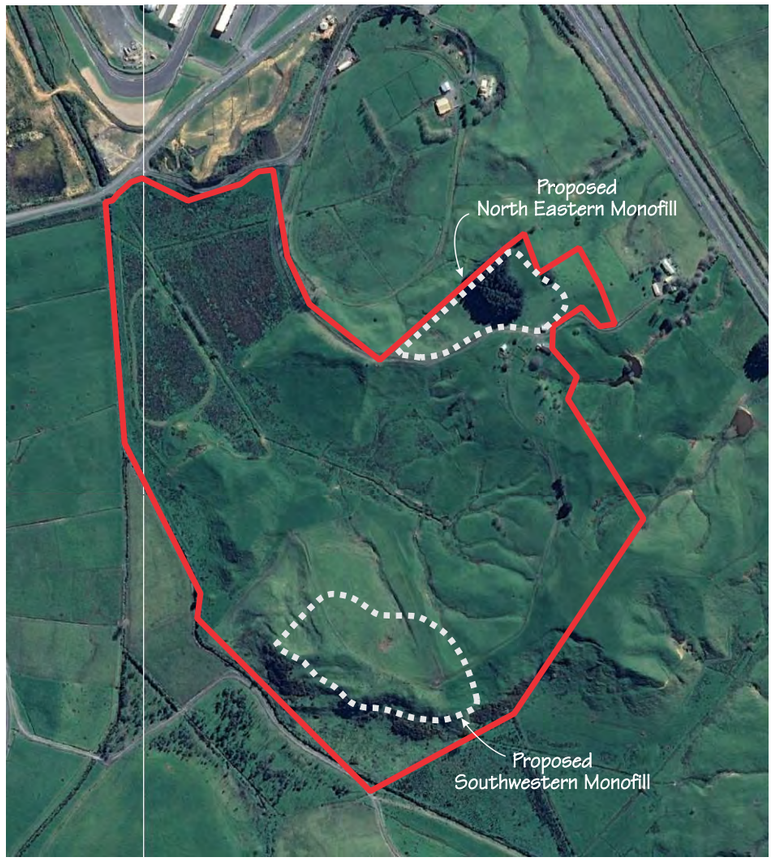
Published Geological Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	06-12-24	FOR REPORT R4424-1	L.S	A.N	S.SW	

DRAWING NO.: FIG. M3.1
REF: 4424
SCALE: 1:15000
CRS: NZTM
DATUM: Moturiki 1953



1942



2013

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MONOFILL GEOTECHNICAL REPORT

THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

National Green Steel Limited

Historic Aerial Photographs 1942 and 2013

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	06-12-24	FOR REPORT R4424-1	A.N	A.N	S.SW	

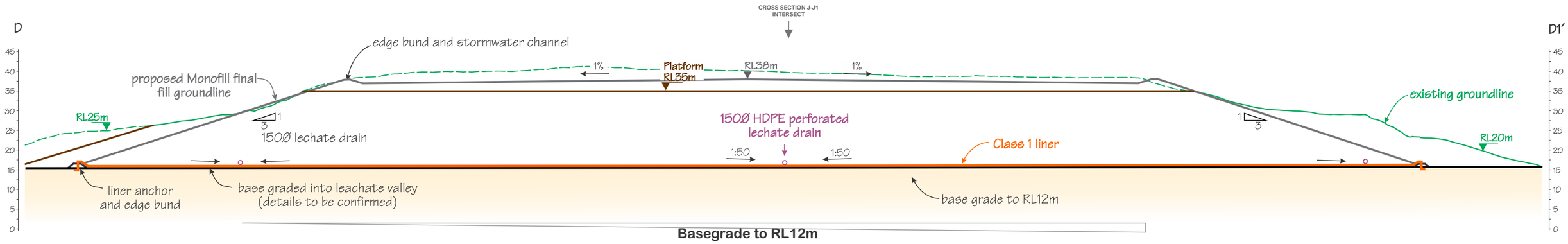
DRAWING NO.: FIG. M3.2

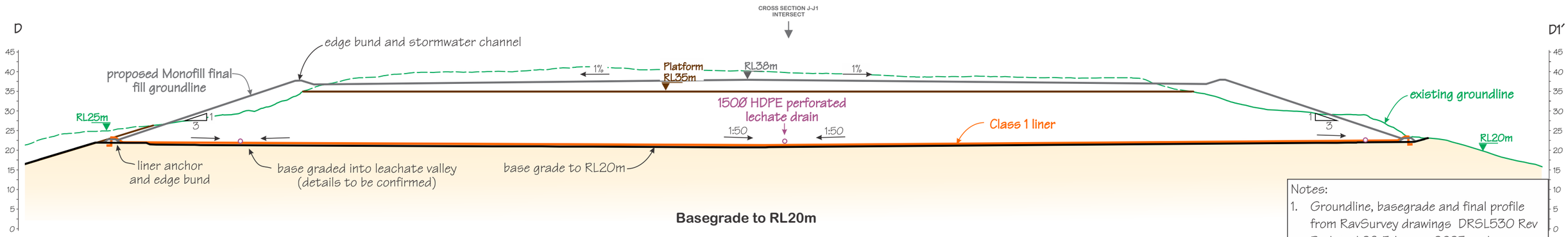
REF: 4424

SCALE: 1:10000 (approx)

CRS:

DATUM:





DRAFT

FOR INFORMATION

Notes:
1. Groundline, basegrade and final profile from RavSurvey drawings DRSL530 Rev B, dated 28 February 2025 and DRSL528, dated 25 February 2025. DRSL482-D, dated 1 November 2024.
2. Indicative ground lines shown and my be amended to suit leachate valley lines.
3. Minimum basegrades of 1:50 (2%) are required for the Class1 liner system.

0m 10 30 50m
Scale 1:1,000

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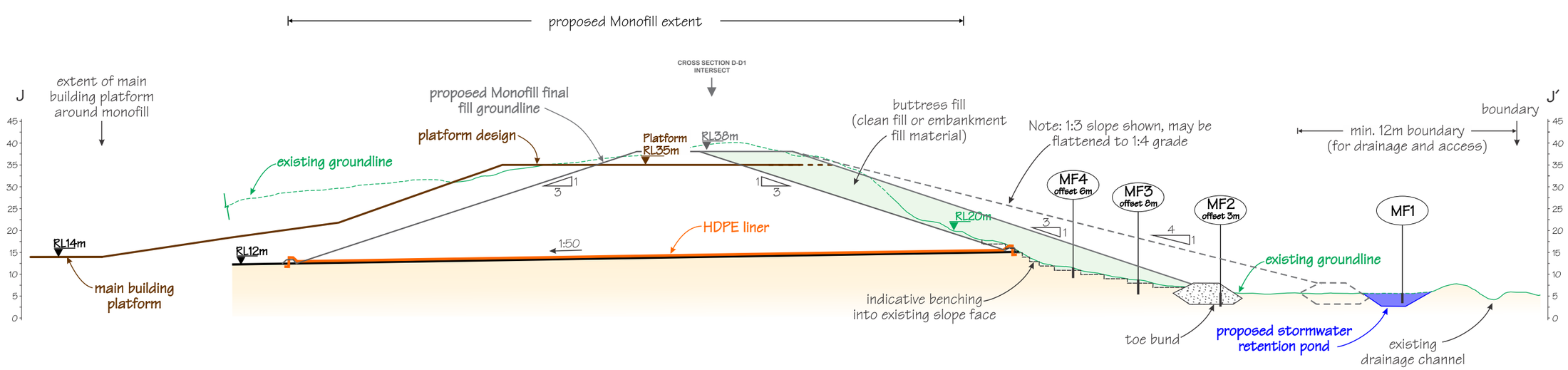
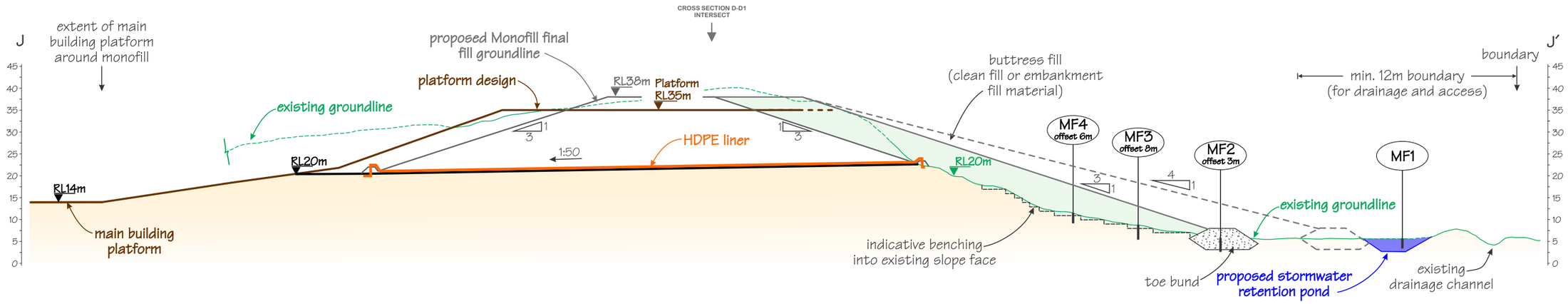
Cross-Section D-D1 - Southwest Monofill

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	06-12-24	DRAFT FOR COMMENT	A.N	A.N	S.SW	
B	28-02-25	DRAFT FOR ENGINEERING REPORT	L.S	A.N	S.SW	

DRAWING NO.: FIG. M4.1
REF: 4424
SCALE: 1:1000
CRS: Mt Eden 2000
DATUM: AVD46



Basegrade to RL12m



Basegrade to RL20m

Notes:

1. Groundline, basegrade and final fill contours from RavSurvey drawings DRSL 529 and DRSL531, dated 28 February 2025.
2. Minimum basegrades of 1:50 (2%) are required for the Class 1 liner system.

0m 10 30 50m

Scale 1:1,000

DRAFT

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MONOFILL ENGINEERING REPORT

THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

National Green Steel Limited

Cross-Section J-J1 - Southwest Monofill

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	06-12-24	DRAFT FOR COMMENT	A.N	A.N	S.SW	
B	28-02-25	DRAFT FOR ENGINEERING REPORT	L.S	A.N	S.SW	

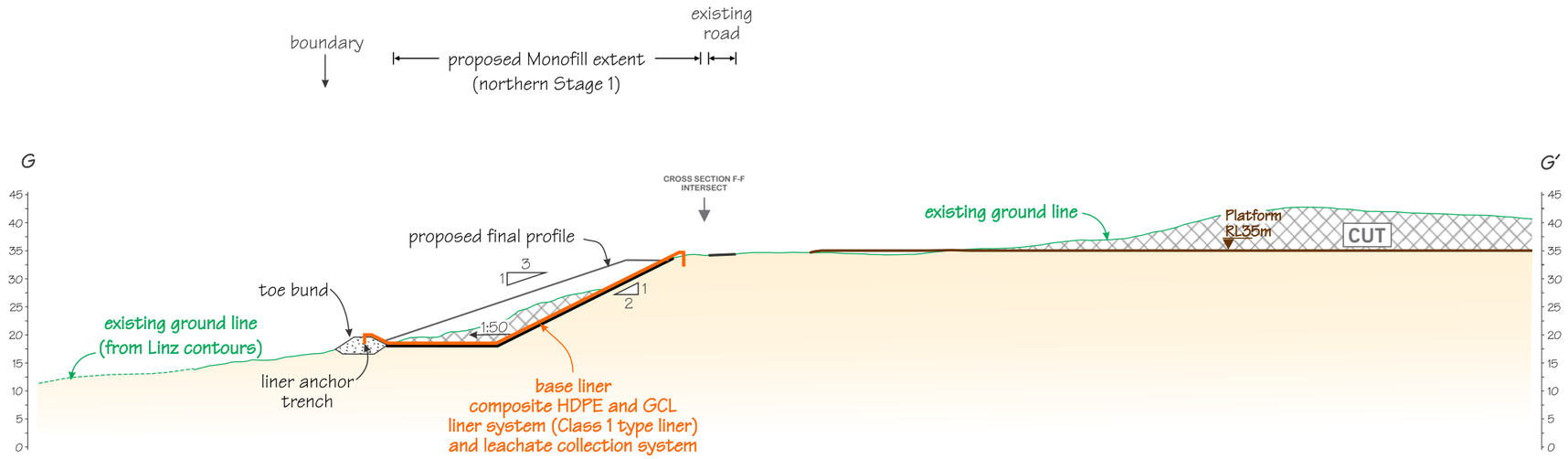
DRAWING NO.: FIG. M4.2

REF: 4424-R2

SCALE: 1:1000

CRS: Mt Eden 2000

DATUM: AVD46



DRAFT

FOR INFORMATION

Notes:
1. Layout from RavSurvey drawing DRSL482 Rev C, dated 21 February 2025.

0m 10 30 50m
Scale 1:1,000

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THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD
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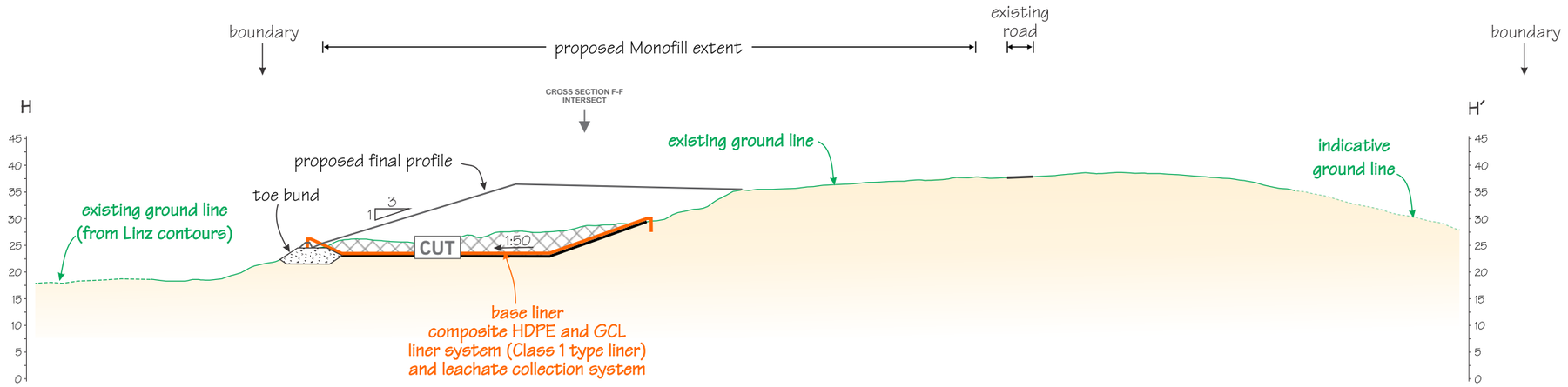
Cross-Section G-G1 - Northeast Monofill

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	29-11-24	DRAFT FOR COMMENT	A.N	A.N	S.SW	
B	24-02-25	UPDATE PLATFORM	L.S	A.N	S.SW	

DRAWING NO.: FIG. M4.4
REF: 4424
SCALE: 1:1000
CRS: Mt Eden 2000
DATUM: AVD46



DRAFT

FOR INFORMATION

Notes:
1. Layout from RavSurvey drawing DRSL482 Rev B, dated 21 February 2025.

0m 10 30 50m
Scale 1:1,000

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

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THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD
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Cross-Section H-H1 - Northeast Monofill

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	29-11-24	DRAFT FOR COMMENT	A.N	A.N	S.SW	
B	28-02-25	UPDATE FINAL FILL	L.S	A.N	S.SW	

DRAWING NO.: FIG. M4.5
REF: 4424
SCALE: 1:1000
CRS: Mt Eden 2000
DATUM: AVD46

Preliminary Geotechnical Assessment

Green Steel Monofill, Hampton Downs

Appendix A

Project Development Drawings

- PD1 (Rev B, 15-04-24) Site Location Plan
- PD2 (Rev E, 19-02-25) Site Plan with Existing Contours
- PD3 (Rev D, 20-05-25) Site Plan
- PD4 (Rev A, 04-12-24) Aerial View
- PD5.1 (Rev C, 30-04-25) Long-Section A-A (3 pages)
- PD5.2 (Rev C, 05-02-25) Cross-Section B-B and C-C

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61 HAMPTON DOWNS ROAD

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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. PD1

REF: 4392

SCALE: 1:15000

CRS: NZTM

DATUM: Moturiki 1953

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

0m 50 100 150 200 250m

Scale 1:5000

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61 HAMPTON DOWNS ROAD

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Site Plan with Existing Contours

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	19-02-25	UPDATE PLATFORMS	L.S	A.N	S.SW	
D	02-05-25	FOR REPORT R4392-3	L.S	A.N	S.SW	
E	20-05-25	UPDATE PLATFORMS	L.S	A.N	S.SW	

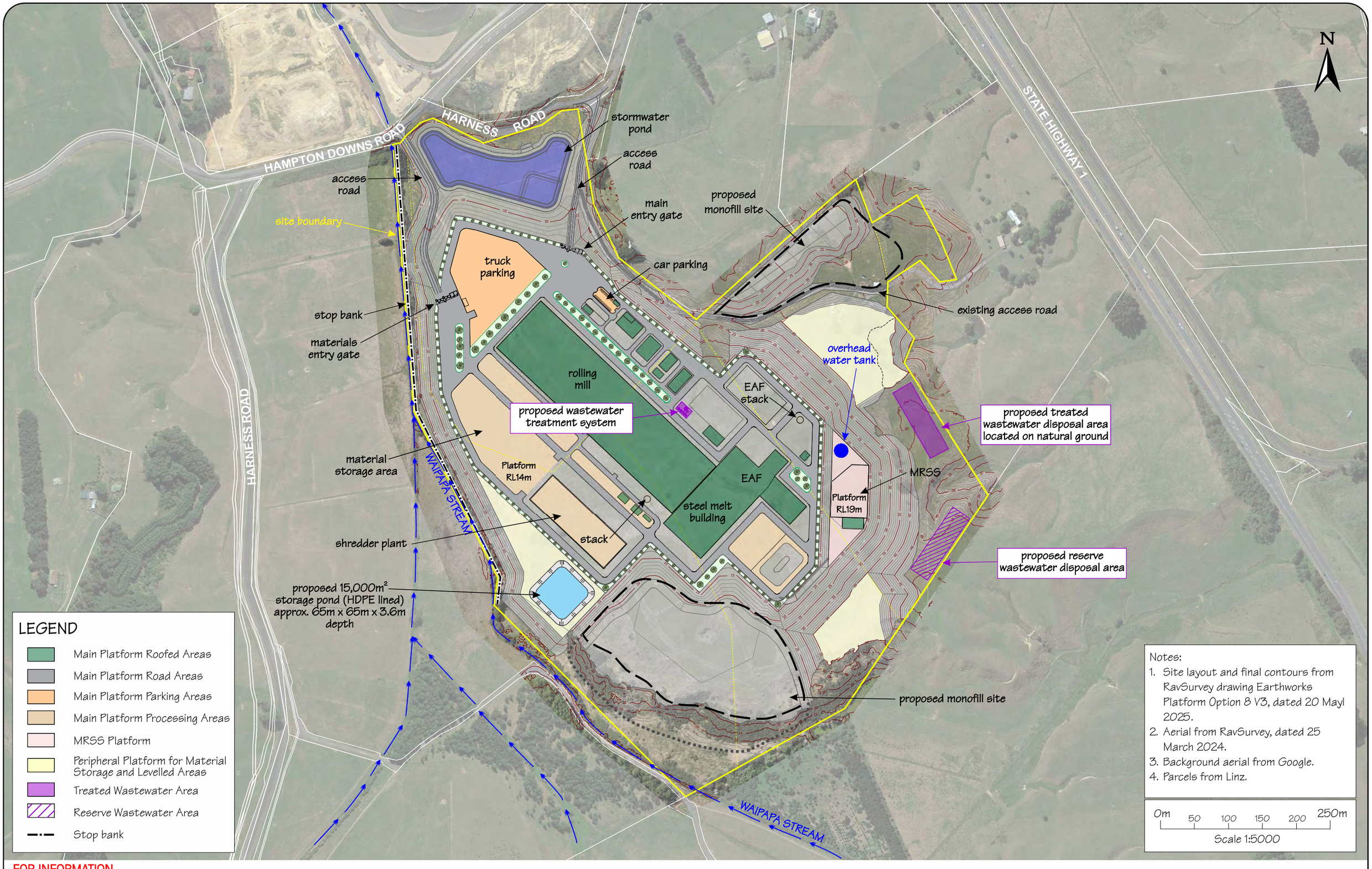
DRAWING NO.: FIG. PD2

REF: 4392

SCALE: 1:5000

CRS: NZTM

DATUM: Moturiki 1953



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Site Plan

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	05-12-24	DRAFT FOR DISCUSSION	L.S	A.N	S.SW	
B	18-02-25	UPDATE PLATFORMS AND CONTOURS	L.S	A.N	S.SW	
C	16-04-25	UPDATE STORMWATER POND	L.S	A.N	S.SW	
D	20-05-25	UPDATE WASTEWATER AREA	L.S	A.N	S.SW	

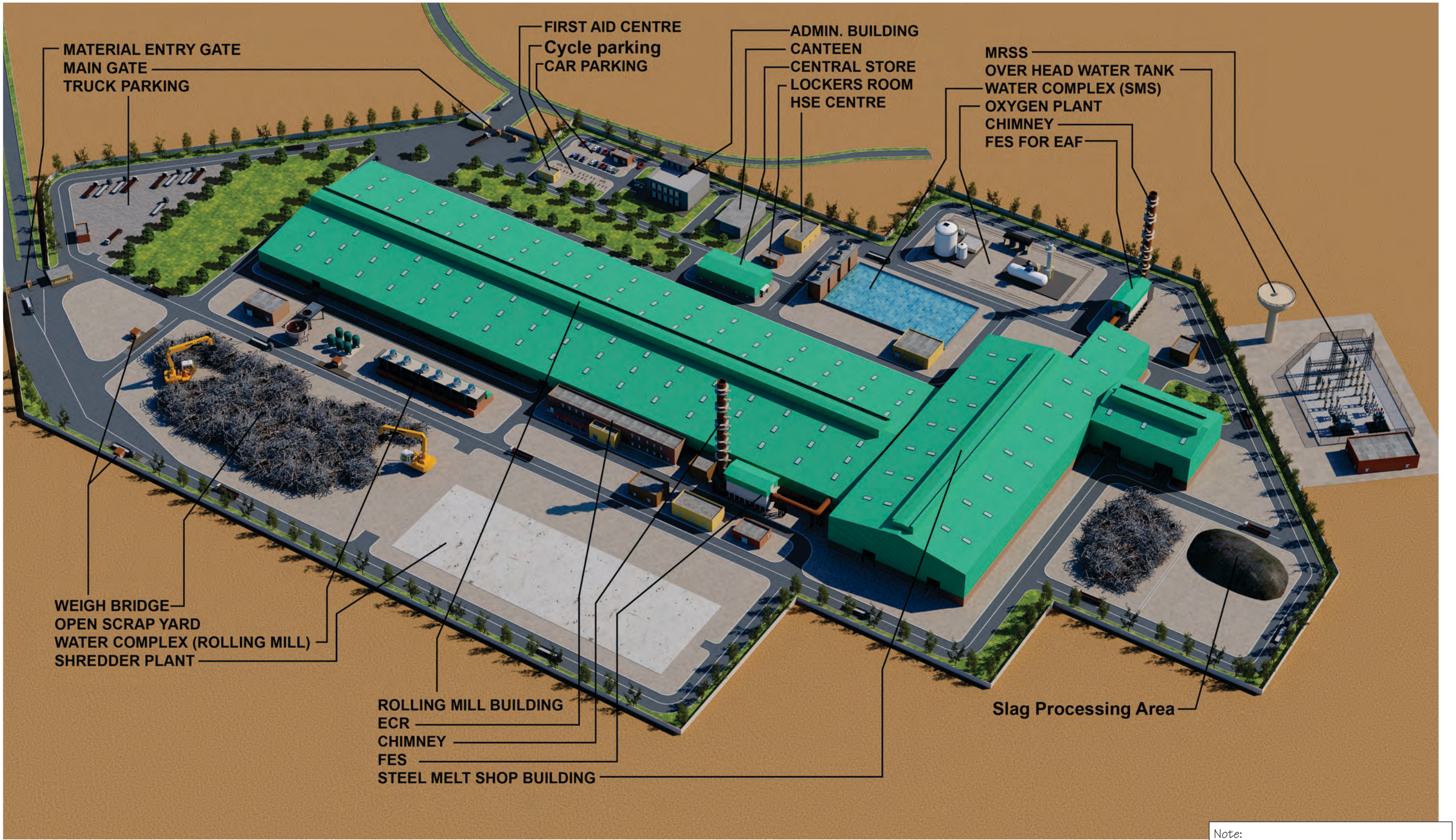
DRAWING NO.: FIG. PD3

REF: 4392

SCALE: 1:5000

CRS: Mt Eden 2000

DATUM: AVD46



Note:
1. Layout drawing received from R. Singh & Associates Pvt. Limited. Ref 2320-002sh1r7y24. Received 29 August 2024.

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Aerial View

REV	DATE	AMENDMENT/ISSUE	DRAWN BY	CHECKED	TRACED BY	APPROVED BY
A	04-12-24	DRAFT FOR DISCUSSION	L.S	A.N	S.SW	

DRAWING NO.: FIG. PD4

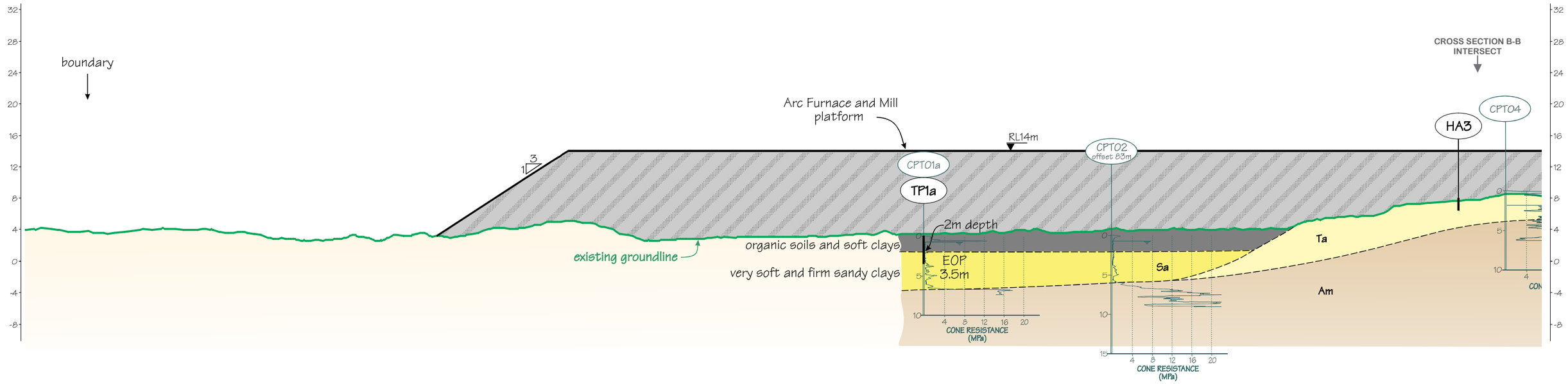
REF: 4392

SCALE: nts

CRS:

DATUM:

JOIN LINE



LEGEND

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

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

0m 10 20 30 40 50m

Scale 1:1000

FOR INFORMATION

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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	

DRAWING NO.: FIG. PD5.1/1

REF: 4392

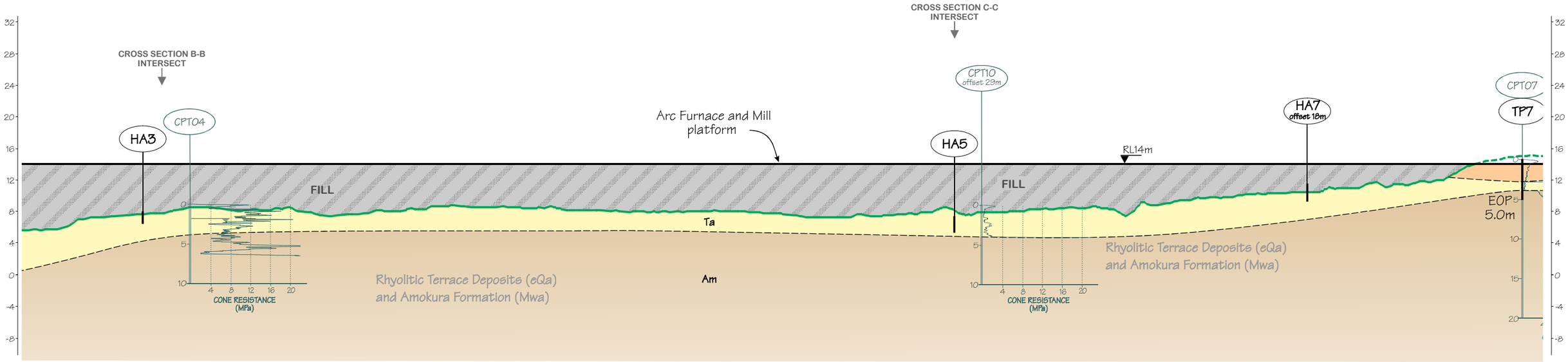
SCALE: 1:1000(h) 1:500(v)

CRS: Mt Eden 2000

DATUM: AVD46

JOIN LINE

JOIN LINE



LEGEND

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

Note:

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

0m 10 20 30 40 50m

Scale 1:1000

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61 HAMPTON DOWNS ROAD

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Long Section A-A - Page 2 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	

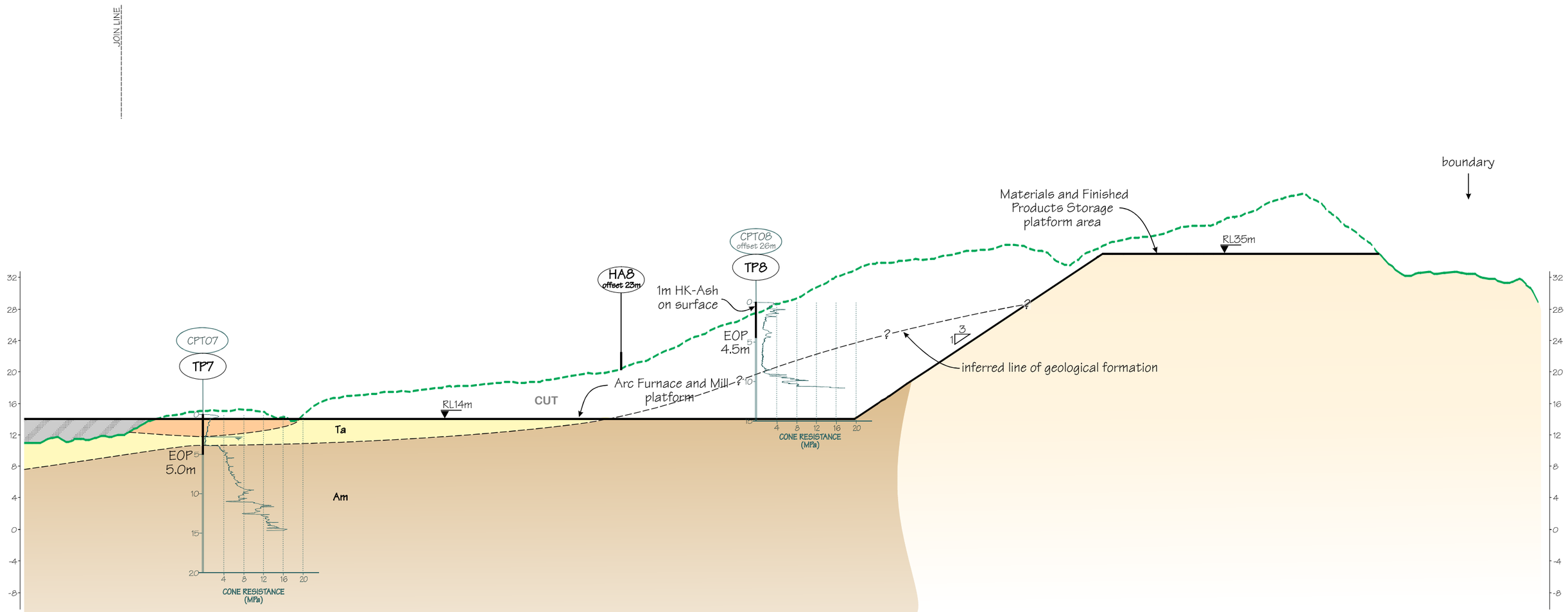
DRAWING NO.: FIG. PD5.1/2

REF: 4392

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

CRS: Mt Eden 2000

DATUM: AVD46



LEGEND

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

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

0m 10 20 30 40 50m
Scale 1:1000

FOR INFORMATION

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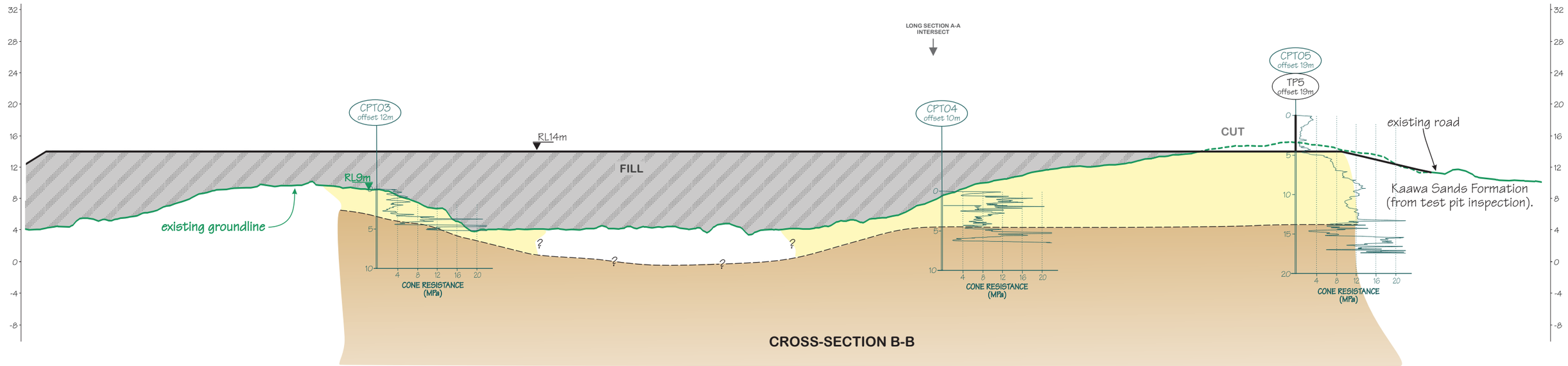
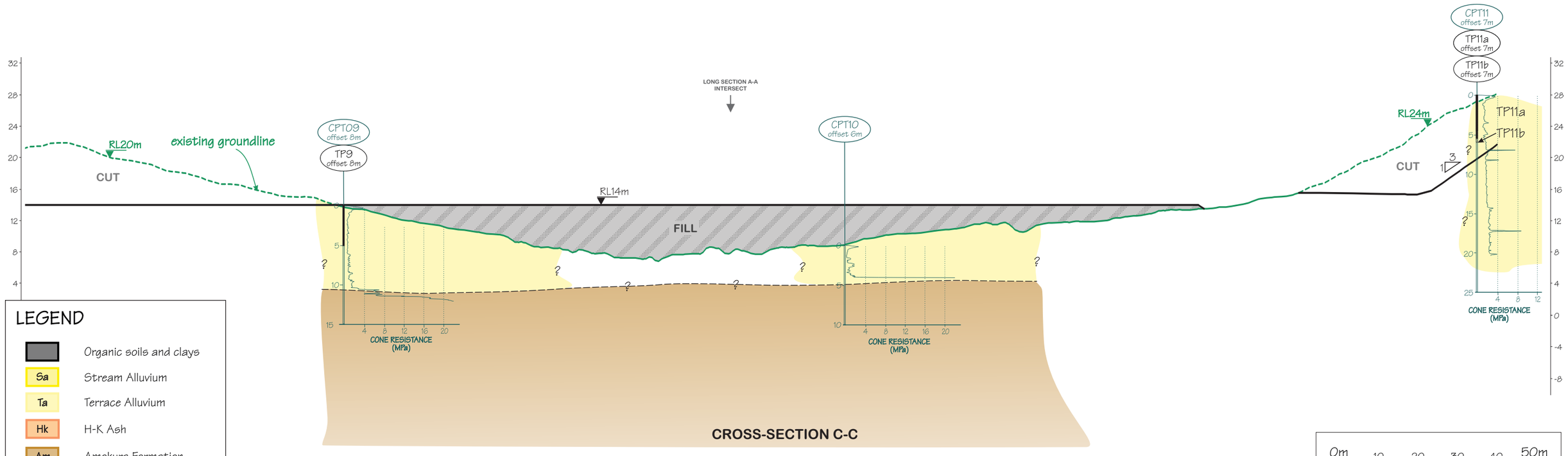
Long Section A-A - Page 3 of 3

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	

DRAWING NO.: FIG. PD5.1/3
REF: 4392
SCALE: 1:1000(h) 1:500(v)
CRS: Mt Eden 2000
DATUM: AVD46





LEGEND

	Organic soils and clays
Sa	Stream Alluvium
Ta	Terrace Alluvium
Hk	H-K Ash
Am	Amokura Formation

0m 10 20 30 40 50m

Scale 1:1000 (h)

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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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

Green Steel Monofill, Hampton Downs

Appendix B

Site Investigation Data

- B1) CPT's – CPT01a to CPT05, CPT07 to CPT11
- B2) Hand Augers and Scala Penetrometer – MF1 to MF7, SPMF1, SPMF2 and SPMF4
- 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

Green Steel Monofill, Hampton Downs

Appendix B1

CPT Data

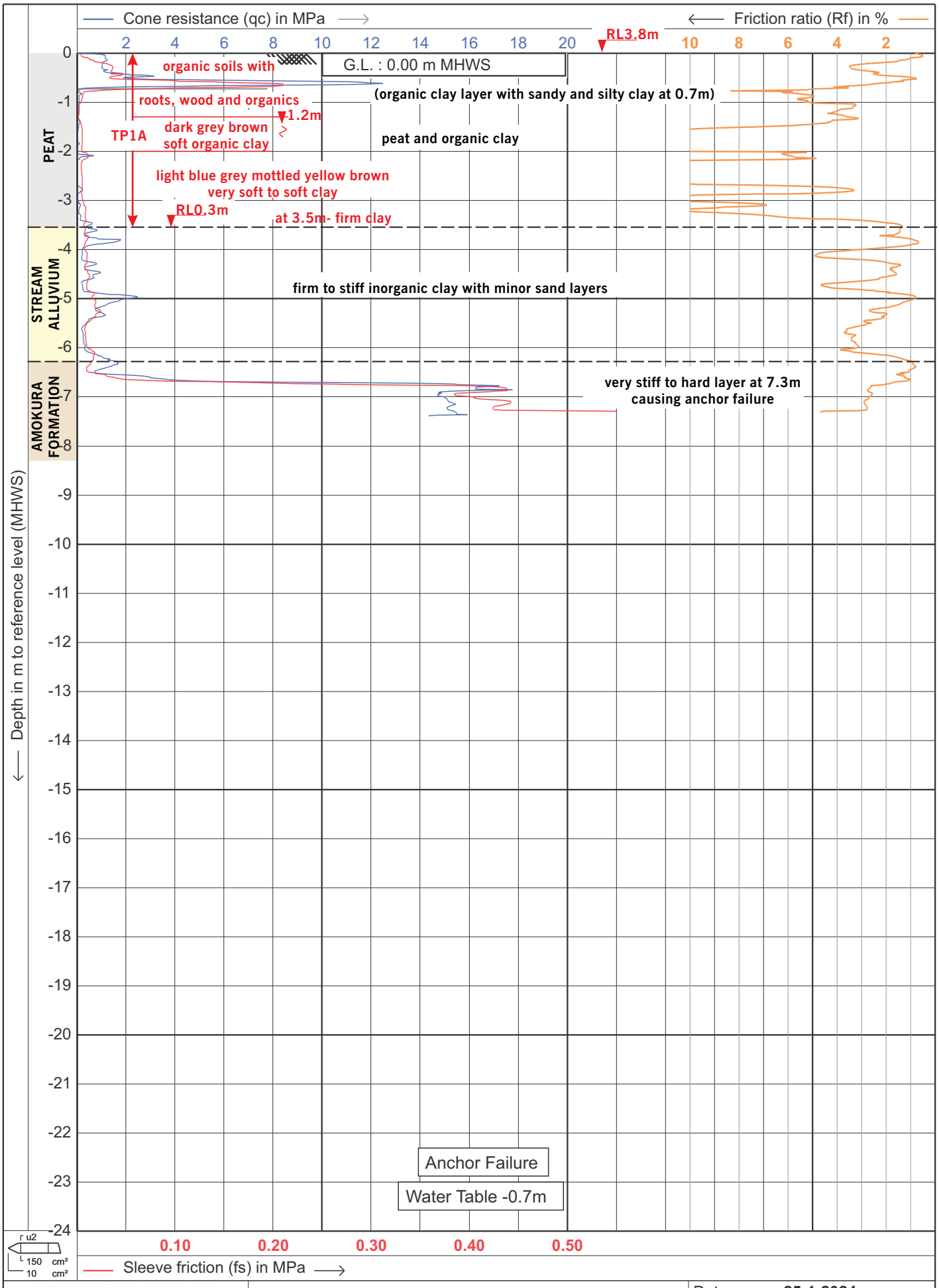
CPT01a to CPT05, CPT07 to CPT11

APPENDIX B1

CPT DATA - 2024 TESTING

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

NOTE: TEST PIT MARKUP IS SHOWN IN RED



GEO CIVIL
TEST RIGHT • BUILD RIGHT
NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Test performed in accordance with ASTM D5778-12

Project : **EARTHTECH**

Location: **Hampton Downs**

Position : **175.077455, -37.361146 WGS84**

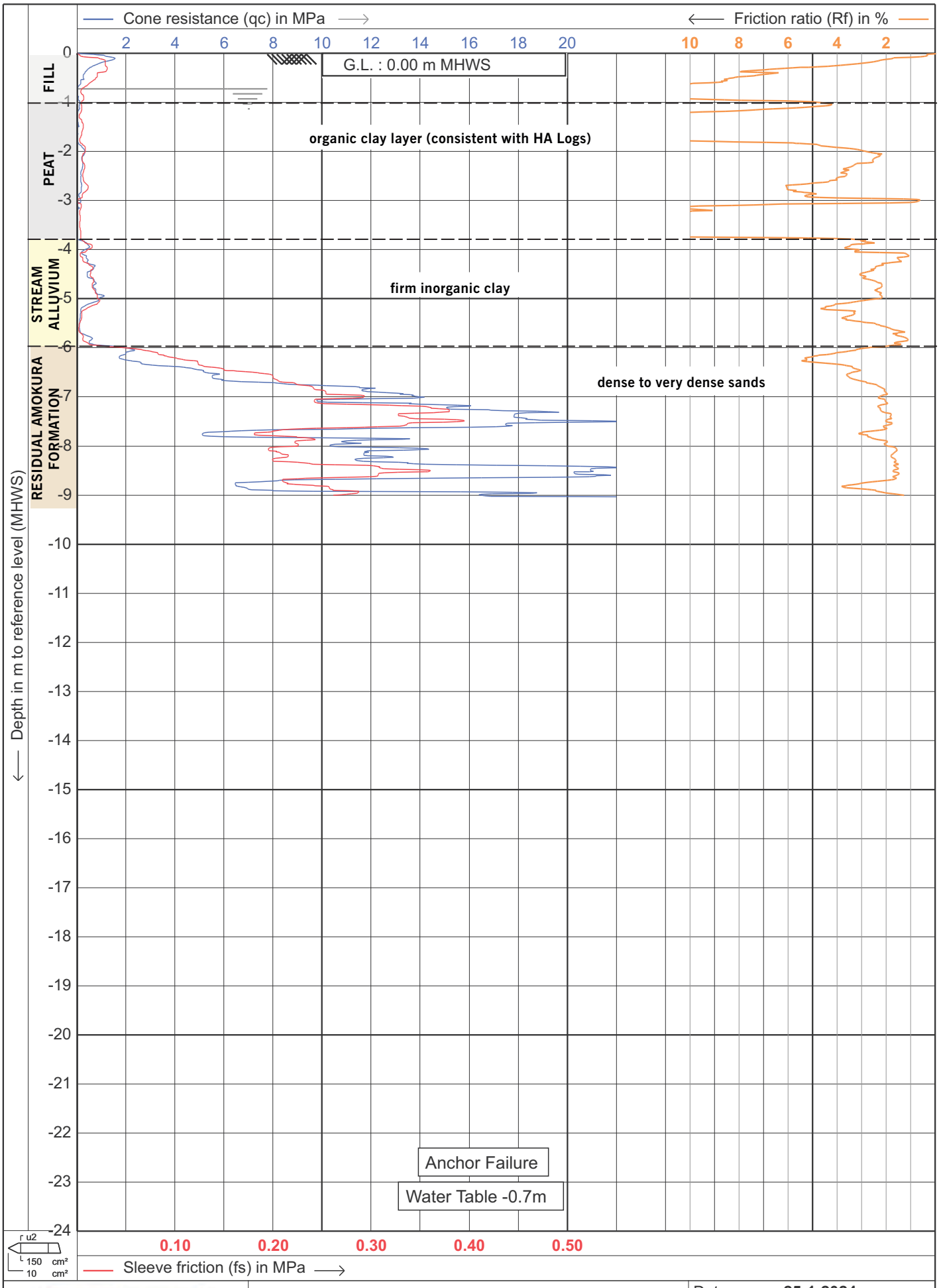
Date : **25-1-2024**

Cone no. : **C10CFIIP.C21103**

Project no. : **8736-010**

CPT no. : **CPT01a** 1/4

1.40



GEO CIVIL
TEST RIGHT • BUILD RIGHT
NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Test performed in accordance with ASTM D5778-12

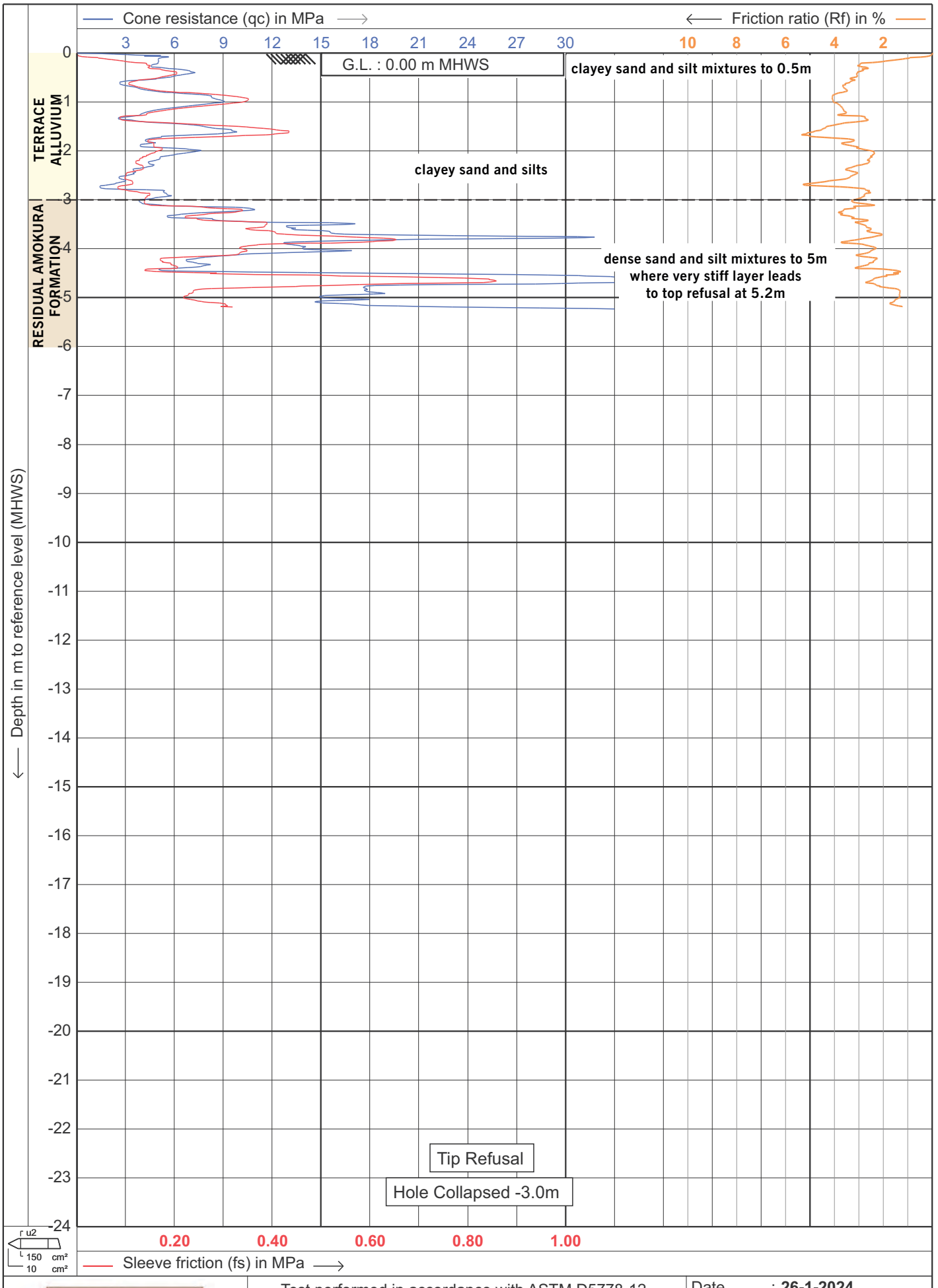
Project : **EARTHTECH**

Location: **Hampton Downs**

Position : **175.077173, -37.361991 WGS84**

Date	: **25-1-2024**
Cone no.	: **C10CFIIP.C21098**
Project no.	: **8736-010**
CPT no.	: **CPT02** 1/4

1.40



GEO CIVIL
TEST RIGHT • BUILD RIGHT
NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Test performed in accordance with ASTM D5778-12

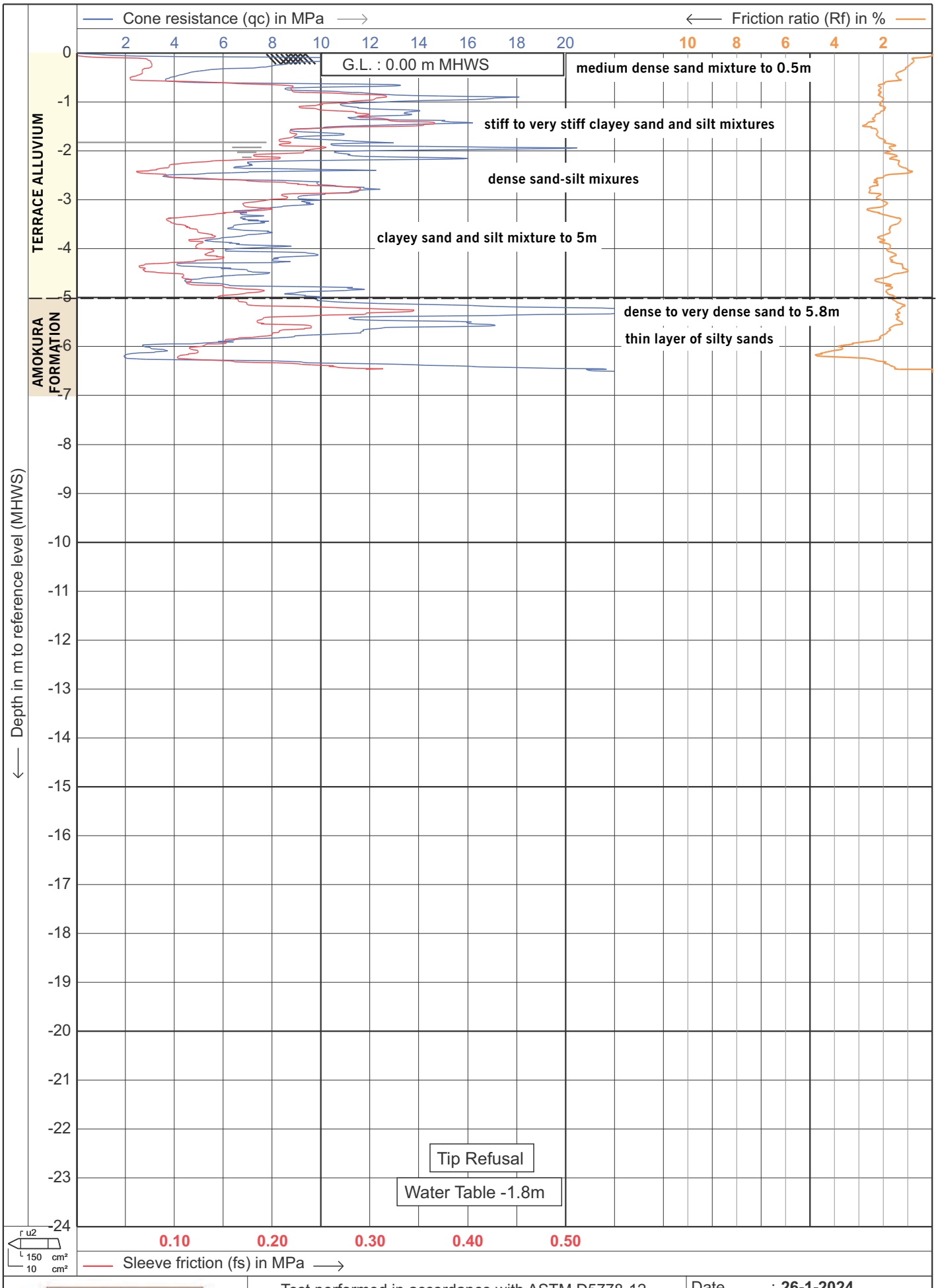
Project : **EARTHTECH**

Location: **Hampton Downs**

Position : **175.077545, -37.36303 WGS84**

Date	: **26-1-2024**
Cone no.	: **C10CFIIP.C21103**
Project no.	: **8736-010**
CPT no.	: **CPT03** 1/4

