2.3 Proposed Development

Chester Consultants have produced a scheme plan for the subdivision. The proposed development works involve:

- The creation of 19 residential lots, ranging from 348 m2 (Lots 6-8) to 7,942 m2 for Lot 19.
- A new accessway off State Highway 11 is proposed, which will require cutting into the existing ridge spur to create the accessway. Based on the earthwork plans, up to 7559 m^3 of cut is proposed across the development, with 3226 m^3 used to create the accessways into the subdivision. The proposed cut batters to create the accessway are approximately 28 degrees (approximately 1V:2H).
- The plans indicate a maximum excavation depth of 5.84 m at Ch. 10 m along the main accessway.
- Retaining walls are proposed to support fills along the accessway, and to supports cuts within Lots 14 and 15. The plans provided by Chester Consultants indicate six individual retaining walls (RW01-RW06). Maximum retained height along the accessway (RW01) is approximately 3.3 m supporting site-won fill material (Ch. 79 m). The maximum retained heights for the walls supporting cut (RW03 – Lot 14) is 3.35 m at wall Ch. 42.0 m.
- Filling across some of the western lots is shown, up to 2.0 m deep thick at Lot 10, and typically 1.0m thick across Lots 1-6. Some localised deeper fills (<2.0m) is required on Lots 2 and 3.

3 Geology

3.1 Published Geology

Sources of Information:

- Institute of Geological & Nuclear Sciences, 1:250,000 Scale, 2009: "*Geology of the Whangarei area*".
- NZMS Sheet 290 P04/05, 1:100,000 scale map, Edition 1, 1980: "Whangaroa-Kaikohe" (Soils).
- NZMS Sheet 290 P04/05, 1:100,000 scale map, Edition 1, 1981: "Whangaroa-Kaikohe" (Rocks).

The site is within the bounds of the GNS Geological Map 2 "Geology of the Whangarei area", 1:250,000 scale. The published geology indicates the site comprises massive to thin bedded, lithic volcaniclastic metasandstone and argillite of the Waipapa Group, which typically exhibits a deep weathering profile of fine-grained silts and clays.

NZMS 290 maps identify the site as interbedded sandstone and mudstone (greywacke and argillite); blue-grey quarts feldspar greywacke sandstone, thinly to thickly interbedded with dark grey argillite mudstone, weathered to brown, sandy clay with harder cores to depths of 30 m, imperfectly to poorly drained.

3.2 Geomorphology

The subject site is primarily situated over spur ridges which slope gently to moderately down towards the north-west and west. The flanks of these spur ridges are moderately sloping with gradients up to 20 - 25°. The slopes can stand at moderately steep gradients due to the relatively high strength of the rock mass and residual soils, although shallow instabilities (e.g. terracettes and shallow slumping) are often found indicative of shallow soil creep. Based on site observations and the LiDAR contours, the terracettes start to form where gradients exceed 18 - 20°, with shallow seated failures observed when slope angles exceed 25°.

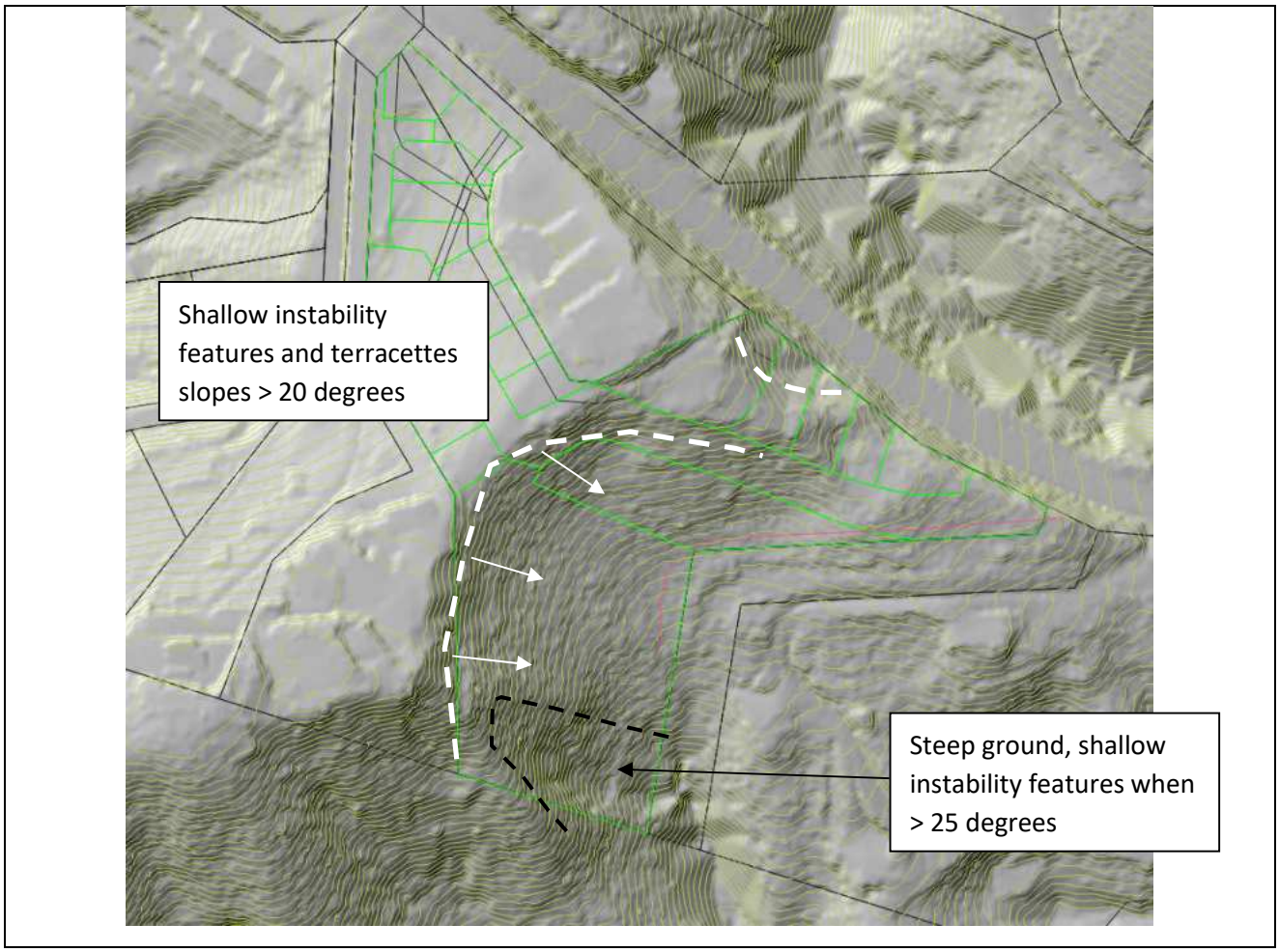

Figure 2 - Proposed subdivision

4 Ground Investigations

4.1 Subsurface Investigations

Subsoil investigations were undertaken between 09 October and 18 October 2020. The investigation consisted of:

- Site walkover and observations.
- 20 hand augered boreholes with in-situ vane shear testing.
- 11 Cone penetration tests (CPTs).

The location of the boreholes and Scala penetrometer tests have been recorded by hand held GPS. The accuracy of the locations would be ± 5.0 m for northing and eastings. Test locations are shown on the appended drawings.

4.1.1 *Site Walkover Observations*

Instability features, including shallow terracette formations and trees leaning with the slopes, were observed on the slopes exceeding 20 degrees (Lot 13 to Lot 21). Shallow instability features were also observed adjacent to State Highway 11 (Lots 1 to 4), with the steeper slopes along the north-eastern boundary of the Lots.

4.1.2 *Hand Auger Investigations*

20 augered boreholes, BH01 to BH20, were completed between the 09 October 2019 to 18 October 2019. Hand augers were completed to a maximum depth of 3.0 mbgl. Fill material was encountered within BH12 to 1.4 m depth, comprising clay material mixed in with shells and gravel, this material is considered recently re-worked material from within the site, with shells encountered at the surface. The remainder of the augerholes encountered residual Waipapa Group greywacke, typically comprising fine-grained silts and clays, with occasional weakly cemented clasts. Hand auger logs are presented in Appendix B.

A hand shear vane with 19 mm blade was used to measure the Vane Shear Strength of the in-situ material. Readings were taken at the base of the auger hole every 0.5 m of depth. All shear strengths shown on the appended logs are Vane Shear Strengths in accordance with the NZGS; “Test Method for determining the Vane Shear Strength of a Cohesive Soil using a Hand-Held Shear Vane,” 2001.

4.1.3 *Cone Penetrometer Tests (CPTs)*

Eleven cone penetration tests (CPTs) were undertaken by Underground Investigation Ltd. Testing was undertaken till anchor pull-out or maximum friction recorded. A maximum depth of 25.15 m was achieved at CPT02 location. Underground Investigation Ltd provided a cone penetration rig attached to a remote controlled, rubber tracked machine to test and record ground information. CPT soundings were taken using a compression cone and are presented in Appendix B.

4.2 Subsoil Conditions

Based on the results of the geotechnical investigation conducted by Haigh Workman and review of published geological maps, the soils directly underlying the site comprise residual greywacke of the Waipapa Group. The delineation between very stiff residual Waipapa Group and hard completely weathered Waipapa Group has been chosen based on a cone resistance of 5 MPa (undrained shear strength, S_u, of 300 kPa). For the purposes of this report, subsoil conditions on the site have been interpolated between the boreholes and variations between borehole positions are likely.

A ground model has been prepared based on the in-situ testing data and topographical survey data provided by Survey and Planning Solutions Ltd (Williams and King). Geological cross sections were developed to undertake slope stability modelling across the proposed building platforms. Geological cross sections show the ground conditions across the site are relatively consistent. Geological cross sections are included within Appendix A. Table 1 summarises the materials encountered, with depth to base of each unit provided.

4.2.1 *Topsoil*

Topsoil thickness across the site was typically 300 mm thick, with minor variations recorded in the auger holes. Topsoil depth may vary across the site. The topsoil typically comprised dark brown SILT with organic matter.

4.2.2 *Non-certified Fill*

Non-certified fill was encountered within HA12, adjacent the western boundary with Lot 2, DP 210907. The fill material comprised clay material mixed in with shells and gravel, this material is considered recently re-worked material from within the site, with shells encountered at the surface.

4.2.3 *Waipapa Group Residual Soils*

The natural ground conditions were generally consistent between all test locations, comprising fine grained clayey Waipapa Group soils. The soils were described as being very stiff clay and silty clay, typically orange brown in colour, dry to moist throughout with low to medium plasticity. Vane shear strength results indicated very stiff soils with recorded vane shear strengths greater than 100kPa. The upper crustal layer (upper 2.0-3.0m typically comprised a fine-grained clay, with silt and weakly cemented clasts becoming more prevalent with depth. CPT soundings showed similar results in the upper residual soils, before coming hard with estimated undrained shear strengths exceeding 200 kPa recorded at all CPT locations.

4.3 Groundwater

Groundwater was not encountered during our site investigations. No evidence of groundwater seepage or static groundwater level was observed near the ground surface during the drilling of the hand auger boreholes. Soil moisture observations were recorded with the hand augered boreholes, with soils noted as being dry to moist throughout the soil column investigated. Groundwater standpipes were not installed to monitor groundwater levels. Groundwater levels can and do fluctuate and perched groundwater within the upper clayey layers may be encountered following periods of prolonged or heavy rainfall.

4.4 Subsoil Summary

Table 1 - Summary of Subsoil Conditions

Augerhole I.D.	Topsoil Depth	Fill	Residual Waipapa Group	CPT. I.D.	Topsoil Depth	Fill	Residual Waipapa Group
All depths measured in metres below current ground level (mbgl)							
HA01 (Lot 1)	0.3	NE	>2.0	CPT01 (Ch. 200 accessway)			>28.80
HA02 (Ch. 269 accessway)	0.4	NE	>2.0	CPT02 (Ch. 150 accessway)			>12.56
HA03 (Lot 11)	0.3	NE	>2.0	CPT03 (Ch. 10 accessway)			>16.62
HA04 (Lot 9)	0.1	NE	>2.0	CPT04 (Lot 19)			>11.48
HA05 (Ch. 150 accessway)	0.2	NE	>2.0	CPT05 (Lot 18)			>8.34
HA06 (Ch. 55 accessway)	0.2	NE	>2.0	CPT06 (Lot 19)			>17.50
HA07 (Ch. 10 accessway)	0.1	NE	>2.0	CPT07 (Lot 19)			>12.56
HA08 (Ch 10 accessway offset 15m east)	0.1	NE	>2.0	CPT08 (Lot 19)			>17.02
HA09 (Lot 18)	0.2	NE	>3.0	CPT09 (Lot 19)			>5.86
HA10 (Lot 19)	0.3	NE	>3.0	CPT10 (Lot 18/Ch. 100 accessway)			>16.50
HA11 (Lot 19)	0.3	NE	>3.0	CPT11 (Lot 18)			>15.14
HA12 (Lot 19)	NE	1.4	>3.0				
HA13 (Lot 19)	0.2	NE	>3.0				
HA14 (Lot 19)	0.2	NE	>2.2				
HA15 (Lot 19)	0.2	NE	>3.0				
HA16 (Lot 16)	0.2	NE	>3.0				
HA17 (Lot 14)	0.1	NE	>2.0				
HA18 (Ch 200 accessway)	0.1	NE	>3.0				
HA19 (Lot 19)	0.2	NE	>3.0				
HA20 (Lot 13)	0.2	NE	>2.0				

NE Not Encountered
NT Not Tested

5 Geotechnical Assessment

5.1 Geotechnical Design Parameters

Geotechnical design parameters recommended in this report are based on in-situ test results, empirical relationships, and back analysis. Refer Table 2 below for soil parameters adopted within this report. Depths for the units are shown in Table 1 on the geological cross sections.

Table 2 - Geotechnical Parameters

Geological Unit	Bulk Unit weight, γ (kN/m3)	Cohesion, c' (kPa)	Friction angle, φ' (degrees)	Groundwater Ru[1]
Non-certified fill	18	3	28	0.30 (0.40)
Waipapa Group Residual (Stiff to very stiff)	18	7	32	0.25 (0.35)
Waipapa Group Completely weathered (Hard)	18	15	32	0.20 (0.25)
Waipapa Group Highly weathered (Weak)	20	30	35	0.10

Notes: 1 Values are for design groundwater. Parenthesis values represent elevated groundwater conditions.

5.2 Seismic Hazard

Anticipated peak ground acceleration has been taken from Module 1: Overview of the guidelines – Earthquake geotechnical engineering practice, adopting the mean hazard value of 0.13 g as the principal parameter for pseudo-static analysis (500-year return period). Step-change behaviour response has been assessed adopting the 'lower-bound' value of 0.19 g.

5.3 Stability Analysis

5.3.1 *Instability Potential*

Slope profile ranges have been used to categorise the potential for instability at the site within the Waipapa Group unit as very low, low, moderate, and high, with corresponding slope angles. Gradients less than 18° are considered to have a low risk of soil creep under natural conditions. Historic scarp features were observed around the head of the central gully and neighbouring southern slopes, generally where gradients exceed 25° therefore high-risk. Gradients between 18° and 25° are therefore considered medium risk. Table 3 summarises the slope profile ranges and potential for instability based on the geomorphology and qualitative assessment. Table 3 shows the slope gradients and corresponding risk across the development area.

Table 3: Instability Risk Categorisation

Risk	Gradient	Slope Instability Potential
High	>25 °	Instability can be expected
Medium	18 – 25 °	Instability can be expected if the development does not have due regard for the site conditions
Low	10 – 18 °	Instability not expected unless major site changes occur
Very low	<10 °	Nil

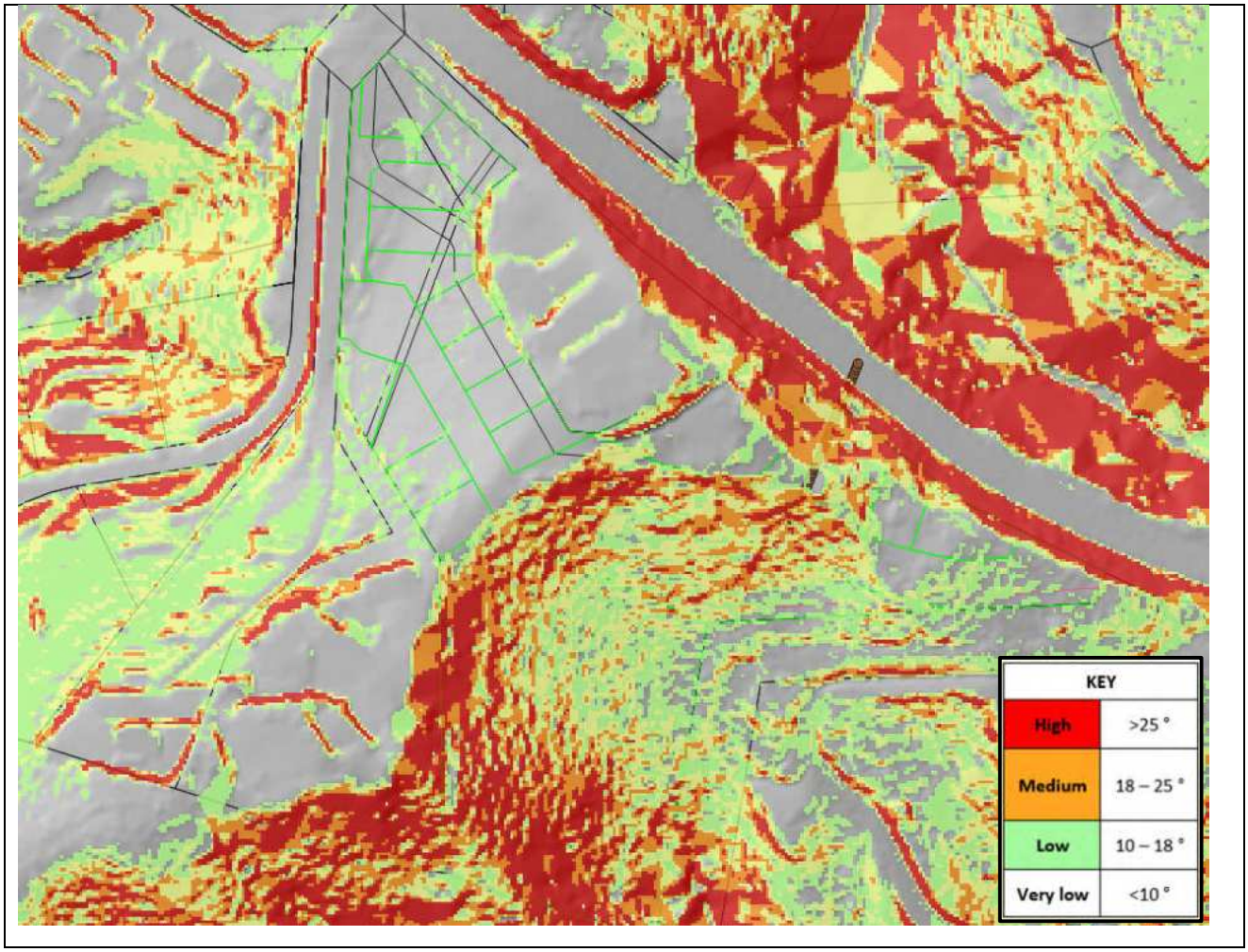

Figure 3 - Slope shading from LiDAR

5.3.2 *Site Stability Assessment*

Site stability has been assessed based on the scheme plan provided by Chester Consultants. Lots 1 to 13 have suitable building platforms without any building restrictions required. Stability modelling was undertaken

across the site and proposed Lots to determine if a safe building platform could be developed, and what engineering / stabilisation would be required to achieve a safe building platform. Stability modelling was carried out using Slide (Version 9.026), with the ground model developed for each section using the geotechnical investigation data from the augerholes and CPTs.

Groundwater effects was modelled using a phreatic surface estimated from the geotechnical investigation data, with a pore pressure coefficient (Ru) applied to the soils above the groundwater level. Effective stress parameters used for slope stability modelling are summarised in Table 2.

The criteria adopted for assessing the global stability is outlined in Table 4 below. The model was developed with the primary purpose of determining a building platform and the extent of engineering works required to achieve a safe building platform. A 10 kPa uniformly distributed load to the ground surface has been applied to represent the dwelling load. Instability of the steeper slopes is still expected and will require careful management through planting and retaining walls.

Table 4 - Design Factors of Safety (FOS) – FNDC Engineering Standards (NZS4404:2010)

Load Case	Design Factor of Safety
Static - Proposed development	≥ 1.5
Static - Elevated groundwater (highest credible groundwater level)	≥ 1.2
Seismic, 0.13 g (mean hazard level, 500-year return period)	≥ 1.0*

* Updated with recommendations from NZGS/MBIE Module 1.

5.3.3 *Stability Results*

Results of the stability modelling are summarised in Table 5 and selected outputs are presented in Appendix C.

Table 5 - Stability results

Section I.D.	Scenario	Result at dwelling	Outcome
A-A (Lot 14)	Static – 10 kPa surcharge	1.5	OK – Foundation design will require specific engineering due to sloping ground.
	Static – Elevated groundwater	1.5	
	Seismic (0.13g) – Proposed Dwelling, effective stress method	1.1	
B-B (Lot 13, Lot 18)	Static – 10 kPa surcharge	1.5	OK – Foundation design will require specific engineering due to sloping ground and proximity to retaining walls.
	Static – Elevated groundwater	1.2	
	Seismic 0.13g – Surcharge 10 kPa (effective stress method)	1.1	
C-C (Main accessway cut batters)	Static – 10 kPa surcharge	1.6	OK, erosion protection measures / planting will be required.
	Static – Elevated groundwater	1.4	
	Seismic 0.13g – Surcharge 10 kPa (effective stress method)	1.2	

Step change behaviour was assessed under seismic conditions by adopting 0.19 g, the results achieved the minimum factor of safety requirements (>1.0).

The results of the stability analysis indicate the proposed lots are suitable and are not subject to a slope stability natural hazard .A summary of specific site investigation and foundation design requirements is given provided in Section 7.

5.4 Building Design Considerations

5.4.1 *Shrink/swell Behaviour*

The geotechnical investigations undertaken across the site indicate the upper crustal layer to comprise plastic fine-grained clayey soils. The reactivity and the typical range of movement that could be expected from soils underlying any given building site depend on the amount of clay present, clay mineral type, and proportion, depth, and distribution of clay throughout the soil profile. Moisture changes tend to occur slowly in clays and produce swelling upon wetting and shrinkage upon drying. In addition, subsequent building damage can be limited by good building practice, including wetting of clay subgrade at least 48 hours ahead of base filling and slab preparation.

Apart from seasonal moisture change (wet winters / dry summers) other factors that can influence soil moisture content include:

- Influence of garden watering and site drainage.
- The presence of large trees.
- Initial soil moisture content conditions at construction time.

Visually, expansive soils are noted for developing extensive cracking during dry periods (especially summer through autumn in Northland) and can be locally identified by this feature when sites are excavated and left to dry out. Based on observation on nearby residential lots and laboratory testing nearby, the foundation soils lie outside the definition of 'good ground' as outlined in NZS3604:2011. In terms of B1/AS1, the soils present are considered to lie within Site Class H (highly expansive). Site specific laboratory testing is recommended to confirm engineering properties of the soil. We recommend samples collected and Atterberg limits and linear shrinkage tested within a laboratory and reported within a geotechnical completion report to confirm the Site Class.

Accordingly, building foundations on this stage of the subdivision will need to be subject to specific foundation design by a Chartered Professional Engineer familiar with the contents of this report. Reference should be made to AS2870:2011 and the New Zealand Building Code (B1/AS1) for assistance.

5.4.2 *Foundations*

The soils tested across the site indicated stiff to very stiff silts and clays. An ultimate bearing capacity of 300 kPa can be adopted for shallow foundation design, with a geotechnical strength reduction factor of 0.5 for limit state design.

The proposed dwellings located on sloping ground will be supported on piled foundations. Due to the sloping ground the foundations will need to be deepened to account for reduction in passive support and potential for lateral earth pressure on the foundations, and will require specific engineering design.

Table 6 - Min. foundation embedment (for concept design purposes only)

Slope angle (degrees)	Min embedment depth (metres below finished ground level)
0	1.0
5	1.2
10	1.4
15	1.5
>15	2.5*

* *Specific geotechnical and structural design to address potential lateral earth pressure on foundations.*

5.4.3 *Settlement*

Residential dwellings should be designed to tolerate angular distortion as a result of consolidation settlement of up to 1:240 (approximately 25 mm over a 6.0 m length) as required by the New Zealand Building Code (B1/VM4). Filling across the site will result in consolidation settlement of the underlying soils; the earthworks plans indicates filling across Lots 1-6 and Lot 10 building platforms, and to create the access road.

The maximum fill thickness within a proposed building lot, as shown on the provided plans, indicates 2.0 m of filling in Lot 10, supported by RW04. Consolidation settlement is estimated to be in the order of 50 mm. We recommend earthworks is completed at least 6 months in advance of building. Alternatively, foundation design can consider the effects of the filling and down drag on the piles and will be subject to specific geotechnical and structural design.

Localised filling may be required to create building platforms, provided the fill thickness does not exceed 1000 mm thick, and the fill is placed to an engineered standard (NZS4431:2022), we do not consider consolidation settlement to cause any undue risk to the building platforms. If fill exceeds 1000 mm thick, then detailed geotechnical investigation and settlement analyses will be required to estimate the differential settlement and associated angular distortion across the proposed buildings.

Where filling is undertaken to form the accessway into the site, we recommend the pavement is not sealed until at least 6 months after the bulk filling has been undertaken, or settlement be monitored to ensure consolidation has completed.

5.5 Liquefaction

The surface geology across the site residual greywacke soils, comprising fine grained clayey soils, which are too plastic to liquefy, i.e., plasticity index greater than 12. Coupled with the age of the deposit (late Permian to late Jurassic), the soils across the site are considered not susceptible to liquefaction.

6 Development Recommendations

6.1 Site Formation Works

Site formation may comprise cuts and fills using material won from the site, clear of any unsuitable material such as non-engineered fill, topsoil, soft or organic soils or vegetation. Earthworks plans prepared by Chester Consultants indicate an approximate cut of 7,559 m^3, of which 3,226 m^3 will be re-used as filling across the site.

Unsuitable materials should be stripped from any areas of earthworks and stockpiled well clear of earthwork operations or removed from the site. It is our understanding that proposed sub-divisional earthworks are minimal however for all earthworks associated with development of the subdivision the following recommendations are provided:

All earthworks should be carried out to the requirements of NZS 4404:2010 'Land Development and Subdivision Infrastructure' and NZS 4431:2022, 'Engineered fill construction for lightweight structures'. It is recommended that any unsuitable material identified during excavation be removed and replaced with granular hardfill or engineered cohesive fill. Filling on slopes needs to be done with caution and needs to be keyed into the slopes, i.e., benching, to ensure the material does not 'slide' down the slopes. Benches should be created for any fills exceeding 1.0 m thickness and subsoil drainage may be required.

Laboratory testing of the material is recommended prior to filling to ensure the material is appropriate to be used as fill. Following confirmation of the material, and if deemed suitable for re-use as fill, the fill will require frequent monitoring during placement to ensure fill material has been placed and compacted to an engineered standard and can be signed off by as certified fill as part of the geotechnical and earthworks completion report. Provided the cut material is at optimum condition and the material is compacted to an engineered standard, then the material will be suitable for engineered fill. Laboratory testing of the material to be used as fill will be required to determine the optimum moisture content. The laboratory testing required will be as follows:

- 2x standard compaction curve (to determine the optimum maximum dry density and moisture content).
- 2x Atterberg limit tests and linear shrinkage tests (to confirm the liquid and plastic limits of the soil, i.e. plastic limit is considered optimum).

Compaction control of the cohesive fill consists of maximum allowable air voids and minimum allowable shear strengths and outlined in NZS4431:2022. The fill specification outlined below is recommended for subdivisional earthworks. An outline of the specification details are as follows, to be read in collaboration with NZS4431:1989:

- Vane shear strength testing comprising an average of ten tests of 140kPa with no single vane shear test of less than 120kPa.
- Testing shall also include air void testing with a minimum of ten consecutive tests with an average of 10% air voids with no single test greater than 12%, in accordance with NZS4402:1986.
- Granular fill for pavement or bulk filling shall be compacted to at least 95% maximum dry density.

6.2 Erosion and Sediment Control

Prior to commencing earthworks, a sediment control system needs to be constructed to ensure the Territorial and Regional Authority requirements are met. Typical details can be found in GD05. Erosion and sediment control should be undertaken as early as possible before soil particles become dislodged and mobilised. The use of contour drains, mulching and earth bunds to control erosion during the construction phase is recommended, as is maintaining vegetation cover where possible to reduce erosion potential.

6.3 Pavement Design

Vegetation, organic and deleterious material, topsoil, and weak non-engineered fill should be removed from the site under pavement areas prior to aggregate placement. Based on our observations during site investigations we consider the stiff natural ground at the site should provide an adequate subgrade for any proposed asphaltic or concrete paved access, parking and turning areas. We recommend for preliminary design a CBR value of 5.0%. Site specific laboratory testing is recommended to confirm the CBR design value.

The subgrade should be proof rolled to detect any significant deflection or soft spots which should be excavated and backfilled with compacted granular fill. Following preparation of the subgrade a basecourse comprising free-draining aggregate should be placed and compacted. The thickness of the basecourse would depend on the final CBR/modulus of subgrade reaction used for the subgrade and the traffic loads anticipated. The compaction of the basecourse should be carried out with a vibratory roller of appropriate static weight and energy.

6.4 Stormwater Control

Concentrated stormwater flows from all impermeable areas must be collected, carried in sealed pipes, and discharged in a manner that will not affect the stability of the ground. Concentrated stormwater flows must not be allowed to saturate the ground to adversely affect foundation conditions.

Design of devices to collect, transport and discharge concentrated flows should be engineered. Devices associated with subdivision development (paved access etc.) should be designed as part of the Subdivision Consent works however design for future house construction can only be carried out as part of Building Consent activities as the design is pertinent to the house and site coverage proposal.

6.5 Service Connections

All external service connections (power, water supply, stormwater, sewer, communication and others) should be detailed for seasonal movement such as the use of rubber ring joints for stormwater or wastewater, or looped power and water connections.

Building foundations within a 45-degree zone of influence from the invert level of any service pipe shall adopt the standard engineering details within the Far North District Council plan and NZS4404:2010.

6.6 Retaining Walls

All retaining walls should be designed by a Chartered Professional Engineer familiar with the contents of this report. Loading from adjacent structures, traffic, slope surcharges above and/or below retaining wall cuts and fills shall be considered during wall design. Retaining walls have been identified in the drawings by Chester Consultants, minimum design requirements are as follows:

- RW01 (118m length) – Main access retaining wall, supporting site-won fill. Maximum height = 3.26 m, design to consider sloping ground in front of wall (reduction in passive support – 18 degrees) and pedestrian and vehicle surcharge.
- RW02 (20m length) – Lot 15. Boundary retaining wall to support excavation. Maximum height = 1.69 m, design to consider boundary surcharge (minimum 12 kPa – AC2231).
- RW03 (60m length) – Lot 14. Boundary retaining wall to support excavation. Maximum height = 3.33 m, design to consider boundary surcharge (minimum 12 kPa – AC2231).
- RW04 (68.8m length) – Lot 10 and accessway along Ash Grove Circle supporting site-won fill. Maximum height = 2.74 m, design to consider surcharge from dwelling and vehicle/pedestrian loading.
- RW05 (49.6m length) – Supporting excavation to create accessway to Lots 18 and 19. Maximum height = 3.42 m, design to consider sloping ground above wall of 20 degrees.
- RW06 (47.5m length) – Supporting site-won fill to create parking areas and access into Lots 18 and 19. Maximum height = 2.5 m, deign to consider vehicle surcharge and sloping ground in front of the wall (reduction in passive support – 18 degrees). Stability modelling indicates minimum embedment length of 5.0 m and 50 kN shear force over slice height = 5.2m (cantilever height = 3.2m, and no passive support zone = 2.0 m). Preliminary design (375 mm SED 'High Density poles', 1.0m c/c spacing, 5.0m embedment, total length 8.0m).

6.7 Unexpected Ground Conditions

Areas of unsuitable ground were encountered outside the area demarcated for subdivision (Lot 20). Other areas of unsuitable ground could be encountered anywhere on the site during site excavations. If unsuitable material is encountered, the Engineer responsible for providing certification of the earthworks and Geotechnical Completion Report should be contacted immediately to provide advice.

6.8 Safety during construction

The recommendations made in this report have been made with regards to safety during construction, which should be considered during the design phase. The following points were raised during planning for safety in design:

- Trench construction for services should be benched to ensure the vertical height does not exceed 1.0 m without shoring / trench shields.
- Temporary battering of excavations.

- Cut slope may become unstable if left exposed for extended periods of time. Cut slopes should either be battered back to a safe angle 1V:2H to a maximum height of 6.0m or be retained by a retaining wall designed by a Chartered Professional Engineer with relevant experience in soil mechanics.

6.9 Construction Monitoring

A Chartered Professional Engineer familiar with the findings of this report should be engaged to carry out construction monitoring during subdivision development and earthworks to confirm soil conditions are consistent with those adopted within this report.

The recommendations given in this report are based on limited site data from discrete locations. Variations in ground conditions could exist across the site. It is in the interests of all parties that a Chartered Professional Engineer inspect excavations and foundation conditions exposed during construction, so that ground conditions can be compared with those assumed in formulating this report. In any event, we should be notified of any variations in ground conditions from those described or assumed to exist.

A geotechnical completion report should be prepared at the completion of subdivision works, with as-builts provided by the Contractor of all earthworks and drainage works undertaken.

7 Conclusion

Geotechnical investigations indicate that the proposed subdivision is stable, and the subsoil properties are appropriate for residential development. The extent of the geotechnical investigations is outlined within this report.

The development will need to be undertaken in accordance with current best engineering practice and the following guidelines are applicable to all Lots:

- The natural ground within the residential lots boundaries is considered suitable for residential development of light-framed, flexible clad residential buildings not requiring specific design in terms of NZS3604:2011, subject to the following conditions:
    - All lots will be subject to site specific geotechnical investigations. Geotechnical reporting to include, but not limited to, site specific testing and confirmation of the underlying geology, recommendations on bearing capacity for foundation soils, expansive soil classification with laboratory testing or visual-tactile assessment, confirmation of slope stability for the proposed building and associated building loads, minimum foundation embedment depths.
    - Foundation soils lie outside the definition of ‘good ground’ in NZS3604:2011 due to the presence of expansive clay soils. Soils are considered to lie in Site Class H (highly expansive) as defined in AS2870:2011 and New Zealand Building Code B1/AS1. All residential lots will be subject to specific engineering design and site-specific geotechnical investigations. This recommendation may be superseded if individual engineers are able to demonstrate their specific design solutions are applicable to site soil conditions to the satisfaction of Far North District Council. Specific design may be undertaken by first principles or by reference to

AS2870:2011, Section 4 and related documents and the updated return periods provided in B1/AS1.

- Foundation design should limit the geotechnical ultimate bearing capacity to 300 kPa, with a geotechnical strength reduction factor of 0.5 for limit state design. Minimum piled foundation embedment 1000 mm on level sites, embedment depth to increase when on sloping sites in accordance with Table 6 and is subject to specific design and individual loading requirements.
- The maximum fill thickness within a proposed building lot, as shown on the provided plans, indicates 2.0 m of filling in Lot 10, supported by RW04. Consolidation settlement is estimated to be in the order of 50 mm. We recommend earthworks is completed at least 6 months in advance of building. Localised filling may be required to create building platforms, provided the fill thickness does not exceed 1000 mm thick, and the fill is placed to an engineered standard (NZS4431:2022), we do not consider consolidation settlement to cause any undue risk to the building platforms. If fill exceeds 1000 mm thick, detailed geotechnical investigation and settlement analyses will be required to estimate the effects of differential settlement and associated angular distortion across the proposed buildings.
- Slab on grade construction (if required) is expected to be relatively straightforward across Lots 1 to 13, but problems can occur with slab construction on shrink/swell sensitive soils. In soils which become desiccated in summer, subsequent capillary moisture rise may cause dry soils to wet up and swell, causing slab uplift and building distress. Conversely, construction during winter may result in subgrade soils with high moisture contents drying out through summer, with subsequent soil shrinkage and possible building deformation. The structural engineer should take likely construction timeframes into account and confirm that their design, or construction methodologies, will accommodate the soil shrinkage or swelling that may occur.

- Retaining walls to be designed by a Chartered Professional Engineer following the design framework provided in Section 7.6.
- Maximum cut batter 1V:2H for slopes less than 6.0 m, retaining walls or flatter batter slopes required if greater than 5.0 m. Fill batters for certified fill shall not exceed 1V:3H.
- No earthworks involving fills or unsupported cuts in excess of 600 mm depth should take place on any Lot unless endorsed by a suitable design undertaken by a Chartered Professional Engineer with suitable geotechnical experience familiar with the contents of this report and responsible for design of structural elements of the building.
- Any earthworks conducted at the site should be undertaken and tested in accordance with NZS4431:2022. Any unsuitable material identified during excavation shall be removed and replaced with granular hardfill in accordance with NZS4431:2022. Granular hardfill is recommended to be GAP40 or GAP65, compacted to 95% MDD.
- Where building envelopes lie adjacent to or across service lines, all foundations should extend and be founded below the 45-degree zone of influence line extending from pipe inverts. This requirement is

to avoid excessive pipe surcharges, and to allow for future maintenance of the system without detrimentally affecting adjacent structures.

- Based on the in-situ Scala penetrometer testing undertaken during the subsoil investigations, a design CBR of 5% is recommended (subject to subgrade testing during construction). Within filled ground a design CBR of 5% should be available.
- Our assessment is based on interpolation between borehole positions and site observations. Local variations in ground conditions may occur. Unfavourable ground conditions may be encountered during earthworks. It is important that we are contacted in this eventuality or if any variation in subsoil conditions from this described in this report are found. Design assistance is available as required to accommodate any unforeseen ground conditions present.

Provided the recommendations provided in this report are followed, the subject is capable of being developed as proposed. All works should be carried under the guidance of a Chartered Professional Engineer familiar with the contents of this report. A geotechnical completion report is recommended at the completion of the earthworks to confirm the findings in this report and document the work undertaken, e.g. earthworks compaction certification.

This report is not intended to be used for foundation design, other than provide general framework for building platform suitability. Specific geotechnical investigations are recommended to confirm the subsoil conditions, confirm the soil expansivity, and provide site specific geotechnical recommendations for foundation design.

Summary of specific site investigation and foundation design requirements for proposed building lots			
Lot No.	**Comments on Nominated Building Platform**	**Bearing Capacity / Expansive Class**	**Anticipated scope of additional works following specific investigation and design. [Comments are given as a guide only – specific engineering to be undertaken by a Chartered Professional Engineer]**
LOT 1-6 & Lot 10	Specific site investigation to confirm AS2870 or B1/AS1 design with minimum pile foundation embedment depth 1000 mm. Filling across building platform to be Certified by a Chartered Professional Engineer (Geotechnical).	300 kPa/ Class H	Site specific geotechnical report to confirm the soil conditions assumed within this report.
LOT 7-9 & LOT 11-13	Specific site investigation to confirm AS2870 or B1/AS1 design with minimum foundation depth 1000 mm.	300 kPa/ Class H	Site specific geotechnical report to confirm the soil conditions assumed within this report.
LOT 14-16	Specific site investigation to confirm AS2870 or B1/AS1 design with minimum foundation depth 1000 mm on level ground, with deeper piles required for foundations on sloping ground.	300 kPa/ Class H	Site specific geotechnical report to confirm the soil conditions assumed within this report.
Lot 17	Specific site investigation, foundation design to consider proximity to accessway cut batter.	300 kPa / Class H	Site specific geotechnical report to confirm the soil conditions assumed within this report. Specific foundation design or setback form cut batter to be demonstrated through design.
LOT 18-19	Specific site investigation, foundation design and construction inspections due to sloping ground. Minimum pile foundation embedment 2.5 m (subject to specific design).	300 kPa/ Class H	Piled foundations to account for sloping ground and loss of passive support. Refer Section 5.4.2.

8 Limitations

This report has been prepared for the use of Te Runanga O Whaingaroa with respect to the brief outlined to us. This report is to be used by our Client and their Consultants and may be relied upon when considering geotechnical advice. Furthermore, this report may be utilised in the preparation of building and/or resource consent applications with local authorities. The information and opinions contained within this report shall not be used in other context for any other purpose without prior review and agreement by Haigh Workman Ltd.

The recommendations given in this report are based on site data from discrete locations. If any changes are made, we must be allowed to review the new development proposal to ensure that the recommendations of this report remain valid Inferences about the subsoil conditions away from the test locations have been made but cannot be guaranteed. We have inferred an appropriate geotechnical model that can be applied for our analyses. However, variations in ground conditions from those described in this report could exist across the site. Should conditions encountered differ to those outlined in this report we ask that we be given the opportunity to review the continued applicability of our recommendations.

Appendix A – Drawings

Drawing No.	Title
24 208/G01	Geotechnical Investigation and Assessment Plan
24 208/G02	Geological Section A-A
24 208/G03	Geological Section B-B
24 208/G04	Geological Section C-C
	Drawing set from Chester Consultants Ltd

NOTES:

1. LOT BOUNDARIES INFORMATION TAKEN FROM LINZ.

LEGEND:

: BUILDING RESTRICTION ZONES

LOT 1 509m²
LOT 2 443m²
LOT 3 458m²
LOT 4 493m²
LOT 5 399m²
LOT 6 348m²
LOT 7 348m²
LOT 8 348m²
LOT 9 374m²
LOT 10 386m²
LOT 11 427m²
LOT 12 380m²
LOT 13 360m²
LOT 14 660m²
LOT 15 526m²
LOT 16 424m²
LOT 17 520m²
LOT 18 3025m²
LOT 19 1435m²
LOT 100 4556m²
LOT 102 6566m²
LOT 1 DP 563441 1537m²

HA01 HA02 HA03 HA04 HA05 HA06 HA07 HA08 HA09 HA10 HA11 HA12 HA13 HA14 HA15 HA16 HA17 HA18 HA19 HA20

CPT01 CPT02 CPT03 CPT04 CPT05 CPT06 CPT07 CPT08 CPT09 CPT10 CPT11

B G03 A G02 C G04

FURTHER ASSESSMENT REQUIRED - NO PROPOSED WORKS IN THIS AREA

Issue	Date	Revision
A	19/11/2024	ASSESSMENT REPORT

DWG GEOTECHNICAL INVESTIGATION & ASSESSEMENT PLAN

Scale 1:1000 @A3 | Date 20/11/2024

Drawn WT | Checked JP | Approved JP

File T:\CLIENTS\TE RUNANGA O WHAINGAROA\JOBS\24 208 2A ASH GROVE HARURU\ENGINEERING\DRAWINGS\19112024_GEOTECHNICAL PLANS.DWG

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Project PROPOSED SUBDIVISION
2A Ash Grove Circle, Haruru

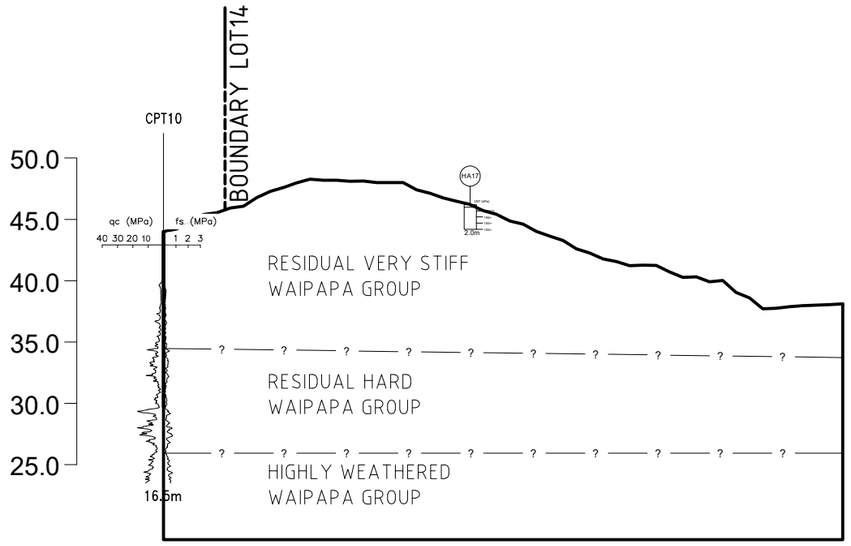
Client TE RUNANGA O WHAINGAROA

Project No. 24 208 | RC no.

DWG No. G01

Sheet No. 1 of 4

Plotted By Wayne Thorburn at 4/12/2024 2:32:44 pm



SECTION A-A

Issue	Date	Revision
A	19/11/2024	ASSESSMENT REPORT

DWG SECTION A-A

Scale 1:500 @A3 | Date 20/11/2024

Drawn WT | Checked JP | Approved JP

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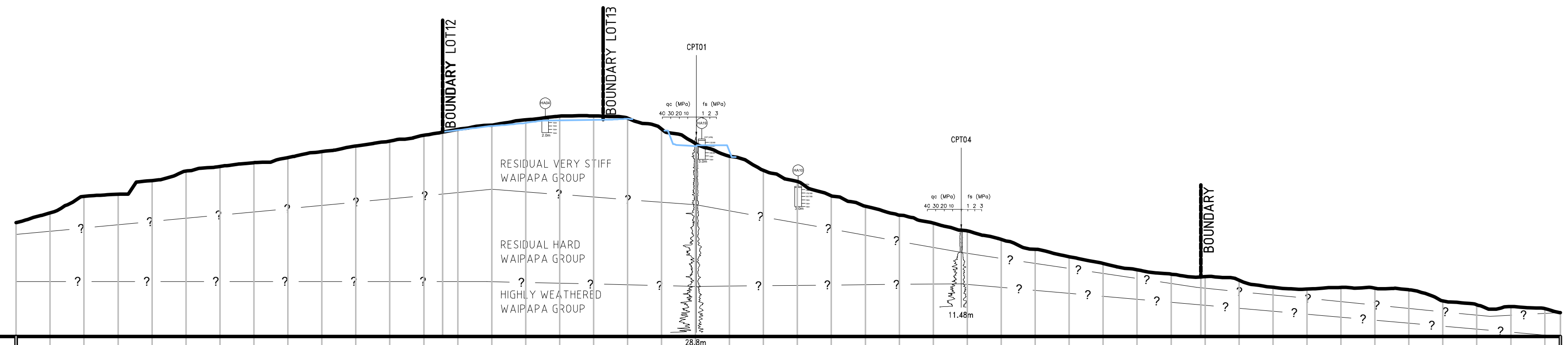
Project No. 24 208 | RC no.