1.40

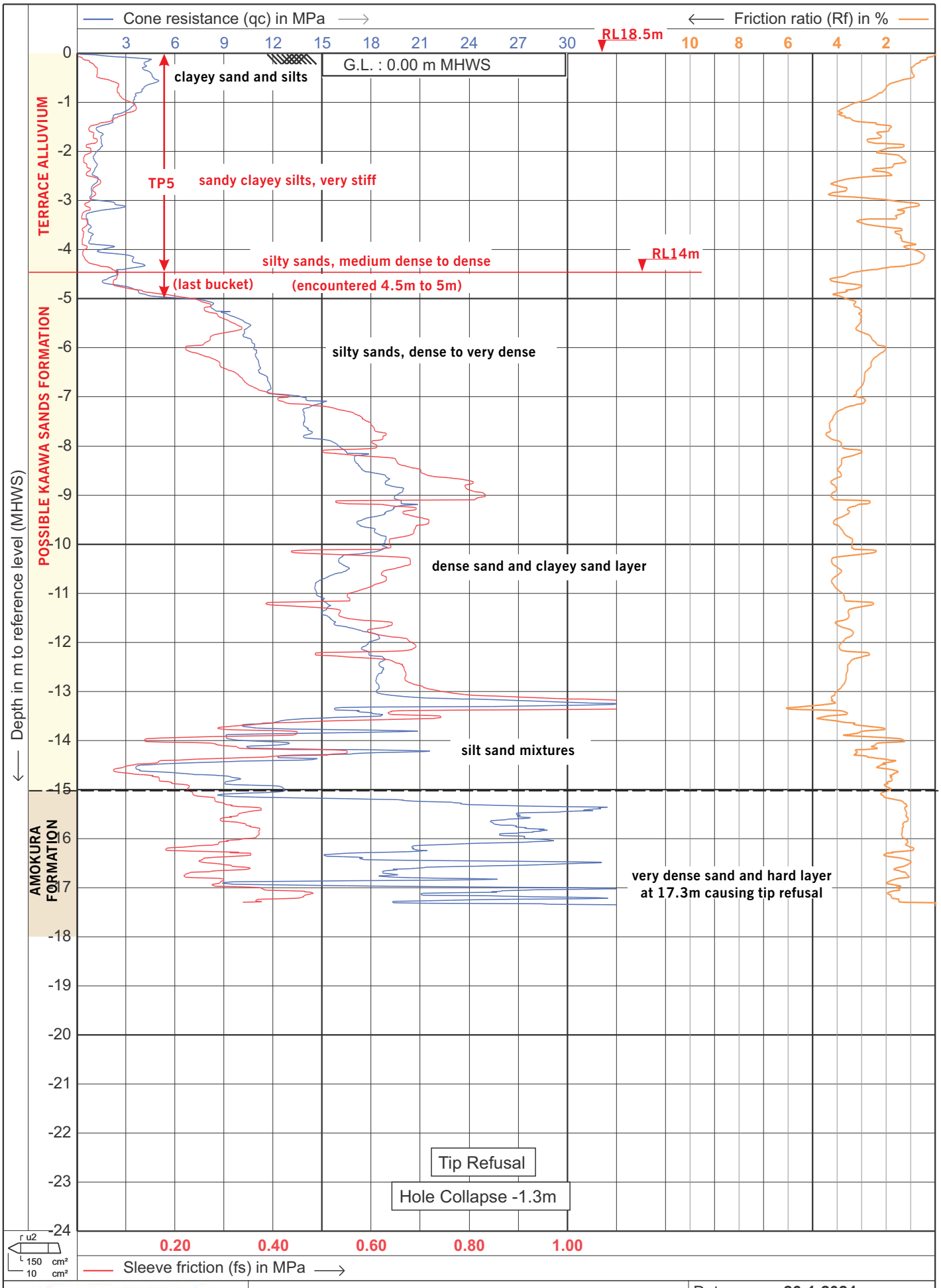


Test performed in accordance with ASTM D5778-12	
Project : **EARTHTECH**	Date : **26-1-2024**
Location: **Hampton Downs**	Cone no. : **C10CFIIP.C21103**
Position : **175.078641, -37.36208 WGS84**	Project no. : **8736-010**
	CPT no. : **CPT04** 1/4

GEO CIVIL
TEST RIGHT • BUILD RIGHT
NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

1.40

NOTE: TEST PIT MARKUP IS SHOWN IN RED



GEO CIVIL
TEST RIGHT • BUILD RIGHT
NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Test performed in accordance with ASTM D5778-12

Project : **EARTHTECH**

Location: **Hampton Downs**

Position : **175.079422, -37.36153 WGS84**

Date : **26-1-2024**

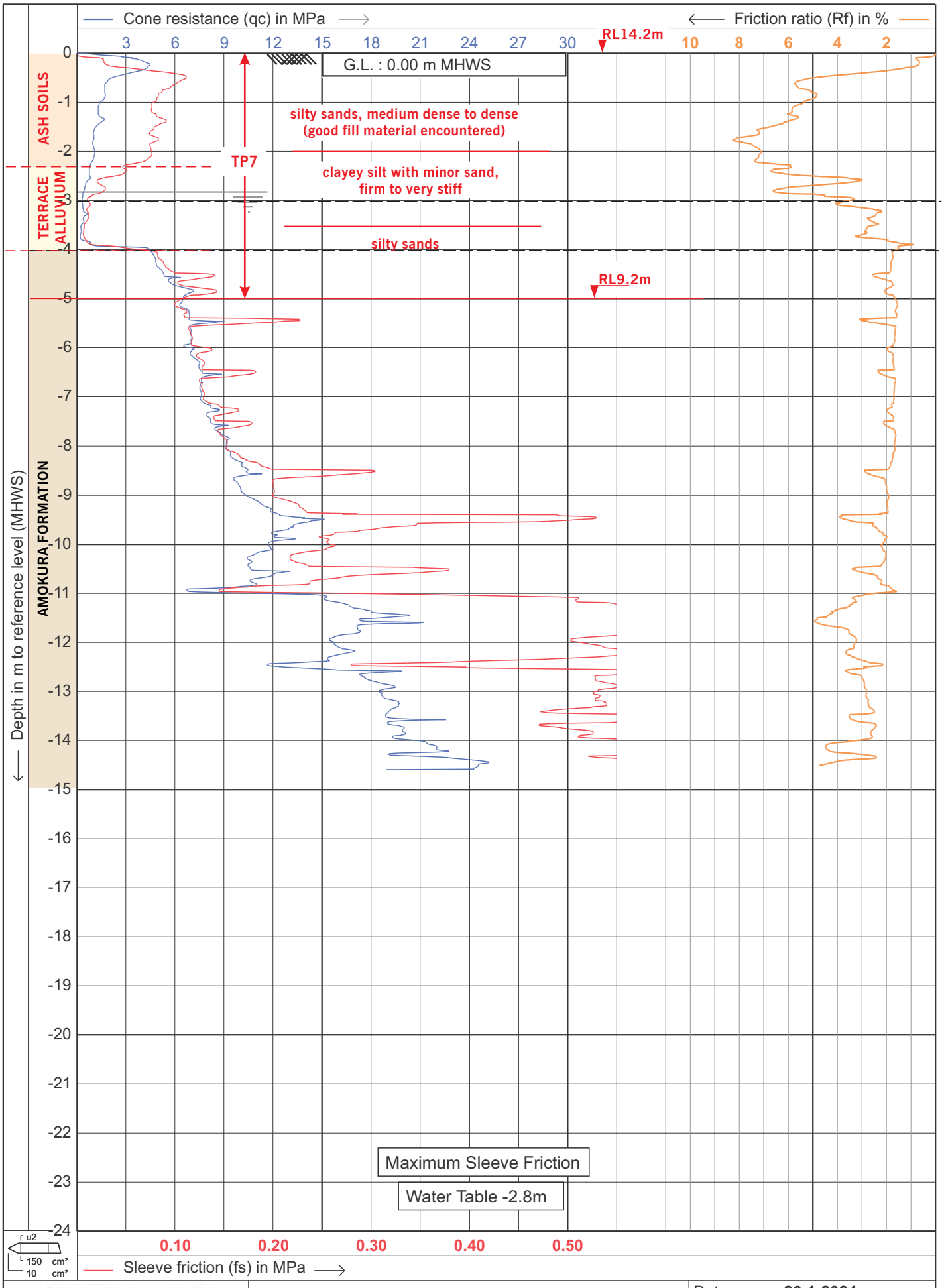
Cone no. : **C10CFIIP.C21103**

Project no. : **8736-010**

CPT no. : **CPT05** 1/4

1.40

NOTE: TEST PIT MARKUP IS SHOWN IN RED



Test performed in accordance with ASTM D5778-12

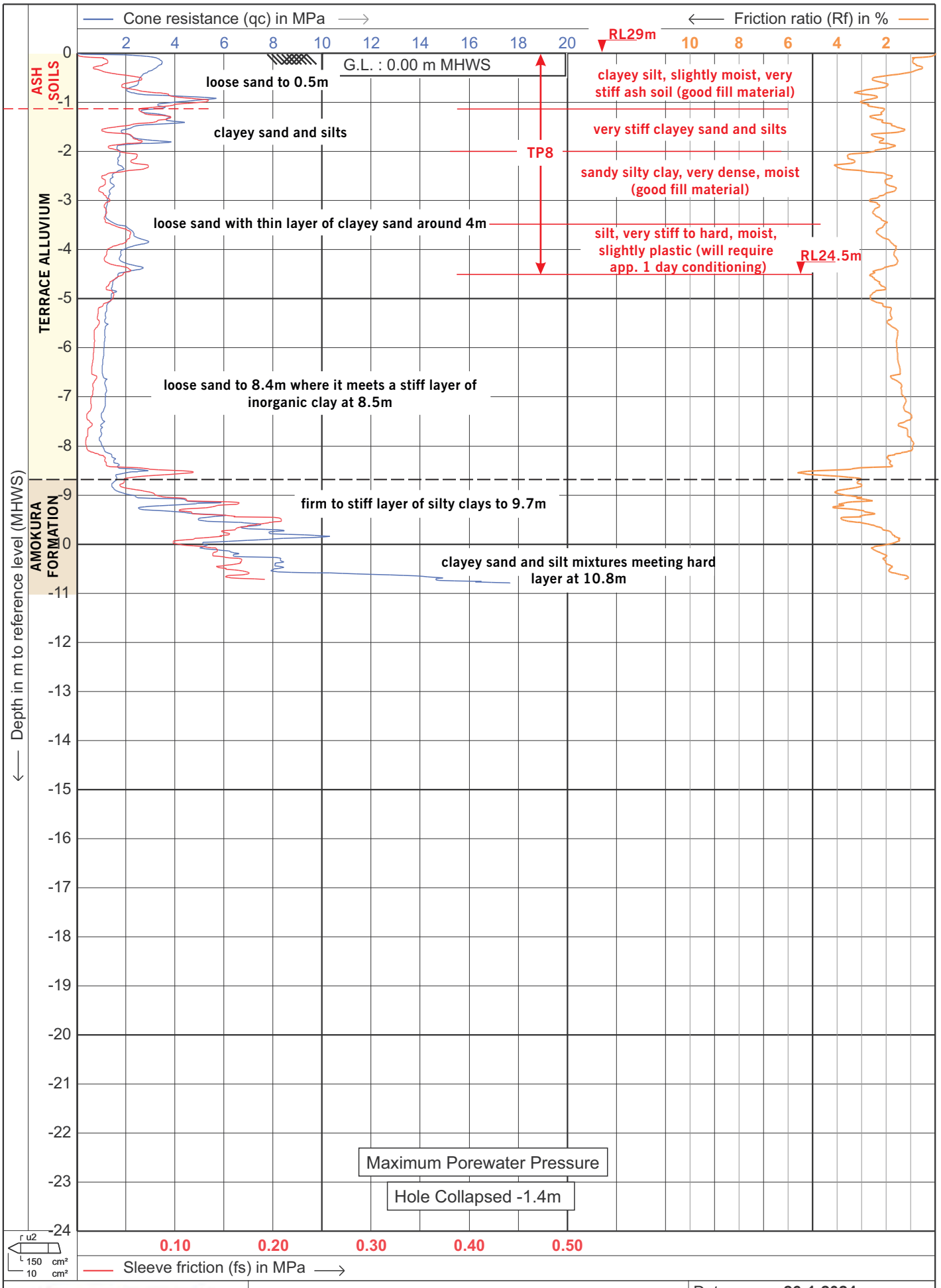
GEO CIVIL
TEST RIGHT • BUILD RIGHT
NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Project : **EARTHTECH**
Location: **Hampton Downs**
Position : **175.081408, -37.364168 WGS84**

Date : **26-1-2024**
Cone no. : **C10CFIIP.C21103**
Project no. : **8736-010**
CPT no. : **CPT07** 1/4

1.40

NOTE: TEST PIT MARKUP IS SHOWN IN RED



GEO CIVIL
TEST RIGHT • BUILD RIGHT
NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Test performed in accordance with ASTM D5778-12

Project : **EARTHTECH**

Location: **Hampton Downs**

Position : **175.08231, -37.365241 WGS84**

Date : **26-1-2024**

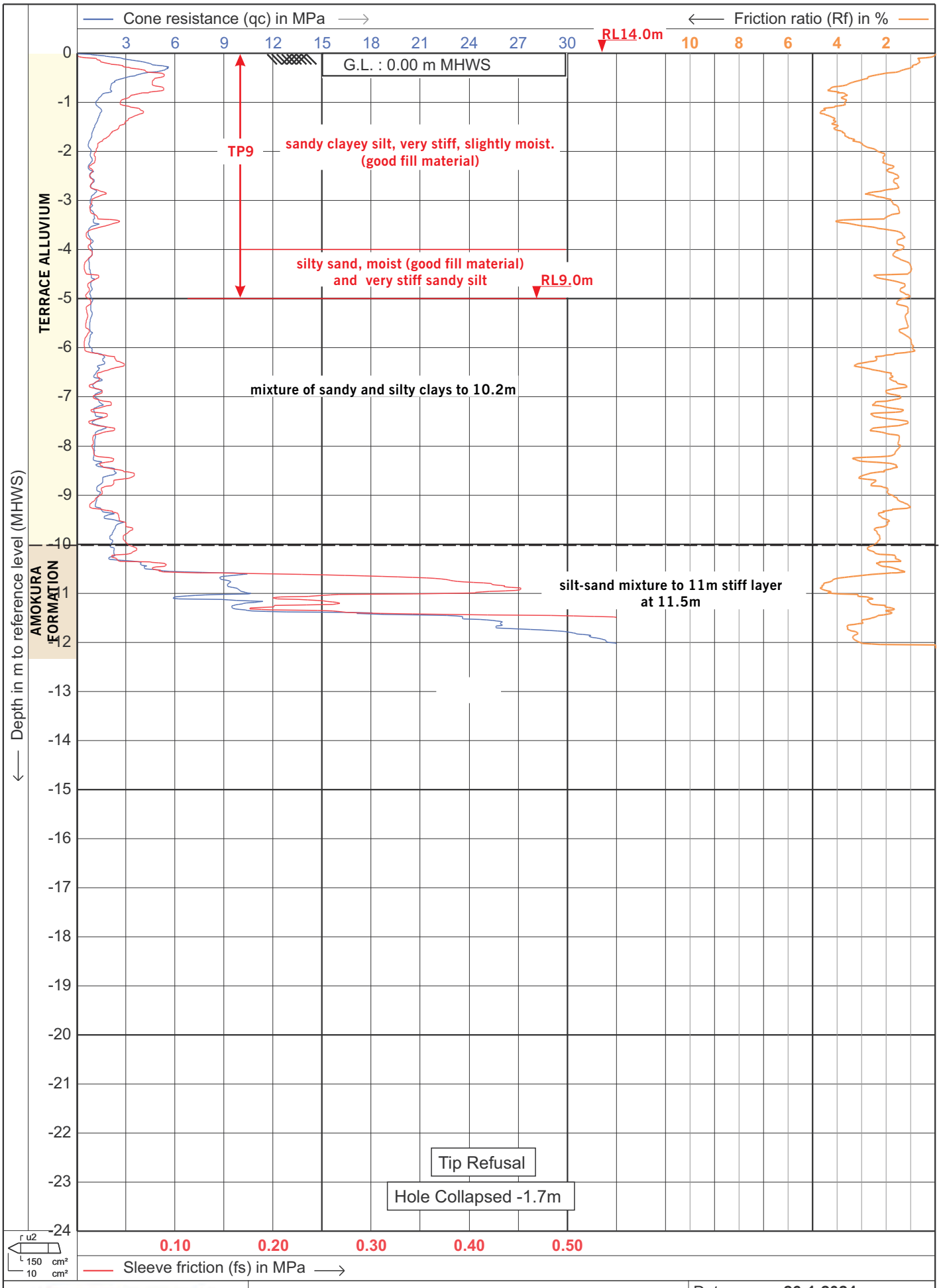
Cone no. : **C10CFIIP.C21103**

Project no. : **8736-010**

CPT no. : **CPT08** 1/4

1.40

NOTE: TEST PIT MARKUP IS SHOWN IN RED



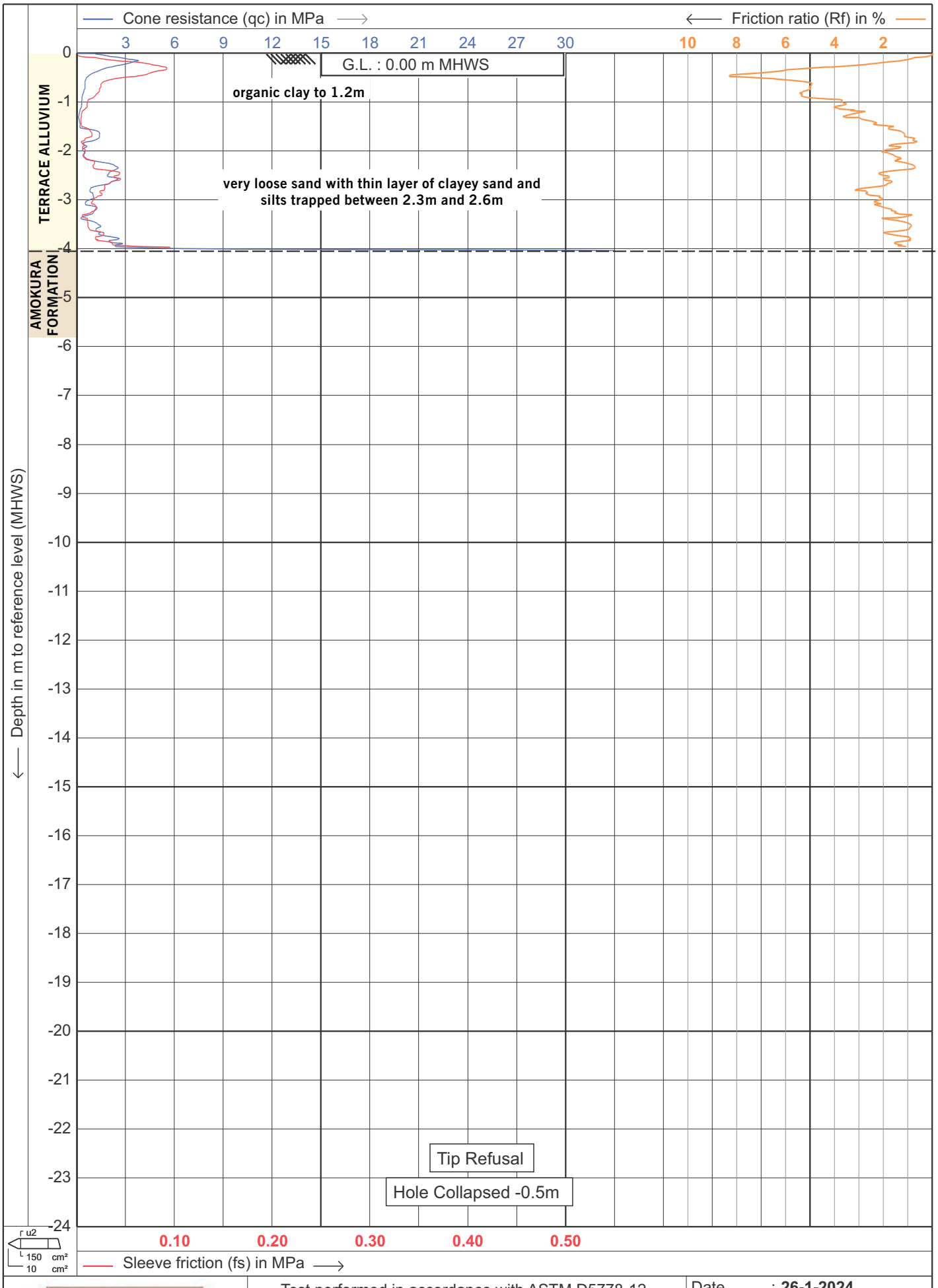
Test performed in accordance with ASTM D5778-12

GEO CIVIL
TEST RIGHT • BUILD RIGHT
NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Project : **EARTHTECH**
Location: **Hampton Downs**
Position : **175.079505, -37.363997 WGS84**

Date : **26-1-2024**
Cone no. : **C10CFIIP.C21103**
Project no. : **8736-010**
CPT no. : **CPT09** 1/4

1.40



GEO CIVIL
TEST RIGHT • BUILD RIGHT
NORTHLAND - WELLINGTON - CANTERBURY - OTAGO

Test performed in accordance with ASTM D5778-12

Project : **EARTHTECH**

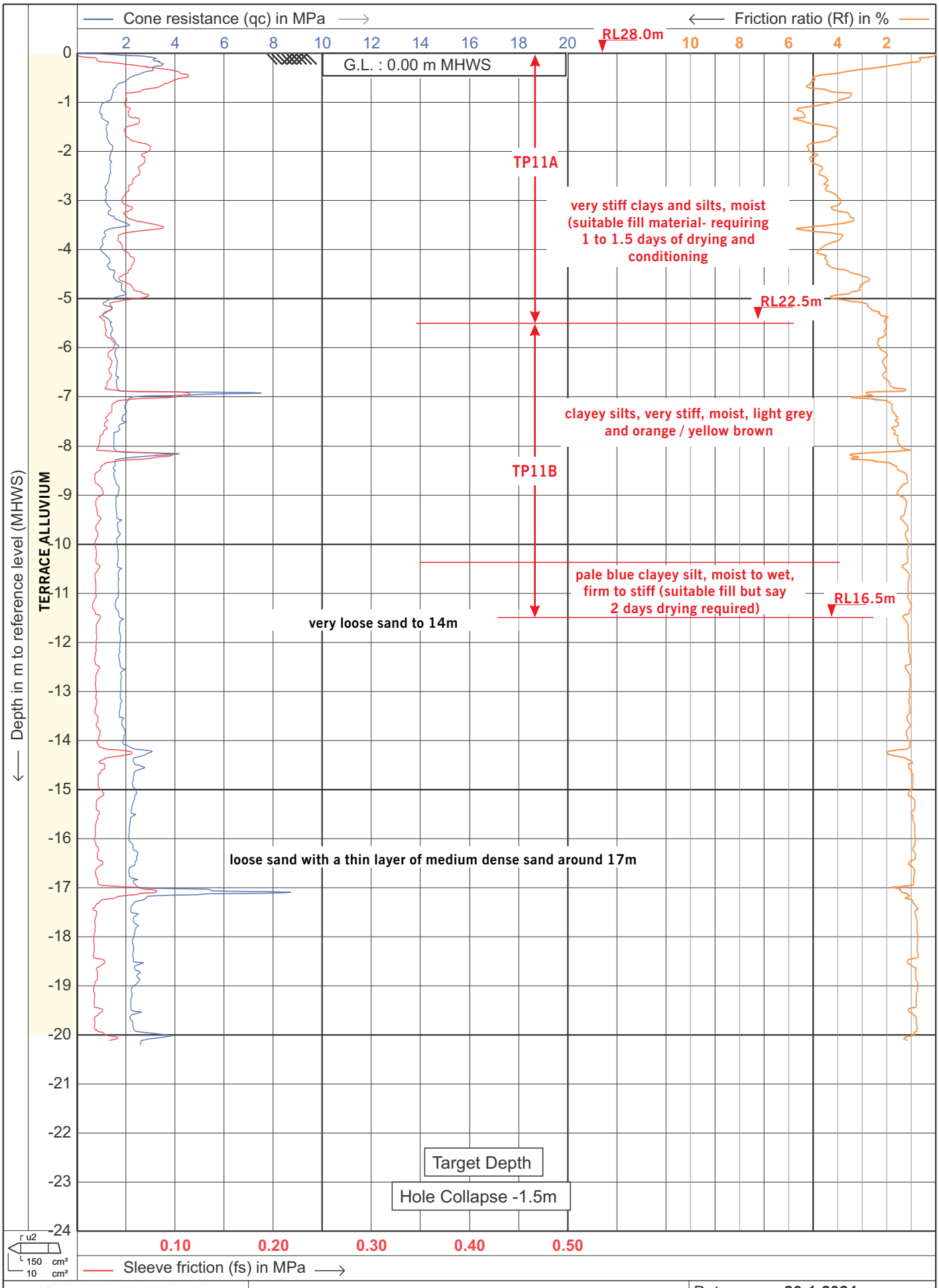
Location: **Hampton Downs**

Position : **175.080474, -37.363137 WGS84**

Date	: **26-1-2024**
Cone no.	: **C10CFIIP.C21103**
Project no.	: **8736-010**
CPT no.	: **CPT10** 1/4

1.40

NOTE: TEST PIT MARKUP IS SHOWN IN RED



GEO CIVIL
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

1.40

Preliminary Geotechnical Assessment

Green Steel Monofill, Hampton Downs

Appendix B2

Hand Auger Data

MF1 to MF7

Scala Penetrometer Data

SPMF1, SPMF2 and SPMF4

HAND AUGER LOG

EARTHTECH

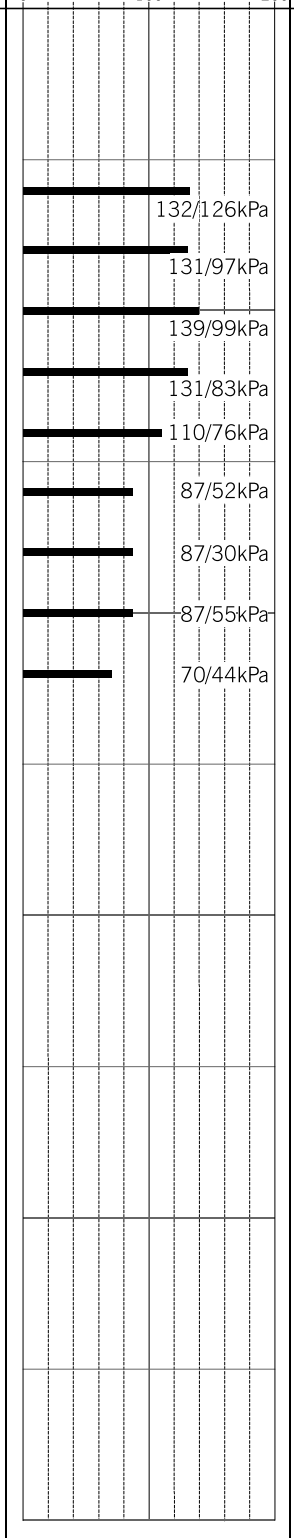
Bore No.:	MF1
Project No.:	4424
Sheet:	1 of 1

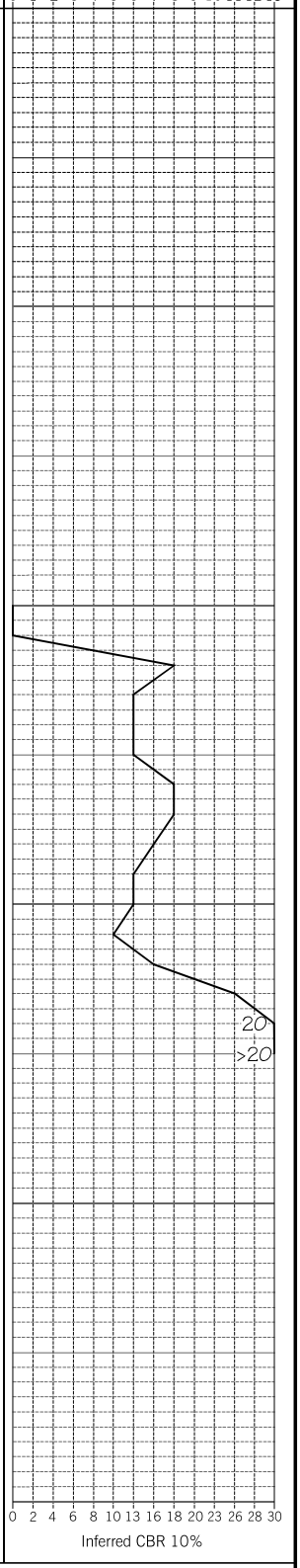
Client:	National Green Steel	Coordinates:	
Project:	Geotechnical Investigations - Southern Monofill	CRS:	
Location:	61 Hampton Downs Road	Elevation:	RL 5.5m (approx.)
Test Location:		Located by:	GIS/Web Map

Test Date:	22/11/2024
Logged by:	LS/CF
Prepared by:	CF
Checked by:	LS

Depth (m)	Geology	Soil Symbol	Soil Description
0.0	TOP SOIL		TOPSOIL, organic mixed soil with rootlets; dark brown.
0.5	ALLUVIUM		Silty CLAY, with organics, rootlets, some sand grains, and fine gravel particles; reddish brown with orange brown mottling. Stiff; moist; plastic.
1.0			Silty CLAY, with some fine gravel and coarse sand grains; yellow brown with dark orange and blue grey striations/streaks. Very stiff; moist; highly plastic.
1.5			Clayey SILT, with some sand; blue grey with orange staining. Very stiff; moist to wet; highly plastic. 1.4m: saturated
2.0			Sandy SILT; blue grey with orange and yellow staining. Stiff; saturated; highly plastic.
2.5			Sandy SILT; yellow brown with blue grey mottling. Stiff; saturated; highly plastic.
3.0			
3.5			
4.0			
4.5			
5.0			

Water Level





Hole Depth: 2.2m

Termination: Target depth reached

Remarks: Groundwater encountered at 1.4m.
Hard material encountered at a depth of 3.5m (RL 2m).

Shear vane ID: Shear vane 3
serial No. 3922

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

HAND AUGER LOG

EARTHTECH

Bore No.: MF2
Project No.: 4424
Sheet: 1 of 1

Client: National Green Steel
Project: Geotechnical Investigations - Southern Monofill
Location: 61 Hampton Downs Road
Test Location:

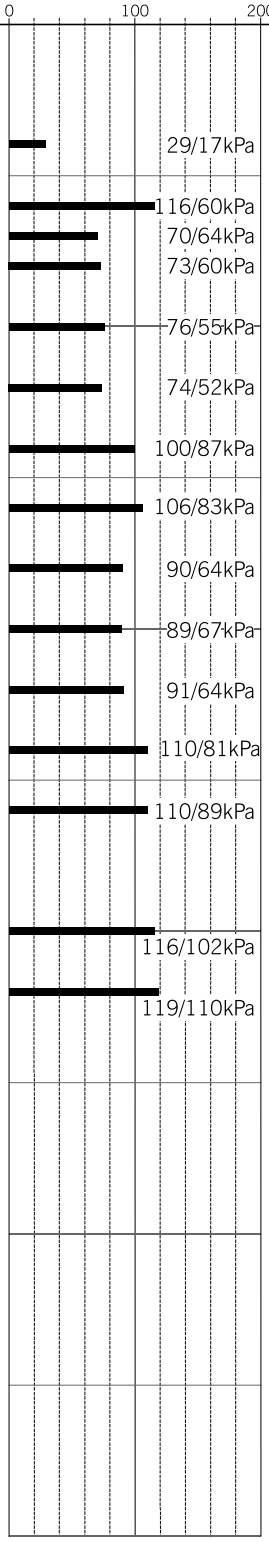
Coordinates:
CRS:
Elevation: RL 6.0m (approx.)
Located by: GIS/Web Map

Test Date: 22/11/2024
Logged by: LS/CF
Prepared by: CF
Checked by: LS

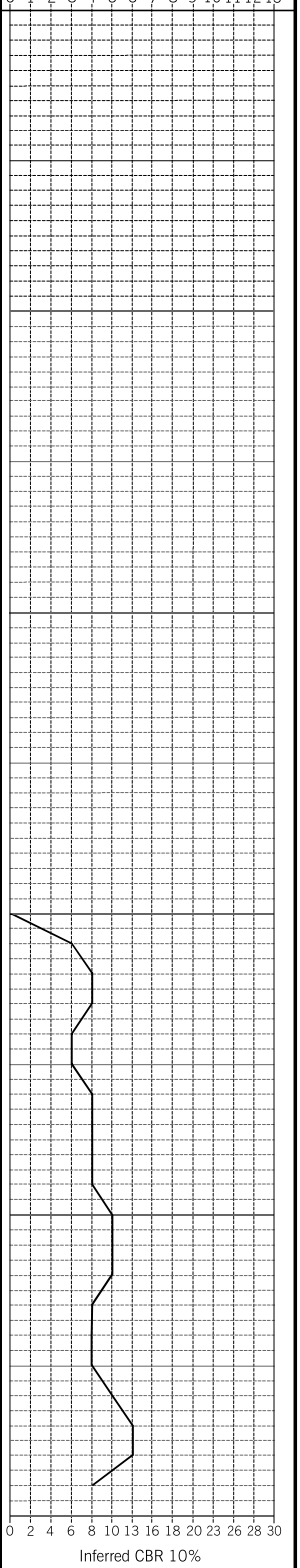
Depth (m)	Geology	Soil Symbol	Soil Description
0.0	TOP SOIL		TOPSOIL, organic mixed soil with rootlets; dark blacky brown. Soft.
0.5	ALLUVIUM		CLAY, with minor silt and some fine to medium sand grains; blue grey and yellow brown staining and occasional orange blotches. Soft to firm; moist; highly plastic. 0.6m: 150mm thin hard reddish brown layer.
1.0			
1.5			Silty CLAY, with some fine to medium sand grains; blue grey and yellow brown. Stiff; moist; highly plastic. 2.0m: wet.
2.0			
2.5			Silty CLAY; blue grey with yellow brown mottling. Very stiff; wet to saturated; highly plastic.
3.0			
3.5			
4.0			
4.5			
5.0			

Water Level

Undrained Shear Strength (kPa)



Scala Penetrometer



Hole Depth: 3.2m
Termination: Target depth reached

Remarks: Groundwater encountered at 3.0m.

Shear vane ID: Shear vane 3 serial No. 3922

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

HAND AUGER LOG

EARTHTECH

Bore No.: MF3
Project No.: 4424
Sheet: 1 of 1

Client: National Green Steel
Project: Geotechnical Investigations - Southern Monofill
Location: 61 Hampton Downs Road
Test Location:

Coordinates:
CRS:
Elevation: RL 8m (approx.)
Located by: GIS/Web Map

Test Date: 26/11/2024
Logged by: LS/CF
Prepared by: CF
Checked by: LS

Depth (m)	Geology	Soil Symbol	Soil Description	Water Level	Undrained Shear Strength (kPa)	Scala Penetrometer Blows/100mm
0.0	TOP SOIL		TOPSOIL, organic mixed soil with rootlets; dark blacky brown.			
	ALLUVIUM		Silty CLAY; yellow brown and light grey mottling. Very stiff; moist; plastic.		157/46kPa	
0.5					136/38kPa	
	VOLCANIC ASH SOILS		Silty CLAY, with some fine gravels and sand grains; yellow-orange brown with orange and mottled light grey, and with some black specks. Very stiff to hard; moist; highly plastic.		>203kPa	
1.0					>203kPa	
					>203kPa	
1.5					>203kPa	
					192/113kPa	
			1.8m: moist to wet. (slightly paler in appearance).		>203kPa	
2.0					183/78kPa	
					148/73kPa	
					>203kPa	
2.5	OLD ALLUVIUM		Sandy silty CLAY, with much gravel particles, sand grains and rootlets; yellow brown mottled orange. Very stiff to hard; moist to wet; highly plastic.		151/70kPa	
					>203kPa	
			Silty CLAY, with gravel (>10mm) and some sand grains; yellow brown with orange and dark brown mottling. Very stiff; moist to wet; highly plastic. (possible volcanic ash)		192/84kPa	
					>203kPa	
3.0			Clayey SILT, with gravel (>5mm), sand grains and some rootlets; yellow brown mottled dark orange. Very stiff; wet; highly plastic.		136/55kPa	
					110/52kPa	
3.5					110/52kPa	
4.0						
4.5						
5.0						

Inferred CBR 10%

Hole Depth: 3.2m
Termination: Target depth reached

Remarks: Groundwater not encountered.

Shear vane ID: Shear vane 3
serial No. 3922

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

HAND AUGER LOG

EARTHTECH

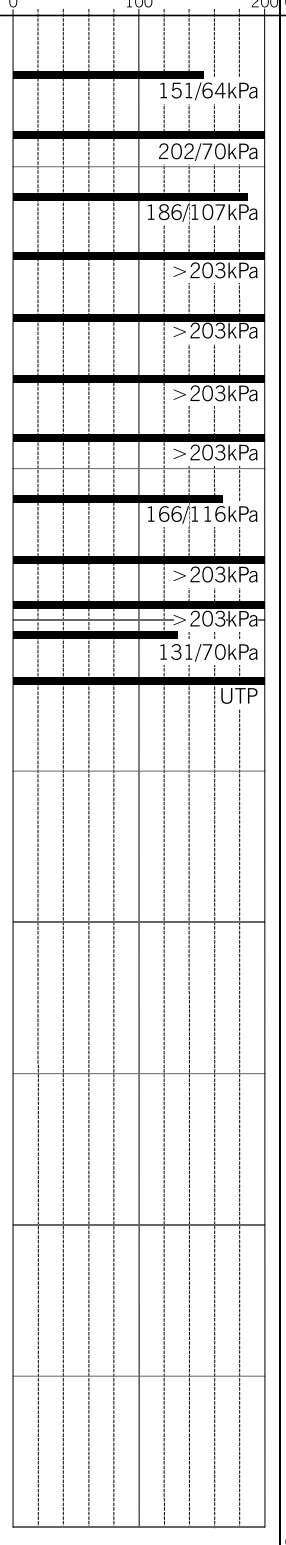
Bore No.: MF4
Project No.: 4424
Sheet: 1 of 1

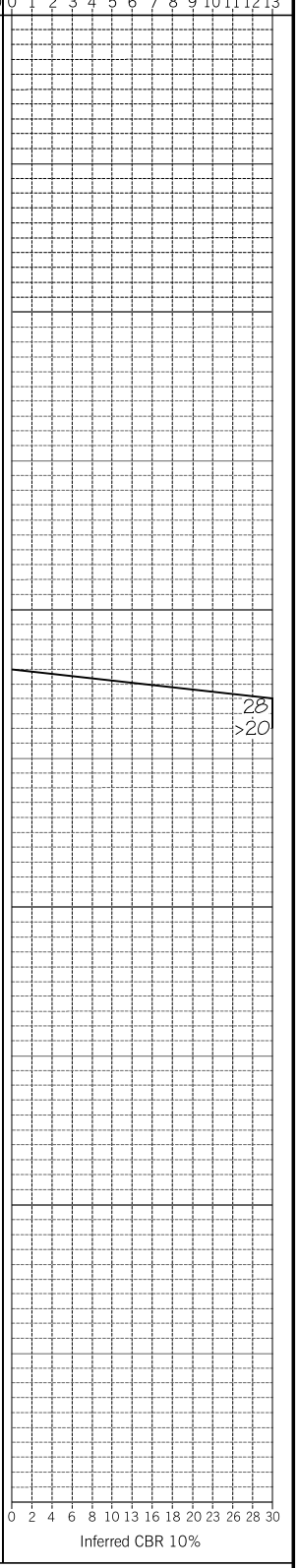
Client: National Green Steel
Project: Geotechnical Investigations - Southern Monofill
Location: 61 Hampton Downs Road
Test Location:

Coordinates:
CRS:
Elevation: RL 12m (approx.)
Located by: GIS/Web Map

Test Date: 26/11/2024
Logged by: LS/CF
Prepared by: CF
Checked by: LS

Depth (m)	Geology	Soil Symbol	Soil Description	Water Level
0.0	TOP SOIL		TOPSOIL, with silts and rootlets; dark brown.	
0.5	ALLUVIUM		Silty CLAY, with gravel particles and some sand grains; yellow brown and light grey mottled dark orange. Very stiff to hard; moist; plastic.	
1.0				
1.5	VOLCANIC ASH SOILS		Silty CLAY, with gravel particles (up to 2mm) and sand specks; yellow brown with beige orange brown mottling. Very stiff to hard; moist; highly plastic.	
2.0	ALLUVIUM		Clayey SILT lense, (100mm thick); yellow brown mottling. Very stiff; wet; highly plastic.	
2.5	AMOKURA SANDSTONE		Fine silty SAND; yellow orange brown with orange blotches/ staining. Very dense; moist; non plastic.	
3.0				
3.5				
4.0				
4.5				
5.0				





Hole Depth: 2.2m
Termination: Refusal

Remarks: Groundwater not encountered.

Shear vane ID: Shear vane 3
serial No. 3922

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

HAND AUGER LOG

EARTHTECH

Bore No.: MF5
Project No.: 4424
Sheet: 1 of 1

Client: National Green Steel
Project: Geotechnical Investigations - Eastern Monofill
Location: 61 Hampton Downs Road
Test Location: Alongside CPT 11

Coordinates:
CRS:
Elevation:
Located by: GIS/Web Map

Test Date: 26/11/2024
Logged by: LS/CF
Prepared by: CF
Checked by: LS

Depth (m)	Geology	Soil Symbol	Soil Description	Undrained Shear Strength (kPa)	Scala Penetrometer (Blows/100mm)
0	TOP SOIL		TOPSOIL, with rootlets; dark brown. Dry.		
0.5	OLD ALLUVIUM		Clayey SILT, with gravel particles and sand grains; yellow brown and light grey. Very stiff to hard; moist; slightly plastic.	>203kPa >203kPa	
1.0			Clayey SILT; light grey mottled dark yellow brown. Very stiff; moist; plastic.	174/64kPa 148/81kPa 163/105kPa 174/102kPa	
1.5			Clayey SILT; light grey with dark yellow brown and dark orange mottling. Very stiff; moist; highly plastic.	171/90kPa 192/116kPa 192/134kPa 157/105kPa	
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					

Undrained Shear Strength: 0 | 100 | 200 (kPa)

Scala Penetrometer: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 (Blows/100mm)

0 2 4 6 8 10 13 16 18 20 23 26 28 30
Inferred CBR 10%

Water Level

Hole Depth: 2.1m
Termination: Target depth reached

Remarks: Groundwater not encountered.

Shear vane ID: Shear vane 3
serial No. 3922

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

HAND AUGER LOG

EARTHTECH

Bore No.:	MF6
Project No.:	4424
Sheet:	1 of 1

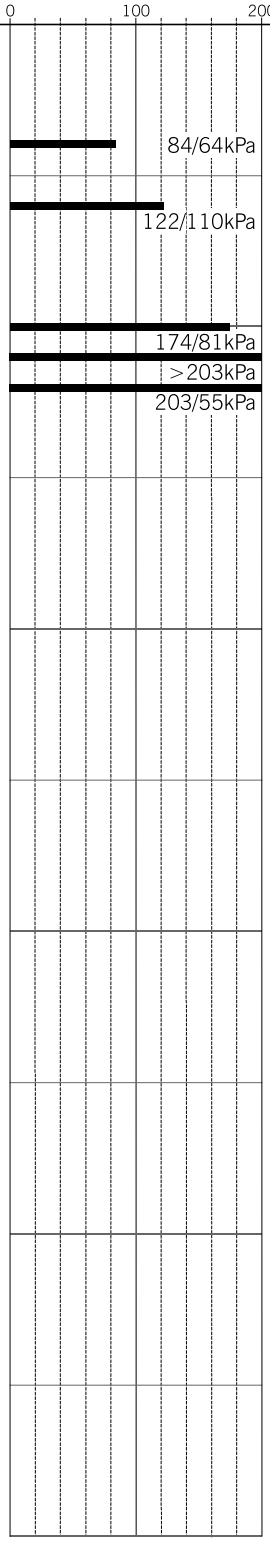
Client:	National Green Steel	Coordinates:	
Project:	Geotechnical Investigations - NE Monofill	CRS:	
Location:	61 Hampton Downs Road	Elevation:	
Test Location:	Western gully	Located by:	GIS/Web Map

Test Date:	26/11/2024
Logged by:	LS/CF
Prepared by:	CF
Checked by:	LS

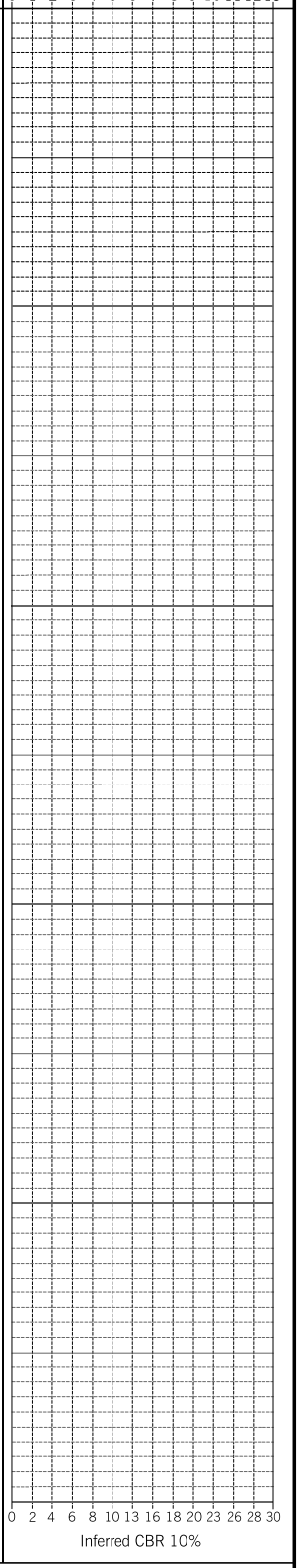
Depth (m)	Geology	Soil Symbol	Soil Description
0	TOP SOIL		TOPSOIL, with much rootlets; dark brown. Dry.
0.5	OLD ALLUVIUM		Clayey SILT, with gravel particles and some sand grains; yellow brown beige with light grey and dark orange mottling. Stiff to very stiff; moist; plastic.
			0.6m: highly plastic.
			0.9m: wet.
1.0			1.2m: saturated.
1.5			
2.0			
2.5			
3.0			
3.5			
4.0			
4.5			
5.0			

Water Level

Undrained Shear Strength (kPa)



Scala Penetrometer



Hole Depth: 1.2m

Termination: Target depth reached

Remarks: Groundwater encountered at 1.2m.

Shear vane ID: Shear vane 3 serial No. 3922

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

HAND AUGER LOG

EARTHTECH

Bore No.:	MF7
Project No.:	4424
Sheet:	1 of 1

Client:	National Green Steel	Coordinates:	
Project:	Geotechnical Investigations - NE Monofill	CRS:	
Location:	61 Hampton Downs Road	Elevation:	
Test Location:	Eastern gully	Located by:	GIS/Web Map

Test Date:	26/11/2024
Logged by:	LS/CF
Prepared by:	CF
Checked by:	LS

Depth (m)	Geology	Soil Symbol	Soil Description
0.0	TOP SOIL		TOPSOIL, with grass cover and much bark (felled pine tree around); grey brown.
0.5	OLD ALLUVIUM		Clayey SILT; yellow brown with orange mottling. Very stiff; dry; slightly plastic; friable.
1.0			Clayey SILT, with some organics and rootlets; beige brown with dark orange staining. Stiff to very stiff; moist; plastic.
1.5			1.6m: saturated.
2.0			
2.5			
3.0			
3.5			
4.0			
4.5			
5.0			

Water Level

Undrained Shear Strength (kPa)

0 100 200

139/41kPa
125/70kPa
76/26kPa
136/116kPa
134/67kPa
160/131kPa
78/55kPa

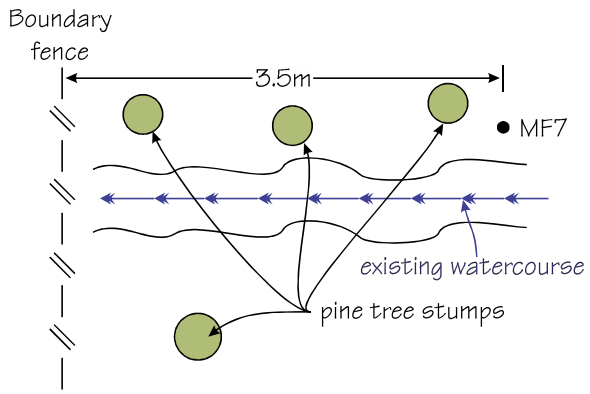
Scala Penetrometer

Blows/100mm

0 1 2 3 4 5 6 7 8 9 10 11 12 13

0 2 4 6 8 10 13 16 18 20 23 26 28 30

Inferred CBR 10%



Hole Depth: 1.6m

Termination: Target depth reached

Remarks: Groundwater encountered at 1.6m.