DWG No. **G02**

Sheet No. **2** of **4**

Plotted By Wayne Thorburn at 20/11/2024 9:45:49 am

EW 6
DATUM: 24.00
VERT. EXAGGERATION 1:1



CHAINAGE	EXISTING LEVELS	DESIGN LEVELS	CUT/FILL DEPTHS
0	40.75		
5	42.21		
10	44.64		
15	44.94		
20	46.96		
25	48.37		
30	49.03		
35	49.59		
40	50.32		
45	51.22		
50	52.04		
55	52.75		
60	53.61		
65	54.50	54.38	-0.11
70	55.13	55.00	-0.13
75	55.91	55.45	-0.46
80	56.44	55.82	-0.62
85	56.48	55.90	-0.58
90	56.14	56.04	-0.10
95	54.53		
100	52.38	52.01	-0.38
105	50.57	51.24	0.67
110	48.46		
115	46.84		
120	44.69		
125	43.17		
130	41.87		
135	40.69		
140	39.55		
145	38.29		
150	36.85		
155	35.73		
160	34.75		
165	33.83		
170	33.18		
175	32.80		
180	32.30		
185	31.24		
190	30.97		
195	31.23		
200	31.11		
205	30.88		
210	29.25		
215	28.64		
220	28.41		
225	28.12		
227	27.49		

SECTION B-B

Issue	Date	Revision
A	19/11/2024	ASSESSMENT REPORT
B	04/12/2024	ASSESSMENT REPORT

DWG SECTION B-B

Scale 1:1000 @A3 | Date 04/12/2024

Drawn WT | Checked JP | Approved JP

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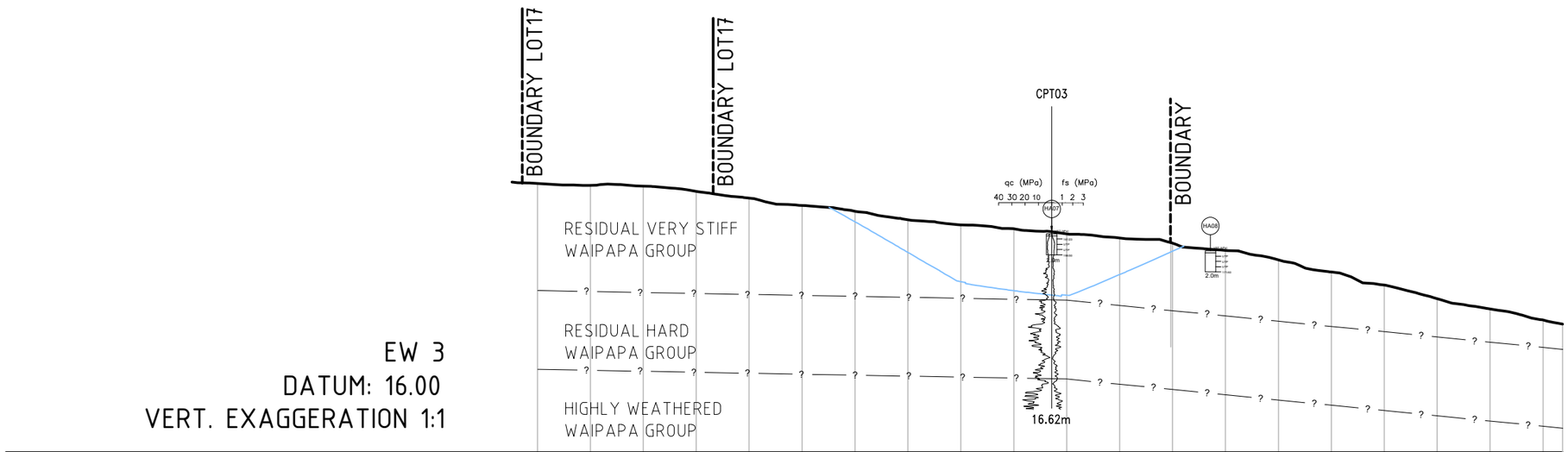
Client TE RUNANGA O WHAINGAROA

Project No. 24 208 | RC no.

DWG No. G03

Sheet No. 3 of 4

Plotted By Wayne Thorburn at 4/12/2024 2:56:05 pm



EW 3
DATUM: 16.00
VERT. EXAGGERATION 1:1

CUT/FILL DEPTHS	-0.22	-0.24					-0.99	-3.09	-5.37	-5.84	-5.79	-3.45	-0.76										
DESIGN LEVELS	41.22	41.02					37.82	34.93	32.17	31.32	30.89	32.84	35.04										
EXISTING LEVELS	41.44	41.26	41.20	40.69	40.07	39.36	38.81	38.02	37.54	37.16	36.69	36.29	35.80	35.11	34.23	33.08	31.85	30.56	29.59	28.54	28.15		
CHAINAGE	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	212		

SECTION C-C

Issue	Date	Revision
A	19/11/2024	ASSESSMENT REPORT
B	04/12/2024	ASSESSMENT REPORT

DWG SECTION C-C

Scale 1:500 @A3 | Date 04/12/2024

Drawn WT | Checked JP | Approved JP

File T:\CLIENTS\TE RUNANGA O WHAINGAROA\JOBS\24 208 2A ASH GROVE HARURU\ENGINEERING\DRAWINGS\19112024_GEOTECHNICAL PLANS.DWG

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Project PROPOSED SUBDIVISION
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Client TE RUNANGA O WHAINGAROA

Project No. 24 208 | RC no.

DWG No. **G04**

Sheet No. **4** of **4**

Plotted By Wayne Thorburn at 4/12/2024 2:55:38 pm

NOTES:

1. THIS PLAN IS FOR A RESOURCE CONSENT APPLICATION ONLY. AREAS, BOUNDARY DIMENSIONS AND LEVELS ARE SUBJECT TO A LAND TRANSFER SURVEY AND APPROVAL BY THE LOCAL AUTHORITY AND LAND INFORMATION NZ.
2. ANY DISCREPANCIES ON THIS PLAN ARE TO BE REFERRED TO CHESTER CONSULTANTS LTD FOR COMMENT OR RESOLUTION.
3. THIS DOCUMENT HAS BEEN PREPARED FOR THE AGREED PURPOSES OF OUR CLIENT. NO REPRODUCTION, COPYING, REUSE, SALE, HIRE, LOAN OR GIFT OF THIS DOCUMENT DIRECTLY OR INDIRECTLY IS PERMITTED WITHOUT PRIOR WRITTEN CONSENT OF CHESTER CONSULTANTS LTD.

SITE DESCRIPTION:

TERRITORIAL AUTHORITY: FAR NORTH DISTRICT COUNCIL
ADDRESS: 2B ASH GROVE CIRCLE, HARURU
APPELLATION: LOT 2 DP 563441
ZONING: RESIDENTIAL
RECORD OF TITLE: 1018776
AREA: 2.3500 Ha

AMALGAMATION CONDITION:

THAT LOT 100 HEREON (JOINTLY OWNED LOT) BE HELD AS TO TWENTY UNDIVIDED ONE - ONE TWENTIETH SHARES BY THE OWNERS OF LOTS 1 TO 19 AND LOT 1 DP 563441 HEREON AS TENANTS IN COMMON IN THE SAID SHARES AND THAT INDIVIDUAL RECORD OF TITLES BE ISSUED IN ACCORDANCE THEREWITH.

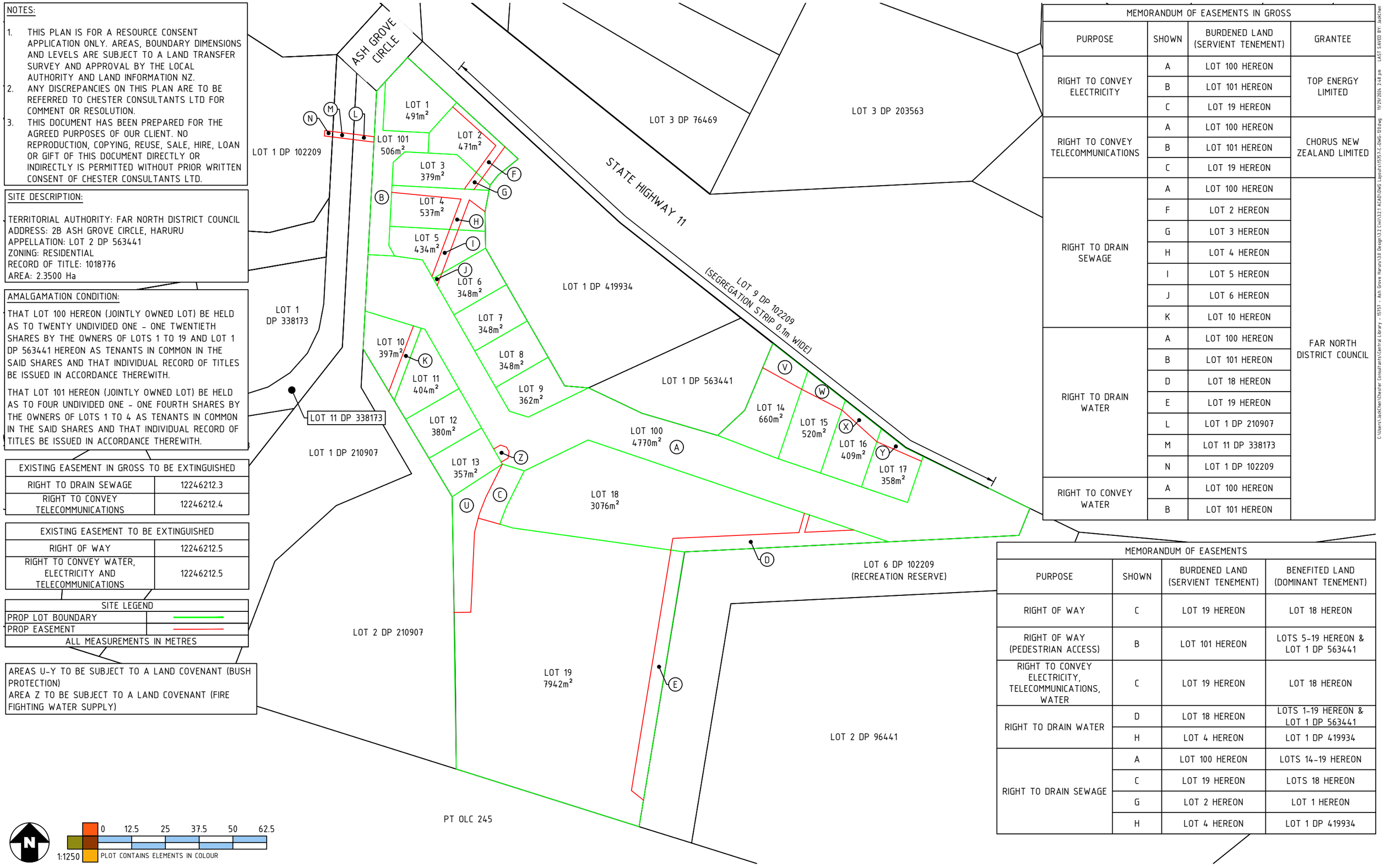
THAT LOT 101 HEREON (JOINTLY OWNED LOT) BE HELD AS TO FOUR UNDIVIDED ONE - ONE FOURTH SHARES BY THE OWNERS OF LOTS 1 TO 4 AS TENANTS IN COMMON IN THE SAID SHARES AND THAT INDIVIDUAL RECORD OF TITLES BE ISSUED IN ACCORDANCE THEREWITH.

EXISTING EASEMENT IN GROSS TO BE EXTINGUISHED	
RIGHT TO DRAIN SEWAGE	12246212.3
RIGHT TO CONVEY TELECOMMUNICATIONS	12246212.4

EXISTING EASEMENT TO BE EXTINGUISHED	
RIGHT OF WAY	12246212.5
RIGHT TO CONVEY WATER, ELECTRICITY AND TELECOMMUNICATIONS	12246212.5

SITE LEGEND	
PROP LOT BOUNDARY	
PROP EASEMENT	
ALL MEASUREMENTS IN METRES	

AREAS U-Y TO BE SUBJECT TO A LAND COVENANT (BUSH PROTECTION)
AREA Z TO BE SUBJECT TO A LAND COVENANT (FIRE FIGHTING WATER SUPPLY)



MEMORANDUM OF EASEMENTS IN GROSS			
PURPOSE	SHOWN	BURDENED LAND (SERVIENT TENEMENT)	GRANTEE
RIGHT TO CONVEY ELECTRICITY	A	LOT 100 HEREON	TOP ENERGY LIMITED
	B	LOT 101 HEREON	
	C	LOT 19 HEREON	
RIGHT TO CONVEY TELECOMMUNICATIONS	A	LOT 100 HEREON	CHORUS NEW ZEALAND LIMITED
	B	LOT 101 HEREON	
	C	LOT 19 HEREON	
RIGHT TO DRAIN SEWAGE	A	LOT 100 HEREON	FAR NORTH DISTRICT COUNCIL
	F	LOT 2 HEREON	
	G	LOT 3 HEREON	
	H	LOT 4 HEREON	
	I	LOT 5 HEREON	
	J	LOT 6 HEREON	
	K	LOT 10 HEREON	
RIGHT TO DRAIN WATER	A	LOT 100 HEREON	
	B	LOT 101 HEREON	
	D	LOT 18 HEREON	
	E	LOT 19 HEREON	
	L	LOT 1 DP 210907	
	M	LOT 11 DP 338173	
	N	LOT 1 DP 102209	
RIGHT TO CONVEY WATER	A	LOT 100 HEREON	
	B	LOT 101 HEREON	

MEMORANDUM OF EASEMENTS			
PURPOSE	SHOWN	BURDENED LAND (SERVIENT TENEMENT)	BENEFITED LAND (DOMINANT TENEMENT)
RIGHT OF WAY	C	LOT 19 HEREON	LOT 18 HEREON
RIGHT OF WAY (PEDESTRIAN ACCESS)	B	LOT 101 HEREON	LOTS 5-19 HEREON & LOT 1 DP 563441
RIGHT TO CONVEY ELECTRICITY, TELECOMMUNICATIONS, WATER	C	LOT 19 HEREON	LOT 18 HEREON
RIGHT TO DRAIN WATER	D	LOT 18 HEREON	LOTS 1-19 HEREON & LOT 1 DP 563441
	H	LOT 4 HEREON	LOT 1 DP 419934
RIGHT TO DRAIN SEWAGE	A	LOT 100 HEREON	LOTS 14-19 HEREON
	C	LOT 19 HEREON	LOTS 18 HEREON
	G	LOT 2 HEREON	LOT 1 HEREON
	H	LOT 4 HEREON	LOT 1 DP 419934

1:1250 0 12.5 25 37.5 50 62.5 PLOT CONTAINS ELEMENTS IN COLOUR

Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter: A BERMINGHAM
Designer: A BERMINGHAM
Checker: N JULL
Date: 28/11/2024

Job Title: CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Client: TE RŪNANGA O WHAINGAROA C/O SCOPE
Address: 2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Drawing Title: PROPOSED SCHEME PLAN

Drawing: 120 Rev: 0
Scale: 1:1250 @ A3
Project: 15757
Issue: CONSENT

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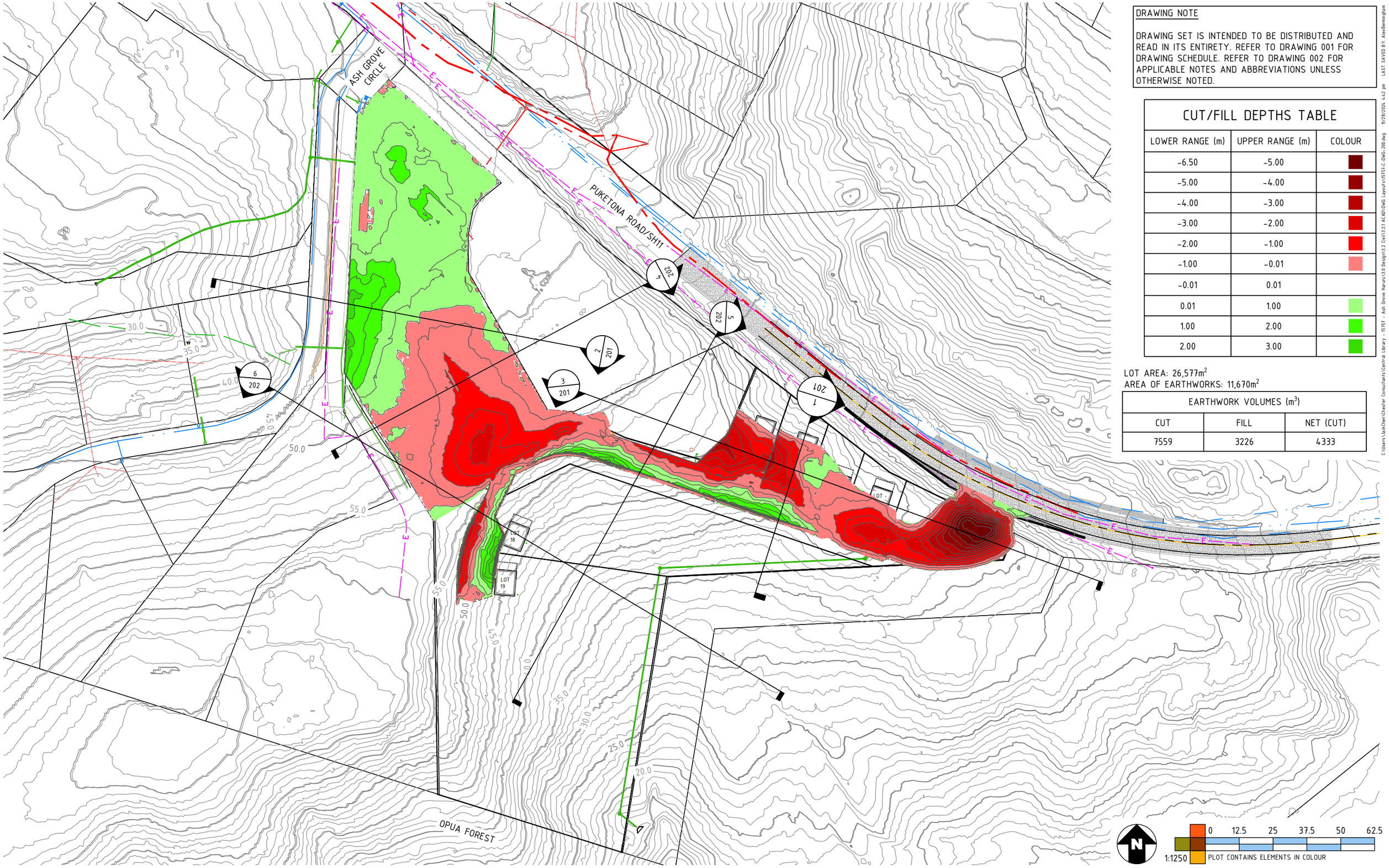

DRAWING NOTE

DRAWING SET IS INTENDED TO BE DISTRIBUTED AND READ IN ITS ENTIRETY. REFER TO DRAWING 001 FOR DRAWING SCHEDULE. REFER TO DRAWING 002 FOR APPLICABLE NOTES AND ABBREVIATIONS UNLESS OTHERWISE NOTED.

CUT/FILL DEPTHS TABLE

LOWER RANGE (m)	UPPER RANGE (m)	COLOUR
-6.50	-5.00	
-5.00	-4.00	
-4.00	-3.00	
-3.00	-2.00	
-2.00	-1.00	
-1.00	-0.01	
-0.01	0.01	
0.01	1.00	
1.00	2.00	
2.00	3.00	

LOT AREA: 26,577m^2
AREA OF EARTHWORKS: 11,670m^2

EARTHWORK VOLUMES (m^3)		
CUT	FILL	NET (CUT)
7559	3226	4333

1:1250 0 12.5 25 37.5 50 62.5 PLOT CONTAINS ELEMENTS IN COLOUR

Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter: A BERMINGHAM
Designer: A BERMINGHAM
Checker: N JULL
Date: 28/11/2024

Job Title: CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Client: TE RŪNANGA O WHAINGAROA C/O SCOPE
Address: 2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Drawing Title: EARTHWORKS PLAN

Drawing: 200 Rev: 0
Scale: 1:1250 @ A3
Project: 15757
Issue: CONSENT

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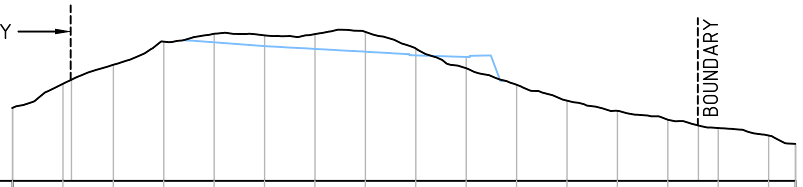
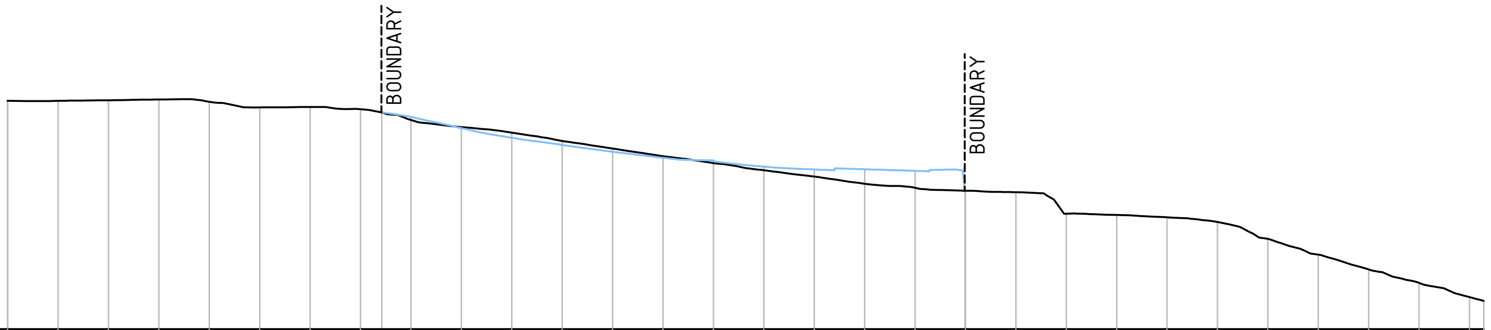


EW 1
DATUM: 30.00
VERT. EXAGGERATION 1:1

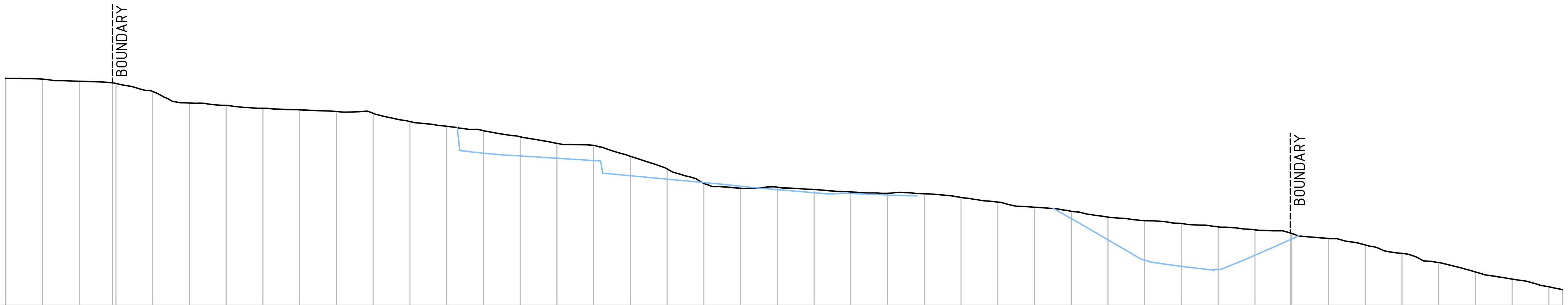
CUT/FILL DEPTHS					-0.84	-1.06	-1.46	-1.97	-0.70	1.12							
DESIGN LEVELS					43.71	43.33	43.05	42.77	42.41	42.25							
EXISTING LEVELS	37.18	39.56	41.46	43.76	44.55	44.39	44.51	44.74	43.11	41.13	39.50	37.92	36.90	36.03	35.20	34.46	33.62
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	78



EW 2
DATUM: 34.00
VERT. EXAGGERATION 1:1

CUT/FILL DEPTHS									0.29	-0.11	-0.53	-0.40	-0.34	-0.16	0.24
DESIGN LEVELS									55.05	53.95	52.98	52.27	51.59	50.99	50.72
EXISTING LEVELS	56.66	56.66	56.72	56.79	56.57	56.00	56.05	55.83	54.76	54.05	53.50	52.67	51.93	51.16	50.48
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70

CUT/FILL DEPTHS	0.34	0.69	1.42	1.67												
DESIGN LEVELS	50.11	49.83	49.85	49.69												
EXISTING LEVELS	49.77	49.14	48.43	48.02	47.73	47.59	45.44	45.33	45.10	44.63	42.95	41.39	39.92	38.58	37.17	36.79
CHAINAGE	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	146



EW 3
DATUM: 26.00
VERT. EXAGGERATION 1:1

CUT/FILL DEPTHS														-3.07	-2.61	-2.02	-2.08	-2.64	-1.38	0.12	0.28
DESIGN LEVELS														46.71	46.34	46.03	45.71	43.65	43.19	42.72	42.22
EXISTING LEVELS	56.91	56.79	56.50	56.21	55.13	53.55	53.23	52.83	52.62	52.39	52.16	51.02	50.38	49.78	48.95	48.05	47.79	46.30	44.57	42.61	41.94
CHAINAGE	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100

CUT/FILL DEPTHS	-0.34	-0.45	-0.22	-0.24					-0.99	-3.09	-5.37	-5.84	-5.79	-3.45	-0.76							
DESIGN LEVELS	41.75	41.34	41.22	41.02					37.82	34.93	32.17	31.32	30.89	32.84	35.04							
EXISTING LEVELS	42.09	41.79	41.44	41.26	41.20	40.69	40.07	39.36	38.81	38.02	37.54	37.16	36.69	36.29	35.80	35.11	34.23	33.08	31.85	30.56	29.59	28.54
CHAINAGE	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210

EXISTING LEVELS	28.15
CHAINAGE	212

DRAWING NOTE

DRAWING SET IS INTENDED TO BE DISTRIBUTED AND READ IN ITS ENTIRETY. REFER TO DRAWING 001 FOR DRAWING SCHEDULE. REFER TO DRAWING 002 FOR APPLICABLE NOTES AND ABBREVIATIONS UNLESS OTHERWISE NOTED.

LONGSECTION LEGEND	
EXISTING GROUND	(black line)
PROPOSED GROUND	(blue line)
ALL MEASUREMENTS IN METRES	

0 7.5 15 22.5 30 37.5
1:750 PLOT CONTAINS ELEMENTS IN COLOUR

Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter: A BERMINGHAM
Designer: A BERMINGHAM
Checker: N JULL
Date: 28/11/2024

Job Title: CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Client: TE RŪNANGA O WHAINGAROA C/O SCOPE
Address: 2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Drawing Title: BULK EARTHWORKS LONG SECTIONS 01

Drawing: 201 Rev: 0
Scale: 1:750 @ A3
Project: 15757
Issue: CONSENT

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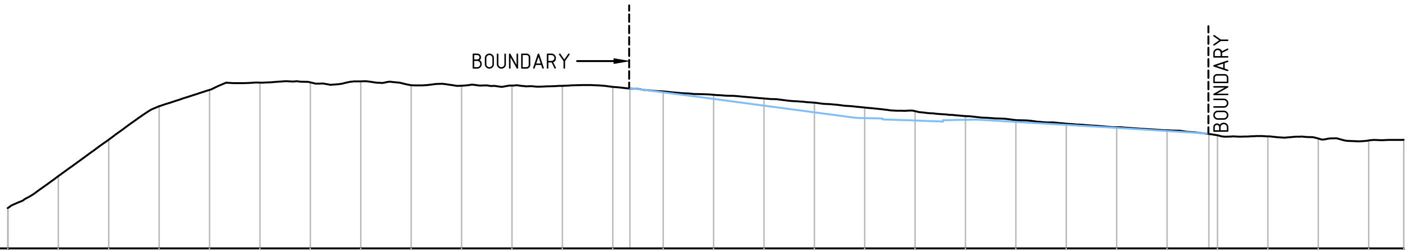
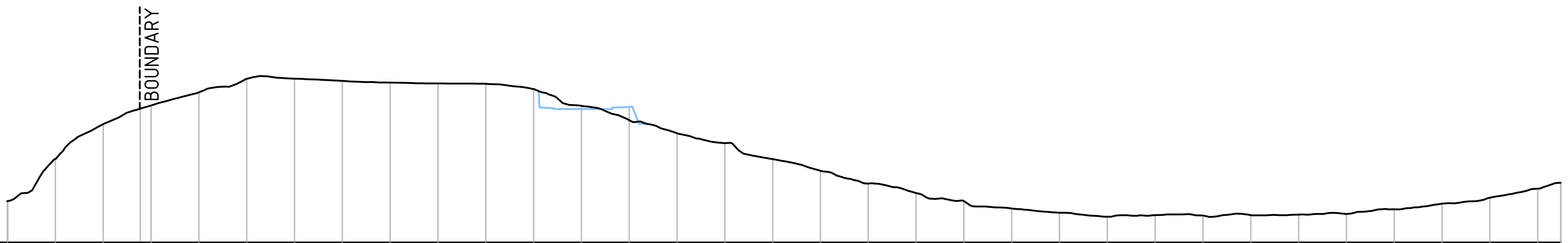


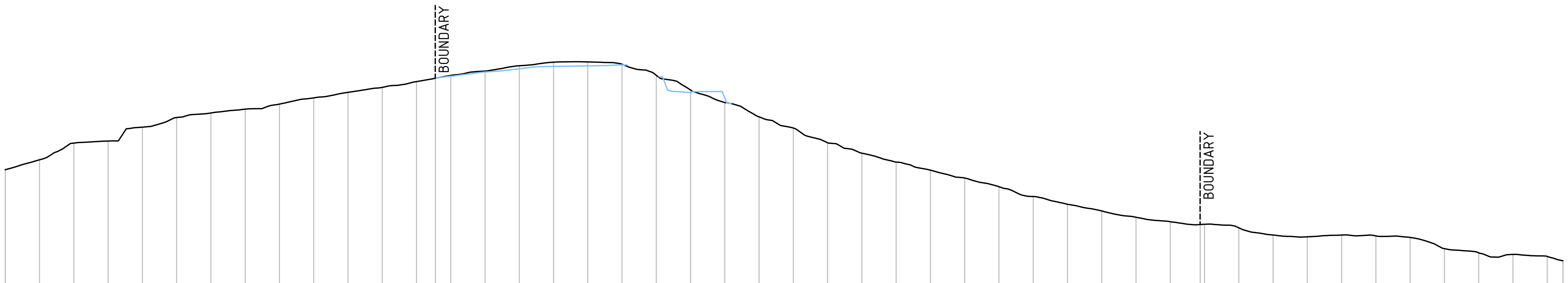
EW 4
DATUM: 40.00
VERT. EXAGGERATION 1:1

CHAINAGE	EXISTING LEVELS	DESIGN LEVELS	CUT/FILL DEPTHS
0	43.97		
5	47.10		
10	50.73		
15	54.03		
20	55.66		
25	56.39		
30	56.42		
35	56.51		
40	56.12		
45	56.08		
50	56.10		
55	56.07		
60	55.97		
65	55.52	55.39	-0.13
70	55.18	54.73	-0.45
75	54.82	54.07	-0.75
80	54.40	53.41	-0.99
85	53.91	52.84	-1.08
90	53.56	52.59	-0.97
95	53.07	52.66	-0.41
100	52.67	52.45	-0.22
105	52.32	52.16	-0.16
110	51.97	51.87	-0.10
115	51.66	51.56	-0.10
120	51.18		
125	51.07		
130	50.85		
135	50.65		
138	50.72		



EW 5
DATUM: 36.00
VERT. EXAGGERATION 1:1

CHAINAGE	EXISTING LEVELS	DESIGN LEVELS	CUT/FILL DEPTHS
0	40.28		
5	44.68		
10	48.30		
15	50.27		
20	51.63		
25	53.05		
30	53.08		
35	52.85		
40	52.67		
45	52.59		
50	52.54		
55	52.00		
60	50.25	49.91	-0.33
65	48.76	50.14	1.38
70	47.39		
75	46.34		
80	44.68		
85	43.47		
90	42.12		
95	41.15		
100	40.30		
105	39.52		
110	39.08		
115	38.66		
120	38.82		
125	38.78		
130	38.82		
135	38.88		
140	38.96		
145	39.43		
150	40.02		
155	40.64		
160	41.59		
162	42.22		



EW 6
DATUM: 24.00
VERT. EXAGGERATION 1:1

CHAINAGE	EXISTING LEVELS	DESIGN LEVELS	CUT/FILL DEPTHS
0	40.75		
5	42.21		
10	44.64		
15	44.94		
20	46.96		
25	48.37		
30	49.03		
35	49.59		
40	50.32		
45	51.22		
50	52.04		
55	52.75		
60	53.61		
65	54.50	54.38	-0.11
70	55.13	55.00	-0.13
75	55.91	55.45	-0.46
80	56.44	55.82	-0.62
85	56.48	55.90	-0.58
90	56.14	56.04	-0.10
95	54.53		
100	52.38	52.01	-0.38
105	50.57	51.24	0.67
110	48.46		
115	46.84		
120	44.69		
125	43.17		
130	41.87		
135	40.69		
140	39.55		
145	38.29		
150	36.85		
155	35.73		
160	34.75		
165	33.83		
170	33.18		
175	32.80		
180	32.30		
185	31.24		
190	30.97		
195	31.23		
200	31.11		
205	30.88		
210	29.25		
215	28.64		
220	28.41		
225	28.12		
227	27.49		

DRAWING NOTE

DRAWING SET IS INTENDED TO BE DISTRIBUTED AND READ IN ITS ENTIRETY. REFER TO DRAWING 001 FOR DRAWING SCHEDULE. REFER TO DRAWING 002 FOR APPLICABLE NOTES AND ABBREVIATIONS UNLESS OTHERWISE NOTED.

LONGSECTION LEGEND	
EXISTING GROUND	(black line)
PROPOSED GROUND	(blue line)
ALL MEASUREMENTS IN METRES	

0 7.5 15 22.5 30 37.5
1:750 PLOT CONTAINS ELEMENTS IN COLOUR

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Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter: A BERMINGHAM
Designer: A BERMINGHAM
Checker: N JULL
Date: 28/11/2024

Job Title: CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Client: TE RŪNANGA O WHAINGAROA C/O SCOPE
Address: 2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Drawing Title: BULK EARTHWORKS LONG SECTIONS 02

Drawing: 202 Rev: 0
Scale: 1:750 @ A3
Project: 15757
Issue: CONSENT

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ASH GROVE CIRCLE

PUKETONA ROAD/SH1T

RETAINING WALL 04

RETAINING WALL 03

RETAINING WALL 02

RETAINING WALL 06

RETAINING WALL 05

RETAINING WALL 01

OPUA FOREST

LOT 1
LOT 2
LOT 3
LOT 4
LOT 5
LOT 6
LOT 7
LOT 8
LOT 9
LOT 10
LOT 11
LOT 12
LOT 13
LOT 14
LOT 15
LOT 16
LOT 17
LOT 18
LOT 19

PROPOSED BOULDER RETAINING STRUCTURE AT ENTRANCEWAY TO A HEIGHT OF APPROX. 2m. BATTERED 1:3 SLOPE BEHIND STRUCTURE. REFER TO LANDSCAPE PLANS FOR DETAILS.

DRAWING NOTE

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THREE WATERS LEGEND	
EX / PROP PRIV. SW PIPE	/
EX / PROP PRIV. WW PIPE	/
EX / PROP PUBLIC SW PIPE	/
EX / PROP PUBLIC WW PIPE	/
EX / PROP SWIC	/
EX / PROP SWCP	/
EX / PROP WWIC	/
CONNECTION DIRECTION	N,NE,E,SE,S,SW,W,NW
EX / PROP WS PIPE	/
ALL MEASUREMENTS IN METRES	

SITE LEGEND	
EX MIN / MAJ CONTOURS	X.X / X.X
PROP MIN / MAJ CONTOURS	X.X / X.X
EX / PROP CONCRETE PAVE	
PROP PERMEABLE PAVE	
EX / PROP. RETAINING WALL	/
EX/PROP SWCP	/
ALL MEASUREMENTS IN METRES	

N

1:1250 0 12.5 25 37.5 50 62.5 PLOT CONTAINS ELEMENTS IN COLOUR

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Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter:	A BERMINGHAM
Designer:	A BERMINGHAM
Checker:	N JULL
Date:	28/11/2024
Job Title:	CIVIL DESIGN – PROPOSED RESIDENTIAL SUBDIVISION
Client:	TE RŪNANGA O WHAINGAROA C/O SCOPE
Address:	2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Drawing Title:	RETAINING WALL PLAN
Drawing:	300 Rev: 0
Scale:	1:1250 @ A3
Project:	15757
Issue:	CONSENT

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TIMBER RETAINING WALL 03
MAX. RETAINED HEIGHT 3.35m
REFER TO DRAWING 303 FOR DETAILS

TIMBER RETAINING WALL 02
MAX. RETAINED HEIGHT 1.70m
REFER TO DRAWING 303 FOR DETAILS

TIMBER RETAINING WALL 06
MAX. RETAINED HEIGHT 2.55m
REFER TO DRAWING 305 FOR DETAILS

TIMBER RETAINING WALL 01
MAX. RETAINED HEIGHT 3.30m
REFER TO DRAWING 302 FOR DETAILS

TIMBER RETAINING WALL 05
MAX. RETAINED HEIGHT 3.15m
REFER TO DRAWING 304 FOR DETAILS

TIMBER RETAINING WALL 04
MAX. RETAINED HEIGHT 2.75m. REFER TO DRAWING 304 FOR DETAILS

LOT 9, LOT 12, LOT 13, LOT 14, LOT 15, LOT 16, LOT 17, LOT 18, LOT 19, LOT 10, LOT 11, LOT 5, LOT 4, LOT 3, LOT 1

ASH GROVE CIRCLE

RW 01 CH 0, RW 01 CH 20, RW 01 CH 40, RW 01 CH 60, RW 01 CH 80, RW 01 CH 100
RW 02 CH 0, RW 02 CH 20
RW 03 CH 0, RW 03 CH 20, RW 03 CH 40, RW 03 CH 60
RW 04 CH 0, RW 04 CH 20, RW 04 CH 40, RW 04 CH 60, RW 04 CH 69
RW 05 CH 0, RW 05 CH 20, RW 05 CH 40, RW 05 CH 50
RW 06 CH 0, RW 06 CH 20, RW 06 CH 40, RW 06 CH 47

DRAWING NOTE

DRAWING SET IS INTENDED TO BE DISTRIBUTED AND READ IN ITS ENTIRETY. REFER TO DRAWING 001 FOR DRAWING SCHEDULE. REFER TO DRAWING 002 FOR APPLICABLE NOTES AND ABBREVIATIONS UNLESS OTHERWISE NOTED.

SITE LEGEND	
EX MIN / MAJ CONTOURS	X.X / X.X
PROP MIN / MAJ CONTOURS	X.X / X.X
EX / PROP CONCRETE PAVE	
PROP PERMEABLE PAVE	
EX / PROP. RETAINING WALL	/
EX/PROP SWCP	/
ALL MEASUREMENTS IN METRES	

N

0 5 10 15 20 25
1:500 PLOT CONTAINS ELEMENTS IN COLOUR

N

0 5 10 15 20 25
1:500 PLOT CONTAINS ELEMENTS IN COLOUR

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Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter:	A BERMINGHAM	Job Title:	CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Designer:	A BERMINGHAM	Client:	TE RŪNANGA O WHAINGAROA C/O SCOPE
Checker:	N JULL	Address:	2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Date:	28/11/2024	Drawing Title:	RETAINING WALL PLAN - ENLARGEMENT

Drawing:	301 Rev: 0
Scale:	1:500 @ A3
Project:	15757
Issue:	CONSENT

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DRAWING NOTE

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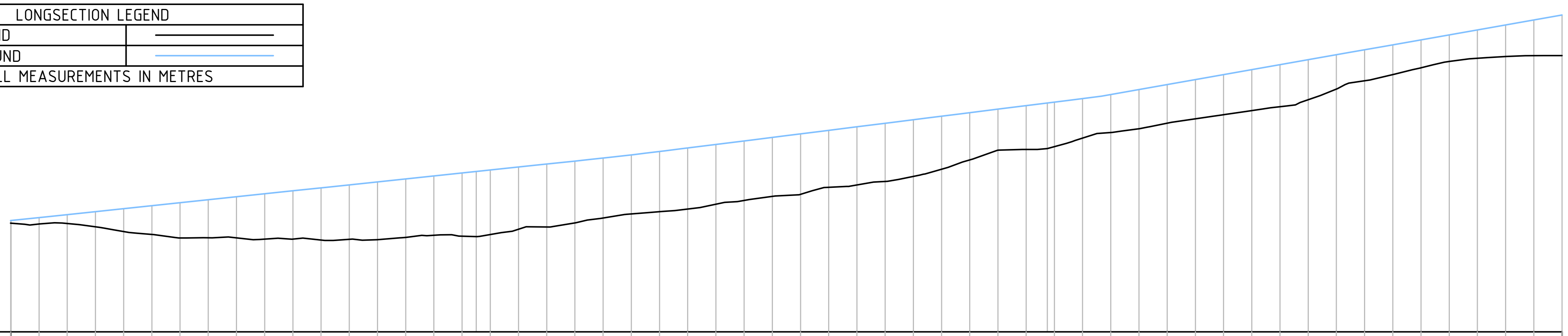
LONGSECTION LEGEND	
EXISTING GROUND	(black line)
PROPOSED GROUND	(blue line)
ALL MEASUREMENTS IN METRES	



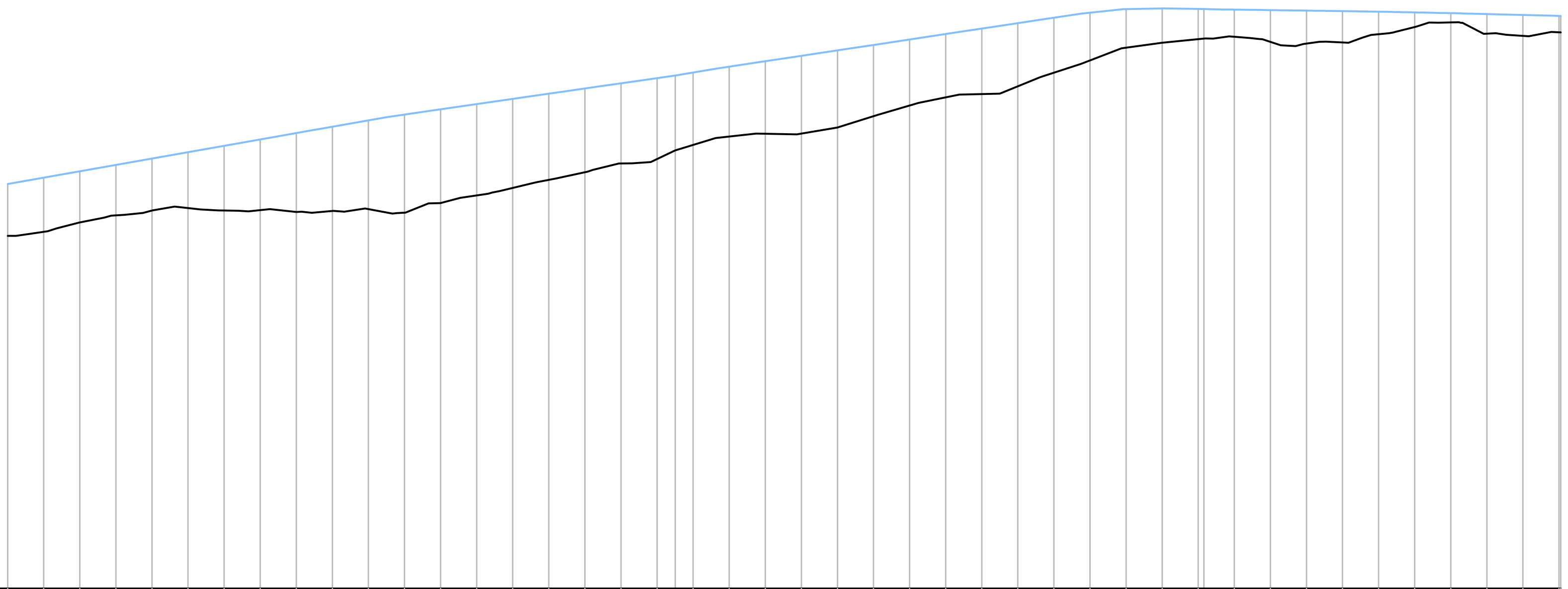
RW 01
DATUM: 36.00
VERT. EXAGGERATION 1:1

TOP OF WALL LEVELS	40.72	40.85	40.97	41.10	41.22	41.35	41.48	41.60	41.73	41.86	41.98	42.11	42.24	42.36
RETAINED HEIGHT	0.11	0.27	0.38	0.64	0.97	1.22	1.50	1.62	1.74	1.93	2.05	2.21	2.31	2.45
BOTTOM OF WALL LEVEL	40.61	40.57	40.60	40.46	40.26	40.13	39.98	39.99	39.99	39.93	39.93	39.89	39.92	39.91
HORIZONTAL GEOMETRY	19.80m 288°41'53"													
CHAINAGE	0.0	1.2	2.4	3.6	4.8	6.0	7.2	8.4	9.6	10.8	12.0	13.2	14.4	15.6

TOP OF WALL LEVELS	42.49	42.62	42.74	42.87	42.99	43.12	43.25	43.38	43.51	43.66	43.80	43.95	44.10	44.25
RETAINED HEIGHT	2.49	2.52	2.69	2.74	2.65	2.67	2.63	2.55	2.51	2.56	2.60	2.54	2.53	2.51
BOTTOM OF WALL LEVEL	40.00	40.10	40.06	40.13	40.35	40.45	40.62	40.83	41.00	41.10	41.21	41.41	41.57	41.75
HORIZONTAL GEOMETRY				24.30m 288°41'53"										
CHAINAGE	16.8	18.0	19.2	20.4	21.6	22.8	24.0	25.2	26.4	27.6	28.8	30.0	31.2	32.4

TOP OF WALL LEVELS	44.40	44.55	44.70	44.85	45.00	45.15	45.30	45.45	45.60	45.75	45.90	46.07	46.29	46.50
RETAINED HEIGHT	2.57	2.42	2.47	2.47	2.41	2.25	2.01	1.74	1.86	1.89	1.68	1.61	1.66	1.64
BOTTOM OF WALL LEVEL	41.83	42.13	42.23	42.38	42.60	42.90	43.29	43.71	43.74	43.86	44.22	44.46	44.62	44.86
HORIZONTAL GEOMETRY										44.10m 288°41'53"				
CHAINAGE	33.6	34.8	36.0	37.2	38.4	39.6	40.8	42.0	43.2	44.4	45.6	46.8	48.0	49.2

TOP OF WALL LEVELS	46.71	46.92	47.13	47.34	47.56	47.77	47.98	48.19	48.40	48.61	48.82	49.04	49.25	49.46
RETAINED HEIGHT	1.67	1.70	1.74	1.79	1.70	1.46	1.32	1.26	1.19	1.13	1.21	1.34	1.52	1.73
BOTTOM OF WALL LEVEL	45.04	45.22	45.39	45.56	45.85	46.31	46.66	46.93	47.21	47.48	47.62	47.69	47.73	47.73
HORIZONTAL GEOMETRY														
CHAINAGE	50.4	51.6	52.8	54.0	55.2	56.4	57.6	58.8	60.0	61.2	62.4	63.6	64.8	66.0



RW 01
DATUM: 36.00
VERT. EXAGGERATION 1:1

TOP OF WALL LEVELS	49.46	49.67	49.88	50.09	50.31	50.52	50.73	50.94	51.15	51.36	51.58
RETAINED HEIGHT	1.73	1.81	1.70	1.68	1.73	1.86	2.15	2.35	2.63	2.81	2.96
BOTTOM OF WALL LEVEL	49.46	49.67	49.88	50.09	50.31	50.52	50.73	50.94	51.15	51.36	51.58
HORIZONTAL GEOMETRY	44.10m 288°41'53"										
CHAINAGE	66.0	67.2	68.4	69.6	70.8	72.0	73.2	74.4	75.6	76.8	78.0

TOP OF WALL LEVELS	51.77	51.94	52.11	52.29	52.46	52.63	52.81	52.98	53.17	53.36	53.54
RETAINED HEIGHT	3.26	3.12	3.04	2.96	2.87	2.78	2.67	2.69	2.41	2.32	2.41
BOTTOM OF WALL LEVEL	51.77	51.94	52.11	52.29	52.46	52.63	52.81	52.98	53.17	53.36	53.54
HORIZONTAL GEOMETRY											
CHAINAGE	79.2	80.4	81.6	82.8	84.0	85.2	86.4	87.6	88.8	90.0	91.2

TOP OF WALL LEVELS	53.72	53.90	54.08	54.26	54.44	54.63	54.81	54.99	55.16	55.27	55.30
RETAINED HEIGHT	2.59	2.57	2.37	2.20	2.11	2.18	2.10	1.83	1.59	1.28	1.14
BOTTOM OF WALL LEVEL	53.72	53.90	54.08	54.26	54.44	54.63	54.81	54.99	55.16	55.27	55.30
HORIZONTAL GEOMETRY											
CHAINAGE	92.4	93.6	94.8	96.0	97.2	98.4	99.6	100.8	102.0	103.2	104.4