Shear vane ID: Shear vane 3 serial No. 3922

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

EARTHTECH

SCALA PENETROMETER TEST SHEET

		Job No.:	4424
		Date:	22/11/2024
Client:	**National Green Steel**	**Augered By:**	CF/LS
Project.:	**Proposed Monofill - Hampton Downs Road**	**Checked By:**	LS

Test No.		SPMF1		SPMF2		SPMF4									
0.10	4.10	Scala in bottom of hand auger hole		Scala in bottom of hand auger hole	5	Scala in bottom of hand auger hole									
0.20	4.20				5										
0.30	4.30				4										
0.40	4.40				4										
0.50	4.50				4										
0.60	4.60				5										
0.70	4.70				6										
0.80	4.80				6										
0.90	4.90				5										
1.00	5.00				EOS 4.9m										
1.10	5.10														
1.20	5.20														
1.30	5.30														
1.40	5.40														
1.50	5.50														
1.60	5.60														
1.70	5.70														
1.80	5.80														
1.90	5.90														
2.00	6.00														
2.10	6.10	Push													
2.20	6.20	8													
2.30	6.30	6					28								
2.40	6.40	6					>20								
2.50	6.50	6					EOS 2.4m								
2.60	6.60	8													
2.70	6.70	8													
2.80	6.80	7													
2.90	6.90	6													
3.00	7.00	6													
3.10	7.10	5		3											
3.20	7.20	7		4											
3.30	7.30	11		4											
3.40	7.40	20		3											
3.50	7.50	>20		3											
3.60	7.60	EOS 3.5m		4											
3.70	7.70			4											
3.80	7.80			4											
3.90	7.90			4											
4.00	8.00			5											

Comments:

Preliminary Geotechnical Assessment

Green Steel Monofill, 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	3.5*m*	3.8*m*	5863038.786	1783976.611
TP5	4.5*m*	18.5*m*	5862992.340	1784149.887
TP7	5*m*	14.2*m*	5862695.752	1784319.328
TP8	4.5*m*	29*m*	5862574.930	1784396.587
TP9	5*m*	14*m*	5862718.441	1784151.206
TP11A	5.5*m*	28*m*	5862934.570	1784343.204
TP11B	6*m*	22.5*m*	5862934.570	1784343.204
TP2-2	4*m*	25*m*	5862784.036	1784417.537
TP2-5	6*m*	36.5*m*	5862454.328	1784295.24
TP2-6	5*m*	27*m*	5862599.255	1784162.211

TEST PIT LOG

EARTHTECH

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	Depth (m)
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
	2.0m: CLAY; light blue grey with yellow brown staining. Soft to firm; saturated; highly plastic.	2.0
		2.5
		3.0
		3.5
		4.0

Soil Symbol

Sample Type

Undrained Shear Strength (kPa)
0 100 200
25/19kPa
29/22kPa

Scala Penetrometer
Blows/100mm
0 1 2 3 4 5 6 7 8 9 10 11 12 13
0 2 4 6 8 10 13 16 18 20 23 26 28 30
Inferred CBR 10%

EXCAVATOR TYPE: 13t
OPERATOR: Grant Fitzgerald
TEST PIT TERMINATED AT: 3.5m

Target Depth	☑	Refusal	☐
Near Refusal	☐	Flooding	☐

SAMPLE TYPE:

bulk sample	☐
tube sample	☐
disturbed profile sample	☑

FIELD SHEAR STRENGTH:

Shear vane	V ✓
Hand penetrometer	P
Estimate only	E

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.

TEST PIT PHOTO **SCALE:** NTS

TEST PIT LOG

EARTHTECH

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) 0 / 100 / 200	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
TOP SOIL	TOPSOIL.		0			
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.		1.5 / 2.0		UTP	
	Clayey SILT with fine sand grains; light grey with dark yellow layers. Hard; moist; plastic. Friable.		2.5 / 3.0		UTP	
			3.5 / 4.0			

Scala Penetrometer: 0 2 4 6 8 10 13 16 18 20 23 26 28 30
Inferred CBR 10%

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	V ☑
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

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

TEST PIT LOG

EARTHTECH

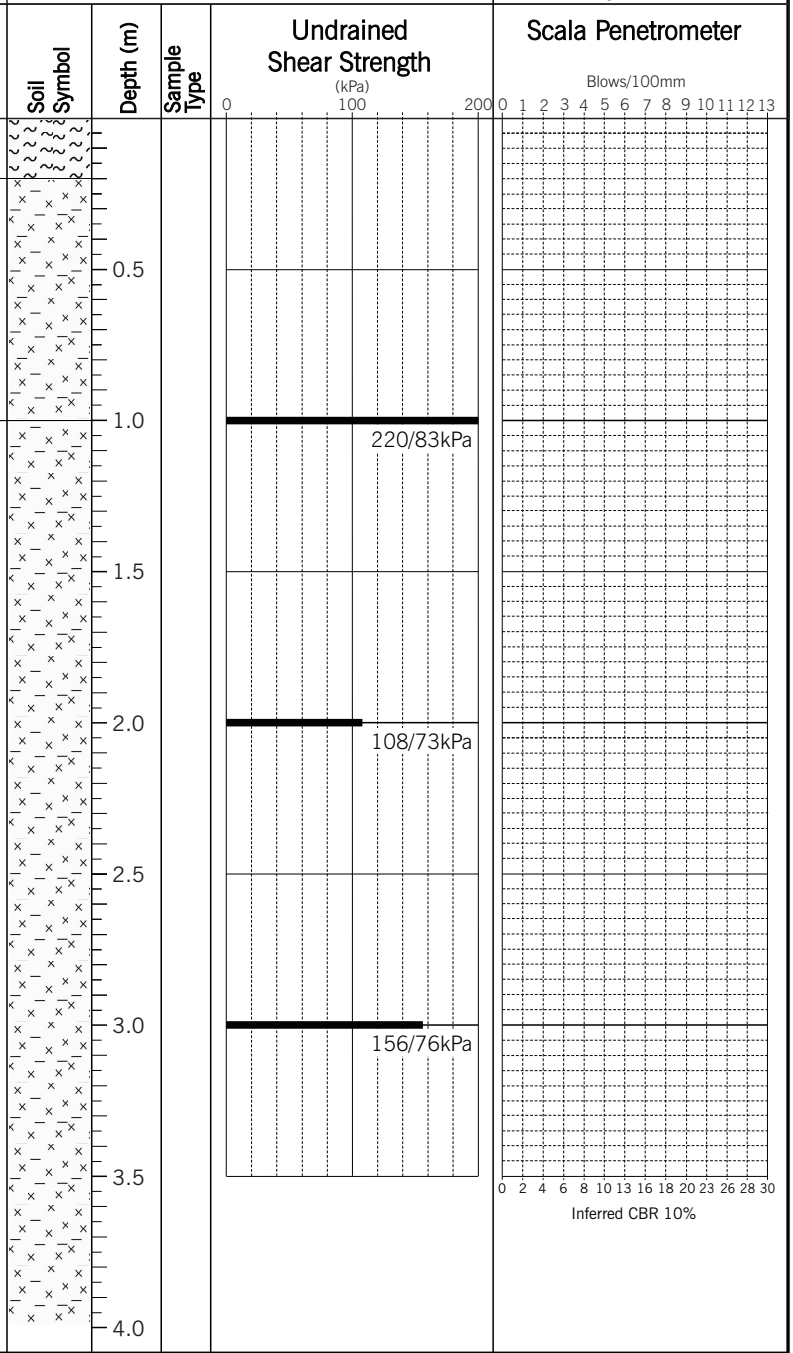
Test Pit No.: TP2-5
Project No.: 4392
Sheet: 1 of 2

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
TOP SOIL	TOPSOIL; dark brown.
ASH SOIL	Clayey SILT with fine sand; dark orange brown. Very stiff to hard; moist. (Good fill material.)
TERRACE ALLUVIUM	Clayey SILT; dark orange brown with black mottling. Very stiff; moist; plastic.
	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.
	3.7m: Clayey SILT; light grey mottled dark yellow and black with dark orange staining. Very stiff to hard; moist; friable. (Good fill material.)



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	V ☑
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

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

TEST PIT PHOTO **SCALE:** NTS

TEST PIT LOG

EARTHTECH

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

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	V ✓
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

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

TEST PIT PHOTO **SCALE:** NTS

TEST PIT LOG

EARTHTECH

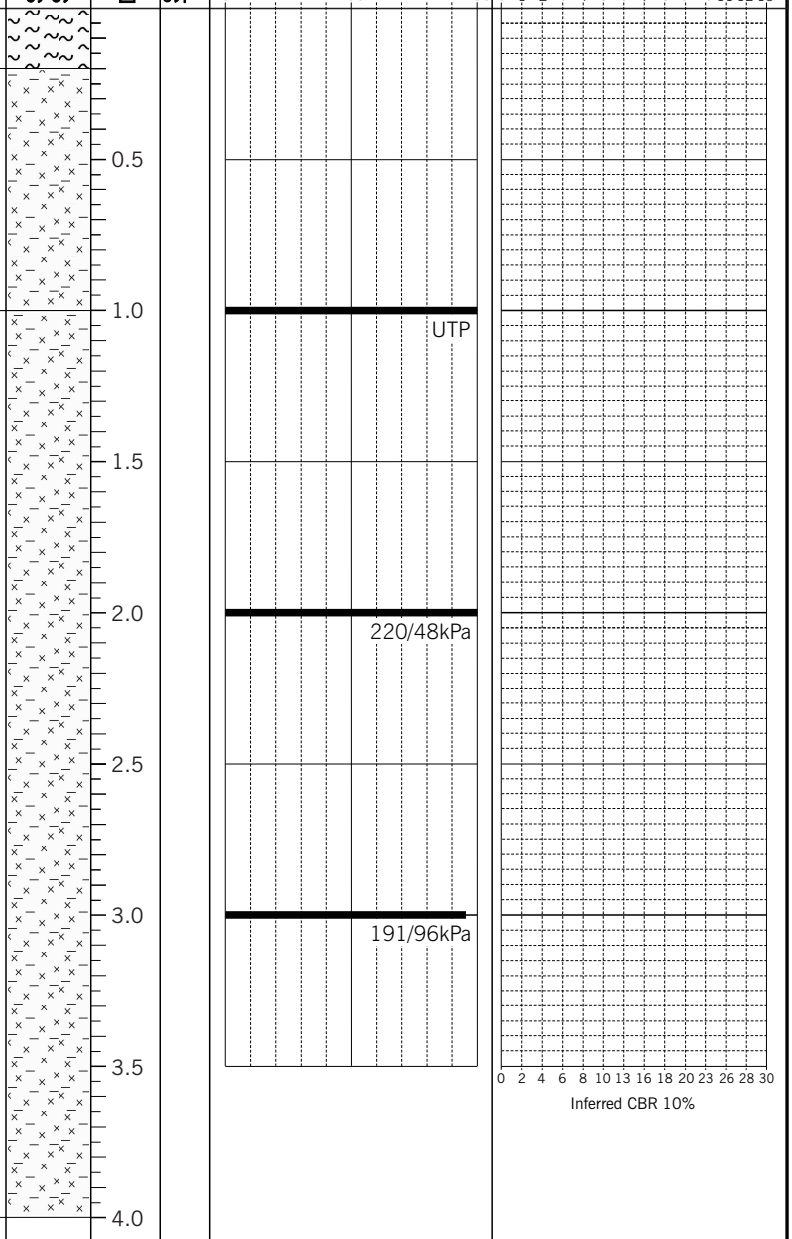
Test Pit No.: TP2-6
Project No.: 4392
Sheet: 1 of 2

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
TOP SOIL	TOPSOIL; dark brown.
ASH SOIL	Clayey SILT with some fine sand; orange brown and dark yellow brown. Hard; slightly moist; slight plastic. (Very good fill material.)
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.)
TERRACE ALLUVIUM	3.0m to 4.0m: clayey SILT with some sand; dark yellow with light grey striations. Very stiff to hard; moist; plastic.



EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

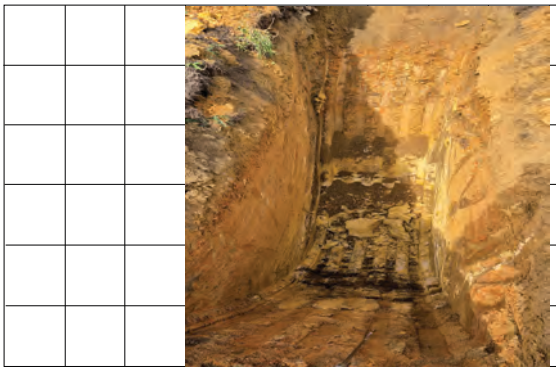
TEST PIT TERMINATED AT: 5m

Target Depth	✓	Refusal	
Near Refusal		Flooding	

SAMPLE TYPE:		FIELD SHEAR STRENGTH:	
bulk sample		Shear vane	V ✓
tube sample		Hand penetrometer	P
disturbed profile sample	✓	Estimate only	E

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

TEST PIT PHOTO **SCALE:** NTS



TEST PIT LOG

EARTHTECH

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
TERRACE ALLUVIUM	Sandy clayey SILT; dark yellow brown with light grey mottling. Very stiff; moist; plastic. (Good for direct fill.)		4.5	

Undrained Shear Strength (kPa): 0, 100, 200

Scala Penetrometer: Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13

0 2 4 6 8 10 13 16 18 20 23 26 28 30
Inferred CBR 10%

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	V ✓
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

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

TEST PIT PHOTO **SCALE:** NTS

TEST PIT LOG

EARTHTECH

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

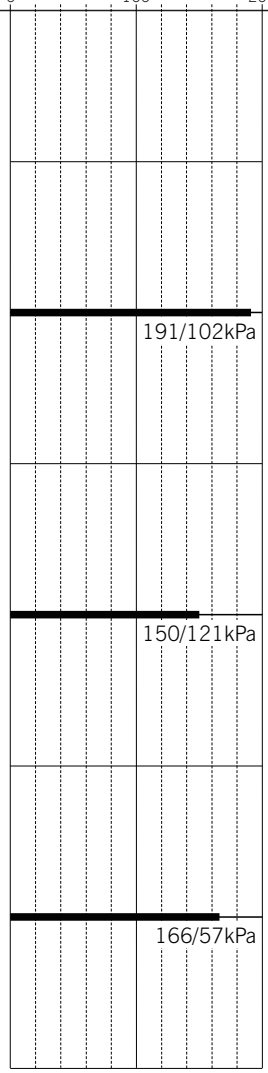
Client: National Green Steel
Project: Green Steel
Location: 61 Hampton Downs Road
Test Location: At CPT5 location

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

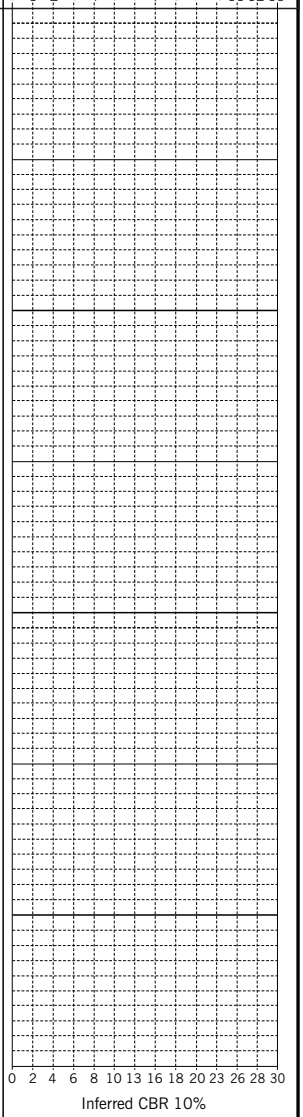
Test Date: 23/04/2025
Logged by: LS
Prepared by: SSW/SP
Checked by: AN

Geology	Soil Description	Depth (m)
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
	2.0m to 3.0m: clayey SILT with minor coarse and fine sand; beige with dark yellow layering. very stiff; moist; plastic.	1.5, 2.0, 2.5, 3.0
	3.0m to 3.5m: same material characteristics but changes to clayey SILT; dark yellow and light grey.	3.5
	3.5m: Clayey SILT with sand particles; light grey with dark yellow and orange layering. Very stiff; moist; plastic. Very good fill material.	4.0

Undrained Shear Strength (kPa)



Scala Penetrometer



EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 4.5m

Target Depth	☑	Refusal	☐
Near Refusal	☐	Flooding	☐

SAMPLE TYPE:

bulk sample	☐
tube sample	☐
disturbed profile sample	☑

FIELD SHEAR STRENGTH:

Shear vane	V ✓
Hand penetrometer	P
Estimate only	E

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

TEST PIT PHOTO **SCALE:** NTS

TEST PIT LOG

EARTHTECH

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) 0 100 200	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
KAAWA SANDS	Silty SAND; yellow brown with dark orange mottling. Medium dense to dense; moist; non plastic.		4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%

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	V ✓
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

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

TEST PIT PHOTO **SCALE:** NTS

TEST PIT LOG

EARTHTECH

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) 0 100 200	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
TOP SOIL	TOPSOIL; dark brown.		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 motlled dark yellow brown. Firm to very stiff; moist to wet; highly plastic.		1.5 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.)		2.5 3.0			
AMOKURA	Silty SAND; blue grey. Medium dense to dense; moist to wet. (Good fill material.)		3.5		92/39kPa	0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%
			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	V ☑
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

Remarks: Refer TP1A note.

TEST PIT PHOTO

SCALE: NTS

TEST PIT LOG

EARTHTECH

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 (kPa) 0 100 200	Scala Penetrometer 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.) 4.5m: Water ingress		4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%

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	V ✓
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

Remarks: Refer TP1A note.

TEST PIT PHOTO **SCALE:** NTS

TEST PIT LOG

EARTHTECH

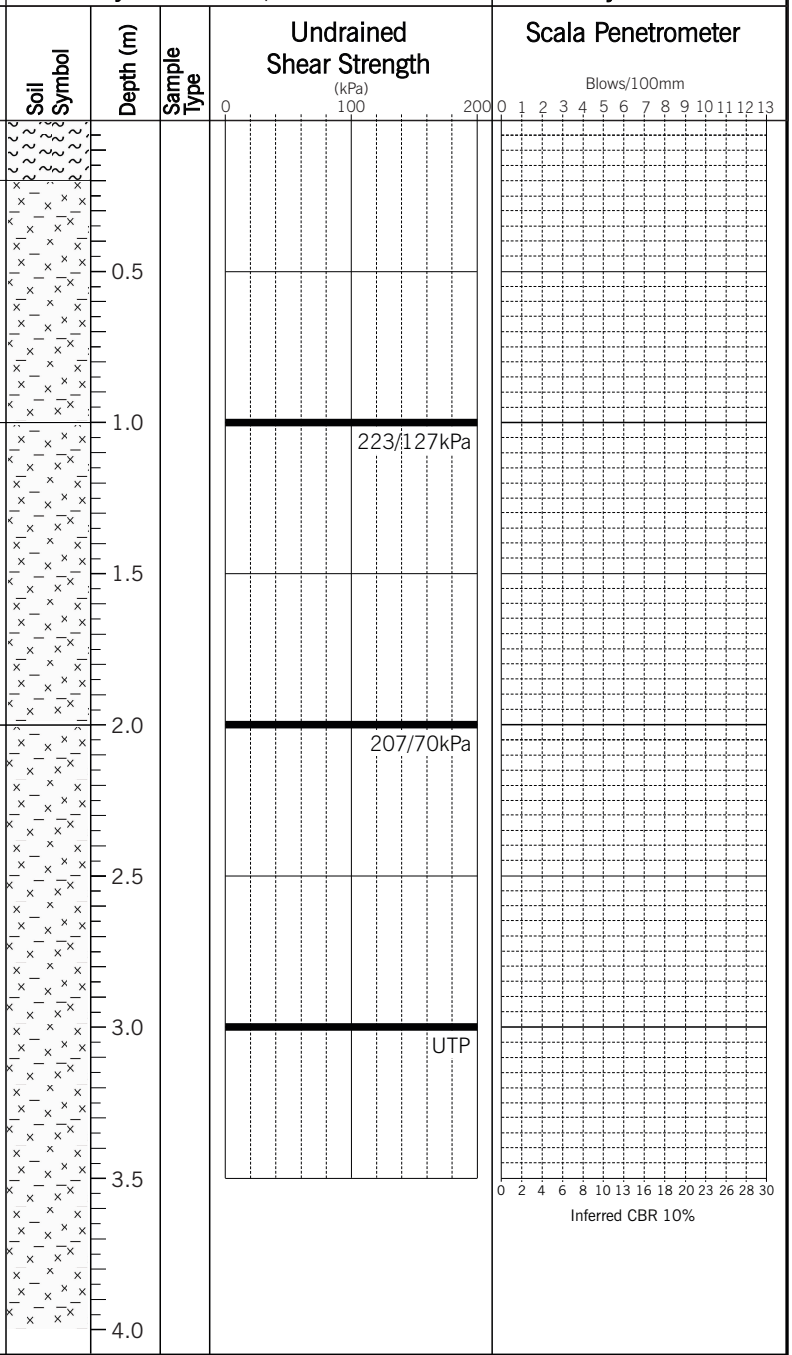
Test Pit No.: TP8
Project No.: 4392
Sheet: 1 of 2

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
TOP SOIL	TOPSOIL; dark brown.
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.)
TERRACE ALLUVIUM	Clayey SILT "sugary" with some fine sand; light grey and dark yellow. Very stiff to hard; moist; friable; plastic.
TERRACE ALLUVIUM	Clayey SILT with some fine and coarse sand; light grey mottled dark brown and yellow. Hard; moist; friable. (Good fill material.)
TERRACE ALLUVIUM	3.5m: becomes beige brown mottled yellow SILT. Very stiff to hard; moist to wet; plastic. (will require ~1 day of drying conditioning.)



EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 4.5m

Target Depth	☑	Refusal	☐
Near Refusal	☐	Flooding	☐

SAMPLE TYPE:

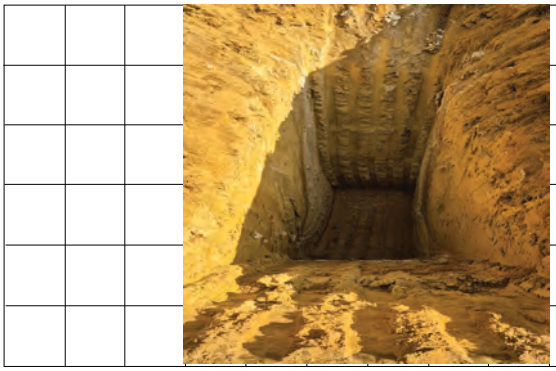
bulk sample	☐
tube sample	☐
disturbed profile sample	☑

FIELD SHEAR STRENGTH:

Shear vane	V ✓
Hand penetrometer	P
Estimate only	E

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

TEST PIT PHOTO **SCALE:** NTS



TEST PIT LOG

EARTHTECH

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) 0 100 200	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
TERRACE ALLUVIUM	4.0m: changes to beige brown mottled reddish pink. Moist to wet.		4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%

EXCAVATOR TYPE: 13t

OPERATOR: Grant Fitzgerald

TEST PIT TERMINATED AT: 4.5m

Target Depth	☑	Refusal	☐
Near Refusal	☐	Flooding	☐

SAMPLE TYPE:

bulk sample	☐
tube sample	☐
disturbed profile sample	☑

FIELD SHEAR STRENGTH:

Shear vane	V ☑
Hand penetrometer	P
Estimate only	E

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

TEST PIT SECTION **SCALE:** NTS

TEST PIT LOG

EARTHTECH

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) 0 / 100 / 200	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
TOP SOIL	TOPSOIL; dark brown.		0			
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	
	Sandy clayey SILT; light beige with dark yellow staining. Hard; slightly moist. Good fill material.		1.5, 2.0		UTP	
	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.		2.5, 3.0, 3.5, 4.0		>223kPa, >223kPa	

Scala Penetrometer: 0 2 4 6 8 10 13 16 18 20 23 26 28 30
Inferred CBR 10%

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	V ✓
tube sample		Hand penetrometer	P
disturbed profile sample	✓	Estimate only	E

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

EARTHTECH

Test Pit No.: TP9
Project No.: 4392
Sheet: 2 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) 0 / 100 / 200	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
KAAWA SANDS	Fine silty SAND. Medium dense to dense; moist; non plastic. (Good fill material.) 5m: Silty SAND; light blue grey. Very dense; moist; non plastic.		4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%

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	V ☑
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

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

EARTHTECH

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) 0 100 200	Scala Penetrometer 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; moist; highly plastic.		0.5			
	Clayey SILT with minor sand; mid pinkish grey. Very stiff; moist; highly plastic. (Suitable fill material with minor drying.) 1m-1.5m: shrink swell occurring.		1.0 1.5		207/103kPa	
	Clayey SILT with minor sand and fine gravels; dark yellow mottled light grey. Very stiff; moist; plastic.		2.0 2.5 3.0		191/102kPa 191/103kPa	
			3.5 4.0			

Scala Penetrometer: 0 2 4 6 8 10 13 16 18 20 23 26 28 30
Inferred CBR 10%

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	V ✓
tube sample		Hand penetrometer	P
disturbed profile sample	✓	Estimate only	E

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

EARTHTECH

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) 0 100 200	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
TERRACE ALLUVIUM	Clayey SILT with minor sand; light white-grey with occasional pink striations/layering. Very stiff; slightly moist; plastic.		4.5			
	Clayey SILT with minor fine sand and gravels; thinly layered grey/pink/white. Very stiff; slightly moist; slightly plastic. 5.5m: Clayey SILT with minor fine sand and gravels; light grey/white grey. Very stiff; moist; slightly plastic.		5.0 5.5 6.0 6.5 7.0 7.5 8.0			0 2 4 6 8 10 13 16 18 20 23 26 28 30 Inferred CBR 10%

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	V ☑
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

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

EARTHTECH

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) 0 / 100 / 200	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
TOP SOIL	TOPSOIL.		0			
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.		1.5 / 2.0		151/86kPa	
	Clayey SILT; yellow (thinly layered yellow and white). Very stiff; moist; plastic.		2.5 / 3.0		150/73kPa	
			3.5 / 4.0			

Scala Penetrometer: 0 2 4 6 8 10 13 16 18 20 23 26 28 30
Inferred CBR 10%

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	V ☑
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

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

EARTHTECH

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) 0 / 100 / 200	Scala Penetrometer Blows/100mm 0 1 2 3 4 5 6 7 8 9 10 11 12 13
TERRACE ALLUVIUM	Clayey SILT; yellow (thinly layered yellow and white). Very stiff; moist; plastic.		4.5			
	4.4m: Clayey SILT; pale blue with minor orange stained fissures. Firm to stiff; moist to wet; plastic.		5.0			
	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			

Scala Penetrometer: 0 2 4 6 8 10 13 16 18 20 23 26 28 30
Inferred CBR 10%

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	V ✓
tube sample	☐	Hand penetrometer	P
disturbed profile sample	☑	Estimate only	E

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				
Client:	National Green Steel	Coordinates:		Test Date:	23/04/2025
Project:	Green Steel	CRS:		Logged by:	LS
Location:	61 Hampton Downs Road	Elevation:	~26m	Prepared by:	SP
Test Location:		Located by:	GIS/Web Map	Checked by:	LS

0.0m-4.0m

CORE PHOTOGRAPHS

Test Pit No.:	TP 2-5
Project No.:	4392
Sheet:	1 of 1

Client:	National Green Steel	Coordinates:		Test Date:	23/04/2025
Project:	Green Steel	CRS:		Logged by:	LS
Location:	61 Hampton Downs Road	Elevation:	~38m	Prepared by:	SP
Test Location:		Located by:	GIS/Web Map	Checked by:	LS

0.0m-6.0m

CORE PHOTOGRAPHS

Test Pit No.:	TP 2-6				
Project No.:	4392				
Sheet:	1 of 1				
Client:	National Green Steel	Coordinates:		Test Date:	23/04/2025
Project:	Green Steel	CRS:		Logged by:	LS
Location:	61 Hampton Downs Road	Elevation:	~28m	Prepared by:	SP
Test Location:		Located by:	GIS/Web Map	Checked by:	LS

0.0m-5.0m

CORE PHOTOGRAPHS

Test Pit No.:	TP 5				
Project No.:	4392				
Sheet:	1 of 1				
Client:	National Green Steel	Coordinates:		Test Date:	23/04/2025
Project:	Green Steel	CRS:		Logged by:	LS
Location:	61 Hampton Downs Road	Elevation:	~19m	Prepared by:	SP
Test Location:	At CPT5 location	Located by:	GIS/Web Map	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	Coordinates:		Test Date:	23/04/2025
Project:	Green Steel	CRS:		Logged by:	LS
Location:	61 Hampton Downs Road	Elevation:	~15m	Prepared by:	SP
Test Location:	At CPT7 location	Located by:	GIS/Web Map	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	Coordinates:		Test Date:	23/04/2025
Project:	Green Steel	CRS:		Logged by:	LS
Location:	61 Hampton Downs Road	Elevation:	~29m	Prepared by:	SP
Test Location:	At CPT8 location	Located by:	GIS/Web Map	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	Coordinates:		Test Date:	23/04/2025
Project:	Green Steel	CRS:		Logged by:	LS
Location:	61 Hampton Downs Road	Elevation:	~14.5m	Prepared by:	SP
Test Location:	At CPT9 location	Located by:	GIS/Web Map	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	Coordinates:		Test Date:	23/04/2025
Project:	Green Steel	CRS:		Logged by:	LS
Location:	61 Hampton Downs Road	Elevation:	~28m	Prepared by:	SP
Test Location:		Located by:	GIS/Web Map	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	Coordinates:		Test Date:	23/04/2025
Project:	Green Steel	CRS:		Logged by:	LS
Location:	61 Hampton Downs Road	Elevation:	~23m	Prepared by:	SP
Test Location:	Downslope of TP11A	Located by:	GIS/Web Map	Checked by:	LS

0.0m-6.0m

Preliminary Geotechnical Assessment

Green Steel Monofill, Hampton Downs

Appendix C

Slope/W Output

Preliminary Geotechnical Assessment

Green Steel Monofill, Hampton Downs

Appendix C1

Slope/W Output for Southwestern Monofill

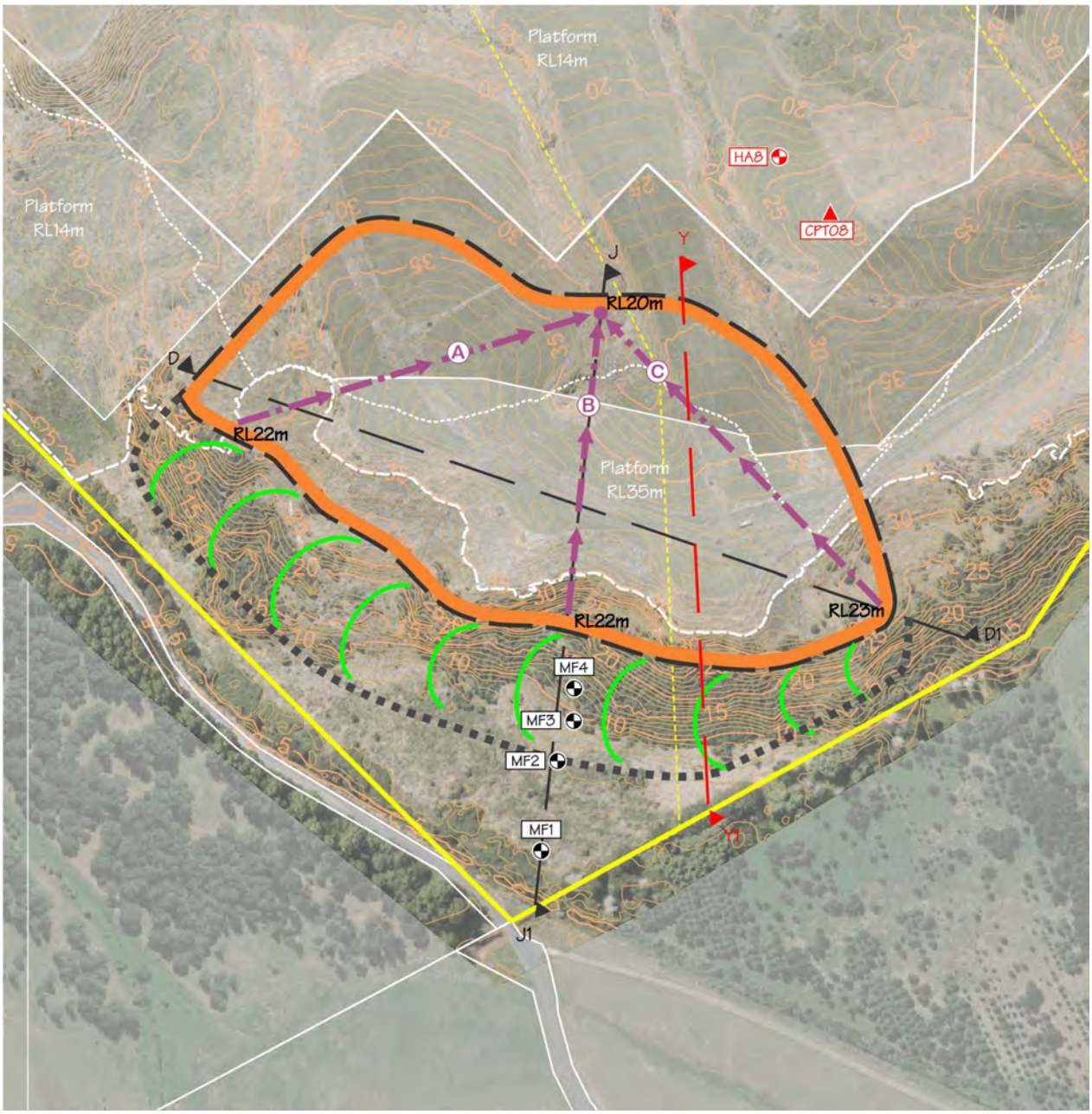
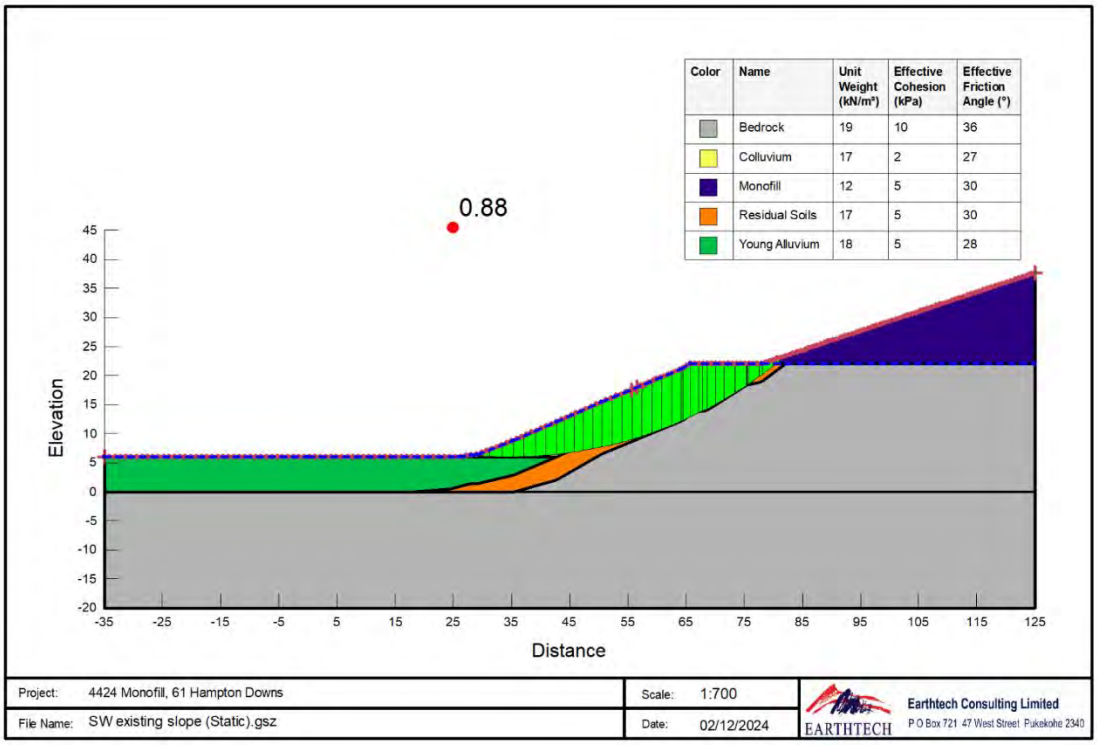


Figure C1: Southwestern Monofill Section Locations (showing critical Section Y-Y1)



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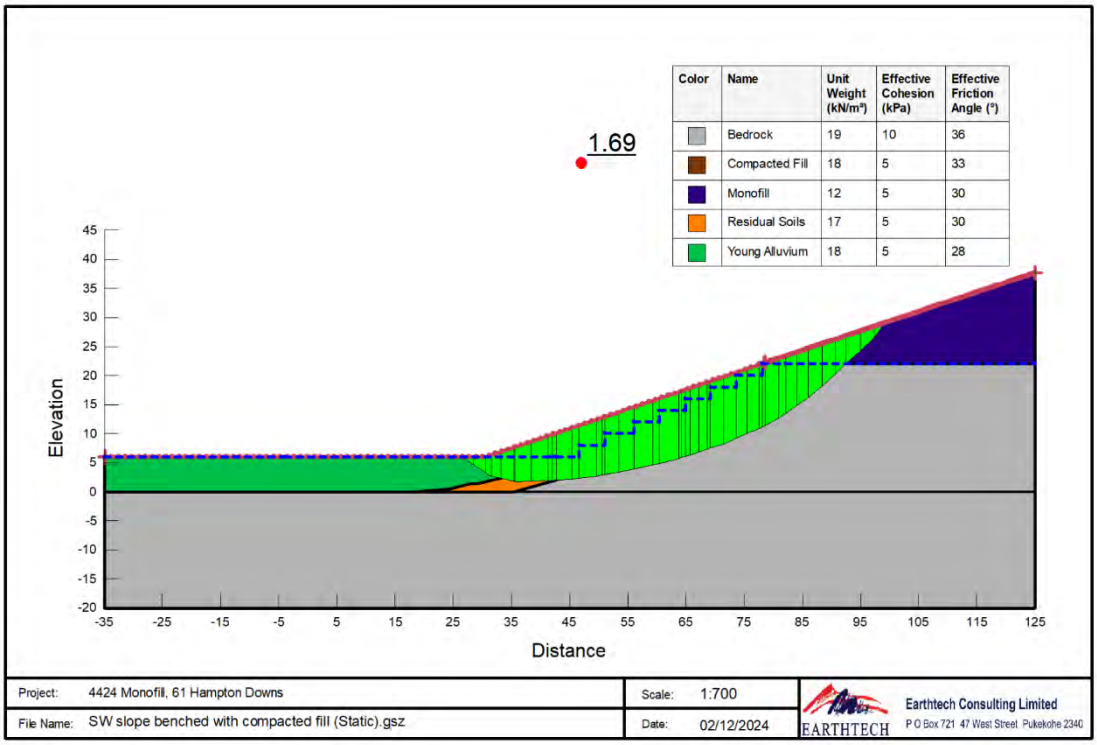
File Name:	SW existing slope (Static).gsz	Date:	02/12/2024

EARTHTECH
Earthtech Consulting Limited
P O Box 721 47 West Street Pukekohe 2340



Project:	4424 Monofill, 61 Hampton Downs	Scale:	1:700
File Name:	SW slope benched with compacted fill (Static).gsz	Date:	02/12/2024

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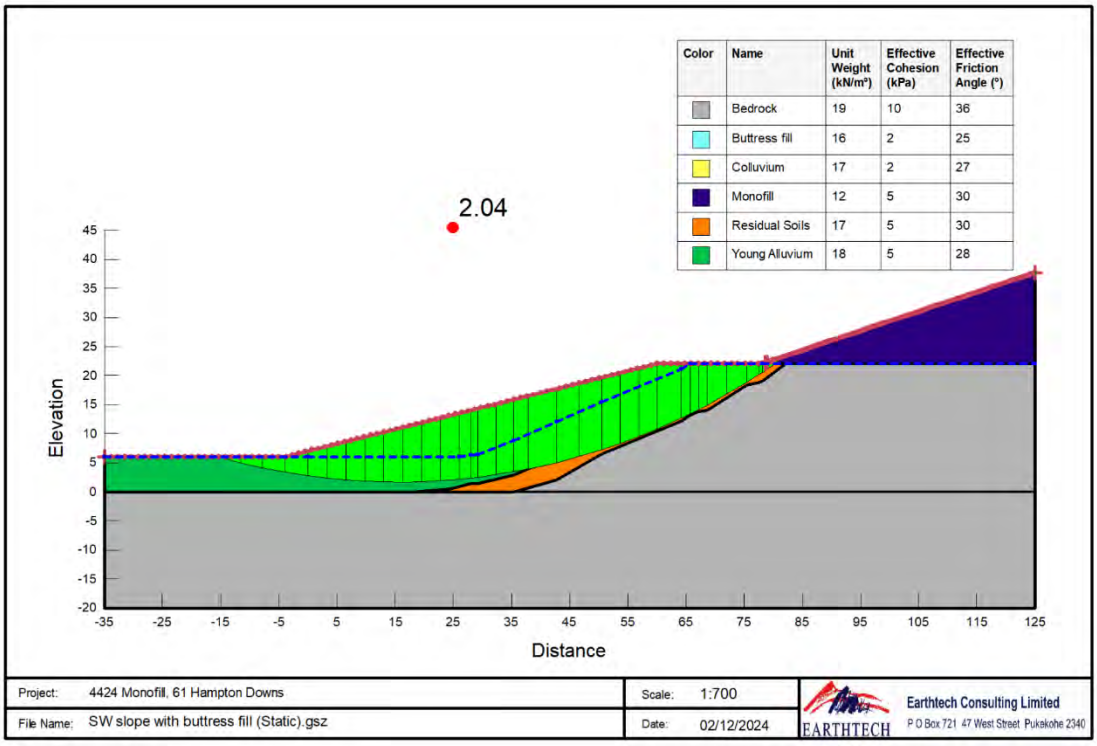
Color
Name
Unit Weight (kN/m³)
Effective Cohesion (kPa)
Effective Friction Angle (°)
Bedrock 19 10 36
Buttress fill 16 2 25
Colluvium 17 2 27
Monofill 12 5 30
Residual Soils 17 5 30
Young Alluvium 18 5 28
2.04
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: SW slope with buttress fill (Static).gsz
Scale: 1:700
Date: 02/12/2024
EARTHTECH
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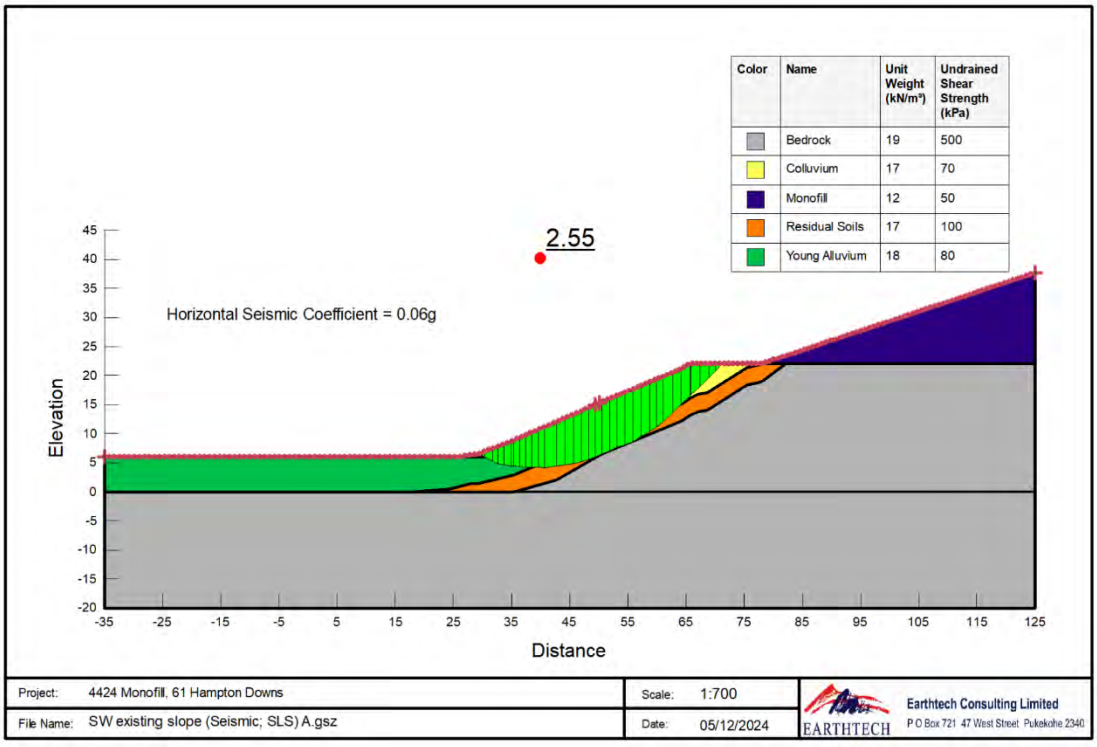
Color
Name
Unit Weight (kN/m³)
Undrained Shear Strength (kPa)
Bedrock 19 500
Colluvium 17 70
Monofill 12 50
Residual Soils 17 100
Young Alluvium 18 80
2.55
Horizontal Seismic Coefficient = 0.06g
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: SW existing slope (Seismic; SLS) A.gsz
Scale: 1:700
Date: 05/12/2024
EARTHTECH
Earthtech Consulting Limited
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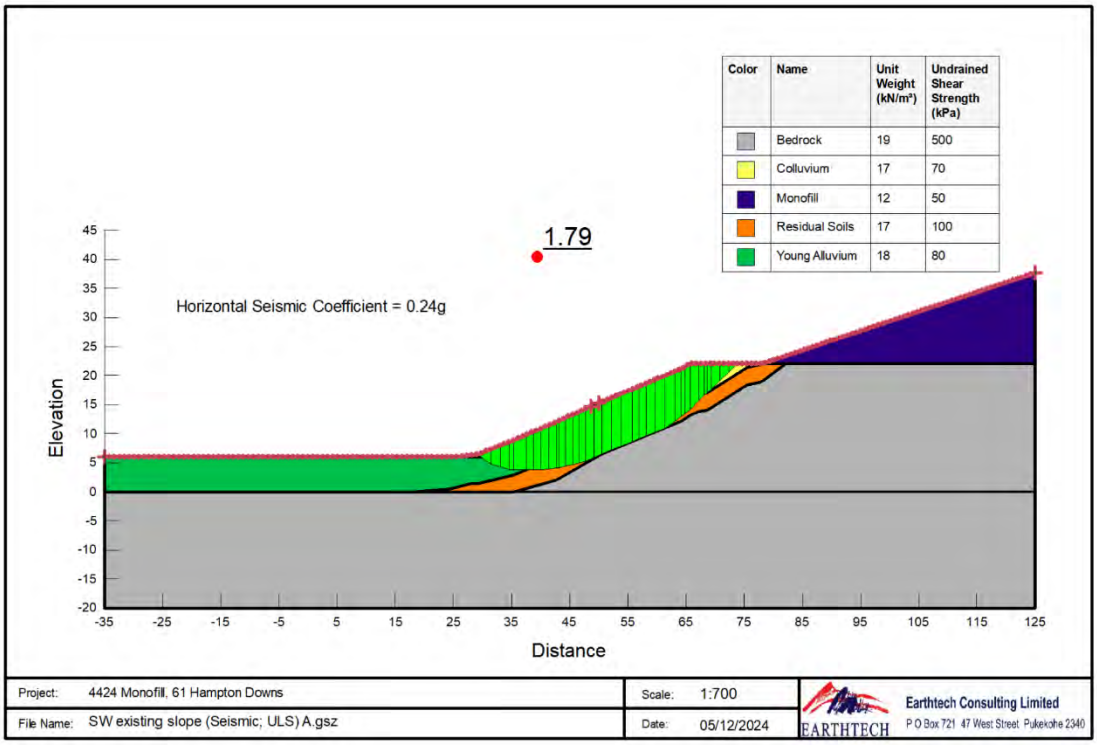

Project:	4424 Monofill, 61 Hampton Downs	Scale:	1:700
File Name:	SW existing slope (Seismic; ULS) A.gsz	Date:	05/12/2024

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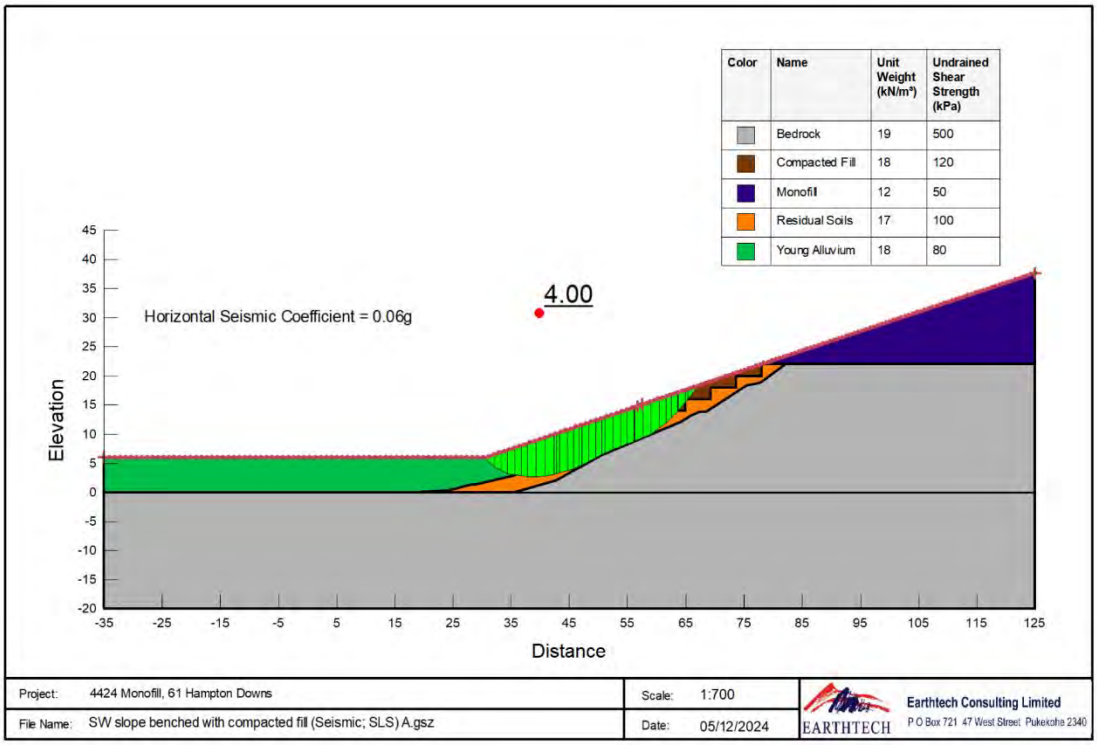

Project:	4424 Monofill, 61 Hampton Downs	Scale:	1:700
File Name:	SW slope benched with compacted fill (Seismic; SLS) A.gsz	Date:	05/12/2024

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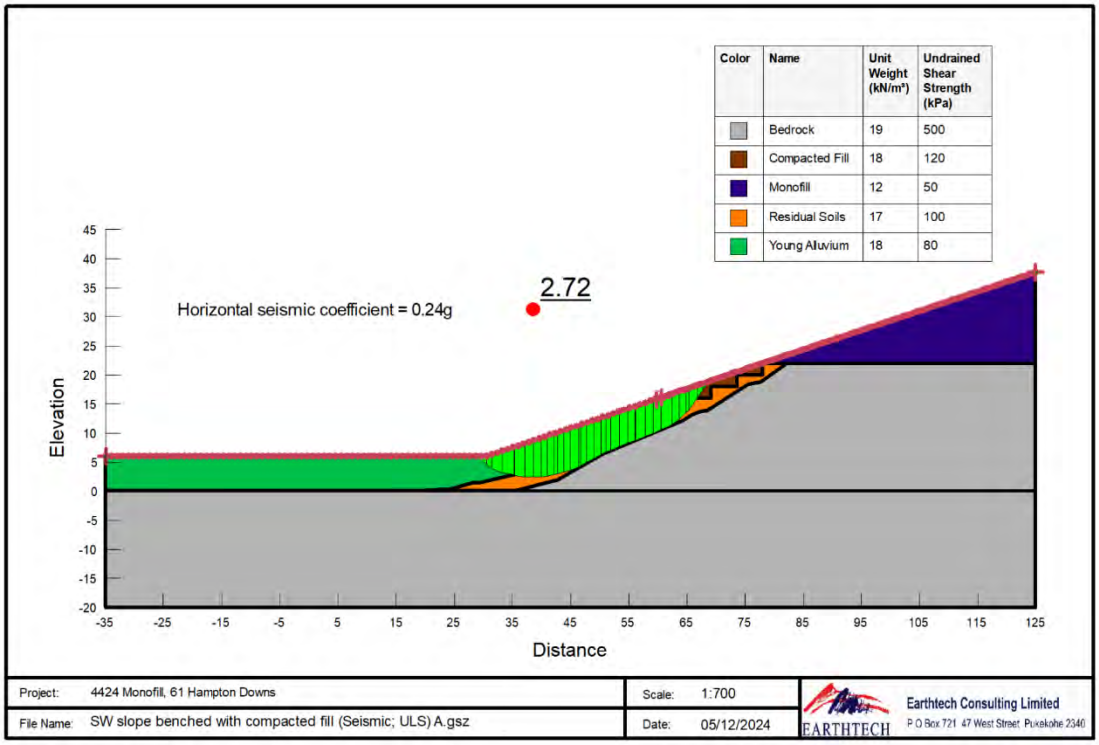

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File Name:	SW slope benched with compacted fill (Seismic; ULS) A.gsz	Date:	05/12/2024

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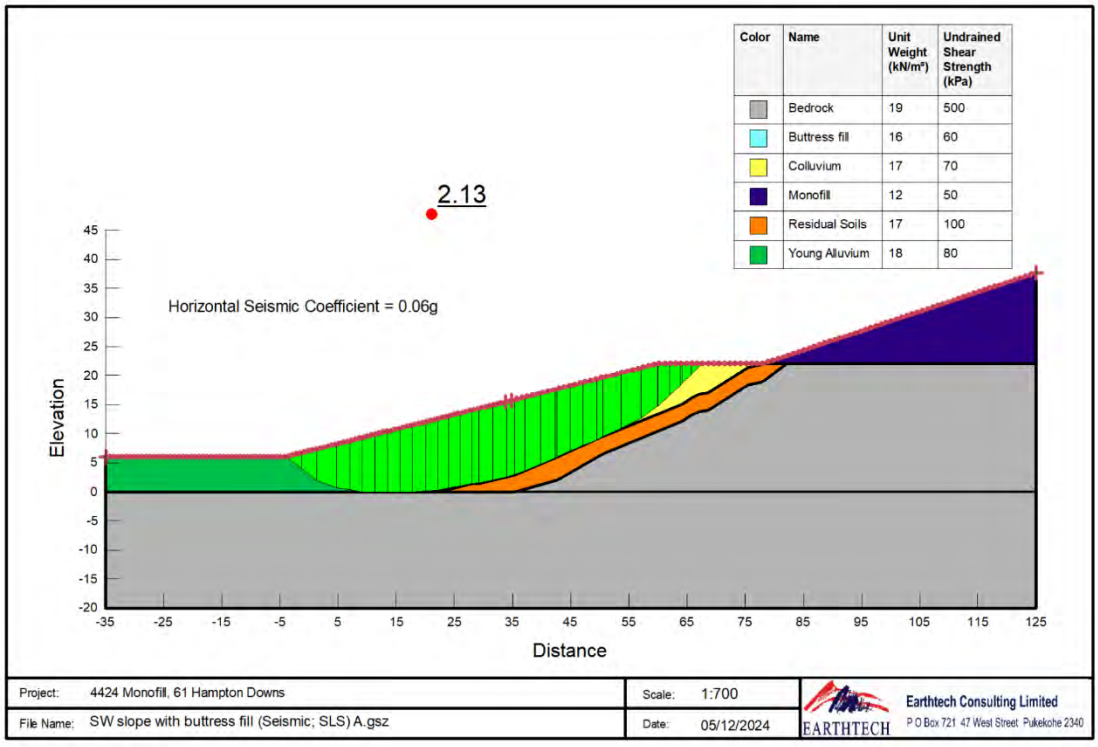

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File Name:	SW slope with buttress fill (Seismic; SLS) A.gsz	Date:	05/12/2024

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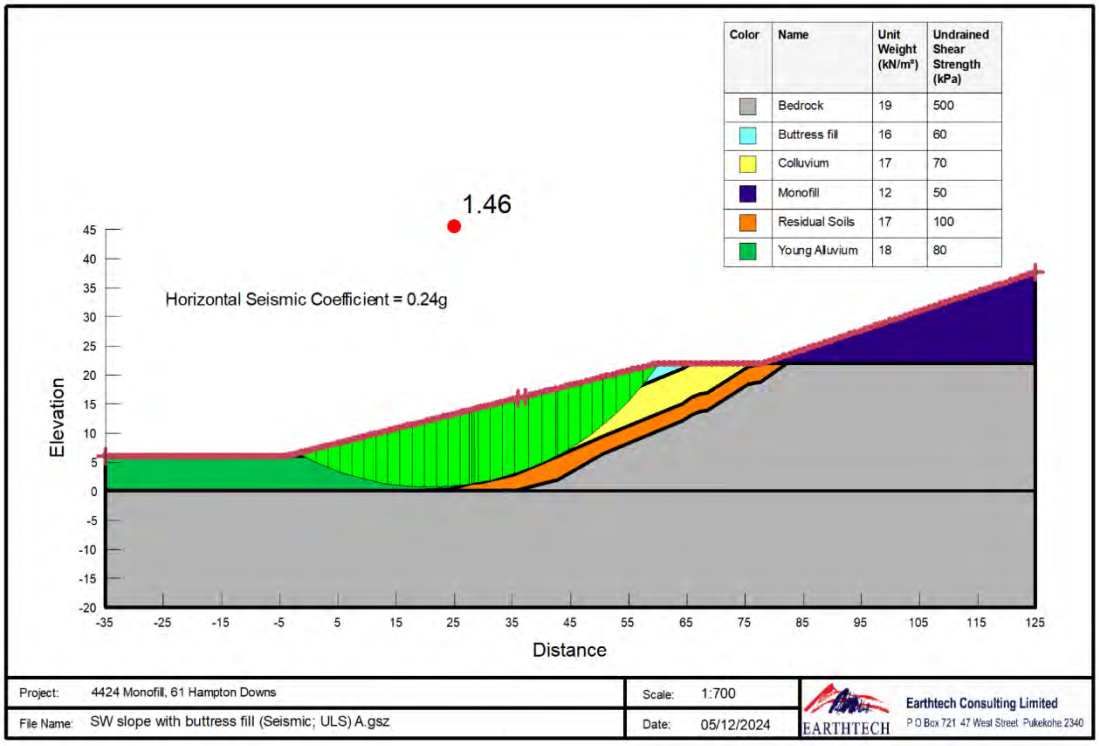
Color
Name
Unit Weight (kN/m³)
Undrained Shear Strength (kPa)
Bedrock 19 500
Buttress fill 16 60
Colluvium 17 70
Monofill 12 50
Residual Soils 17 100
Young Alluvium 18 80
1.46
Horizontal Seismic Coefficient = 0.24g
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: SW slope with buttress fill (Seismic; ULS) A.gsz
Scale: 1:700
Date: 05/12/2024
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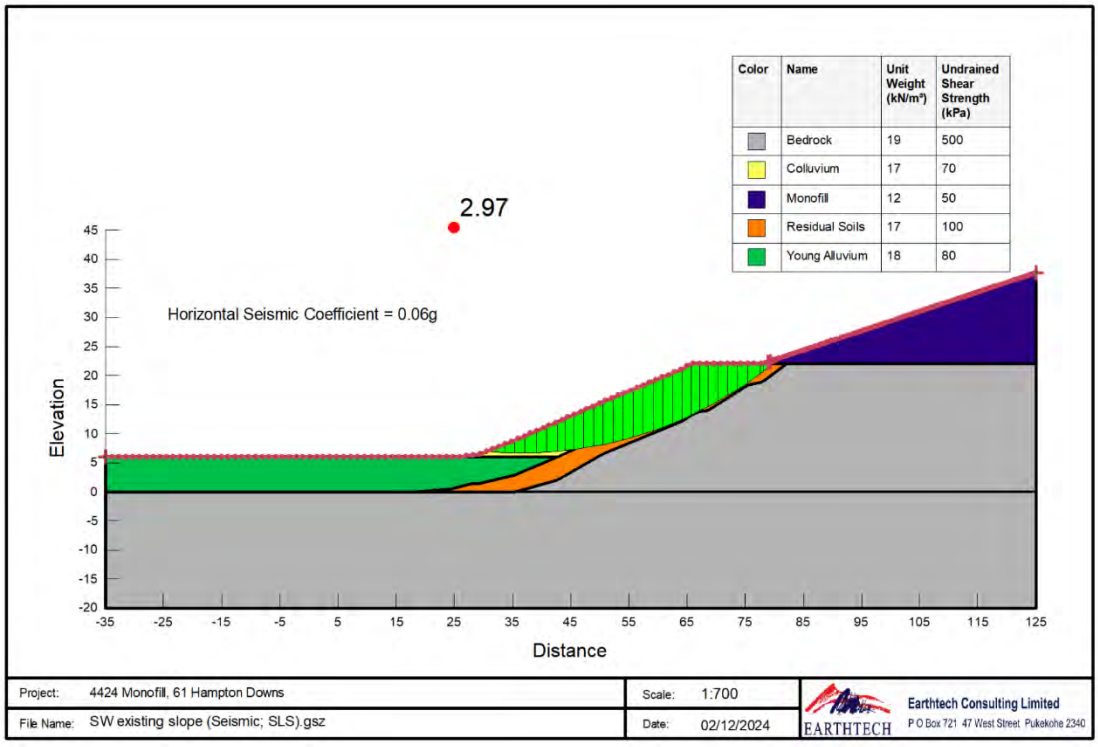
Color
Name
Unit Weight (kN/m³)
Undrained Shear Strength (kPa)
Bedrock 19 500
Colluvium 17 70
Monofill 12 50
Residual Soils 17 100
Young Alluvium 18 80
2.97
Horizontal Seismic Coefficient = 0.06g
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: SW existing slope (Seismic; SLS).gsz
Scale: 1:700
Date: 02/12/2024
EARTHTECH
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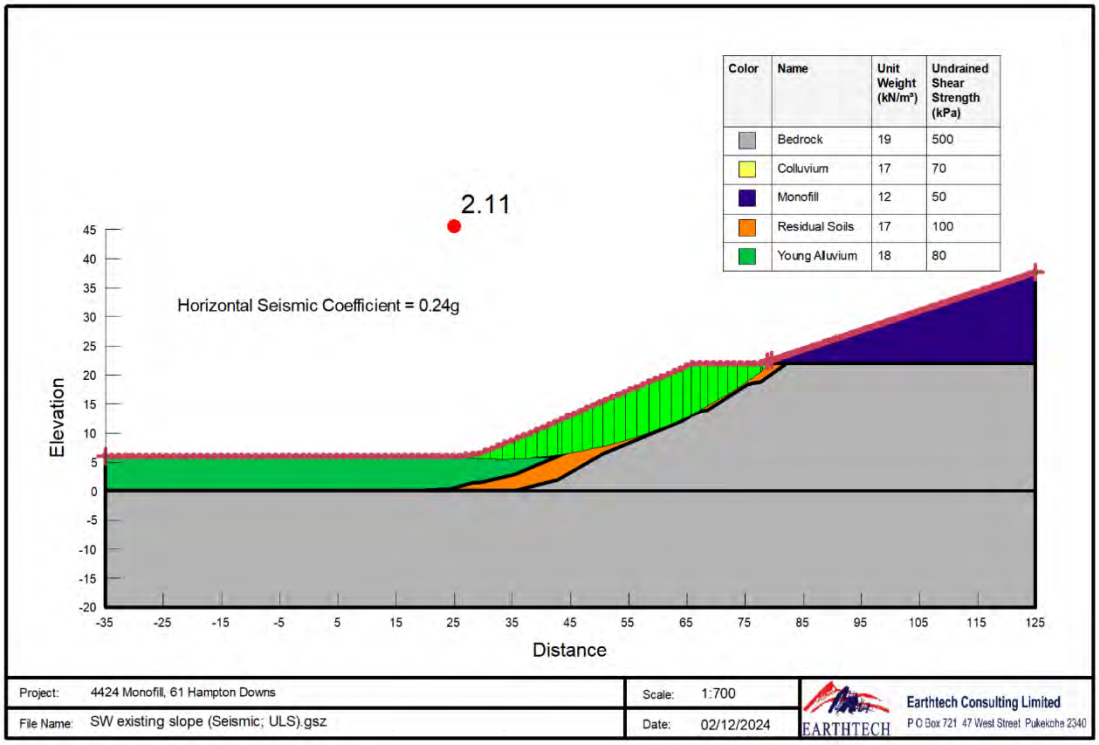
P O Box 721 47 West Street Pukekohe 2340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Name
Unit Weight (kN/m³)
Undrained Shear Strength (kPa)
Bedrock 19 500
Colluvium 17 70
Monofill 12 50
Residual Soils 17 100
Young Alluvium 18 80
2.11
Horizontal Seismic Coefficient = 0.24g
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: SW existing slope (Seismic; ULS).gsz
Scale: 1:700
Date: 02/12/2024
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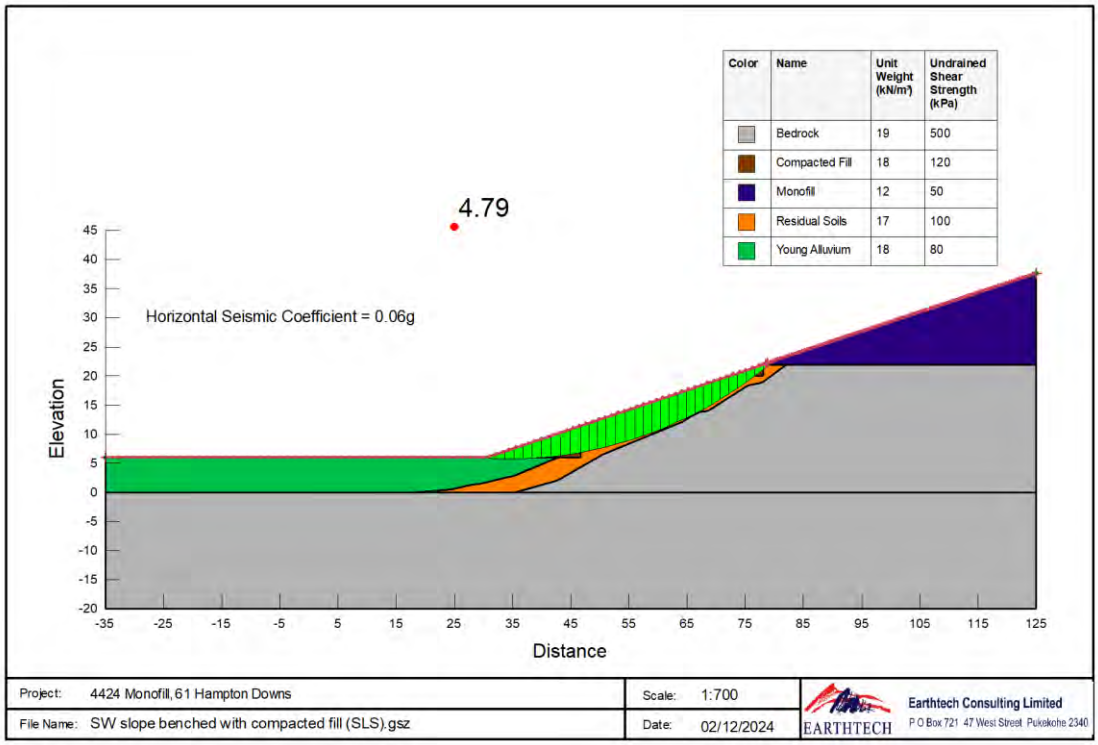
Color
Name
Unit Weight (kN/m³)
Undrained Shear Strength (kPa)
Bedrock 19 500
Compacted Fill 18 120
Monofill 12 50
Residual Soils 17 100
Young Alluvium 18 80
4.79
Horizontal Seismic Coefficient = 0.06g
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: SW slope benched with compacted fill (SLS).gsz
Scale: 1:700
Date: 02/12/2024
EARTHTECH
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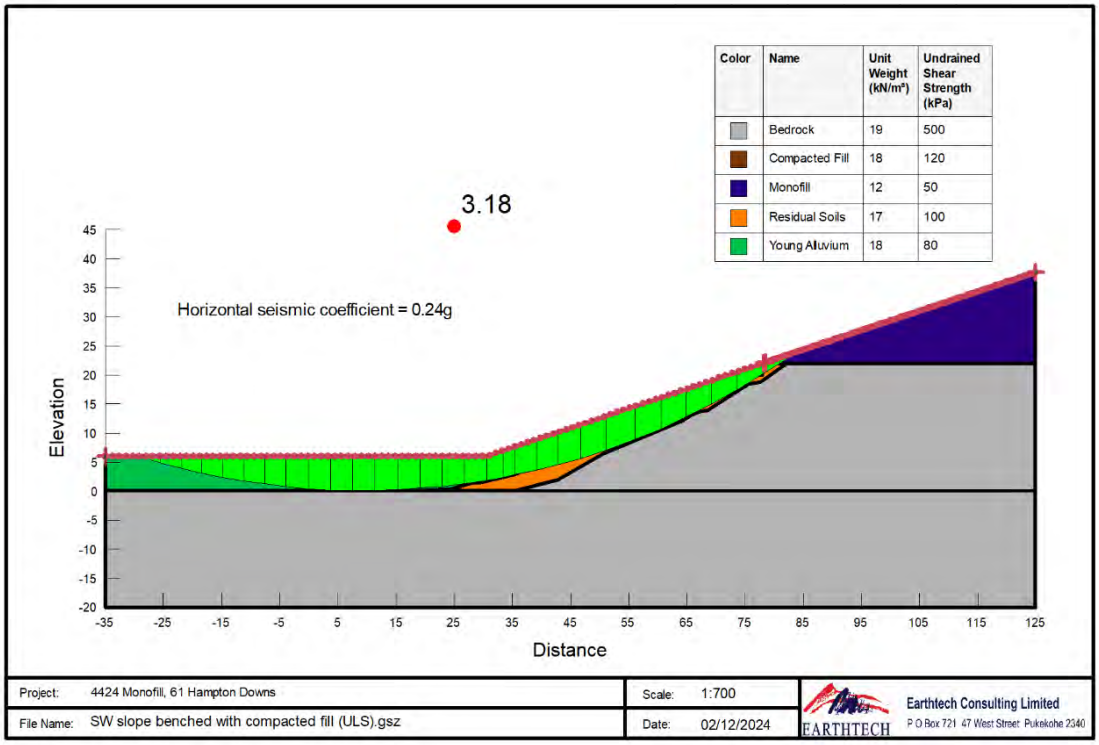
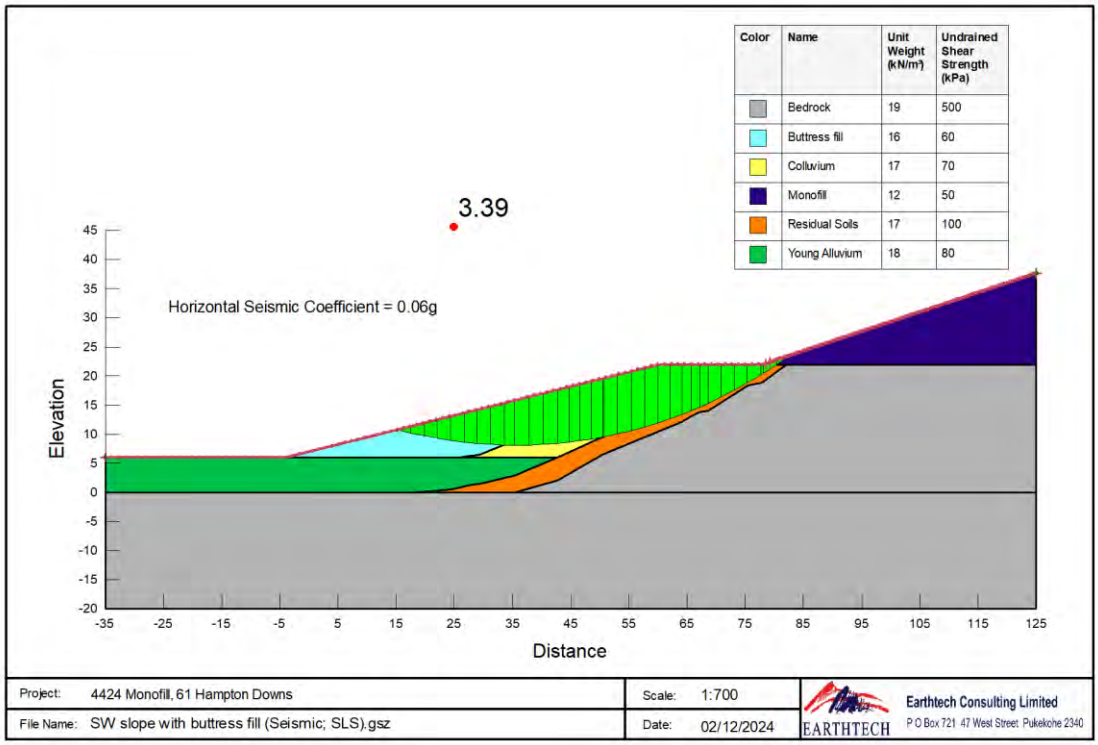
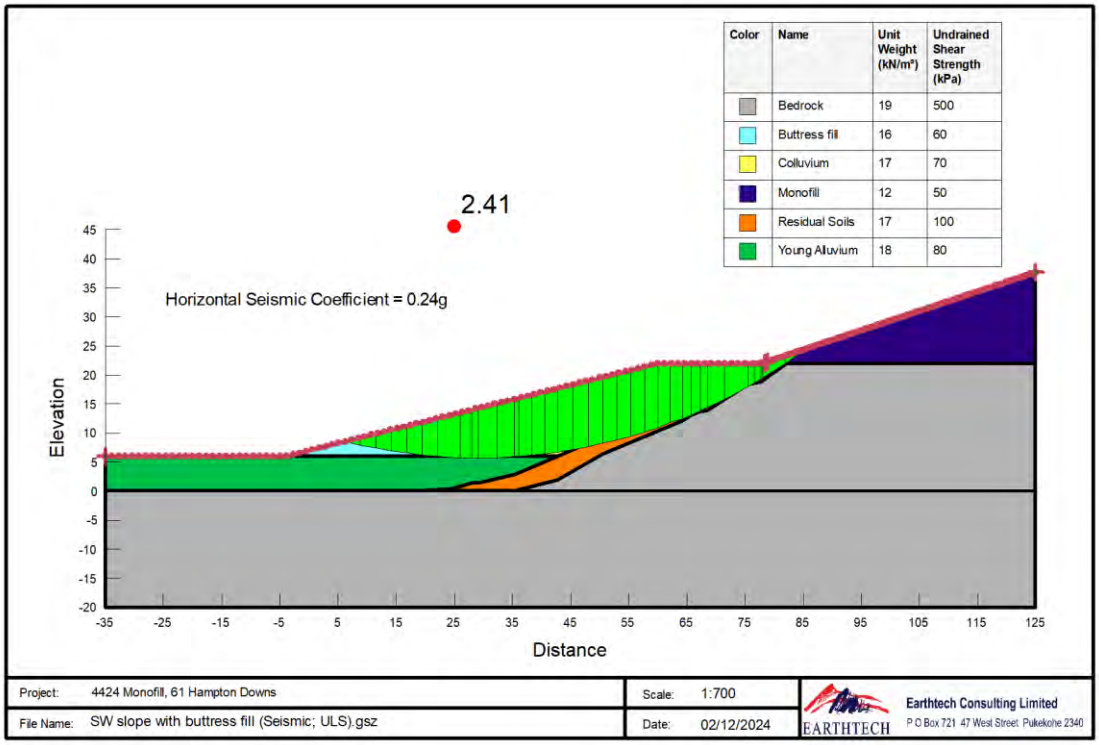
P O Box 721 47 West Street Pukekohe 2340


Color
Name
Unit Weight (kN/m³)
Undrained Shear Strength (kPa)
Bedrock 19 500
Compacted Fill 18 120
Monofill 12 50
Residual Soils 17 100
Young Alluvium 18 80
3.18
Horizontal seismic coefficient = 0.24g
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: SW slope benched with compacted fill (ULS).gsz
Scale: 1:700
Date: 02/12/2024
EARTHTECH
Earthtech Consulting Limited
P O Box 721 47 West Street Pukekohe 2340


Color
Name
Unit Weight (kN/m³)
Undrained Shear Strength (kPa)
Bedrock 19 500
Buttress fill 16 60
Colluvium 17 70
Monofill 12 50
Residual Soils 17 100
Young Alluvium 18 80
3.39
Horizontal Seismic Coefficient = 0.06g
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: SW slope with buttress fill (Seismic; SLS).gsz
Scale: 1:700
Date: 02/12/2024
EARTHTECH
Earthtech Consulting Limited
P O Box 721 47 West Street Pukekohe 2340



Project:	4424 Monofill, 61 Hampton Downs	Scale:	1:700
File Name:	SW slope with buttress fill (Seismic; ULS).gsz	Date:	02/12/2024

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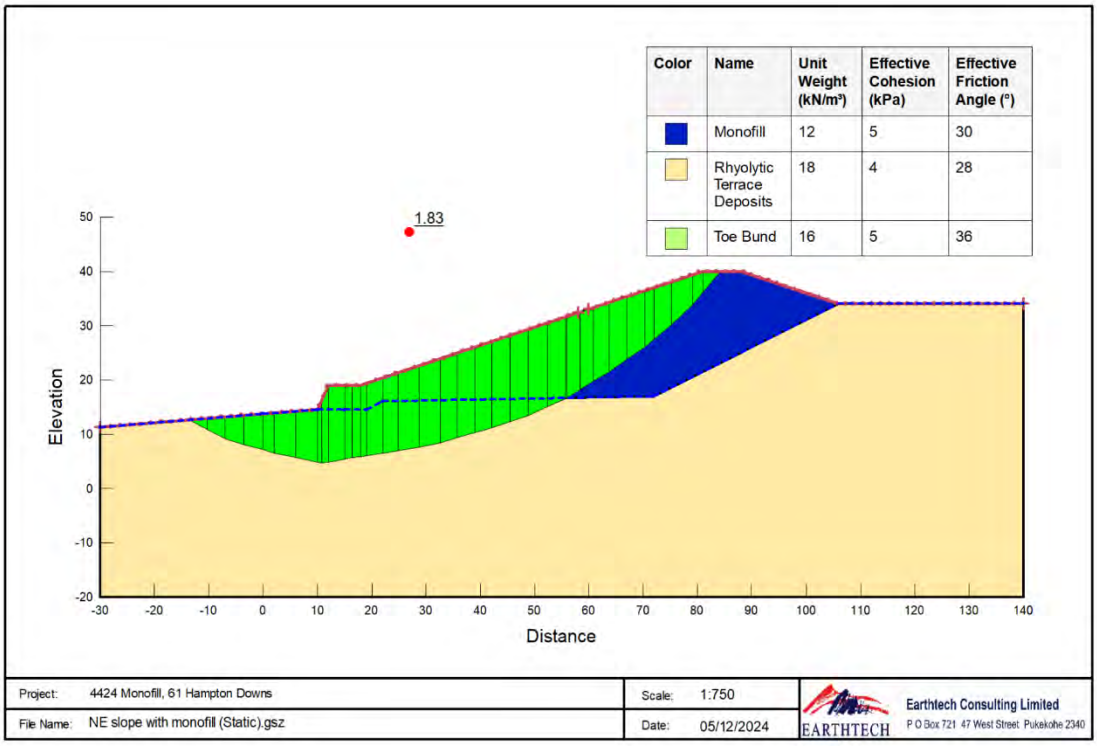
P O Box 721 47 West Street Pukekohe 2340

Preliminary Geotechnical Assessment

Green Steel Monofill, Hampton Downs

Appendix C2

Slope/W Output for Northeastern Monofill


Color
Name
Unit Weight (kN/m³)
Effective Cohesion (kPa)
Effective Friction Angle (°)
Monofill
12
5
30
Rhyolytic Terrace Deposits
18
4
28
Toe Bund
16
5
36
1.83
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: NE slope with monofill (Static).gsz
Scale: 1:750
Date: 05/12/2024
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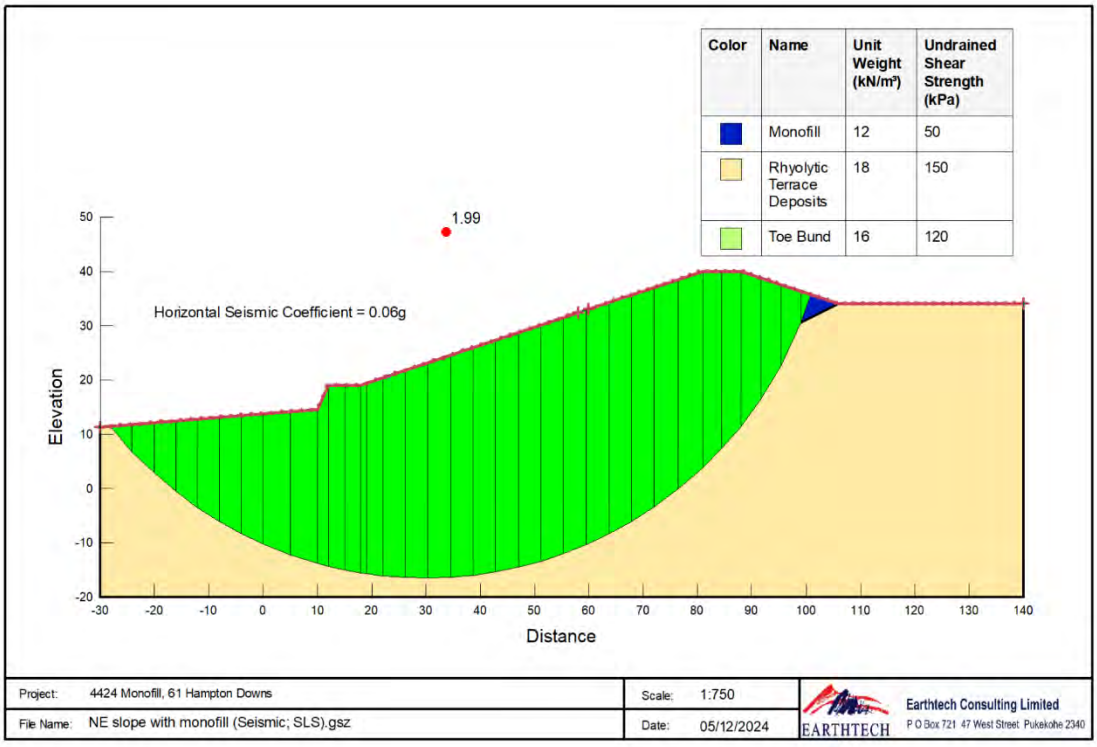
Color
Name
Unit Weight (kN/m³)
Undrained Shear Strength (kPa)
Monofill
12
50
Rhyolytic Terrace Deposits
18
150
Toe Bund
16
120
1.99
Horizontal Seismic Coefficient = 0.06g
Elevation
Distance
Project: 4424 Monofill, 61 Hampton Downs
File Name: NE slope with monofill (Seismic; SLS).gsz
Scale: 1:750
Date: 05/12/2024
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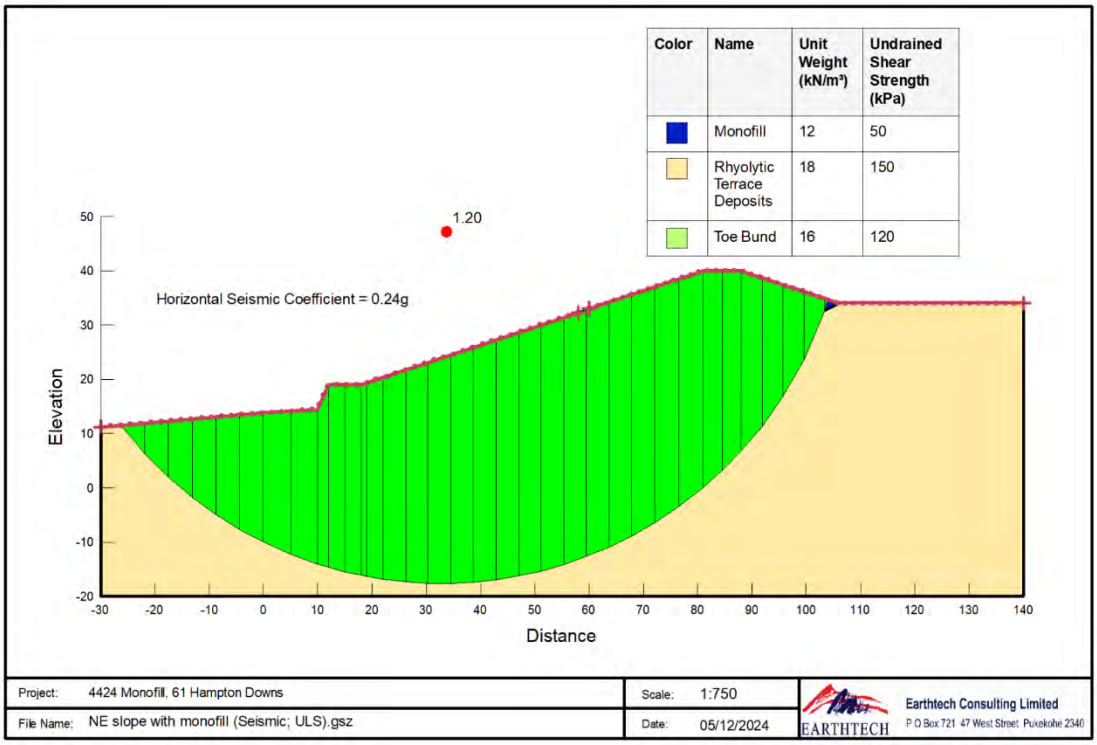

Project:	4424 Monofill, 61 Hampton Downs	Scale:	1:750
File Name:	NE slope with monofill (Seismic; ULS).gsz	Date:	05/12/2024

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Engineering Report

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Appendix C

Waste Lysimeter Trials Report

Includes:

R4424-3, Draft, 28 February 2025

Laboratory Test Results

Tonkin and Taylor Report, Characterisation Testing of Shredding Wastes, 1004057.000, 19 February 2019

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AHN/R4424-3/ls/cam

28 February 2025

The Managing Director
National Green Steel Limited
29 Hobill Avenue
Wiri
Manukau 2104

Attention: **Mr Vipan Garg**
vipan@nationalsteel.co.nz

Dear Sir

RE: WASTE LYSIMETER TRIALS: LEACHATE CHARACTERISATION TESTING AND FLOW RATES - MONOFILL AT THE GREEN STEEL PROJECT, 61 HAMPTON DOWNS ROAD

1. Background

The key determinant for a landfill (monofill) liner or barrier system, for any proposed waste containment site containing a material that may potentially pollute the natural receiving environment, is the quality and volume characteristics of the leachable liquid from such material. This leached liquid, typically referred to as '*leachate'* is produced by rainfall leaching through waste undergoing physical change, chemical breakdown and biodegradation within the waste body. The quality characteristics of this leachate will be specific to the waste floc material produced by National Steel's materials recovery processes, of end-of-life vehicles (ELVs) and whiteware.

An early study entitled 'Characterisation testing of shredding wastes' by Tonkin and Taylor (2019), attached to this letter report for reference, carried out two leaching tests on samples of the material, namely an SPLP (Synthetic Precipitation Leaching Procedure) and a TCLP (Toxicity Characteristic Leaching Procedure) test. The latter (TCLP) test is arguably more relevant to a landfilled waste body containing biodegradable organics (i.e. a Municipal Solid Waste (MSW) type landfill), and the former test is more relevant to the *real-life* situation (simulating normal atmospheric conditions) for a monofill located on the Green Steel site. Each test procedure involved testing of three 50*g* samples collected from the floc stockpile on 24 April 2018. Results were presented by Tonkin and Taylor (2019) for the six tests. Key parameters are presented in Table 2 (attached) of this letter report as the maximum recorded value of each of the SPLP and TCLP tests. Tonkin and Taylor (2019) concluded levels of concern with specific parameters – notably zinc and ethylene glycol. Other parameters of concern in the TCLP test were elevated levels of nickel and lead.

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Following a pre-consenting project introduction meeting with the Waikato Regional Council (WRC) and in a follow-up email letter on 22 January 2021 from Jonathan Caldwell (WRC) to Craig Shearer (National Steel's Planner), the WRC requested that Per- and Polyfluoroalkyl Substances (PFAS) be determined in the leaching water from the material to be monofilled.

Earthtech Consulting Limited (ECL) has carried out the engineering design of the proposed site and calculated that a potential leaching water volume of up to $12m^3$ per day for Stage 1, increasing to $21m^3$ per day could be generated by the site. If a very 'tight' cell-technique operation is employed (described herein) then such *leachate* water could be reduced.

In order to appropriately model actual waste leaching conditions, a waste lysimeter was established at National Steel's yard comprising an enclosed leaching column some $2m$ in height, subjected to water ingress equivalent to rainfall conditions that may occur on the proposed Green Steel site at 61 Hampton Downs Road, Hampton Downs, Waikato. A total of $1{,}526kg$ of waste floc was tested in the lysimeter over a period of two months.

2. Aim and Objectives of the Lysimeter Trials

The aim of the lysimeter trials was to determine the quality characteristics of water (leachate) that leaches through a depth of representative waste materials from National Steel's materials recovery processes, under rainfall conditions equivalent to the actual site. Furthermore, the aim was to provide an experimental apparatus that would mimic the actual (full-scale) monofill landfill leaching behavioural conditions, producing an equivalent leachate that can be analysed for quality characteristics.

Objectives of the trials were to:

i. Obtain a representative waste volume that is typical of the sustained output from the National Steel processes (in Manukau, Auckland) and establish a leaching column of such wastes of a practicably applicable height (of some $2m$);
ii. Subject the waste column to water ingress that accurately mimics rainfall conditions at the site. Lysimeter leaching conditions are to be over two (2) stages, i.e. (Stage 1) an initial flush stage and (Stage 2) a stage for ongoing or long-term representative leaching conditions;
iii. To assess any possible biodecomposition, biochemical or any chemical effects of the waste under field capacity (saturated) conditions;
iv. Sustain the trials for a period of eight weeks with regular sampling and analytical testing – specifically concentrating on the parameters of specific concern, i.e. PFAS, zinc, ethylene glycol, lead and nickel; and
v. To report on findings.

3. Per- and Polyfluoroalkyl Substances (PFAS)

Per- and Polyfluoroalkyl Substances (PFAS) are a large group of manufactured compounds that are used in a wide range of industrial applications. PFAS are the major components in legacy Aqueous Film Forming Foams (AFFF) firefighting products that met former military and domestic specifications (Eurofins, 2021). PFAS compounds are also used to repel oil and water in textile products like clothing, carpeting, furniture and car textiles, as well as in food packaging and in the manufacture of fluoropolymers used in non-stick cookware.

Some of the unique chemical characteristics that make PFAS compounds attractive for use in textiles, packaging and cookware, also render them resistant to biodegradation in the environment. Therefore,

PFAS compounds are persistent and have been widely reported to bioaccumulate in humans and wildlife. PFAS compounds have been found throughout the environment in groundwater, surface water, biosolids, soil and sediment, and studies have shown detections of PFAS in air, biota and food (Eberle, 2021).

4. Previous Findings

The previous findings originated from the report 'Characterisation testing of shredding wastes' (Tonkin and Taylor, 2019). The principal parameters of concern were established to be zinc and ethylene glycol from the SPLP testing procedure and lead and nickel from the TCLP testing procedure. A summary of the previous findings is listed as follows:

i. Under normal atmospheric conditions, the wastes generated leachate that generally complied with Class 2 landfill acceptance criteria, except for zinc concentrations which exceeded these criteria;
ii. Aside from the major minerals that are expected to be present (calcium, magnesium, potassium, sodium), zinc and ethylene glycol were reported at the highest concentrations in both the SPLP and TCLP analyses. Ethylene glycol is a primary component of antifreeze formulations used in motor vehicle engine cooling systems;
iii. The concentrations of zinc, nickel, and lead were reported to exceed Class 2 landfill criteria in the results of the TCLP analyses;
iv. The material may be suitable for disposal to a new Class 2 monofill (i.e. accepting only this waste type) if either:
    - There is potential to pre-treat the waste to reduce zinc concentrations; or
    - The facility is or can be designed in a way that mitigates zinc discharges; and
v. Unless pre-treatment, which could potentially include stabilisation, can be demonstrated to sufficiently reduce zinc concentrations, both a new monofill or stockpiling facility will need to be engineered to mitigate zinc discharges, i.e. appropriate lining required.

5. Establishment of the Trials and Methodology

The waste leaching lysimeter apparatus was established on 27 January 2021 at National Steel's property at 29 Hobill Avenue, Manukau. The apparatus, illustrated in Figure A below, contains a 2*m* column of representative wastes. The establishment of the trials is described in the notes provided in Table 1 below, including the set-up and testing stages of the methodology.

Water (leachate) samples from the lysimeter were tested at the Eurofins Environmental Laboratories located in New Zealand and Australia. Eurofins Environment Australia carried out the PFAS analyses.

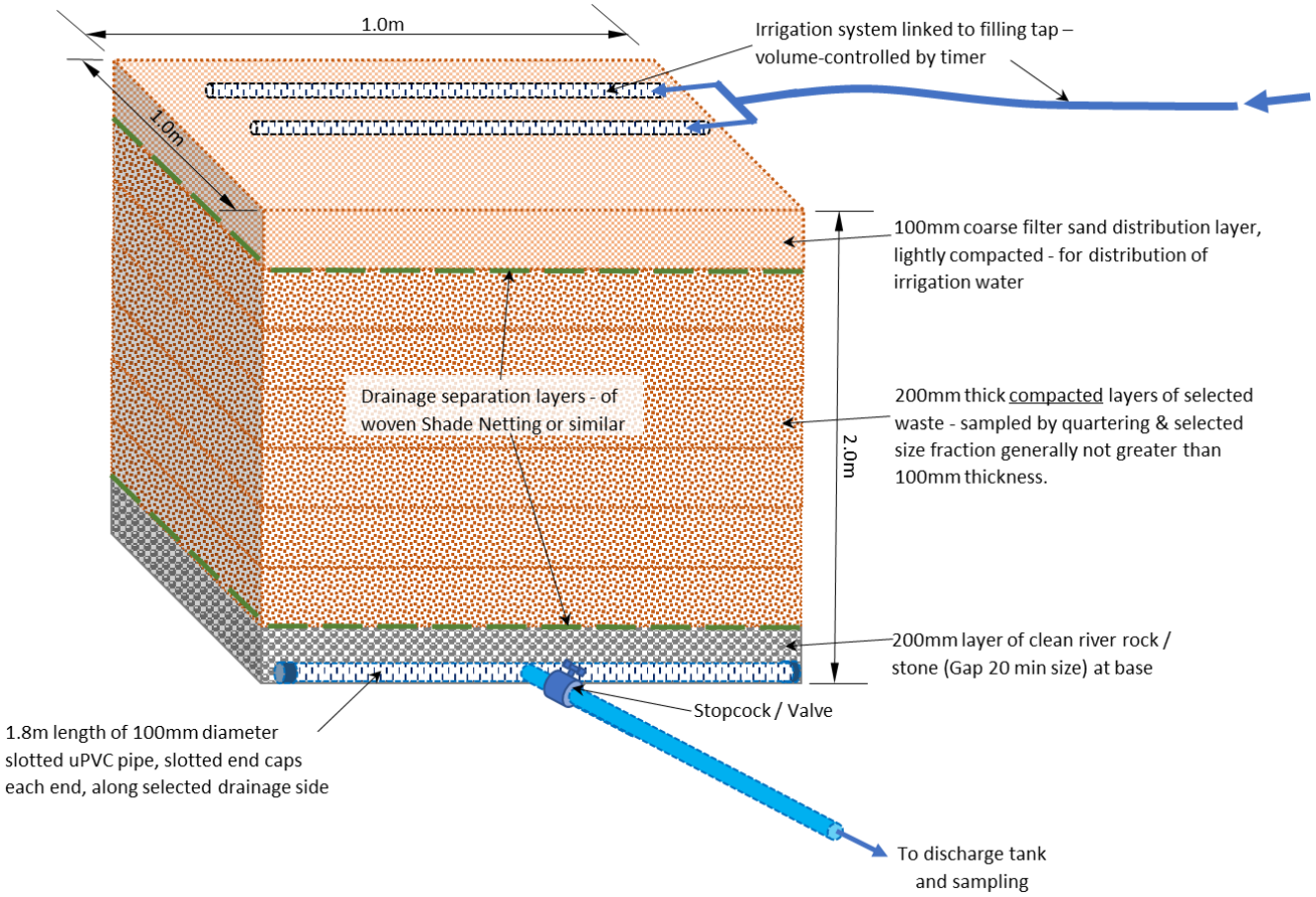


Figure A: National Steel's Monofill Waste Lysimeter Apparatus

6. Lysimeter Trials Findings and Results

The initial sampling from the waste lysimeter provided results that were somewhat closely comparable to those obtained by Tonkin and Taylor (2019), except for ethylene glycol. The latter results were distinctly lower throughout the trials for ethylene glycol. The representative wastes in the lysimeter were obtained off-conveyor during the course of several hours of production as well as from the stockpile in the yard where quartering techniques were employed. It is possible, whilst arguably *stating the obvious*, that the reason for ethylene glycol not being detected at any elevated levels throughout these lysimeter trials is owed to the representativity of the waste samples. Zinc levels were comparably higher, whilst lead and nickel levels were comparably similar across the combined range of analytical results of samples from the lysimeter.

PFAS levels were detected from samples but showed to be below recreational water quality levels as well as levels reported in the Ecological Freshwater Guideline PFAS Management Plan HEPA (PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA), January 2018) (PDP, 2019). PFAS levels during Stage 2, i.e. leaching conditions, displayed to be only at traceable levels of concentrations <0.1$\mu g/\ell$. Whilst found to not be a current concern, it can be recommended that PFAS checks be carried out on samples from the site in the future.

Zinc concentrations were initially high but dropped below the 1.0mg/ℓ threshold for a Class 2 and/or Class 3 landfill for ongoing leaching conditions of the wastes (Stage 2), with levels from 0.67mg/ℓ to

0.83*mg/ℓ*. Zinc concentrations during the initial flush stage (Stage 1) demonstrated elevated levels exceeding Class 1 landfill waste acceptance criteria (WAC) (WasteMINZ, 2023). Boron concentrations showed to initially exceed Class 2 and 3 landfill limits but lower than the Class 1 landfill limit, during the initial flush stage (Stage 1). Boron levels were then reduced to below Class 2 and 3 landfill limits during ongoing leaching conditions (Stage 2). Concentrations for chromium and lead showed to be lower than the 1.0*mg/ℓ* and 0.5*mg/ℓ* thresholds, respectively, for Class 2 and/or Class 3 landfills. Levels for nickel also showed to be lower than the 1.0*mg/ℓ* threshold for Class 2 and/or Class 3 landfills. Concentration levels for copper demonstrated to be up to 0.23*mg/ℓ* during the initial flush stage (Stage 1), reducing to traceable levels 0.003*mg/ℓ* during ongoing leaching conditions (Stage 2), hence lower than the 0.5*mg/ℓ* threshold, for Class 2 and/or Class 3 landfills.

The analytical results for the lysimeter trials are presented in Table 2 (attached), with L1-1 and L1-2 representing the initial flush results and L1-3 and L1-4 representing longer term conditions.

Table 1: National Steel's Monofill Waste Lysimeter Apparatus and Experimentation

Establishment on Wednesday 27 January 2021 at National Steel's Yard

Description	Qty	Units	Comment
Empty Bucket:	0.5	kg	
Full Bucket:	11.2	kg	Lightly Compacted Wastes
Water Added:	12.75	litres	
Mass of water:	12.75	kg	
Vol. of Bucket:	19	litres	
Void Ratio:	67%		
Full Bucket:	14.5	kg	Compacted Wastes (with 5kg hand tamper)
Vol. Water Added:	9.5	litres	
Void Ratio:	50%		
Density of Lightly Comp. Waste:	589.5	kg/m^3	
Density of Comp. Waste:	763.2	kg/m^3	
Lysimeter Vol Waste:	2,000	litres	
Surface Area:	1	m^2	
Est. Mass of Waste:	1,526	kg	
Field Capacity Vol Water:	1,000	litres	
Field Capacity Mass Water:	1,000	kg	
Irrigation Flow Rate:	8	litres/min	As measured
Stage 1			***Attaining Field Capacity Conditions***
No. Days to achieve Field Capacity:	5	days	To achieve field capacity
Volume of Water Reqd:	1,000	litres	To achieve field capacity
Adjustment of Timer:	192	litres/day	1 dose per hour
Time for Completion:	5.2	days	
Stage 2			***Attaining Steady Leaching Conditions***
Annual Rainfall (Max):	1,440	mm/year	
Volume of Water Reqd:	4	litres/day	To achieve equivalent rainfall conditions
Adjustment of Timer:	24	litres/day	1 dose per 8 hours - OK.

7. Monofill Leachate Strength Design Parameters

The monofill design, construction and operation are closely aligned to standard municipal solid waste (MSW) landfills. The waste floc is considered biologically 'inert' and distinctly very different to MSW. The waste body is, however, expected to behave physically in a similar manner in regard to leachate production rates. Leachate quality will be distinctly different to MSW landfill leachate since there will be no (or extremely low effects from) biological breakdown of the wastes. The leachate quality is expected to mirror the results obtained in the lysimeter trials. Predicted leachate quality concentrations for parameters of particular concern, for initial flush and longer-term leaching conditions, are provided in Table 3 below.

The initial flush strength parameters apply to Stage 1A, but as the existing fill ages in place, the strength is expected to reduce to the long-term leachate strength parameters.

Table 3: Leachate Quality Predictions from National Steel's Monofill

Leachate Lysimeter Apparatus and Experimentation

Establishment on Wednesday 27 January 2021 at National Steel's Yard

Leachate Quality Predictions*			
Parameter	Units	Initial Flush Leaching Strength	Long Term Leaching Strength
pH	-	7.0 to 7.1	7.2 to 7.3
PFAS	µg/l	0.700	<0.1
Boron	mg/l	5.0	0.8
Chromium (Cr)	mg/l	0.05	0.003
Copper (Cu)	mg/l	0.23	0.003
Iron	mg/l	47.0	0.05
Lead (Pb)	mg/l	0.22	0.18
Manganese (Mn)	mg/l	4.1	0.2
Nickel (Ni)	mg/l	0.32	0.002
Zinc (Zn)	mg/l	16.0	0.83
Ethylene glycol	mg/l	<20	<20
Chemical Oxygen Demand (COD)	mg/l	2,000	280

*based on lysimeter trials set up on 27/01/2021

8. Filling Techniques to Reduce Leachate Volumes

The majority of the site extends over Amokura Formation and rhyolitic terrace deposits geology. Overall, this geology underlying the proposed monofill (two areas within the Green Steel site, i.e. southwest and northeast) is characterised by low permeability soils and rock that provide favourable conditions for secondary site containment of monofill leachate. Notwithstanding this, the reduction (or minimisation) of water ingress into the monofill is crucial to ensure that leachate production is minimal.

The proposed filling technique to be employed is that of the 'Cellular Technique' whereby small individual 'cells' are planned, stormwater appropriately managed around such cells, rainwater ingress

minimised through the use of temporary covers and a continued (daily) cover-soil operation, with a *bottom-up* or *top-down* filling approach applied. This technique is illustrated in the indicative sketches of Figure B below:

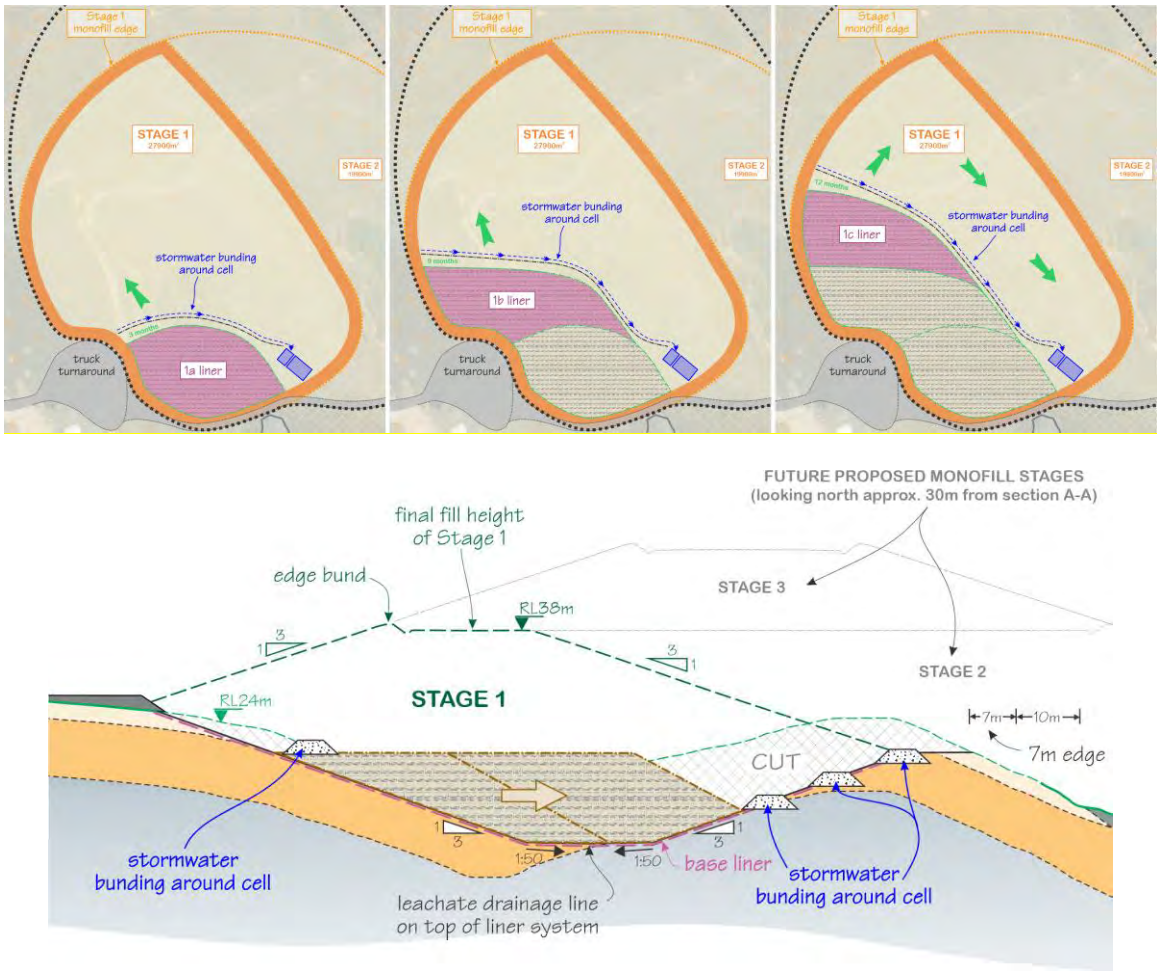


Figure B: Indicative Sketches Illustrating Cellular Filling Technique for the Monofill

9. Monofill Leachate Production Rates

Leachate flow is essentially created by rainfall which infiltrates cover and capping materials and slowly percolates through the waste body to collect in the purpose designed leachate collection layer which sits directly on top of the landfill liner. Daily leachate flow is affected by:

- daily rainfall
- daily evaporation
- surface area of exposed waste
- cover and capping layers that deflect the rainfall
- absorptive capacity (or loss) of the waste – also referred to as 'field capacity'
- rate of placement of the waste and compactive effort
- diversion controls in place to divert clean water run-off

Typical MSW landfills generally return leachate flows as a percentage of annual rainfall as follows:

Operational Area	Intermediate Cover Area	Final Cap Area
20%	12%	7%

Leachate flow rates are highly sensitive to major storm events and the integrity of the cover at the time of the event. Best estimates to indicate likely flows have been calculated on the basis of a high-end 1.4*m* of annual average rainfall, provided in the table below.