TOP OF WALL LEVELS	55.28	55.26	55.24	55.22	55.21	55.19	55.17	55.14	55.11	55.08	**55.05**
RETAINED HEIGHT	1.01	0.90	1.06	1.10	1.04	0.75	0.49	0.31	0.65	0.70	**0.55**
BOTTOM OF WALL LEVEL	55.28	55.26	55.24	55.22	55.21	55.19	55.17	55.14	55.11	55.08	**55.05**
HORIZONTAL GEOMETRY		11.88m 244°27'19"									
CHAINAGE	105.6	106.8	108.0	109.2	110.4	111.6	112.8	114.0	115.2	116.4	**117.6**

0 2.5 5 7.5 10 12.5
1:250 PLOT CONTAINS ELEMENTS IN COLOUR

Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter: A BERMINGHAM
Designer: A BERMINGHAM
Checker: N JULL
Date: 28/11/2024

Job Title: CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Client: TE RŪNANGA O WHAINGAROA C/O SCOPE
Address: 2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Drawing Title: RETAINING WALL LONG SECTION 01

Drawing: 302 Rev: 0
Scale: 1:250 @ A3
Project: 15757
Issue: CONSENT

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DRAWING NOTE

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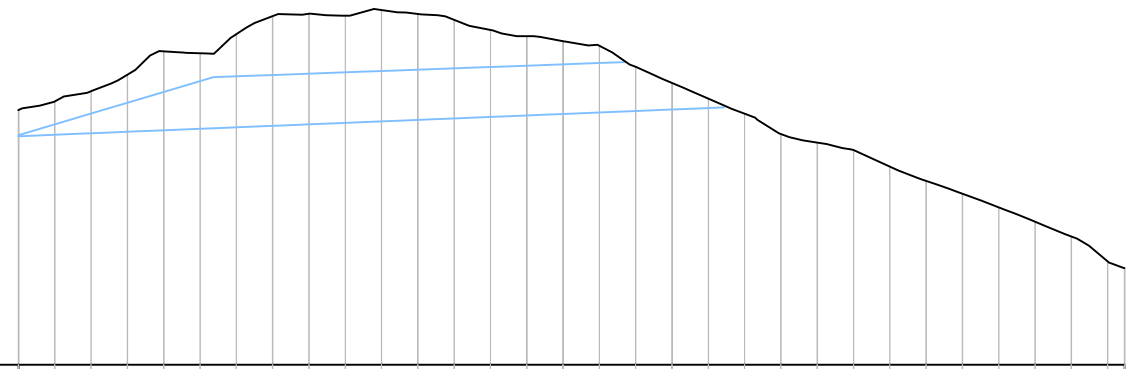
LONGSECTION LEGEND	
EXISTING GROUND	black line
PROPOSED GROUND	blue line
ALL MEASUREMENTS IN METRES	

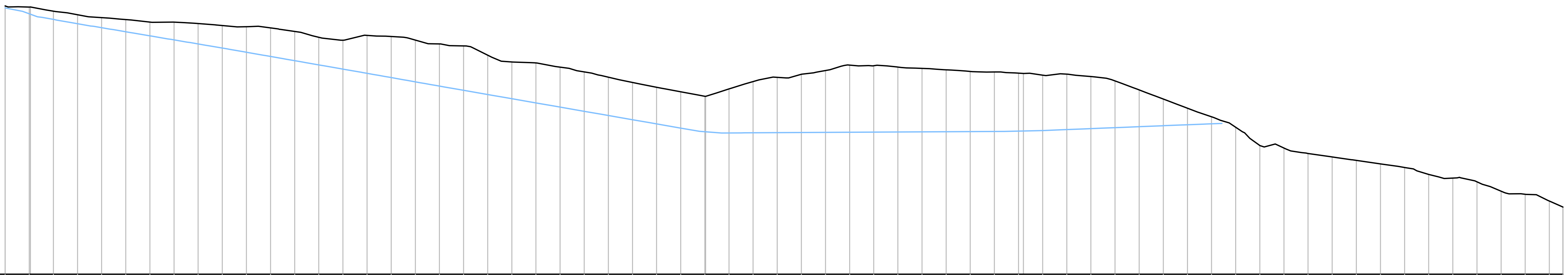
RW 02
DATUM: 36.00
VERT. EXAGGERATION 1:1



HORIZONTAL GEOMETRY: 36.56m 18°49'28"

CHAINAGE	TOP OF WALL LEVELS	RETAINED HEIGHT	BOTTOM OF WALL LEVEL
0.0	43.58	0.03	43.55
1.2	43.94	0.34	43.59
2.4	44.29	0.65	43.64
3.6	44.65	0.96	43.69
4.8	45.01	1.27	43.74
6.0	45.37	1.57	43.79
7.2	45.53	1.69	43.84
8.4	45.57	1.68	43.89
9.6	45.62	1.68	43.94
10.8	45.66	1.67	43.99
12.0	45.70	1.67	44.04
13.2	45.75	1.66	44.09
14.4	45.79	1.66	44.13
15.6	45.84	1.65	44.18
16.8	45.88	1.65	44.23
18.0	45.92	1.64	44.28
19.2	45.97	1.64	44.33
20.4			44.38
21.6			44.43
22.8			44.48
24.0			
25.2			
26.4			
27.6			
28.8			
30.0			
31.2			
32.4			
33.6			
34.8			
36.0			
36.6			

RW 03
DATUM: 40.00
VERT. EXAGGERATION 1:1



HORIZONTAL GEOMETRY: 1.26m 199°32'59" (0.0–1.2); 33.58m 108°41'53" (to 34.8); 15.81m 47°00'25" (to 50.4); 26.83m 22°49'41" (to 77.5)

CHAINAGE	TOP OF WALL LEVELS	RETAINED HEIGHT	BOTTOM OF WALL LEVEL
0.0	53.32	0.10	53.22
1.2	53.27	0.34	52.93
2.4	53.06	0.40	52.66
3.6	52.88	0.45	52.44
4.8	52.74	0.50	52.24
6.0	52.64	0.61	52.04
7.2	52.52	0.68	51.84
8.4	52.52	0.88	51.63
9.6	52.45	1.01	51.43
10.8	52.35	1.12	51.23
12.0	52.29	1.27	51.02
13.2	52.23	1.42	50.81
14.4	52.05	1.45	50.60
15.6	51.76	1.37	50.39
16.8	51.62	1.43	50.18
18.0	51.86	1.88	49.97
19.2	51.80	2.04	49.76
20.4	51.62	2.07	49.55
21.6	51.43	2.10	49.34
22.8	51.34	2.21	49.13
24.0	50.87	1.95	48.92
25.2	50.54	1.82	48.71
26.4	50.49	1.98	48.51
27.6	50.28	1.98	48.30
28.8	50.05	1.96	48.09
30.0	49.78	1.90	47.88
31.2	49.52	1.85	47.67
32.4	49.28	1.82	47.46
33.6	49.06	1.80	47.25
34.8	48.84	1.76	47.07
36.0	49.20	2.19	47.01
37.2	49.56	2.54	47.02
38.4	49.77	2.74	47.03
39.6	49.93	2.89	47.04
40.8	50.11	3.07	47.04
42.0	50.38	3.33	47.05
43.2	50.35	3.30	47.05
44.4	50.28	3.22	47.06
45.6	50.22	3.15	47.07
46.8	50.15	3.08	47.07
48.0	50.07	2.99	47.08
49.2	50.04	2.96	47.09
50.4	49.98	2.88	47.11
51.6	49.88	2.75	47.13
52.8	49.93	2.75	47.18
54.0	49.81	2.58	47.23
55.2	49.59	2.32	47.27
56.4	49.15	1.83	47.32
57.6	48.70	1.32	47.37
58.8	48.24	0.82	47.42
60.0	47.82	0.35	47.47
61.2	47.30		
62.4	46.39		
63.6	46.26		
64.8	45.99		
66.0	45.82		
67.2	45.65		
68.4	45.48		
69.6	45.30		
70.8	44.95		
72.0	44.77		
73.2	44.59		
74.4	44.12		
75.6	43.97		
76.8	43.63		
77.5	43.33		

0 2.5 5 7.5 10 12.5
1:250 PLOT CONTAINS ELEMENTS IN COLOUR

Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter: A BERMINGHAM
Designer: A BERMINGHAM
Checker: N JULL
Date: 28/11/2024

Job Title: CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Client: TE RŪNANGA O WHAINGAROA C/O SCOPE
Address: 2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Drawing Title: RETAINING WALL LONG SECTION 02

Drawing: 303 Rev: 0
Scale: 1:250 @ A3
Project: 15757
Issue: CONSENT

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C:\Users\JackChen\Chester Consultants\Central Library - 15757 - Ash Grove Haruru\3.0 Design\3.2 Civil\3.2.1 ACAD\DWG Layouts\15757-C-DWG-300.dwg 11/28/2024 4:43 pm LAST SAVED BY: AlexBermingham

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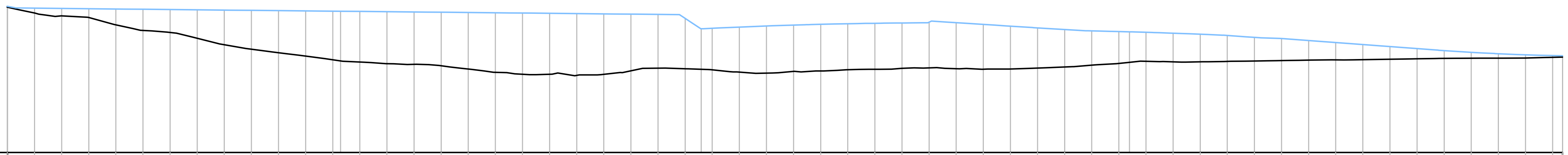
LONGSECTION LEGEND	
EXISTING GROUND	(black line)
PROPOSED GROUND	(blue line)
ALL MEASUREMENTS IN METRES	

RW 04
DATUM: 44.00
VERT. EXAGGERATION 1:1

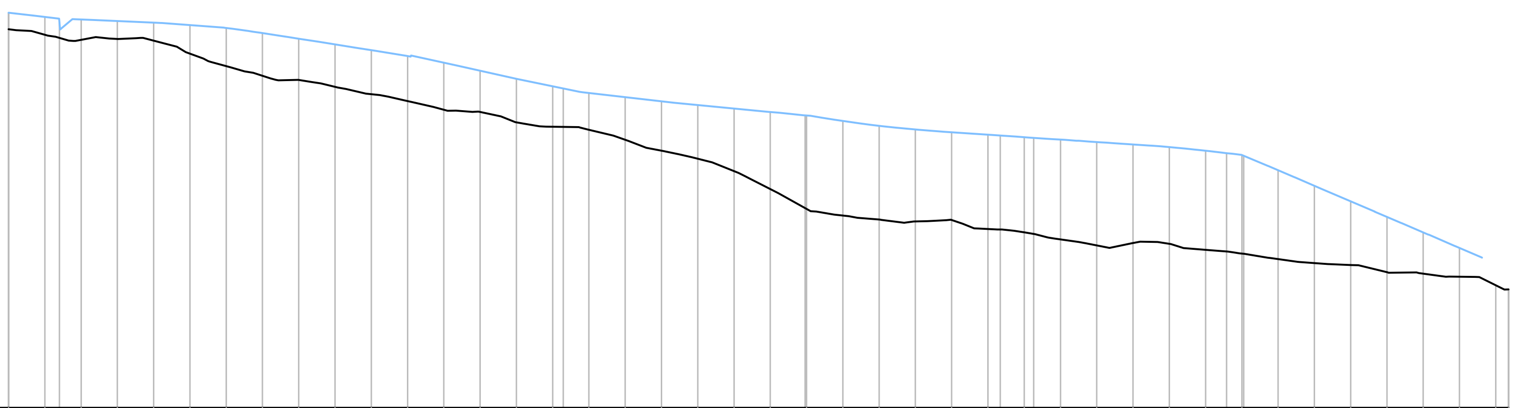


CHAINAGE	TOP OF WALL LEVELS	RETAINED HEIGHT	BOTTOM OF WALL LEVEL
0.0	50.46	0.04	50.43
1.2	50.38	0.21	50.17
2.4	50.37	0.33	50.04
3.6	50.35	0.39	49.97
4.8	50.34	0.70	49.65
6.0	50.33	0.94	49.39
7.2	50.32	1.01	49.30
8.4	50.30	1.26	49.05
9.6	50.29	1.53	48.76
10.8	50.28	1.72	48.57
12.0	50.27	1.86	48.41
13.2	50.26	2.00	48.26
14.4	50.25	2.15	48.09
15.6	50.23	2.24	47.99
16.8	50.22	2.30	47.92
18.0	50.21	2.32	47.89
19.2	50.20	2.36	47.83
20.4	50.19	2.50	47.69
21.6	50.17	2.64	47.54
22.8	50.16	2.71	47.45
24.0	50.15	2.70	47.45
25.2	50.14	2.74	47.40
26.4	50.13	2.68	47.45
27.6	50.11	2.51	47.60
28.8	50.10	2.38	47.72
30.0	49.93	2.23	47.70
31.2	49.49	1.84	47.65
32.4	49.54	1.99	47.55
33.6	49.59	2.08	47.50
34.8	49.63	2.05	47.58
36.0	49.66	2.06	47.60
37.2	49.69	2.04	47.65
38.4	49.71	2.03	47.67
39.6	49.72	2.01	47.72
40.8	49.76	2.02	47.74
42.0	49.74	2.04	47.70
43.2	49.66	1.98	47.68
44.4	49.58	1.89	47.69
45.6	49.51	1.78	47.73
46.8	49.43	1.66	47.77
48.0	49.37	1.52	47.86
49.2	49.34	1.41	47.93
50.4	49.31	1.28	48.03
51.6	49.27	1.27	48.00
52.8	49.22	1.22	48.00
54.0	49.17	1.15	48.02
55.2	49.09	1.05	48.04
56.4	49.04	0.98	48.06
57.6	48.95	0.87	48.08
58.8	48.86	0.77	48.09
60.0	48.77	0.67	48.10
61.2	48.68	0.56	48.12
62.4	48.59	0.45	48.14
63.6	48.50	0.34	48.16
64.8	48.42	0.26	48.16
66.0	48.36	0.20	48.17
67.2	48.31	0.14	48.17
68.4	48.28	0.08	48.20
68.8	48.27	0.06	48.21

HORIZONTAL GEOMETRY

Length	Bearing
14.75m	328°57'00"
15.96m	3°00'00"
18.96m	3°00'00"
19.17m	3°00'00"

RW 05
DATUM: 42.00
VERT. EXAGGERATION 1:1



CHAINAGE	TOP OF WALL LEVELS	RETAINED HEIGHT	BOTTOM OF WALL LEVEL
0.0	55.05	0.55	54.50
1.2	54.91	0.59	54.32
2.4	54.83	0.67	54.15
3.6	54.77	0.59	54.18
4.8	54.72	0.59	54.13
6.0	54.64	0.94	53.70
7.2	54.55	1.26	53.29
8.4	54.38	1.41	52.97
9.6	54.19	1.36	52.83
10.8	54.00	1.40	52.60
12.0	53.81	1.45	52.36
13.2	53.62	1.49	52.13
14.4	53.40	1.55	51.84
15.6	53.13	1.36	51.77
16.8	52.87	1.44	51.43
18.0	52.62	1.34	51.28
19.2	52.40	1.22	51.18
20.4	52.26	1.41	50.85
21.6	52.12	1.63	50.50
22.8	52.00	1.77	50.23
24.0	51.89	2.07	49.82
25.2	51.77	2.55	49.23
26.4	51.66	3.08	48.57
27.6	51.47	3.12	48.35
28.8	51.32	3.10	48.22
30.0	51.19	3.03	48.16
31.2	51.10	2.90	48.20
32.4	51.02	3.11	47.91
33.6	50.94	3.14	47.79
34.8	50.86	3.29	47.57
36.0	50.78	3.42	47.36
37.2	50.70	3.26	47.44
38.4	50.61	3.19	47.42
39.6	50.49	3.27	47.22
40.8	50.35	3.26	47.10
42.0	49.85	2.94	46.91
43.2	49.33	2.55	46.78
44.4	48.82	2.10	46.72
45.6	48.31	1.83	46.48
46.8	47.79	1.36	46.43
48.0	47.28	0.95	46.33
49.2			46.05
49.6			45.91

HORIZONTAL GEOMETRY

Length	Bearing
1.68m	197°30'16"
16.66m	206°42'07"
8.00m	156°21'56"
6.45m	201°21'56"
1.11m	195°13'19"
6.38m	190°31'03"
0.56m	184°45'03"
8.76m	181°56'42"

Scale: 0 2.5 5 7.5 10 12.5 — 1:250 — PLOT CONTAINS ELEMENTS IN COLOUR

Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter: A BERMINGHAM
Designer: A BERMINGHAM
Checker: N JULL
Date: 28/11/2024

Job Title: CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Client: TE RŪNANGA O WHAINGAROA C/O SCOPE
Address: 2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Drawing Title: RETAINING WALL LONG SECTION 03

Drawing: 304 Rev: 0
Scale: 1:250 @ A3
Project: 15757
Issue: CONSENT

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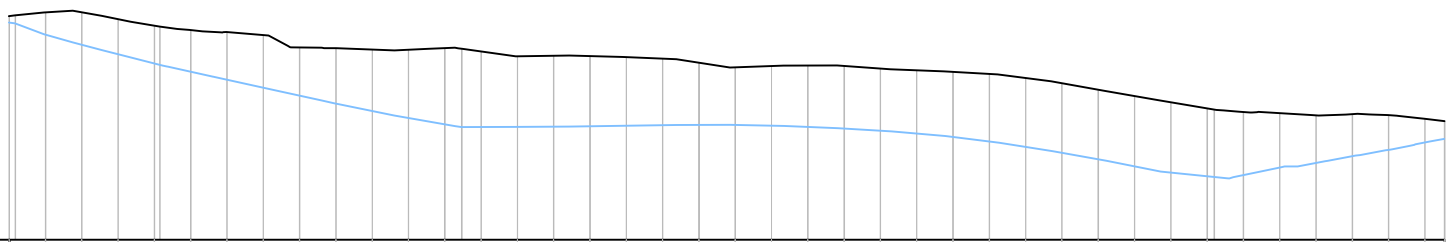
LONGSECTION LEGEND	
EXISTING GROUND	(black line)
PROPOSED GROUND	(blue line)
ALL MEASUREMENTS IN METRES	

RW 06
DATUM: 48.00
VERT. EXAGGERATION 1:1



CHAINAGE	TOP OF WALL LEVELS	RETAINED HEIGHT	BOTTOM OF WALL LEVEL	HORIZONTAL GEOMETRY
0.0	55.39	0.21	55.17	0.20m 185°03'00"
1.2	55.51	0.73	54.77	
2.4	55.52	1.08	54.44	
3.6	55.29	1.16	54.13	
4.8	55.07	1.25	53.82	
6.0	54.93	1.38	53.55	9.98m 206°34'32"
7.2	54.86	1.57	53.29	
8.4	54.76	1.74	53.02	
9.6	54.35	1.59	52.76	
10.8	54.32	1.83	52.49	
12.0	54.28	2.03	52.25	
13.2	54.27	2.26	52.02	
14.4	54.33	2.52	51.81	
15.6	54.22	2.50	51.72	
16.8	54.06	2.34	51.72	
18.0	54.08	2.35	51.73	
19.2	54.07	2.32	51.74	
20.4	54.03	2.27	51.76	
21.6	53.98	2.20	51.78	
22.8	53.85	2.06	51.79	
24.0	53.69	1.91	51.79	
25.2	53.73	1.97	51.76	
26.4	53.75	2.03	51.72	
27.6	53.74	2.07	51.67	
28.8	53.65	2.06	51.60	
30.0	53.59	2.09	51.50	
31.2	53.54	2.15	51.39	
32.4	53.47	2.23	51.24	
33.6	53.34	2.28	51.06	
34.8	53.17	2.30	50.87	
36.0	52.95	2.30	50.65	
37.2	52.74	2.32	50.42	
38.4	52.54	2.32	50.21	
39.6	52.34	2.25	50.09	
40.8	52.22	2.09	50.13	7.62m 185°23'21"
42.0	52.18	1.80	50.38	
43.2	52.11	1.58	50.53	
44.4	52.15	1.39	50.75	
45.6	52.11	1.15	50.96	
46.8	51.99	0.78	51.21	
47.5	51.91			

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0 2.5 5 7.5 10 12.5
1:250 PLOT CONTAINS ELEMENTS IN COLOUR

Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter: A BERMINGHAM
Designer: A BERMINGHAM
Checker: N JULL
Date: 28/11/2024

Job Title: CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Client: TE RŪNANGA O WHAINGAROA C/O SCOPE
Address: 2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Drawing Title: RETAINING WALL LONG SECTION 04

Drawing: 305 Rev: 0
Scale: 1:250 @ A3
Project: 15757
Issue: CONSENT

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DRAWING NOTE

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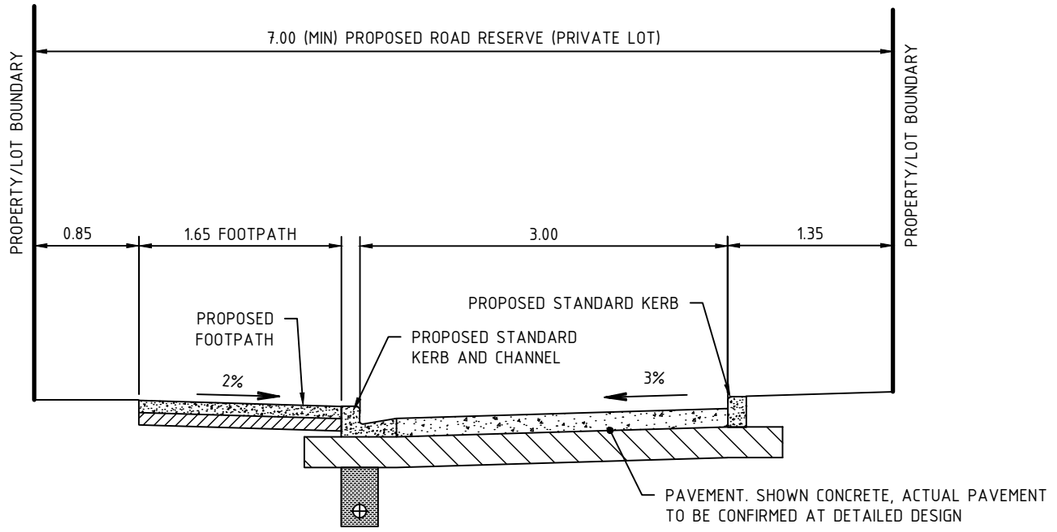
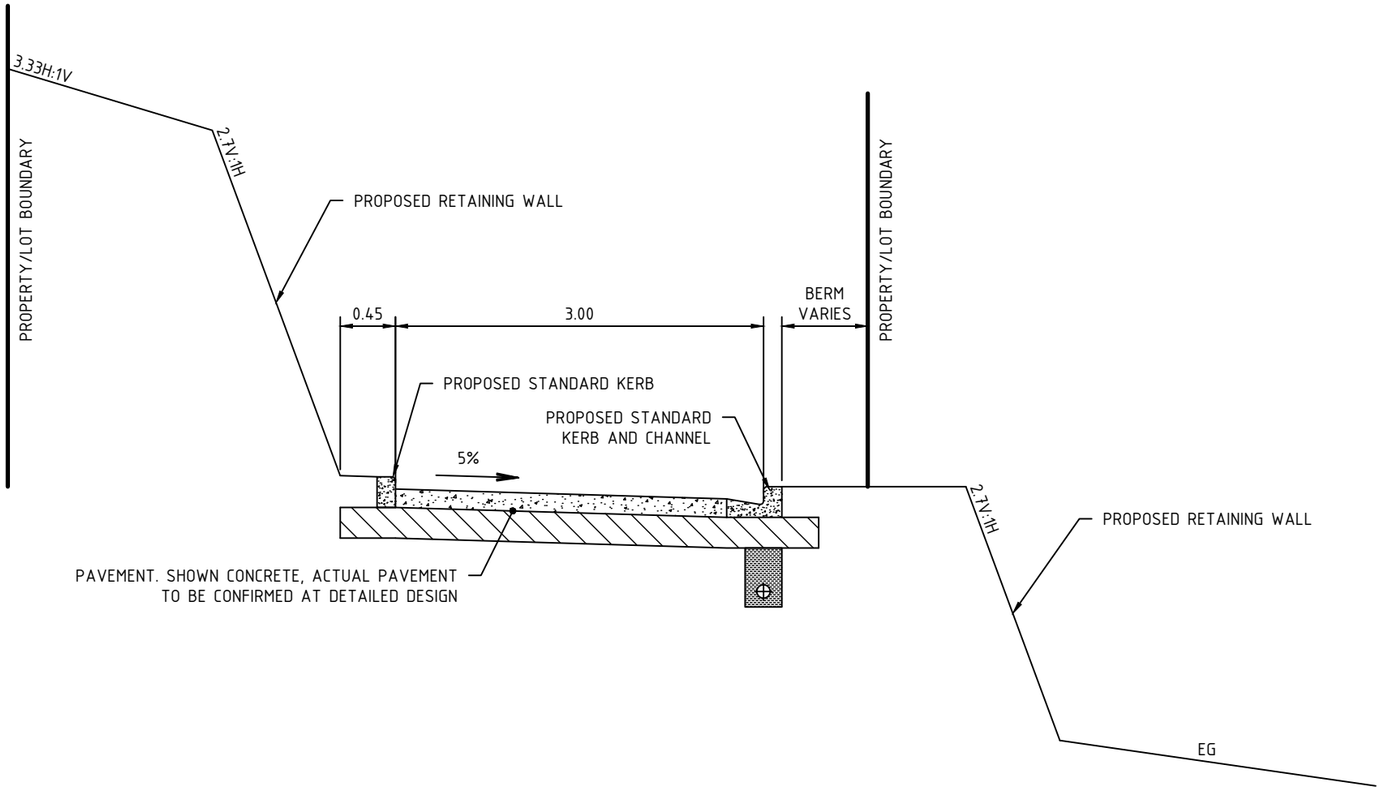


1 COMMON ACCESSWAY TYPICAL SECTION 01

Scale: 1:50



2 COMMON ACCESSWAY TYPICAL SECTION 02

Scale: 1:50

0 0.5 1 1.5 2 2.5

1:50 PLOT CONTAINS ELEMENTS IN COLOUR

Rev	Date	Amendments	By
0	28/11/24	ISSUED FOR RESOURCE CONSENT	AB

Drafter:	A BERMINGHAM	Job Title:	CIVIL DESIGN - PROPOSED RESIDENTIAL SUBDIVISION
Designer:	A BERMINGHAM	Client:	TE RŪNANGA O WHAINGAROA C/O SCOPE
Checker:	N JULL	Address:	2B ASH GROVE CIRCLE, HARURU, LOT 2 DP 563441
Date:	28/11/2024	Drawing Title:	COMMON ACCESSWAY TYPICAL SECTIONS

Drawing:	802	Rev:	0
Scale:	1:50 @ A3		
Project:	15757		
Issue:	CONSENT		

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Appendix B – Geotechnical Investigation Lots

Hand Auger Logs

Cone Penetrometer Tests

PO Box 89, 0245
6 Fairway Drive
Kerikeri, 0230
New Zealand

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Fax 09 407 8378
www.haighworkman.co.nz
info@haighworkman.co.nz

Borehole Log - BH1

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	10/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP
	~~10/10/2019~~				

Soil Description

Based on NZGS Logging Guidelines 2005

Clayey **SILT**; yellowish grey/ brown, mottled orange brown, firm, moist, low plasticity, rootlets. [Topsoil]

Clayey **SILT;** light yellowish grey/ brown mottled reddish brown, very stiff, moist, low plasticity, rootlets, trace weakly cemented clasts. [Waipapa Group]

0.7m: becoming fine gravelly (weakly cemented clasts), yellowish grey.

Silty **CLAY;** yellowish brown, very stiff, moist, high plasticity.

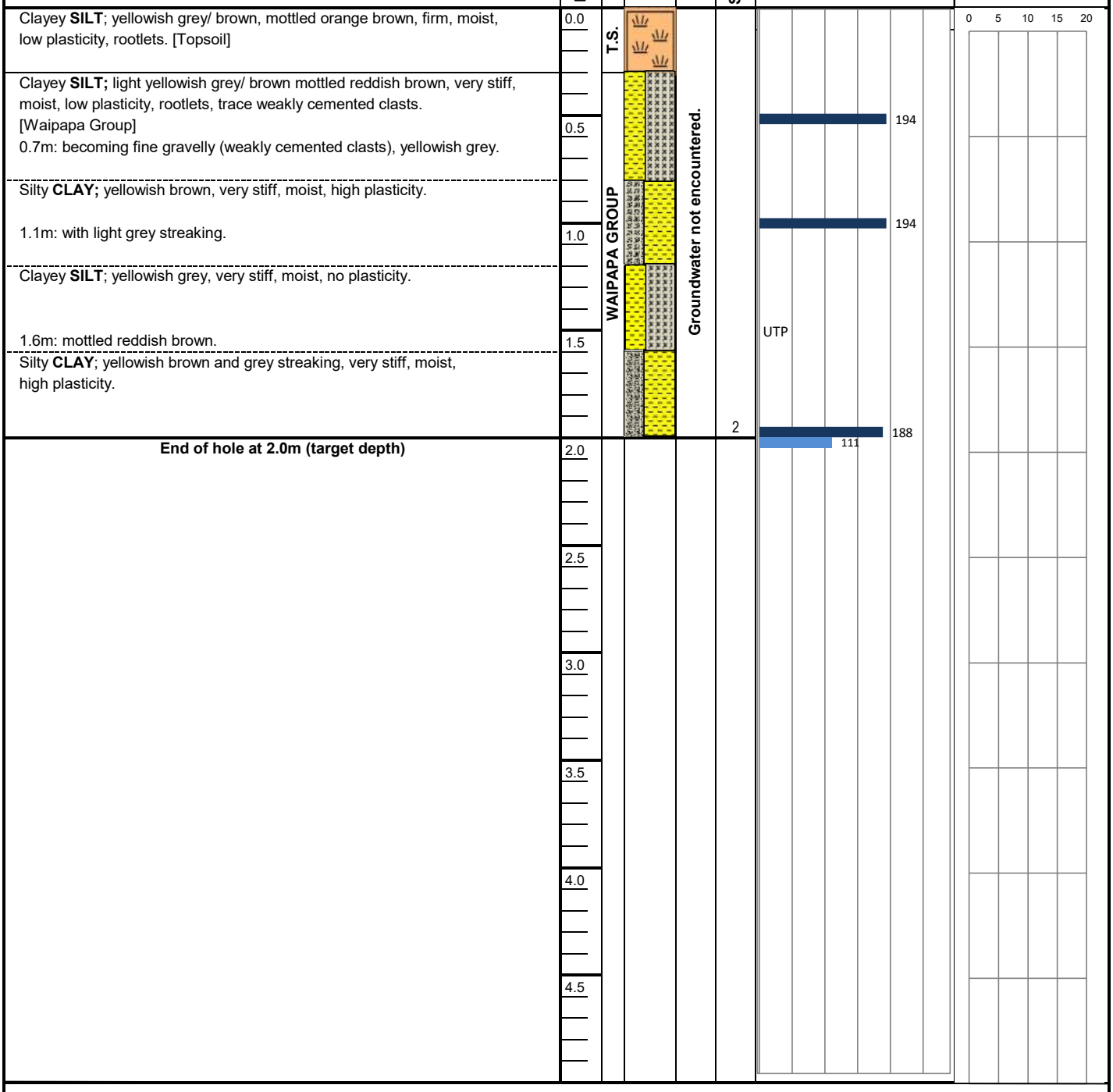
1.1m: with light grey streaking.

Clayey **SILT**; yellowish grey, very stiff, moist, no plasticity.

1.6m: mottled reddish brown.

Silty **CLAY**; yellowish brown and grey streaking, very stiff, moist, high plasticity.

End of hole at 2.0m (target depth)



LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 1.7

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Fax 09 407 8378
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info@haighworkman.co.nz

Borehole Log - BH2

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	10/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP
	~~10/10/2019~~				

Soil Description

Based on NZGS Logging Guidelines 2005

Clayey **SILT**; dark grey mottled orange/ brown and yellowish streaking, firm, moist, low plasticity. [Topsoil.]
0.3m: becoming wet - saturated.

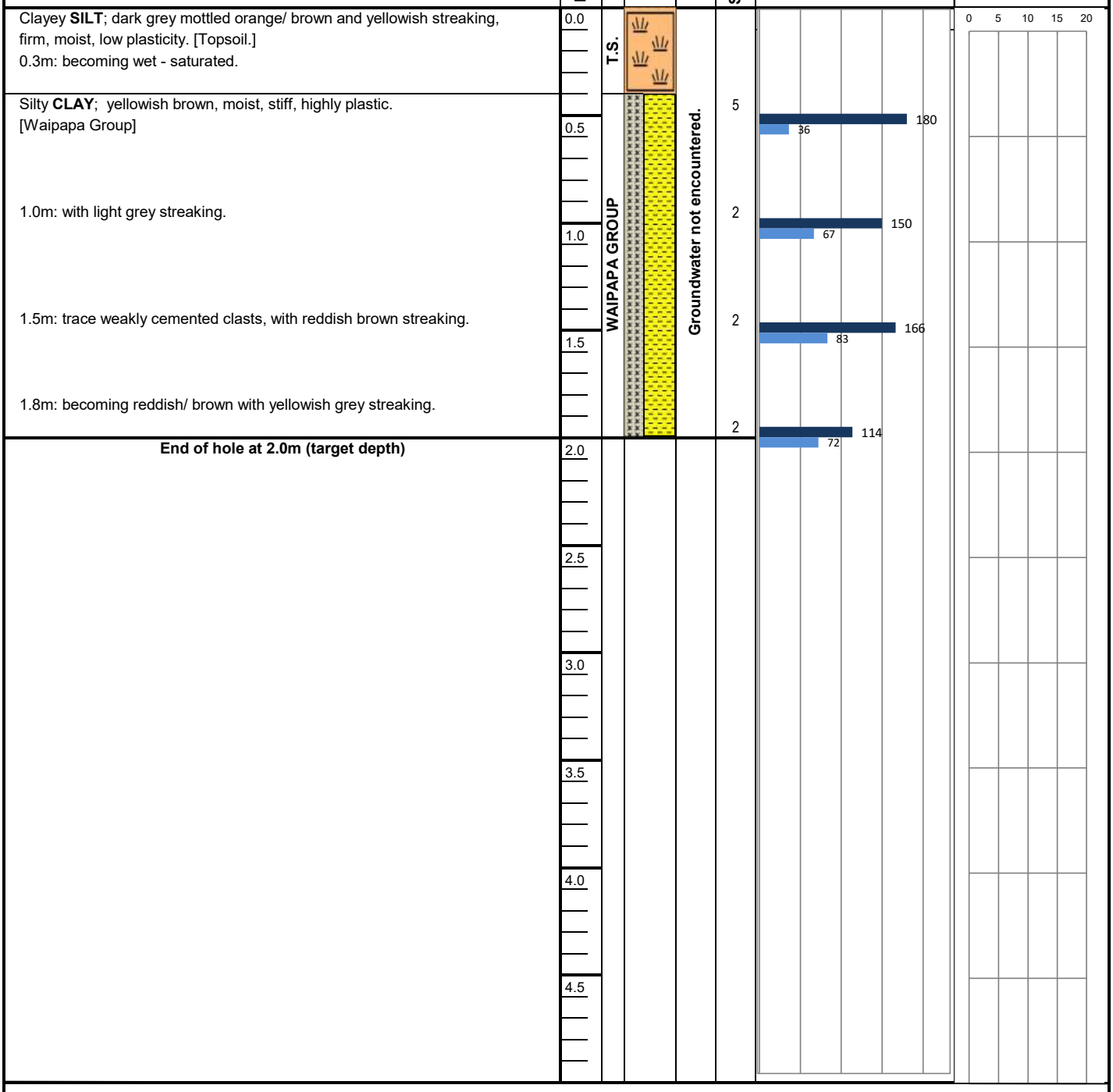
Silty **CLAY**; yellowish brown, moist, stiff, highly plastic. [Waipapa Group]

1.0m: with light grey streaking.

1.5m: trace weakly cemented clasts, with reddish brown streaking.

1.8m: becoming reddish/ brown with yellowish grey streaking.

End of hole at 2.0m (target depth)



LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 2.7

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Borehole Log - BH3

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	10/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP
	~~10/10/2019~~				

Soil Description

Based on NZGS Logging Guidelines 2005

Clayey **SILT**; dark grey/ brown, very stiff, moist, low plasticity, rootlets. [Topsoil.]

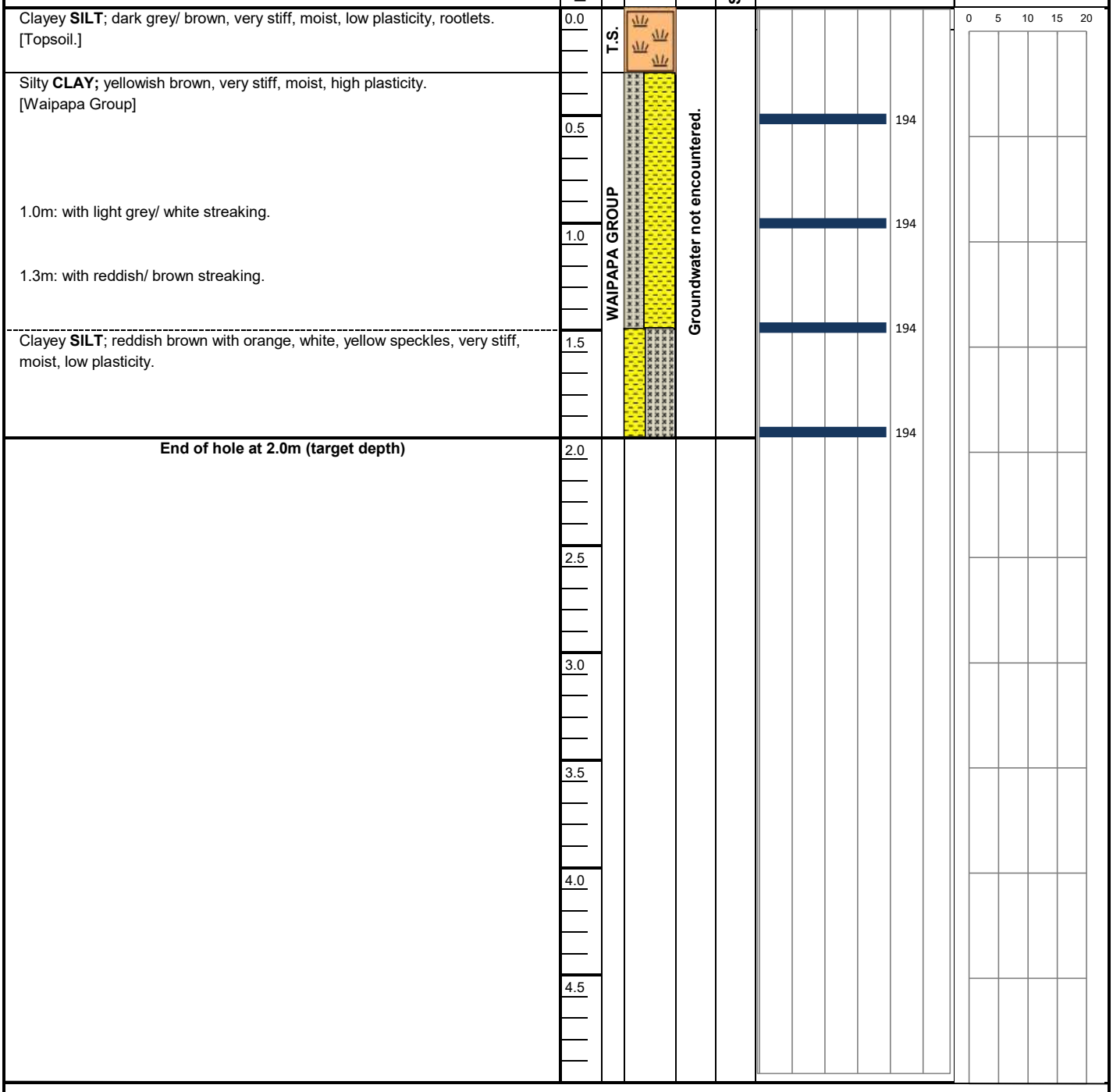
Silty **CLAY;** yellowish brown, very stiff, moist, high plasticity. [Waipapa Group]

1.0m: with light grey/ white streaking.

1.3m: with reddish/ brown streaking.

Clayey **SILT**; reddish brown with orange, white, yellow speckles, very stiff, moist, low plasticity.

End of hole at 2.0m (target depth)



LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity

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Kerikeri, 0230
New Zealand

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Borehole Log - BH4

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	09/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	~~09/10/2019~~	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP

Soil Description (Based on NZGS Logging Guidelines 2005)	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Corrected Shear Vane Strength (kPa)	Scala Penetrometer (blows/100mm)
SILT; minor clayey, yellowish brown, very stiff, dry, non plastic. [Topsoil]	0.0	T.S		Groundwater not encountered.		194	0 5 10 15 20
SILT; minor clayey, yellowish grey/ brown, very stiff, dry - moist, low plasticity, rootlets. [Waipapa Group].		WAIPAPA GROUP					
CLAY; silty, yellowish brown with white spotting, very stiff, highly plastic. [Waipapa Group]	0.5					194	
0.8m: becoming mottled whitish grey.	1.0					194	
SILT; clayey, yellowish brown and red/ brown streaking, very stiff, moist, non - low plasticity. [Waipapa Group] 1.3m: becoming reddish brown with whitish grey mottling.	1.5					194	
End of hole at 2.0m (target depth).	2.0						
	2.5						
	3.0						
	3.5						
	4.0						
	4.5						

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 0.0

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Borehole Log - BH5

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	09/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	~~09/10/2019~~	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP

Soil Description
Based on NZGS Logging Guidelines 2005

SILT; clayey, greyish brown with litgh yellowish brown streaking, firm, moist, non plastic, rootlets. [Topsoil]

CLAY; silty, light yellowish grey/ brown, very stiff, moist, high plasticity, rootlets. [Waipapa Group]

1.0m: rootlets absent, becoming light orange/ brown streaking, white spotting.

1.5m: becoming dark orange/ brown, trace weakly cemented clasts <1mm.

SILT; clayey, orange/ brown with white and pink streaking, very stiff, moist, non - low plasticity. [Waipapa Group]

End of hole at 2.0m (target depth).

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: T.S. / WAIPAPA GROUP

Graphic Log

Water Level: Groundwater not encountered.

Sensitivity: 1, 2

Corrected Shear Vane Strength (kPa): 194; 180; 128; 158; 97; 194

Scala Penetrometer (blows/100mm): 0 5 10 15 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 1.5

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Borehole Log - BH6

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	09/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	~~09/10/2019~~	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP

Soil Description
Based on NZGS Logging Guidelines 2005

SILT; clayey, dark grey, friable, dry, non plastic, rootlets. [Topsoil] — 0.0 — T.S.

CLAY; silty, light grey and yellowish/ brown, very stiff, moist, highly plastic, rootlets. [Waipapa Group] — WAIPAPA GROUP

0.5m: becoming light yellowish brown.

1.4m: with reddish streaking.

SILT; clayey, reddish brown mottled light greyish/ white, moist, very stiff, low plasticity. [Waipapa Group] — 1.5

End of hole at 2.0m (target depth). — 2.0

Groundwater Not Encountered.

Corrected Shear Vane Strength (kPa): 194, 194, 194, 194

Scala Penetrometer (blows/100mm): 0, 5, 10, 15, 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity #####

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Borehole Log - BH7

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	09/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	JP
Date Completed:	~~09/10/2019~~	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	RH

Soil Description (Based on NZGS Logging Guidelines 2005)	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Corrected Shear Vane Strength (kPa)	Scala Penetrometer (blows/100mm)
SILT; brown to light brown. Firm, moist, low plasticity. Minor rootlets. [Topsoil]	0.0	TS		Groundwater Not Encountered			
Silty **CLAY**; light orange, streaked light brown. Very stiff, moist, medium plasticity. [Waipapa Group]		WAIPAPA GROUP			7	161 / 23	
At 0.4m: Becomes light orange, streaked light greyish brown.	0.5						
At 0.8m: Becomes light orange, streaked light grey and pinkish red.						UTP	
Clayey **SILT**; light orange and pinkish red, streaked whitish grey. Very stiff, dry to moist, low to medium plasticity.	1.0						
At 1.4m: Becomes pinkish red, streaked orange, mottled whitish grey. Moist.	1.5					UTP	
					7	198 / 30	
End of hole at 2.0m (Target Depth)	2.0						
	2.5						
	3.0						
	3.5						
	4.0						
	4.5						

Scala Penetrometer: 0 5 10 15 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2278. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater not encountered.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 6.7

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Borehole Log - BH8

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	JP
Date Completed:	09/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	RH
	~~09/10/2019~~				

Soil Description

Based on NZGS Logging Guidelines 2005

SILT; light brown. Stiff, dry, low plasticity. Some rootlets. [Topsoil] — 0.0 — TS

Silty **CLAY**; light orange, streaked light brown. Very stiff, dry to moist, medium plasticity. [Waipapa Group] — WAIPAPA GROUP

At 0.4m: Becomes light orange, streaked orange and light greyish brown.

At 0.7m: Becomes light orange to orange, streaked pinkish red.

At 0.9m: Becomes pinkish red and light orange.

At 1.1m: Becomes pinkish red, streaked light orange. — 1.0

Clayey **SILT**; pinkish red, streaked light orange and greyish white. Very stiff, moist, medium plasticity. — 1.5

At 1.8m: Becomes pinkish red, mottled orange and greyish white.

End of hole at 2.0m (Target Depth) — 2.0

2.5

3.0

3.5

4.0

4.5

Groundwater Not Encountered

Sensitivity: 4

Corrected Shear Vane Strength (kPa): UTP; UTP; UTP; 171; 40

Scala Penetrometer (blows/100mm): 0 5 10 15 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2278. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater not encountered.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 4.3

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Borehole Log - BH9

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	17/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	17/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP

Soil Description

Based on NZGS Logging Guidelines 2005

SILT; clayey, greyish brown with yellow streaking, firm, moist, non plastic, rootlets. [Topsoil]

CLAY; silty, yellowish brown with grey streaking, very stiff, moist, highly plastic, rootlets. [Waipapa Group]

0.7m: becoming yellowish brown.

1.0m: rootlets absent.

1.4m: with white streaking.

1.6m: becoming yellowish grey mottled orange

SILT; clayey, pinkish grey mottled orange, very stiff, moist, low plasticity. [Waipapa Group]

2.4m: trace gravel (weakly cemented clast).

End of hole at 3.0m (target depth)

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: T.S., W/

Graphic Log

Water Level: Groundwater not encountered.