Monofill Stage	Total Area	Unit	Operational 20%	Volume	Intermediate Cover 12%	Volume	Final Cover 7%	Volume	Total Est. Leachate Production
			Area (ha)	(m^3/day)	Area (ha)	(m^3/day)	Area (ha)	(m^3/day)	(m^3/day)
Stage 1a (SW Monofill)	50 x 100 Area = 5,000 0.5	m^2 ha	0.5	3.8	-	0	-	0	**3.8**
Stages 1 & 2 (SW Monofill)	27,000 2.7	m^2 ha	0.5	3.8	1.2	5.5	1.0	2.7	**12.0**
Stages 3 & 4 (SW Monofill)	2.7 +1.45 = 4.15	ha	0.5	3.8	1.55	7.1	2.1	5.6	**16.6**
Stages 1 & 2 (NE Monofill)	0.5 + 1.54 = 2.04	ha	0.5	3.8	1.04	4.8	0.5	1.3	**10.0**
Long Term (All Monofill Stages)	6.2	ha	0	0.0	0	0.0	6.2	16.7	**16.7**

As the monofill increases with size, the buffering capacity of the site increases, and daily averages should be more accurate. At the start of filling, the entire site is operational over 0.5*ha* and exposed to a single heavy rainfall event. Hence, the above estimates need to be interpreted with caution and allowance for unforeseen events (heavy rainfall and maximum operational area). Seasonal influences can be very strong, with higher flows often in winter (June to November) and lower flows in summer (notwithstanding any extreme climatic event, e.g. the high rainfall and cyclone events that occurred in January through February 2023).

The site should be designed to accommodate the following leachate flows during the operation of both monofill areas in any sequence:

- Year 1 – 4m^3/*day* with peak of 12m^3/*day* over three days
- Year 5 – 17m^3/*day* with peak of 30m^3/*day* over three days
- Year 10 – 27m^3/*day* with peak of 50m^3/*day* over three days

  Long-term flow rate estimate at 17m^3/*day* (combined monofills)

10. Conclusions and Recommendations

The monofill waste lysimeter trials were sustained for some eight weeks, allowing for appropriate flushing to mimic rainfall waters through a column of representative wastes (from National Steel's materials recovery processes). Regular sampling and analytical testing were carried out across the trial period, specifically concentrating on the parameters of specific concern, i.e. PFAS, zinc, ethylene glycol, lead and nickel.

Previous investigation works by others (Tonkin and Taylor, 2019) reported zinc and ethylene glycol as the highest concentrations in both the SPLP and TCLP analyses. The concentrations of zinc, nickel, and lead were reported to exceed Class 2 landfill criteria in the results of the TCLP analyses. A conclusion of this previous work was that unless pre-treatment, which could potentially include stabilisation, can be demonstrated to sufficiently reduce zinc concentrations, a new monofill will need to be engineered to mitigate zinc discharges, e.g. appropriate lining (as a minimum).

Zinc levels were found to be comparably higher than the Tonkin and Taylor (2019) results during the initial flush (Stage 1) conditions. During ongoing leaching conditions (Stage 2), zinc concentrations showed to be below the 1mg/ℓ threshold for a Class 2 and/or Class 3 landfill, with levels from 0.67mg/ℓ to 0.83mg/ℓ.

PFAS levels were detected from the wastes under initial flush conditions (Stage 1). However, under long-term leaching conditions (Stage 2), showed to be below recreational water quality levels as well as below levels reported in the Ecological Freshwater Guideline PFAS Management Plan HEPA (PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA), January 2018) (PDP, 2019). Whilst found not to be a current concern, PFAS checks could be carried out on samples from the site in the future as part of the monitoring protocol.

Leachate quality predictions and estimated flows are provided in this report for the proposed life of the monofill operations. Extreme weather events can significantly alter these figures. Therefore, an operational plan should be closely followed to ensure that rainfall ingress is minimised throughout the operational phase of the monofill.

The lysimeter trials have demonstrated the importance of scale whereby laboratory scale has been increased to pilot-plant scale magnitude, with representativity of the wastes and equatable environmental conditions. Indeed, the initial results for some parameters of concern showed to be similar to the findings by others – wherein the SPLP test results were found to be comparable. The water effluent (leachate) quality concentrations for the parameters of particular concern (PFAS, zinc, ethylene glycol, lead and nickel levels) have shown to be below the concentration thresholds for Class 2 and Class 3 landfills. The lysimeter trials demonstrated long-term leaching conditions for the combined range of analytical results of samples. Zinc levels during the initial flush life phase of the monofill will be elevated. Additionally, the nature of the wastes that are to be disposed, or stored for a lengthy period in the proposed monofill are definably 'non-putrescible industrial/commercial wastes' (WasteMINZ, 2023).

In conclusion, a Class 2 landfill lining system is recommended for a proposed monofill facility on the Green Steel site at 61 Hampton Downs Road, Hampton Downs, Waikato.

Predicted leachate quality parameters and quantities are provided in this report to calculate environmental loadings.

Yours faithfully

LINDSAY STRACHAN CPEng.
Senior Engineer
EARTHTECH CONSULTING LTD

A H NELSON CPEng.
Principal Geotechnical Engineer
EARTHTECH CONSULTING LTD

Encls: Table 2 – National Steel's Monofill Waste Lysimeter Trials Analytical Results
Lysimeter Establishment Presentation
Full Laboratory Results for LS-1, LS-2, LS-3 and LS-4 Samples
Tonkin and Taylor (2019) Report

References

Eurofins (2021) — *Eurofins Environmental Testing - PFAS Analysis in New Zealand*. environment.eurofins.com.au

Eberle (2021) — Remediation Journal - Evaluation of the effects of PFAS soil adsorption and transformation in the presence of divalent cations under ambient conditions, and https://regenesis.com/wp-content/uploads/2021/10/2021_McGregor-Zhao_PFAS-TCE_rem.21675.pdf (2021)

PDP (2019) — HEPA (PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA), January 2018). From Pattle Delamore Partners (2019) report on PFAS (https://www.mfe.govt.nz/sites/default/files/media/Land/woodbourne-csir-2019-part-1.pdf)

Tonkin and Taylor (2019) — *Characterisation testing of shredding wastes.* Report submitted to Mr Vipan Garg, National Steel, 19 February 2019. Tonkin and Taylor, Job No: 1004057.0000.

WasteMINZ (2023) — *Technical Guidelines for Disposal to Land*. Waste Management Institute New Zealand (WasteMINZ), Revision 3.1, September 2023.

Table 2: National Steel's Monofill Waste Lysimeter Trials Analytical Results

Leachate Lysimeter Apparatus and Experimentation

Establishment on Wednesday 27 January 2021 at National Steel's Yard

				MONOFILL WASTE LYSIMETER TRIALS												
				Initial Flush (Stage 1)		Leaching Conditions (Stage 2)										
Parameter	**Units**	**T&T (2019) Results**		**Result L1-1** (Eurofins Ref.: Sample 1)	**Result L1-2** (Eurofins Ref.: Sample 2)	**Result L1-3** (Eurofins Ref.: L1)	**Result L1-4** (Eurofins Ref.: L2)	**Class 1 Landfill**	**Class 2 Landfill**	**Class 3 Landfill**	**Freshwater Trigger**	**Drinking Water+**	**Recreational Water Quality++**	**Ecological Freshwater Guideline - 99% Ecosystem Protection***	**Ecological Freshwater Guideline - 95% Ecosystem Protection***	**Ecological Freshwater Guideline - 90% Ecosystem Protection***
		SPLP	**TCLP**													
Dates				**3-Feb-21**	**11-Feb-21**	**9-Mar-21**	**23-Mar-21**									
pH	-	8.0		7.0	7.1	7.3	7.2	5.9 – 8.5	5.9 – 8.3	>6.5pH<8.5						
PFAS (Sum)	µg/l	not tested		0.665	0.682	<0.1	<0.1	no limit	no limit	no limit						
Sum (PFHxS + PFOS)	µg/l	not tested		0.082	0.114	<0.1	<0.1	no limit	no limit	no limit		0.070	2.0			
PFOA (Sum)	µg/l	not tested		0.133	0.142	<0.1	<0.1	no limit	no limit	no limit		0.560	10.0	19.0	220	632
Total PFOS	µg/l	not tested		0.192	0.234	<0.1	<0.1	no limit	no limit	no limit				0.00023	0.130	2.0
Boron (B)	mg/l	0.670	1.010	5.0	4.3	0.640	0.820	20.0	2.0	2.0						
Chromium (Cr)	mg/l	0.018	<0.011	0.048	0.022	0.002	0.003	5.0	1.0	0.5						
Copper (Cu)	mg/l	0.129	0.139	0.230	0.150	0.003	0.002	5.0	0.5	0.5						
Iron (Fe)	mg/l	not tested	not tested	47.0	25.0	<0.05	<0.05	no limit	no limit	no limit						
Lead (Pb)	mg/l	0.087	1.070	0.220	0.190	0.024	0.180	5.0	1.0	0.5	0.0034					
Manganese (Mn)	mg/l	not tested	not tested	4.1	3.0	0.110	0.190	no limit	no limit	no limit						
Nickel (Ni)	mg/l	0.050	1.880	0.320	0.190	0.001	0.002	10.0	1.0	1.0	0.011					
Zinc (Zn)	mg/l	5.60	73.00	5.2	16.0	0.670	0.830	10.0	1.0	1.0	0.008					
Ethylene glycol	mg/l	123.0	100.0	<20	<20	<20	<20	no limit	no limit	no limit	0.33					
Chemical Oxygen Demand (COD)	mg/l	not tested	not tested	2,000	1,300	86	280	no limit	no limit	no limit						

Notes:

+ MOH (Ministry of Health - MoH, 2017)

++ AGNHMRC (Australian Govt Health and Medical Research Council (2019)

* HEPA - PFAS Management Plan: Heads of EPA's Australian and New Zealand (HEPA) (Jan, 2018)

Concentration limits for Class 1, 2 and 3 landfills refer to maximum allowable TCLP concentrations

Denotes where a Class 1 Landfill limit is exceeded

GREEN STEEL MONOFILL

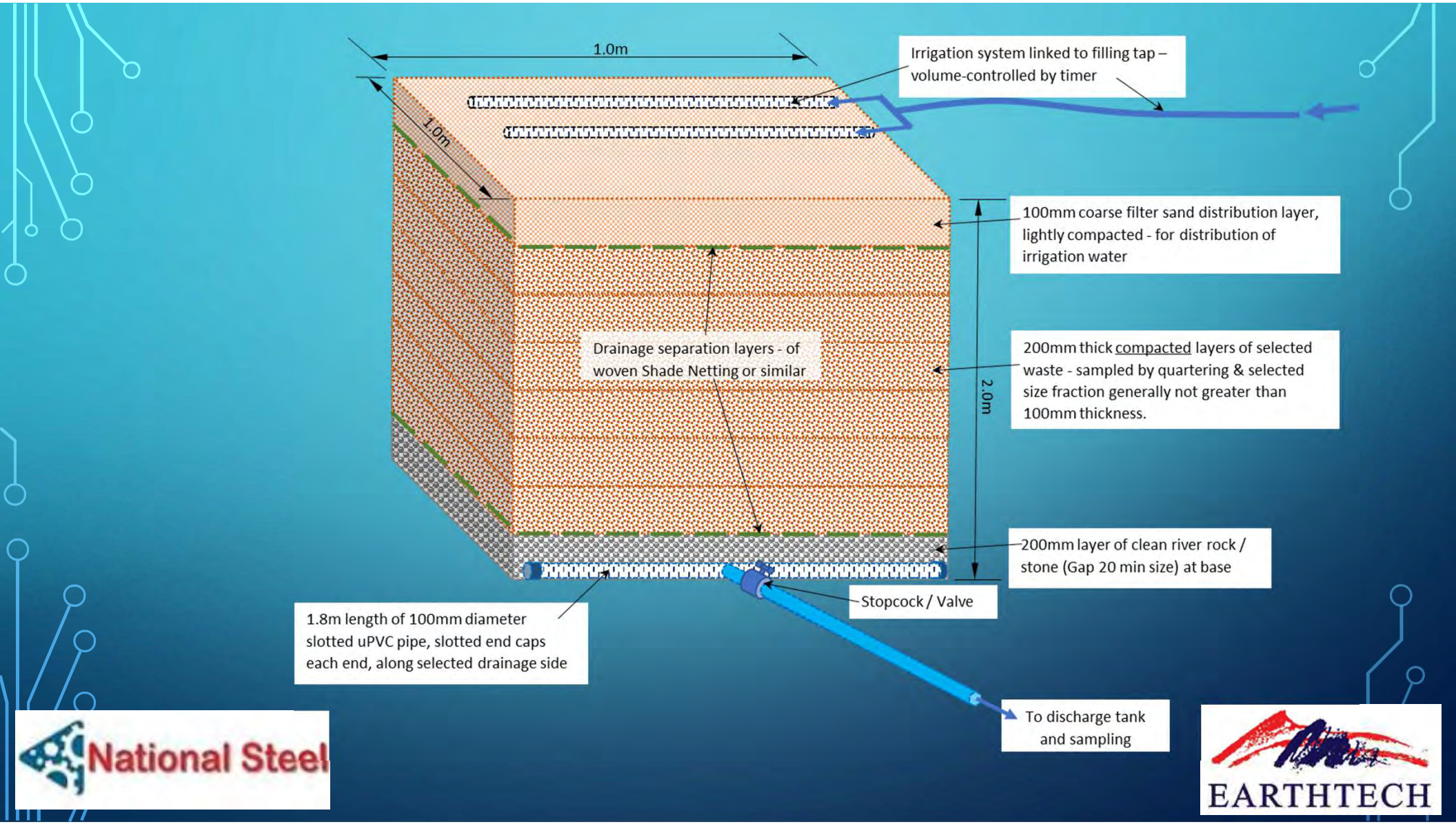
61 HAMPTON DOWNS ROAD, HAMPTON DOWNS, WAIKATO

Leachate Lysimeter Apparatus Establishment

27 JANUARY 2021

National Steel

EARTHTECH



National Steel

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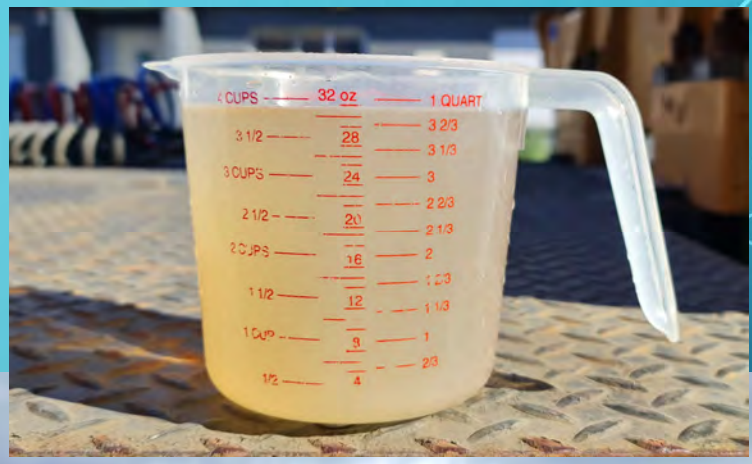
4 CUPS
32 oz
1 QUART
3 1/2
28
3 2/3
3 CUPS
24
3
2 1/2
20
2 2/3
2 CUPS
16
2
1 1/2
12
1 1/3
1 CUP
8
1
1/2
4
2/3


PFOS/PFOA/Fluorotelomers
Client: NATIONAL STEEL
Ref: 4197
Sample ID: "L2" LYSIMETER
Date/Time: 23/03/2021
Sampled By: LINDSAY 0210259386
Inorganics
Client: NATIONAL STEEL
Ref: 4197
Sample ID: "L2" LYSIMETER
Date/Time: 23/03/2021
Sampled By: LINDSAY 021 025938
Semi-Volatile Organics
Client: NATIONAL STEEL
Ref: 4197
Sample ID: "L2" LYSIMETER
Date/Time: 23/03/2021
Sampled By: LINDSAY 021 025938
Preserved Inorganics
Client: NATIONAL STEEL
Ref: 4197
Sample ID: "L2"
Date/Time: 23/03/2021
Sampled By: LINDSAY 021 025938
Metals

National Steel Ltd
29 Hobill Avenue
Wiri Maukau Auckland
NZ 2104

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection and proficiency testing scheme providers reports.

Attention: **Brett Howlett**

Report **782420-W_INT**
Project name
Project ID 4197
Received Date Mar 24, 2021

Client Sample ID			**L1**	**L2**
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**K21-Ma43216**	**K21-Ma43217**
Date Sampled			**Mar 09, 2021**	**Mar 23, 2021**
Test/Reference	LOR	Unit		
Volatile Organics				
1.1-Dichloroethane	0.001	mg/L	< 0.001	< 0.001
1.1-Dichloroethene	0.001	mg/L	< 0.001	< 0.001
1.1.1-Trichloroethane	0.001	mg/L	< 0.001	< 0.001
1.1.1.2-Tetrachloroethane	0.001	mg/L	< 0.001	< 0.001
1.1.2-Trichloroethane	0.001	mg/L	< 0.001	< 0.001
1.1.2.2-Tetrachloroethane	0.001	mg/L	< 0.001	< 0.001
1.2-Dibromoethane	0.001	mg/L	< 0.001	< 0.001
1.2-Dichlorobenzene	0.001	mg/L	< 0.001	< 0.001
1.2-Dichloroethane	0.001	mg/L	< 0.001	< 0.001
1.2-Dichloropropane	0.001	mg/L	< 0.001	< 0.001
1.2.3-Trichloropropane	0.001	mg/L	< 0.001	< 0.001
1.2.4-Trimethylbenzene	0.001	mg/L	< 0.001	0.003
1.3-Dichlorobenzene	0.001	mg/L	< 0.001	< 0.001
1.3-Dichloropropane	0.001	mg/L	< 0.001	< 0.001
1.3.5-Trimethylbenzene	0.001	mg/L	< 0.001	< 0.001
1.4-Dichlorobenzene	0.001	mg/L	< 0.001	< 0.001
2-Butanone (MEK)	0.001	mg/L	< 0.001	< 0.001
2-Propanone (Acetone)	0.001	mg/L	0.009	0.049
4-Chlorotoluene	0.001	mg/L	< 0.001	< 0.001
4-Methyl-2-pentanone (MIBK)	0.001	mg/L	< 0.001	0.004
Allyl chloride	0.001	mg/L	< 0.001	< 0.001
Benzene	0.001	mg/L	< 0.001	0.001
Bromobenzene	0.001	mg/L	< 0.001	< 0.001
Bromochloromethane	0.001	mg/L	< 0.001	< 0.001
Bromodichloromethane	0.001	mg/L	< 0.001	< 0.001
Bromoform	0.001	mg/L	< 0.001	< 0.001
Bromomethane	0.001	mg/L	< 0.001	< 0.001
Carbon disulfide	0.001	mg/L	< 0.001	< 0.001
Carbon Tetrachloride	0.001	mg/L	< 0.001	< 0.001
Chlorobenzene	0.001	mg/L	< 0.001	< 0.001
Chloroethane	0.001	mg/L	< 0.001	< 0.001
Chloroform	0.005	mg/L	< 0.005	< 0.005
Chloromethane	0.001	mg/L	< 0.001	< 0.001
cis-1.2-Dichloroethene	0.001	mg/L	< 0.001	< 0.001
cis-1.3-Dichloropropene	0.001	mg/L	< 0.001	< 0.001

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Volatile Organics				
Dibromochloromethane	0.001	mg/L	< 0.001	< 0.001
Dibromomethane	0.001	mg/L	< 0.001	< 0.001
Dichlorodifluoromethane	0.001	mg/L	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	0.002
Iodomethane	0.001	mg/L	< 0.001	< 0.001
Isopropyl benzene (Cumene)	0.001	mg/L	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	0.005
Methylene Chloride	0.001	mg/L	0.001	0.006
o-Xylene	0.001	mg/L	< 0.001	0.004
Styrene	0.001	mg/L	< 0.001	< 0.001
Tetrachloroethene	0.001	mg/L	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	0.009
trans-1.2-Dichloroethene	0.001	mg/L	< 0.001	< 0.001
trans-1.3-Dichloropropene	0.001	mg/L	< 0.001	< 0.001
Trichloroethene	0.001	mg/L	< 0.001	< 0.001
Trichlorofluoromethane	0.001	mg/L	0.009	0.017
Vinyl chloride	0.001	mg/L	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	0.010
Total MAH*	0.003	mg/L	< 0.003	0.021
Vic EPA IWRG 621 CHC (Total)*	0.005	mg/L	< 0.005	0.006
Vic EPA IWRG 621 Other CHC (Total)*	0.005	mg/L	< 0.005	0.006
4-Bromofluorobenzene (surr.)	1	%	106	110
Toluene-d8 (surr.)	1	%	92	111
Glycols*				
Di-Ethylene Glycol*	20	mg/L	< 20	< 20
Ethylene glycol*	20	mg/L	< 20	< 20
Propylene glycol*	20	mg/L	< 20	< 20
Triethylene glycol*	20	mg/L	< 20	< 20
Polychlorinated Biphenyls				
Aroclor-1016	0.001	mg/L	< 0.001	< 0.001
Aroclor-1221	0.001	mg/L	< 0.001	< 0.001
Aroclor-1232	0.001	mg/L	< 0.001	< 0.001
Aroclor-1242	0.001	mg/L	< 0.001	< 0.001
Aroclor-1248	0.001	mg/L	< 0.001	< 0.001
Aroclor-1254	0.001	mg/L	< 0.001	< 0.001
Aroclor-1260	0.001	mg/L	< 0.001	< 0.001
Total PCB*	0.001	mg/L	< 0.001	< 0.001
Dibutylchlorendate (surr.)	1	%	127	94
Tetrachloro-m-xylene (surr.)	1	%	109	107
Total Petroleum Hydrocarbons (NZ MfE 1999)				
TPH-SG C7-C9	0.1	mg/L	< 0.1	< 0.1
TPH-SG C10-C14	0.2	mg/L	< 0.2	< 0.2
TPH-SG C15-C36	0.4	mg/L	< 0.4	< 0.4
TPH-SG C7-C36 (Total)	0.7	mg/L	< 0.7	< 0.7
Semivolatile Organics				
2-Methyl-4.6-dinitrophenol	0.03	mg/L	< 0.03	< 0.03
1-Chloronaphthalene	0.005	mg/L	< 0.005	< 0.005
1-Naphthylamine	0.005	mg/L	< 0.005	< 0.005
1.2-Dichlorobenzene	0.005	mg/L	< 0.005	< 0.005

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
1.2.3-Trichlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.2.3.4-Tetrachlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.2.3.5-Tetrachlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.2.4-Trichlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.2.4.5-Tetrachlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.3-Dichlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.3.5-Trichlorobenzene	0.005	mg/L	< 0.005	< 0.005
1.4-Dichlorobenzene	0.005	mg/L	< 0.005	< 0.005
2-Chloronaphthalene	0.005	mg/L	< 0.005	< 0.005
2-Chlorophenol	0.003	mg/L	< 0.003	< 0.003
2-Methylnaphthalene	0.005	mg/L	< 0.005	< 0.005
2-Methylphenol (o-Cresol)	0.003	mg/L	< 0.003	< 0.003
2-Naphthylamine	0.005	mg/L	< 0.005	< 0.005
2-Nitroaniline	0.005	mg/L	< 0.005	< 0.005
2-Nitrophenol	0.01	mg/L	< 0.01	< 0.01
2-Picoline	0.005	mg/L	< 0.005	< 0.005
2.3.4.6-Tetrachlorophenol	0.01	mg/L	< 0.01	< 0.01
2.4-Dichlorophenol	0.003	mg/L	< 0.003	< 0.003
2.4-Dimethylphenol	0.003	mg/L	< 0.003	< 0.003
2.4-Dinitrophenol	0.03	mg/L	< 0.03	< 0.03
2.4-Dinitrotoluene	0.005	mg/L	< 0.005	< 0.005
2.4.5-Trichlorophenol	0.01	mg/L	< 0.01	< 0.01
2.4.6-Trichlorophenol	0.01	mg/L	< 0.01	< 0.01
2.6-Dichlorophenol	0.003	mg/L	< 0.003	< 0.003
2.6-Dinitrotoluene	0.005	mg/L	< 0.005	< 0.005
3&4-Methylphenol (m&p-Cresol)	0.006	mg/L	< 0.006	0.008
3-Methylcholanthrene	0.005	mg/L	< 0.005	< 0.005
3.3'-Dichlorobenzidine	0.005	mg/L	< 0.005	< 0.005
4-Aminobiphenyl	0.005	mg/L	< 0.005	< 0.005
4-Bromophenyl phenyl ether	0.005	mg/L	< 0.005	< 0.005
4-Chloro-3-methylphenol	0.01	mg/L	< 0.01	< 0.01
4-Chlorophenyl phenyl ether	0.005	mg/L	< 0.005	< 0.005
4-Nitrophenol	0.03	mg/L	< 0.03	< 0.03
4.4'-DDD	0.005	mg/L	< 0.005	< 0.005
4.4'-DDE	0.005	mg/L	< 0.005	< 0.005
4.4'-DDT	0.005	mg/L	< 0.005	< 0.005
7.12-Dimethylbenz(a)anthracene	0.005	mg/L	< 0.005	< 0.005
a-BHC	0.005	mg/L	< 0.005	< 0.005
Acenaphthene	0.001	mg/L	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001
Acetophenone	0.005	mg/L	< 0.005	< 0.005
Aldrin	0.005	mg/L	< 0.005	< 0.005
Aniline	0.005	mg/L	< 0.005	< 0.005
Anthracene	0.001	mg/L	< 0.001	< 0.001
b-BHC	0.005	mg/L	< 0.005	< 0.005
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001
Benzo(b&j)fluoranthene[N07]	0.001	mg/L	< 0.001	< 0.001
Benzo(g.h.i)perylene	0.001	mg/L	< 0.001	< 0.001

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001
Benzyl chloride	0.005	mg/L	< 0.005	< 0.005
Bis(2-chloroethoxy)methane	0.005	mg/L	< 0.005	< 0.005
Bis(2-chloroisopropyl)ether	0.005	mg/L	< 0.005	< 0.005
Bis(2-ethylhexyl)phthalate	0.005	mg/L	< 0.005	< 0.005
Butyl benzyl phthalate	0.005	mg/L	< 0.005	< 0.005
Chrysene	0.001	mg/L	< 0.001	< 0.001
d-BHC	0.005	mg/L	< 0.005	< 0.005
Di-n-butyl phthalate	0.005	mg/L	< 0.005	< 0.005
Di-n-octyl phthalate	0.005	mg/L	< 0.005	< 0.005
Dibenz(a.h)anthracene	0.001	mg/L	< 0.001	< 0.001
Dibenz(a.j)acridine	0.005	mg/L	< 0.005	< 0.005
Dibenzofuran	0.005	mg/L	< 0.005	< 0.005
Dieldrin	0.005	mg/L	< 0.005	< 0.005
Diethyl phthalate	0.005	mg/L	< 0.005	< 0.005
Dimethyl phthalate	0.005	mg/L	< 0.005	< 0.005
Dimethylaminoazobenzene	0.005	mg/L	< 0.005	< 0.005
Diphenylamine	0.005	mg/L	< 0.005	< 0.005
Endosulfan I	0.005	mg/L	< 0.005	< 0.005
Endosulfan II	0.005	mg/L	< 0.005	< 0.005
Endosulfan sulphate	0.005	mg/L	< 0.005	< 0.005
Endrin	0.005	mg/L	< 0.005	< 0.005
Endrin aldehyde	0.005	mg/L	< 0.005	< 0.005
Endrin ketone	0.005	mg/L	< 0.005	< 0.005
Fluoranthene	0.001	mg/L	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001
g-BHC (Lindane)	0.005	mg/L	< 0.005	< 0.005
Heptachlor	0.005	mg/L	< 0.005	< 0.005
Heptachlor epoxide	0.005	mg/L	< 0.005	< 0.005
Hexachlorobenzene	0.005	mg/L	< 0.005	< 0.005
Hexachlorobutadiene	0.005	mg/L	< 0.005	< 0.005
Hexachlorocyclopentadiene	0.005	mg/L	< 0.005	< 0.005
Hexachloroethane	0.005	mg/L	< 0.005	< 0.005
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001
Methoxychlor	0.005	mg/L	< 0.005	< 0.005
N-Nitrosodibutylamine	0.005	mg/L	< 0.005	< 0.005
N-Nitrosodipropylamine	0.005	mg/L	< 0.005	< 0.005
N-Nitrosopiperidine	0.005	mg/L	< 0.005	< 0.005
Naphthalene	0.001	mg/L	< 0.001	< 0.001
Nitrobenzene	0.005	mg/L	< 0.005	< 0.005
Pentachlorobenzene	0.005	mg/L	< 0.005	< 0.005
Pentachloronitrobenzene	0.005	mg/L	< 0.005	< 0.005
Pentachlorophenol	0.01	mg/L	< 0.01	< 0.01
Phenanthrene	0.001	mg/L	< 0.001	< 0.001
Phenol	0.003	mg/L	< 0.003	0.004
Pronamide	0.005	mg/L	< 0.005	< 0.005
Pyrene	0.001	mg/L	< 0.001	< 0.001
Trifluralin	0.005	mg/L	< 0.005	< 0.005
Phenol-d6 (surr.)	1	%	25	60

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
Nitrobenzene-d5 (surr.)	1	%	72	58
2-Fluorobiphenyl (surr.)	1	%	60	84
2.4.6-Tribromophenol (surr.)	1	%	27	84
Chemical Oxygen Demand (filtered)	20	mg/L	86	280
pH (at 25 °C)	0.1	pH Units	7.3	7.2
Metals M22 (NZ MfE)				
Aluminium	0.05	mg/L	< 0.05	< 0.05
Antimony	0.005	mg/L	0.024	0.008
Arsenic	0.001	mg/L	0.082	0.053
Barium	0.02	mg/L	< 0.02	< 0.02
Beryllium	0.001	mg/L	< 0.001	< 0.001
Boron	0.05	mg/L	0.64	0.82
Cadmium	0.0002	mg/L	0.26	0.43
Chromium	0.001	mg/L	0.002	0.003
Cobalt	0.001	mg/L	0.031	0.053
Copper	0.001	mg/L	0.003	0.002
Iron	0.05	mg/L	< 0.05	< 0.05
Lead	0.001	mg/L	0.024	0.18
Manganese	0.005	mg/L	0.11	0.19
Mercury	0.0001	mg/L	0.0002	0.0004
Molybdenum	0.005	mg/L	< 0.005	< 0.005
Nickel	0.001	mg/L	0.001	0.002
Selenium	0.001	mg/L	< 0.001	< 0.001
Silver	0.005	mg/L	< 0.005	< 0.005
Thallium	0.005	mg/L	< 0.005	< 0.005
Tin	0.005	mg/L	< 0.005	< 0.005
Vanadium	0.005	mg/L	0.13	11
Zinc	0.005	mg/L	0.67	0.83
PFASs Summations				
Comments			G01	G01
Sum (PFHxS + PFOS)*	0.001	ug/L	< 0.1	< 0.1
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	< 0.1	< 0.1
Sum of PFASs (n=30)*	0.005	ug/L	< 0.1	< 0.1
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	< 0.1	< 0.1
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	< 0.1	< 0.1
Perfluoroalkyl sulfonamido substances- Trace				
Comments			G01	G01
Perfluorooctane sulfonamide (FOSA)[N11]	0.005	ug/L	< 0.1	< 0.1
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.005	ug/L	< 0.1	< 0.1
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.005	ug/L	< 0.1	< 0.1
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)[N11]	0.005	ug/L	< 0.1	< 0.1
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)[N11]	0.005	ug/L	< 0.1	< 0.1
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.005	ug/L	< 0.1	< 0.1
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.005	ug/L	< 0.1	< 0.1
13C8-FOSA (surr.)	1	%	116	124

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
Perfluoroalkyl sulfonamido substances- Trace				
D3-N-MeFOSA (surr.)	1	%	128	143
D5-N-EtFOSA (surr.)	1	%	138	146
D7-N-MeFOSE (surr.)	1	%	134	146
D9-N-EtFOSE (surr.)	1	%	153	156
D5-N-EtFOSAA (surr.)	1	%	117	153
D3-N-MeFOSAA (surr.)	1	%	128	162
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				
Comments			G01	G01
Perfluorobutanoic acid (PFBA)[N11]	0.005	ug/L	< 0.1	< 0.1
Perfluoropentanoic acid (PFPeA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorohexanoic acid (PFHxA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluoroheptanoic acid (PFHpA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorooctanoic acid (PFOA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorononanoic acid (PFNA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorodecanoic acid (PFDA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorotridecanoic acid (PFTrDA)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluoroundecanoic acid (PFUnDA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorododecanoic acid (PFDoDA)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.001	ug/L	< 0.1	< 0.1
13C4-PFBA (surr.)	1	%	109	124
13C5-PFPeA (surr.)	1	%	138	143
13C5-PFHxA (surr.)	1	%	139	152
13C4-PFHpA (surr.)	1	%	134	141
13C8-PFOA (surr.)	1	%	124	139
13C5-PFNA (surr.)	1	%	122	126
13C6-PFDA (surr.)	1	%	121	132
13C2-PFUnDA (surr.)	1	%	133	136
13C2-PFDoDA (surr.)	1	%	117	147
13C2-PFTeDA (surr.)	1	%	149	162
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				
Comments			G01	G01
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	< 0.1	< 0.1
Perfluorooctanesulfonic acid (PFOS)[N11]	0.001	ug/L	< 0.1	< 0.1
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.1	< 0.1
13C3-PFBS (surr.)	1	%	121	125
18O2-PFHxS (surr.)	1	%	110	122
13C8-PFOS (surr.)	1	%	91	107

Client Sample ID			L1	L2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Ma43216	K21-Ma43217
Date Sampled			Mar 09, 2021	Mar 23, 2021
Test/Reference	LOR	Unit		
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				
Comments			G01	G01
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.1	< 0.1
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)[N11]	0.005	ug/L	< 0.1	< 0.1
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	< 0.1	< 0.1
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.1	< 0.1
13C2-4:2 FTS (surr.)	1	%	132	144
13C2-6:2 FTSA (surr.)	1	%	167	INT
13C2-8:2 FTSA (surr.)	1	%	109	133
13C2-10:2 FTSA (surr.)	1	%	139	INT

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Volatile Organics	Melbourne	Apr 08, 2021	7 Days
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices (USEPA 8260)			
Glycols*	Melbourne	Apr 08, 2021	7 Days
- Method: GLYCOLS- US EPA SW846 METHOD 8000 GC-FID.			
Polychlorinated Biphenyls	Melbourne	Apr 08, 2021	7 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8082)			
Total Petroleum Hydrocarbons (NZ MfE 1999)	Melbourne	Apr 08, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Semivolatile Organics	Melbourne	Apr 08, 2021	7 Days
- Method: LTM-ORG-2190 SVOC in Water & Soil by GC-MS			
Chemical Oxygen Demand (filtered)	Melbourne	Apr 08, 2021	28 Days
- Method: LTM-INO-4220 Determination of COD in Water			
pH (at 25 °C)	Melbourne	Apr 08, 2021	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Metals M22 (NZ MfE)	Melbourne	Apr 08, 2021	6 Months
- Method: LTM-MET-3040 Metals in Waters Soils Sediments by ICP-MS			
Per- and Polyfluoroalkyl Substances (PFASs) - Trace			
Perfluoroalkyl sulfonamido substances- Trace	Brisbane	Mar 26, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - low level			
Perfluoroalkyl carboxylic acids (PFCAs) - Trace	Brisbane	Mar 26, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - low level			
Perfluoroalkyl sulfonic acids (PFSAs)- Trace	Brisbane	Mar 26, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - low level			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace	Brisbane	Mar 26, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS) - low level			

eurofins | Environment Testing

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Company Name: National Steel Ltd
Address: 29 Hobill Avenue
Wiri Maukau Auckland
NZ 2104

Project Name:
Project ID: 4197

Order No.:
Report #: 782420
Phone: 021 704 000
Fax:

Received: Mar 24, 2021 11:30 AM
Due: Mar 31, 2021
Priority: 5 Day
Contact Name: Brett Howlett

Eurofins Analytical Services Manager : Swati Shahaney

Sample Detail						Chemical Oxygen Demand (filtered)	pH (at 25 °C)	Glycols*	Polychlorinated Biphenyls	Volatile Organics	Total Petroleum Hydrocarbons (NZ MfE 1999)	Semivolatile Organics	Metals M22 (NZ MfE)	Per- and Polyfluoroalkyl Substances (PFASs) - Trace
Auckland Laboratory - IANZ# 1327														
Christchurch Laboratory - IANZ# 1290														
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X	X	
Brisbane Laboratory - NATA Site # 20794														X
External Laboratory														
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**									
1	L1	Mar 09, 2021		Water	K21-Ma43216	X	X	X	X	X	X	X	X	X
2	L2	Mar 23, 2021		Water	K21-Ma43217	X	X	X	X	X	X	X	X	X
Test Counts						2	2	2	2	2	2	2	2	2

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Volatile Organics							
1.1-Dichloroethane	mg/L	< 0.001			0.001	Pass	
1.1-Dichloroethene	mg/L	< 0.001			0.001	Pass	
1.1.1-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.1.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dibromoethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.2-Dichloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.3-Trichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.4-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.3.5-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.4-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
2-Butanone (MEK)	mg/L	< 0.001			0.001	Pass	
2-Propanone (Acetone)	mg/L	< 0.001			0.001	Pass	
4-Chlorotoluene	mg/L	< 0.001			0.001	Pass	
4-Methyl-2-pentanone (MIBK)	mg/L	< 0.001			0.001	Pass	
Allyl chloride	mg/L	< 0.001			0.001	Pass	
Benzene	mg/L	< 0.001			0.001	Pass	
Bromobenzene	mg/L	< 0.001			0.001	Pass	
Bromochloromethane	mg/L	< 0.001			0.001	Pass	
Bromodichloromethane	mg/L	< 0.001			0.001	Pass	
Bromoform	mg/L	< 0.001			0.001	Pass	
Bromomethane	mg/L	< 0.001			0.001	Pass	
Carbon disulfide	mg/L	< 0.001			0.001	Pass	
Carbon Tetrachloride	mg/L	< 0.001			0.001	Pass	
Chlorobenzene	mg/L	< 0.001			0.001	Pass	
Chloroethane	mg/L	< 0.001			0.001	Pass	
Chloroform	mg/L	< 0.005			0.005	Pass	
Chloromethane	mg/L	< 0.001			0.001	Pass	
cis-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
cis-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Dibromochloromethane	mg/L	< 0.001			0.001	Pass	
Dibromomethane	mg/L	< 0.001			0.001	Pass	
Dichlorodifluoromethane	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
Iodomethane	mg/L	< 0.001			0.001	Pass	
Isopropyl benzene (Cumene)	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
Methylene Chloride	mg/L	< 0.001			0.001	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Styrene	mg/L	< 0.001			0.001	Pass	
Tetrachloroethene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
trans-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
trans-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Trichloroethene	mg/L	< 0.001			0.001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Trichlorofluoromethane	mg/L	< 0.001			0.001	Pass	
Vinyl chloride	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Glycols*							
Di-Ethylene Glycol*	mg/L	< 20			20	Pass	
Ethylene glycol*	mg/L	< 20			20	Pass	
Propylene glycol*	mg/L	< 20			20	Pass	
Triethylene glycol*	mg/L	< 20			20	Pass	
Method Blank							
Polychlorinated Biphenyls							
Aroclor-1016	mg/L	< 0.001			0.001	Pass	
Aroclor-1221	mg/L	< 0.001			0.001	Pass	
Aroclor-1232	mg/L	< 0.001			0.001	Pass	
Aroclor-1242	mg/L	< 0.001			0.001	Pass	
Aroclor-1248	mg/L	< 0.001			0.001	Pass	
Aroclor-1254	mg/L	< 0.001			0.001	Pass	
Aroclor-1260	mg/L	< 0.001			0.001	Pass	
Total PCB*	mg/L	< 0.001			0.001	Pass	
Method Blank							
Total Petroleum Hydrocarbons (NZ MfE 1999)							
TPH-SG C7-C9	mg/L	< 0.1			0.1	Pass	
TPH-SG C10-C14	mg/L	< 0.2			0.2	Pass	
TPH-SG C15-C36	mg/L	< 0.4			0.4	Pass	
TPH-SG C7-C36 (Total)	mg/L	< 0.7			0.7	Pass	
Method Blank							
Semivolatile Organics							
2-Methyl-4.6-dinitrophenol	mg/L	< 0.03			0.03	Pass	
1-Chloronaphthalene	mg/L	< 0.005			0.005	Pass	
1-Naphthylamine	mg/L	< 0.005			0.005	Pass	
1.2-Dichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.3-Trichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.3.4-Tetrachlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.3.5-Tetrachlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.4-Trichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.2.4.5-Tetrachlorobenzene	mg/L	< 0.005			0.005	Pass	
1.3-Dichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.3.5-Trichlorobenzene	mg/L	< 0.005			0.005	Pass	
1.4-Dichlorobenzene	mg/L	< 0.005			0.005	Pass	
2-Chloronaphthalene	mg/L	< 0.005			0.005	Pass	
2-Chlorophenol	mg/L	< 0.003			0.003	Pass	
2-Methylnaphthalene	mg/L	< 0.005			0.005	Pass	
2-Methylphenol (o-Cresol)	mg/L	< 0.003			0.003	Pass	
2-Naphthylamine	mg/L	< 0.005			0.005	Pass	
2-Nitroaniline	mg/L	< 0.005			0.005	Pass	
2-Nitrophenol	mg/L	< 0.01			0.01	Pass	
2-Picoline	mg/L	< 0.005			0.005	Pass	
2.3.4.6-Tetrachlorophenol	mg/L	< 0.01			0.01	Pass	
2.4-Dichlorophenol	mg/L	< 0.003			0.003	Pass	
2.4-Dimethylphenol	mg/L	< 0.003			0.003	Pass	
2.4-Dinitrophenol	mg/L	< 0.03			0.03	Pass	
2.4-Dinitrotoluene	mg/L	< 0.005			0.005	Pass	
2.4.5-Trichlorophenol	mg/L	< 0.01			0.01	Pass	
2.4.6-Trichlorophenol	mg/L	< 0.01			0.01	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
2.6-Dichlorophenol	mg/L	< 0.003			0.003	Pass	
2.6-Dinitrotoluene	mg/L	< 0.005			0.005	Pass	
3&4-Methylphenol (m&p-Cresol)	mg/L	< 0.006			0.006	Pass	
3-Methylcholanthrene	mg/L	< 0.005			0.005	Pass	
3.3'-Dichlorobenzidine	mg/L	< 0.005			0.005	Pass	
4-Aminobiphenyl	mg/L	< 0.005			0.005	Pass	
4-Bromophenyl phenyl ether	mg/L	< 0.005			0.005	Pass	
4-Chloro-3-methylphenol	mg/L	< 0.01			0.01	Pass	
4-Chlorophenyl phenyl ether	mg/L	< 0.005			0.005	Pass	
4-Nitrophenol	mg/L	< 0.03			0.03	Pass	
4.4'-DDD	mg/L	< 0.005			0.005	Pass	
4.4'-DDE	mg/L	< 0.005			0.005	Pass	
4.4'-DDT	mg/L	< 0.005			0.005	Pass	
7.12-Dimethylbenz(a)anthracene	mg/L	< 0.005			0.005	Pass	
a-BHC	mg/L	< 0.005			0.005	Pass	
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Acetophenone	mg/L	< 0.005			0.005	Pass	
Aldrin	mg/L	< 0.005			0.005	Pass	
Aniline	mg/L	< 0.005			0.005	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
b-BHC	mg/L	< 0.005			0.005	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzyl chloride	mg/L	< 0.005			0.005	Pass	
Bis(2-chloroethoxy)methane	mg/L	< 0.005			0.005	Pass	
Bis(2-chloroisopropyl)ether	mg/L	< 0.005			0.005	Pass	
Bis(2-ethylhexyl)phthalate	mg/L	< 0.005			0.005	Pass	
Butyl benzyl phthalate	mg/L	< 0.005			0.005	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
d-BHC	mg/L	< 0.005			0.005	Pass	
Di-n-butyl phthalate	mg/L	< 0.005			0.005	Pass	
Di-n-octyl phthalate	mg/L	< 0.005			0.005	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.001			0.001	Pass	
Dibenz(a.j)acridine	mg/L	< 0.005			0.005	Pass	
Dibenzofuran	mg/L	< 0.005			0.005	Pass	
Dieldrin	mg/L	< 0.005			0.005	Pass	
Diethyl phthalate	mg/L	< 0.005			0.005	Pass	
Dimethyl phthalate	mg/L	< 0.005			0.005	Pass	
Dimethylaminoazobenzene	mg/L	< 0.005			0.005	Pass	
Diphenylamine	mg/L	< 0.005			0.005	Pass	
Endosulfan I	mg/L	< 0.005			0.005	Pass	
Endosulfan II	mg/L	< 0.005			0.005	Pass	
Endosulfan sulphate	mg/L	< 0.005			0.005	Pass	
Endrin	mg/L	< 0.005			0.005	Pass	
Endrin aldehyde	mg/L	< 0.005			0.005	Pass	
Endrin ketone	mg/L	< 0.005			0.005	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
g-BHC (Lindane)	mg/L	< 0.005			0.005	Pass	
Heptachlor	mg/L	< 0.005			0.005	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Heptachlor epoxide	mg/L	< 0.005			0.005	Pass	
Hexachlorobenzene	mg/L	< 0.005			0.005	Pass	
Hexachlorobutadiene	mg/L	< 0.005			0.005	Pass	
Hexachlorocyclopentadiene	mg/L	< 0.005			0.005	Pass	
Hexachloroethane	mg/L	< 0.005			0.005	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Methoxychlor	mg/L	< 0.005			0.005	Pass	
N-Nitrosodibutylamine	mg/L	< 0.005			0.005	Pass	
N-Nitrosodipropylamine	mg/L	< 0.005			0.005	Pass	
N-Nitrosopiperidine	mg/L	< 0.005			0.005	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Nitrobenzene	mg/L	< 0.005			0.005	Pass	
Pentachlorobenzene	mg/L	< 0.005			0.005	Pass	
Pentachloronitrobenzene	mg/L	< 0.005			0.005	Pass	
Pentachlorophenol	mg/L	< 0.01			0.01	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Phenol	mg/L	< 0.003			0.003	Pass	
Pronamide	mg/L	< 0.005			0.005	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Trifluralin	mg/L	< 0.005			0.005	Pass	
Method Blank							
Chemical Oxygen Demand (filtered)	mg/L	< 20			20	Pass	
Method Blank							
Metals M22 (NZ MfE)							
Aluminium	mg/L	< 0.05			0.05	Pass	
Antimony	mg/L	< 0.005			0.005	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Barium	mg/L	< 0.02			0.02	Pass	
Beryllium	mg/L	< 0.001			0.001	Pass	
Boron	mg/L	< 0.05			0.05	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Cobalt	mg/L	< 0.001			0.001	Pass	
Iron	mg/L	< 0.05			0.05	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Manganese	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Molybdenum	mg/L	< 0.005			0.005	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Selenium	mg/L	< 0.001			0.001	Pass	
Silver	mg/L	< 0.005			0.005	Pass	
Thallium	mg/L	< 0.005			0.005	Pass	
Tin	mg/L	< 0.005			0.005	Pass	
Vanadium	mg/L	< 0.005			0.005	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	ug/L	< 0.005			0.005	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.005			0.005	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.005			0.005	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	ug/L	< 0.005			0.005	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	ug/L	< 0.005			0.005	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.005			0.005	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.005			0.005	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	ug/L	< 0.005			0.005	Pass	
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanoic acid (PFOA)	ug/L	< 0.001			0.001	Pass	
Perfluorononanoic acid (PFNA)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanoic acid (PFDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/L	< 0.001			0.001	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.001			0.001	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.001			0.001	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.001			0.001	Pass	
Perfluorononanesulfonic acid (PFNS)	ug/L	< 0.001			0.001	Pass	
Perfluoropropanesulfonic acid (PFPrS)	ug/L	< 0.001			0.001	Pass	
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanesulfonic acid (PFOS)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.001			0.001	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	ug/L	< 0.005			0.005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.001			0.001	Pass	
LCS - % Recovery							
Volatile Organics							
1.1-Dichloroethene	%	98			70-130	Pass	
1.1.1-Trichloroethane	%	91			70-130	Pass	
1.2-Dichlorobenzene	%	91			70-130	Pass	
1.2-Dichloroethane	%	104			70-130	Pass	
Benzene	%	100			70-130	Pass	
Ethylbenzene	%	104			70-130	Pass	
m&p-Xylenes	%	98			70-130	Pass	
Trichloroethene	%	77			70-130	Pass	
Xylenes - Total*	%	100			70-130	Pass	
LCS - % Recovery							
Glycols*							
Ethylene glycol*	%	113			70-130	Pass	
Propylene glycol*	%	112			70-130	Pass	
LCS - % Recovery							
Total Petroleum Hydrocarbons (NZ MfE 1999)							
TPH-SG C7-C9	%	91			70-130	Pass	
LCS - % Recovery							
Semivolatile Organics							
2-Methyl-4.6-dinitrophenol	%	75			30-130	Pass	
1.2-Dichlorobenzene	%	78			75-125	Pass	
1.2.4-Trichlorobenzene	%	87			70-130	Pass	
1.4-Dichlorobenzene	%	73			70-130	Pass	
2-Chlorophenol	%	53			30-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
2-Methylphenol (o-Cresol)	%	51			30-130	Pass	
2-Nitrophenol	%	72			30-130	Pass	
2.4-Dichlorophenol	%	80			30-130	Pass	
2.4-Dimethylphenol	%	62			30-130	Pass	
2.4-Dinitrotoluene	%	78			70-130	Pass	
2.4.5-Trichlorophenol	%	72			30-130	Pass	
2.4.6-Trichlorophenol	%	70			30-130	Pass	
2.6-Dichlorophenol	%	64			30-130	Pass	
3&4-Methylphenol (m&p-Cresol)	%	61			30-130	Pass	
4-Chloro-3-methylphenol	%	65			30-130	Pass	
4-Nitrophenol	%	42			30-130	Pass	
Acenaphthene	%	89			70-130	Pass	
Acenaphthylene	%	79			70-130	Pass	
Anthracene	%	80			70-130	Pass	
Benz(a)anthracene	%	75			70-130	Pass	
Benzo(a)pyrene	%	89			70-130	Pass	
Benzo(b&j)fluoranthene	%	92			70-130	Pass	
Benzo(g.h.i)perylene	%	79			70-130	Pass	
Benzo(k)fluoranthene	%	80			70-130	Pass	
Chrysene	%	98			70-130	Pass	
Dibenz(a.h)anthracene	%	89			70-130	Pass	
Fluoranthene	%	103			70-130	Pass	
Fluorene	%	105			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	87			70-130	Pass	
N-Nitrosodipropylamine	%	88			70-130	Pass	
Naphthalene	%	93			70-130	Pass	
Pentachlorophenol	%	71			30-130	Pass	
Phenanthrene	%	99			70-130	Pass	
Phenol	%	40			30-130	Pass	
Pyrene	%	104			70-130	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	%	121			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	137			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	109			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	%	120			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	%	114			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	119			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	119			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	%	93			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	130			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	120			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	107			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	116			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	109			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	106			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	126			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	115			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	113			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	120			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluorobutanesulfonic acid (PFBS)	%	104			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	%	114			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	%	145			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	95			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	97			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	106			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	106			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	112			50-150	Pass	
LCS - % Recovery							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	114			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	%	117			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	118			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	110			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Perfluoroalkyl sulfonamido substances- Trace				Result 1					
Perfluorooctane sulfonamide (FOSA)	B21-Ma48936	NCP	%	98			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	B21-Ma48936	NCP	%	116			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	B21-Ma48936	NCP	%	110			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	B21-Ma48936	NCP	%	114			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	B21-Ma48936	NCP	%	111			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	B21-Ma48936	NCP	%	105			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	B21-Ma48936	NCP	%	103			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1					
Perfluorobutanoic acid (PFBA)	B21-Ma48936	NCP	%	83			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	B21-Ma48936	NCP	%	103			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	B21-Ma48936	NCP	%	105			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	B21-Ma48936	NCP	%	90			50-150	Pass	
Perfluorooctanoic acid (PFOA)	B21-Ma48936	NCP	%	95			50-150	Pass	
Perfluorononanoic acid (PFNA)	B21-Ma48936	NCP	%	94			50-150	Pass	
Perfluorodecanoic acid (PFDA)	B21-Ma48936	NCP	%	104			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	B21-Ma48936	NCP	%	128			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	B21-Ma48936	NCP	%	114			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	B21-Ma48936	NCP	%	119			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	B21-Ma48936	NCP	%	125			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				Result 1					
Perfluorobutanesulfonic acid (PFBS)	B21-Ma48936	NCP	%	76			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	B21-Ma48936	NCP	%	87			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	B21-Ma48936	NCP	%	93			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluoropentanesulfonic acid (PFPeS)	B21-Ma48936	NCP	%	91			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	B21-Ma48936	NCP	%	88			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	B21-Ma48936	NCP	%	108			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	B21-Ma48936	NCP	%	77			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				Result 1					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	B21-Ma48936	NCP	%	109			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	B21-Ma48936	NCP	%	114			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	B21-Ma48936	NCP	%	105			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	B21-Ma48936	NCP	%	99			50-150	Pass	
Spike - % Recovery									
Glycols*				Result 1					
Di-Ethylene Glycol*	K21-Ma43217	CP	%	102			70-130	Pass	
Ethylene glycol*	K21-Ma43217	CP	%	110			70-130	Pass	
Propylene glycol*	K21-Ma43217	CP	%	106			70-130	Pass	
Triethylene glycol*	K21-Ma43217	CP	%	84			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Glycols*				Result 1	Result 2	RPD			
Di-Ethylene Glycol*	K21-Ma43216	CP	mg/L	< 20	< 20	<1	30%	Pass	
Ethylene glycol*	K21-Ma43216	CP	mg/L	< 20	< 20	<1	30%	Pass	
Propylene glycol*	K21-Ma43216	CP	mg/L	< 20	< 20	<1	30%	Pass	
Triethylene glycol*	K21-Ma43216	CP	mg/L	< 20	< 20	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
pH (at 25 °C)	M21-Ap10040	NCP	pH Units	8.4	8.5	pass	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	

Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)	B21-Ma48936	NCP	ug/L	0.026	0.023	12	30%	Pass	
Perfluoropentanoic acid (PFPeA)	B21-Ma48936	NCP	ug/L	0.004	0.004	4.0	30%	Pass	
Perfluorohexanoic acid (PFHxA)	B21-Ma48936	NCP	ug/L	0.009	0.009	5.0	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	B21-Ma48936	NCP	ug/L	0.002	0.002	2.0	30%	Pass	
Perfluorononanoic acid (PFNA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	B21-Ma48936	NCP	ug/L	0.002	0.002	1.0	30%	Pass	
Perfluorononanesulfonic acid (PFNS)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	B21-Ma48936	NCP	ug/L	0.001	0.001	1.0	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	B21-Ma48936	NCP	ug/L	0.010	0.009	13	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				Result 1	Result 2	RPD			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	B21-Ma48936	NCP	ug/L	< 0.005	< 0.005	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	B21-Ma48936	NCP	ug/L	< 0.001	< 0.001	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
G01	The LORs have been raised due to matrix interference
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).
N16	Analysis performed by Eurofins Environment Testing Australia

Authorised by:

Swati Shahaney	Analytical Services Manager
Emily Rosenberg	Senior Analyst-Metal (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Sarah McCallion	Senior Analyst-PFAS (QLD)
Scott Beddoes	Senior Analyst-Inorganic (VIC)
Vivian Wang	Senior Analyst-Volatile (VIC)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

National Steel Ltd
29 Hobill Avenue
Wiri Maukau Auckland
NZ 2104

Attention: **Vipan Garg**

Report **773546-W_INT**
Project name 650 FALLS ROAD MONOFILL FACILITY
Project ID 4197
Received Date Feb 11, 2021

Client Sample ID			**SAMPLE 1**	**SAMPLE 2**
Sample Matrix			**Water**	**Water**
Eurofins Sample No.			**K21-Fe24634**	**K21-Fe24635**
Date Sampled			**Feb 03, 2021**	**Feb 11, 2021**
Test/Reference	LOR	Unit		
Volatile Organics				
1.1-Dichloroethane	0.001	mg/L	< 0.002	< 0.01
1.1-Dichloroethene	0.001	mg/L	< 0.002	< 0.002
1.1.1-Trichloroethane	0.001	mg/L	< 0.002	< 0.01
1.1.1.2-Tetrachloroethane	0.001	mg/L	< 0.002	< 0.01
1.1.2-Trichloroethane	0.001	mg/L	< 0.002	< 0.01
1.1.2.2-Tetrachloroethane	0.001	mg/L	< 0.002	< 0.01
1.2-Dibromoethane	0.001	mg/L	< 0.002	< 0.01
1.2-Dichlorobenzene	0.001	mg/L	< 0.002	< 0.01
1.2-Dichloroethane	0.001	mg/L	< 0.002	< 0.01
1.2-Dichloropropane	0.001	mg/L	0.003	< 0.01
1.2.3-Trichloropropane	0.001	mg/L	< 0.002	< 0.01
1.2.4-Trimethylbenzene	0.001	mg/L	0.028	< 0.01
1.3-Dichlorobenzene	0.001	mg/L	< 0.002	< 0.01
1.3-Dichloropropane	0.001	mg/L	< 0.002	< 0.01
1.3.5-Trimethylbenzene	0.001	mg/L	0.005	< 0.01
1.4-Dichlorobenzene	0.001	mg/L	< 0.002	< 0.01
2-Butanone (MEK)	0.001	mg/L	0.050	0.15
2-Propanone (Acetone)	0.001	mg/L	0.12	1.4
4-Chlorotoluene	0.001	mg/L	< 0.002	< 0.01
4-Methyl-2-pentanone (MIBK)	0.001	mg/L	0.17	0.15
Allyl chloride	0.001	mg/L	< 0.02	< 0.01
Benzene	0.001	mg/L	0.011	< 0.01
Bromobenzene	0.001	mg/L	< 0.002	< 0.01
Bromochloromethane	0.001	mg/L	< 0.002	< 0.01
Bromodichloromethane	0.001	mg/L	< 0.002	< 0.01
Bromoform	0.001	mg/L	< 0.002	< 0.01
Bromomethane	0.001	mg/L	< 0.002	< 0.01
Carbon disulfide	0.001	mg/L	< 0.002	< 0.01
Carbon Tetrachloride	0.001	mg/L	< 0.002	< 0.01
Chlorobenzene	0.001	mg/L	< 0.002	< 0.01
Chloroethane	0.001	mg/L	< 0.002	< 0.01
Chloroform	0.005	mg/L	< 0.005	< 0.01
Chloromethane	0.001	mg/L	0.002	< 0.01
cis-1.2-Dichloroethene	0.001	mg/L	< 0.002	< 0.01
cis-1.3-Dichloropropene	0.001	mg/L	< 0.002	< 0.01

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Fe24634	K21-Fe24635
Date Sampled			Feb 03, 2021	Feb 11, 2021
Test/Reference	LOR	Unit		
Volatile Organics				
Dibromochloromethane	0.001	mg/L	< 0.002	< 0.01
Dibromomethane	0.001	mg/L	< 0.002	< 0.01
Dichlorodifluoromethane	0.001	mg/L	< 0.002	< 0.01
Ethylbenzene	0.001	mg/L	0.021	0.015
Iodomethane	0.001	mg/L	< 0.002	< 0.01
Isopropyl benzene (Cumene)	0.001	mg/L	< 0.002	< 0.01
m&p-Xylenes	0.002	mg/L	0.052	0.038
Methylene Chloride	0.001	mg/L	< 0.002	< 0.002
o-Xylene	0.001	mg/L	0.050	0.036
Styrene	0.001	mg/L	0.009	< 0.01
Tetrachloroethene	0.001	mg/L	< 0.002	< 0.01
Toluene	0.001	mg/L	0.088	0.083
trans-1.2-Dichloroethene	0.001	mg/L	< 0.002	< 0.01
trans-1.3-Dichloropropene	0.001	mg/L	< 0.002	< 0.01
Trichloroethene	0.001	mg/L	< 0.002	< 0.01
Trichlorofluoromethane	0.001	mg/L	0.022	< 0.01
Vinyl chloride	0.001	mg/L	< 0.002	< 0.01
Xylenes - Total*	0.003	mg/L	0.10	0.074
Total MAH*	0.003	mg/L	0.231	0.172
Vic EPA IWRG 621 CHC (Total)*	0.005	mg/L	< 0.005	< 0.01
Vic EPA IWRG 621 Other CHC (Total)*	0.005	mg/L	< 0.005	< 0.01
4-Bromofluorobenzene (surr.)	1	%	140	148
Toluene-d8 (surr.)	1	%	94	123
Glycols*				
Di-Ethylene Glycol*	20	mg/L		
Ethylene glycol*	20	mg/L		
Propylene glycol*	20	mg/L		
Triethylene glycol*	20	mg/L		
Polychlorinated Biphenyls				
Aroclor-1016	0.001	mg/L		
Aroclor-1221	0.001	mg/L		
Aroclor-1232	0.001	mg/L		
Aroclor-1242	0.001	mg/L		
Aroclor-1248	0.001	mg/L		
Aroclor-1254	0.001	mg/L		
Aroclor-1260	0.001	mg/L		
Total PCB*	0.001	mg/L		
Dibutylchlorendate (surr.)	1	%		
Tetrachloro-m-xylene (surr.)	1	%		
Total Petroleum Hydrocarbons (NZ MfE 1999)				
TPH-SG C7-C9	0.1	mg/L		
TPH-SG C10-C14	0.2	mg/L		
TPH-SG C15-C36	0.4	mg/L		
TPH-SG C7-C36 (Total)	0.7	mg/L		
Semivolatile Organics				
2-Methyl-4.6-dinitrophenol	0.03	mg/L		
1-Chloronaphthalene	0.005	mg/L		
1-Naphthylamine	0.005	mg/L		
1.2-Dichlorobenzene	0.005	mg/L		

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Fe24634	K21-Fe24635
Date Sampled			Feb 03, 2021	Feb 11, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
1.2.3-Trichlorobenzene	0.005	mg/L		
1.2.3.4-Tetrachlorobenzene	0.005	mg/L		
1.2.3.5-Tetrachlorobenzene	0.005	mg/L		
1.2.4-Trichlorobenzene	0.005	mg/L		
1.2.4.5-Tetrachlorobenzene	0.005	mg/L		
1.3-Dichlorobenzene	0.005	mg/L		
1.3.5-Trichlorobenzene	0.005	mg/L		
1.4-Dichlorobenzene	0.005	mg/L		
2-Chloronaphthalene	0.005	mg/L		
2-Chlorophenol	0.003	mg/L		
2-Methylnaphthalene	0.005	mg/L		
2-Methylphenol (o-Cresol)	0.003	mg/L		
2-Naphthylamine	0.005	mg/L		
2-Nitroaniline	0.005	mg/L		
2-Nitrophenol	0.01	mg/L		
2-Picoline	0.005	mg/L		
2.3.4.6-Tetrachlorophenol	0.01	mg/L		
2.4-Dichlorophenol	0.003	mg/L		
2.4-Dimethylphenol	0.003	mg/L		
2.4-Dinitrophenol	0.03	mg/L		
2.4-Dinitrotoluene	0.005	mg/L		
2.4.5-Trichlorophenol	0.01	mg/L		
2.4.6-Trichlorophenol	0.01	mg/L		
2.6-Dichlorophenol	0.003	mg/L		
2.6-Dinitrotoluene	0.005	mg/L		
3&4-Methylphenol (m&p-Cresol)	0.006	mg/L		
3-Methylcholanthrene	0.005	mg/L		
3.3'-Dichlorobenzidine	0.005	mg/L		
4-Aminobiphenyl	0.005	mg/L		
4-Bromophenyl phenyl ether	0.005	mg/L		
4-Chloro-3-methylphenol	0.01	mg/L		
4-Chlorophenyl phenyl ether	0.005	mg/L		
4-Nitrophenol	0.03	mg/L		
4.4'-DDD	0.005	mg/L		
4.4'-DDE	0.005	mg/L		
4.4'-DDT	0.005	mg/L		
7.12-Dimethylbenz(a)anthracene	0.005	mg/L		
a-BHC	0.005	mg/L		
Acenaphthene	0.001	mg/L		
Acenaphthylene	0.001	mg/L		
Acetophenone	0.005	mg/L		
Aldrin	0.005	mg/L		
Aniline	0.005	mg/L		
Anthracene	0.001	mg/L		
b-BHC	0.005	mg/L		
Benz(a)anthracene	0.001	mg/L		
Benzo(a)pyrene	0.001	mg/L		
Benzo(b&j)fluoranthene[N07]	0.001	mg/L		
Benzo(g.h.i)perylene	0.001	mg/L		

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Fe24634	K21-Fe24635
Date Sampled			Feb 03, 2021	Feb 11, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
Benzo(k)fluoranthene	0.001	mg/L		
Benzyl chloride	0.005	mg/L		
Bis(2-chloroethoxy)methane	0.005	mg/L		
Bis(2-chloroisopropyl)ether	0.005	mg/L		
Bis(2-ethylhexyl)phthalate	0.005	mg/L		
Butyl benzyl phthalate	0.005	mg/L		
Chrysene	0.001	mg/L		
d-BHC	0.005	mg/L		
Di-n-butyl phthalate	0.005	mg/L		
Di-n-octyl phthalate	0.005	mg/L		
Dibenz(a.h)anthracene	0.001	mg/L		
Dibenz(a.j)acridine	0.005	mg/L		
Dibenzofuran	0.005	mg/L		
Dieldrin	0.005	mg/L		
Diethyl phthalate	0.005	mg/L		
Dimethyl phthalate	0.005	mg/L		
Dimethylaminoazobenzene	0.005	mg/L		
Diphenylamine	0.005	mg/L		
Endosulfan I	0.005	mg/L		
Endosulfan II	0.005	mg/L		
Endosulfan sulphate	0.005	mg/L		
Endrin	0.005	mg/L		
Endrin aldehyde	0.005	mg/L		
Endrin ketone	0.005	mg/L		
Fluoranthene	0.001	mg/L		
Fluorene	0.001	mg/L		
g-BHC (Lindane)	0.005	mg/L		
Heptachlor	0.005	mg/L		
Heptachlor epoxide	0.005	mg/L		
Hexachlorobenzene	0.005	mg/L		
Hexachlorobutadiene	0.005	mg/L		
Hexachlorocyclopentadiene	0.005	mg/L		
Hexachloroethane	0.005	mg/L		
Indeno(1.2.3-cd)pyrene	0.001	mg/L		
Methoxychlor	0.005	mg/L		
N-Nitrosodibutylamine	0.005	mg/L		
N-Nitrosodipropylamine	0.005	mg/L		
N-Nitrosopiperidine	0.005	mg/L		
Naphthalene	0.001	mg/L		
Nitrobenzene	0.005	mg/L		
Pentachlorobenzene	0.005	mg/L		
Pentachloronitrobenzene	0.005	mg/L		
Pentachlorophenol	0.01	mg/L		
Phenanthrene	0.001	mg/L		
Phenol	0.003	mg/L		
Pronamide	0.005	mg/L		
Pyrene	0.001	mg/L		
Trifluralin	0.005	mg/L		
Phenol-d6 (surr.)	1	%		

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Fe24634	K21-Fe24635
Date Sampled			Feb 03, 2021	Feb 11, 2021
Test/Reference	LOR	Unit		
Semivolatile Organics				
Nitrobenzene-d5 (surr.)	1	%		
2-Fluorobiphenyl (surr.)	1	%		
2.4.6-Tribromophenol (surr.)	1	%		
Chemical Oxygen Demand (filtered)	20	mg/L		
pH (at 25 °C)	0.1	pH Units	7.0	-
Metals M22 (NZ MfE)				
Aluminium	0.05	mg/L	0.10	0.06
Antimony	0.005	mg/L	0.10	0.053
Arsenic	0.001	mg/L	0.011	0.011
Barium	0.02	mg/L	0.36	0.26
Beryllium	0.001	mg/L	< 0.001	< 0.001
Boron	0.05	mg/L	5.0	4.3
Cadmium	0.0002	mg/L	< 0.0002	0.0007
Chromium	0.001	mg/L	0.048	0.022
Cobalt	0.001	mg/L	0.11	0.058
Copper	0.001	mg/L	0.23	0.15
Iron	0.05	mg/L	47	25
Lead	0.001	mg/L	1070000	1070000
Manganese	0.005	mg/L	4.1	3.0
Mercury	0.0001	mg/L	0.0002	0.0002
Molybdenum	0.005	mg/L	0.23	0.29
Nickel	0.001	mg/L	0.32	0.19
Selenium	0.001	mg/L	0.001	< 0.001
Silver	0.005	mg/L	< 0.005	< 0.005
Thallium	0.005	mg/L	< 0.005	< 0.005
Tin	0.005	mg/L	0.009	0.014
Vanadium	0.005	mg/L	< 0.005	0.005
Zinc	0.005	mg/L	52	16
PFASs Summations				
Sum (PFHxS + PFOS)*	0.001	ug/L	0.082	0.114
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	0.192	0.234
Sum of PFASs (n=30)*	0.005	ug/L	0.665	0.682
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	0.133	0.142
Sum of WA DWER PFAS (n=10)*	0.005	ug/L	0.637	0.651
Perfluoroalkyl sulfonamido substances- Trace				
Perfluorooctane sulfonamide (FOSA)[N11]	0.005	ug/L	< 0.005	< 0.005
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	0.005	ug/L	< 0.005	< 0.005
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	0.005	ug/L	< 0.005	< 0.005
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)[N11]	0.005	ug/L	< 0.005	< 0.005
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)[N11]	0.005	ug/L	< 0.005	< 0.005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	0.005	ug/L	< 0.005	< 0.005
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	0.005	ug/L	< 0.005	< 0.005
13C8-FOSA (surr.)	1	%	96	132
D3-N-MeFOSA (surr.)	1	%	85	120
D5-N-EtFOSA (surr.)	1	%	91	128

Client Sample ID			SAMPLE 1	SAMPLE 2
Sample Matrix			Water	Water
Eurofins Sample No.			K21-Fe24634	K21-Fe24635
Date Sampled			Feb 03, 2021	Feb 11, 2021
Test/Reference	LOR	Unit		
Perfluoroalkyl sulfonamido substances- Trace				
D7-N-MeFOSE (surr.)	1	%	101	137
D9-N-EtFOSE (surr.)	1	%	90	130
D5-N-EtFOSAA (surr.)	1	%	119	142
D3-N-MeFOSAA (surr.)	1	%	135	76
Perfluoroalkyl carboxylic acids (PFCAs) - Trace				
Perfluorobutanoic acid (PFBA)[N11]	0.005	ug/L	0.16	0.10
Perfluoropentanoic acid (PFPeA)[N11]	0.001	ug/L	0.043	0.040
Perfluorohexanoic acid (PFHxA)[N11]	0.001	ug/L	0.085	0.099
Perfluoroheptanoic acid (PFHpA)[N11]	0.001	ug/L	0.040	0.047
Perfluorooctanoic acid (PFOA)[N11]	0.001	ug/L	0.11	0.12
Perfluorononanoic acid (PFNA)[N11]	0.001	ug/L	0.026	0.028
Perfluorodecanoic acid (PFDA)[N11]	0.001	ug/L	0.002	0.002
Perfluorotridecanoic acid (PFTrDA)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluoroundecanoic acid (PFUnDA)[N11]	0.001	ug/L	< 0.001	< 0.001
Perfluorododecanoic acid (PFDoDA)[N11]	0.001	ug/L	< 0.001	< 0.001
Perfluorotetradecanoic acid (PFTeDA)[N11]	0.001	ug/L	< 0.001	< 0.001
13C4-PFBA (surr.)	1	%	102	130
13C5-PFPeA (surr.)	1	%	71	60
13C5-PFHxA (surr.)	1	%	75	96
13C4-PFHpA (surr.)	1	%	96	120
13C8-PFOA (surr.)	1	%	100	129
13C5-PFNA (surr.)	1	%	106	144
13C6-PFDA (surr.)	1	%	104	135
13C2-PFUnDA (surr.)	1	%	111	126
13C2-PFDoDA (surr.)	1	%	130	118
13C2-PFTeDA (surr.)	1	%	92	138
Perfluoroalkyl sulfonic acids (PFSAs)- Trace				
Perfluorobutanesulfonic acid (PFBS)[N11]	0.001	ug/L	0.051	0.062
Perfluorononanesulfonic acid (PFNS)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluoropropanesulfonic acid (PFPrS)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluoropentanesulfonic acid (PFPeS)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluorohexanesulfonic acid (PFHxS)[N11]	0.001	ug/L	0.059	0.092
Perfluoroheptanesulfonic acid (PFHpS)[N15]	0.001	ug/L	< 0.001	< 0.001
Perfluorooctanesulfonic acid (PFOS)[N11]	0.001	ug/L	0.023	0.022
Perfluorodecanesulfonic acid (PFDS)[N15]	0.001	ug/L	< 0.001	< 0.001
13C3-PFBS (surr.)	1	%	74	90
18O2-PFHxS (surr.)	1	%	72	96
13C8-PFOS (surr.)	1	%	77	105
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	0.001	ug/L	< 0.001	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)[N11]	0.005	ug/L	0.063	0.067
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	0.001	ug/L	0.003	0.002
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	0.001	ug/L	< 0.001	0.001
13C2-4:2 FTS (surr.)	1	%	97	121
13C2-6:2 FTSA (surr.)	1	%	120	84
13C2-8:2 FTSA (surr.)	1	%	81	109
13C2-10:2 FTSA (surr.)	1	%	129	97

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Volatile Organics	Melbourne	Feb 18, 2021	7 Days
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices (USEPA 8260)			
Glycols*	Melbourne	Feb 18, 2021	7 Days
- Method: GLYCOLS- US EPA SW846 METHOD 8000 GC-FID.			
Polychlorinated Biphenyls	Melbourne	Feb 18, 2021	7 Days
- Method: LTM-ORG-2220 OCP & PCB in Soil and Water (USEPA 8082)			
Total Petroleum Hydrocarbons (NZ MfE 1999)	Melbourne	Feb 18, 2021	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Semivolatile Organics	Melbourne	Feb 18, 2021	7 Days
- Method: LTM-ORG-2190 SVOC in Water & Soil by GC-MS			
Chemical Oxygen Demand (filtered)	Melbourne	Feb 18, 2021	28 Days
- Method: LTM-INO-4220 Determination of COD in Water			
pH (at 25 °C)	Melbourne	Feb 18, 2021	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Metals M22 (NZ MfE)	Melbourne	Feb 18, 2021	6 Months
- Method: LTM-MET-3040 Metals in Waters Soils Sediments by ICP-MS			
Per- and Polyfluoroalkyl Substances (PFASs) - Trace			
PFASs Summations	Melbourne	Feb 12, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonamido substances- Trace	Melbourne	Feb 18, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl carboxylic acids (PFCAs) - Trace	Melbourne	Feb 18, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonic acids (PFSAs)- Trace	Melbourne	Feb 18, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace	Melbourne	Feb 18, 2021	14 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			

eurofins | Environment Testing

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Address: 29 Hobill Avenue
Wiri Maukau Auckland
NZ 2104

Project Name: 650 FALLS ROAD MONOFILL FACILITY
Project ID: 4197

Order No.:
Report #: 773546
Phone: 021 704 000
Fax:

Received: Feb 12, 2021 12:00 AM
Due: Feb 18, 2021
Priority: 5 Day
Contact Name: Vipan Garg

Eurofins Analytical Services Manager : Swati Shahaney

Sample Detail						Chemical Oxygen Demand (filtered)	pH (at 25 °C)	Glycols*	Polychlorinated Biphenyls	Volatile Organics	Total Petroleum Hydrocarbons (NZ MfE 1999)	Semivolatile Organics	Metals M22 (NZ MfE)	Per- and Polyfluoroalkyl Substances (PFASs) - Trace
Auckland Laboratory - IANZ# 1327														
Christchurch Laboratory - IANZ# 1290														
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X	X	X	X
External Laboratory														
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**									
1	SAMPLE 1	Feb 03, 2021		Water	K21-Fe24634	X	X	X	X	X	X	X	X	X
2	SAMPLE 2	Feb 11, 2021		Water	K21-Fe24635	X		X	X	X	X	X	X	X
Test Counts						2	1	2	2	2	2	2	2	2

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Volatile Organics							
1.1-Dichloroethane	mg/L	< 0.001			0.001	Pass	
1.1-Dichloroethene	mg/L	< 0.001			0.001	Pass	
1.1.1-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.1.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2-Trichloroethane	mg/L	< 0.001			0.001	Pass	
1.1.2.2-Tetrachloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dibromoethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.2-Dichloroethane	mg/L	< 0.001			0.001	Pass	
1.2-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.3-Trichloropropane	mg/L	< 0.001			0.001	Pass	
1.2.4-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
1.3-Dichloropropane	mg/L	< 0.001			0.001	Pass	
1.3.5-Trimethylbenzene	mg/L	< 0.001			0.001	Pass	
1.4-Dichlorobenzene	mg/L	< 0.001			0.001	Pass	
2-Butanone (MEK)	mg/L	< 0.001			0.001	Pass	
2-Propanone (Acetone)	mg/L	< 0.001			0.001	Pass	
4-Chlorotoluene	mg/L	< 0.001			0.001	Pass	
4-Methyl-2-pentanone (MIBK)	mg/L	< 0.001			0.001	Pass	
Allyl chloride	mg/L	< 0.001			0.001	Pass	
Benzene	mg/L	< 0.001			0.001	Pass	
Bromobenzene	mg/L	< 0.001			0.001	Pass	
Bromochloromethane	mg/L	< 0.001			0.001	Pass	
Bromodichloromethane	mg/L	< 0.001			0.001	Pass	
Bromoform	mg/L	< 0.001			0.001	Pass	
Bromomethane	mg/L	< 0.001			0.001	Pass	
Carbon disulfide	mg/L	< 0.001			0.001	Pass	
Carbon Tetrachloride	mg/L	< 0.001			0.001	Pass	
Chlorobenzene	mg/L	< 0.001			0.001	Pass	
Chloroethane	mg/L	< 0.001			0.001	Pass	
Chloroform	mg/L	< 0.005			0.005	Pass	
Chloromethane	mg/L	< 0.001			0.001	Pass	
cis-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
cis-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Dibromochloromethane	mg/L	< 0.001			0.001	Pass	
Dibromomethane	mg/L	< 0.001			0.001	Pass	
Dichlorodifluoromethane	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
Iodomethane	mg/L	< 0.001			0.001	Pass	
Isopropyl benzene (Cumene)	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
Methylene Chloride	mg/L	< 0.001			0.001	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Styrene	mg/L	< 0.001			0.001	Pass	
Tetrachloroethene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
trans-1.2-Dichloroethene	mg/L	< 0.001			0.001	Pass	
trans-1.3-Dichloropropene	mg/L	< 0.001			0.001	Pass	
Trichloroethene	mg/L	< 0.001			0.001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Trichlorofluoromethane	mg/L	< 0.001			0.001	Pass	
Vinyl chloride	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Metals M22 (NZ MfE)							
Aluminium	mg/L	< 0.05			0.05	Pass	
Antimony	mg/L	< 0.005			0.005	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Barium	mg/L	< 0.02			0.02	Pass	
Beryllium	mg/L	< 0.001			0.001	Pass	
Boron	mg/L	< 0.05			0.05	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Cobalt	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Iron	mg/L	< 0.05			0.05	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Manganese	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Molybdenum	mg/L	< 0.005			0.005	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Selenium	mg/L	< 0.001			0.001	Pass	
Silver	mg/L	< 0.005			0.005	Pass	
Thallium	mg/L	< 0.005			0.005	Pass	
Tin	mg/L	< 0.005			0.005	Pass	
Vanadium	mg/L	< 0.005			0.005	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	ug/L	< 0.005			0.005	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.005			0.005	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.005			0.005	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	ug/L	< 0.005			0.005	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	ug/L	< 0.005			0.005	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.005			0.005	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.005			0.005	Pass	
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	ug/L	< 0.005			0.005	Pass	
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanoic acid (PFOA)	ug/L	< 0.001			0.001	Pass	
Perfluorononanoic acid (PFNA)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanoic acid (PFDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/L	< 0.001			0.001	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.001			0.001	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.001			0.001	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.001			0.001	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.001			0.001	Pass	
Perfluorononanesulfonic acid (PFNS)	ug/L	< 0.001			0.001	Pass	
Perfluoropropanesulfonic acid (PFPrS)	ug/L	< 0.001			0.001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.001			0.001	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.001			0.001	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.001			0.001	Pass	
Perfluorooctanesulfonic acid (PFOS)	ug/L	< 0.001			0.001	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.001			0.001	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	ug/L	< 0.005			0.005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.001			0.001	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.001			0.001	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances- Trace							
Perfluorooctane sulfonamide (FOSA)	%	70			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	122			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	96			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	%	108			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	%	105			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	90			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	95			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs) - Trace							
Perfluorobutanoic acid (PFBA)	%	136			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	81			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	89			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	89			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	89			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	81			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	84			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	112			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	91			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	94			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	92			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)- Trace							
Perfluorobutanesulfonic acid (PFBS)	%	83			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	%	79			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	%	86			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	87			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	90			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	94			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	91			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	69			50-150	Pass	
LCS - % Recovery							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	103			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	%	118			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	96			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	88			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
pH (at 25 °C)	B21-Fe31696	NCP	pH Units	8.8	8.8	pass	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	No
Sample correctly preserved	No
Appropriate sample containers have been used	No
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).
N16	Analysis performed by Eurofins Environment Testing Australia

Authorised by:

Emily Rosenberg	Senior Analyst-Metal (VIC)
Joseph Edouard	Senior Analyst-Organic (VIC)
Joseph Edouard	Senior Analyst-PFAS (VIC)
Scott Beddoes	Senior Analyst-Inorganic (VIC)
Vivian Wang	Senior Analyst-Volatile (VIC)

Glenn Jackson
General Manager

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Tonkin+Taylor

Job No: 1004057.0000
19 February 2019

National Steel Limited
29 Hobill Ave
Manukau
Auckland

Attention: Mr Vipan Garg

Dear Vipan

Characterisation testing of shredding wastes

Tonkin & Taylor Limited (T+T) is pleased to present the results of contaminant testing of metal shredding waste at National Steel Limited's site in Manukau, Auckland. This work was carried out in accordance with our proposal of 27 March 2018.

1 Background

National Steel operates a metal shredding facility at 29 Hobill Ave, Manukau (the site). Various types of ferrous and non-ferrous metals are received in various forms and sizes (such as car bodies, whiteware, building materials, cans, cables etc.) from a network of scrap metal suppliers. The metal products are shredded and the metallic component is separated for recycling. Currently the non-metallic component is disposed of as waste to landfill.

National Steel wishes to explore options for disposing of the non-metallic waste in a private landfill, both to reduce disposal costs and potentially allow the materials to be reprocessed in future when technologies become available to recover more of its reusable content.

2 Objective and scope of work

The objective of this investigation was to characterise the discharge (leachate) that may be produced by the waste once it has been disposed to land, and the implications of this on disposal options. The following scope of work was undertaken:

- Collection of three composite samples of non-metallic waste from the output of the shredder;
- Laboratory analysis of the samples for a range of potential contaminants using the Toxicity Characteristic Leaching Procedure (TCLP) and Synthetic Precipitation Leaching Procedure (SPLP);
- Preparation of this report, which summarises our work and comments on the implications of the findings including the potential design and consenting requirements for a private landfill.

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3 Methodology

A site visit was made on 24 April 2018. Three samples were collected from across the stockpile formed below the output chute of the non-metallic waste shredder (refer to Photograph 1 provided in Appendix A). The materials appeared to comprise predominantly foam, plastic, vinyl, rubber and very small metallic or wire pieces (refer to Photograph 2 to Photograph 4 provided in Appendix A) in particle sizes from a few to some 200 millimetres.

Samples were shipped to Hill Laboratories in Hamilton for analysis, using TCLP and SPLP methods, for:

- Metals;
- Total petroleum hydrocarbons (TPH);
- Semi-volatile organic compounds (SVOC);
- Polychlorinated biphenyls (PCB);
- Methanol and ethylene; and
- Propylene glycol.

The TCLP method provides an indication of leachate that may be generated under typical landfill conditions (acidic), while the SPLP methods provides an indication of leachate that may be generated under normal atmospheric conditions (e.g. exposure to rainfall), such as might occur within a cleanfill environment.

It was originally proposed that the bulk samples would also be tested, alongside the TCLP and SPLP analyses, to establish the potential contaminant concentrations in the raw waste. However, due to the nature of the materials (principally comprising foam and plastic) the laboratory was unable to perform testing on the bulk samples. Similarly, the particles size of the samples also prevented analysis of the samples for volatile organic compounds (VOCs). These data gaps are not considered to compromise the findings of this preliminary assessment and options to address the gaps are provided in this report.

4 Assessment criteria

The classification of wastes for disposal is addressed by a number of guidelines, standards and regulations including:

- The Ministry for the Environment (MfE) in its documents:
  - A Guide to the Management of Cleanfills. Prepared by Beca Carter Hollings & Ferner Ltd. Published in January 2002 by the Ministry for the Environment (MfE, 2002); and
  - Module 2: Hazardous Waste Guidelines, Landfill Waste Acceptance Criteria and Landfill Classification. Published in May 2004 by the Ministry for the Environment (MfE, 2004).
- Landfill Guidelines. Centre for Advanced Engineering, University of Canterbury, Christchurch New Zealand. First published April 2000 (CAE, 2000).
- In mid-2012 WasteMINZ's Landfill and Residual Waste Sector Group formed a Project Team to guide the development of the "Technical Guidelines for Disposal to Land". The document was been designed to bring together and supersedes the following documents:
  - A Guide to the Management of Cleanfills (MfE, 2002); and
  - Landfill Guidelines (CAE, 2000).

  The "Technical Guidelines for Disposal to Land" were updated in August 2018 (WasteMINZ, 2018) but have yet to be formally endorsed by the MfE.

- Definitions and rules included in various District and Regional Plans, for example in the Auckland Region discharges from cleanfills, managed fills and landfills are controlled by the rules set out in Section E13 of the Auckland Unitary Plan (AUP). Effectively the deposition of more than 250 m^3 per year of cleanfill material (as defined below) triggers the need for resource consent. Cleanfill is defined in the AUP as:

  "Cleanfill material means natural material such as clay, gravel, sand, soil and rock which has been excavated or quarried from areas that are not contaminated with manufactured chemicals or chemical residues as a result of industrial, commercial, mining or agricultural activities. It excludes:

  - *Hazardous substances and material (such as municipal solid waste) likely to create leachate by means of biological breakdown;*
  - *Product and materials derived from hazardous waste treatment, stabilisation and disposal practices;*
  - *Materials such as medical and veterinary waste, asbestos, and radioactive substances;*
  - *Soil and fill material which contain any trace element specified in Table E30.6.1.4.2 at a concentration greater than the background concentration in Auckland soils specified;*
  - *Sulfidic ores and soils;*
  - *Combustible components;*
  - *More than 5% by volume of inert manufactured materials (e.g. concrete, brick, tiles); and*
  - *More than 2% by volume of attached biodegradable material (e.g. vegetation)."*

  Similar definitions and rules are included in most regional plans, including the Waikato and Northland regions.
- Under the AUP discharges to surface or groundwater are required to be considered against the 2000 version of the Australian and New Zealand Environment and Conservation Council's "Australian and New Zealand guidelines for Fresh and Marine Water Quality" (ANZECC Guidelines). These guidelines have recently been superseded by the Australian & New Zealand Guidelines for Fresh and Marine Water Quality[1], however, for the contaminants considered by this assessment the trigger levels/acceptance criteria generally remain unchanged. On this basis this assessment refers to the ANZECC Guidelines, as required by the AUP.

These guidelines have been used to assess the both visual and analytical results obtained by this investigation. We note that the WasteMINZ, 2018 guidelines do not currently provide acceptance criteria for Class 3 landfills (Managed Fill) so this assessment has been limited to Class 2 (C&D landfills). The guidelines note that Class 2 (C&D landfills) may be developed for specific industrial wastes including, monofills, which could include the scenario of a developing a private landfill for National Steel's non-metallic waste.

5 Results

5.1 Visual assessment

As described in Section 4 most regional plans define cleanfill as natural materials which generally exclude manufactured products, particularly those that have the potential to generate leachate. Based on our visual inspection of the shredded non-metallic waste it is clear that the materials would not be able to meet the definition of cleanfill applied in Auckland or the neighbouring regions.

[1] http://www.waterquality.gov.au/anz-guidelines

As a result the material would need to be disposed of to a facility(ies) which meet (as a minimum) the requirements for Class B or Class 2/3 (Managed Fill/C&D Landfills).

Class B or Class 2/3 (Managed Fill/C&D Landfills) are defined in varying ways across the current (CAE, 2000) and proposed (WasteMINZ, 2018) guidance documents but can be summarised as being facilities that have limited or no engineered systems designed to collect landfill leachate or gases. Potential effects at such facilities are controlled by restricting the types of wastes received and appropriately capping the materials once placed. Further assessment of the potential for to dispose of the non-metallic waste to these types of facilities is provided in the following sections.

5.2 Analytical results

A summary of the analytical results if provided in comparison to the relevant acceptance criteria in Appendix B. Only those compounds that were reported above the laboratory limit of reporting and/or for which acceptance criteria are available are shown in Appendix B. Full transcripts as received from the laboratory are provided in Appendix C.

In summary the results show:

- Aside from the major minerals that are expected to be present (calcium, magnesium, potassium, sodium) zinc and ethylene glycol were reported at the highest concentrations in both the SPLP and TCLP analyses. Ethylene glycol is a primary component of antifreeze formulations used in motor vehicle engine cooling systems.
- As expected the TCLP analyses generally resulted in higher concentrations of contaminants in leachate than the SPLP analyses.
- The results of both the SPLP and TCLP analyses reported concentrations of a large number of metals and ethylene glycol which exceeded the ANZECC Guidelines acceptance criteria indicating that that leachate that may be produced from these material could have negative effects on environmental receptors if discharged to natural waterways or groundwater. A number of SVOC compounds are shown as potentially exceeding the ANZECC Guidelines acceptance criteria, however, this is a function of the laboratory reporting limit exceeding the acceptance criteria. There is no other indication that there compounds would be expected to be present in the samples.
- Of the SVOCs only:
    - Phthalates were reported above the laboratory limit of reporting, but below acceptance criteria, in the results of the SPLP analyses. Phthalates are mainly used as plasticisers, substances which are added to plastics to increase their flexibility, transparency, durability, and longevity;
    - Phenols were reported above the laboratory limit of reporting, but below acceptance criteria, in the results of the TCLP analyses. The presence of phenol in the TCLP results could be the result of acid catalysing precursor compounds including benzene and propylene (used in plastics, carpets, paints etc.);
    - Naphthalene and Bis(2-chloroethyl)ether were reported in one sample each, but in both cases the concentrations were close to the laboratory limit of reporting.
- Total petroleum hydrocarbons were also reported above the laboratory limit of reporting in results of both the SPLP and TCLP analyses. Neither environmental nor landfill acceptance criteria are available for these contaminants in the liquid phase. However, the MfE's "Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011)" provides acceptance criteria for potable use which have been used as a conservative screening threshold. The concentrations of TPH are all well below the

acceptance criteria for potable use of groundwater and are therefore unlikely to present a significant risk to human health or the environment if discharged as leachate.

- Only zinc concentrations were reported to exceed (by an average of less than 3 times) Class B and/or Class2/C&D landfill criteria in the results of the SPLP analyses. Therefore if processes to separate metallic items from the waste were able to be improved, , or the zinc stabilised by treatment, this could reduce concentrations and potentially allow disposal to a Class B and/or Class2/C&D landfill where wastes are placed and maintained under normal atmospheric conditions, i.e. do no become acidic. Alternatively, wastes maybe suitable for disposal to a Class B or Class2/C&D landfill that can accept slightly elevated zinc concentrations as part of its waste stream. As acceptance criteria for Class B and/or Class2/C&D landfill are generally defined by site specific consent conditions further work would be required to identify if such sites are currently available within economic transport distance.

  If the wastes are maintained under normal atmospheric conditions it may also be an option to stockpile the materials on a suitable site, with appropriate control and treatment of runoff, for later reprocessing. However, if reprocessing does not occur the materials may still require disposal resulting in double handling/storage costs.

  In any case unless pre-treatment, which could potentially include stabilisation, can be demonstrated to sufficiently reduce zinc concentrations both a new monofill or stockpiling facility will need to be engineered to mitigate zinc discharges, e.g. appropriate lining (as a minimum). The costs of design, consenting, construction and operation of a suitable facility may exceed the potential cost savings and return from later reprocessing.
- The concentrations of zinc, nickel, and in one instance lead, were reported to exceed Class B and/or Class2/C&D landfill criteria in the results of the SPLP analyses. Therefore the materials are unlikely to be suitable for disposal to Class B and/or Class2/C&D landfills in which acidic conditions may develop. However, as indicated above if processes to separate metallic items from the waste were able to be improved this could reduce concentrations and potentially allow disposal to a Class B and/or Class2/C&D landfill. Alternatively disposal to Class A landfill indicated to be appropriate (see below).
- TCLP testing indicates that only zinc was reported at concentrations above Class A landfill acceptance criteria. These results indicate that under the acidic conditions, which are expected to occur in a mixed waste landfill, unacceptable zinc concentrations may result in leachate. This may not be a problem where the wastes are being accepted as a small part of a wider mixed waste stream, i.e. zinc concentrations will be diluted, or the disposal site has appropriate engineering controls to capture and treat leachate.

6 Summary and conclusions

In summary the results of this assessment show:

1 Due to their composition the non-metallic shredded wastes are not suitable for disposal as cleanfill. The generation of leachate during SPLP testing (i.e. simulating normal atmospheric conditions), which exceeds typical environmental acceptance criteria, confirms this interpretation.

2 Under normal atmospheric conditions the wastes generate leachate that generally complies with Class B or Class2/C&D landfill acceptance criteria, however, zinc concentrations exceeded these criteria. The wastes maybe therefore be suitable for disposal to Class B or Class2/C&D landfill that can accept slightly elevated zinc concentrations as part of its waste stream and where wastes are placed and maintained under normal atmospheric conditions, i.e. do no become acidic. Further work is required to identify if such sites are currently available within economic transport distance from National Steel's operations.

3 Alternatively the material maybe suitable for disposal to a new Class 2 monofill (i.e. accepting only this waste) if either:

   a There is potential to pre-treat the waste to reduce zinc concentrations; or

   b The facility is or can be designed in a way which mitigate zinc discharges.

   If the above controls are applied it may also be an option to stockpile the materials on a suitable site for later reprocessing. However, if reprocessing does not occur the materials may still require disposal resulting in double handling/storage costs.

   In any case unless pre-treatment, which could potentially include stabilisation, can be demonstrated to sufficiently reduce zinc concentrations both a new monofill or stockpiling facility will need to be engineered to mitigate zinc discharges, e.g. appropriate lining (as a minimum).The costs of design, consenting, construction and operation of a suitable facility may exceed the potential cost savings and return from later reprocessing.

4 TCLP testing indicates that unacceptable zinc concentrations may result in leachate under the acidic conditions that are expected to occur in a mixed waste landfill. This may not be an issue where the wastes are being accepted as a small part of a wider mixed waste stream. However, it does mean that disposal to Class B or Class2/C&D landfill or design of a new private monofill would need to be carefully considered to minimise the potential for acidic conditions to develop.

5 Testing of the non-metallic shredded wastes does indicate that the materials include metallic content that may be available for later recovery by reprocessing in future, when technologies become available/economically viable.

6 Due to the nature of the materials some testing (of raw waste and for VOCs) was not able to be completed using standard laboratory methods. Before further consideration of alternative disposal options is undertaken it is recommended that use of alternative testing methods be assessed in order to address these data gaps and confirm the interpretations presented in this assessment.

7 Applicability

This report has been prepared for the exclusive use of our client National Steel Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Recommendations and opinions in this report are based on discrete sampling data. The nature and continuity of materials are inferred from the discrete data points and it must be appreciated that actual conditions could vary from the assumed model.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Authorised for Tonkin & Taylor Ltd by:

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Shane Moore
Project Director

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Appendix A: Photographs

Photograph 1: Overview of waste output from non-metallic shredder

Photograph 2: Close-up of waste output from non-metallic shredder (jar lid ~90 mm diameter for scale)

Photograph 3: Close-up of waste output from non-metallic shredder (jar ~150 mm long for scale)

Photograph 4: Rubber waste on margin of non-metallic shredder waste pile

Appendix B: Summary analytical results

	Acceptance criteria				Analytical results					
	ANZECC 95% trigger levels freshwater [1]	Class B landfill criteria [2]	C&D (Class 2) landfill criteria [3]	Class A landfill criteria [2]	SPLP analysis			TCLP analysis		
					OP1	OP2	OP3	OP1	OP2	OP3
Metals										
Total Aluminium	0.055	4	4	40	0.3	0.44	0.048	0.45	0.177	< 0.063
Total Arsenic	0.013	0.5	1	5	0.0028	0.0031	0.0013	< 0.021	< 0.021	< 0.021
Total Antimony	*0.009*	0.06	0.06	0.6	0.05	0.055	0.0139	0.0148	0.0147	0.0058
Total Barium	-	10	20	100	0.092	0.21	0.13	0.99	1.22	0.81
Total Beryllium	*0.00013*	1	1	10	< 0.00011	< 0.00011	< 0.00011	< 0.0021	< 0.0021	< 0.0021
Total Boron	0.37	2	2	20	0.67	0.56	0.46	1.01	0.64	0.89
Total Cadmium	0.0002	0.1	0.2	1	0.0006	0.0006	0.00054	0.064	0.033	0.083
Total Calcium	-	-	-	-	21	27	47	230	210	230
Total Chromium	0.001	0.5	1	5	0.0183	0.0097	0.00178	< 0.011	< 0.011	< 0.011
Total Copper	0.0014	0.5	0.5	5	0.129	0.084	0.078	0.044	0.026	0.139
Total Lead	0.0034	0.5	1	5	0.065	0.087	0.044	1.07	0.22	0.54
Total Lithium	-	2	2	20	0.137	0.145	0.099	0.164	0.119	0.146
Total Magnesium	-	-	-	-	3.1	2.3	4.9	20	8.4	14.1
Total Mercury	0.0006	0.02	0.04	0.2	< 0.00008	< 0.00008	< 0.00008	< 0.0021	< 0.0021	< 0.0021
Total Molybdenum	*0.034*	1	1	10	0.43	0.08	0.066	< 0.021	< 0.0042	< 0.0042
Total Nickel	0.011	1	1	10	0.05	0.04	0.05	1.88	1.47	1.61
Total Potassium	-	-	-	-	5.9	4.3	5.7	7.3	5.5	9.4
Total Selenium	0.011	0.11	0.2	1	< 0.0011	< 0.0011	< 0.0011	0.034	0.027	0.056
Total Silver	0.00005	0.5	1	5	0.00013	0.00011	< 0.00011	< 0.0022	< 0.0022	< 0.0022
Total Sodium	-	-	-	-	25	18	25	-	-	-
Total Tin	*0.003*	100	100	1000	0.0105	0.0055	0.00156	< 0.011	< 0.011	< 0.011
Total Uranium	-	-	-	-	0.000026	0.000027	< 0.000021	< 0.00042	< 0.00042	< 0.00042
Total Zinc	0.008	1	1	10	5.6	1.67	1.11	460	340	730
Ethylene glycol	*0.33*	-	-	-	123	91	5	100	69	8
Polycyclic Aromatic Hydrocarbons										
Anthracene	*0.0004*	-	-	-	< 0.0013	< 0.0013	< 0.0013	< 0.003	< 0.003	< 0.003
Benzo[a]pyrene (BAP)	*0.0002*	-	-	-	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Fluoranthene	*0.0014*	-	-	-	< 0.0013	< 0.0013	< 0.0013	< 0.003	< 0.003	< 0.003
Naphthalene	0.016	1	1	10	< 0.0013	0.002	< 0.0013	< 0.003	< 0.003	< 0.003
Total Petroleum Hydrocarbons										
C7 - C9	18 [4]	-	-	-	< 0.06	0.13	< 0.06	0.06	0.11	< 0.06
C10 - C14	> S [4]	-	-	-	< 0.2	0.3	< 0.2	0.3	< 0.2	< 0.2
C15 - C36	> S [4]	-	-	-	1.6	1.2	< 0.4	< 0.4	< 0.4	< 0.4
PCBs										
Total PCB (Sum of 35 congeners)	-	< LOR	5	< LOR	< 0.0006	< 0.0006	< 0.0005	< 0.005	< 0.005	< 0.005
Haloethers										
Bis(2-chloroethyl)ether	-	-	-	-	< 0.003	0.006	< 0.003	< 0.005	< 0.005	< 0.005
Phenols										
2-Chlorophenol	0.49	0.005	-	0.05	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
2,4-Dichlorophenol	0.16	0.005	0.005	0.05	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
3 & 4-Methylphenol (m- + p-cresol)	-	-	20	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
2-Methylphenol (o-Cresol)	-	-	20	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
2-Nitrophenol	*0.002*	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Pentachlorophenol (PCP)	0.01	-	10	-	< 0.05	< 0.05	< 0.05	< 0.10	< 0.10	< 0.10
Phenol	0.32	4	4	40	< 0.005	< 0.005	< 0.005	0.036	0.032	0.017
2,4,5-Trichlorophenol	*0.0005*	-	40	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
2,4,6-Trichlorophenol	0.02	0.01	0.2	0.1	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Plasticisers										
Diethylphthalate	*1*	10	10	100	0.011	0.013	< 0.005	< 0.010	< 0.010	< 0.010
Dimethylphthalate	*3.7*	40	40	400	0.01	0.007	< 0.005	< 0.010	< 0.010	< 0.010
Di-n-butylphthalate	-	30	-	300	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Nitrogen containing compounds										
2,4-Dinitrotoluene	0.065	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Nitrobenzene	0.55	-	0.2	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
Organochlorine Pesticides										
Aldrin	0.000001	0.000008	-	0.00008	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
gamma-BHC (Lindane)	0.0002	-	0.08	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
4,4'-DDE	*0.00003*	-	-	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
4,4'-DDT	0.00001	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Dieldrin		0.04	-	0.4	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
Endosulfan I	0.0002	0.03	-	0.3	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Endrin	0.00002	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Heptachlor	0.00009	-	0.0008	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
Other Halogenated compounds										
1,2-Dichlorobenzene	0.16	0.02	0.02	0.2	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
1,3-Dichlorobenzene	0.26	5	-	50	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
1,4-Dichlorobenzene	0.06	-	0.75	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Hexachlorobutadiene	*0.00004*	-	-	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
Hexachloroethane	0.36	-	0.3	-	< 0.005	< 0.005	< 0.005	< 0.010	< 0.010	< 0.010
1,2,4-Trichlorobenzene	0.17	4		40	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
Other SVOC										
Isophorone	*0.12*	-	-	-	< 0.003	< 0.003	< 0.003	< 0.005	< 0.005	< 0.005
All other SVOC compounds reported below the laboratory limit of reporting										

Notes:

All results in mg/l

< LOR indicates less than laboratory limit of reporting

Dash (-) indicates no trigger level provided or analyte not tested.

Blue shaded values indicate ANZECC 95% guideline exceeded (including low and moderate reliability trigger levels).

Green shaded values indicate Class B and/or C&D landfill criteria exceeded.

Orange shaded values indicate C&D landfill criteria exceeded.

Brown shaded values indicate Class A landfill criteria exceeded.

1 - Australian and New Zealand Environment and Conservation Council (ANZECC), 2000. *Australian and New Zealand guidelines for Fresh and Marine Water Quality* . Values in italics indicate insufficient data available to derive high reliability trigger level. Low or moderate reliability trigger levels are provided.

2 - Ministry for the Environment, 2004. *Module 2: Hazardous Waste Guidelines, Landfill Waste Acceptance Criteria and Landfill Classification.* Table 2, Appendix A.

3 - Waste Management Institute New Zealand (WasteMINZ), August 2018. *Technical Guidelines for Disposal to Land.*

4 - Ministry for the Environment, 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011). Potable criteria used as a conservative proxy.

Appendix C: Laboratory analytical report

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Private Bag 3205
Hamilton 3240 New Zealand

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T +64 7 858 2000
E mail@hill-labs.co.nz
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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	1969553 SPv1
Contact:	S Moore	**Date Received:**	26-Apr-2018
	C/- Tonkin & Taylor	**Date Reported:**	11-May-2018
	PO Box 5271	**Quote No:**	87655
	Auckland 1141	**Order No:**	1004057
		Client Reference:	1004057
		Submitted By:	Penelope Lindsay

Sample Type: Miscellaneous

Sample Name:		OP1 24-Apr-2018	OP2 24-Apr-2018	OP3 24-Apr-2018		
Lab Number:		1969553.1	1969553.2	1969553.3		
Individual Tests						
SPLP Sample Weight	g	50	50	50	-	-
SPLP Extractant Type*		De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	De-ionised Water, pH 5.8 +/- 0.4	-	-
SPLP Final pH	pH Units	7.6	8.2	8.2	-	-
TCLP Weight of Sample Taken	g	50	50	50	-	-
TCLP Initial Sample pH	pH Units	8.5	8.9	8.6	-	-
TCLP Acid Adjusted Sample pH	pH Units	2.1	2.1	3.1	-	-
TCLP Extractant Type*		NaOH/Acetic acid at pH 4.93 +/- 0.05	NaOH/Acetic acid at pH 4.93 +/- 0.05	NaOH/Acetic acid at pH 4.93 +/- 0.05	-	-
TCLP Extraction Fluid pH	pH Units	5.0	5.0	5.0	-	-
TCLP Post Extraction Sample pH	pH Units	5.8	5.7	6.2	-	-

Sample Type: Aqueous

Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Individual Tests						
Total Aluminium	g/m³	0.45	0.177	< 0.063	0.30	0.44
Total Antimony	g/m³	0.0148	0.0147	0.0058	0.050	0.055
Total Barium	g/m³	0.99	1.22	0.81	0.092	0.21
Total Beryllium	g/m³	< 0.0021	< 0.0021	< 0.0021	< 0.00011	< 0.00011
Total Boron	g/m³	1.01	0.64	0.89	0.67	0.56
Total Calcium	g/m³	230	210	230	21	27
Total Lithium	g/m³	0.164	0.119	0.146	0.137	0.145
Total Magnesium	g/m³	20	8.4	14.1	3.1	2.3
Total Mercury	g/m³	< 0.0021	< 0.0021	< 0.0021	< 0.00008	< 0.00008
Total Molybdenum	g/m³	< 0.021	< 0.0042	< 0.0042	0.43	0.080
Total Potassium	g/m³	7.3	5.5	9.4	5.9	4.3
Total Selenium	g/m³	0.034	0.027	0.056	< 0.0011	< 0.0011
Total Silver	g/m³	< 0.0022	< 0.0022	< 0.0022	0.00013	0.00011
Total Sodium	g/m³	-	-	-	25	18.0
Total Tin	g/m³	< 0.011	< 0.011	< 0.011	0.0105	0.0055
Total Uranium	g/m³	< 0.00042	< 0.00042	< 0.00042	0.000026	0.000027
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m³	-	-	-	0.0028	0.0031
Total Cadmium	g/m³	-	-	-	0.00060	0.00060
Total Chromium	g/m³	-	-	-	0.0183	0.0097
Total Copper	g/m³	-	-	-	0.129	0.084
Total Lead	g/m³	-	-	-	0.065	0.087

Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Nickel	g/m³	-	-	-	0.050	0.040
Total Zinc	g/m³	-	-	-	5.6	1.67
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m³	< 0.021	< 0.021	< 0.021	-	-
Total Cadmium	g/m³	0.064	0.033	0.083	-	-
Total Chromium	g/m³	< 0.011	< 0.011	< 0.011	-	-
Total Copper	g/m³	0.044	0.026	0.139	-	-
Total Lead	g/m³	1.07	0.22	0.54	-	-
Total Nickel	g/m³	1.88	1.47	1.61	-	-
Total Zinc	g/m³	460	340	730	-	-
Ethylene Glycol in Water						
Ethylene glycol*	g/m³	100	69	8	123	91
Propylene Glycol in Water						
Propylene glycol*	g/m³	< 4	< 4	< 4	< 4	< 4
Methanol in Water - Aqueous Solvents						
Methanol*	g/m³	< 2	< 2	< 2	< 2	< 2
Polychlorinated Biphenyls Screening in Water, By Liq/Liq						
PCB-18	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-28	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-31	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-44	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-49	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-52	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-60	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-77	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-81	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-86	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-101	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-105	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-110	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-114	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-118	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-121	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-123	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-126	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-128	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-138	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-141	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-149	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-151	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-153	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-156	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-157	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-159	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-167	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-169	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-170	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-180	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-189	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-194	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-206	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
PCB-209	g/m³	< 0.00010	< 0.00010	< 0.00010	-	-
Total PCB (Sum of 35 congeners)	g/m³	< 0.005	< 0.005	< 0.005	-	-

Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Polychlorinated Bipheyls Trace in Water, By Liq/Liq						
Total PCB (Sum of 35 congeners)	g/m³	-	-	-	< 0.0006	< 0.0006
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	-	-	-	< 0.003	< 0.003
Bis(2-chloroethyl)ether	g/m³	-	-	-	< 0.003	0.006
Bis(2-chloroisopropyl)ether	g/m³	-	-	-	< 0.003	< 0.003
4-Bromophenyl phenyl ether	g/m³	-	-	-	< 0.003	< 0.003
4-Chlorophenyl phenyl ether	g/m³	-	-	-	< 0.003	< 0.003
Haloethers in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	< 0.005	< 0.005	< 0.005	-	-
Bis(2-chloroethyl)ether	g/m³	< 0.005	< 0.005	< 0.005	-	-
Bis(2-chloroisopropyl)ether	g/m³	< 0.005	< 0.005	< 0.005	-	-
4-Bromophenyl phenyl ether	g/m³	< 0.005	< 0.005	< 0.005	-	-
4-Chlorophenyl phenyl ether	g/m³	< 0.005	< 0.005	< 0.005	-	-
Nitrogen containing compounds in SVOC Water Samples by GC-MS						
2,4-Dinitrotoluene	g/m³	< 0.010	< 0.010	< 0.010	-	-
2,6-Dinitrotoluene	g/m³	< 0.010	< 0.010	< 0.010	-	-
Nitrobenzene	g/m³	< 0.005	< 0.005	< 0.005	-	-
N-Nitrosodi-n-propylamine	g/m³	< 0.010	< 0.010	< 0.010	-	-
N-Nitrosodiphenylamine + Diphenylamine*	g/m3	< 0.010	< 0.010	< 0.010	-	-
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
2,4-Dinitrotoluene	g/m³	-	-	-	< 0.005	< 0.005
2,6-Dinitrotoluene	g/m³	-	-	-	< 0.005	< 0.005
Nitrobenzene	g/m³	-	-	-	< 0.003	< 0.003
N-Nitrosodi-n-propylamine	g/m³	-	-	-	< 0.005	< 0.005
N-Nitrosodiphenylamine + Diphenylamine	g/m3	-	-	-	< 0.005	< 0.005
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m³	-	-	-	< 0.003	< 0.003
alpha-BHC	g/m³	-	-	-	< 0.003	< 0.003
beta-BHC	g/m³	-	-	-	< 0.003	< 0.003
delta-BHC	g/m³	-	-	-	< 0.003	< 0.003
gamma-BHC (Lindane)	g/m³	-	-	-	< 0.003	< 0.003
4,4'-DDD	g/m³	-	-	-	< 0.003	< 0.003
4,4'-DDE	g/m³	-	-	-	< 0.003	< 0.003
4,4'-DDT	g/m³	-	-	-	< 0.005	< 0.005
Dieldrin	g/m³	-	-	-	< 0.003	< 0.003
Endosulfan I	g/m³	-	-	-	< 0.005	< 0.005
Endosulfan II	g/m³	-	-	-	< 0.005	< 0.005
Endosulfan sulfate	g/m³	-	-	-	< 0.005	< 0.005
Endrin	g/m³	-	-	-	< 0.005	< 0.005
Endrin ketone	g/m³	-	-	-	< 0.005	< 0.005
Heptachlor	g/m³	-	-	-	< 0.003	< 0.003
Heptachlor epoxide	g/m³	-	-	-	< 0.003	< 0.003
Hexachlorobenzene	g/m³	-	-	-	< 0.003	< 0.003
Organochlorine Pesticides in SVOC Water Samples by GC-MS						
Aldrin	g/m³	< 0.005	< 0.005	< 0.005	-	-
alpha-BHC	g/m³	< 0.005	< 0.005	< 0.005	-	-
beta-BHC	g/m³	< 0.005	< 0.005	< 0.005	-	-
delta-BHC	g/m³	< 0.005	< 0.005	< 0.005	-	-
gamma-BHC (Lindane)	g/m³	< 0.005	< 0.005	< 0.005	-	-
4,4'-DDD	g/m³	< 0.005	< 0.005	< 0.005	-	-
4,4'-DDE	g/m³	< 0.005	< 0.005	< 0.005	-	-
4,4'-DDT	g/m³	< 0.010	< 0.010	< 0.010	-	-
Dieldrin	g/m³	< 0.005	< 0.005	< 0.005	-	-
Endosulfan I	g/m³	< 0.010	< 0.010	< 0.010	-	-

Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Organochlorine Pesticides in SVOC Water Samples by GC-MS						
Endosulfan II	g/m³	< 0.010	< 0.010	< 0.010	-	-
Endosulfan sulfate	g/m³	< 0.010	< 0.010	< 0.010	-	-
Endrin	g/m³	< 0.010	< 0.010	< 0.010	-	-
Endrin ketone	g/m³	< 0.010	< 0.010	< 0.010	-	-
Heptachlor	g/m³	< 0.005	< 0.005	< 0.005	-	-
Heptachlor epoxide	g/m³	< 0.005	< 0.005	< 0.005	-	-
Hexachlorobenzene	g/m³	< 0.005	< 0.005	< 0.005	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m³	-	-	-	< 0.0013	< 0.0013
Acenaphthylene	g/m³	-	-	-	< 0.0013	< 0.0013
Anthracene	g/m³	-	-	-	< 0.0013	< 0.0013
Benzo[a]anthracene	g/m³	-	-	-	< 0.0013	< 0.0013
Benzo[a]pyrene (BAP)	g/m³	-	-	-	< 0.003	< 0.003
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	-	-	-	< 0.003	< 0.003
Benzo[g,h,i]perylene	g/m³	-	-	-	< 0.003	< 0.003
Benzo[k]fluoranthene	g/m³	-	-	-	< 0.003	< 0.003
1&2-Chloronaphthalene	g/m³	-	-	-	< 0.0013	< 0.0013
Chrysene	g/m³	-	-	-	< 0.0013	< 0.0013
Dibenzo[a,h]anthracene	g/m³	-	-	-	< 0.003	< 0.003
Fluoranthene	g/m³	-	-	-	< 0.0013	< 0.0013
Fluorene	g/m³	-	-	-	< 0.0013	< 0.0013
Indeno(1,2,3-c,d)pyrene	g/m³	-	-	-	< 0.003	< 0.003
2-Methylnaphthalene	g/m³	-	-	-	< 0.0013	< 0.0013
Naphthalene	g/m³	-	-	-	< 0.0013	0.0020
Phenanthrene	g/m³	-	-	-	< 0.0013	< 0.0013
Pyrene	g/m³	-	-	-	< 0.0013	< 0.0013
Polycyclic Aromatic Hydrocarbons in SVOC Water Samples by GC-MS						
Acenaphthene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Acenaphthylene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Anthracene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Benzo[a]anthracene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.003	< 0.003	< 0.003	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Benzo[g,h,i]perylene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Benzo[k]fluoranthene	g/m³	< 0.003	< 0.003	< 0.003	-	-
1&2-Chloronaphthalene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Chrysene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Fluoranthene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Fluorene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.003	< 0.003	< 0.003	-	-
2-Methylnaphthalene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Naphthalene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Phenanthrene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Pyrene	g/m³	< 0.003	< 0.003	< 0.003	-	-
Phenols in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m³	< 0.010	< 0.010	< 0.010	-	-
2-Chlorophenol	g/m³	< 0.005	< 0.005	< 0.005	-	-
2,4-Dichlorophenol	g/m³	< 0.005	< 0.005	< 0.005	-	-
2,4-Dimethylphenol	g/m³	< 0.005	< 0.005	< 0.005	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m³	< 0.010	< 0.010	< 0.010	-	-
2-Methylphenol (o-Cresol)	g/m³	< 0.005	< 0.005	< 0.005	-	-
2-Nitrophenol	g/m³	< 0.010	< 0.010	< 0.010	-	-

Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Phenols in SVOC Water Samples by GC-MS						
Pentachlorophenol (PCP)	g/m³	< 0.10	< 0.10	< 0.10	-	-
Phenol	g/m³	0.036	0.032	0.017	-	-
2,4,5-Trichlorophenol	g/m³	< 0.010	< 0.010	< 0.010	-	-
2,4,6-Trichlorophenol	g/m³	< 0.010	< 0.010	< 0.010	-	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m³	-	-	-	< 0.003	< 0.003
2,4-Dichlorophenol	g/m³	-	-	-	< 0.003	< 0.003
2,4,6-Trichlorophenol	g/m³	-	-	-	< 0.005	< 0.005
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m³	-	-	-	< 0.005	< 0.005
2,4-Dimethylphenol	g/m³	-	-	-	< 0.003	< 0.003
3 & 4-Methylphenol (m- + p-cresol)	g/m³	-	-	-	< 0.005	< 0.005
2-Methylphenol (o-Cresol)	g/m³	-	-	-	< 0.003	< 0.003
2-Nitrophenol	g/m³	-	-	-	< 0.005	< 0.005
Pentachlorophenol (PCP)	g/m³	-	-	-	< 0.05	< 0.05
Phenol	g/m³	-	-	-	< 0.005	< 0.005
2,4,5-Trichlorophenol	g/m³	-	-	-	< 0.005	< 0.005
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m³	-	-	-	< 0.005	< 0.005
Diethylphthalate	g/m³	-	-	-	0.011	0.013
Dimethylphthalate	g/m³	-	-	-	0.010	0.007
Di-n-butylphthalate	g/m³	-	-	-	< 0.005	< 0.005
Di-n-octylphthalate	g/m³	-	-	-	< 0.005	< 0.005
Plasticisers in SVOC Water Samples by GC-MS						
Bis(2-ethylhexyl)phthalate	g/m³	< 0.03	< 0.03	< 0.03	-	-
Butylbenzylphthalate	g/m³	< 0.010	< 0.010	< 0.010	-	-
Di(2-ethylhexyl)adipate	g/m³	< 0.005	< 0.005	< 0.005	-	-
Diethylphthalate	g/m³	< 0.010	< 0.010	< 0.010	-	-
Dimethylphthalate	g/m³	< 0.010	< 0.010	< 0.010	-	-
Di-n-butylphthalate	g/m³	< 0.010	< 0.010	< 0.010	-	-
Di-n-octylphthalate	g/m³	< 0.010	< 0.010	< 0.010	-	-
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m³	-	-	-	< 0.010	< 0.010
Di(2-ethylhexyl)adipate	g/m³	-	-	-	< 0.003	< 0.003
Other Halogenated compounds in SVOC Water Samples by GC-MS						
1,2-Dichlorobenzene	g/m³	< 0.010	< 0.010	< 0.010	-	-
1,3-Dichlorobenzene	g/m³	< 0.010	< 0.010	< 0.010	-	-
1,4-Dichlorobenzene	g/m³	< 0.010	< 0.010	< 0.010	-	-
Hexachlorobutadiene	g/m³	< 0.010	< 0.010	< 0.010	-	-
Hexachloroethane	g/m³	< 0.010	< 0.010	< 0.010	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.005	< 0.005	< 0.005	-	-
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m³	-	-	-	< 0.005	< 0.005
1,3-Dichlorobenzene	g/m³	-	-	-	< 0.005	< 0.005
1,4-Dichlorobenzene	g/m³	-	-	-	< 0.005	< 0.005
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m³	-	-	-	< 0.005	< 0.005
Hexachloroethane	g/m³	-	-	-	< 0.005	< 0.005
1,2,4-Trichlorobenzene	g/m³	-	-	-	< 0.003	< 0.003
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m³	-	-	-	< 0.03	< 0.03
Carbazole	g/m³	-	-	-	< 0.003	< 0.003
Dibenzofuran	g/m³	-	-	-	< 0.003	< 0.003
Isophorone	g/m³	-	-	-	< 0.003	< 0.003

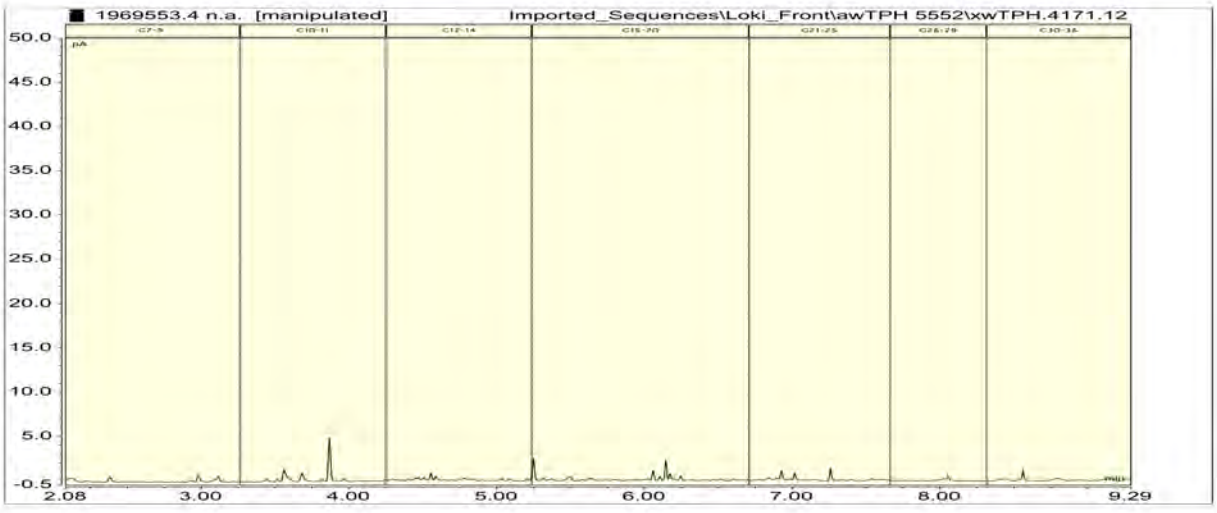
Sample Type: Aqueous						
Sample Name:		OP1 [TCLP Extract]	OP2 [TCLP Extract]	OP3 [TCLP Extract]	OP1 [SPLP Extract]	OP2 [SPLP Extract]
Lab Number:		1969553.4	1969553.5	1969553.6	1969553.10	1969553.11
Other compounds in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m³	< 0.05	< 0.05	< 0.05	-	-
Carbazole	g/m³	< 0.005	< 0.005	< 0.005	-	-
Dibenzofuran	g/m³	< 0.005	< 0.005	< 0.005	-	-
Isophorone	g/m³	< 0.005	< 0.005	< 0.005	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	0.06	0.11	< 0.06	< 0.06	0.13
C10 - C14	g/m³	0.3	< 0.2	< 0.2	< 0.2	0.3
C15 - C36	g/m³	< 0.4	< 0.4	< 0.4	1.6	1.2
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	< 0.7	1.6	1.7

Sample Name:		OP3 [SPLP Extract]				
Lab Number:		1969553.12				
Individual Tests						
Total Aluminium	g/m³	0.048	-	-	-	-
Total Antimony	g/m³	0.0139	-	-	-	-
Total Barium	g/m³	0.130	-	-	-	-
Total Beryllium	g/m³	< 0.00011	-	-	-	-
Total Boron	g/m³	0.46	-	-	-	-
Total Calcium	g/m³	47	-	-	-	-
Total Lithium	g/m³	0.099	-	-	-	-
Total Magnesium	g/m³	4.9	-	-	-	-
Total Mercury	g/m³	< 0.00008	-	-	-	-
Total Molybdenum	g/m³	0.066	-	-	-	-
Total Potassium	g/m³	5.7	-	-	-	-
Total Selenium	g/m³	< 0.0011	-	-	-	-
Total Silver	g/m³	< 0.00011	-	-	-	-
Total Sodium	g/m³	25	-	-	-	-
Total Tin	g/m³	0.00156	-	-	-	-
Total Uranium	g/m³	< 0.000021	-	-	-	-
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Total Arsenic	g/m³	0.0013	-	-	-	-
Total Cadmium	g/m³	0.00054	-	-	-	-
Total Chromium	g/m³	0.00178	-	-	-	-
Total Copper	g/m³	0.078	-	-	-	-
Total Lead	g/m³	0.044	-	-	-	-
Total Nickel	g/m³	0.050	-	-	-	-
Total Zinc	g/m³	1.11	-	-	-	-
Ethylene Glycol in Water						
Ethylene glycol*	g/m³	5	-	-	-	-
Propylene Glycol in Water						
Propylene glycol*	g/m³	< 4	-	-	-	-
Methanol in Water - Aqueous Solvents						
Methanol*	g/m³	< 2	-	-	-	-
Polychlorinated Bipheyls Trace in Water, By Liq/Liq						
Total PCB (Sum of 35 congeners)	g/m³	< 0.0005	-	-	-	-
Haloethers Trace in SVOC Water Samples by GC-MS						
Bis(2-chloroethoxy) methane	g/m³	< 0.003	-	-	-	-
Bis(2-chloroethyl)ether	g/m³	< 0.003	-	-	-	-
Bis(2-chloroisopropyl)ether	g/m³	< 0.003	-	-	-	-
4-Bromophenyl phenyl ether	g/m³	< 0.003	-	-	-	-
4-Chlorophenyl phenyl ether	g/m³	< 0.003	-	-	-	-
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
2,4-Dinitrotoluene	g/m³	< 0.005	-	-	-	-
2,6-Dinitrotoluene	g/m³	< 0.005	-	-	-	-

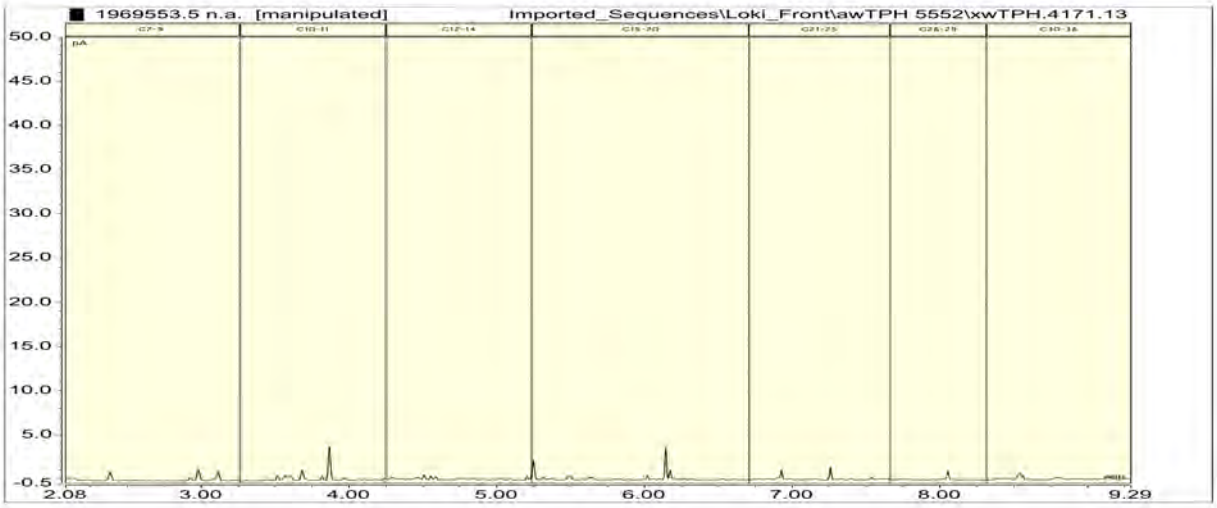
Sample Type: Aqueous						
Sample Name:		OP3 [SPLP Extract]				
Lab Number:		1969553.12				
Nitrogen containing compounds Trace in SVOC Water Samples, GC-MS						
Nitrobenzene	g/m³	< 0.003	-	-	-	-
N-Nitrosodi-n-propylamine	g/m³	< 0.005	-	-	-	-
N-Nitrosodiphenylamine + Diphenylamine	g/m3	< 0.005	-	-	-	-
Organochlorine Pesticides Trace in SVOC Water Samples by GC-MS						
Aldrin	g/m³	< 0.003	-	-	-	-
alpha-BHC	g/m³	< 0.003	-	-	-	-
beta-BHC	g/m³	< 0.003	-	-	-	-
delta-BHC	g/m³	< 0.003	-	-	-	-
gamma-BHC (Lindane)	g/m³	< 0.003	-	-	-	-
4,4'-DDD	g/m³	< 0.003	-	-	-	-
4,4'-DDE	g/m³	< 0.003	-	-	-	-
4,4'-DDT	g/m³	< 0.005	-	-	-	-
Dieldrin	g/m³	< 0.003	-	-	-	-
Endosulfan I	g/m³	< 0.005	-	-	-	-
Endosulfan II	g/m³	< 0.005	-	-	-	-
Endosulfan sulfate	g/m³	< 0.005	-	-	-	-
Endrin	g/m³	< 0.005	-	-	-	-
Endrin ketone	g/m³	< 0.005	-	-	-	-
Heptachlor	g/m³	< 0.003	-	-	-	-
Heptachlor epoxide	g/m³	< 0.003	-	-	-	-
Hexachlorobenzene	g/m³	< 0.003	-	-	-	-
Polycyclic Aromatic Hydrocarbons Trace in SVOC Water Samples						
Acenaphthene	g/m³	< 0.0013	-	-	-	-
Acenaphthylene	g/m³	< 0.0013	-	-	-	-
Anthracene	g/m³	< 0.0013	-	-	-	-
Benzo[a]anthracene	g/m³	< 0.0013	-	-	-	-
Benzo[a]pyrene (BAP)	g/m³	< 0.003	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	g/m³	< 0.003	-	-	-	-
Benzo[g,h,i]perylene	g/m³	< 0.003	-	-	-	-
Benzo[k]fluoranthene	g/m³	< 0.003	-	-	-	-
1&2-Chloronaphthalene	g/m³	< 0.0013	-	-	-	-
Chrysene	g/m³	< 0.0013	-	-	-	-
Dibenzo[a,h]anthracene	g/m³	< 0.003	-	-	-	-
Fluoranthene	g/m³	< 0.0013	-	-	-	-
Fluorene	g/m³	< 0.0013	-	-	-	-
Indeno(1,2,3-c,d)pyrene	g/m³	< 0.003	-	-	-	-
2-Methylnaphthalene	g/m³	< 0.0013	-	-	-	-
Naphthalene	g/m³	< 0.0013	-	-	-	-
Phenanthrene	g/m³	< 0.0013	-	-	-	-
Pyrene	g/m³	< 0.0013	-	-	-	-
Phenols Trace (drinkingwater) in SVOC Water Samples by GC-MS						
2-Chlorophenol	g/m³	< 0.003	-	-	-	-
2,4-Dichlorophenol	g/m³	< 0.003	-	-	-	-
2,4,6-Trichlorophenol	g/m³	< 0.005	-	-	-	-
Phenols Trace (non-drinkingwater) in SVOC Water Samples by GC-MS						
4-Chloro-3-methylphenol	g/m³	< 0.005	-	-	-	-
2,4-Dimethylphenol	g/m³	< 0.003	-	-	-	-
3 & 4-Methylphenol (m- + p-cresol)	g/m³	< 0.005	-	-	-	-
2-Methylphenol (o-Cresol)	g/m³	< 0.003	-	-	-	-
2-Nitrophenol	g/m³	< 0.005	-	-	-	-
Pentachlorophenol (PCP)	g/m³	< 0.05	-	-	-	-
Phenol	g/m³	< 0.005	-	-	-	-
2,4,5-Trichlorophenol	g/m³	< 0.005	-	-	-	-

Sample Type: Aqueous						
Sample Name:		OP3 [SPLP Extract]				
Lab Number:		1969553.12				
Plasticisers Trace (non-drinkingwater) in SVOC Water by GCMS						
Butylbenzylphthalate	g/m³	< 0.005	-	-	-	-
Diethylphthalate	g/m³	< 0.005	-	-	-	-
Dimethylphthalate	g/m³	< 0.005	-	-	-	-
Di-n-butylphthalate	g/m³	< 0.005	-	-	-	-
Di-n-octylphthalate	g/m³	< 0.005	-	-	-	-
Plasticisers Trace (drinkingwater) in SVOC Water Samples by GCMS						
Bis(2-ethylhexyl)phthalate	g/m³	< 0.010	-	-	-	-
Di(2-ethylhexyl)adipate	g/m³	< 0.003	-	-	-	-
Other Halogenated compounds Trace (drinkingwater) in SVOC Water						
1,2-Dichlorobenzene	g/m³	< 0.005	-	-	-	-
1,3-Dichlorobenzene	g/m³	< 0.005	-	-	-	-
1,4-Dichlorobenzene	g/m³	< 0.005	-	-	-	-
Other Halogenated compounds Trace (non-drinkingwater) in SVOC						
Hexachlorobutadiene	g/m³	< 0.005	-	-	-	-
Hexachloroethane	g/m³	< 0.005	-	-	-	-
1,2,4-Trichlorobenzene	g/m³	< 0.003	-	-	-	-
Other SVOC Trace in SVOC Water Samples by GC-MS						
Benzyl alcohol	g/m³	< 0.03	-	-	-	-
Carbazole	g/m³	< 0.003	-	-	-	-
Dibenzofuran	g/m³	< 0.003	-	-	-	-
Isophorone	g/m³	< 0.003	-	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	-	-	-	-
C10 - C14	g/m³	< 0.2	-	-	-	-
C15 - C36	g/m³	< 0.4	-	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	-	-	-	-

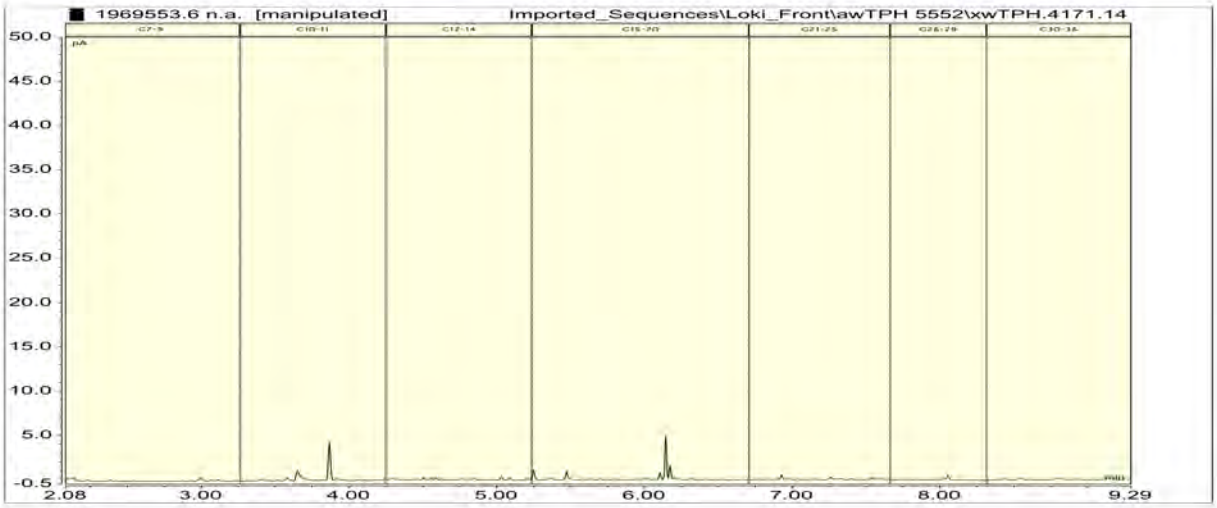
1969553.4
OP1 [TCLP Extract]
Client Chromatogram for TPH by FID



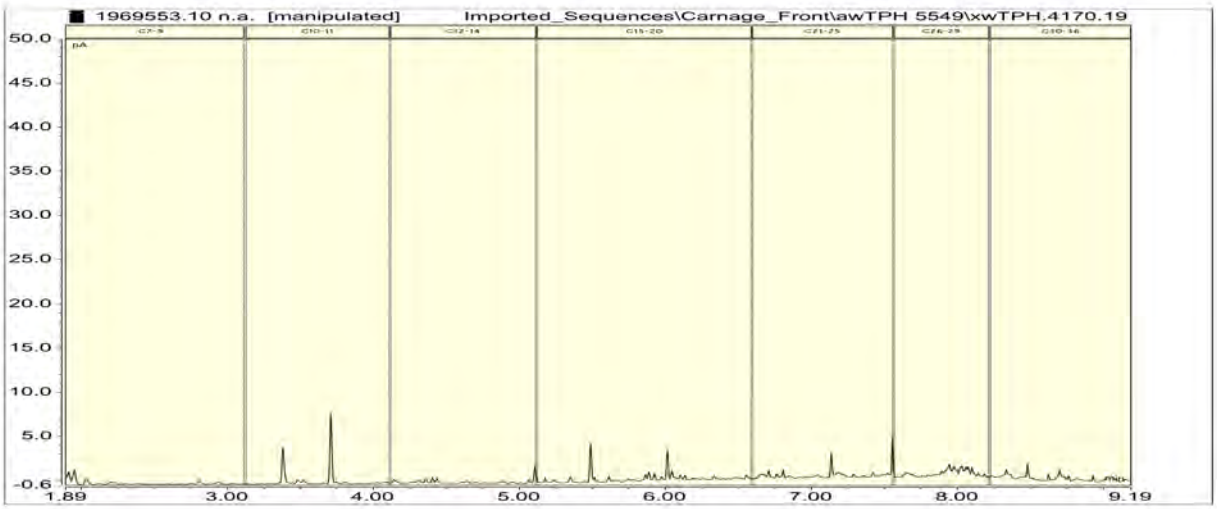
1969553.5
OP2 [TCLP Extract]
Client Chromatogram for TPH by FID



1969553.6
OP3 [TCLP Extract]
Client Chromatogram for TPH by FID



1969553.10
OP1 [SPLP Extract]
Client Chromatogram for TPH by FID



1969553.11
OP2 [SPLP Extract]
Client Chromatogram for TPH by FID

Analyst's Comments

The matrix in samples 1969553.10, .11 and .12 has affected the System Monitoring Compounds Tetrachloro-m-xylene and 3-Bromobiphenyl in the PCB analysis, whereby the recovery for sample 10 was 12% & 24%, sample 11 was 18% & 26% and sample 12 was 16% & 36% respectively. Therefore the results may be underestimated.
The analysis was done on limited sample, hence the higher detection limits reported.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Miscellaneous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Environmental Solids Sample Preparation	Air dried at 35°C and sieved, <2mm fraction. Used for sample preparation. May contain a residual moisture content of 2-5%.	-	3
Sample preparation by Trace Elements section*	Sample preparation as per requirement.	-	1-3
SPLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1312	-	1-3
TCLP Profile*	Extraction at 30 +/- 2 rpm for 18 +/- 2 hours, (Ratio 1g sample : 20g extraction fluid). US EPA 1311	-	1-3
SPLP Profile			
SPLP Sample Weight	Gravimetric. US EPA 1312.	0.1 g	1-3
SPLP Extractant Type*	US EPA 1312 (Modified for New Zealand conditions to use De-ionised Water unless otherwise specified).	-	1-3
SPLP Final pH	pH meter. US EPA 1312.	0.1 pH Units	1-3
TCLP Profile			
TCLP Weight of Sample Taken	Gravimetric. US EPA 1311.	0.1 g	1-3
TCLP Initial Sample pH	pH meter. US EPA 1311.	0.1 pH Units	1-3
TCLP Acid Adjusted Sample pH	pH meter. US EPA 1311.	0.1 pH Units	1-3
TCLP Extractant Type*	US EPA 1311.	-	1-3
TCLP Extraction Fluid pH	pH meter. US EPA 1311.	0.1 pH Units	1-3
TCLP Post Extraction Sample pH	pH meter. US EPA 1311.	0.1 pH Units	1-3

Sample Type: Aqueous

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Total Digestion with HCl	Nitric/hydrochloric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	4-6
Total Digestion of Extracted Samples*	Nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified).	-	4-6, 10-12
Total acid digest for Silver analysis	Boiling nitric / hydrochloric acid digestion (5:1 ratio). APHA 3030 F (modified) 22nd ed. 2012.	-	4-6, 10-12

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Aluminium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.063 g/m3	4-6
Total Aluminium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.0032 g/m3	10-12
Total Antimony	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0042 g/m3	4-6
Total Antimony	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00021 g/m3	10-12
Total Barium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.11 g/m3	4-6
Total Barium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.0053 g/m3	10-12
Total Beryllium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0021 g/m3	4-6
Total Beryllium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00011 g/m3	10-12
Total Boron	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.11 g/m3	4-6
Total Boron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.063 g/m3	10-12
Total Calcium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	1.1 g/m3	4-6
Total Calcium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.053 g/m3	10-12
Total Lithium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0042 g/m3	4-6
Total Lithium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00021 g/m3	10-12
Total Magnesium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.42 g/m3	4-6
Total Magnesium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m3	10-12
Total Mercury	Acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0021 g/m3	4-6
Total Mercury	Bromine Oxidation followed by Atomic Fluorescence. US EPA Method 245.7, Feb 2005.	0.00008 g/m3	10-12
Total Molybdenum	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0042 g/m3	4-6
Total Molybdenum	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.00021 g/m3	10-12
Total Potassium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	1.1 g/m3	4-6
Total Potassium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.053 g/m3	10-12
Total Selenium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.021 g/m3	4-6
Total Selenium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.0011 g/m3	10-12
Total Silver	Boiling nitric / hydrochloric acid digestion (5:1 ratio), ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0022 g/m3	4-6
Total Silver	Boiling nitric / hydrochloric acid digestion (5:1 ratio), ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00011 g/m3	10-12
Total Sodium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.021 g/m3	10-12
Total Tin	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.011 g/m3	4-6
Total Tin	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00053 g/m3	10-12
Total Uranium	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.00042 g/m3	4-6
Total Uranium	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8.	0.000021 g/m3	10-12
C7 - C9	Head Space, GCMS analysis.	0.06 g/m3	4-6, 10-12
Heavy metals, totals, trace As,Cd,Cr,Cu,Ni,Pb,Zn	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8	0.000053 - 0.0011 g/m3	10-12
Heavy metals, totals, screen As,Cd,Cr,Cu,Ni,Pb,Zn	Nitric acid digestion, ICP-MS, screen level. APHA 3125 B 22nd ed. 2012.	0.0011 - 0.021 g/m3	4-6
Ethylene Glycol in Water*	Direct injection, dual column GC-FID	4 g/m3	4-6, 10-12

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Propylene Glycol in Water*	Direct injection, dual column GC-FID	4 g/m^3	4-6, 10-12
Methanol in Water - Aqueous Solvents*	Direct injection, dual column GC-FID	1.0 g/m^3	4-6, 10-12
Polychlorinated Biphenyls Screening in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS analysis	0.00010 - 0.005 g/m^3	4-6
Polychlorinated Bipheyls Trace in Water, By Liq/Liq	Liquid / liquid extraction, SPE (if required), GC-MS analysis	0.0002 g/m^3	10-12
Semivolatile Organic Compounds Screening in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	4-6
Semivolatile Organic Compounds Trace in Water by GC-MS	Liquid/Liquid extraction, GPC cleanup (if required), GC-MS FS analysis	-	10-12
Total Petroleum Hydrocarbons in Water*	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	4-6, 10-12

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Kim Harrison MSc
Client Services Manager - Environmental

Engineering Report

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Appendix D

Management Plan

R4424·4, Rev B, 30 May 2025

Report

Management Plan

Green Steel Monofill, Hampton Downs

61 Hampton Downs Road, Hampton Downs, Waikato

Prepared for National Green Steel Limited

Prepared by Earthtech Consulting Limited

30 May 2025
Reference: R4424-4

EARTHTECH

Document Control

Management Plan

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Client:	National Green Steel Limited
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R4424-4	B	30/05/2025	Final

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Management Plan

Green Steel, Hampton Downs

61 Hampton Downs Road, Hampton Downs, Waikato

Important Note for all Readers of this Report:

This report should be read in conjunction with the Engineering Report (Earthtech, 2025C).

1. Introduction

A monofill is a small, tightly controlled waste storage facility for floc sourced solely from the New Zealand Steel resource recovery plant. Two separate monofill sites are proposed on the southwest and northeast areas of the main Green Steel Project site located off Hampton Downs Road in the Waikato. The floc material is considered to be a future resource (energy) and is to be stored separately and safely until it can be reused.

This Management Plan provides a detailed description of the methods and practices applied to the southwest monofill site to ensure compliance with the consent conditions and ensure that best environmental practice standards are followed at all times. Similar procedures will be followed at the northeast site. The two sites may operate together.

This report is an early draft that indicates the general scope of the proposed Management Plan. Full details will be included once the resource consent conditions are available and detailed design proceeds for each stage or substage.

A Preliminary Geotechnical Assessment Report (Earthtech, 2025B) and an Engineering Report (Earthtech, 2025C) have been prepared, as well as an Earthworks Management and Erosion and Sediment Control Plan (Earthtech, 2025A). The reader of this Management Plan should understand the supporting documentation listed in Appendix A. A set of project development drawings (Figures PD1 to PD5.2, Earthtech, 2025C) has been prepared to provide an overview of the Green Steel Project details.

2. Site Details

Site details are to be confirmed and recorded as follows:

- Owner and contact details.
- Site Manager and contact details.
- Site boundaries and survey details.
- Monofill stages and boundaries.
- Interaction with other site operations.
- Site-specific restrictions or constraints (shared use accessway).

3. Resource Consents and Consent Conditions

The following consents are currently being processed:

- Land Use
  - Soil disturbance earthworks, including
  - Soil materials stockpiling
  - Erosion and sediment control structures
- Water – use, take and storage.
  - Water take from groundwater
- Discharges to land, water and air
  - Place monofill on land, i.e. discharge of waste onto or into land.
  - Of leachate into ground or groundwater (liner potential leakage effects).
  - Air discharge consents (dust).
- Stormwater diversion and discharge consents.
- Other consents if relevant.

4. Management of the Site

4.1 Management Policies, Objectives and Priorities

The purpose of this management plan is to describe the procedures that are adopted to provide best practice management of the monofill and to detail how the resource consent conditions will be achieved. Best practice management of the monofill includes waste minimisation (at the recovery plant in this instance, i.e. optimisation of resource recovery efficiencies), minimisation of leachate, dust, and odours generated by the floc materials and site storage of the materials for beneficial use of resources wherever possible.

Waste Minimisation Policies and Objectives:

Green Steel's approach to waste minimisation is well known as a result of the metals recovery sites operated in Auckland and Christchurch. This monofill facility will extend the waste minimisation work by allowing storage and then possible future reuse of the waste floc that is currently disposed to landfill.

Green Steel is committed to maintaining a safe and healthy workplace and a high standard of environmental performance throughout its processing activities. Health, safety, and environmental considerations are of equal status to the company's primary business objectives.

This includes mandatory reporting of health, safety and environmental incidents (accidents or near misses) so that procedures can be reviewed when necessary, changed to prevent recurrences, and to achieve ongoing improvement by identifying and managing risks.

An audit of the general site conditions, risks and management systems will be undertaken at least annually by Head Office staff.

Green Steel encourages a high degree of health, safety and environmental awareness through:

- Personal Accountability
- Commitment
- Continuous Performance Improvement
- Teamwork
- Initiatives to eventually close the loop in regard to recycling.
- Promoting circular economy through up-cycling and reusing available resources to channel value-add back into the economy.

Green Steel will operate the business to meet or exceed statutory health, safety and environmental requirements as well as relevant codes of practice. Green Steel will also establish effective standards or protocols where they are known not presently to exist.

Green Steel will develop and implement Best Management Practices where appropriate. In particular:

- To identify, control and monitor work-related health and safety hazards.
- To avoid, reduce or control waste and pollutants.
- To manage the natural and physical resources on the site in a reusable and/or renewable manner and to adopt practices which use energy effectively.

Training:

Green Steel is committed to training managers, employees, partners, contractors and third parties to ensure that they are competent in meeting the company's health, safety and environmental standards.

The monofill contractor will ensure that all employees and contractors are made aware of the practical requirements of this management plan and resource consent conditions. These requirements will include:

- Substances accepted
- Floc tipping and covering
- Maintenance, operation and disposal of leachate

- Waste characterisation and safety
- Progressive rehabilitation and/or reuse of the site.

Site inductions will be conducted for all new staff and visitors to the site. Staff will also undergo annual refresher courses which include the following:

- Contents of the Management Plan
- Resource consent requirements
- Emergency plan
- Waste acceptance criteria
- Handling and disposal of floc
- Odour and dust control measures
- Monitoring and management of the stormwater system
- Monitoring and management of the groundwater bores
- Monitoring and management of the leachate system
- Plant and equipment requirements and maintenance

A record of training that has been undertaken will be maintained in the site records. Competency assessments will be carried out where possible.

Employee Involvement:

Green Steel is committed to employee involvement in developing and reviewing health and safety management practices on their worksites.

Continuous Improvement:

Green Steel will actively monitor, audit, and review procedures, processes, and management systems, including objectives and targets, to ensure continuous health, safety, and environmental performance improvement.

Responsibility and Compliance:

Responsibility for the application of this policy and compliance with the company's health, safety and environmental standards lies with all company personnel, partners, contractors and any party working directly on behalf of Green Steel.

4.2 Monofill Operating Contract

The monofill will be managed in accordance with a contractual agreement between the monofill users and Green Steel. Monofill users may be in-house or external contractors. The terms of the agreement will include compliance with the resource consent conditions.

The agreement with monofill users will specify the constraints of access and use of the monofill.

4.3 Responsibilities

Green Steel will supervise, direct and control all activities on the monofill site, as well as controls on the privately owned access routes to the monofill. Green Steel will also carry out required regular monitoring of the monofill in compliance with consent requirements.

The resource consent holder (Green Steel) will report to WRC regarding compliance with resource consents.

4.4 Health and Safety Considerations

Engineering design for the monofills is aimed at minimising or eliminating health and safety risks so far as reasonably possible, and will continue to enhance engineering through to final design for construction. Indeed, if elimination or significant reduction of risk isn't possible, then the degree of risk to be managed by the owner and/or operator will be clearly identified and listed in updates to this Management Plan.

The placement of floc waste with suitable landfill-type machinery, operated by experienced and skilled operators and supervision staff, is a key element in minimising risk for overall monofill development. The monofill operators and supervision staff must demonstrate appropriate experience in landfill operational development and site management.

Key areas of risk responsibility are listed as follows:

- Management and handling of leachate, i.e. inspection, pumping, containment and installation of new pipework to existing systems. Leachate is hazardous and can be potentially harmful. Suitable PPE, including gloves and eyewear, must be worn at all times, and good personal sanitation.
- Landfill machinery is large and potentially hazardous, and due care must be taken.
- All common earthworks construction health and safety risks apply to monofills.

The placement of floc waste with suitable landfill-type machinery, operated by experienced and skilled operators and supervision staff, is a key element in minimising risk for overall monofill development. The monofill operators and supervision staff must demonstrate.

5. Monofill Access and Waste Acceptance Details

5.1 Access to the Monofill

All users of the site will need to be pre-approved by Green Steel. No casual users will be permitted on the site. Floc will be sourced from the site itself and from the National Steel recovery and recycling plant.

Monofill operating hours are as follows:

- Daylight hours between 7 am and 5 pm, seven days/week.

Clear signage and instructions will be provided at the entrance gate to direct deliveries to the correct site. Note: The Green Steel plant will operate at different operating hours.

5.2 Substances Accepted

The purpose of the monofill is to provide a storage facility for the floc material as a potential future resource - sourced primarily from end-of-life vehicles (ELVs) and white-ware resource recovery plant. This is referred to as "floc" and consists of silt to gravel-sized particles from pulverised car upholstery, foams, plastics, small wiring and other materials.

More details on the nature and properties of the floc are provided in the Leachate Lysimeter Trial Report (Earthtech, 2025D).

Responsibility for any testing to demonstrate compliance lies with the waste generator. The Resource Consent holder must seek the written authority of the WRC for the disposal of any unscheduled wastes or to have them added to the list of approved types.

No tyres, drums or containers will be accepted for disposal at the monofill.

No liquid wastes will be accepted at the monofill.

5.3 Waste Identification Procedures on Site

A docket will be used to record each load, including its type, source, and origin. The monofill operator is responsible for maintaining an accurate record of this information and making it available to WRC upon request.

The monofill operator will verify the contents of each load as it is tipped. If any load or part load does not comply with the accepted substances list, the operator will set the load aside and remove the waste to a "quarantine" storage area until testing is completed. Any such action will be recorded, kept on file, and available for inspection by WRC upon request. Unacceptable waste will be removed from the site and returned to the source for further processing or delivered as waste to an approved landfill.

5.4 Weighbridge Details

Each load will pass over a weigh station, and a record of waste type and weight will be issued to the truck driver and the monofill operator. The docket will clearly specify which area is to be used for disposal. Green Steel will retain this record, and it will be available to the Council upon request.

Weighbridge records will be used to calculate the waste-type levies (if any).

6. Monofill Design and Construction Details

6.1 Monofill Development

The Preliminary Geotechnical Assessment Report (Earthtech, 2025B) addresses ground conditions and stability of the two monofill sites. Development of the overall site engineering details has modified the southwest monofill site to a lower level. This improves overall geotechnical conditions.

Further geotechnical investigations will be required prior to the preparation of detailed drawings. Project Development (PD) design drawings form part of this report (Figures PD1 to PD5).

The two sites will be developed in stages. Each stage of development involves the following sequence of earthworks.

- Access roading and fencing;
- Construction of stormwater and sediment controls within the site;
- Excavation of stormwater diversion channels around the area;
- Construction of permanent stormwater ponds, soakaways and discharge structures;
- Removal of topsoil and stockpiling this for use in restoration;
- Bulk earthworks and stockpiling of surplus materials for future use as cover and capping materials;
- Subgrade preparation and installation of subsoil drains;
- Construction of the toe bunds, liner and leachate control systems;
- Intermediate cover layers; and
- Final cap and rehabilitation.