Sensitivity: 2, 2

Corrected Shear Vane Strength (kPa): 155, 75, 169, 78, 194, 194, UTP, 194

Scala Penetrometer (blows/100mm): 0, 5, 10, 15, 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 2.1

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Borehole Log - BH10

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	17/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	17/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP

Soil Description

Based on NZGS Logging Guidelines 2005

CLAY; silty, greyish brown mottled yellow, firm, moist, low plasticity, rootlets. [Topsoil]

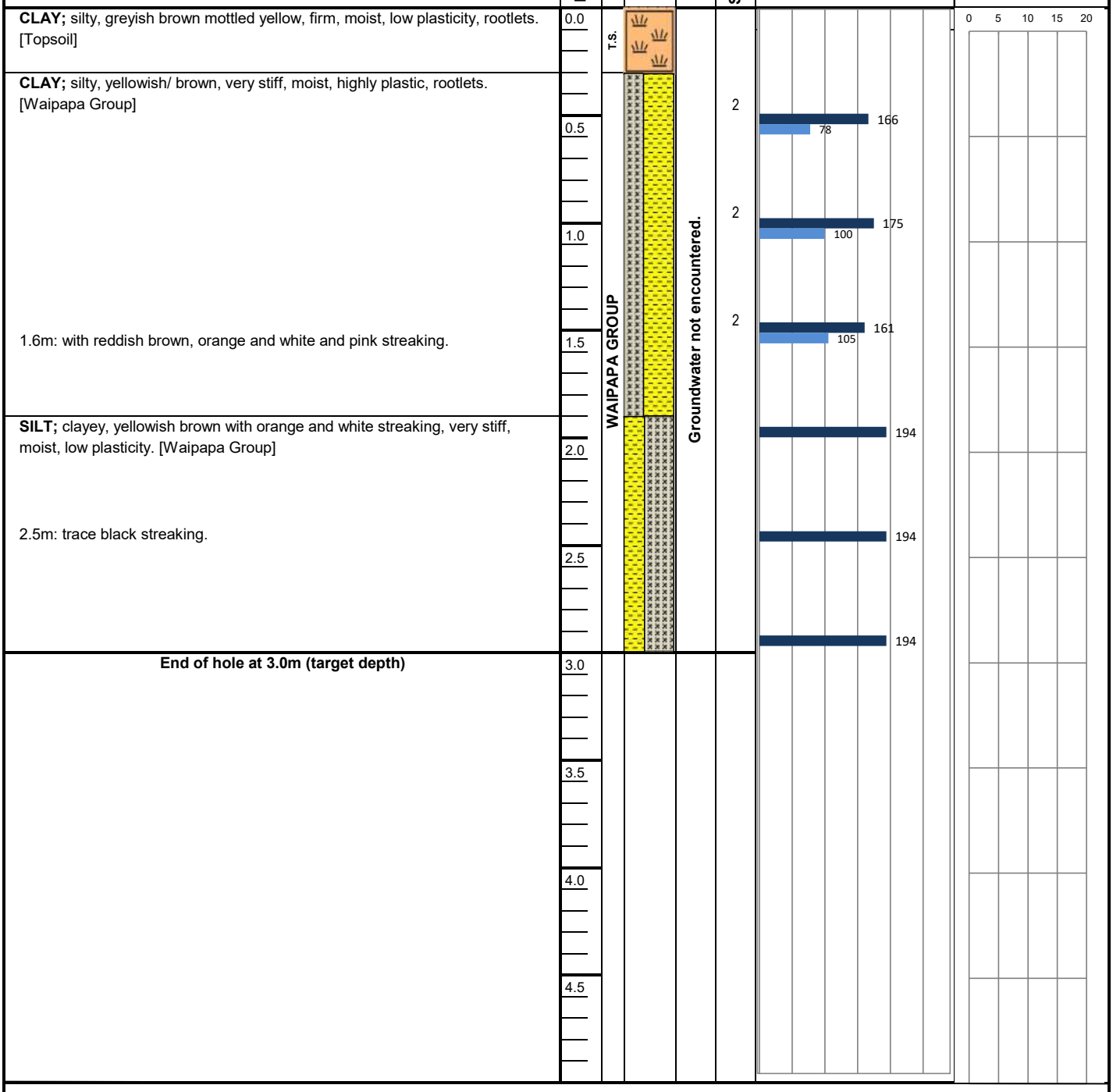
CLAY; silty, yellowish/ brown, very stiff, moist, highly plastic, rootlets. [Waipapa Group]

1.6m: with reddish brown, orange and white and pink streaking.

SILT; clayey, yellowish brown with orange and white streaking, very stiff, moist, low plasticity. [Waipapa Group]

2.5m: trace black streaking.

End of hole at 3.0m (target depth)



LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 1.8

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Borehole Log - BH11

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	09/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP
	~~09/10/2019~~				

Soil Description

Based on NZGS Logging Guidelines 2005

SILT; minor clayey, dark grey yellowstreaking, firm, moist, no - low plasticity, rootlets. [Topsooil]

CLAY; silty, greyish yellow/ brown, very stiff, moist, highly plastic, rootlets. [Waipapa Group]

0.8m: becoming yellowish brown.

1.5m: with orange/ brown streaking.

SILT; clayey, orange/ brown with white and blue spotting, very stiff, moist, low plasticity [Waipapa Group]

2.4m: with grey, white and pink spotting.

End of hole at 3.0m (target depth).

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: T.S. / WAIPAPA GROUP

Graphic Log

Water Level: Groundwater not encountered.

Sensitivity: 2, 3

Corrected Shear Vane Strength (kPa): 194, 194, 194, 194, 175, 72, 183, 64

Scala Penetrometer (blows/100mm): 0 5 10 15 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 2.6

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Borehole Log - BH12

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	17/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	17/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP

Soil Description

Based on NZGS Logging Guidelines 2005

CLAY; silty, some shells, greyish brown, dry - moist, soft - firm, non plastic. [Fill]

0.8m: becoming gravelly.

0.9m: becoming yellowish grey/ brown, highly plastic.

CLAY; silty, yellowish brown with grey streaking, very stiff, moist, highly plastic, rootlets. [Waipapa Group]

1.7m: yellowish brown with orange streaking.

2.2m: grey and orange/ brown streaking.

SILT; clayey, orange/ brown with pinkish white streaking.

2.8m: becoming pinkish white motttled orange/ brown.

End of hole at 3.0m (target depth)

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: FILL; WAIPAPA GROUP

Graphic Log

Water Level: Groundwater not encountered.

Sensitivity: 6

Corrected Shear Vane Strength (kPa): 155, 28, UTP, 194, 194, 194, UTP

Scala Penetrometer (blows/100mm): 0 5 10 15 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 5.6

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Borehole Log - BH13

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	18/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP
	~~18/10/2019~~				

Soil Description

Based on NZGS Logging Guidelines 2005

SILT; clayey, dark greyish brown with yellow streaking, firm, moist, low plasticity, rootlets. [Topsoil]

CLAY; silty, yellowish brown with grey streaking, very stiff, moist, highly plastic, rootlets. [Waipapa Group]

0.5m: becoming yellowish brown.

1.4m: with reddish brown streaking.

SILT; clayey, trace gravel (weakly cemented clast), orange brown with white and reddish brown streaking, very stiff, oist, low plasticity. [Waipapa Group]

2.5m: some black streaking.

End of hole at 3.0m (target depth)

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: T.S. (Topsoil); WAIPAPA GROUP

Graphic Log

Water Level: Groundwater not encountered.

Sensitivity	Corrected Shear Vane Strength (kPa)	Scala Penetrometer (blows/100mm)
2	172 / 69	
2	144 / 78	
	194	
1	166 / 128	
2	188 / 76	
4	180 / 50	

Scala Penetrometer scale: 0 5 10 15 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 2.3

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Borehole Log - BH14

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	JP
Date Completed:	09/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	RH
	~~09/10/2019~~				

Soil Description

Based on NZGS Logging Guidelines 2005

SILT, minor clay; light brown to brown, mottled dark brown. Firm, moist, low plasticity. Minor rootlets. [Topsoil]

Silty **CLAY**; light orange, streaked light brown. Very stiff, moist, medium plasticity. [Waipapa Group]

At 0.4m: Becomes light orange to orange, streaked light brownish grey.

At 0.9m: Becomes light orange to orange, streaked pinkish red and light grey.

At 1.3m: Becomes orange, mottled dark orange, streaked light grey, trace limonite staining. Moist to wet.

Clayey **SILT**; light grey to light whitish grey, streaked orange. Very stiff, moist to wet, low plasticity.

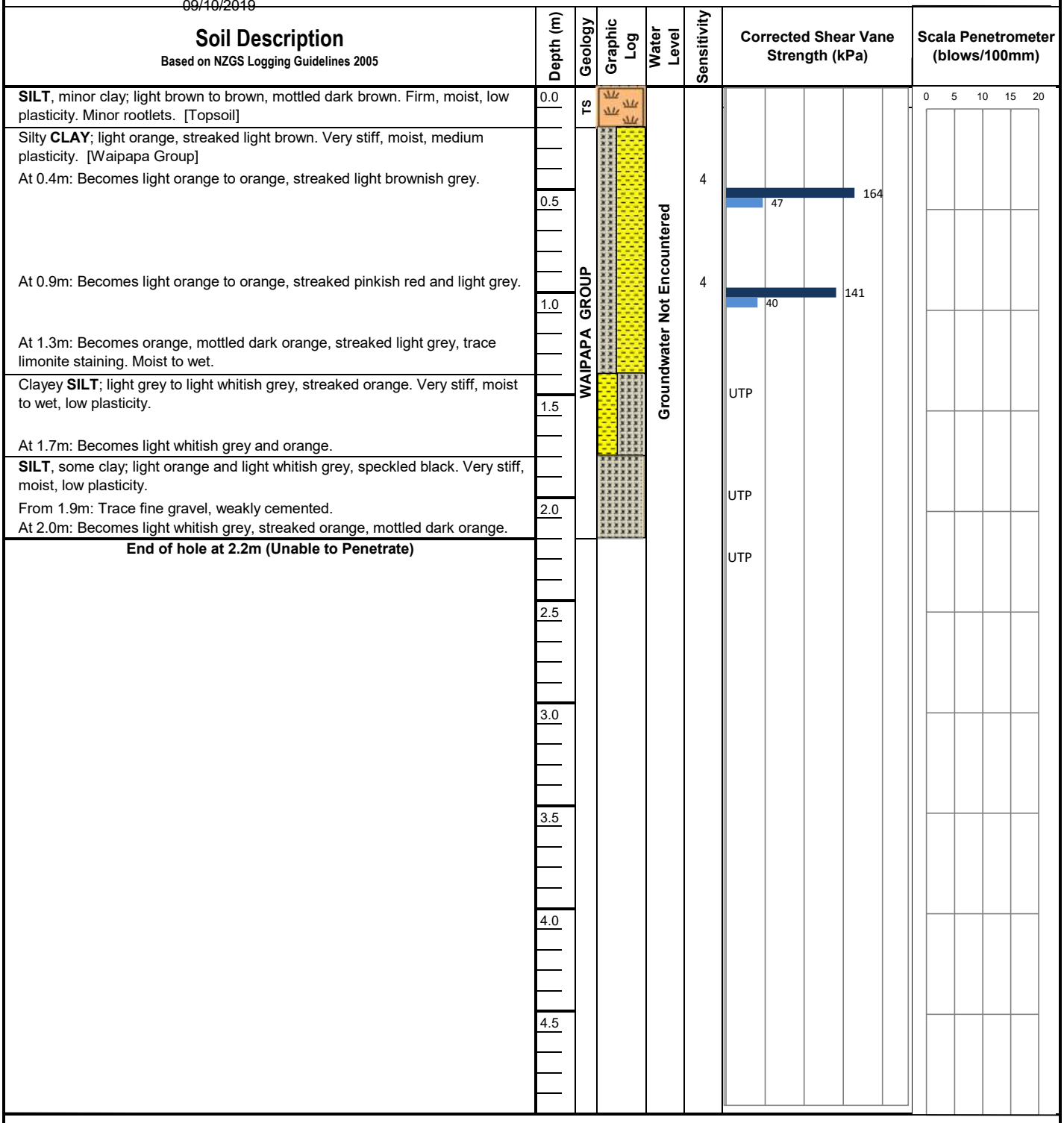
At 1.7m: Becomes light whitish grey and orange.

SILT, some clay; light orange and light whitish grey, speckled black. Very stiff, moist, low plasticity.

From 1.9m: Trace fine gravel, weakly cemented.

At 2.0m: Becomes light whitish grey, streaked orange, mottled dark orange.

End of hole at 2.2m (Unable to Penetrate)



LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2278. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater not encountered.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 3.5

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Borehole Log - BH15

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	18/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP
	~~18/10/2019~~				

Soil Description

Based on NZGS Logging Guidelines 2005

CLAY; silty, yellowish brown, stiff, moist, low plasticity, rootlets. [Topsoil]

CLAY; silty, yellowish brown with grey streaking, very stiff, moist, high plasticity, rootlets. [Waipapa Group]

0.4m: becoming yellowish brown.

0.9m: with reddish brown streaking.

1.2m: becoming orange brown with white streaking.

SILT; clayey, whitish grey and orange/ brown, moist, very stiff, low plasticity. [Waipapa Group]

1.9m: with black mottling.

2.0m: becoming yellowish grey with orange/ brown streaking.

2.2m: with black mottling.

SILT; gravelly (weakly cemented clast), yellowish grey with orange and black streaking, very stiff to hard, moist, no plasticity.

End of hole at 3.0m (target depth)

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: T.S. (Topsoil); WAIPAPA GROUP

Graphic Log

Water Level: Groundwater not encountered.

Sensitivity: 2, 1

Corrected Shear Vane Strength (kPa): 147, 72, 166, 125, 194, 194, UTP, UTP

Scala Penetrometer (blows/100mm): 0, 5, 10, 15, 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 1.7

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Borehole Log - BH16

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	17/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP
	~~17/10/2019~~				

Soil Description

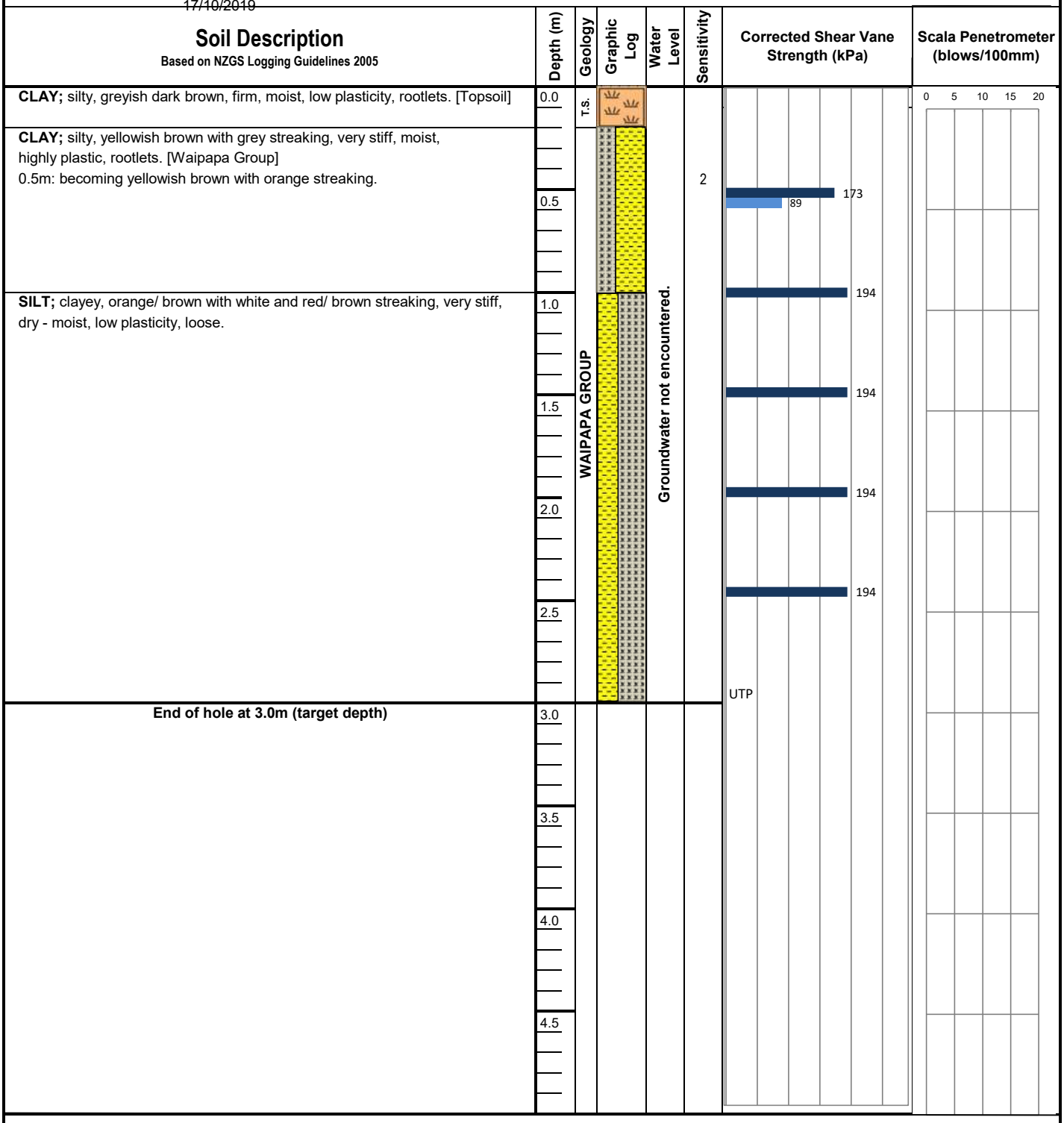
Based on NZGS Logging Guidelines 2005

CLAY; silty, greyish dark brown, firm, moist, low plasticity, rootlets. [Topsoil]

CLAY; silty, yellowish brown with grey streaking, very stiff, moist, highly plastic, rootlets. [Waipapa Group]
0.5m: becoming yellowish brown with orange streaking.

SILT; clayey, orange/ brown with white and red/ brown streaking, very stiff, dry - moist, low plasticity, loose.

End of hole at 3.0m (target depth)



LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 2.0

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Borehole Log - BH17

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	09/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	09/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP

Soil Description
Based on NZGS Logging Guidelines 2005

SILT; with organic material, greyish brown, firm, dry, friable, non plastic, rootlets. T.S.

CLAY; silty, greyish brown mottled light yellow, very stiff, dry, friable, rootlets.
[Waipapa Group]
0.3m: becoming light yellowish/ brown.

0.6m: becoming dry to moist, very stiff to hard.

1.4m: with reddish/ brown streaking.

SILT, clayey, light yellowish grey and reddish/ brown, very striff, moist, no to low plasticity.
1.7m: becoming reddish brown and white.

1.9m: becoming pinkish red/ brown mottled white.

End of hole at 2.0m (target depth).

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: T.S. / WAIPAPA GROUP

Graphic Log

Water Level: Groundwater not encountered.

Sensitivity: 4

Corrected Shear Vane Strength (kPa): 169, 42, 194, 194, 194

Scala Penetrometer (blows/100mm): 0 5 10 15 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 4.1

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Borehole Log - BH18

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	17/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	~~17/10/2019~~	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP

Soil Description

Based on NZGS Logging Guidelines 2005

CLAY; silty, greyish brown, stiff, moist, low plasticity, rootlets. [Topsoil]

CLAY; silty, yellowish brown with grey/ brown streaking, very stiff, moist, highly plastic, rootlets. [Waipapa Group]

0.5m: becoming orange/ brown.

1.0m: becoming reddish/ brown.

SILT; clayey, reddish/ brown mottled grey, orange and pink, very stiff, moist, low plasticity. [Waipapa Group]

End of hole at 3.0m (target depth)

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: T.S; WAIPAPA GROUP

Graphic Log

Water Level: Groundwater not encountered.

Sensitivity: 2

Corrected Shear Vane Strength (kPa): 186, 89, 194, 194, 194, 194, 194

Scala Penetrometer (blows/100mm): 0 5 10 15 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 2.1

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Borehole Log - BH19

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O Whaingaroa	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	17/10/2019	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	17/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP

Soil Description

Based on NZGS Logging Guidelines 2005

SILT; clayey, greyish brown with yellow streaking, firm, moist, low plasticity, rootlets. [Topsoil]

CLAY; silty, yellowish brown with grey streaking, very stiff, moist, highly plastic. [Waipapa Group]

0.5m: becoming yellowish brown.

1.0m: rootlets absent.

1.4m: with orange/ brown streaking.

1.6m: becoming orange/ brown with yellow, pink, white streaking.

SILT; clayey, trace fine gravel, pinkish brown with white and orange streaking, very stiff, moist, low to medium plasticity. [Waipapa Group]

End of hole at 3.0m (target depth)

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: T.S, W

Groundwater not encountered.

Sensitivity	Corrected Shear Vane Strength (kPa)	Scala Penetrometer (blows/100mm)
3	132 / 49	
2	125 / 61	
	194	
	194	
2	180 / 80	
	194	

Scala Penetrometer scale: 0 5 10 15 20

LEGEND

TOPSOIL CLAY SILT SAND GRAVEL FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity 2.3

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Borehole Log - BH20

Hole Location: Refer to Site Plan

JOB No. 24 208

CLIENT:	Te Runanga O	**SITE:**	2A Ash Grove Circle, Haruru		
Date Started:	Whaingaroa	**DRILLING METHOD:**	Hand Auger	**LOGGED BY:**	RH
Date Completed:	10/10/2019	**HOLE DIAMETER (mm)**	50mm	**CHECKED BY:**	JP
	~~10/10/2019~~				

Soil Description

Based on NZGS Logging Guidelines 2005

Silty **CLAY**; yellowish grey/ brown, very stiff, moist, medium plasticity. [Topsoil]

Silty **CLAY**; yellowish brown, very stiff, moist, high plasticity. [Waipapa Group]

Clayey **SILT;** orange/ brown mottled pinkish white, very stiff, moist, medium plasticity.

1.3m: becoming orange brown and bluish white.

End of hole at 2.0m (target depth)

Depth (m): 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Geology: T.S. / WAIPAPA GROUP

Graphic Log

Water Level: Groundwater not encountered.

Sensitivity

Corrected Shear Vane Strength (kPa): 194, 194, 194, 194

Scala Penetrometer (blows/100mm): 0, 5, 10, 15, 20

LEGEND

TOPSOIL | CLAY | SILT | SAND | GRAVEL | FILL

Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Note: Hand Held Shear Vane S/N: 2220. UTP = Unable to penetrate. T.S. = Topsoil.
Groundwater measurement undertaken before departing site.
Scala penetrometer testing not undertaken.

Average Soil Sensitivity

CPT Test Information

Test Hole Number	CPT01	Job Identifier	HW - OTL Developments
Test Date	9/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	5325	Battery Voltage Start	6.56
Start Recording	11:30:00 AM	Finish Recording	12:20:00 PM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	28.812
Date of Last Calibration		Metres To Next Calibration	840
		Test ended due to:	Anchor Failure

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.00%	0.00%	0.02%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

Data loss (typically at rod change points). Either deleted or averaged

qc	fs	u
0.54	0.54	14.58
1.54	2.54-2.56	
2.54	3.54	
3.52	4.54	
4.56	5.52	
5.52	6.54	
5.56	7.54	
6.54-6.56	8.56	
8.52	9.56	
9.56	11.54-11.56	
10.56	12.58-12.6	
13.56	13.56-13.58	
14.56	16.58-16.6	
15.58	17.58	
16.56	18.58	
17.56	19.56-19.58	
18.56-18.58	22.64	
19.56-19.58	23.64	
21.66	24.62-24.64	
23.6		
24.62		

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT02	Job Identifier	HW - OTL Developments
Test Date	9/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	5233	Battery Voltage Start	6.32
Start Recording	1:25:00 PM	Finish Recording	1:55:00 PM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	12.562
Date of Last Calibration		Metres To Next Calibration	1254
		Test ended due to:	Anchor Failure

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.00%	0.05%	0.16%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

Data loss corrected (typically at rod change points). Either deleted or averaged

qc	fs	u
2.56	2.54	
3.56	7.58	
5.56	9.56	
6.56		
7.58		
9.58		

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT03	Job Identifier	HW - OTL Developments
Test Date	9/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	4595	Battery Voltage Start	6.15
Start Recording	3:15:00 PM	Finish Recording	3:45:00 PM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	16.622
Date of Last Calibration		Metres To Next Calibration	1382
		Test ended due to:	Rods buckling

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.02%	0.01%	0.10%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

	qc	fs	u
Data loss (typically at rod change points). Either deleted or averaged	1.56 2.56 3.54 4.56 5.54-5.56 9.58 10.58 11.62 13.62 14.62 15.6	1.56 3.56 4.56 5.54-5.56 6.58 7.58 9.58 10.58 12.62 13.62 14.6-14.62 15.58	3.56

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT04	Job Identifier	HW - OTL Developments
Test Date	10/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	5343	Battery Voltage Start	6.1
Start Recording	9:05:00 AM	Finish Recording	9:30:00 AM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	11.482
Date of Last Calibration		Metres To Next Calibration	1300
		Test ended due to:	Anchor failure

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.00%	0.01%	0.12%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

Data loss (typically at rod change points). Either deleted or averaged

qc	fs	u
0.46	1.46	
1.48	2.48	
2.48	4.46-4.48	
5.48	6.48	
6.5	7.48	
7.5	8.5	
9.5		
10.5		

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT05	Job Identifier	HW - OTL Developments
Test Date	9/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	5325	Battery Voltage Start	6.12
Start Recording	4:50:00 PM	Finish Recording	5:10:00 AM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	8.357
Date of Last Calibration		Metres To Next Calibration	811
		Test ended due to:	Anchor Failure

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.01%	0.01%	0.00%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

Data loss corrected (typically at rod change points). Either deleted or averaged

qc	fs	u
0.54	0.54	
1.54	1.56	
2.52-2.54	2.48	
3.52-3.54	4.52-4.54	
4.52-4.54	5.56	
5.54-5.56	6.66	
7.54		

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT06	Job Identifier	HW - OTL Developments
Test Date	10/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	4595	Battery Voltage Start	6.04
Start Recording	10:05:00 AM	Finish Recording	11:30:00 AM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	17.505
Date of Last Calibration		Metres To Next Calibration	1366
		Test ended due to:	Anchor Failure

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.01%	0.01%	0.18%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments
CPT06-1	7.507	253s	0.03

Notes and Comments

Data loss (typically at rod change points). Either deleted

qc	fs	u
0.5	1.48	
1.5	2.46	
2.5	3.5	
3.5	4.54	
6.52	6.5	
8.52	7.5	
9.5	8.48-8.5	
10.52	9.48	
11.5	10.48	
14.5	11.5	
15.5	13.5	
	14.48-14.5	
	15.5	

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT07	Job Identifier	HW - OTL Developments
Test Date	10/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	5343	Battery Voltage Start	5.89
Start Recording	2:40:00 PM	Finish Recording	3:06:00 PM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	13.32
Date of Last Calibration		Metres To Next Calibration	1289
		Test ended due to:	Anchor Failure

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.00%	0.00%	0.18%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

Data loss corrected (typically at rod change points). Either deleted or averaged

qc	fs	u
0.52	0.54	
1.54	1.52-1.54	
2.54	3.54	
5.56	4.56	
6.52-6.54	5.54-5.56	
8.56	6.56	
9.56	7.56	
10.52-10.54	8.56	
11.52-11.54	9.56-9.58	

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT08	Job Identifier	HW - OTL Developments
Test Date	10/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	5325	Battery Voltage Start	5.92
Start Recording	12:55:00 PM	Finish Recording	1:30:00 PM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	17.02
Date of Last Calibration		Metres To Next Calibration	802
		Test ended due to:	Anchor Failure

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.04%	0.03%	0.40%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

Data loss (typically at rod change points). Either deleted or averaged

qc	fs	u
0.52	0.52	
1.54	1.52	
2.52	2.52	
5.56	2.54	
6.54	4.54-4.56	
8.54	5.54	
11.56	6.5-6.52	
12.56	7.52	
13.54	7.56	
15.56	8.5-8.52	
	9.56	
	10.54	
	11.52-11.54	
	12.54	
	14.56	

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT09	Job Identifier	HW - OTL Developments
Test Date	10/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	5233	Battery Voltage Start	5.88
Start Recording	4:15:00 PM	Finish Recording	4:40:00 PM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	5.865
Date of Last Calibration		Metres To Next Calibration	1226
		Test ended due to:	Anchor Failure

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.04%	0.00%	0.04%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

	qc	fs	u
Data loss (typically at rod change points). Either deleted or averaged	2.48 4.48 5.48	0.48 2.48 5.46-5.48	

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT10	Job Identifier	HW - OTL Developments
Test Date	10/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	5343	Battery Voltage Start	6.24
Start Recording	2:15:00 PM	Finish Recording	2:503:56:00 PM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	16.505
Date of Last Calibration		Metres To Next Calibration	1317
		Test ended due to:	Anchor Failure

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.04%	0.01%	0.22%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

Data loss corrected (typically at rod change points). Either deleted or averaged

qc	fs	u
0.54	0.56	
3.54	1.54	
6.56	2.52	
7.56	4.56	
8.58	5.54-5.56	
9.58	6.54-6.56	
10.58	9.54-9.56	
11.58	11.58	
12.58	13.56	
13.58	15.56	
14.58		
15.6		

UNDERGROUND INVESTIGATION

CPT Test Information

Test Hole Number	CPT11	Job Identifier	HW - NRC Awanui Spillway op Juken Nisho
Test Date	9/10/2019	Operator	Craig Greenfield
CPT Rig Type	Georig 220 with Screw Anchors	Cone Type	Nova Cone 100MPa
Cone Serial Number	5233	Battery Voltage Start	6.08
Start Recording	5:25:00 PM	Finish Recording	6:00:00 PM
Pre Drill Depth		Ground Water Depth	
Data Interval	20mm	Total Penetration Depth (m)	15.157
Date of Last Calibration		Metres To Next Calibration	1241
		Test ended due to:	Tilt Alarm

Zero Value Change % FSO

	Point Resistance	Pore Pressure	Sleeve Friction
End of test with tip loosened	0.01%	0.01%	0.12%

Dissipation Testing

Test No	Depth (m)	Duration (secs)	Comments

Notes and Comments

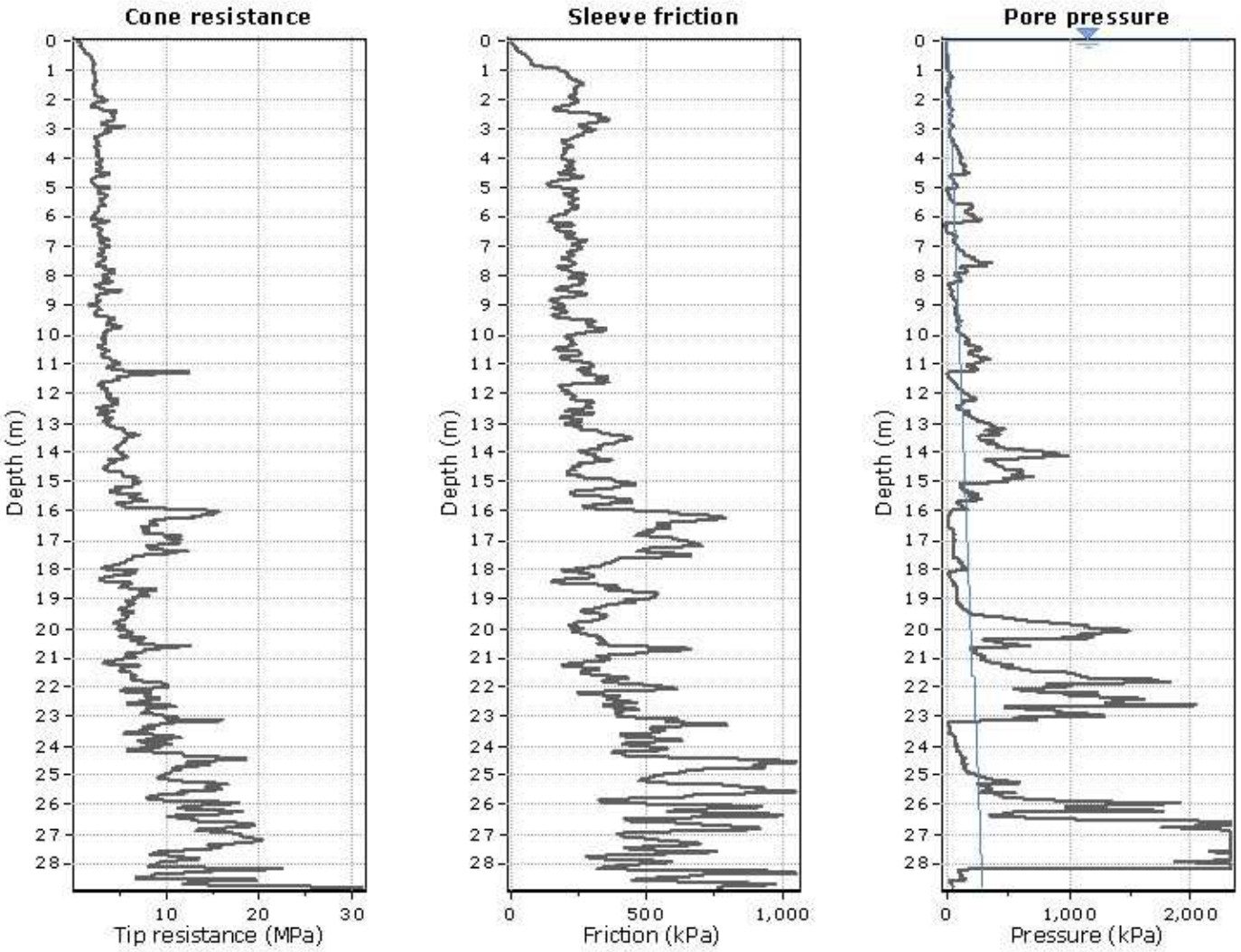
Data loss (typically at rod change points). Either deleted or averaged

qc	fs	u
1.48	0.48	
6.5	1.46	
7.52	2.46-2.48	
8.5	3.48-3.5	
9.5	4.5-4.52	
10.5	5.48-5.5	
12.5-12.52	6.46-6.48	
13.52	7.5	
14.5-14.52	8.5	
	9.5	
	11.5	
	12.5	
	13.5	
	14.48	

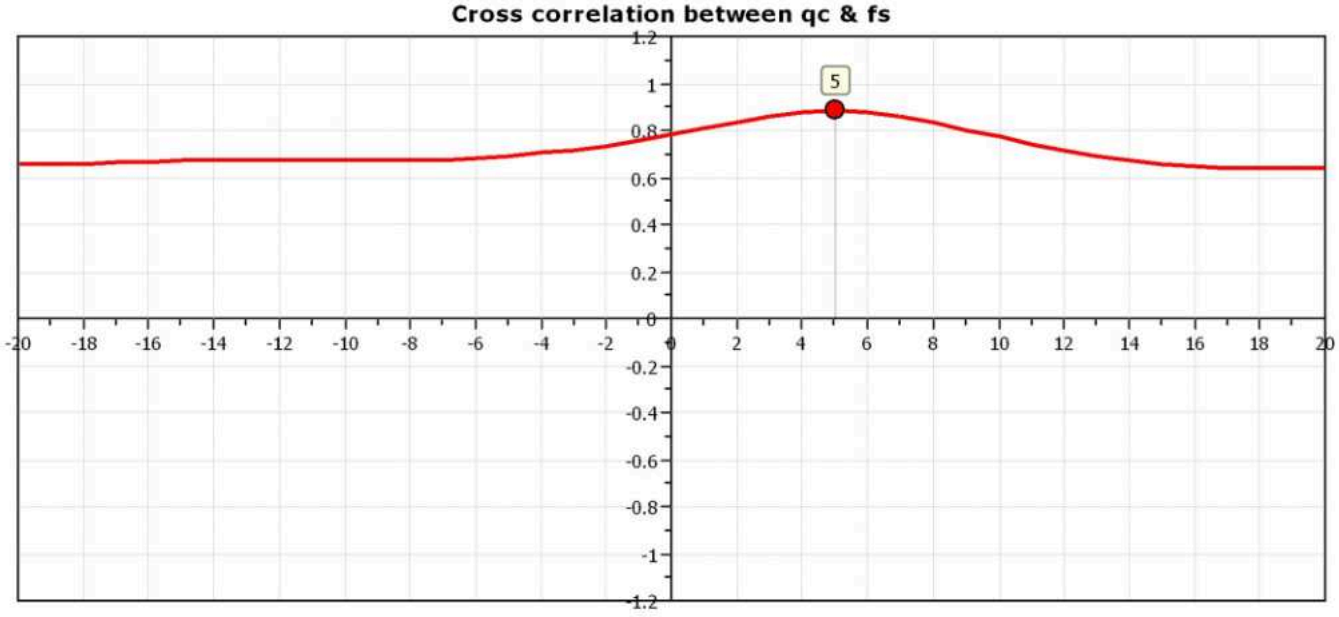
CPT: CPT01

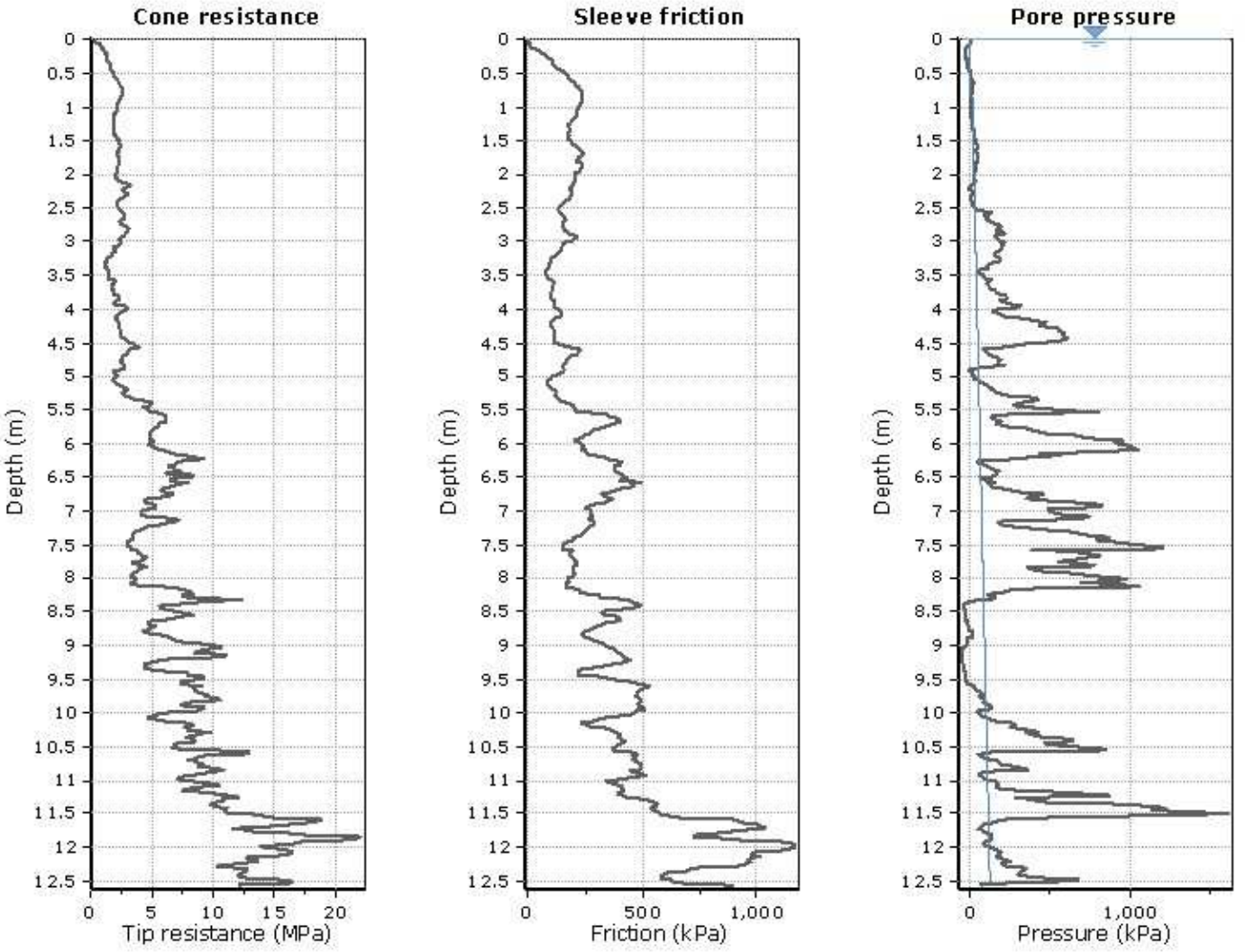
Total depth: 28.80 m, Date: 13/10/2019
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: Te Runanga O
Location: Whaingaroa

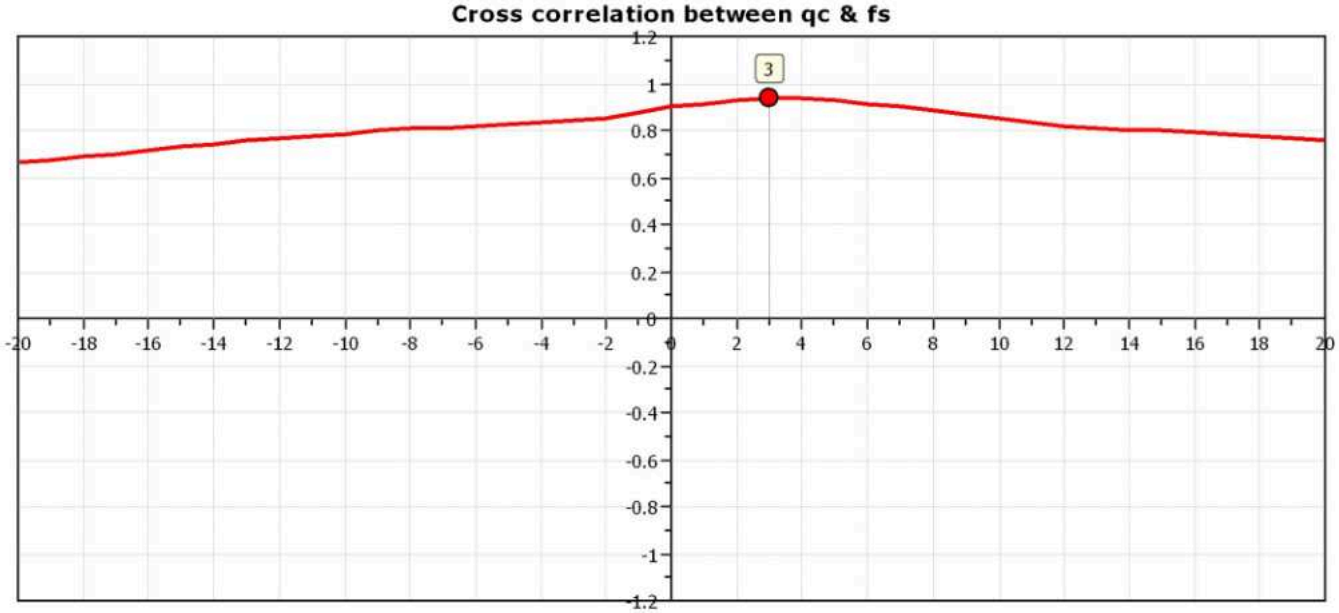


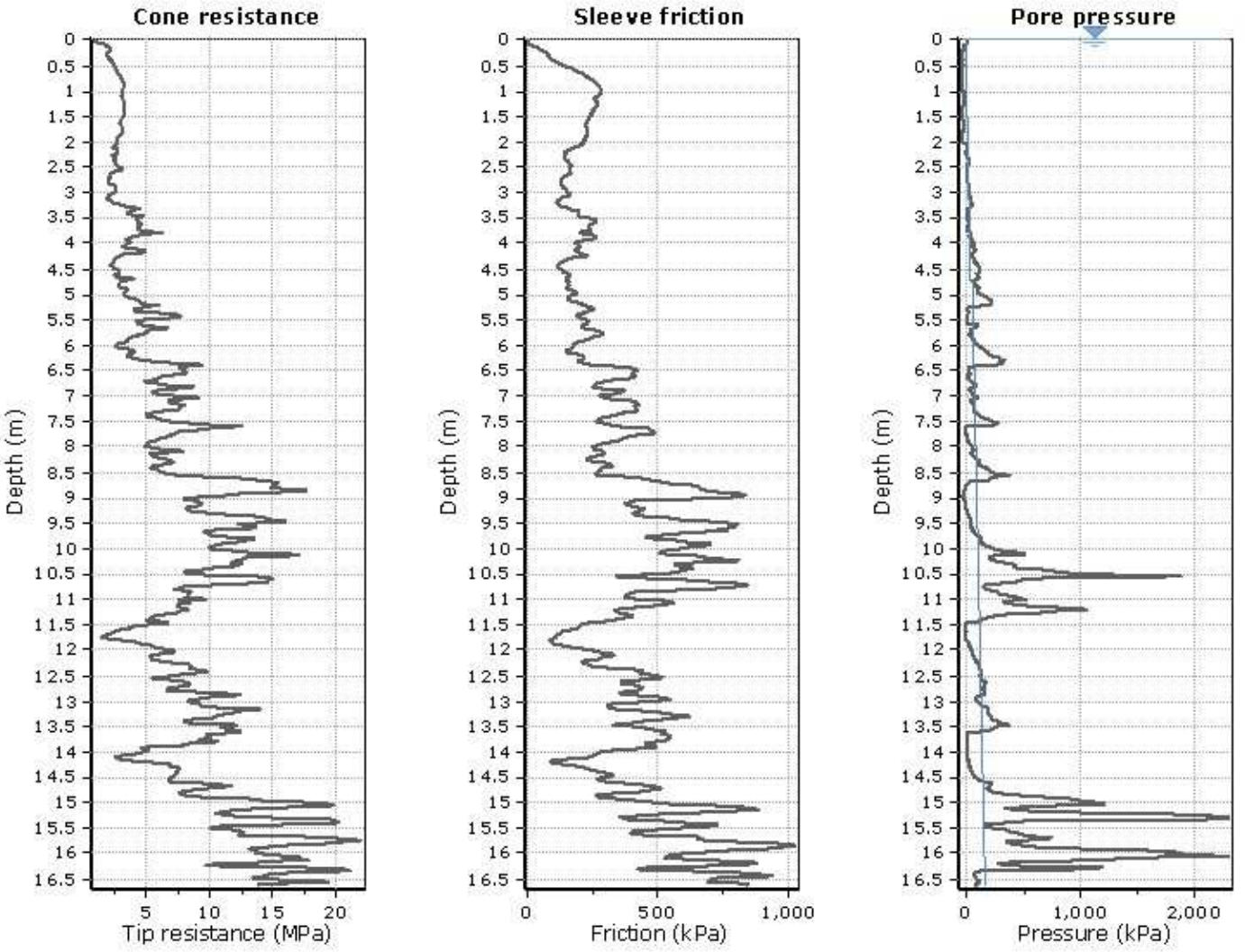
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



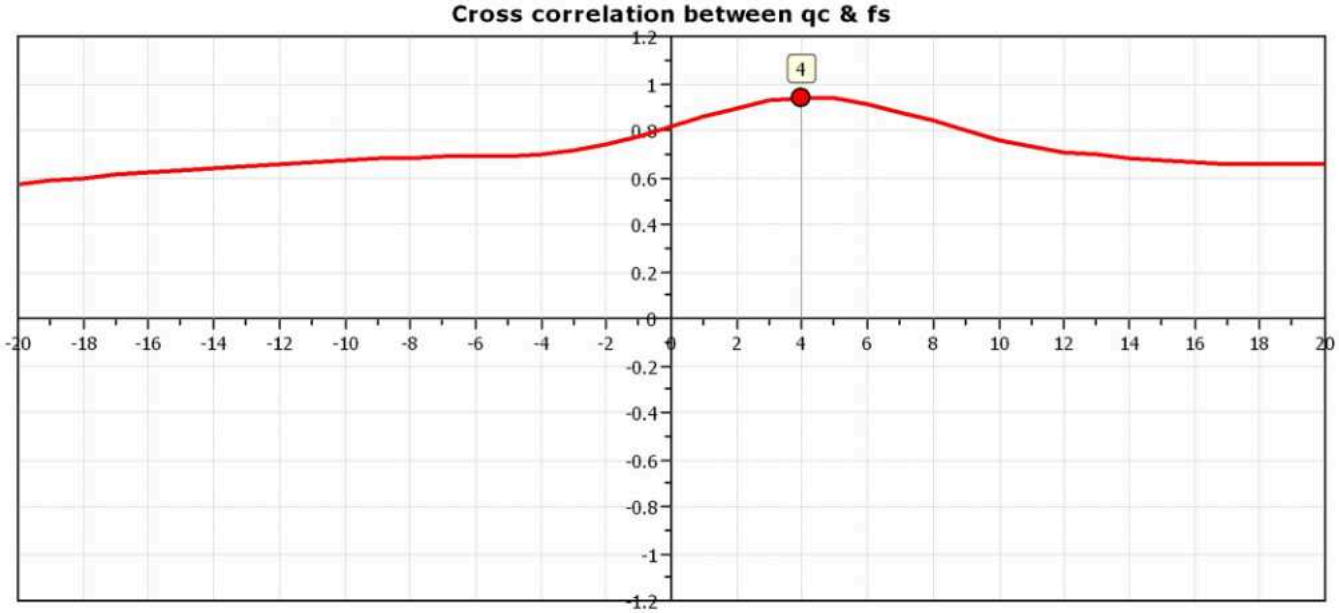


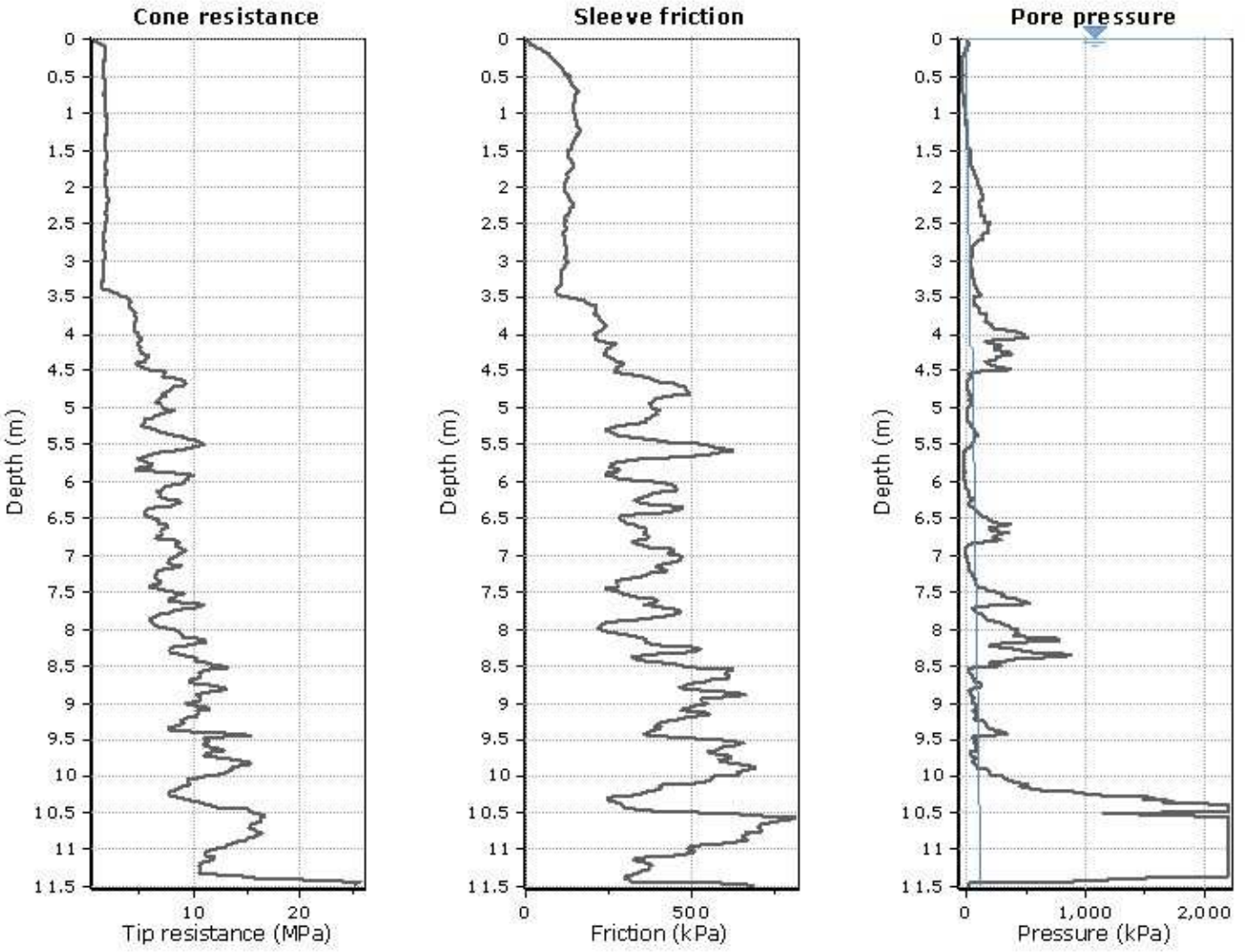
The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



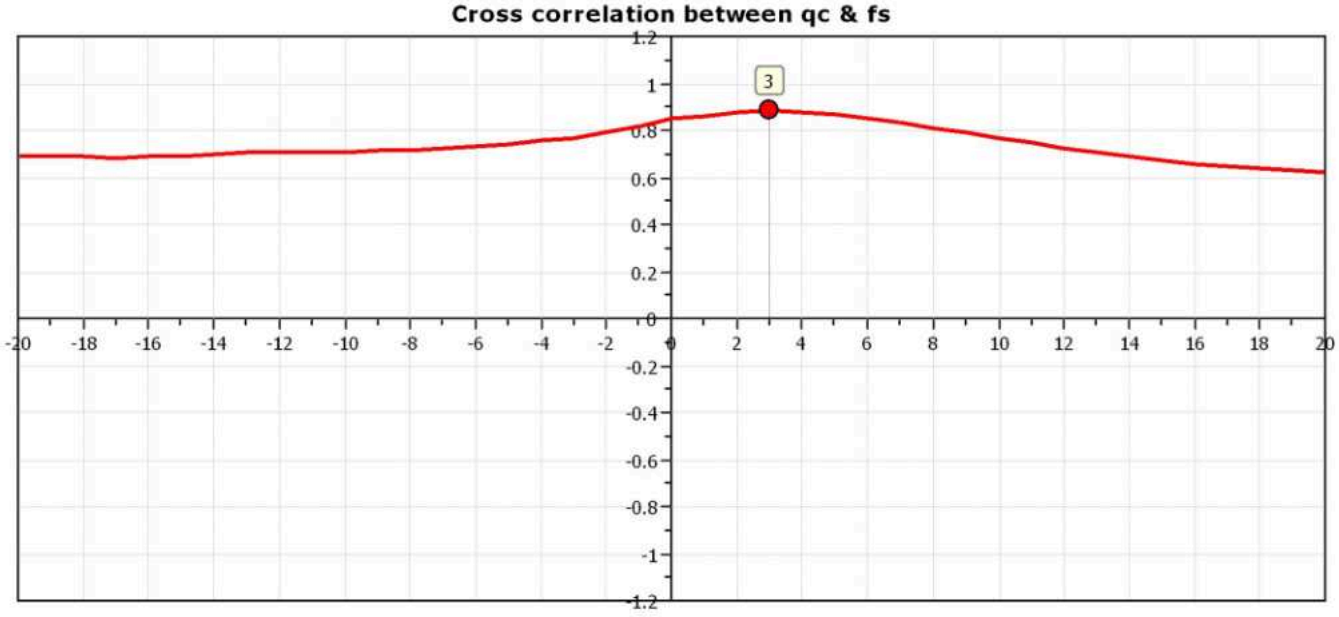


The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



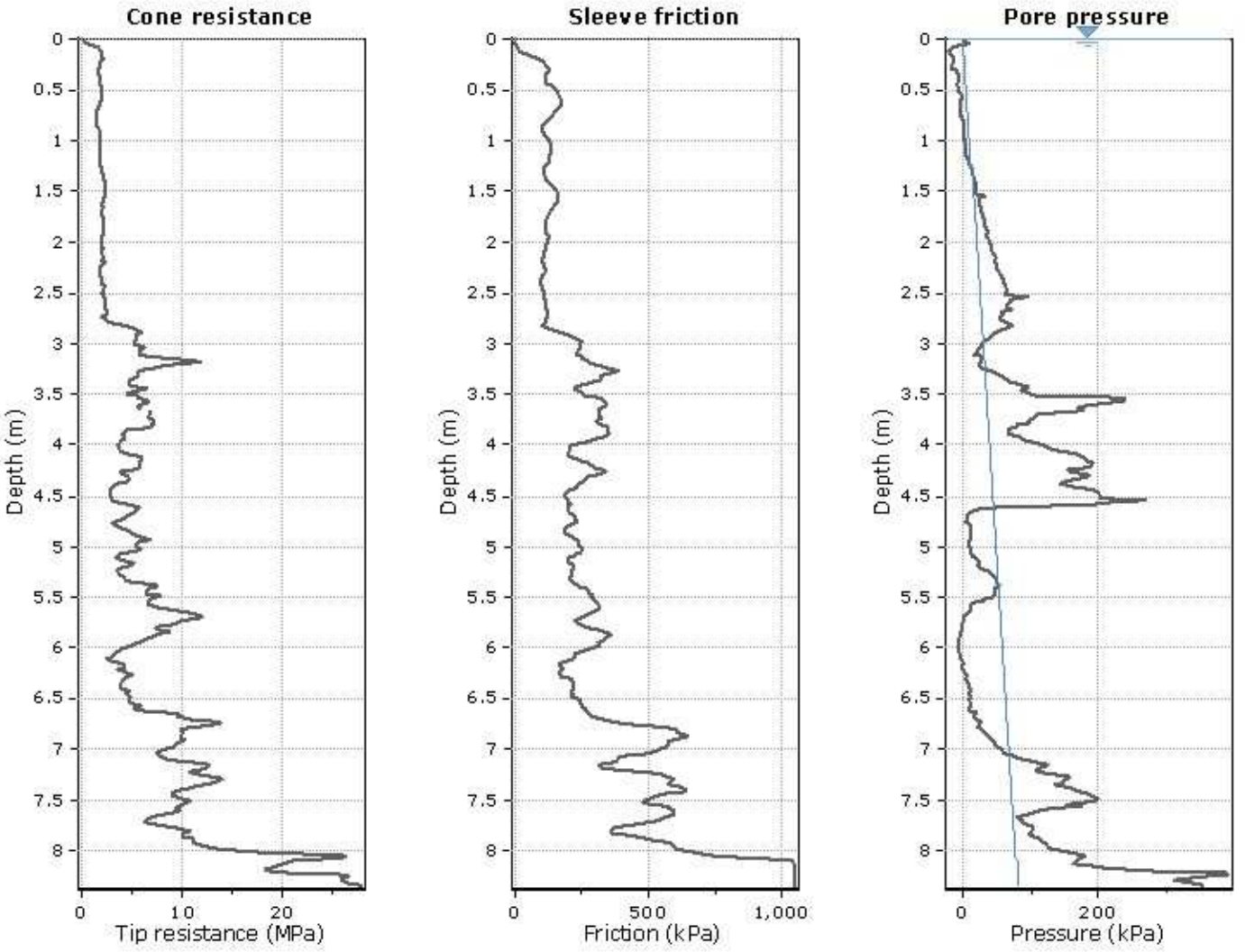


The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



Total depth: 8.34 m, Date: 13/10/2019
Surface Elevation: 0.00 m
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Uknown

Project: **Te Runanga O**
Location: **Whaingaroa**



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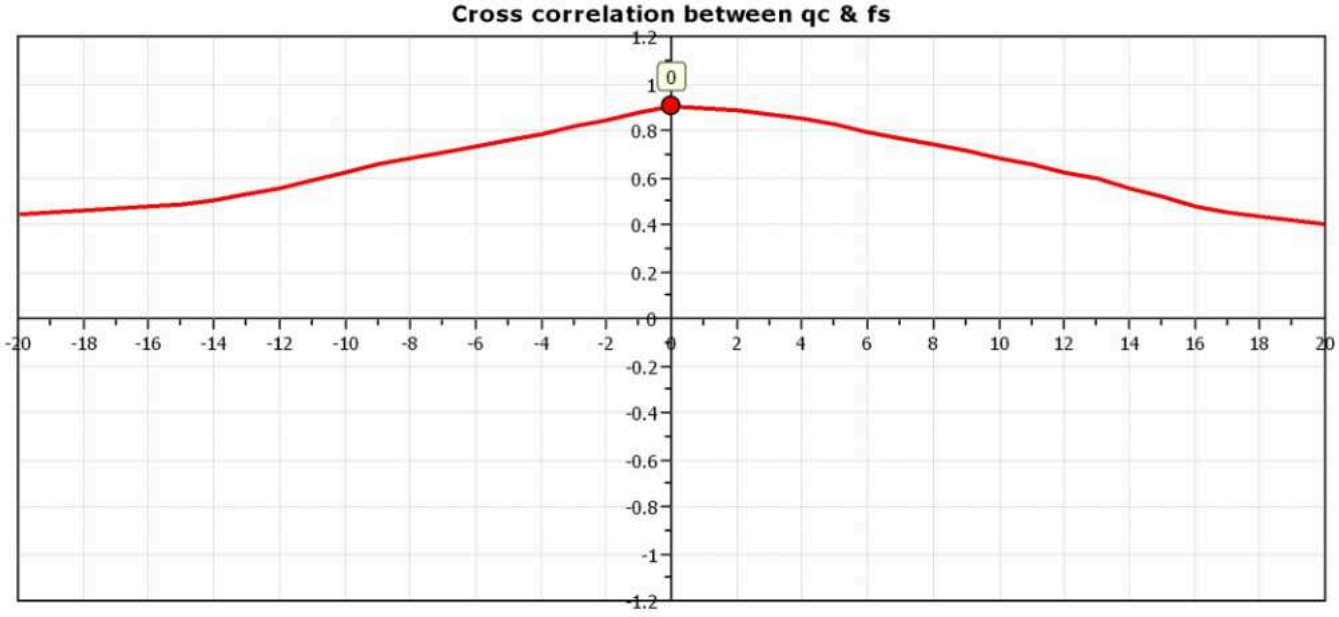

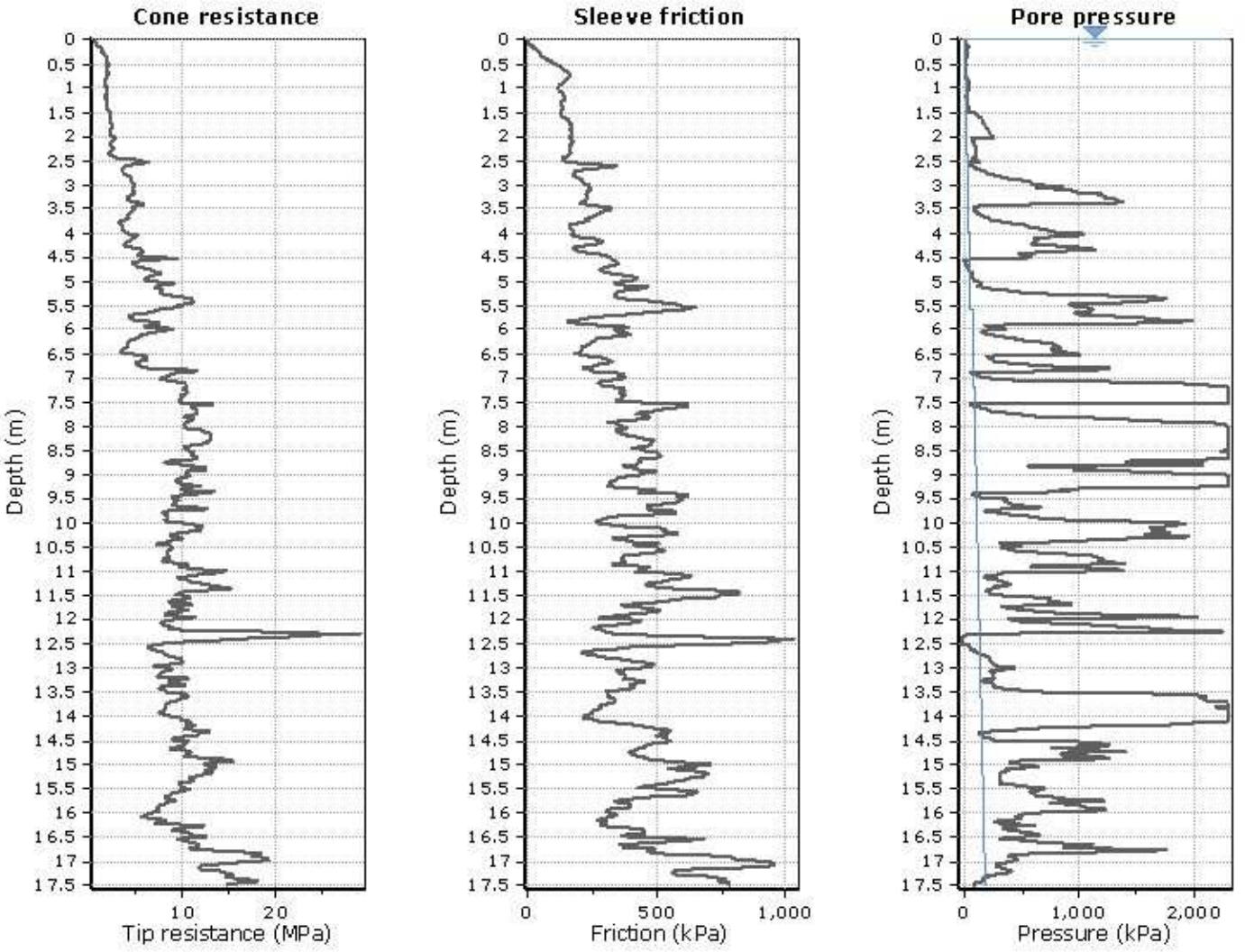

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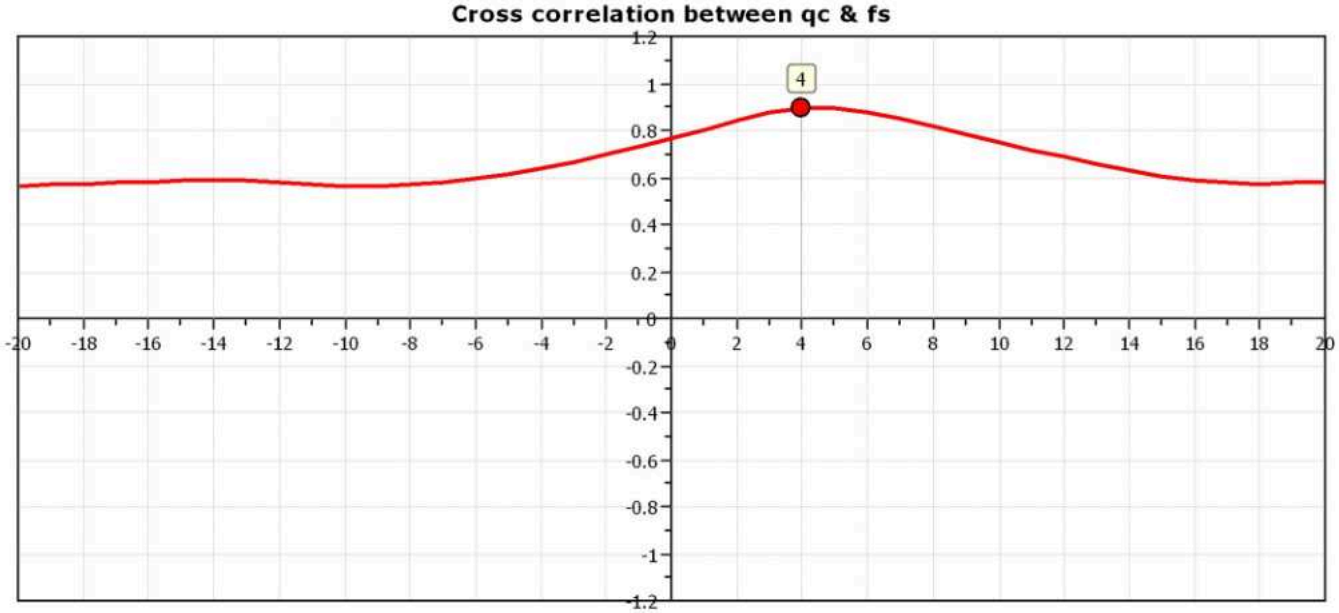

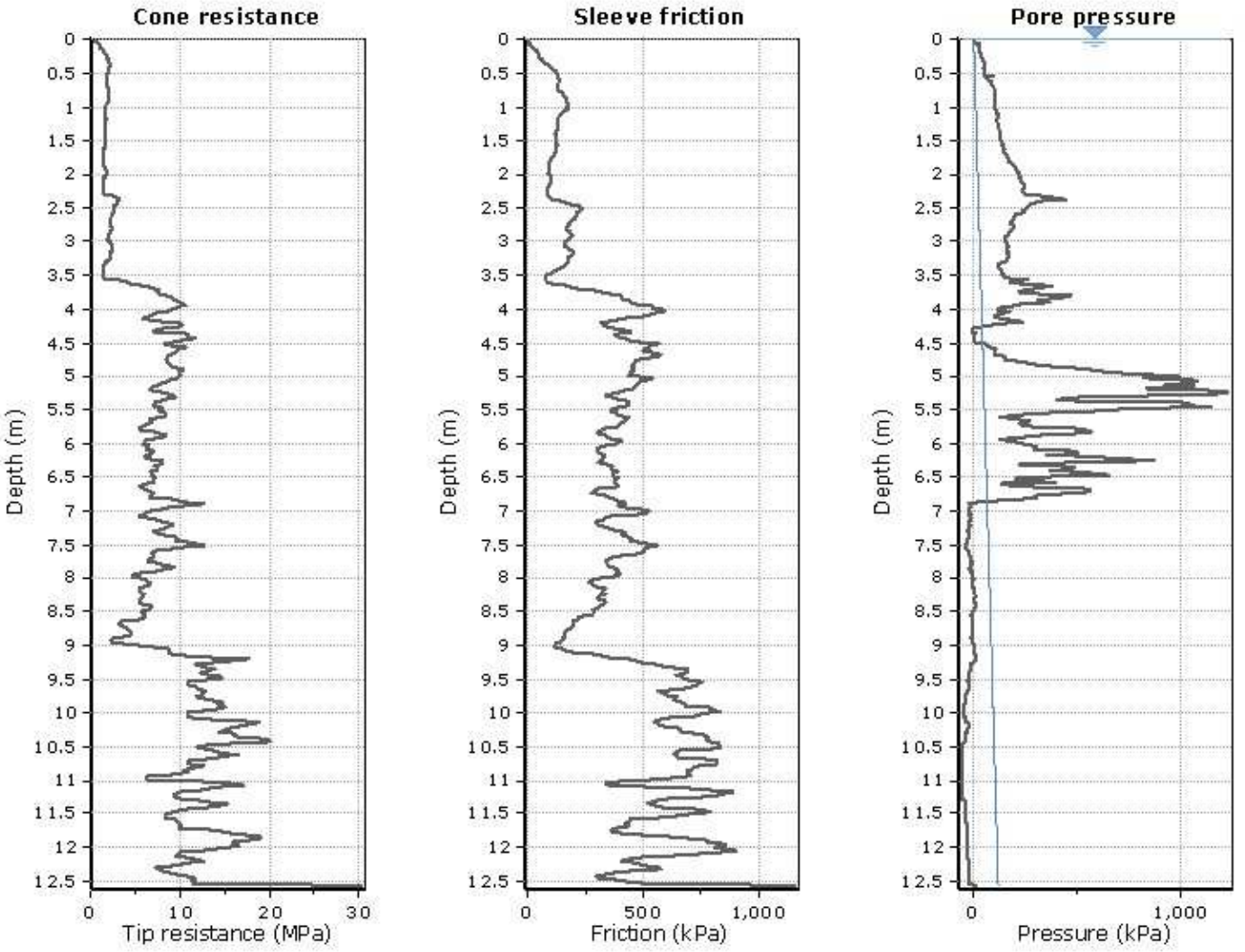

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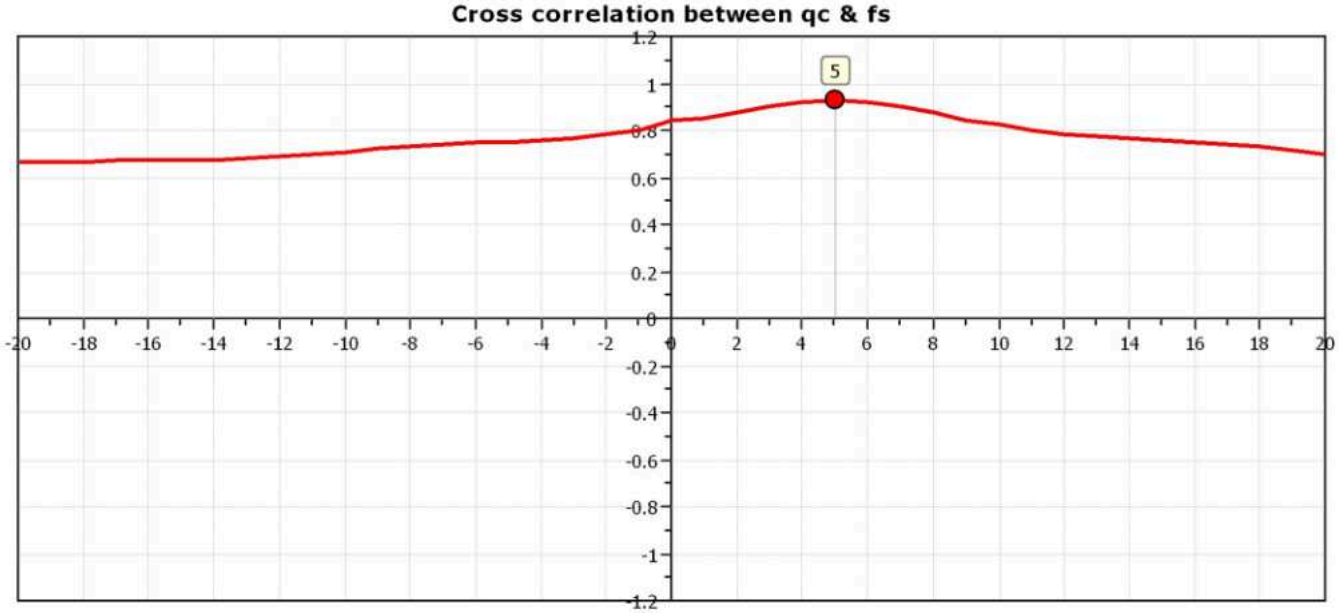

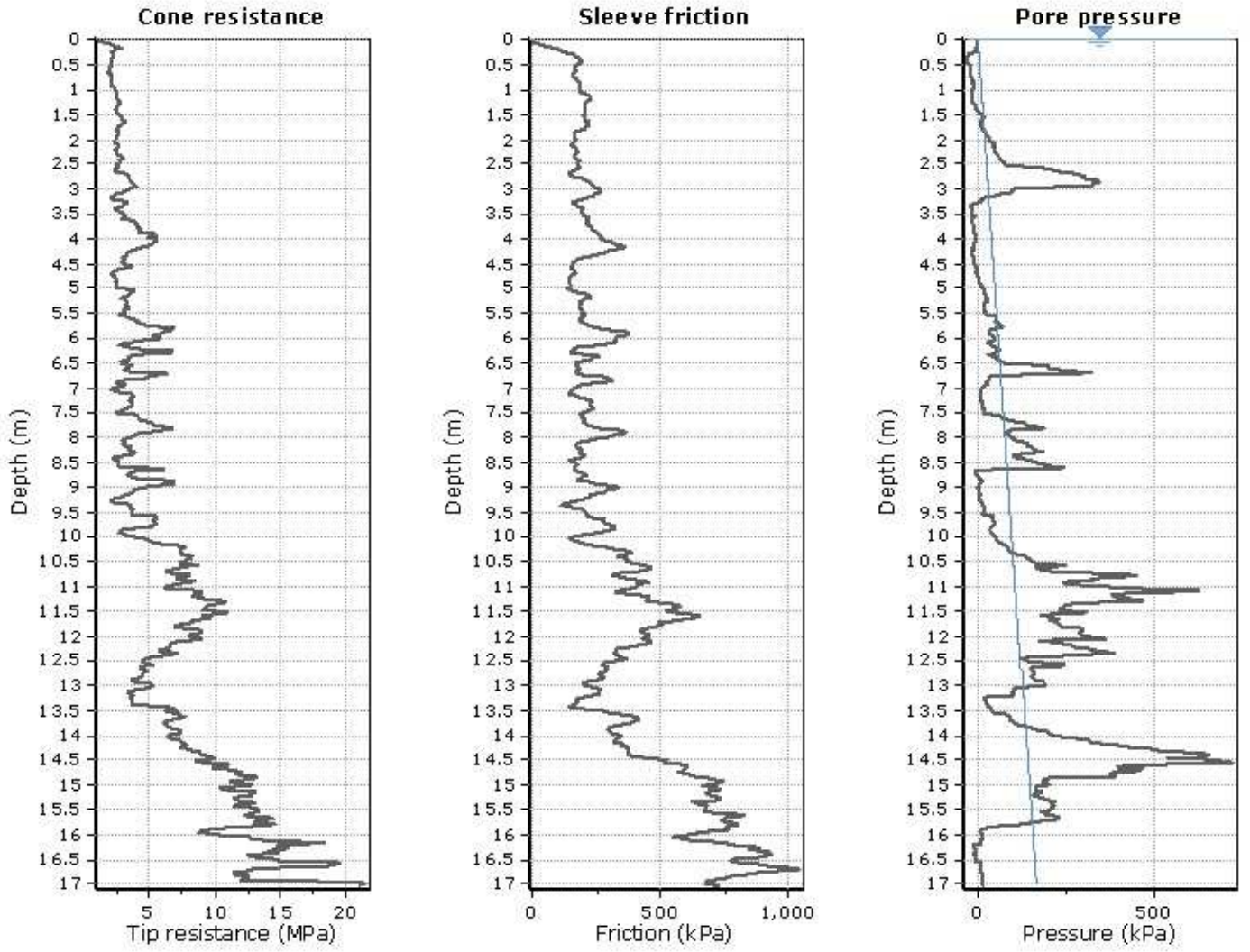

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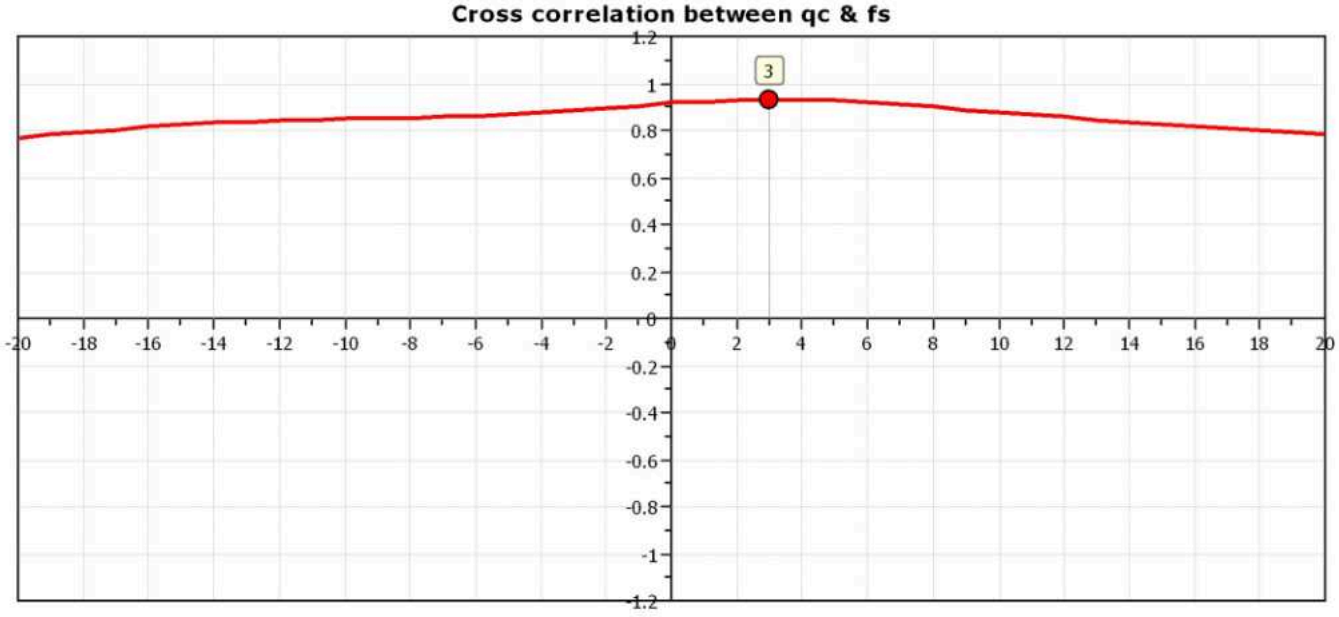

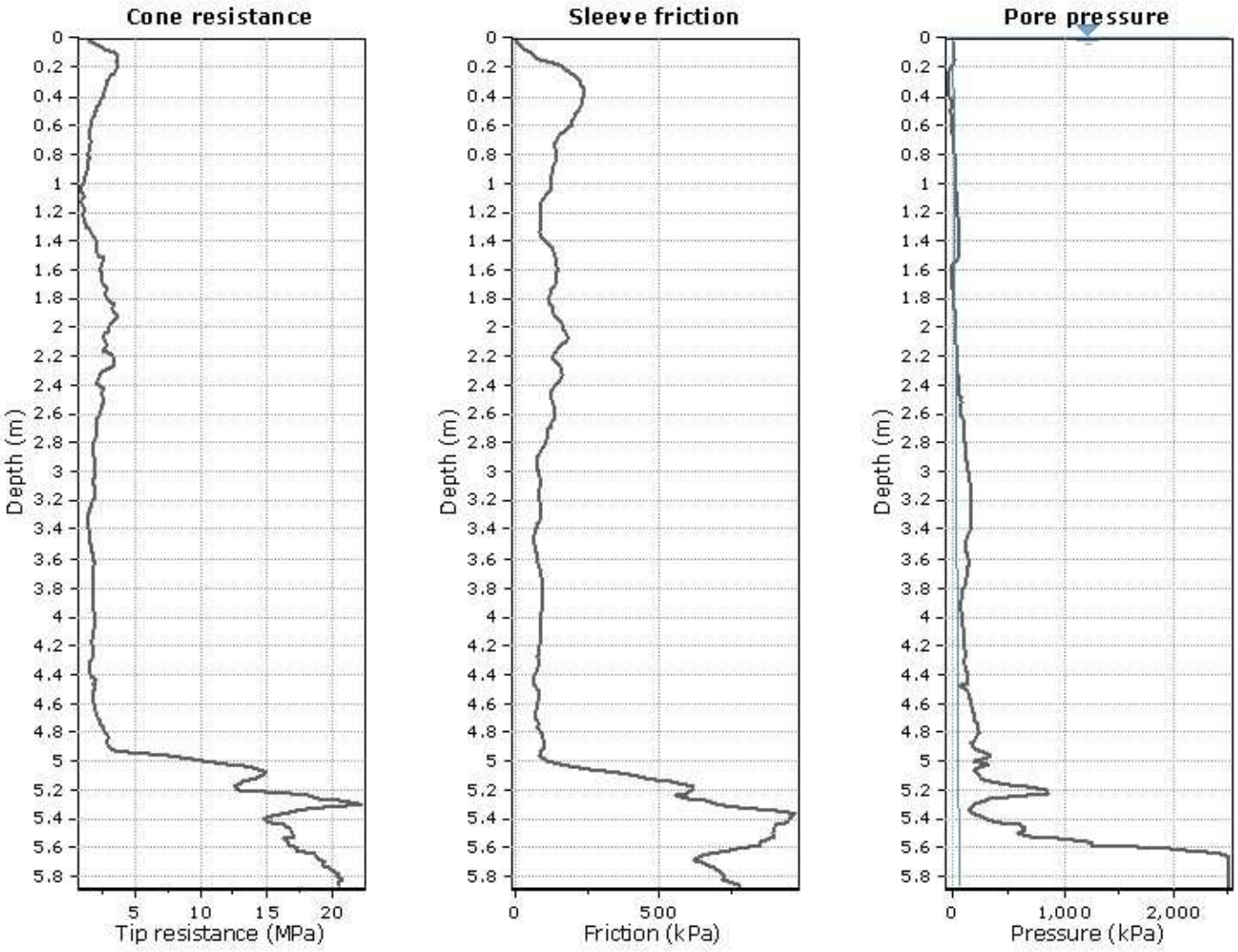

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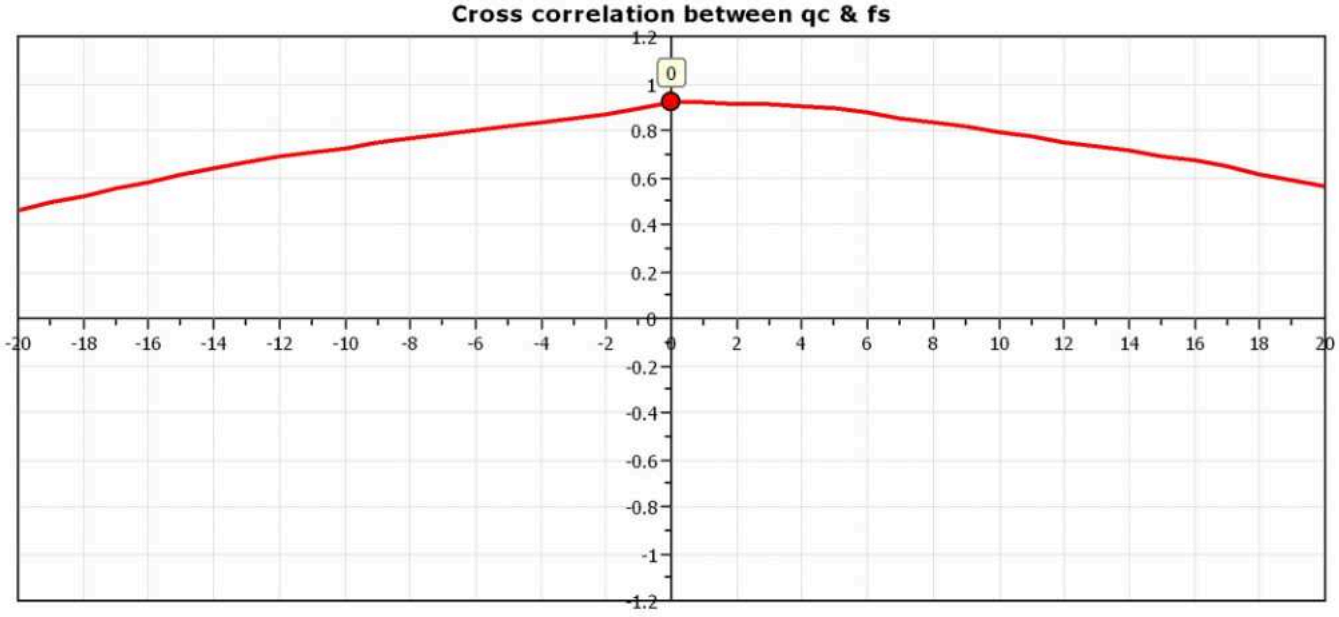

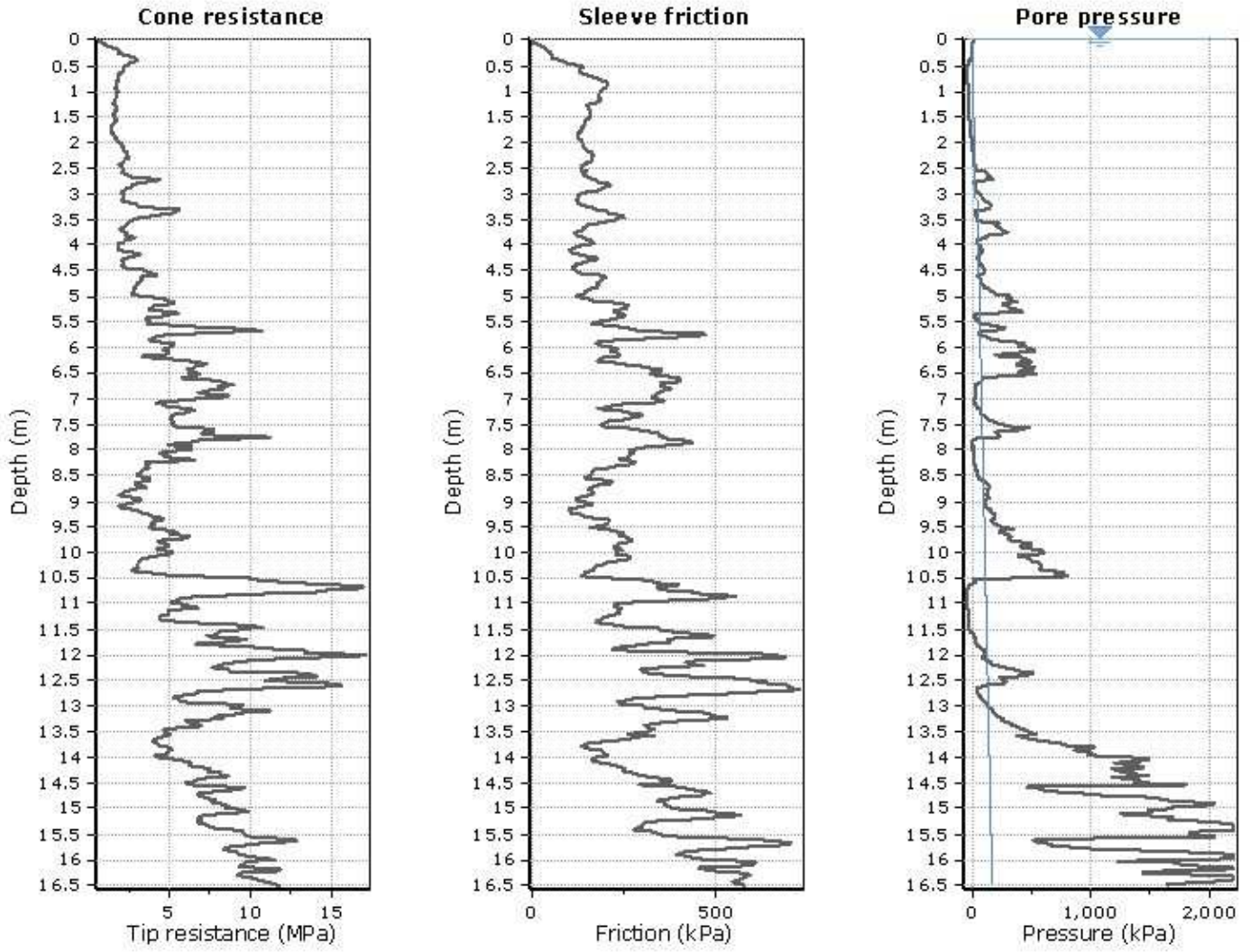

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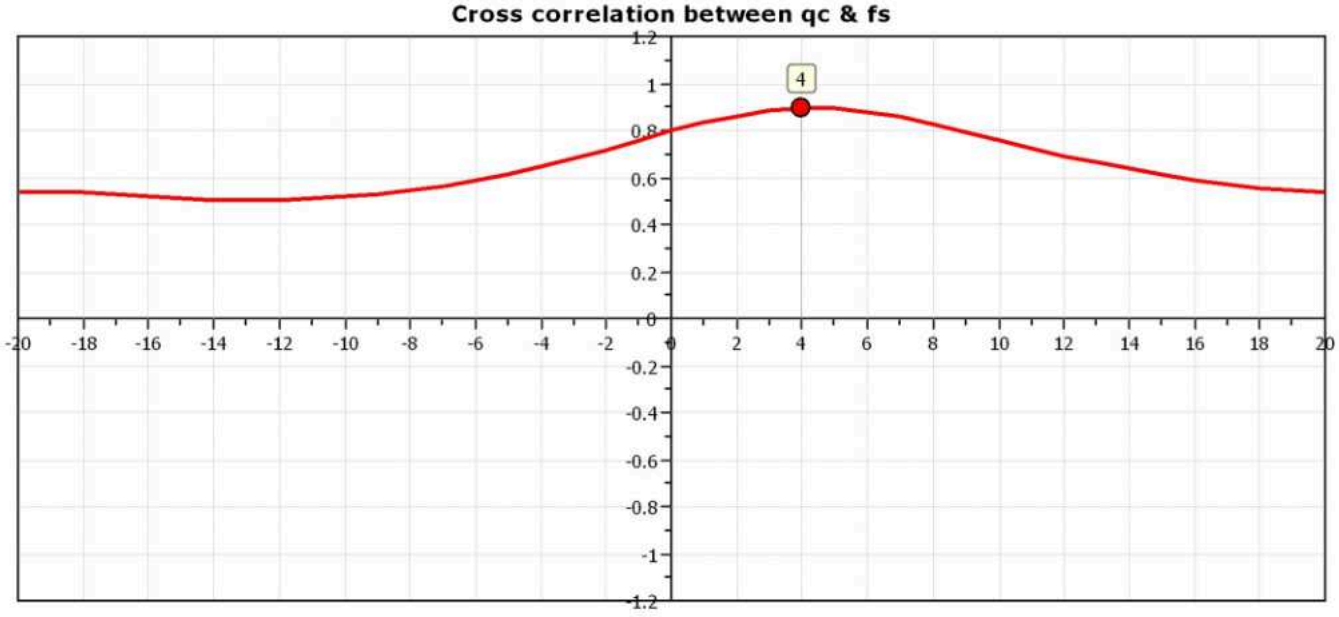