6.2 Access Roading and Fencing

Site access roads are to be gravel (metalled) type roads of a single or dual carriageway width of typically 3.5 to 5.5*m* (Figure M5.1). Permanent access roads, are to be constructed within the Green Steel facility as part of the internal roads network, as shown in the Site Plan PD3 of the Project Design drawings. Proposed access roads are shown in the site preparation plans in Figures M5.1 and M5.2. Access roads into the monofill are to be single lane. A passing bay may be provided at a strategic location between the point of entrance to the cell and the disposal face.

Access roads within the cell are to be crossfalled to drain into the waste body area. All access roads will include stormwater culvert crossing where required.

6.3 Construction of Stormwater and Sediment Controls

A site-wide stormwater and sediment control plan has been prepared (Earthtech, 2025A).

Stormwater is to be managed from the higher areas to the lower areas as follows:

i. Divert clean runoff above the site.
ii. Construct local sediment ponds where required.
iii. Construct main stormwater control ponds to accept both clean runoff and sediment-laden runoff where needed.
iv. Construct dirty stormwater diversion bunds and contour drains to channel flows into stormwater treatment devices.

6.4 Excavation of Stormwater Diversion Channels

Diversion channels are to be lined as follows:

- Grass-lined where gradient is less than 1:20.
- Coir mattress lined between 1:20 and 1:15.
- Rock rip-rap lined where steeper than 1:15.

6.5 Construction of Permanent Stormwater Ponds, Soakaways and Discharge Structures

- All ponds to be designed to contain a 1:2-year event.
- All ponds/dams to have a rock-lined spillway to safely pass a 1:100 year flood event.
- All sediment control ponds are to be inspected at least every six months and immediately after a rainfall event exceeding 30*mm* in 24 hours. Sediment removal is to be undertaken as necessary.
- Other design criteria relating to devices and AEP events are noted as follows:
    - Where catchments are ≥3*ha* and long-term stability of any sediment retention pond emergency spillway is required, then consideration must be given to incorporating a concrete manhole riser and larger diameter outlet pipe as a primary spillway. Design capacity is to be sufficient to accommodate the 5% AEP rainfall event.
    - Emergency spillways must be capable of accommodating the 1% AEP event without eroding.

6.6 Removal and Stockpiling of Topsoil

All topsoil is to be carefully removed from earthworks areas and either reused directly or stockpiled in designated areas for reuse. Topsoil stockpiles must be shaped with suitably stable slopes stabilised with and grassed if left for six months or longer.

6.7 Bulk Earthworks and Future Use Stockpiles

Bulk earthworks will be required to shape the cell prior to completion of the subgrade foundation works and/or liner works. Selected materials may be used as fill on other site areas or stockpiled with surplus cut materials diverted to intermediate cover or final cap stockpiles.

Specially prepared bunded areas must be provided for any acid soils if found on site. Acidic-type soil stockpiles should be stabilised to prevent erosion. All stockpiles are to be located within the overall footprint where possible.

6.8 Subgrade Preparation

The site requires a well-compacted base (subgrade layer) that has been shaped to the design contours. Where weak soils are encountered at this level, the weak materials need to be reworked or excavated and replaced with better material.

6.9 Liner and Leachate Control Systems

- Detailed design of liner stages (refer staging drawings).

- HDPE liner specification:
    - A typical liner specification is attached in Appendix A, titled General Specifications for HDPE Liner by GR Environmental Lining Services Limited. This includes details on the manufacturing process, delivery methods, subgrade preparation and acceptance, installation details, hot-wedge fusion welding, hand welds, quality control testing requirements, record-keeping and independent testing methodology. This specification (or similar) will form part of the site-specific documentation to be prepared for the construction of each liner stage.

- GCL liner specification:
    - The GCL liner (Geosynthetic Clay Liner) is a liner in its own right, composed of high-quality bentonite clay sandwiched between two layers of stitched geotextiles. A range of thicknesses, bentonite contents and strengths are available and in general use worldwide. Site-specific details need to be assessed and specified as part of the detailed design process. These include consideration of the permeability, thickness, roll width and length, interface shear strength, supply and delivery details, temporary protection requirements and detailed installation instructions. All of these items are well documented in standard specifications that are widely used and accepted by liner contractors in New Zealand.

- Leachate collection system specifications:
    - The leachate collection system includes the collection pipes, infiltration blankets (gravel collection layers), protection required above and below the drainage system, pipe sizes, thicknesses and joining details, installation details, quality control procedures and in-situ

testing requirements. Full details need to be prepared and specified on a site-specific basis as part of the detailed design and QA/QC requirements for each cell.

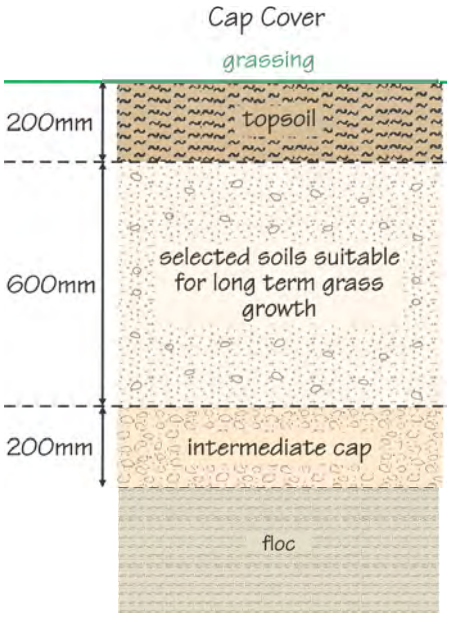
- Leachate storage on site (collection manhole, pump systems, storage tanks, load-out facilities).
- Leachate disposal (tanker sizes and movements for disposal to off-site treatment facility).

6.10 Intermediate Cover Layers

The monofill is to be constructed in 3*m* thick lifts with a 100*mm* thick layer of soil cover between each lift.

6.11 Final Cap and Rehabilitation

The final cap is expected to be detailed as follows:



Vegetation cover includes grassed paddock, sediment control vegetative strips, flax and other low-ground cover shrubs that require little maintenance.

6.12 Certification of Each Stage

Detailed plans for the development of the monofill are required to be completed and certified by a registered engineer. Draft plans are provided in the Engineering Report (Earthtech, 2025C) and the preliminary monofill development drawings.

Supervision of the monofill cell construction phase will be carried out by Green Steel, with support from the registered engineer who has provided the design plans.

On completion of each phase of cell construction, the engineer will provide a certificate stating that the monofill has been constructed in accordance with the approved design and in accordance with good engineering practice. A copy of that certificate will be forwarded to the WRC as soon as practicable after the completion of each stage. Each stage will include accurate asbuilt plans of the prepared area.

7. Operational and Management Details

7.1 General Guidelines

Site operational practices will follow the guidance of the CAE (2000) Landfill Guidelines and WasteMINZ (2023), with specific requirements detailed below.

7.2 Equipment and Personnel Requirements

Day-to-day placement and compaction of the floc will be undertaken by a 12t to 20t excavator. Additional equipment will include dump trucks, a sheepsfoot compactor and water truck for cover construction and dust control. Agricultural machinery will be used for the final cap.

Routine maintenance of drains and sediment control ponds will also be required.

Green Steel will be responsible for the management of personnel, equipment, materials and quality control procedures. The monofill operator will keep the site free of gorse, noxious weeds and pests.

7.3 Floc Handling and Placement

The floc will be tipped, spread and compacted to form layers with a height of 2m to 3m. The active tip face will be confined to as small an area as is practicable. The exposed area of floc will be kept to a minimum by ensuring that soil cover material is progressively advanced at a similar rate as the tip face advances.

Floc which can cause excessive dust, will be carefully placed and immediately covered with suitable material. Dusty floc will not be placed if wind speeds exceed 40km/hr.

The layout of the workable tip face and other active areas of the monofill will be kept in an orderly state and will follow the approved design plans.

7.4 Leachate Management

The Engineering Report (Earthtech, 2025C) indicates the anticipated strength of the monofill leachate and confirms the requirement for a Class 1 landfill liner and leachate collection system.

Leachate flows will collect at the low point of the site with a valve-controlled outlet to a holding tank. Details are provided in the drawings attached to the Engineering Report.

Leachate flow rates will vary with rainfall and evaporation conditions and will also be controlled by management practices.

Predicted leachate production flow rates, provided in the Engineering Report, are as follows:

Monofill Stage	Total Area	Unit	Operational	Volume	Intermediate Cover	Volume	Final Cover	Volume	Total Est. Leachate Production
			20%		12%		7%		
			Area (ha)	(m^3/day)	Area (ha)	(m^3/day)	Area (ha)	(m^3/day)	(m^3/day)
Stage 1a (SW Monofill)	50 x 100 Area = 5,000 0.5	m^2 ha	0.5	3.8	-	0	-	0	**3.8**
Stages 1 & 2 (SW Monofill)	27,000 2.7	m^2 ha	0.5	3.8	1.2	5.5	1.0	2.7	**12.0**
Stages 3 & 4 (SW Monofill)	2.7 +1.45 = 4.15	ha	0.5	3.8	1.55	7.1	2.1	5.6	**16.6**
Stages 1 & 2 (NE Monofill)	0.5 + 1.54 = 2.04	ha	0.5	3.8	1.04	4.8	0.5	1.3	**10.0**
Long Term (All Monofill Stages)	6.2	ha	0	0.0	0	0.0	6.2	16.7	**16.7**

The holding tank will be emptied once it reaches 50% to 70% capacity, with leachate tankered to the Wiri liquid waste disposal site and/or agreed trade waste outfall. Options for on-site treatment can be explored for possible water-use by the Green Steel facility.

Leachate monitoring and analysis will be the responsibility of the resource consent holder and will be carried out as detailed in the Monitoring Plan.

7.5 Stormwater Management

Stormwater is to be diverted around the active monofill so that the water runoff quality can be maintained and the area is not adversely affected by surface runoff waters. Appropriate erosion controls will be installed (per WRC Guidelines Tech Report 2009/02) to mitigate erosion and sedimentation effects.

The design of the Stormwater System is detailed in the Engineering Report.

Monitoring of stormwater runoff quality will be carried out as detailed in the monitoring plan procedures.

7.6 Daily, Intermediate and Final Cover

The monofill drawings indicate how the floc will be placed and protected on a daily basis. Tarpaulins may be used on a daily basis to reduce leachate production and contain dust. Soil cover will be used at each main lift (2*m* to 3*m*), and the final cap will protect the flox materials from an indefinite storage period.

7.7 Record Keeping and Reporting

7.7.1. Daily and Weekly Records

Records will be maintained of the volume and types of floc disposed of at the site.

A weekly log will be maintained by the monofill operator, recording the location of the working tip face and other operational notes. Together with the load dockets, this log will provide a record of the type of floc in each segment of the monofill.

7.7.2. Survey Data

The topographic profile of both sites will be established and updated at least every 12 months.

7.7.3. Leachate Flow Data

Continuous records will be kept of the volume of leachate collected and taken off site.

7.7.4. Reporting Procedures

The Resource Consent holder will report to the Waikato Regional Council as required by the Resource Consent conditions, but not less than annually. The report is to include the following information:

- The progression of disposal operations on the site.
- A discussion of any difficulties which have arisen in the preceding year and measures taken to address those difficulties.
- The summary and interpretation of monitoring results for the previous year.
- Disposal and monitoring activities proposed for the next year of site operations.

8. Environmental Monitoring

8.1 General Discussion

Discharge management is focused on limiting rainfall/stormwater ingress into the monofill so as to reduce the volume of leachate produced. This is achieved by:

8.1.1. Monofill Operation and Cover

- The active monofill area will be kept to a minimum area of no greater than 0.1*ha*.
- The area of exposed waste will be minimised by ensuring that soil interlayer material and capping material is progressively advanced at a similar rate as the tip face.
- Soil cover will be placed over each completed monofill cell in accordance with relevant guidelines.

8.1.2. Stormwater

- Clean stormwater will be diverted around the active filling area using diversion channelling.
- Mobilised sediment will be collected in a series of stormwater detention dams 50*m* to 100*m* downgradient of the active filling area.

8.1.3. Monitoring Plan

- The activities listed above will be monitored on a regular basis, with specific checks after rainfall events of 30*mm* or more. Monofill monitoring is to be in accordance with the Monofill Monitoring Plan (Earthtech, 2025E).

8.2 Stormwater Monitoring

Stormwater sampling will be undertaken according to the details in Table 1 and the following:

- Samples will be collected as grab samples in laboratory supplied containers.
- Chain-of-custody documentation will be completed for all samples.
- Samples will be kept on ice and dispatched to the laboratory within one day of collection.
- All sample analyses will be undertaken in accordance with “Standard Methods for the Examination of Water and Waste Water, APHA 2012”.

Table 1: Surface Water Sampling Requirements

Location	Frequency	Parameters	Laboratory Detection Limit	Trigger Value[1]
			(mg/l)	(mg/l)
Lowest sediment retention pond (SRP)	Following significant rainfall events	pH		-
		Total Hardness		-
		Dissolved Total Organic Carbon[2]		-
		EC		-
		COD		-
		Suspended Solids		-
		Dissolved boron		2.5
		Dissolved chromium		0.04
		Dissolved copper		0.0025[2]
		Dissolved nickel		0.017
		Dissolved zinc		0.031

[1] The trigger values are based on the ANZECC (2000) and ANZECC (2018) Default Guideline Values for 80% protection of freshwater species.

[2] Copper DGVs to be modified for DOC.

8.3 Leachate Monitoring

Leachate sampling will be undertaken according to the details in Table 2 and the following:

- The water/leachate level will be measured from a specific reference point prior to each sampling occasion.
- Samples will be collected with specific bailers and placed in laboratory supplied containers.
- Measurements of temperature, conductivity, and pH will be monitored on-site.
- Field filtering for samples to be analysed for dissolved constituents will be conducted whenever practicable.
- Chain-of-custody documentation will be completed for all samples.
- Samples will be kept on ice and dispatched to the laboratory within one day of collection.
- All sample analyses will be undertaken in accordance with "Standard Methods for the Examination of Water and Waste Water, APHA 2012".

Table 2: Leachate Sampling Requirements and Predicted Leachate Quality (Annual *Full Suite*)

Leachate Quality Parameter	Units	Predicted Monofill Leachate Quality
pH	-	7.0 to 7.1
PFAS	*µg/l*	<0.1 to 0.700
Boron	*mg/l*	0.6 to 1.9
Chromium (Cr)	*mg/l*	<0.1 to 1.00
Copper (Cu)	*mg/l*	<0.1 to 0.3
Iron	*mg/l*	<0.1 to 0.5
Lead (Pb)	*mg/l*	<0.1 to 0.3
Manganese (Mn)	*mg/l*	0.1 to 2.0
Nickel (Ni)	*mg/l*	<0.1 to 0.4
Zinc (Zn)	*mg/l*	<0.1 to 2.8
Ethylene glycol	*mg/l*	<20
Chemical Oxygen Demand (COD)	*mg/l*	<1000

8.4 Groundwater Monitoring

Groundwater sampling will be undertaken according to the details in Table 3 and the following:

- The water level will be measured from the top of casing prior to each sampling occasion.
- Samples will be collected with groundwater bailers and placed in laboratory supplied containers.
- Prior to sampling, a minimum of three casing volumes of water will be removed from the borehole. Alternatively, measurements of temperature, conductivity and pH will be monitored, and sampling undertaken once these parameters have stabilised.
- Samples to be analysed for dissolved constituents will be field filtered whenever practicable.
- Chain-of-custody documentation will be completed for all samples.
- Samples will be kept on ice and dispatched to the laboratory within one day of collection.
- All sample analyses will be undertaken in accordance with "Standard Methods for the Examination of Water and Waste Water, APHA 2012".

Table 3: Groundwater Sampling Requirements

Location	Frequency	Parameters	Laboratory Detection Limit	Trigger Value[1]
			(mg/l)	(mg/l)
Bores MBA, MBB and MBC	Half-yearly (August and March month)	pH	-	-
		Total Hardness	*mg/l (as $CaCO_3$)*	-
		Dissolved Total Organic Carbon	*mg/l*	-
		EC (Electrical Conductivity)	*mS/m*	-
		Dissolved boron	*mg/l*	2.5
		Dissolved chromium	*mg/l*	0.04
		Dissolved copper	*mg/l*	0.0025
		Dissolved nickel	*mg/l*	0.017
		Dissolved lead	*mg/l*	0.0094
		Dissolved zinc	*mg/l*	0.031
Bores MBA, MBB and MBC	Biennially	COD	*mg/l*	-
		Alk (Alkalinity)	*mg/l (as $CaCO_3$)*	-
		Ammoniacal-Nitrogen	*mg/l*	2.18
		Sodium	*mg/l*	-
		Sulphate	*mg/l*	-
		Chloride	*mg/l*	-
		Reactive silica	*mg/l*	-
		Dissolved arsenic	*mg/l*	0.36
		Dissolved boron	*mg/l*	2.5
		Dissolved cadmium	*mg/l*	0.0008
		Dissolved chromium	*mg/l*	0.040
		Dissolved copper	*mg/l*	0.0025
		Dissolved lead	*mg/l*	0.0094
		Dissolved mercury	*mg/l*	0,001
		Dissolved zinc	*mg/l*	0.031
		PFAS	*µg/l*	tbd

[1] The trigger values are based on the ANZECC (2000) and ANZECC (2018) Default Guideline Values for 80% protection of freshwater species.

8.5 Dust Monitoring

Regular monitoring for dust is to be conducted (daily and weekly), with monthly sampling carried out at the perimeter of the monofill operation and at the nearest property boundary. Results are to be reported to the WRC.

8.6 Landfill Gas Monitoring

The floc materials are not expected to produce any landfill gas, and no landfill gas monitoring is required.

8.7 Pest Monitoring

Monthly monitoring of pests.

9. Contingency Plans

9.1 Reporting of Incidents

Notification will be made to the WRC within seven days in the event of any failure of the waste containment facilities at the site. Any potential effect on groundwater or surface water users' downgradient of a contamination release will be notified immediately upon detection of a threat to water quality downgradient of the site. In the event of a detected release of contaminants or non-compliance of the waste discharge requirements, corrective measures will be conducted in accordance with Consent requirements. The potential downgradient neighbours are to be listed and kept updated.

9.2 Groundwater Contingency Options

The monofill sites may be subjected to possible extreme natural and/or manmade events that fall outside the range of anticipated design scenarios. Possible events are listed in the Engineering Report (Earthtech, 2025C), along with probable response actions.

10. Closure and Post-Closure Maintenance Plan

10.1 Earthworks Handling and Preferences

When each cell reaches full capacity, it will be closed and capped. Material excavated from the construction of subsequent cells will be used as far as possible to restore completed areas. Direct stripping and placement of soil will be carried out wherever possible. This will help retain the nutrient status and structure of the soil and reduce the risk of sediment runoff from any stockpiled material.

10.2 Revegetation

Ground cover will be established as soon as possible following spreading of cover material to prevent erosion.

As each cell is completed, final cover will be placed and graded to the final design contours. Upon completion of the grading there will be no flat spots or depressions which could collect surface water drainage. The top layer of soil will be topsoil or soil amended to perform as topsoil and will be placed immediately prior to anticipated seeding operations. It may be necessary to roughen the compacted soil surface prior to the addition of this material to allow adequate binding of the topsoil to the surface of the landfill and to prevent the development of a slip plane between the cover material and topsoil.

10.3 Fertilisation

Fertiliser requirements will be dependent on a number of factors:

- Amount of topsoil available, and initial nutrient status.
- Nutrient status of any soil-forming material incorporated into the upper layers.
- Length of time the soil was stockpiled, and amount of leaching suffered.
- Effects of imported materials (e.g. pH raising capacity of bark ash).
- Proposed after-use and species choice.

Fertiliser will be incorporated into the soil if necessary, immediately before or during seeding. The fertiliser mix and application rates will be based on soil testing performed on potential soils and on the seed mix specified in the following section. Amendments to the soil, in addition to the fertiliser, will be incorporated to enhance soil structure and organic matter content where these properties are deficient. These amendments, such as compost or animal manure, will be added immediately prior to seeding and will be incorporated into the soil.

10.4 Seeding

Seeding for the establishment of permanent vegetation at the site should be conducted when moisture levels are likely to promote good germination and survival, i.e. in autumn or spring. Whenever possible, a grass drill with depth bands and press wheels will be used to plant the seed. However, in areas which are inaccessible with a drill seeder, the seed will be broadcast, followed by a harrow. The seed will be covered to encourage germination.

Rapid ground cover establishment is important to prevent surface sheet and rill erosion. An appropriate ground cover mix such as the following list (Table 1) or mixes suggested in WRC Erosion and Sediment Control Guidelines (2009).

Table 4: Suggested Reclamation Seed Mix

Environment Waikato		Environment Bay of Plenty		
Species	**Rate** (kg/ha)		**Mix**	**Rate** (kg/ha)
Perennial Ryegrass (Lolium sp.)	24	Seeding	Annual Rye Grass, e.g. Tama and Clover	300
White Clover (Trifolium repens)	7			
Annual Ryegrass (Moata)	5		DAP	240
Cocksfoot (Dactylis glomerata)	2	Fertiliser	N, P, K, S 18:20:0:2	
Yorkshire Fog (Holucs lanatus)	1			
Red Clover (T. pratense)	1	Maintenance	Nitrogen (Urea) – 46% N	120
Total Rate (*kg/ha*)	**40**			

10.5 Longer-Term Erosion Control

The rapid development of ground cover will reduce the risk of erosion.

For longer-term cover, appropriate shrub species (e.g. Manuka) may be planted, though it is possible that the site will be developed as grazing pasture. Tree species should not be planted on the restored area, although shrub willows may be planted below the toe of the face to help soil stability and as a measure to reduce surface storm runoff velocity.

If necessary, additional temporary water control structures will be utilised until vegetation cover is established. These may include straw bales, dykes or other measures in line with those recommended in WRC "Erosion and Sediment Control Guidelines".

11. Catastrophic Failure (Risk and Contingency Options)

The likely nature of a catastrophic event would be related to a large stormwater event, earthquake, or volcanic eruption. The possible consequence of each of these phenomena are discussed below.

11.1 Large Stormwater Event

A high volume precipitation event would be likely to create significant overland flow as well as to saturate the contained floc materials and associated cover material.

The sites are located at the top of local catchments and well clear of any regional or Waikato River floodpaths.

The significance of this potential is minimised by local topography in the immediate area of the monofill and by providing adequate stormwater cut-off and control bunds down the valley. Compaction of the floc material will reduce the risk of serious erosion of the floc. Any material that is washed out should be recovered as far as possible from the swale drains and stormwater ponds.

A vegetation barrier at the downstream boundary would help to contain any debris. (Manuka shelter belt.)

11.2 Earthquake

When the shaking starts:

- **Take cover!** Crouch beside a solid structure (load-bearing wall, etc.).
- Keep away from windows and glass doors.
- Keep away from equipment that may fall over.
- If you are outside, keep clear of loose material, glass, overhead cables, equipment or installations likely to fall over.

When the shaking stops and if it is safe to do so:

- Remove anyone from danger and administer first aid.
- Isolate hazards (check for gas and/or electrical hazards, turn off gas/power at the mains).
- Check buildings and utilities (phone, power, gas, water) for damage.
- If necessary, contact emergency services.

If damage has occurred:

- Stop all operations in the vicinity of the damage.
- Contact your manager; they will inform the Health and Safety Advisor and the Environmental Coordinator.
- Put out fires if it is safe to do so.
- Assess damage and repair if possible; if repair is impossible or dangerous, evacuate the building or area.

The possibility of a serious earthquake event causing severe damage to the monofil is unlikely. Any cracking of monofill cover material could be easily repaired. The base liner is unlikely to be affected unless fault rupture occurs through the site. The leachate drainage system is flexible and tolerant to ground shaking and ground movement.

Slope failure of temporary and cut batters is possible and equipment should stay clear until remedial works have been determined.

After a serious earthquake, you may be isolated for up to 72 hours. In this situation:

- Attempt to contact the nearest Civil Defence post. Consider evacuation. Monitor local radio for Civil defence announcements.
- You may need to be self-sufficient; collect/organise food, water, shelter, sanitation, and communications.
- Make the injured as comfortable as possible.
- Assign tasks/organise rosters.

11.3 Volcanic Eruption

The effects of this will depend entirely on the nature and size of the eruption. The site is located in a low risk eruption area of the Waikato Region.

12. Post-Closure Site Maintenance

Leachate management will be required on a daily to weekly basis.

Post-closure maintenance will be performed, as needed, based on routine inspections of the site. Inspection of the site will include checking for surface soil cracking, ponding, erosion, proper slope, proper drainage, erosion of channels, condition of any rip-rap, leachate and monitoring station condition, and vegetative cover condition. Inspection of the site will be conducted on a monthly basis. Monthly audit will be fully

documented and retained by Green Steel. Based on the audits, routine maintenance will be undertaken as and where necessary.

Any deficiencies encountered during the inspections will be recorded, and the necessary repairs will be made.

13. End Use Considerations

The site is intended to be reused at some stage in the future. The site will remain closed to public access during the monofilling operation. On completion, the site could have a number of potential after-uses; however, any use of the site must be compatible with the retention of the integrity of the soil cap.

The location of the site minimises the potential for any future use as a public amenity. The location could, if appropriate to Green Steel owner needs, be utilised as a pasture or grazing area. Large tree species should not be included in the vegetation cover. Evidence from surrounding areas of soil disturbance indicates that locally occurring species will also colonise the restored site. Shrub canopy species will create a low maintenance cover, which will enhance soil stability in the longer term. It is likely that the level surface of the site will likely be utilised as grazing pasture, similar to that currently to the adjacent sites.

If short-term storage (say three to five) is likely, pasture management by tractor mowing (and silage production) is expected to be the preferred maintenance method.

14. References

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Management Plan

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Appendix A

General Specifications for HDPE Liner

By GR Environmental Lining Services Limited (undated)

GR Environmental
Lining Services Limited

GENERAL SPECIFICATIONS for HDPE LINER

GR Environmental Lining Services Ltd
P O Box 6119, Otaika, Whangarei 0147
Phone : (09) 432 9677
Graham Mobile : 027 484 3206
Steven Mobile : 021 126 0555
Email: gbr1@xtra.co.nz
Web: www.environmentallining.co.nz

GR Environmental
Lining Services Limited

1. Scope of Works

The scope of works covered by this specification is for the supply, installation and testing of a (thickness)mm, **H**igh **D**ensity **P**olyethylene (HDPE) geomembrane,

The scope of work includes the following items:

- Supply, Delivery and Installation of the Specified Premium Grade HDPE geomembrane liner.
- Provide all Administration, Management, Supervision, Labour and Equipment to perform the installation of the HDPE geomembrane lining to the manufacturers recommendations.
- Supply of all approved High Density Polyethylene geomembrane Welding and QA/QC testing equipment.
- Provision of QA/QC Certificates for Raw materials, Manufactured materials, Site works and Site Testing as detailed in this specification.
- Installation, Testing, submittals for approval and commissioning of all High Density Polyethylene geomembrane lining as detailed in this specification.

2. Experience

The Installer shall, at the time of tendering, provide evidence of his ability and experience to supply and install the specified HDPE geomembrane lining. The Installer at a minimum must have at least five (5) years continuous experience in the installation of HDPE sheet. Full details of experience must be lodged at the time of tender for approval by the Principal. Failure to demonstrate prior use and vast experience with the specified materials will be grounds for rejection of any tender.

3. Membrane Manufacturer and Supply

3.1 Material Specifications

The geomembrane shall be Premium Grade High Density Polyethylene or equivalent. The membrane shall be manufactured by flat-cast extrusion process only, and consist of single resin being one hundred percent Virgin and of a narrow molecular distribution. Carbon black shall be added to the Resin for ultraviolet resistance. The flexible membrane shall be manufactured to the following approximate ratios; HDPE 97.5% - Carbon Black 2.5%.

All membrane shall be provided in rolls of a minimum width of 6.8 metres. Each roll shall be labelled to provide the following identifying data:

- Name of manufacturer and type
- Material thickness
- Roll Number
- Roll Length
- Roll Weight
- Roll Width
- Cross reference numbers to Raw Material Batch and all Laboratory certified reports
- The manufacturers approved QA stamp and the technicians signature

The material shall be free from holes, blisters, folds, undispersed raw materials, and any sign of contamination by foreign matter.

Membrane material shall meet the requirements of the attached technical specifications.

3.2 QA/QC Requirement for Membrane Raw Materials

All raw material supplied to the manufacturer shall be delivered in rail car batches and must be supplied with test certification from the raw material supplier. The certification must state the results of tests which confirm the quality of the resin. The raw material supplier must also confirm that each batch of resin is all of the same type and is 100% Virgin. Each batch of resin shall be given an identification (bath) number and remain on file to keep track of all rolls manufactured from each batch.

The use of any off spec, recycled or blends of resins will not be considered.
Prior to the production of the membrane, the Membrane Manufacturer tests the raw material batches to certify that the raw material supplier test results identify the singular resin.

The Membrane Manufacturer shall provide certification and all available test results for raw materials prior to the delivery of materials to site.

3.3 QA/QC Requirements for Membrane Manufacturing

The manufacturing process shall be a fully automated Flat-Cast extrusion process controlled by a fully computerised system. The control system shall provide for the continuous monitoring of the following parameters; Temperature, Pressure and Speed.

The manufacturing process must also provide for the automated continuous monitoring of thickness and sheet quality.

Thickness: Each roll shall be tested automatically and evenly over its entire surface area. The minimum parameters acceptable for testing each roll shall be 6,000 thickness point checks. The acceptable thickness for each roll shall not be greater than – 10% of the specified material thickness.

Sheet Quality: Each roll shall be tested automatically High Voltage over it entire surface area for any point of Electrical Continuity through (across) the thickness of the sheet. The high voltage scanner shall be capable of detecting any pinhole, and void or significant reduction of the electrical resistance. Any roll detected to have holes or electrically conductive inclusions shall be rejected and not sent to the site.

Each roll delivered to site shall be provided with a roll test date report. These reports must provide the following information and test results as per the specified ASTM standards. Reports must also carry the manufacturers laboratory QA/QC approval seal.

4. Subgrade Preparation

All subgrade surfaces, over which the HDPE Flexible Membrane shall be placed, will be prepared as follows; New line area to be lined shall be smooth and free of stones, rocks, roots, sticks and any sharp objects or debris on any kind. The surface shall provide a firm unyielding uniform base for the membrane. The surface shall be compacted to a density to allow the movement of vehicles, welding equipment and personnel on it without causing rutting or other detrimental effect. The area to be lined shall not be effected by rising ground water, or ponding of water. The earthworks contractor shall complete the subgrade preparation to the approval of the lining contractor.

5. Installation of Flexiable Membrane

The installer shall install the membrane as per the recommended methods of the Membrane Manufacturer. The membrane panel layout will be the responsibility of the Installers Site Manager, in conjunction with the Principals approval. Individual panels of membrane shall be overlapped with adjacent membrane sheets by a minimum of 50mm.

The membrane liner shall terminate within an anchor trench located .5 metre away from the top of the embankment. Once the membrane is in place the anchor trench must be backfilled and suitably compacted to prevent slippage of the membrane.

The Membrane Installer shall be responsible for making allowances considered necessary to accommodate variations in temperature and weather conditions.

6. Field Welding of Flexiable Membrane

All welds require a minimum of 50mm overlap. Two types of welding methods shall be approved for this project.

6.1 Primary Welding Method

All primary welds shall utilise the Split Hot-Wedge Fusion welding method. The Split Hot-Wedge welder shall be a fully automated device comprising of a heated copper wedge, pressure rollers and electronic controls. The copper wedge shall be controlled and constantly monitored by a programmable controller with an audible off-temperature alarm and a variable speed drive unit. The copper wedge shall create two contact fusion areas of a minimum width of10mm and a 2mm minimum wide void between each of the separate parallel weld zones. This void shall be created over the entire seam length to allow for field weld pressure testing.

6.2 Secondary Welding Method

All secondary welds shall utilise the manufacturers' surface Extrusion Hand Welders. The minimum width of the surface extruded bead shall be 15mm. The surface extrusion welder shall be semi-automated and equipped with electronic controls which constantly monitor outputs for both preheat and HDPE extrudate. The unit shall be capable of pre-heating the sheet just prior to the casting of HDPE extrudate over the upper and lower section of the weld zone.

The extrusion rod for the surface extruding welding shall be manufactured from the same resin type used in the manufacture of the membrane. All physical properties shall be identical to those possessed by the membrane raw material. The manufacturer shall provide certified test data with each batch of welding rod. All rod supplied shall be packed to prevent the ingress of moisture and other contaminates. If necessary the Installer shall also employ an apparatus specifically built for drying rod to ensure weld quality.

6.3 General Site Welding

The Installer shall be responsible for regularly checking, calibrating and recording the following items:-

- Preheat temperature at the nozzle
- Internal barrel temperature
- Split Copper wedge temperature
- Split Copper wedge speed.

6.4 Weld Preparation

The Installer shall ensure prior to any primary or secondary welding that weld zones be clean, free from moisture, dust, and any other foreign matter. All weld zone surfaces shall be either cleaned or abraded no more that 60 minutes prior to the commencement of welding any seam. In extremely bad conditions it may be necessary for the installer to clean and/or abrade the weld zone areas only minutes prior to the required weld.

6.5 Trial Welds

Trial welds shall be made on fragment pieces of membrane to verify that welding machine parameters are set to produce satisfactory welds. Such trial welds shall be made prior to actual field welds at the beginning of each working day. Samples shall be cut from the trial weld using a calibrated die cutter and tested on a calibrated tensiometer in shear and peel to determine whether the test welds have passed or failed.

7. Testing of Wedge Fusion Weld

Destructive Testing – Prior to actual field welding, the machine technician will run trial welds on fragment pieces of membrane. Such trial welds shall be made at the beginning of each working day. The trial weld sample shall be at a minimum 1.0m long by 0.3m wide with the weld centered lengthways. Four 25mm wide samples shall be cut from the trial weld sample using a calibrated die cutter. Test will be in shear and peel using a calibrated tensiometer to determine whether the test welds have passed.

Destructive seam tests shall also be performed at random selected locations during the installation by the Principal and Installer, at a minimum of one sample every 300m. The purpose of these tests shall be to confirm and evaluate seam strength and continuity during the field seaming. Each sample shall be cut using a calibrated die cutter into two 25mm wide pieces and shall be tested in shear and peel.

In the event of a failure, all prior welds shall be tested back to the last test which passed. It will be the responsibility of the Installer to repair and make good the seam/seams to the satisfaction of the Principal.

***Non-Destructive Testing*: -** 100% of all wedge welds will be tested. The air pressure testing kit required, shall be an apparatus consisting of a hollow needle attached to a pressure gauge and air fitting. Air pressure can generally be provided by manual or mechanical pumps. The testing unit shall be capable of withstanding and maintaining pressures between 20 to 45 PSI.

The following procedure for air channel testing shall be followed:

a. Seal both ends of the seam to be tested.
b. Insert needle into the channel created by the wedge welder.
c. Connect air pump and pressurize the channel to a minimum of 20PSI and maintain the pressure for approximately two (2) minutes
d. If loss of pressure exceeds 10% or does not stabilize, locate faulty area, repair with surface extrusion weld and re-test seam.
e. Remove the APT kit.

7.1 Testing of Surface Extrusion Welding

Destructive Testing: - Prior to actual field welding, the Machine Technician will run trial welds on fragment pieces of membrane. Such trial welds shall be made at the beginning of each welding period. The trial weld sample shall be at a minimum .5mm long by 0.3m wide with the weld centered lengthways.

Four 25mm wide samples shall be cut from the trial weld sample and tested in shear and peel using a field tensile tester to determine whether the test welds have passed.

Non-Destructive Testing: - 100% of all surface extrusion welds will be tested. The High Voltage Spark Gun unit required for testing will be supplies by installer.

The procedure for High Voltage Spark Testing shall be as follows:-

a. Area of well must be clean and dry.

b. Patch is to be heat tacked firm

c. Overlap of area to be abraded (min 10mm)

d. Copper wire to be inserted at overlap of material

e. Surface weld to be carried out

f. Allow to cool

g. Point H.V.S.T at weld moving slowly over welded area

h. If a spark shows repair and retest.

8. QA/QC Certificates and Records for Material and Installation

The installer shall provide the Principal with the following listed Test Certificates and Records prior to, during and/or at the completion of the works as each report and record is required.

• Certification and Test results of Raw Materials from Raw Materials Supplier

• Certification and Test results of Raw Materials from Membrane Manufacturer

• Roll Test Data Reports for Each Roll of Material

• HDPE Welding rod Test Reports

• Daily Installation Reports for each welder and technician:-

- Trial Test weld Record
- Wedge Weld Records
- Surface Extrusion Weld Records
- Weld Peel and Tensile Test Records
- Wedge Air Channel Pressure Test Records
- Patch, Repair and HVT Records

• Completed as Built Drawing, including roll numbers, panel layout, seam locations and repair locations.

9. Independent Testing

The Principal at his own discretion and cost may require the Installer to extract random samples of sheet from each roll and from welded seams to qualify the Manufacturers and Installers test results. Samples shall be kept to a minimum and the following frequency of samples shall apply:

• Material samples = 1 – sample per roll
• Weld Samples from Site – 1 sample for every 300 metres, of seam.

All subsequent independent tests shall be undertaken by an approved testing authority experienced in the testing and evaluation of HDPE Flexible Membrane liners. The tests and results shall be subject to review and/or confirmation by the Membrane Manufacturer.

- **Roll identification and dimensions**
  - Roll number
  - Production Date
  - Area of Sheet on Roll\
  - Roll Length
  - Roll Width
  - Roll Weight

- **Resin lot information**

  Batch Number

  Resin Type

  Resin Test Results – ASTM

Density	D792
Moisture	D570
Brittleness	D746
Melt Index	D1238
O.I.T.	D3895

GR Environmental Lining Services Limited

- **MEMBRANE PROPERTY, ASTM METHOD, MINIMUM SPECS AND ROLL REST VALUES FOR THE FOLLOWING:**

	ASTM
Carbon Black Dispersion	D3015
Carbon Black Content	D1603
Geomembrane Density	D792
ESCR	D1693-B
Thickness – Normal	D1593/D751
Minimum	
Ave. Thickness	
Puncture Resistance (Strength)	FTMS 101/2065

The following items shall be tested in both machine and cross direction:

	ASTM
Tensile Yield Strength	D638
Yield Elongation	D638
Tensile Break Strength	D638
Break Elongation	D638
Tensile Impact Strength	D1822
Tensile Impact Elongation	D1822
Tear Resistance	D1004
Dimensional Stability	D1204

Any material rejected on site by the Principal shall be jointly inspected by the Principal, the installer and the manufacturer. If required, the material shall be tested, and if the material is unable to meet the specification, it shall be replaced by the manufacturer/installer at his cost.

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Engineering Report

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Appendix E

Quality Control Plan (QCP)

Construction of the Monofill Liner (Barrier),
Leachate Collection and Underdrainage Systems

R4424-5, Rev A, 30 May 2025

Report

Quality Control Plan (QCP) for Monofill Lining Systems

Green Steel Monofill, Hampton Downs

61 Hampton Downs Road, Hampton Downs, Waikato

Prepared for National Green Steel Limited

Prepared by Earthtech Consulting Limited

30 May 2025
Reference: R4424-5 QCP

EARTHTECH

Document Control

Quality Control Plan (QCP) for Monofill Lining Systems

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

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Contents

Appendices

Quality Control Plan (QCP)

Green Steel, Hampton Downs

61 Hampton Downs Road, Hampton Downs, Waikato

1. Project Overview

National Green Steel's engineering design for the monofill will be a Class 1-Type 2 liner (barrier) system comprising a 1.5*mm* thick HDPE geomembrane on a 5*mm* thick geosynthetic clay liner (GCL), both placed on a 600*mm* thick compacted clay liner layer (CCL) of a permeability of $k<10^{-8}m/s$, overlain with a 200*mm* thick leachate drainage system. The lining system is underlain with an engineered underdrainage system comprising of 150*mm* diameter subsoil drains. Design details and specifications of the monofill lining system, leachate drainage system and underdrainage system are provided in the Engineering Report (Earthtech, 2025)[1].

The monofill lining system is designed in accordance with the WasteMINZ Technical Guidelines (WasteMINZ, 2023). A sketch (Figure 1) is provided below for explanation clarity:

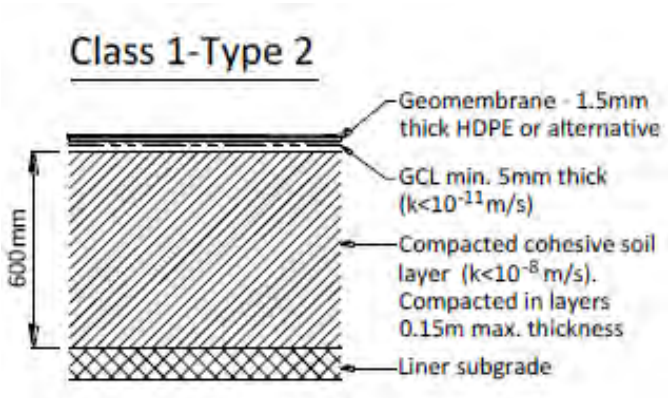

Figure 1: Class 1 Monofill Liner
(Source: WasteMINZ, 2023[2])

[1] Earthtech (2025). *Engineering Report, Green Steel Monofill, Hampton Downs.* Ref: R4424-2, 30 May 2025.
[2] *WasteMINZ Technical Guidelines for Disposal to Land.* Revision 3.1, September 2023.

2. Quality Control Plan (QCP) Purpose

2.1 Quality Control Objectives

2.1.1 To ensure that the monofill lining system provides an effective barrier between the disposed floc material and the natural environment, minimising or eliminating potential risk of flow of leachate through the lining system.

The composite lining system comprising a leachate drainage layer, high-density polyethylene (HDPE) geomembrane, geosynthetic clay liner (GCL), compacted clay liner (CCL) layers, and underdrainage system is collectively termed the monofill barrier system. The combined HDPE, GCL and CCLs are collectively termed the monofill lining system.

2.1.2 To ensure the installation meets design specifications and regulatory requirements. Specifically, to ensure that the monofill lining system is constructed with accurate adherence to the engineering design and specification, required material standards are provided, and the highest achievable standard is attained for the installation of the lining materials.

2.1.3 To verify the integrity and effectiveness of the liner and leachate collection systems.

2.1.4 For the purpose of this specification, quality control shall be defined as a planned system of inspection and tests to directly monitor and control the quality of the works and materials.

2.1.5 The Applicant (National Green Steel Limited) shall submit this Quality Control Plan (QCP) to the Quality Control Team (refer to Section 2.2) for implementation ahead of construction and installation.

2.1.6 The Applicant (National Green Steel Limited) shall employ a nominated suitably experienced quality control inspector (inspector) who may be the same person as the installation supervisor. The design engineer and specifier of the systems may fulfill this role.

2.2 Quality Control Team

The QCP is to nominate a Quality Control Team to include the following key professionals:

- **Project Manager:** Responsible for overall quality control (QC) coordination.
- **Quality Control Inspector:** Responsible for overseeing the implementation of the monofill lining and barrier system overall.
- **Inspection Team:** Suitably qualified and/or experienced inspectors to conduct checks and tests.

- **Contractor Representatives:** Experienced barrier system contractor able to collaborate with the QC team for compliance.

2.3 Construction Monitoring Level

The QCP defines recommended construction monitoring levels in accordance with Engineering New Zealand guidelines. These are presented as follows:

2.3.1 A Construction Monitoring Level of CM3 is recommended for the construction of the monofill compacted clay liner (CCL) layers, including on-site in-situ testing and laboratory testing of samples obtained during construction. This level of monitoring is also applicable to the construction of the underdrainage and leachate drainage systems.

2.3.2 A Construction Monitoring Level of CM4 is recommended for the construction of the monofill linings, i.e. the HDPE liner and the GCL liner, in accordance with Engineering New Zealand and ACE New Zealand guidance (February 2022 or current edition).

3. Quality Control Plan (QCP) Process and Procedures

The QCP details the process and procedures to ensure the overall effective construction and installation of the monofill liner and barrier system.

The QCP comprises a three (3) phase process, each with required procedures as detailed below.

A. Pre-Construction Phase
B. Construction Phase
C. Post-Construction / Close-Out Phase

3.1 Pre-Construction Phase

3.1.1. Review of Specifications

- Ensure all materials and methods comply with design specifications and materials quality requirements.

3.1.2. Pre-Construction Meetings

- Coordinate with project owner, contractors, engineers, inspectors, health and safety appointees and environmental compliance professionals to review plans and procedures.

3.1.3. Training and Qualifications

- Inspector Training: Ensure all inspectors are appropriately trained in relevant testing procedures and/or methods.
- Contractor Qualifications: Verify contractor capabilities and certifications.

- Design Engineer/Approval Engineer: Ensure the Engineer is appropriately experienced in lining systems and is a registered professional engineer (CPEng).

3.1.4. Compliance and Regulatory Requirements

- Consent and Permit Requirements: Ensure all required Consents for the proposed activity are valid and in place, and all required permits for the works obtained.
- Regulatory Standards: Proposed works are to be in accordance with/adhere to local, district, regional and national regulations and/or laws.

3.1.5. Health and Safety (H&S) Requirements

- Ensure all health and safety plans are submitted by all relevant parties associated with the proposed monofill lining project.
- Ensure all staff are suitably aware of all potential risks and hazards and have signed onto the Site Safety Register.
- All staff or persons involved in the works on site are expected to comply with H&S requirements.

3.2 Construction Phase

Materials testing is to be carried out in accordance with the material manufacturer's delivery and control processes.

Testing control tables and/or sheets are to be provided for the various liner construction materials as per examples provided in Attachment 1. Materials qualities are to comply with the specifications provided on the engineering design drawings (figures) attached to the Engineering Report.

Information to be provided in accordance with this QCP on inspections/checks/reporting documentation is as follows:

3.2.1. Materials Inspections

- Verify all liner materials (geomembrane, geosynthetic clay liner, compacted clay liner material) meet specifications.
- Check all leachate collection pipework, connection fittings, chambers and all other components. Additionally, check all subsoil (underdrainage system) pipework, fittings and components.
- Check drainage stone quality to be clean and free of impurities for the leachate collection system and underdrainage system.

3.2.2. Installation Inspections

- Conduct inspections during liner installation.
- Verify correct placement and overlaps of geotextile and geomembrane layers.

- Ensure proper seaming techniques (heat sealing, welding, etc).
- Inspect leachate collection drainage layer, excavation and pipework installation.
- Material quality specification requirements will include:
  i. Minimum roll width of all membranes to be provided.
  ii. Each roll shall be labelled to provide the following identifying data, i.e.:
    - Name of manufacturer and type
    - Material thickness
    - Roll number, roll length, roll weight, roll width
  iii. Cross-reference numbers to raw material batch and all laboratory certified reports.
  iv. Resin lot information to be documented.
  v. The manufacturer's approved QA stamp and the technician's signature.
  vi. The liner material shall be free from holes, blisters, folds, undispersed raw materials, and any sign of contamination by foreign matter.
  vii. Membrane material shall meet the requirements of the attached technical specifications (to be provided, e.g. carbon black content ASTM D1603, etc).

3.2.3. Field Testing

- Perform field tests in accordance with the technical specifications and approved methodologies and/or guidelines.
- Geomembrane (HDPE Liner): Conduct leak detection surveys, i.e. vacuum testing and electrical methods.
- Geosynthetic Clay Liner (GCL): Conduct visual inspection for placement orientation, lap widths and strength, i.e. rip-testing unit mass checks.
- Compacted Clay Liner (CCL): Visual checks on material type and characteristics, in-situ compaction testing, i.e. shear vane, field compaction density and moisture content, volume of air voids.
- Leachate Collection System: Pressure testing of pipework (unperforated sections) for integrity, visual checking, grade checks.

3.2.4. Quality Control Checks and Tests

- Visual Inspections: Regular checks during installation.
- Non-destructive Testing: Leak detection surveys for geomembrane, HDPE weld testing.
- Field Permeability Testing: Ensure GCL and HDPE geomembrane meet permeability integrity requirements.
- Pressure Testing: Confirm leachate collection system integrity (unperforated sections) and the integrity of collection sumps.

3.2.5. Documentation

- Verify compliance with specifications and regulatory requirements – following all testing procedures.

- Maintain detailed records of inspections, test results, and deviations. Note: Keep/store samples and document location (i.e. roll number, delivery batch details, etc) of on-site field testing as required.
- Document corrective actions taken if non-conformities are found.
- Documentation Retention Period: Maintain records per regulatory requirements.
- Accessibility: Ensure documentation is accessible for audits and future reference.

3.2.6. Reporting and Communication

- Daily Reports: Toolbox meetings, summarise activities, inspections, and test results.
- Weekly Meetings: Discuss progress, issues, and corrective actions.
- Final Reporting: Document overall compliance with QCP and any recommendations for future projects/installations.

3.3 Post-Construction/Close-Out Phase

3.3.1. Final Inspection

- Verify completeness and quality of installed systems.

3.3.2. As-Built Documentation

- Update drawings to reflect as-built conditions and details.
- Include installation details and any modifications made during construction.

3.4 Conclusion

- Project Sign-off: Confirm all QCP activities are complete and systems meet design and materials quality requirements.
- Producer Statements (PS) to be signed and submitted according to compliance requirements.
- Final Close-Out Report with as-built drawings to be submitted to National Green Steel Limited.

Quality Control Plan (QCP) for Monofill Lining Systems

Green Steel Monofill

61 Hampton Downs Road, Hampton Downs, Waikato

Appendix A

Quality Control Testing Sheets

Table 1: Geomembrane

Table 2: Geosynthetic Clay Liner (GCL)
(specification to be appended to final issued QCP)

Table 3: Compacted Clay Liner (CCL)
(specification to be appended to final issued QCP)

Table 1: Geomembrane

Note: Materials testing according to the material manufacturer's delivery and control processes

(Example of material quality specification provided below)

Material Property	Minimum Average Roll Values (Metric)	
Nominal Thickness		**1.5mm**
	Units	**Value**
Thickness, ASTM[4] D751, NSF[5] Mod., Nominal	*mm*	1.50
Indent Lowest Individual Reading	*mm*	1.37
Density, ASTM D1505	g/cm^3	0.940
Melt Flow Index, ASTM D1238 Cond. E. Max	*g*/10 min.	1.0
Carbon Black Content, ASTM D1603	percent	2.0 - 3.0
Carbon Black Dispersion, ASTM D3015	rating	A2
Minimum Tensile Properties, ASTM D638 Stress at Yield	*N/cm*	231
Stress at Break	*N/cm*	399
Stress at Yield nominal gage of 1.30" per NSF Mod.	percent	13
Stress at Break nominal gage of 2.5" per NSF Mod.	percent	560
Tear Resistance, ASTM D1004	*N/cm* *N*	1230 200
Puncture Resistance, FTMS[2] 101, 2065	*N/cm* *N*	2280 347
ESCR[3], ASTM D1693, NSF Mod., Pass	hours	1500
Dimensial Stability, ASTM D1204, NSF Mod., Max.	percent	2.0
Low Temperature Brittleness	^oC	-60
Single-Point Notched Constant Tensile Load Time to Failure	(*hr*)	200
Field Seam Properties 1. Shear Strength 2. Peel Strength	 *N/cm* *N/cm*	 212 FTB and 139

1. Film Tear Bond (FTB) is defined as failure of one of the sheets by tearing, instead of separating from the welded seam. The test specimen shall not fail by more than 10% into the seam. For double hot wedge fusion welded seam, both inside and outside tracks shall be tested.
2. FTMS: US Federal Test Method Standard
3. ESCR: Environmental Stress Crack
4. ASTM: American Society for Testing and Materials Standards
5. NSF: National Sanitation Foundation

If the seam fails to pass, the seaming apparatus shall not be used for field seaming until any deficiencies have been corrected. This shall be verified by the production and successful testing of two consecutive test seams.

Summary of testing methods to determine monofill geomembrane quality requirements:	
	ASTM
• Carbon Black Dispersion	D3015
• Carbon Black Content	D1603
• Geomembrane Density	D792
• ESCR	D1693-B
• Thickness – Normal	D1593/D751
Minimum	
Average Thickness	
• Puncture Resistance (Strength)	FTMS 101/2065
• Tensile Yield Strength	D638
• Yield Elongation	D638
• Tensile Break Strength	D638
• Break Elongation	D638
• Tensile Impact Strength	D1822
• Tensile Impact Elongation	D1822
• Tear Resistance	D1004
• Dimensional Stability	D1204

Table 2: Geosynthetic Clay Liner (GCL)

(specification to be appended to final issued QCP)

Table 3: Compacted Clay Liner (CCL)

(specification to be appended to final issued QCP)