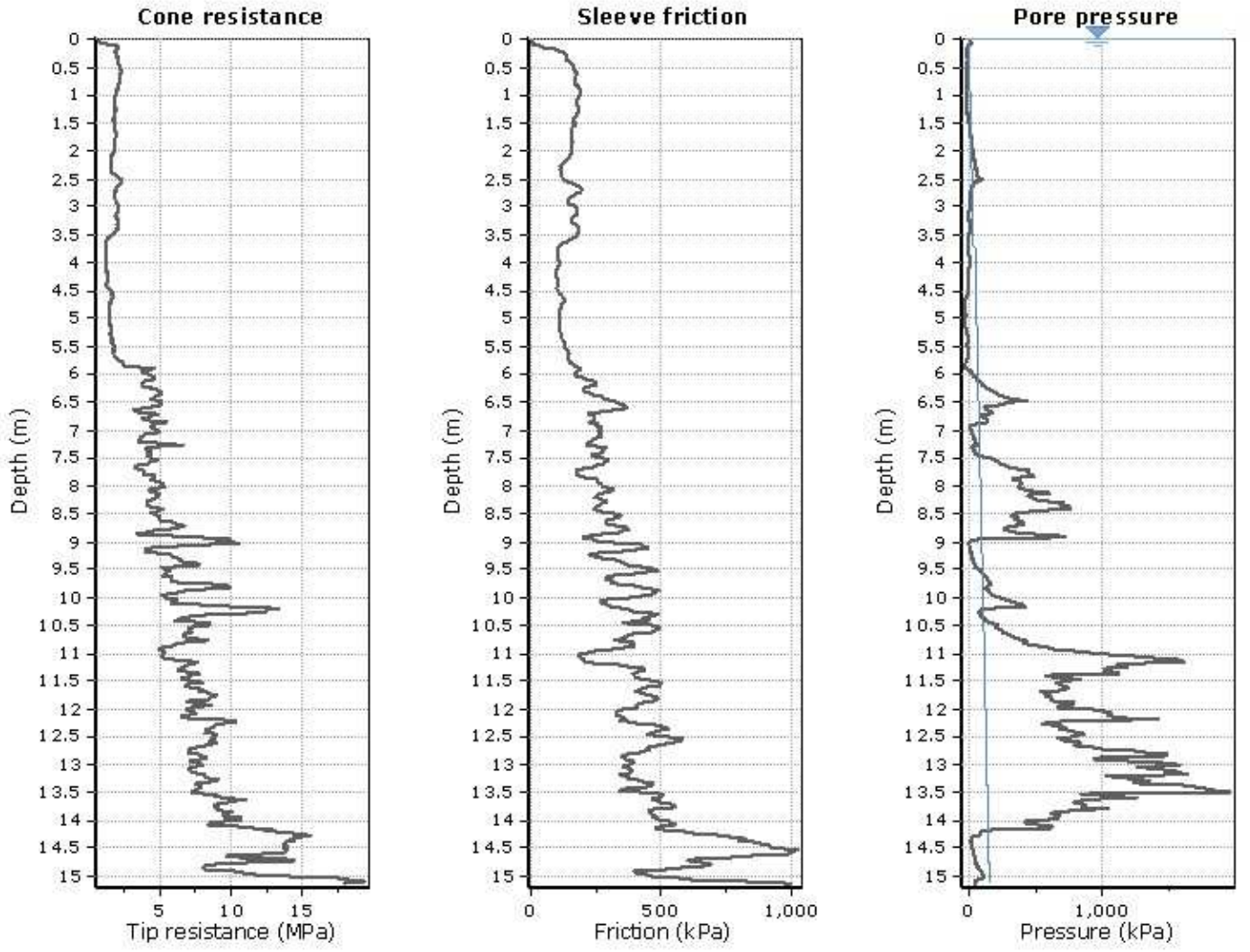

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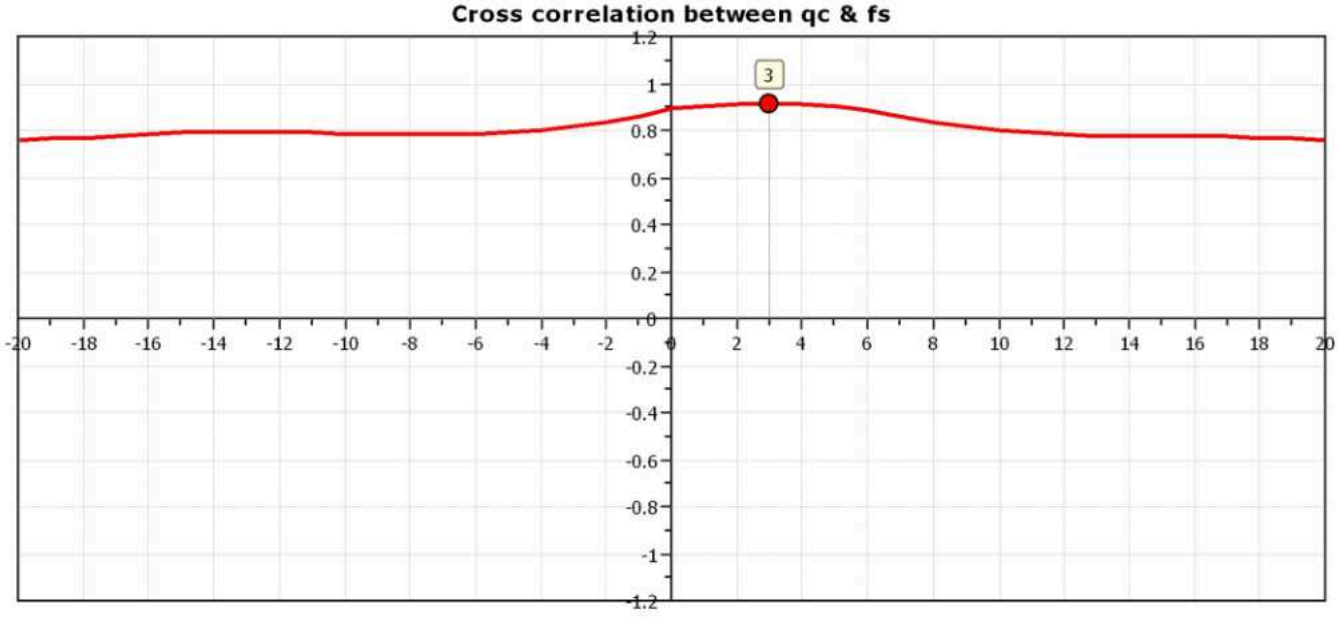
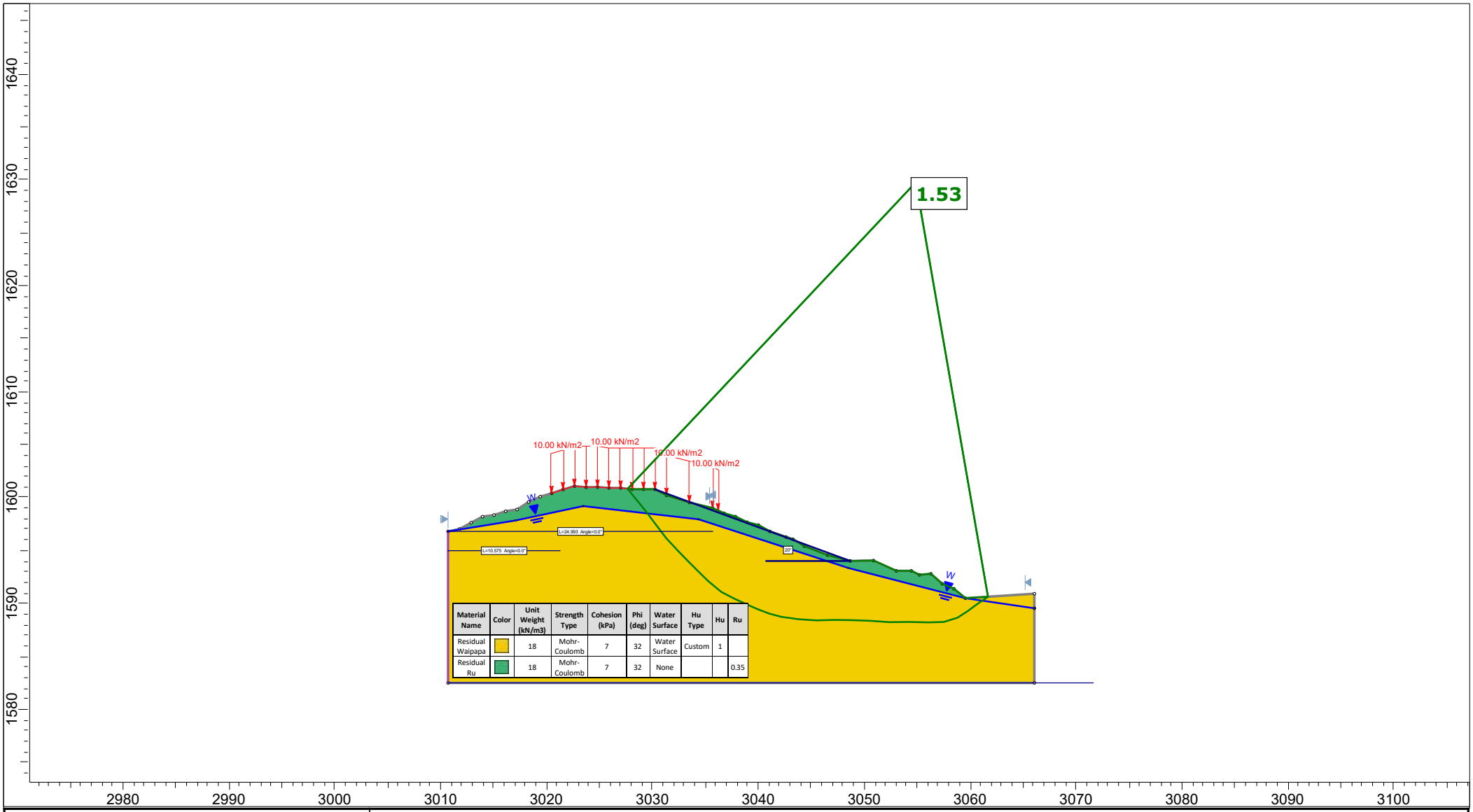


Appendix C – Slope Stability Models

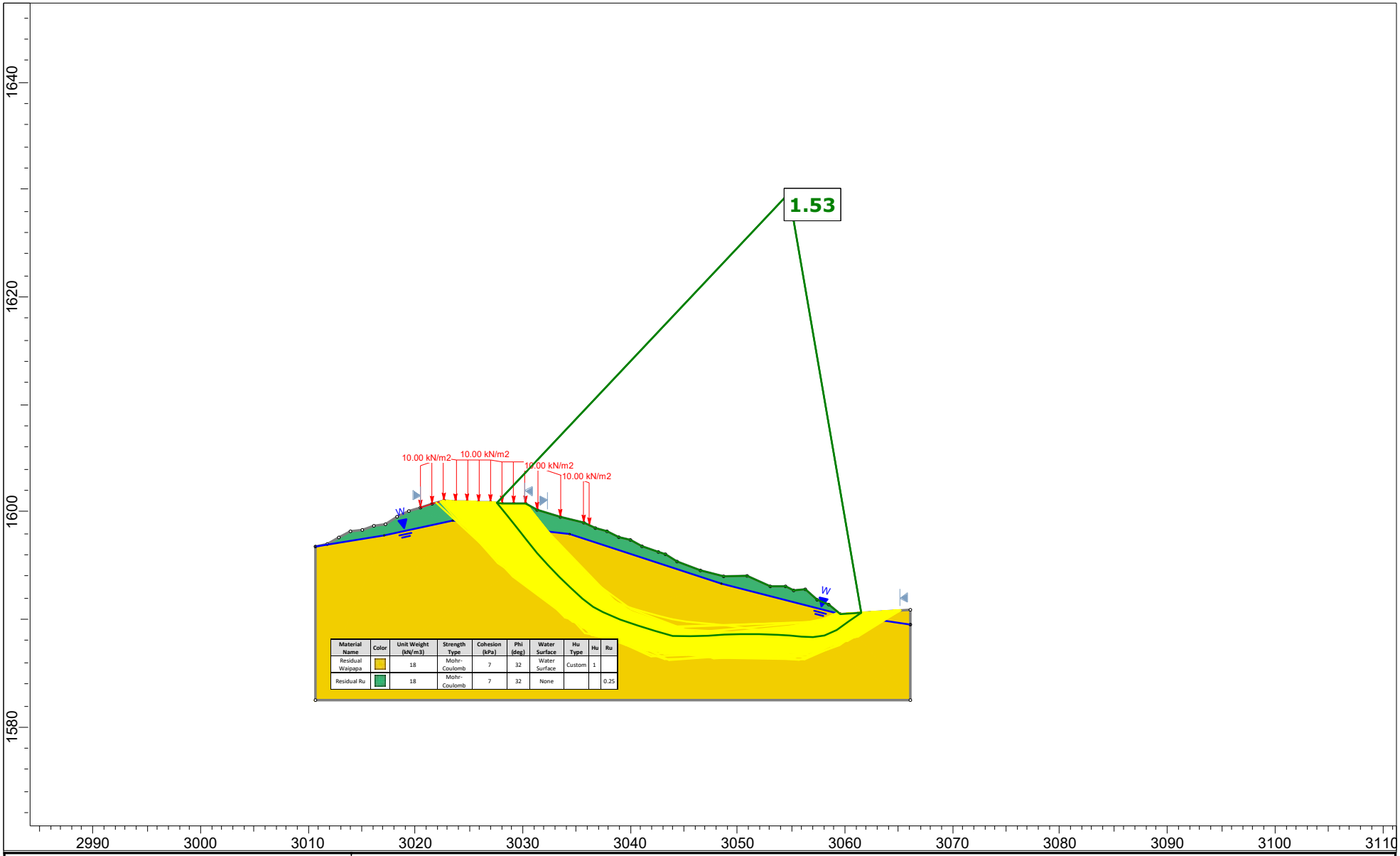


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Residual Waipapa		18	Mohr-Coulomb	7	32	Water Surface	Custom	1	
Residual Ru		18	Mohr-Coulomb	7	32	None			0.35

rocscience

SLIDEINTERPRET 9.026

Project	Te Runanga O Whaingaroa		
Group	SecAA_Lot 14_extreme.slim	*Scenario*	SecAA_Lot 14_extreme.slim
Drawn By	WT	*Company*	HW Ltd
Date	13/11/2024, 2:21:50 pm	*File Name*	SecAA_Lot 14_extreme.slim



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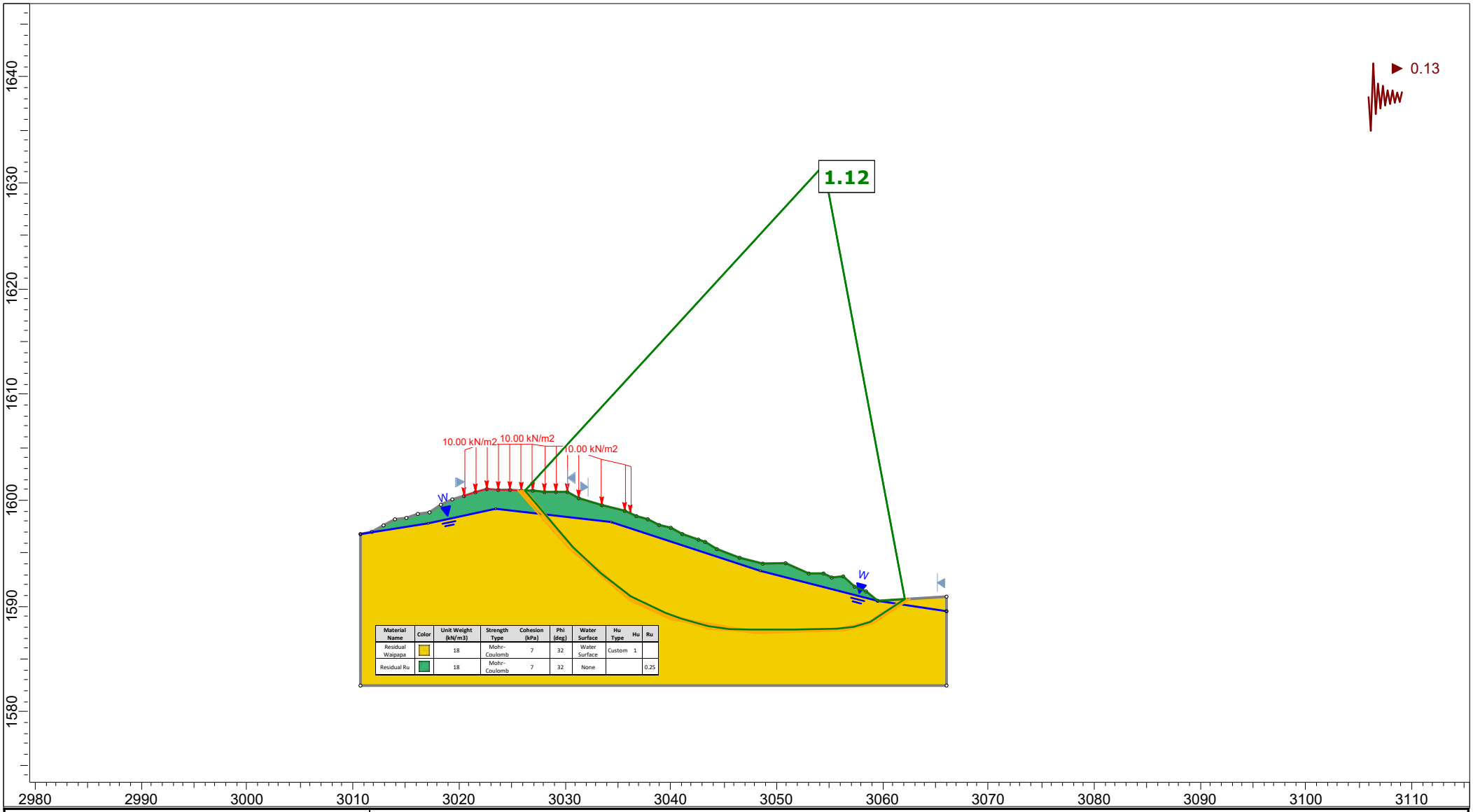
Residual Waipapa		18	Mohr-Coulomb	7	32	Water Surface	Custom	1	
Residual Ru		18	Mohr-Coulomb	7	32	None			0.25

rocscience

SLIDEINTERPRET 9.026

Project	Te Runanga O Whaingaroa		
Group	SecAA_Lot 14.slim	*Scenario*	SecAA_Lot 14.slim
Drawn By	WT	*Company*	HW Ltd
Date	13/11/2024, 2:21:50 pm	*File Name*	SecAA_Lot 14.slim



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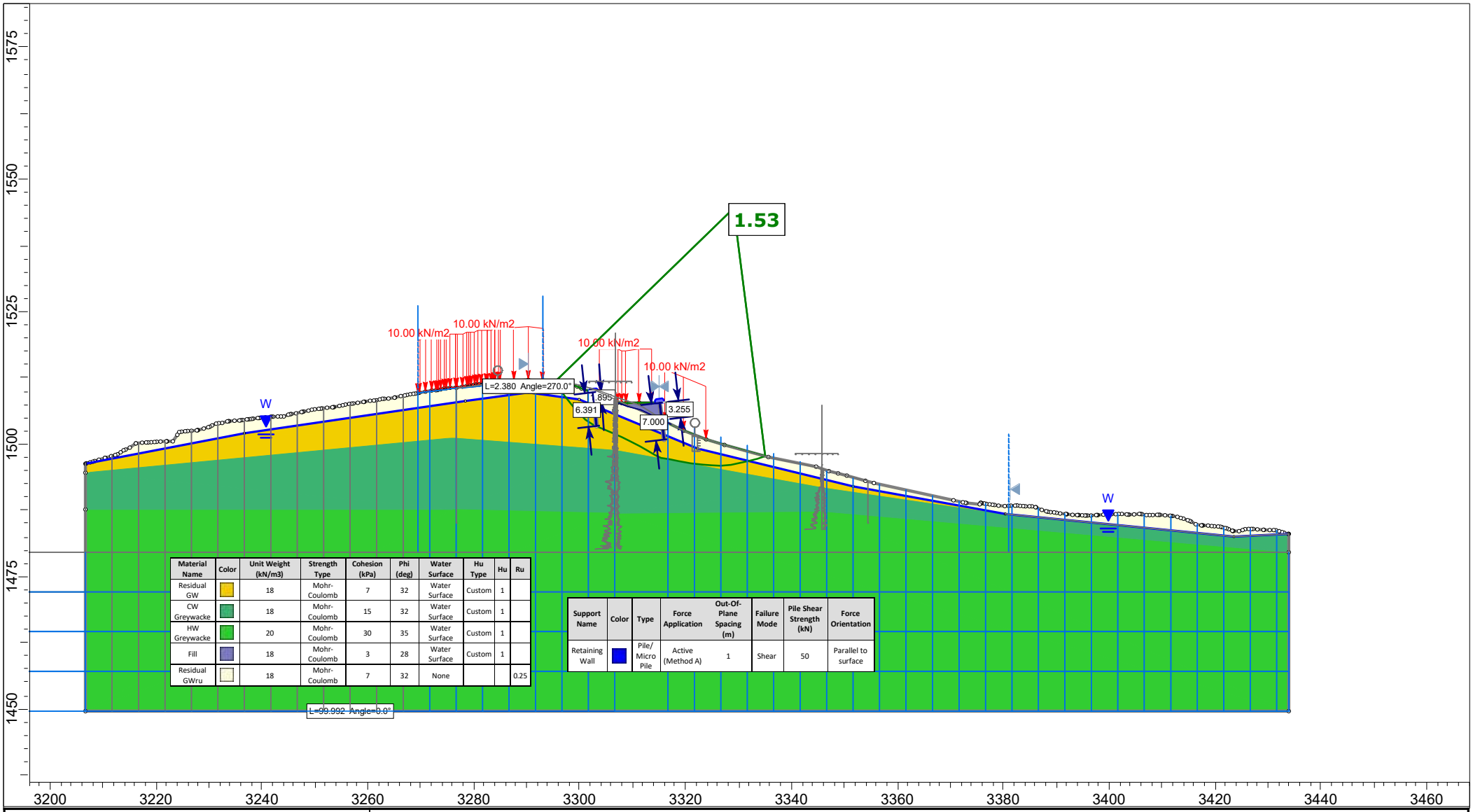
Residual Waipapa		18	Mohr-Coulomb	7	32	Water Surface	Custom	1	
Residual Ru		18	Mohr-Coulomb	7	32	None			0.25

rocscience

SLIDEINTERPRET 9.026

Project	Te Runanga O Whaingaroa		
Group	SecAA_Lot 14.slim	*Scenario*	SecAA_Lot 14.slim
Drawn By	WT	*Company*	HW Ltd
Date	13/11/2024, 2:21:50 pm	*File Name*	SecAA_Lot 14.slim



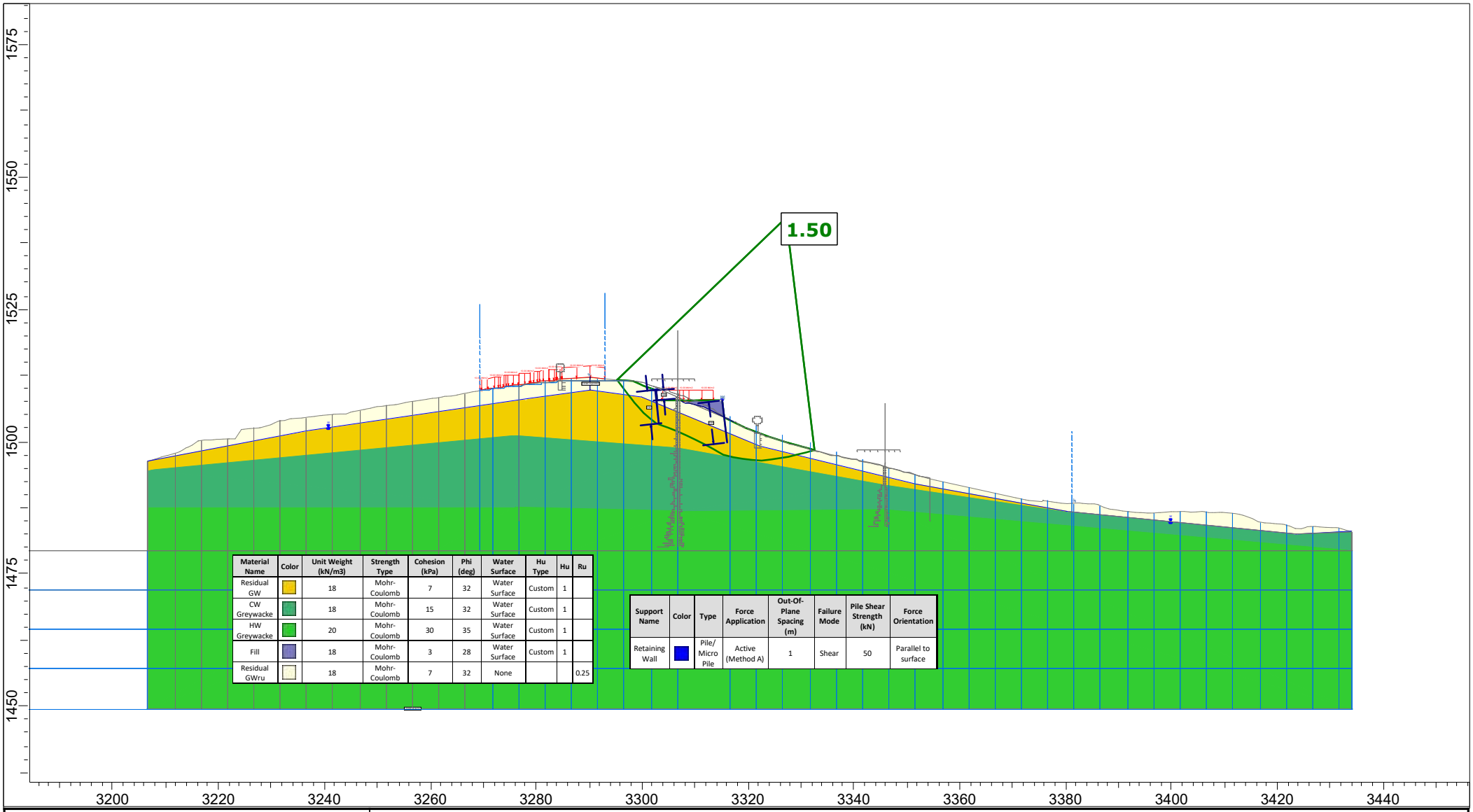
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Residual GW		18	Mohr-Coulomb	7	32	Water Surface	Custom	1	
CW Greywacke		18	Mohr-Coulomb	15	32	Water Surface	Custom	1	
HW Greywacke		20	Mohr-Coulomb	30	35	Water Surface	Custom	1	
Fill		18	Mohr-Coulomb	3	28	Water Surface	Custom	1	
Residual GWru		18	Mohr-Coulomb	7	32	None			0.25

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (m)	Failure Mode	Pile Shear Strength (kN)	Force Orientation
Retaining Wall		Pile/ Micro Pile	Active (Method A)	1	Shear	50	Parallel to surface

rocscience

SLIDEINTERPRET 9.026

Project	Te Runanga O Whaingaroa		
Group	Earthworks (Sec BB)	*Scenario*	Master Scenario
Drawn By	W. Thorburn	*Company*	Haigh Workman
Date		*File Name*	01_Static_earthworks.slmd



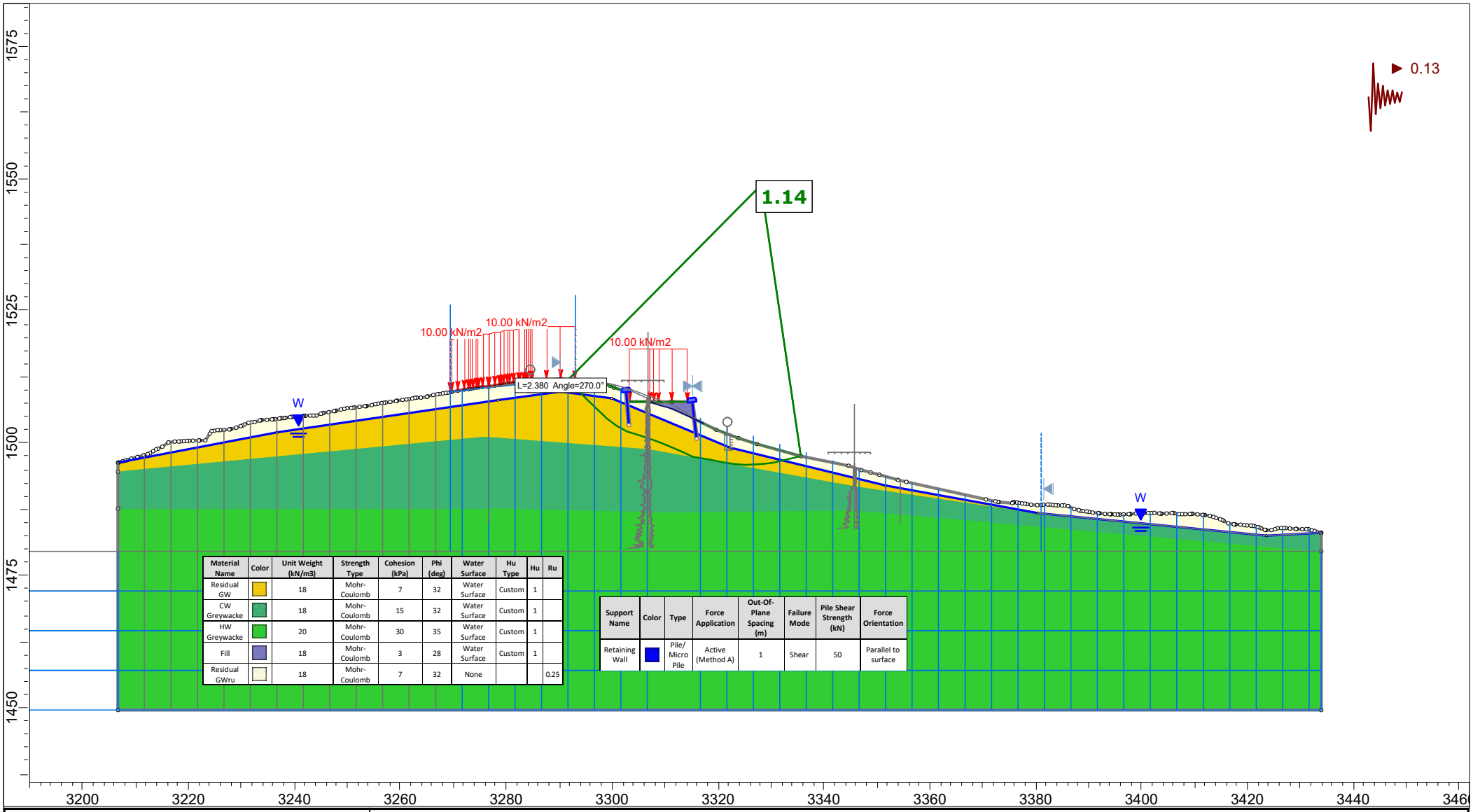
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Residual GW		18	Mohr-Coulomb	7	32	Water Surface	Custom	1	
CW Greywacke		18	Mohr-Coulomb	15	32	Water Surface	Custom	1	
HW Greywacke		20	Mohr-Coulomb	30	35	Water Surface	Custom	1	
Fill		18	Mohr-Coulomb	3	28	Water Surface	Custom	1	
Residual GWru		18	Mohr-Coulomb	7	32	None			0.25

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (m)	Failure Mode	Pile Shear Strength (kN)	Force Orientation
Retaining Wall		Pile/ Micro Pile	Active (Method A)	1	Shear	50	Parallel to surface

rocscience

SLIDEINTERPRET 9.026

Project	Te Runanga O Whaingaroa		
Group	Earthworks (Sec BB)	*Scenario*	Master Scenario
Drawn By	W. Thorburn	*Company*	Haigh Workman
Date		*File Name*	01_Static_earthworks.slmd



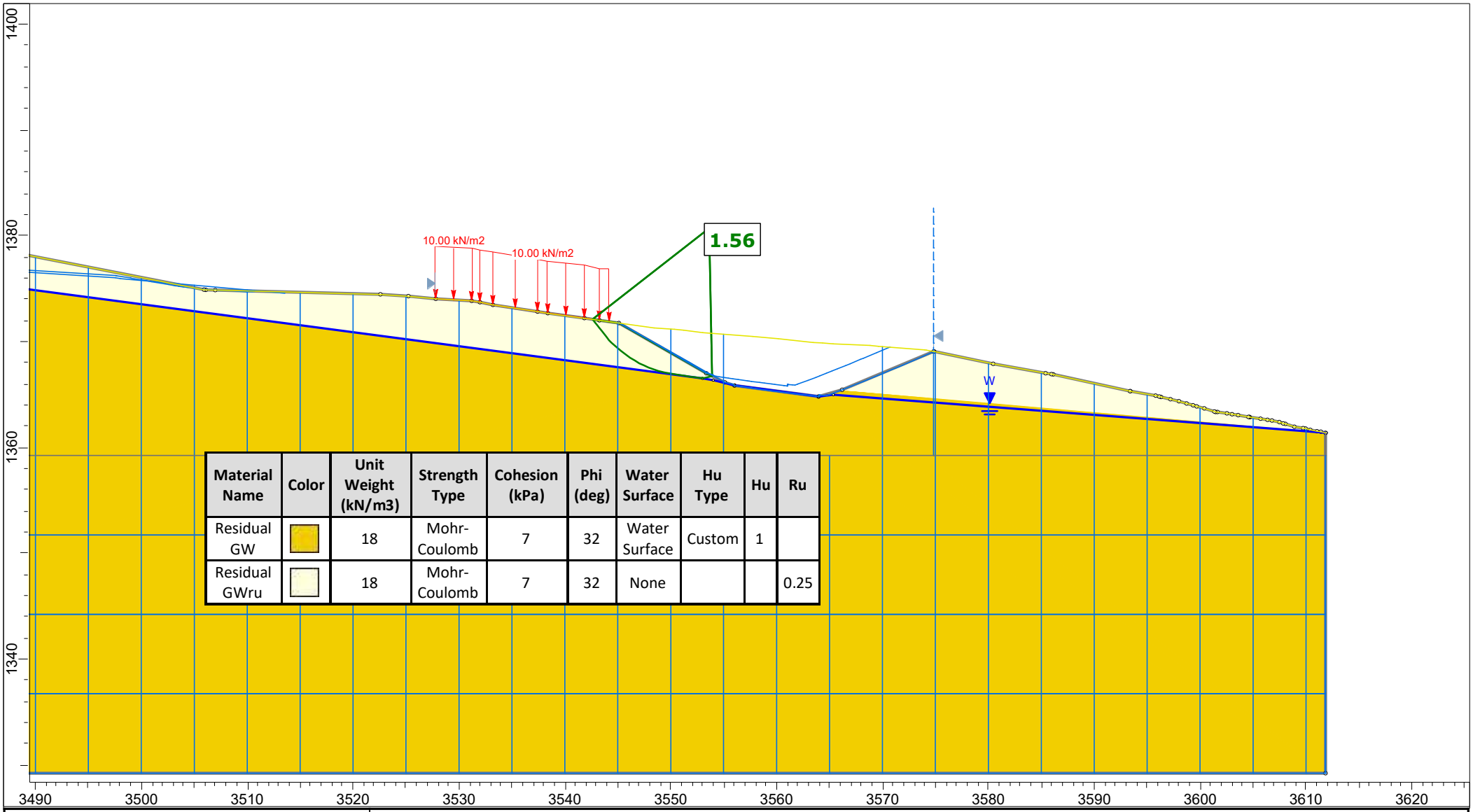
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Residual GW		18	Mohr-Coulomb	7	32	Water Surface	Custom	1	
CW Greywacke		18	Mohr-Coulomb	15	32	Water Surface	Custom	1	
HW Greywacke		20	Mohr-Coulomb	30	35	Water Surface	Custom	1	
Fill		18	Mohr-Coulomb	3	28	Water Surface	Custom	1	
Residual GWru		18	Mohr-Coulomb	7	32	None			0.25

Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (m)	Failure Mode	Pile Shear Strength (kN)	Force Orientation
Retaining Wall		Pile/ Micro Pile	Active (Method A)	1	Shear	50	Parallel to surface

rocscience

SLIDEINTERPRET 9.026

Project	Te Runanga O Whaingaroa		
Group	Earthworks (Sec BB)	*Scenario*	Master Scenario
Drawn By	W. Thorburn	*Company*	Haigh Workman
Date		*File Name*	01_Static_earthworks_seismic.slmd

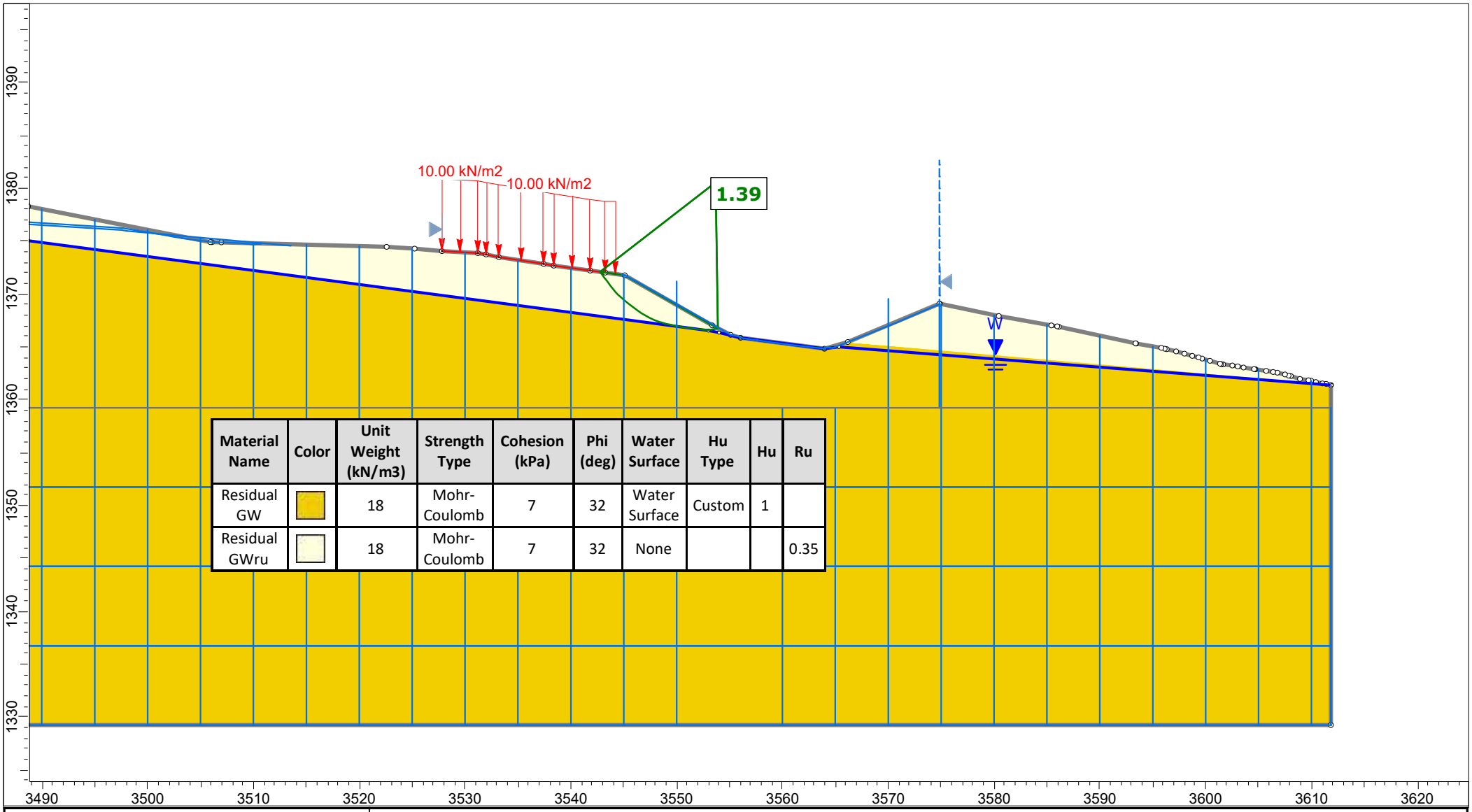


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Residual GW		18	Mohr-Coulomb	7	32	Water Surface	Custom	1	
Residual GWru		18	Mohr-Coulomb	7	32	None			0.25

rocscience

SLIDEINTERPRET 9.026

Project	Te Runanga O Whaingaroa		
Group	Earthworks (Sec CC)	*Scenario*	Master Scenario
Drawn By	W. Thorburn	*Company*	Haigh Workman
Date		*File Name*	01_Static_earthworks.slmd

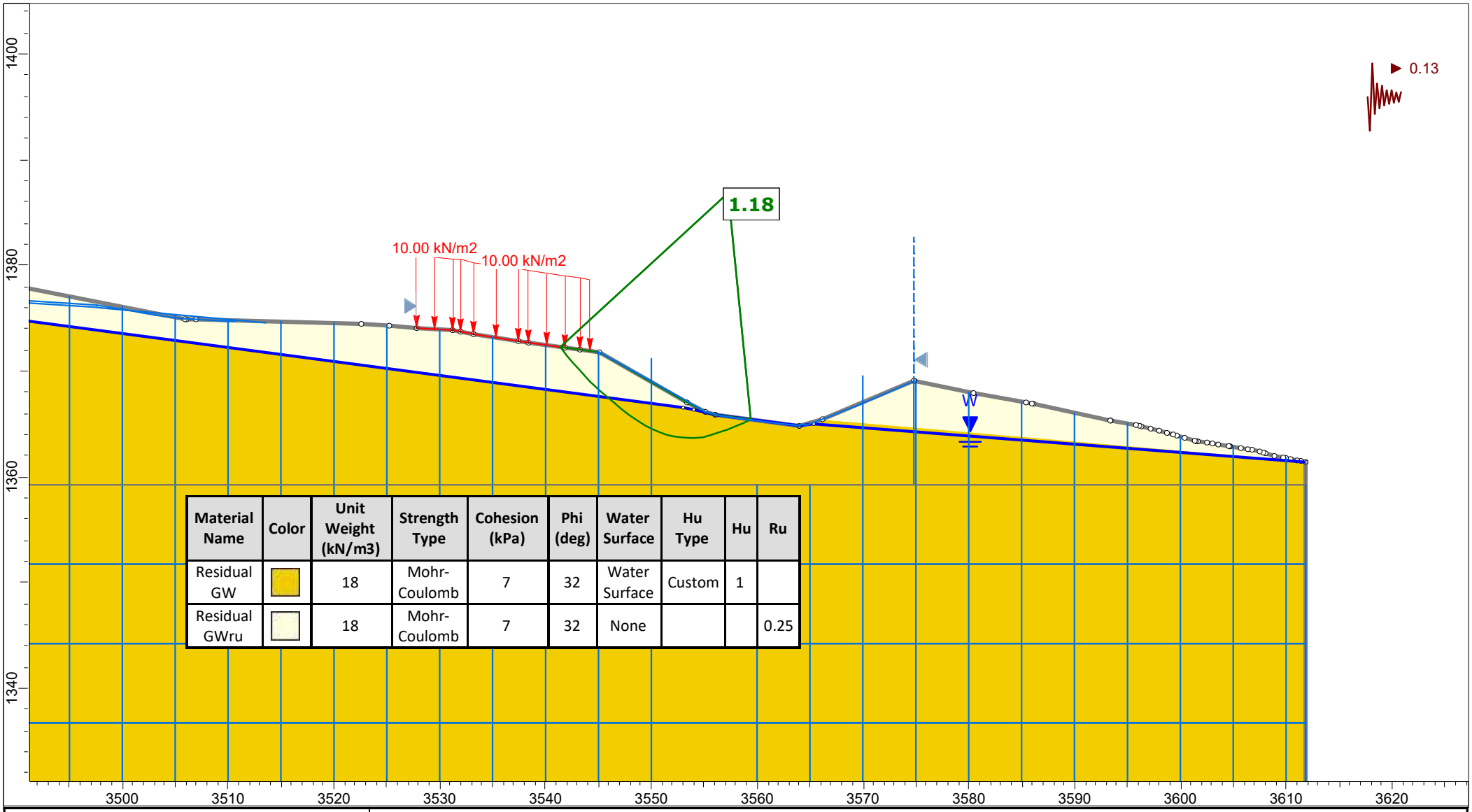


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Residual GW		18	Mohr-Coulomb	7	32	Water Surface	Custom	1	
Residual GWru		18	Mohr-Coulomb	7	32	None			0.35

rocscience

SLIDEINTERPRET 9.026

Project	Te Runanga O Whaingaroa		
Group	Earthworks (Sec CC)	*Scenario*	Master Scenario
Drawn By	W. Thorburn	*Company*	Haigh Workman
Date		*File Name*	01_Static_earthworks_elevated gwl.slmd



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Residual GW		18	Mohr-Coulomb	7	32	Water Surface	Custom	1	
Residual GWru		18	Mohr-Coulomb	7	32	None			0.25

rocscience

SLIDEINTERPRET 9.026

Project	Te Runanga O Whaingaroa		
Group	Earthworks (Sec CC)	*Scenario*	Master Scenario
Drawn By	W. Thorburn	*Company*	Haigh Workman
Date		*File Name*	01_Sesimic_earthworks.slmd

Traffic Engineering & Management Ltd
Level 2, 1b Buscomb Avenue,
Henderson, Auckland
PO Box 21-803, Henderson, Auckland 0650

Ref: 241222
29 November 2024

Chester Limited
PO Box 34405
Auckland 0746

Attn: Andrew Hill

Dear Andrew

2 & 2A ASH GROVE CIRCLE, HARURU – PROPOSED RESIDENTIAL DEVELOPMENT
VEHICLE ACCESS AND PARKING REVIEW

As requested, we have undertaken a review and assessment of traffic and transport matters pertaining to a proposed residential development at the above site in Haruru. This statement considers vehicle access for the site which is via a state highway (SH 11) and provision of vehicle and pedestrian access within the site, including vehicle manoeuvring for proposed on-site parking.

Background

The proposed development generally aligns with a subdivision consent granted by the Far North District Council (Council) in March 2021 (reference RC 2300241) with vehicle access arrangements approved by the New Zealand Transport Agency Waka Kotahi (NZTA) (reference LUD 2020-0625, dated 25 June 2021).

The granted consent allowed for 20 residential lots (the NZTA approval provides for 21 residential lots) with a single lot being access via an existing vehicle crossing on Ash Grove Circle. The remaining 19 residential lots were to be accessed via a new vehicle crossing on Puketona Road/SH 11 at a location agreed with NZTA following assessment and review. The proposed new vehicle crossing requires effective widening of available road carriageway to achieve the NZTA Diagram D layout standard.

Proposed vehicle access within the subdivision site was consented on the basis of private road and accessway use and ownership, despite the number of residential lots triggering the normal threshold for public road provision (greater than eight household equivalents).

The proposed subdivision layout consented by Council did not include specific footpath provision within the site.

The Proposal

The current proposal generally follows the consented subdivision with respect to the number of dwellings anticipated and vehicle movements generated by the development. The main differences between proposed and consented outcomes when considering traffic and transport relates effects are;

- vehicle access for the site will be via a new crossing point on SH 11 (no direct vehicle access via Ash Grove Circle);
- the geometry of the proposed private road and accessways has been adjusted to better reflect site topography and feasible build platforms; and

- a pedestrian footpath is included to provide continuous connection between Ash Grove Circle and all proposed dwellings.

The current proposal includes detail for proposed dwellings which will be a combination of two, three and four bedroom units in addition to retention of an existing dwelling. Each of the proposed new dwellings will have on-site parking for two vehicles on a formed parking pad with dedicated vehicle crossing to an adjoining section of vehicle access.

Figure 1 below shows the general site layout as taken from Drawings Sheet 110, prepared by Chester Limited.

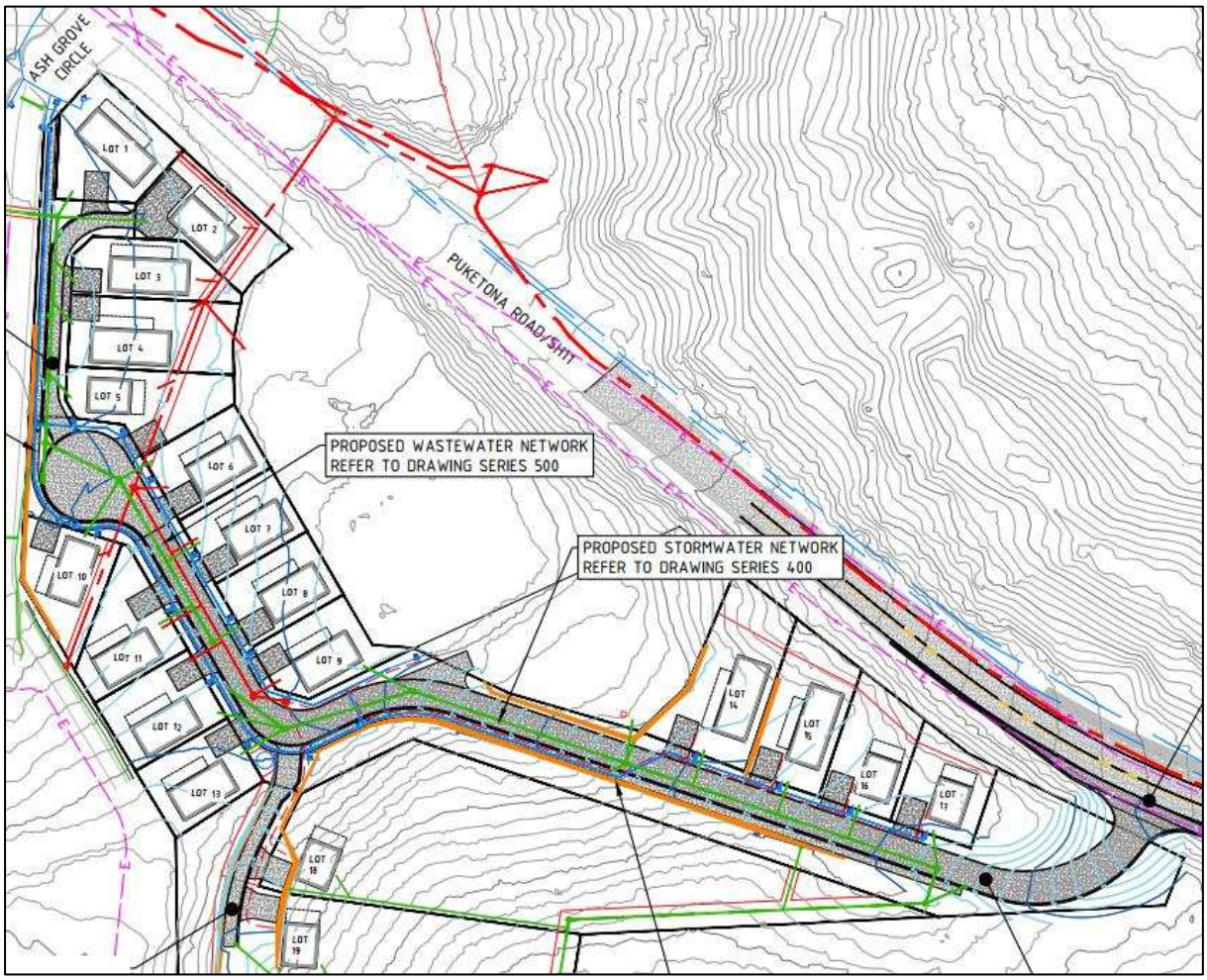


Figure 1: Proposed site plan

Site Access (SH 11)

The proposed site access will be via SH 11 at a location subject to agreement with NZTA. The general layout and design of the proposed access is shown on Drawing Sheet 703 of the Civil Design prepared by Chester Limited.

The proposed works to form the access include realignment of the existing traffic lanes and centre line to provide for effective widening on the northern side of the carriageway to achieve intended 'Diagram D' operation for eastbound traffic passing a vehicle turning right into the site.

We note the following points with respect to the proposed site access on SH 11.

- The underlying agreement with NZTA allows for up to 20 residential lots to access the site via the proposed new access/crossing point. General traffic operation on SH 11 since the NZTA approval confirmation is largely unchanged with similar traffic volumes of circa. 5,200 vehicles per day[1] and no changes to posted speed limits along the site frontage[2].

- There are no reported crashes on SH 11 in the near vicinity of the proposed site access between the previous assessment period of 2020/2021 and the time of writing.

- The general effects of traffic generated by the proposal can be considered to be anticipated through the underlying consent for a 20-lot residential subdivision. Notwithstanding this, we note that the proposal will exceed relevant permitted (20 vehicle trips) and discretionary (40 vehicle trips) values stated in Table 15.1.6A.1 of the Far North District Plan.

- The proposed dwellings with two on-site parking spaces each can be expected to generate variable rates of vehicle movements depending on dwelling size and residents. Average rates in the order of six to eight vehicle trips per day and up to one trip per hour during peak periods are considered appropriate for assessment purposes. A resulting peak hour generation of up to 20 vehicle trips per hour, split by direction of travel on SH11 and inbound/outbound movement can comfortably be accommodated by the proposed access arrangements.

- The proposed access design allows for variable vertical grading through the transition from the SH 11 carriageway into the site with suitable entry platform grades provided. The design long section for the proposed access is shown on Drawing Sheet 701 of the Chester Civil Design.

- We have checked vehicle tracking for the proposed vehicle crossing/intersection on SH 11. Attached tracking diagrams (sheets 7 and 8) show a large rigid truck (LRT) turning left to and from SH 11 while passing an opposing B85 design car with acceptable clearances between vehicles.

Site Access (internal)

As noted above, internal vehicle access will be a combination of formed roads and accessways which will be maintained on a private basis. Proposed road formation will extend from the site access at SH 11 to a turning circle with continuous provision of two-way operation. The proposed internal road includes curve widening where necessary to maintain two-way operation for cars and light vehicles.

Design detail for proposed internal access is provided in the Civil Design prepared by Chester with drawing sheets 700 to 702 for road formation and sheets 800 to 802 for common access ways (CAWs) most relevant to consideration of traffic and transport matters.
The following points are considered relevant with respect to the proposed internal access design.

[1] State Highway traffic monitoring database; continuous count station at site 01100027, to west of site

[2] 80km/h at proposed access location, transitioning to 60km/h between the access and Ash Grove Circle

- The proposed private road carriageway will generally be 6.0 metres wide, kerb to kerb. The proposed width aligns with the minimum width shown in Appendix 3B-2 of the District Plan for public roads, albeit the road type category applies to rural areas. The site can be considered urban for which the required minimum road carriageway width is 6.5 metres for public roads. The proposed carriageway width of 6.0 metres is considered suitable for normal traffic operation and two-way movement within a residential cul-de-sac.

- Curve widening where necessary and a standard residential turning circle provides for acceptable access and on-site turning for service vehicles. Localised yielding may be necessary through the horizontal curves at Chainages 170 and 200 depending on vehicle size. This outcome is considered acceptable given low frequency of service vehicle access and similarly low incidence of opposing vehicles meeting at the horizontal curves.

- The formed width for two proposed CAWs will be at least 3.0 metres which aligns with minimum requirements for up to four dwellings or household equivalents. CAW1 will serve four dwellings and CAW 2 will serve two dwellings.

- The proposed private road will have two short sections where the design vertical grade exceeds a standard upper value of 12.5%. The two relevant sections are between Chainages 13 and 36 (20%) and between Chainages 120 and 152 (17.6%). These sections are clear of proposed access crossings for individual lots with the steeper road sections providing for appropriate manoeuvring grades for proposed parking pads. The proposed vertical grading along the private roads is considered acceptable for residential activity.

- The proposed vertical grading for the two CAWs will following variable grading with a maximum value less than the permitted maximum of 25% for residential access. The maximum design grade of 22% on CAW2 is clear of vehicle crossings for individual lots. The proposed vertical grading along CAW1 supports vehicle manoeuvring to and from proposed parking pads.

<u>On-site Parking</u>

Each of the proposed dwellings will have a formed parking pad for two cars or light vehicles. This level of parking provision aligns with requirements for standard residential units as defined in Appendix 3C of the District Plan.

Proposed parking pads will be formed to a width of at least 5.0 metres and a typical depth of 6.0 metres within individual lot boundaries. Parking spaces that access directly onto the proposed private road will have effective manoeuvring depth of at least 8.5 metres when allowing for the carriageway width and berm and/or footpath along the property frontage. All parking spaces that access onto the private road comply with dimensional requirements prescribed for regular users in Appendix 3D of the District Plan.

Some of the proposed parking spaces that connect onto private accessways will have limited manoeuvring depth due to the narrower access width. Where necessary, the formed parking pad has been increased in width to compensate for reduced manoeuvring depth; lots 18 and 19 have 5.4 metre wide parking pads for effective parking space width of 2.7 metres.

We have undertaken vehicle tracking checks for parking spaces that manoeuvring onto the private accessways. Attached vehicle tracking diagrams (sheets 1 to 6) show assessed tracking checks for

proposed lots 1 to 4, 18 and 19. The B85 design car was adopted for tracking checks with a clearance of at least 300mm maintained outside of the manoeuvring vehicle.

Conclusion

The proposal will establish 20 residential lots with 19 new dwellings. The proposed development generally aligns with an underlying subdivision consent for the site which was granted approval from Council and NZTA. The proposed vehicle access for the site on SH 11 is unchanged from the previously approved location and intended formation with traffic movements at the access point similarly in line with anticipated outcomes.

The proposed internal access arrangements are considered suitable for residential activity. The majority of vehicle access length will be along a formed road with provision for two-way operation. Sections of single lane accessway will provide access for a defined number of dwellings. All internal access will be privately owned and maintained.

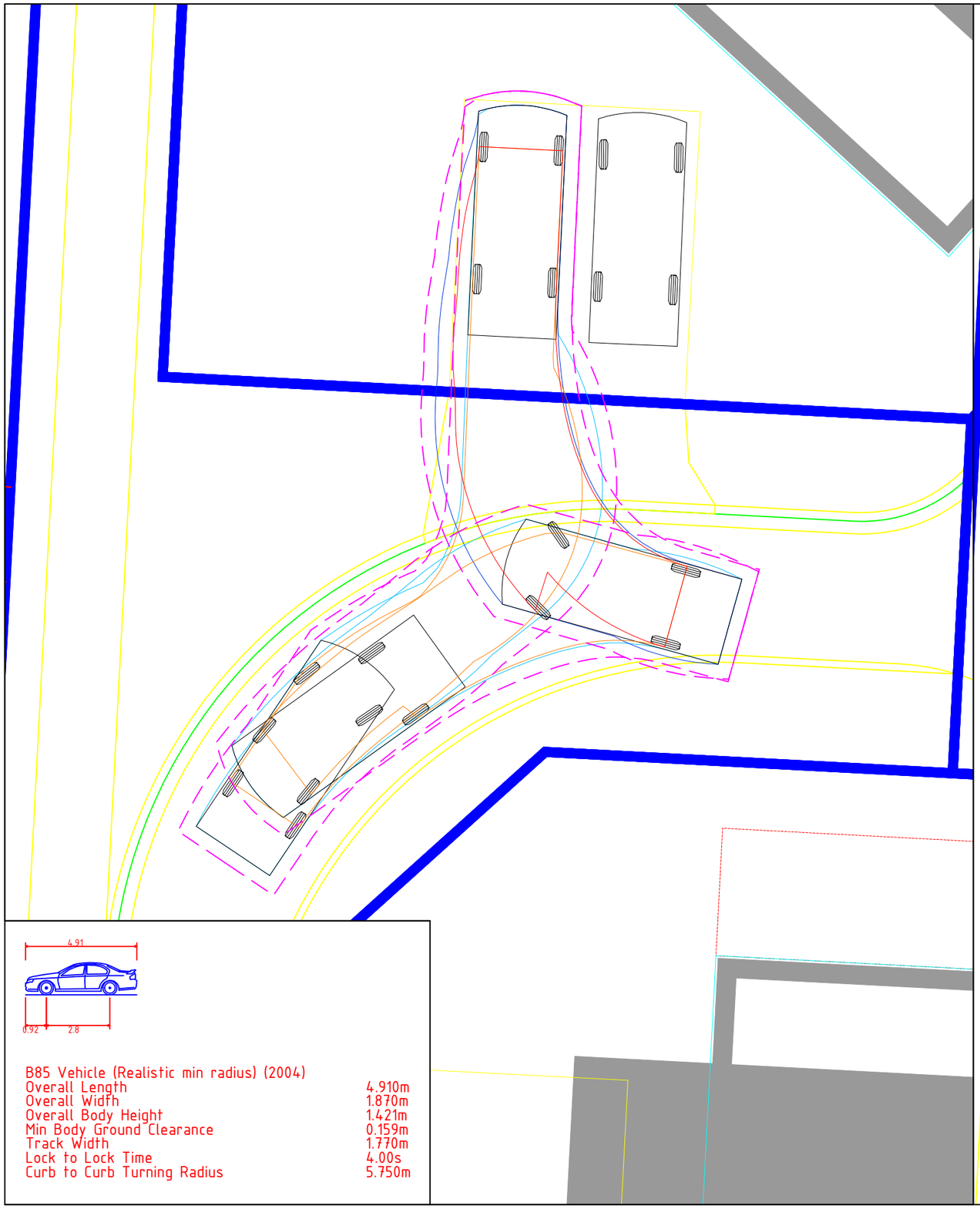
All proposed dwellings will have a formed pad for two on-site parking spaces. Vehicle manoeuvring will typically be partly within adjacent sections of road or accessway with sufficient space available for effective residential parking.

We trust the above provides sufficient detail for your immediate needs. Should you wish to discuss any matter in greater detail, do not hesitate contacting the undersigned.

Yours faithfully
TRAFFIC ENGINEERING & MANAGEMENT LTD

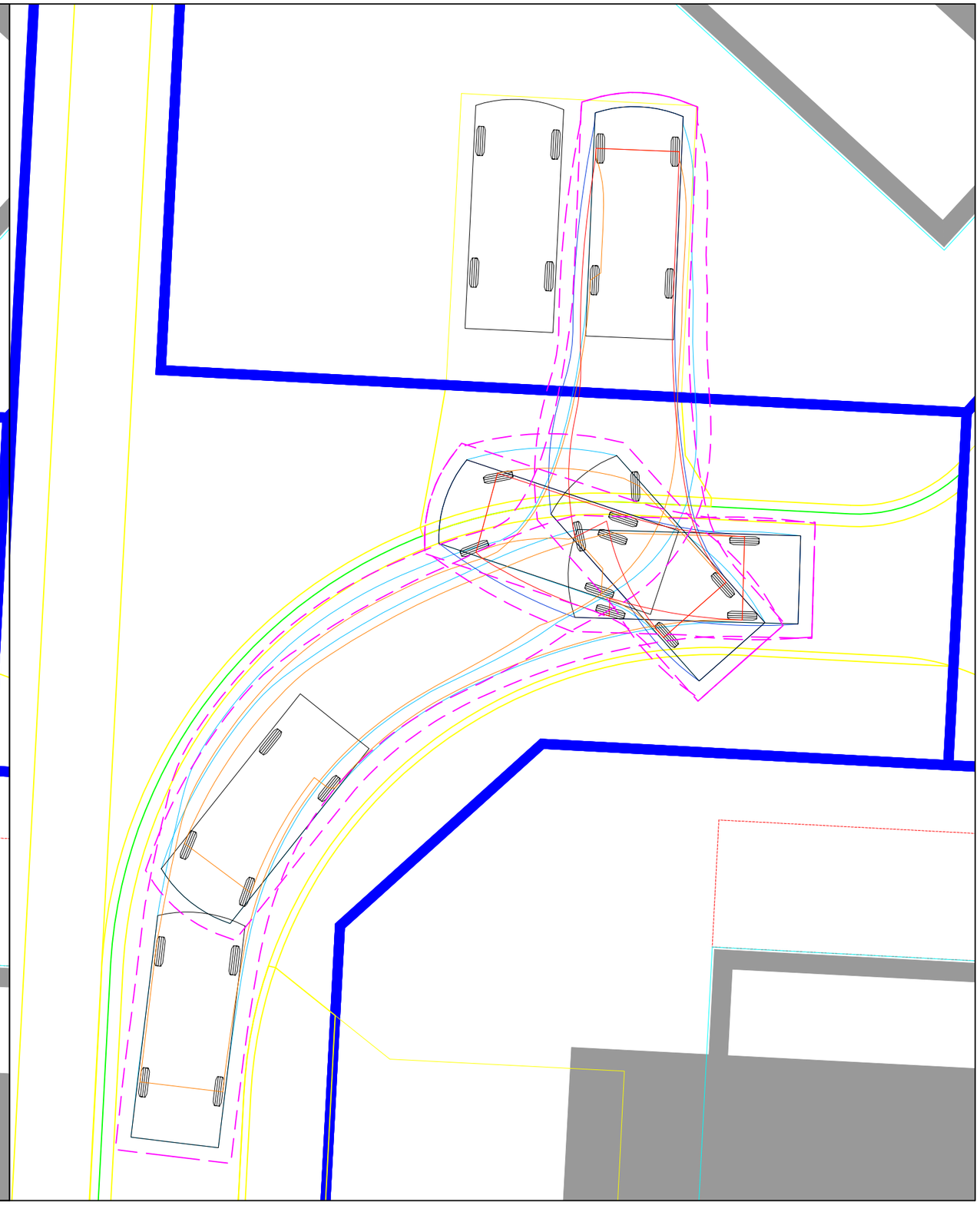
David Philip

Attachments – Vehicle tracking diagrams



B85 Vehicle (Realistic min radius) (2004)

Overall Length	4.910m
Overall Width	1.870m
Overall Body Height	1.421m
Min Body Ground Clearance	0.159m
Track Width	1.770m
Lock to Lock Time	4.00s
Curb to Curb Turning Radius	5.750m



Traffic Engineering & Management Ltd.

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NOTES

PROJECT
2 & 2A ASH GROVE CIRCLE, HARURU

STATUS
VEHICLE TRACKING ANALYSIS

DATE
29/11/2024

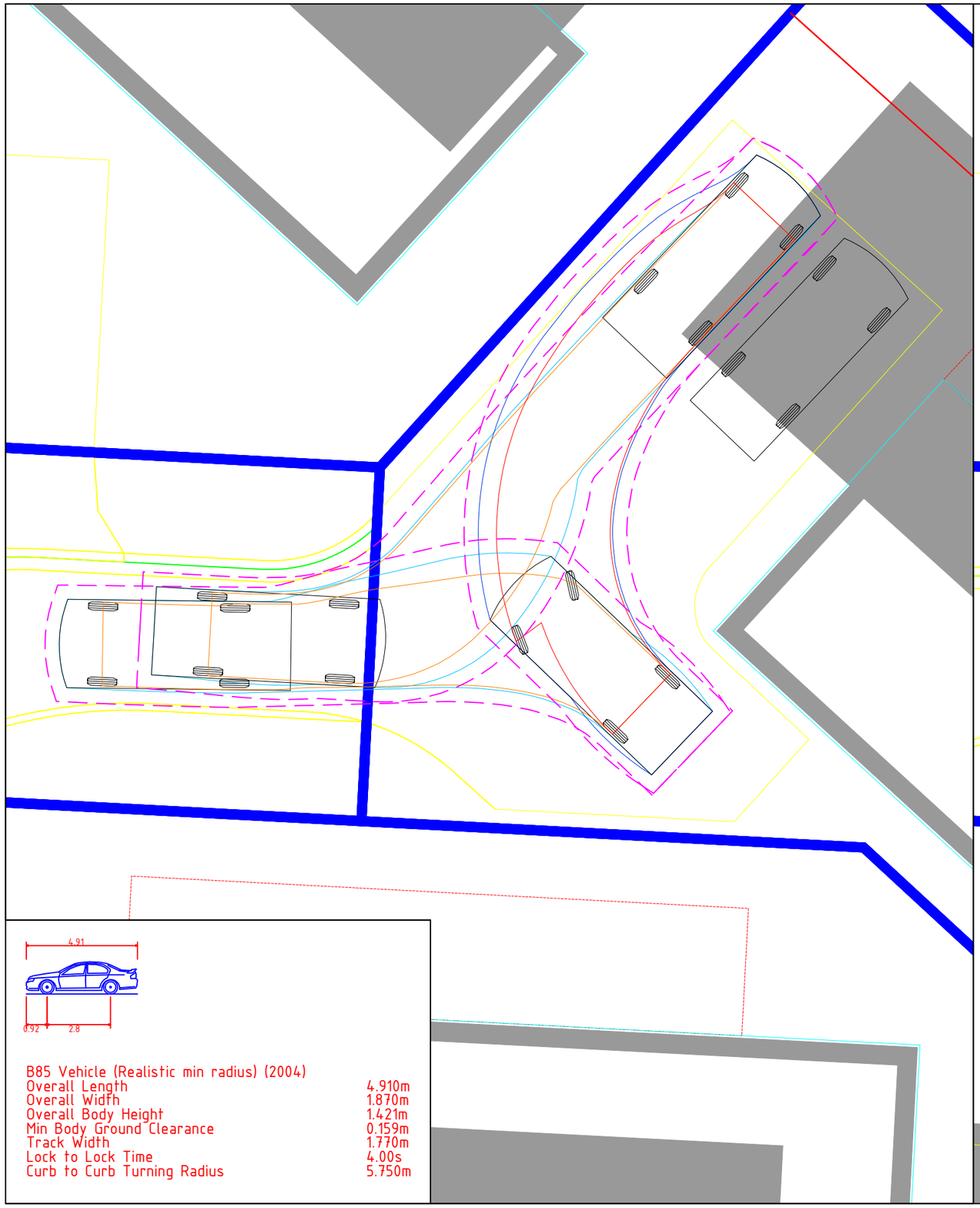
DRAWING TITLE
LOT 1 - B85 CAR

PROJECT NO.
241237

SCALE
1:100
A3

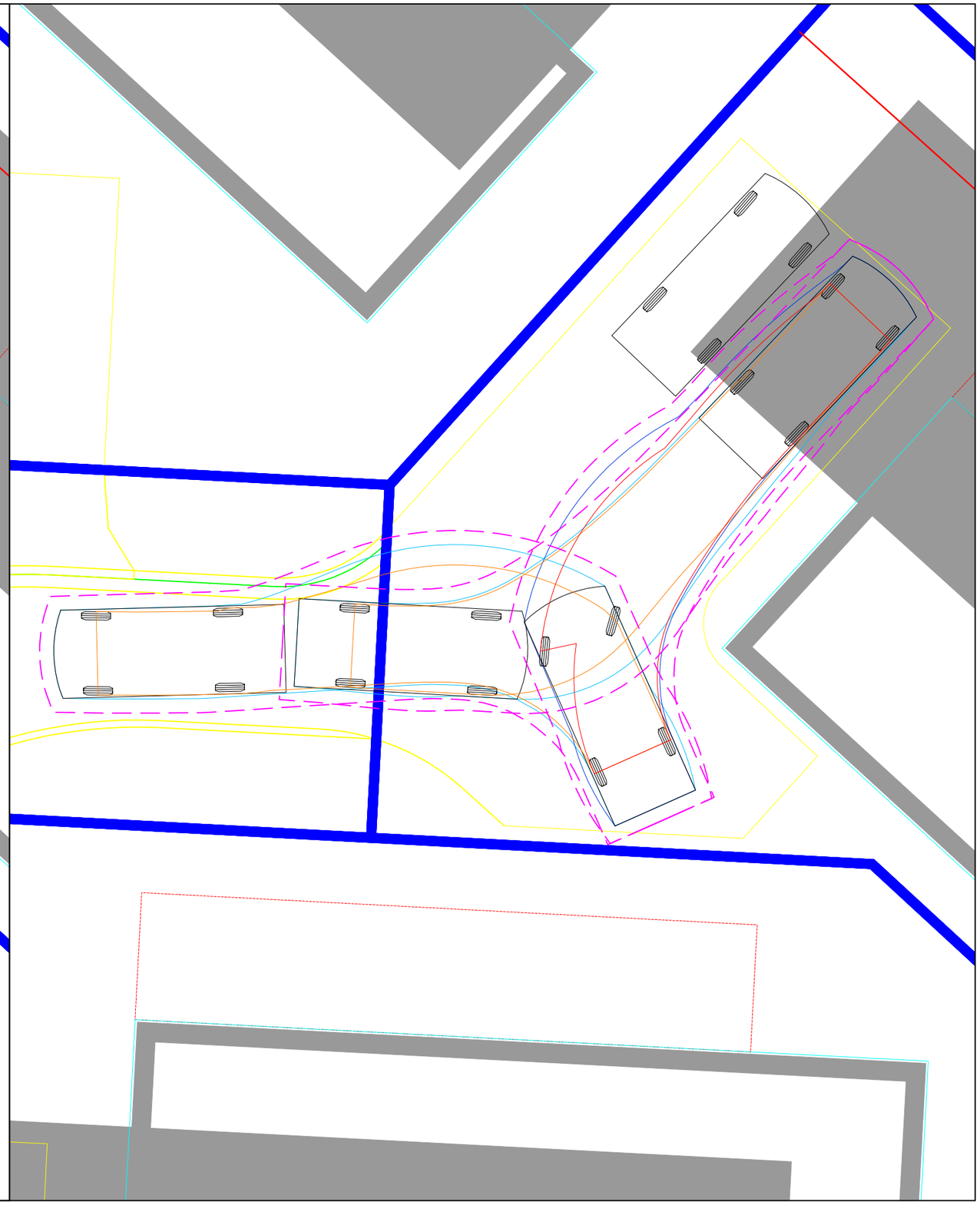
SHEET
1

REV
A



B85 Vehicle (Realistic min radius) (2004)

Overall Length	4.910m
Overall Width	1.870m
Overall Body Height	1.421m
Min Body Ground Clearance	0.159m
Track Width	1.770m
Lock to Lock Time	4.00s
Curb to Curb Turning Radius	5.750m



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NOTES

PROJECT: 2 & 2A ASH GROVE CIRCLE, HARURU

STATUS: VEHICLE TRACKING ANALYSIS

DATE: 29/11/2024

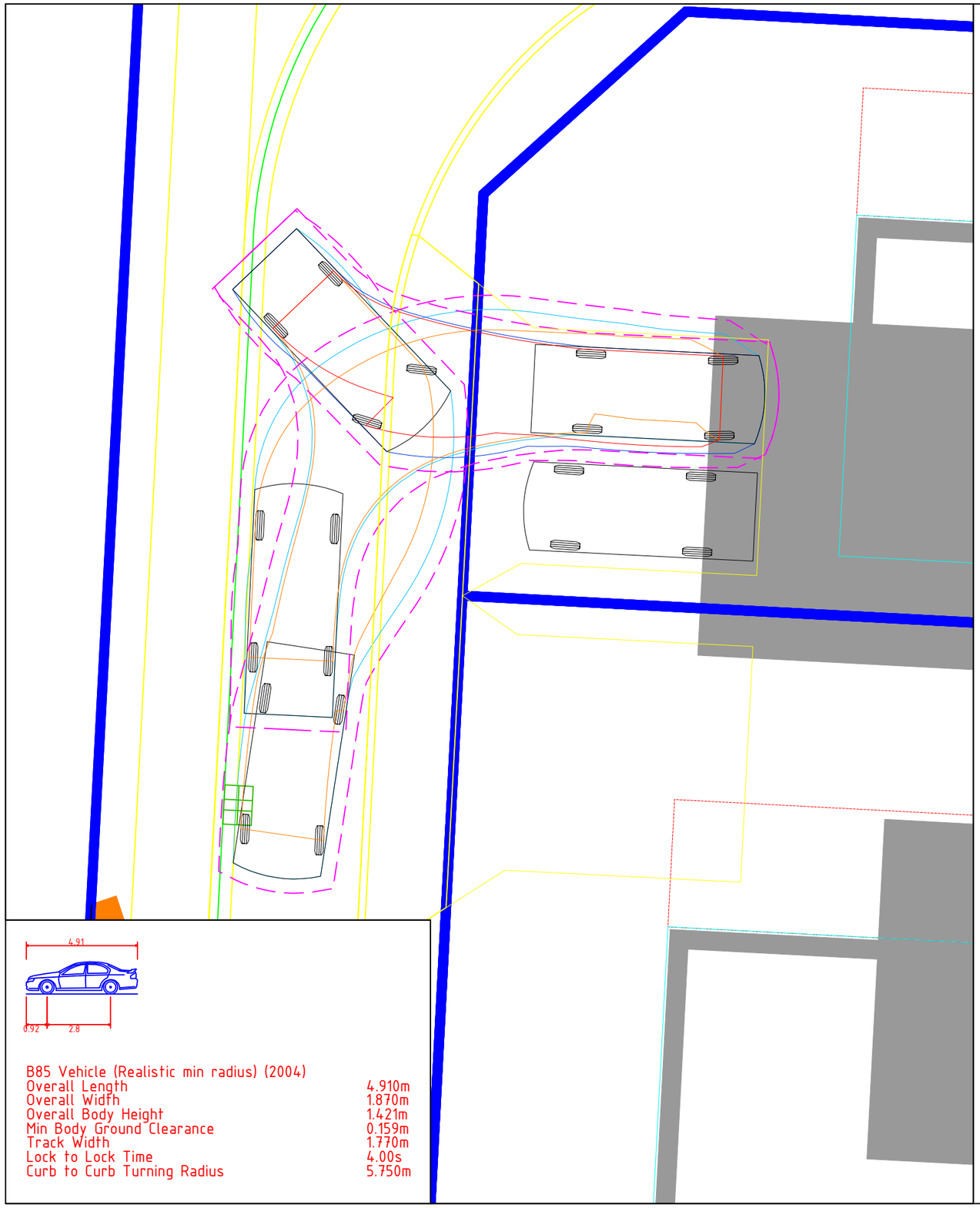
DRAWING TITLE: LOT 2 - B85 CAR

PROJECT NO.: 241237

SCALE: 1:100 A3

SHEET: 2

REV: A



B85 Vehicle (Realistic min radius) (2004)

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Min Body Ground Clearance	0.159m
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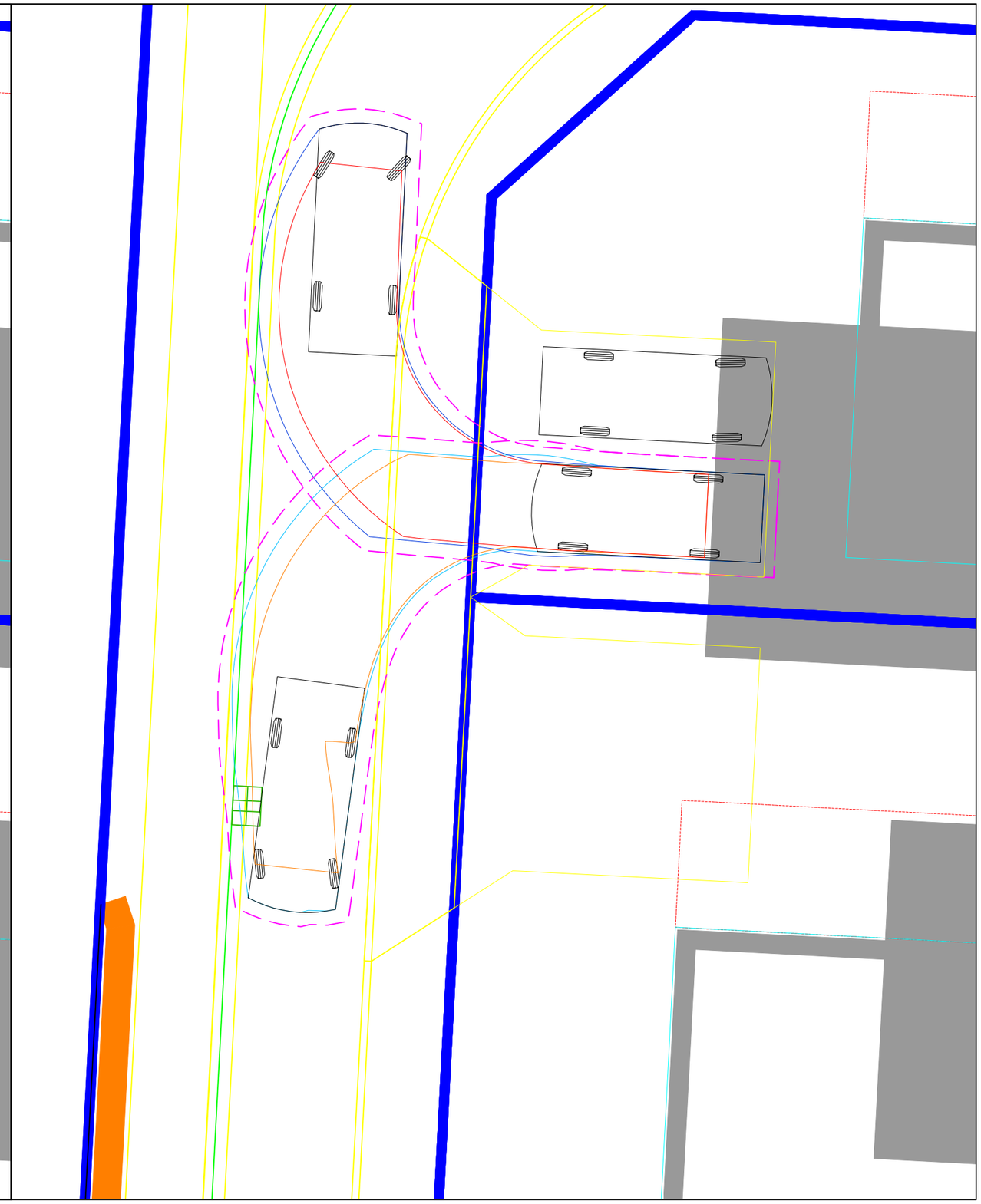

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NOTES

PROJECT: 2 & 2A ASH GROVE CIRCLE, HARURU

STATUS: VEHICLE TRACKING ANALYSIS

DATE: 29/11/2024

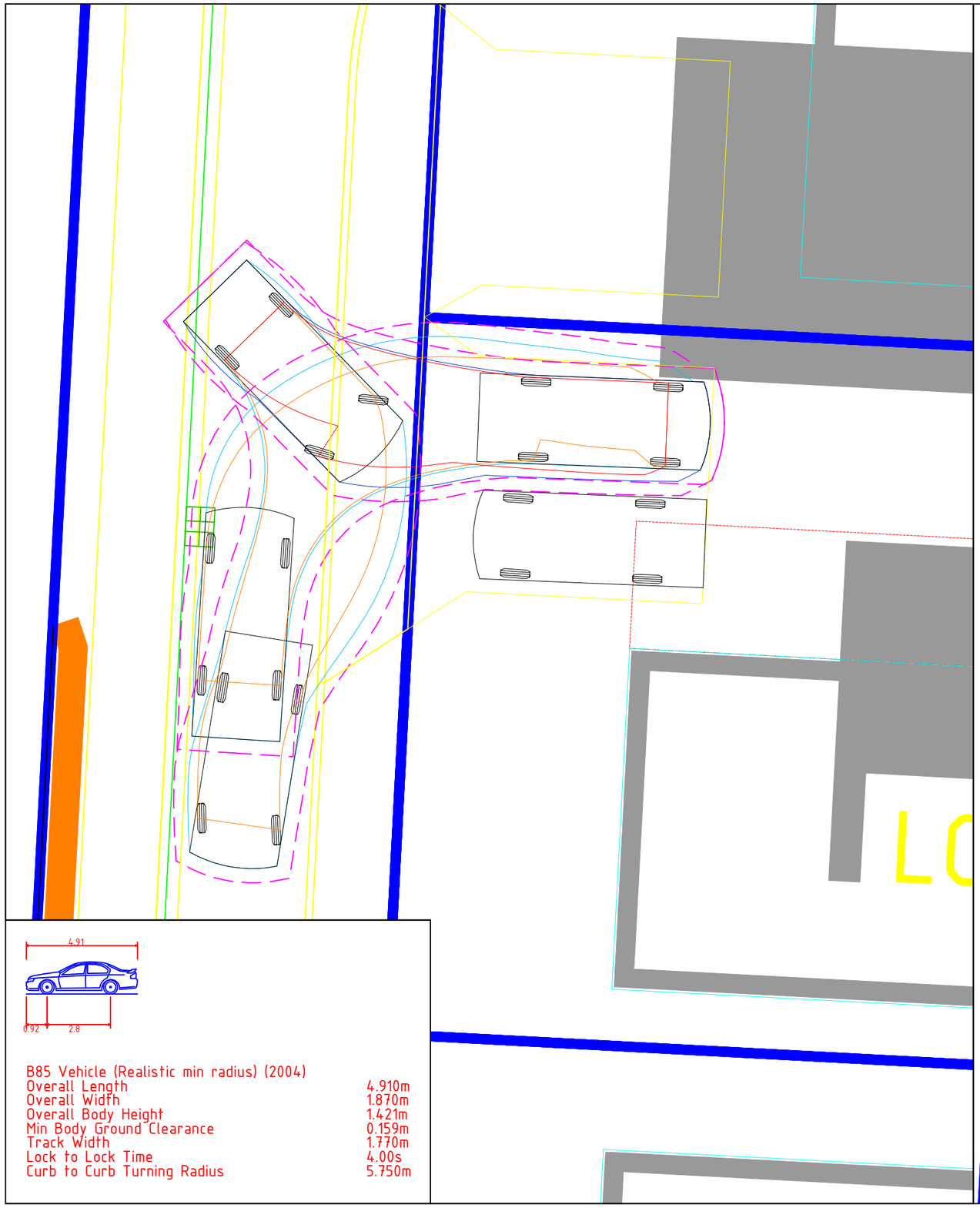
DRAWING TITLE: LOT 3 - B85 CAR

PROJECT NO.: 241237

SCALE: 1:100 A3

SHEET: 3

REV: A



B85 Vehicle (Realistic min radius) (2004)

Overall Length	4.910m
Overall Width	1.870m
Overall Body Height	1.421m
Min Body Ground Clearance	0.159m
Track Width	1.770m
Lock to Lock Time	4.00s
Curb to Curb Turning Radius	5.750m

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NOTES

PROJECT
2 & 2A ASH GROVE CIRCLE, HARURU

STATUS
VEHICLE TRACKING ANALYSIS

DATE
29/11/2024

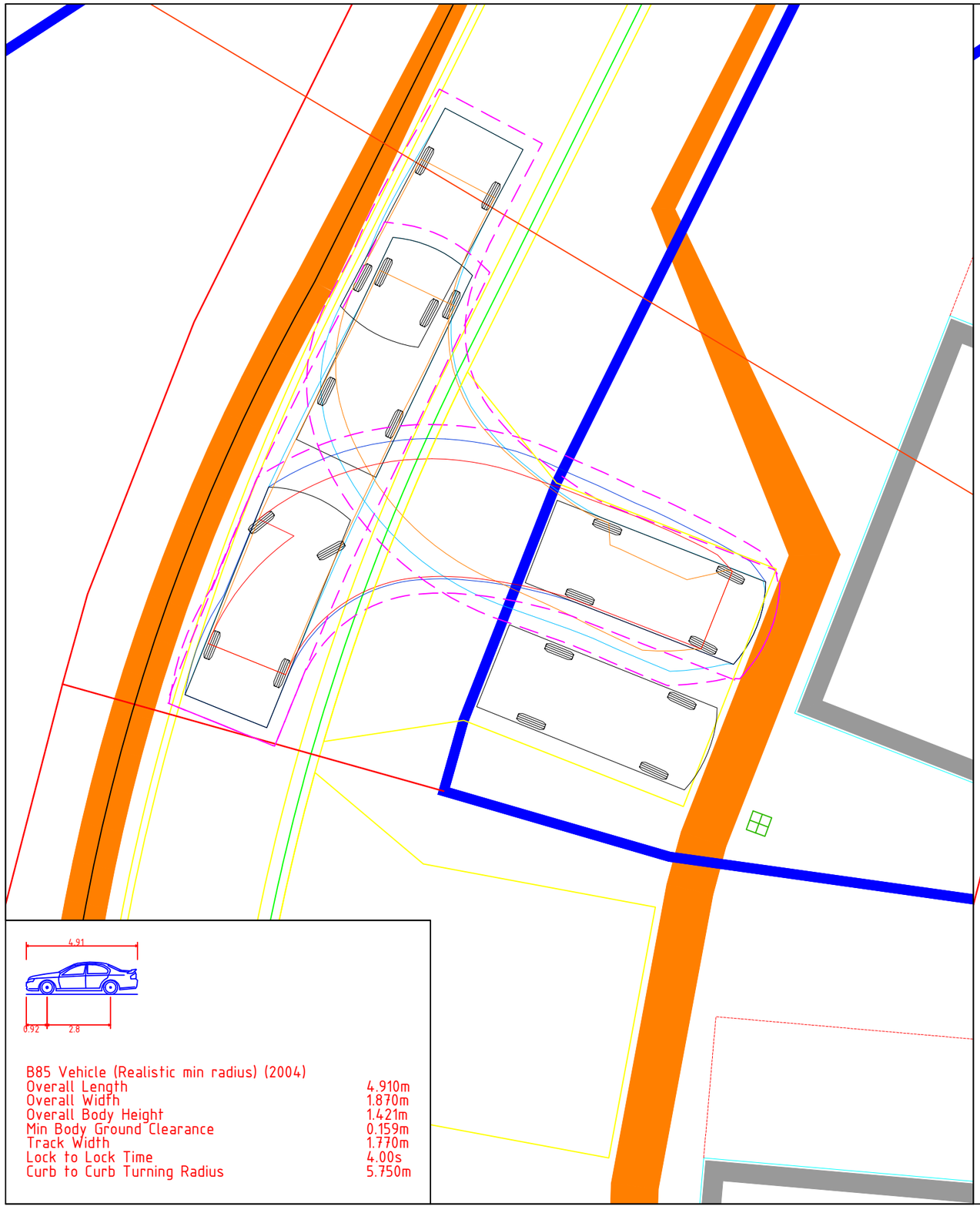
DRAWING TITLE
LOT 4 - B85 CAR

PROJECT NO.
241237

SCALE
1:100
A3

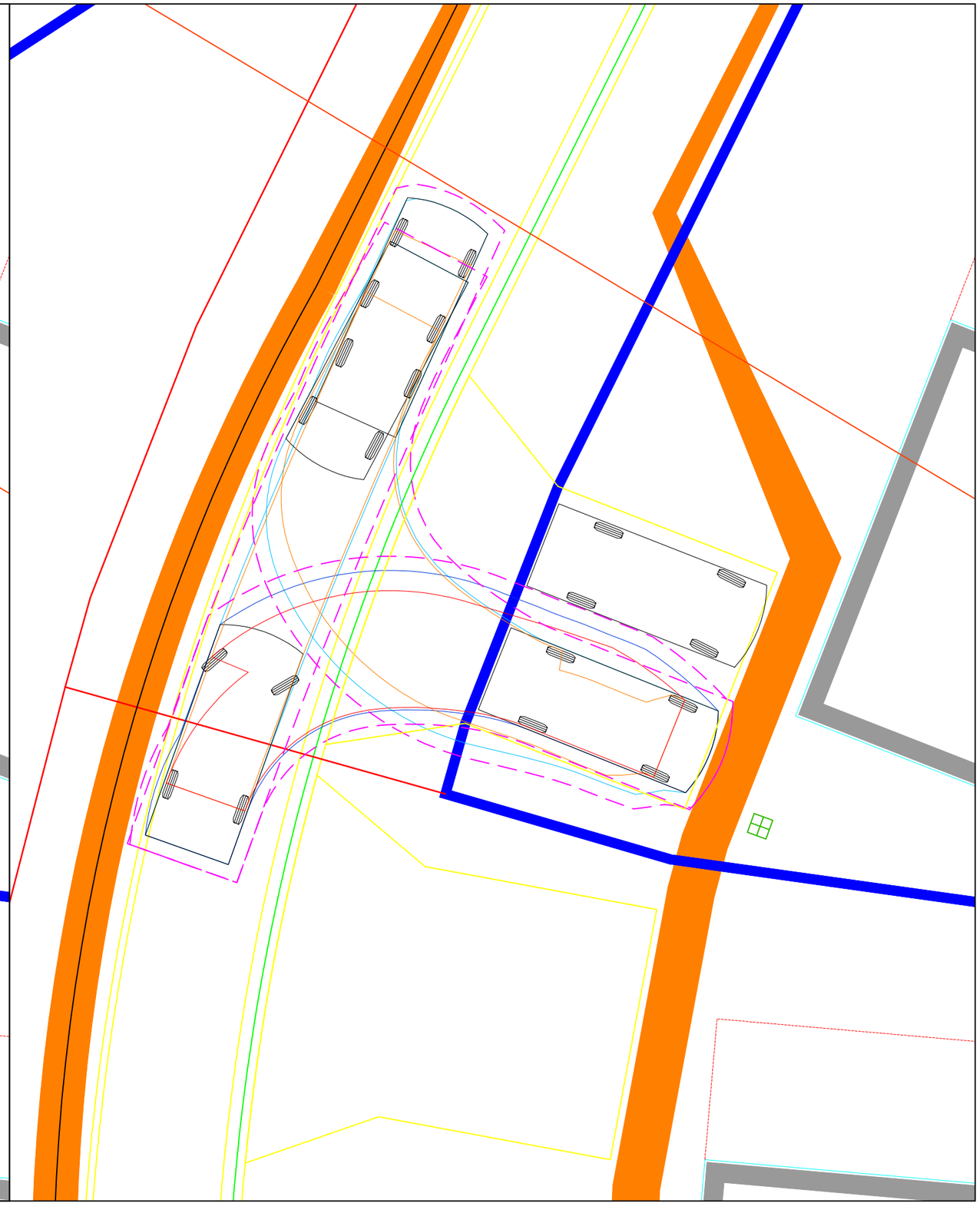
SHEET
4

REV
A



B85 Vehicle (Realistic min radius) (2004)

Overall Length	4.910m
Overall Width	1.870m
Overall Body Height	1.421m
Min Body Ground Clearance	0.159m
Track Width	1.770m
Lock to Lock Time	4.00s
Curb to Curb Turning Radius	5.750m



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NOTES

PROJECT
2 & 2A ASH GROVE CIRCLE, HARURU

STATUS
VEHICLE TRACKING ANALYSIS

DATE
29/11/2024

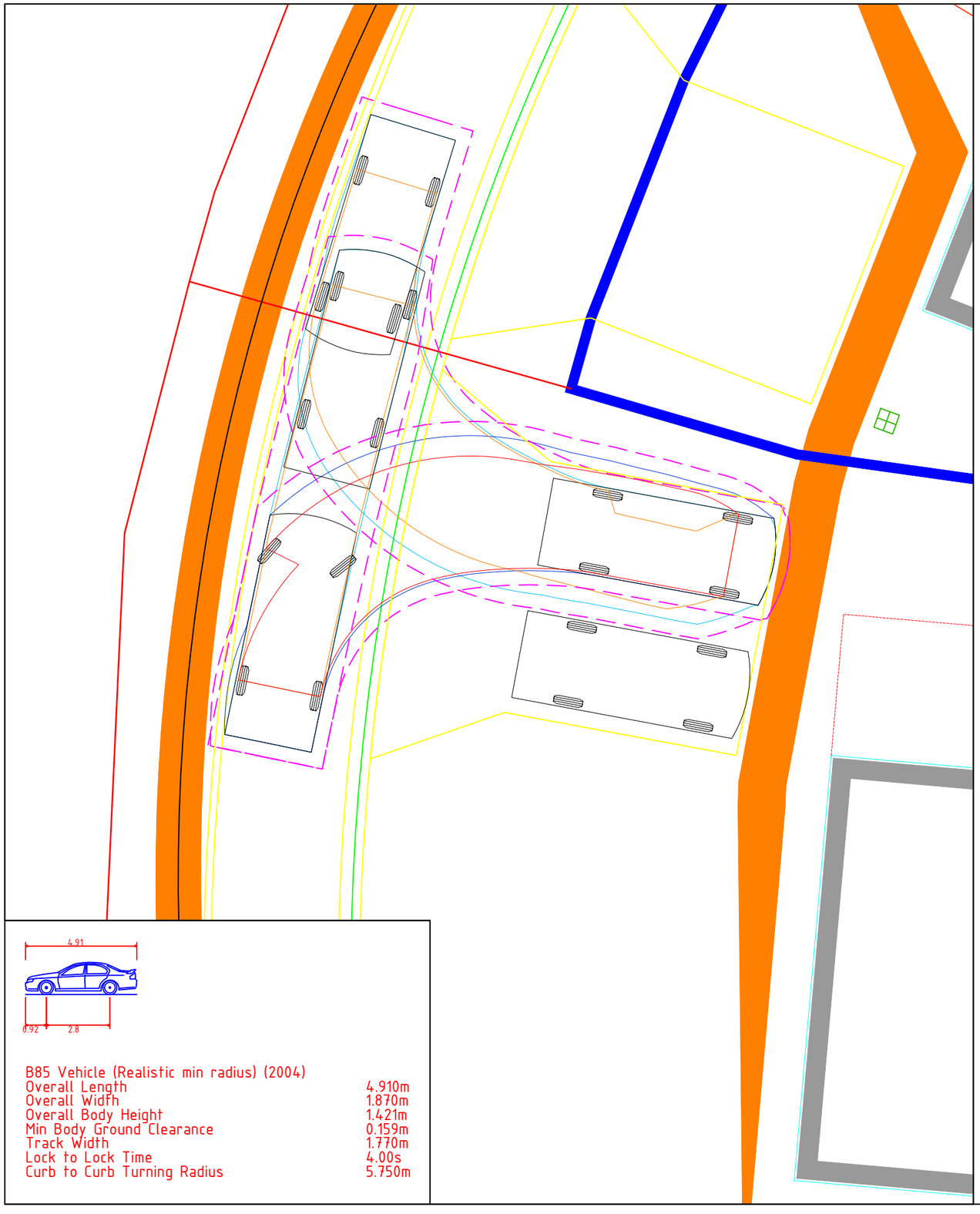
DRAWING TITLE
LOT 18 - B85 CAR

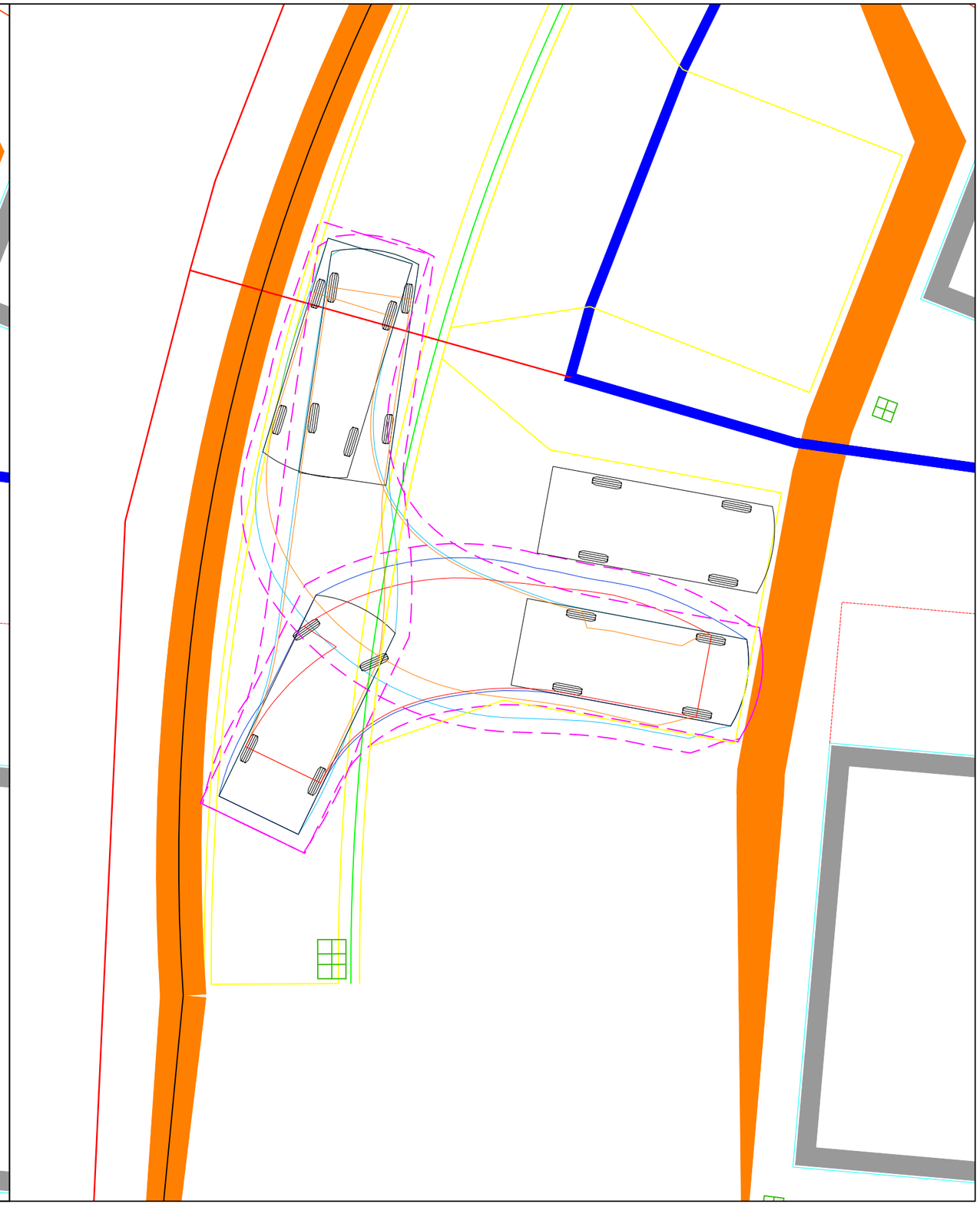
PROJECT NO.
241237

SCALE
1:100
A3

SHEET
5

REV
A





B85 Vehicle (Realistic min radius) (2004)	
Overall Length	4.910m
Overall Width	1.870m
Overall Body Height	1.421m
Min Body Ground Clearance	0.159m
Track Width	1.770m
Lock to Lock Time	4.00s
Curb to Curb Turning Radius	5.750m

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NOTES

PROJECT
2 & 2A ASH GROVE CIRCLE, HARURU

STATUS
VEHICLE TRACKING ANALYSIS

DATE
29/11/2024

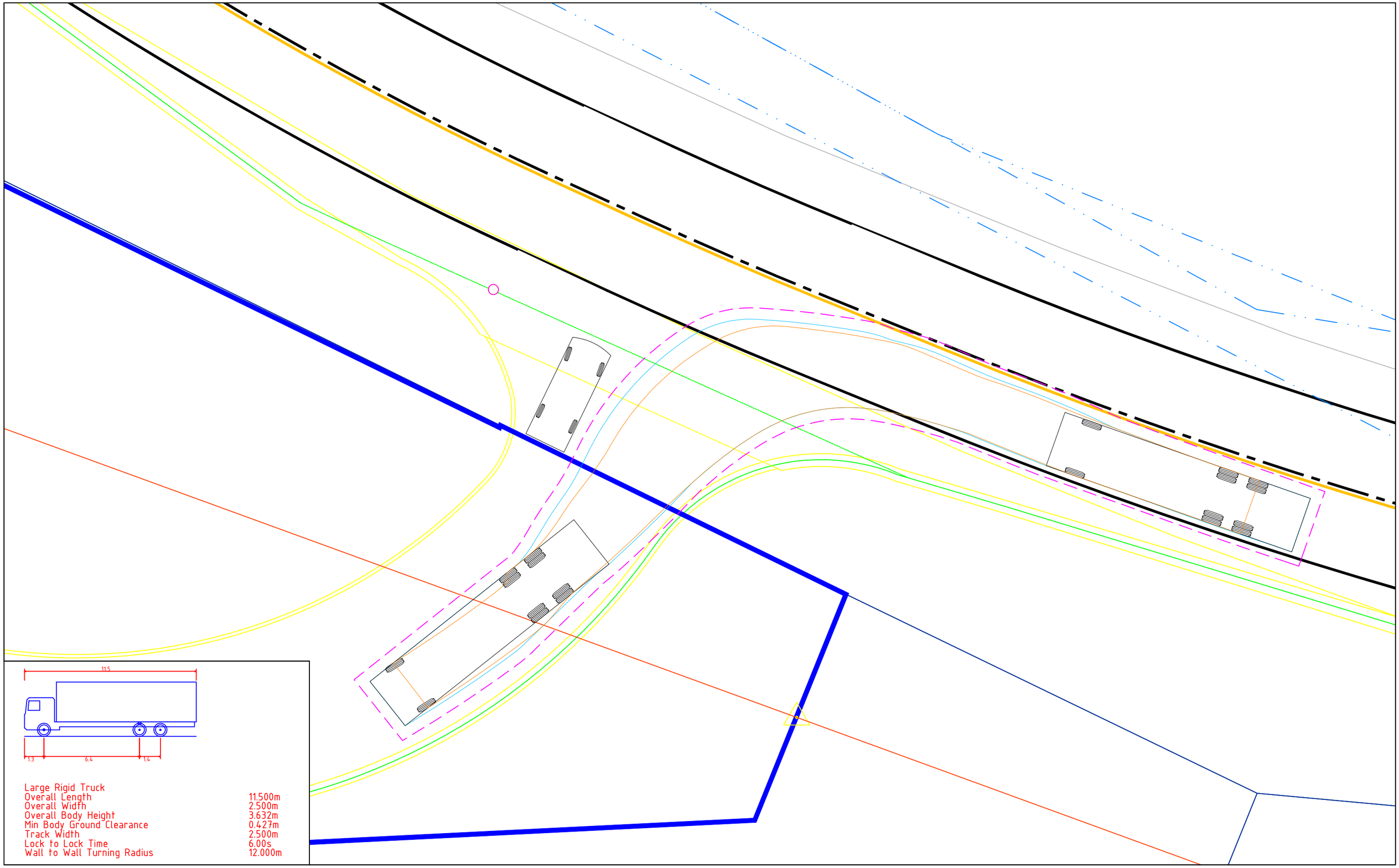
DRAWING TITLE
LOT 19 - B85 CAR

PROJECT NO.
241237

SCALE
1:100
A3

SHEET
6

REV
A



Large Rigid Truck	
Overall Length	11.500m
Overall Width	2.500m
Overall Body Height	3.632m
Min Body Ground Clearance	0.427m
Track Width	2.500m
Lock to Lock Time	6.00s
Wall to Wall Turning Radius	12.000m

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NOTES

PROJECT
2 & 2A ASH GROVE CIRCLE, HARURU

STATUS
VEHICLE TRACKING ANALYSIS

DATE
29/11/2024

DRAWING TITLE
11.5 METRE LARGE RIGID TRUCK - LEFT IN

PROJECT NO.
241237

SCALE
1:100
A3

SHEET
7

REV
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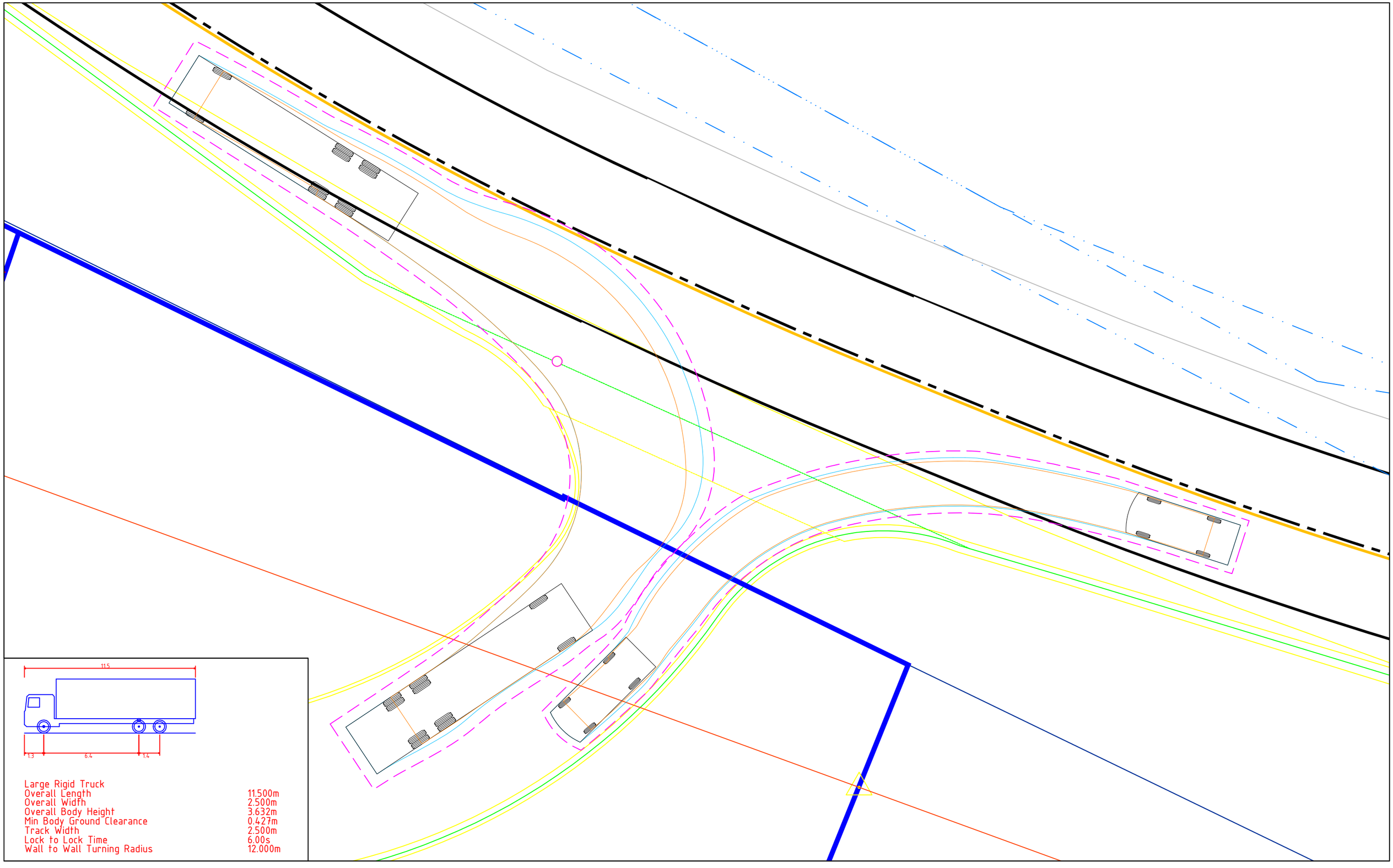

Large Rigid Truck

Overall Length	11.500m
Overall Width	2.500m
Overall Body Height	3.632m
Min Body Ground Clearance	0.427m
Track Width	2.500m
Lock to Lock Time	6.00s
Wall to Wall Turning Radius	12.000m

team
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NOTES

PROJECT
2 & 2A ASH GROVE CIRCLE, HARURU

STATUS
VEHICLE TRACKING ANALYSIS

DATE
29/11/2024

DRAWING TITLE
11.5 METRE LARGE RIGID TRUCK - LEFT OUT

PROJECT NO.
241237

SCALE
1:100
A3

SHEET
8

REV
A

Ecoprojects Consulting Network Ltd trading as
Ecoprojects Consulting Collaborative
landscape architecture, ecology, site development planning,
Landscape & ecological assessments as required by regulatory authorities
Specialists in assisted indigenous regeneration
Whangarei & Hokianga
0274 738 216 (Hedley Evans - Director)
landscape architect, landscape planner, site planner
ecopro@xtra.co.nz
30 November 2024

ADDENDUM: Ecological assessment update for redesigned subdivision, 2 Ash Grove Circle, Haruru, Northland.

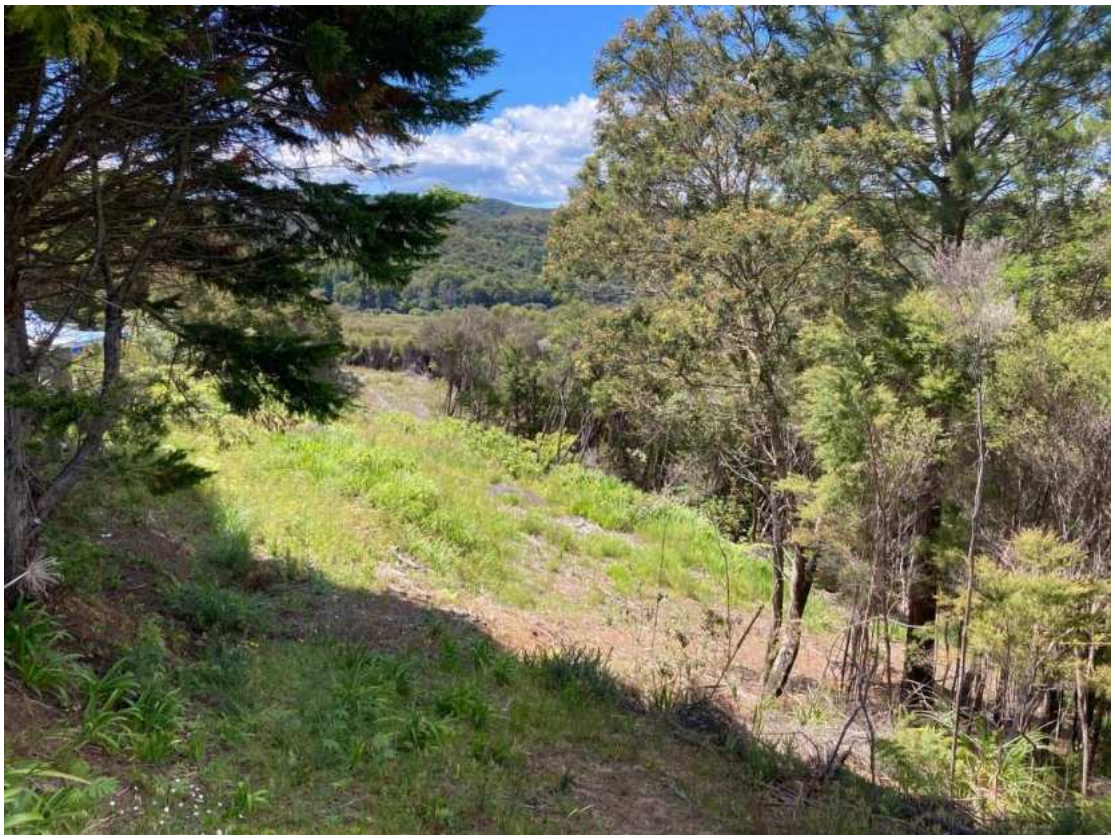

Photo 28 November 2021. View from high ground across a clear area on the site. The balance of the site in the western and southern portion of the property was at the time of the photo and still is, under canopy. See glimpse of the Kaipatiki Estuary near the top left corner of the photo and hills on the southeast side of the estuary in the background.

Report to:
Andrew Hill
Principal Planner
Chester
land development & infrastructure | engineering | surveying | planning | project management
+64 021 825 627
andrew.h@chester.co.nz

Client:
Te Rūnanga O Whaingaroa
Care of Scope

Report prepared by:
Terry Kennedy, ecologist, *National Diploma in Sustainable Rural Development.*
Ecoprojects Consulting Collaborative
Hokianga

Introduction

On behalf of Te Rūnanga O Whaingaroa., Andrew Hill, Principal Planner, Chester (consultants) contacted Ecoprojects Consulting Collaborative re preparing an ecological assessment update. The original ecological report dated 4 February 2021 (*"Ecological Report on 2A Ash Grove Circle, Haruru, Northland"*) prepared by Ecoprojects, was included in the OTL (the previous owner) consent application that was approved in March 2021. As the subdivision is currently being re-designed, an updated assessment is required in support of the application to be made to Far North District Council for a consent variation. The variation application still includes the proposed clearance of over 500 m^2 of indigenous vegetation over 10 years old, which is subject to Far North District Plan Rule 12.2.6.1.4 (indigenous vegetation clearance in other zones). Refer to *Appendix 1*.

This update has been prepared as an addendum to be reviewed with reference to the original February 2021 ecological report on 2A Ash Grove Circle, Haruru. It provides new information, but to provide context, includes some information contained in the original report. Proposed variations to the originally consented subdivision and the ecology related changes are as detailed in this addendum. Otherwise, the detail in the original report is generally consistent with and therefore is still relevant to the proposed variations, as are the ecology-related conditions issued in the 12 March 2021 Decision. The annotation associated with various photos & reduced scale plans in both the original report and this addendum should be reviewed as a component of the ecological assessments.

Terry Kennedy, ecologist, originally undertook an ecological survey of the site on 28 November 2020. Preparation of this addendum required a further survey which was carried out by Terry on 1 November 2024.

The February 2021 Ecoprojects report detailed the degraded state of the regenerating indigenous forest on the block. Around four years later the return survey assessed the current condition of the forest cover and understory vegetation.

The site has not been disturbed in the period between surveys and the regeneration process, albeit gradual, has continued without interference.

The existing site

Fig 1: The site property boundary overlaid on an aerial photo circa 2023/2024.

Fig 2: Current drone aerial coverage of the site (20 November 2024). This is the clearest image of the existing bush canopy that is currently available.

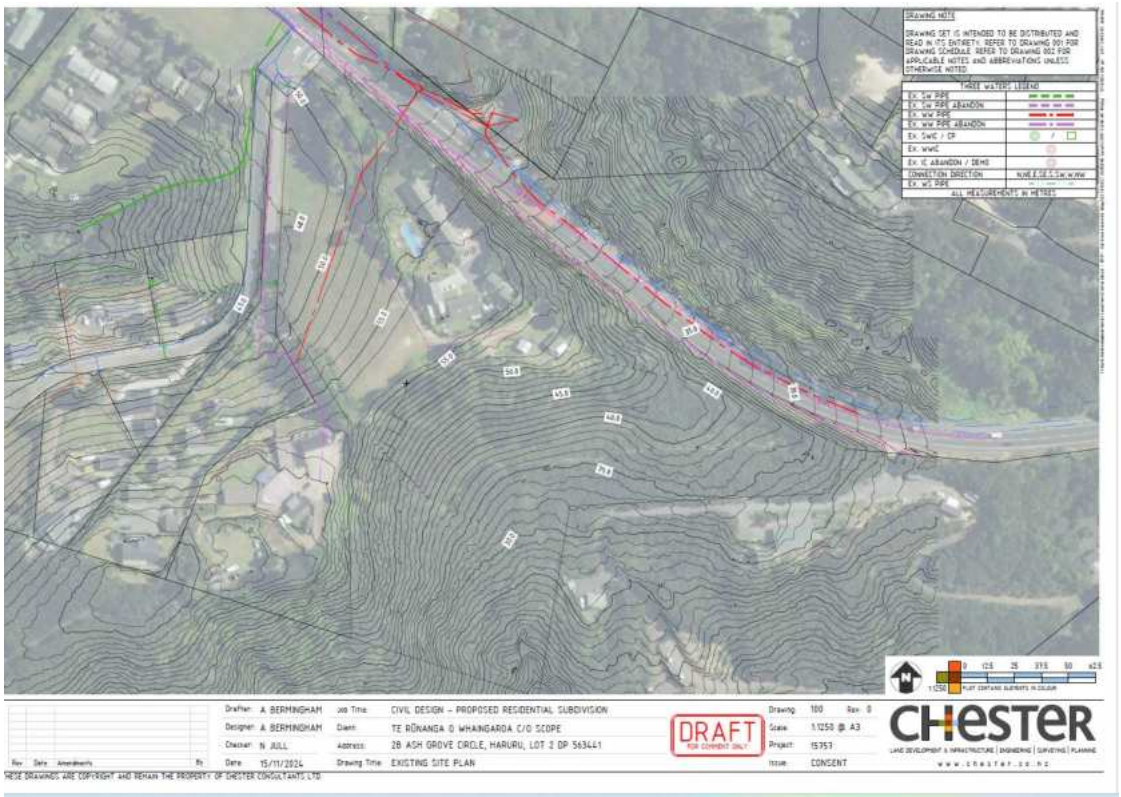

Fig 3: **The existing site.** Note 1 metre contours over the site and adjoining areas.

Proposed site development plans - overview

For easy reference, the reduced scale site plans (figures 1-10) have been included to provide a broad overview of key elements of the proposed form of site development that are relevant to the proposed enhancement to the ecology of the site. Finalised site plans will be available at their more readable full scale (A3 plan size) elsewhere within the variation applicant documents.

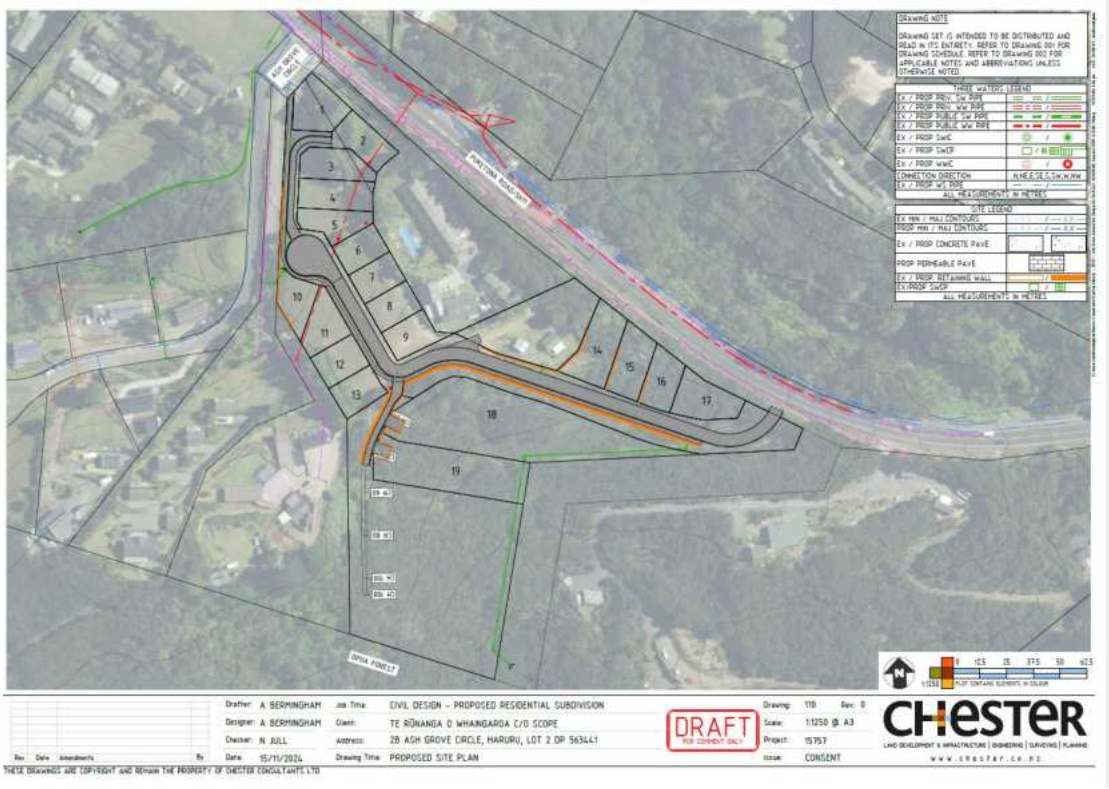

Fig 4: Proposed site plan. Note lot numbers and varying lot sizes.

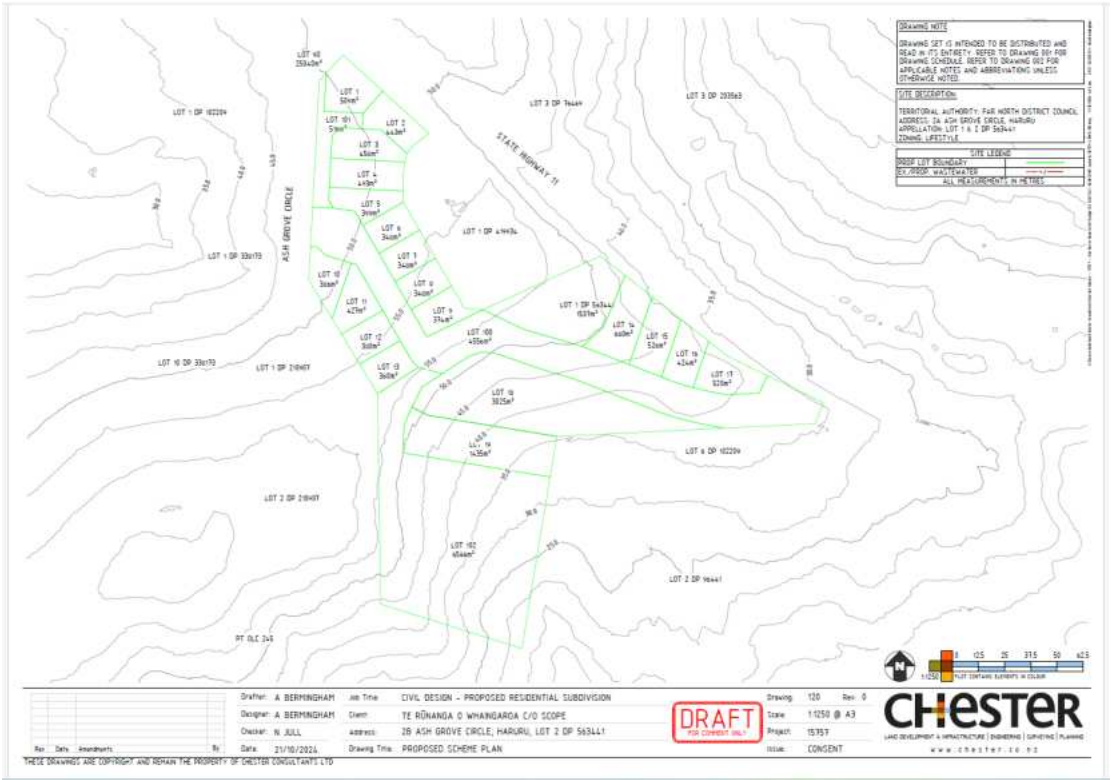

Fig 5: Proposed scheme plan. Lot numbers & area of each lot noted. Contour interval 5m.

Fig 6: Proposed landscape plan includes footprint of the 19 houses to be built for rental. The areas of retained bush are highlighted

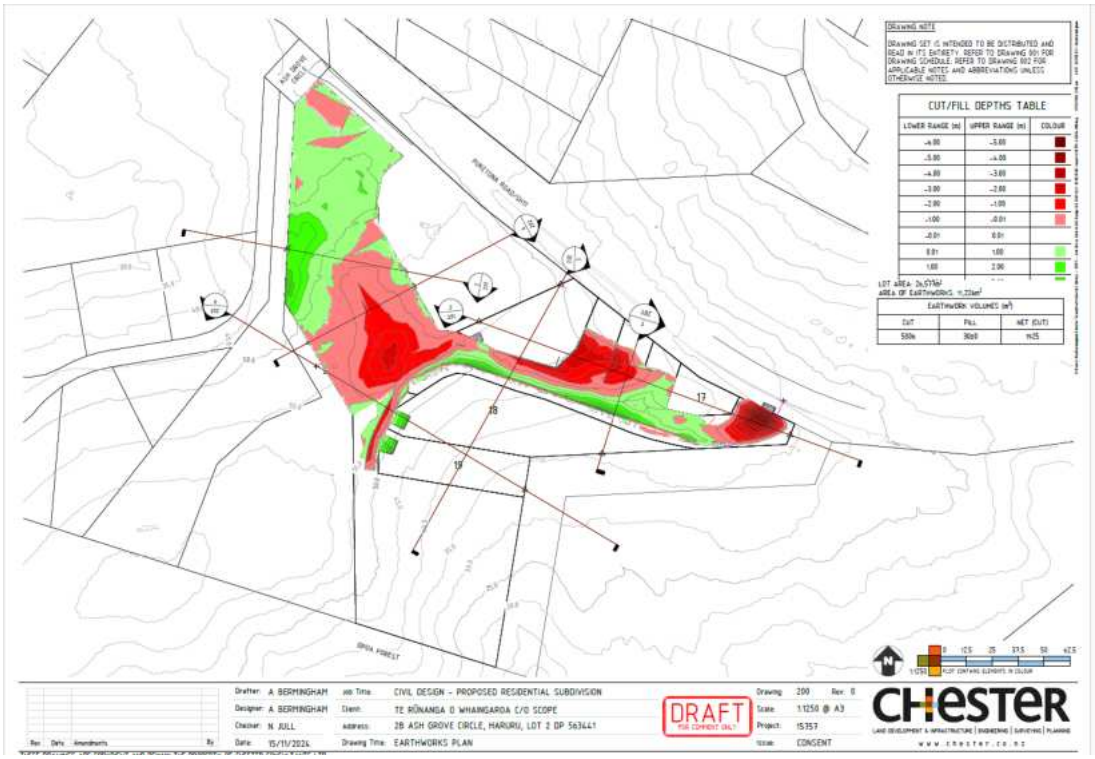

Fig 7: Earthworks plan. No vegetation can be retained within the earthworked areas.
COLOUR CODING: Deepest red areas are 5 to 6 metres fill, graduated through to lightest red areas, with 0.1 to 1m fill. Lighter green areas are 0.1 to 1m cut, with darker green areas 1 to 2m cut.

Fig 8: Bush clearance plan. Indicative bush clearance extent is shown in orange hatch. Note: Lots 1-13 have existing grass cover. The entire retained bush area is to be enhanced through the removal of invasive exotic species, pest weeds, dead / dying / unhealthy and fallen Manuka / Kanuka and other highly combustible matter.

Fig 9: Areas of bush clearance (red hatch) **/ bush edge understory planting** (mid green) are shown on this **overview vegetation management plan**. Part of the retained bush is to be enhanced to form a **'green belt bush edge buffer zone'** through understory planting of low flammability indigenous species. This includes: **1.** Within the first 5m back from the northern edge of the bush clearance line below the main access road. Where retained bush adjoins the houses on Lots 18 & 19, the planting will extend through the bush area within 20m of the houses, to reduce fire risk. **2.** Within the bush area to be retained adjoining lot 13 (i.e. to the west of the access road to lots 18 & 19). **3.** Within the bush to be retained on the northern portions of lots 14 to 17 (adjoining Puketona Road). Note: The strips cleared for the installation of stormwater pipes are to be left to regenerate naturally.

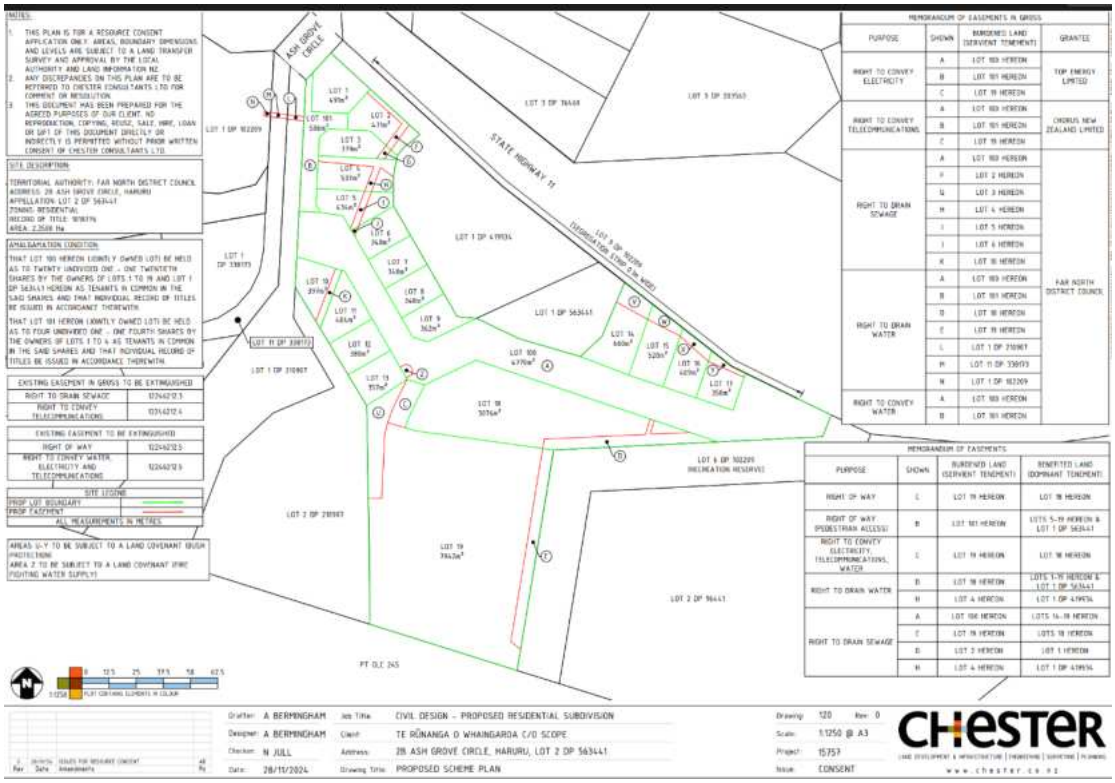

Fig 10: Bush protection mechanisms: There are two areas of bush shown on this scheme plan to be subject to a bush protection land covenant. These are the bush to be retained on the northern portions of lots 14 to 17 (adjoining Puketona Road) and the bush to be retained adjoining lot 13 (i.e. to the west of the access road to lots 18 & 19). Both bush covenant areas are defined with a fine red line. The bush area to be retained extending over lots 18 & 19 is to be protected by conditions of consent on these two titles.

Current ecology / bush enhancement measures

The site is situated on the edge of the Opua Forest. The vegetation cover is dominated by a stand of *Kunzea ericoides* (Kanuka) / *Leptospermum scoparium* (Manuka), approximately 15-20 years old that has reached an average height of 3-5m.

The Manuka /Kanuka cover is in poor condition and is showing signs of ongoing deterioration. The ground cover is sparse and limited to species that can survive in poor soil.

The sub-canopy layer of broad leaf flora found in a healthy forest eco-system is absent, being almost entirely devoid of indigenous re-growth. It is characterised by dry hanging Manuka and Kanuka stems. The biodiversity in this area of the greater Opua Forest environment is limited.

The Kanuka / Manuka canopy is largely intact throughout the forest and reduces light levels reaching the ground by approximately 25 – 30%.

Piles of dry stems, particularly those that haven't dropped to ground level where they would decompose faster, have not shown any obvious signs of decomposition over the four-year period between surveys, indicating a scarcity of decomposing insects and fungi.

The ground cover is mainly dry detritus and bracken. Bracken is an indigenous open ground cover and occurs when the canopy is deteriorating and tends to stifle healthy understory regeneration. There are small outcrops of *Doodia media*, (rasp fern or Pukupuku), occasional *Cyathea dealbata* (tree ferns or Ponga) and *Pomaderris kumeraho* (Poverty weed or Kumeraho).

The forest area dries out rapidly in summer. With no understory or bush edge protection, wind passes through the block drawing moisture with it and raising temperatures within the canopy.

Fig 11: The pioneering species, Manuka / Kanuka (approximately 15-20 years old) have reached the end of their growth cycle, with indigenous broadleaf species having failed to colonise the subcanopy areas. (Refer to Fig 4 in the 2021 report). There is no natural indigenous regeneration taking place under the bush canopy except for bracken and groundcover. Photo 1 November 2024.

Fig 12: The piles of fallen Manuka / Kanuka after around four years have not broken down. Photo 1 November 2024.

Fig 13: A further example of stacks of Manuka / Kanuka stems that have remained in place over the past four years or so, with little to no further deterioration / decomposition. Photo 1 November 2024.

Fig 14: Regeneration in the areas that were originally cleared for access is remarkable after around four years. The coverage is predominately Manuka. The regrowth, which is around 2 metres tall, is healthy and dense. This illustrates that any areas that are to be temporarily completely cleared e.g. for the installation of storm water pipes etc., can be left to regenerate naturally. Photo 1 November 2024. Refer Fig 5 in 2021 report.

Invasive flora

The quantity of exotic tree and scrub species is substantial and if left unmanaged would inexorably alter the nature of the forest to a chaotic mixed bush block (Refer to *Appendix 4: "Predominant invasive exotic tree and shrub species present"*).

Fig 15: This section of nearby bush (on the opposite side of Puketona Road) is a good illustration of a forest of invasive and exotic species similar to those also becoming established in the Ash Grove property. Photo 1 November 2024.

Extent of proposed retention of existing indigenous vegetation on site

The redesigned subdivision layout includes significant changes. Smaller lots are now proposed on the typically gentler sloping upper portion of the site (lots 1 –13). The number of house lots proposed down slope of the accessway off Puketona Road has been reduced from 8 to 2. These two house lots are therefore correspondingly much larger in size. This has enabled the retention, enhancement and protection of a significantly increased total area of bush on the subdivision.

Limited bush clearance is required for the houses on lots 18 & 19. Also, the stormwater easements on these two lots are to be cleared of vegetation for the installation of the stormwater system (refer to *Figure 8: "Bush clearance plan"*). The cleared easement areas are to be left to successfully regenerate naturally. Otherwise, the existing indigenous vegetation cover on these two lots, which is down slope of the proposed earthworks elsewhere on the subdivision, is to be retained.

This retention of existing vegetation cover below the main access road, will facilitate the filtering of silt from stormwater runoff during the subdivisions earthwork's construction period and therefore complies with the relevant condition of the current consent. Beyond the construction period, this retained vegetation cover will continue to filter any stormwater runoff that passes through it and down into the adjoining area of the adjoining Opua Forest.

When compared to the originally consented subdivision, retention of this area of vegetation cover has enabled a substantially increased and contiguous area of bush buffer to be retained immediately adjoining the Opua Forest boundary. This extended area is not critical from an ecological perspective, but the increased area is an enhancement to this on-site 'Opua Forest' bush buffer.

Clearance / cleanup & planting within retained bush areas

The vegetation cover which is to be retained on the project site is a deteriorating ecosystem currently in very poor condition. The entire retained bush area is to be enhanced through the removal of the copious quantity of invasive exotic species, pest weeds, dead / dying / unhealthy and fallen Manuka / Kanuka and other highly combustible material. This will assist in both planted and natural bush regeneration and therefore in reducing fire risk throughout all bush areas on the site. ALL highly flammable debris on the ground close to buildings is to be removed and maintained that way.

All healthy indigenous vegetation is to be retained within the existing canopy in the bush areas that are to remain. The removal of invasive exotic species will leave gaps in the bush canopy. Following on from bush cleanup, the retention of all available healthy bush canopy overhead will increase the bush blocks' capacity to regenerate

naturally and will provide a nursery type environment for the replanting. This will enable the fire-resistant understory species plantings to establish faster.

There is next to no natural indigenous regeneration taking place under that bush canopy at present except for bracken and groundcover.

The understory planting of low flammability indigenous species is to be carried out where indicated in *Figure 9: "Areas of bush clearance / bush edge understory planting"*. This planting is also to enhance bush edge protection. The low flammability broadleaf species are to be planted within retained bush areas to a depth of 20 metres back from any adjoining houses. For example, on lots 18 & 19.

Other proposed lots on the residential development (lots 1-13) are to be largely cleared of all vegetation (including grass) due to the extent of cutting and filling required (refer to *Figure 7: "Earthworks plan"*) and the relatively small sizes of the lots. There is no particular ecological significance to retaining any of the existing generally sparsely spread indigenous vegetation on lots 1-17. However, it is proposed that any quality indigenous vegetation on lots 14-17 be retained to assist in maintaining stability on any steep northern edge on these lots where they adjoin Puketona Rd and to assist in optimizing the overall amount of indigenous vegetation that can be practically retained throughout the development. The retention of these areas of vegetation will also assist with the visual enhancement of the site.

Consistency of bush enhancement measures with February 2021 ecological report

The proposed cleanup of the existing poor quality bush cover throughout the site and the proposed method of assisted indigenous regeneration is consistent with what was proposed in the February 2021 ecological report, so as far as is feasible, it has not been duplicated in this addendum.

Suggestions regarding conditions of consent

- On a permanent basis, all ecological works on the project site are to be in general accordance with the *"Ecological Report on 2A Ash Grove Circle, Haruru, Northland" dated 4 February* 2021 and its "*ADDENDUM: Ecological assessment update for redesigned subdivision, 2 Ash Grove Circle, Haruru, Northland"* dated 30 November 2024. Both reports were prepared by Ecoprojects Consulting Collaborative. For ease of ongoing reference in managing the ecological aspects of the project site, it is recommended that consideration be given to attaching a copy of these two documents to the property titles of any lots containing bush to be protected.

- The vegetation cover which is to be retained on the project site is a deteriorating ecosystem currently in very poor condition. The entire retained

bush area is to be enhanced through the removal of invasive exotic species, pest weeds, dead / dying / unhealthy and fallen Manuka / Kanuka & other highly combustible matter. To provide for best practice leading to surety of outcome, this cleanup work is to be supervised by a suitably qualified and experienced ecologist.

- The proposed planting of low flammability indigenous understory species within the cleaned up 'green belt bush edge buffer zone' (including the replacement of any losses) is to be supervised by a suitably qualified and experienced ecologist.

- The retained bush areas, including the indigenous species planted within the 'green belt bush edge buffer zone' are to be maintained in perpetuity by the property owner.

- In the interests of protecting the kiwi habitat value of the retained bush and the wildlife value generally, there is to be a maximum of one dog and one cat on the property. Any dog on the property is required to have a current Kiwi aversion training certificate. Our experience is that this eliminates the need for any dog proof fencing, which would be both costly and potentially restrictive to movement around the individual lots.

Concluding comment

This ecological assessment has been carried out by a Far North based ecologist, Terry Kennedy, who is very familiar with Northland ecology and highly experienced in ecological restoration.

As with the 2021 ecological report, this addendum has been peer reviewed by landscape architect Hedley Evans, who is also highly experienced in ecological restoration. Hedley both peer reviewed and critiqued several drafts of this document to provide input during its preparation.

Based on the ecological assessment in both the 2021 report and this addendum, we conclude that the subdivision can be carried out as proposed with the result that the overall ecological value of the subdivision site will be significantly enhanced. The indigenous vegetation that currently exists is of extremely poor quality. Mitigation and enhancement measures as proposed for the indigenous bush area to be retained, will result in a significant improvement in the value of the site for brown kiwi and other indigenous bird species habitat.

The areas to be retained and ecologically enhanced are to be protected as detailed in *Figure 10: "Bush protection mechanisms"*.

With the proposed ecological treatment of the site as detailed, the resultant ecological effects are assessed as being an overall enhancement and certainly less than minor.

Based on these findings it is recommended that with regard to potential ecological outcomes, that consent for the proposed variations to the project be granted.

Ecoprojects Consulting Collaborative
Per: Terry Kennedy
National Diploma in Sustainable Rural Development
ecologist
0273 201 989

LIST OF APPENDICES

Appendix 1: Far North District Plan Rules 12.2.6.1.1 & 12.2.6.1.4
Appendix 2: Former SNA designated area on the site
Appendix 3: Suggested low flammability indigenous species for establishing green belt bush edge buffer zone
Appendix 4: Predominant invasive exotic tree and shrub species present

Appendix 1: Far North District Plan Rules 12.2.6.1.1 & 12.2.6.1.4

Rule 12.2.6.1.4 INDIGENOUS VEGETATION CLEARANCE IN OTHER ZONES

The clearance of indigenous vegetation is a permitted activity if the site meets the definition of an "urban environment" site as specified in Rule 12.2.6.1.1(p) above. On all other sites in other zones, the clearance of indigenous vegetation is a permitted activity, provided that the clearance does not increase the total area of cleared land on the site above 500m2 . Note 1: Refer also to Rule 12.1.6.1.2, which applies to vegetation clearance in Outstanding Landscapes and Rule 12.1.6.1.1(d), which applies to Outstanding Landscape Features. Note 2: This means that if a site not meeting the definition in Rule 12.2.6.1.1(p) already has 500m2 of cleared land, any further clearance involving indigenous vegetation will require resource consent under this Rule. Note 3: Refer also to Regulations 93 and 94 of the National Environmental Standards Plantation Forestry which prevail over this rule. 12.2.6.2 RESTRICTED DISCRETIONARY ACTIVITIES.

Rule 12.2.6.1.1 INDIGENOUS VEGETATION CLEARANCE PERMITTED THROUGHOUT THE DISTRICT

A portion of the bush area to be cleared does comply with Rule 12.2.6.1.1.

12.2.6.1.1 INDIGENOUS VEGETATION CLEARANCE PERMITTED THROUGHOUT THE DISTRICT

Notwithstanding any rule in the Plan to the contrary but subject to ***Rules 12.5.6.1.1***, ***12.5.6.1.3*** and ***12.5.6.2.2*** in the Heritage section of this Plan, indigenous vegetation clearance is permitted throughout the District where the clearance is for any of the following purposes:

(n) vegetation clearance of land which has been previously cleared and where the vegetation to be cleared is less than 10 years old.

We understand that beyond the grassed areas, the road access ways on the original subdivision consented on 12 March 2021 had been cleared of bush (prior to the application being lodged) back far enough on either side of the proposed accessways to enable pegging of the front of each of the proposed lots.

We expect that this previous clearance should at least reduce the currently proposed 6,230m^2 bush clearance area that is subject to Rule 12.2.6.1.4. Clearly, the 6,230m^2 is a substantial reduction when compared to the amount of bush consented for clearance in the original subdivision decision.

The proposed clearance does not comply with Rule 12.2.6.1.4.

It would appear unlikely that a further restricted discretionary activity application would be required within the variation application for the redesigned subdivision, when the total bush protection area that is to be retained (including the on-site Opua Forest bush buffer area) is to be substantially increased.

Appendix 2: Former Significant Natural Area (SNA) designated area on the site

Sometime after the original consent application was approved in March 2021, part of the site was designated as a Significant Natural Area (SNA). The plan below shows the outline of the project boundary in blue, with the area of the site that was designated as SNA cross hatched.

By way of background to the current non-SNA designated status, on14 March 2024, Associate Environment Minister Andrew Hoggard announced that the Government had agreed to suspend the requirement for councils to comply with the Significant Natural Areas (SNA) provisions of the National Policy Statement for Indigenous Biodiversity for three years, while it replaces the Resource Management Act (RMA).

In line with this nationwide suspension, the Far North District Council removed SNA mapping from its website. As a result, there is no SNA on the Ash Grove site.

However, all councils have had to protect areas with significant indigenous biodiversity since the Resource Management Act (RMA) was introduced in 1991. This requirement has remained in place and wasn't affected by the suspension. Other NPSIB National Policy Statement for Indigenous Biodiversity (NPSIB) provisions including the management of existing SNAs continue to apply.

We understand that the SNA designation that had applied to the site was based on a broadbrush desk study analysis of satellite imagery. The assessment looked at areas surrounding the Opua Forest and came up with a greater Opua Forest SNA area of over 4,800 hectares which included extensive areas adjoining but outside of the Opua Forest boundary.

The forest canopy on the site would have looked reasonable on a satellite image but could not have shown the degraded state of the underlying regenerating forest cover on the block.

If the SNA status had currently applied, an application to FNDC (on behalf of the property owner) for the removal of the SNA status of the bush on site, based on our

experience would likely have triggered an on-site assessment by a Department of Conservation ecologist followed by removal of the SNA status on the basis that the quality of the bush on site did not meet benchmark SNA criteria.

Appendix 3: Suggested low flammability indigenous species for establishing green belt bush edge buffer zone

It is proposed that planting be in general accordance with this species list.

Five finger	*Pseudopanax aboreus*
Karamu	*Coprosma robusta*
Raurekau/Kanono	*Coprosma grandifolia*
Hangehange	*Geniostoma ligustrifolium*
Taupata	*Coprosma repens*
Putaputaweta	*Carpodetus serratus*
Karaka	*Corynocarpus laevigatus*
Kawakawa	*Macropiper excelsum*
Puka	*Griselinia lucida*

Appendix 4: Predominant invasive exotic tree and shrub species present

Acacia
Banksia
Eucalyptus
Gorse
Pampas
Taiwanese Cherry