BCD GROUP

COPY

Geotechnical Assessment Report

JOB NUMBER: 25-0008

New 3 Lot Subdivision
27 Cureton Street, Morrinsville

PROJECT

LandHQ Consultancy Group

CLIENT

Resource Consent – REV 2
31 January 2025

25-0008 New 3 Lot Subdivision at 27 Cureton Street, Morrinsville

Prepared for: LandHQ Consultancy Group **Project no:** 25-0008

Prepared by: **Blake Buxton** | Engineering Geologist

Reviewed by: **Mitch Cateley** | Geotechnical Engineering Manager

Revision	Date	Status	Authorised by:
1	29/01/2025	Resource Consent	**Mitch Cateley | Geotechnical Engineering Manager BE(Hons), CPEng, CMEngNZ**
2	31/01/2025	Resource Consent	**Mitch Cateley | Geotechnical Engineering Manager BE(Hons), CPEng, CMEngNZ**

EXECUTIVE SUMMARY

LandHQ Consultancy Group Limited is planning to subdivide an existing lot into three new residential three lots at 27 Cureton Road, Morrinsville generally designed in accordance with NZS3604. BCD Group Limited (BCD) has been requested to provide geotechnical engineering services for the project. This report presents a summary of our assessment, recommendations, and next steps for Land Consultancy Group Limited. This report may support a Resource Consent if the recommendations are followed.

	Item	Comments
Our key findings	Services	A council wastewater pipe runs through the new proposed Lot 2. Recommendations on mitigation measures are within section 7.1.1
	'Good ground'	The underlaying soils do not achieve 'good ground' due to liquefaction and low bearing soils.
	Liquefaction risk	The site is considered to have a mild to moderate risk of liquefaction
	Slope stability risk	the site is not considered to be at risk of slope instability due to no slopes nearby the site
	Expansive soils	The underlaying soils are not considered expansive.
	Potentially compressible soils	The investigations did not identify any potentially compressible soils
	Bearing Strength	The underlaying soils are conserved to have a bearing capacity of 300kPa above 1.5m BGL.
Recommendations	Siteworks	Minor site works is required for the site.
	Foundations	The site is considered suitable for TC2 type foundation systems.
	Stormwater management	The site is suitable for soakage.

CONTENTS

Table of Appendices

1 INTRODUCTION

LandHQ Consultancy Group Limited (LandHQ) is proposing to subdivide an existing lot into three new residential three lots at 27 Cureton Street, Morrinsville with dwellings generally designed in accordance with NZS3604. BCD Group Limited (BCD) has been requested to provide geotechnical engineering services for the project. This report presents a summary of our assessment and recommendations for LandHQ.

The subject site is legally described as Lot 17 DP 15688 and has an area of approximately 1359m². The site is within the jurisdictions of Waikato Regional Council (WDC) and Matamata-Piako District Council (MPDC).

The scope of this assessment was carried out in accordance with our Short Form Agreement dated 13/01/2025 and can support a Resource Consent application if the recommendations in this report are followed.

2 PROJECT DESCRIPTION

It is proposed to subdivide the existing property into 3 new lots. At this preliminary stage, the nature of the proposed structures are unknown however BCD understands that any proposed structure would likely be designed and constructed in accordance with NZS3604:2011.

The proposed cut and fill volumes associated with the development of the site are unknown at this stage, however we expect any earthworks to be minor. Further details of cut/fill volumes and placement will be required for building consent phase.

3 SITE DESCRIPTION

The site is located on the southern side of the township of Morrisville. The site location, topography and geological plans are in Appendix B.

The site is a single residential property and is in a residential area. Vegetation cover across the property is predominantly lawn with medium sized trees scattered throughout the property.

The site is accessed via a short driveway directly off of Cureton Street. The site is relatively level with less than 0.4m of elevation difference. Based on LINZ data, the elevation of the existing ground surface at the site varies from RL[1] 27m to 27.5m.

The site has connections to Council reticulation for wastewater with stormwater going to onsite soak pits. Soak pits may be encountered during building platform construction.

Based on the topography and Lidar the overland flow is towards the south.

[1] Reduced Level to NZVD2016

4 DESKTOP REVIEW

The WRC and MPDC GIS system[2] and the GNS website[3] were checked by BCD on 21/01/2025 for mapped natural hazards, and buried services. Aerial photographs of the site were reviewed using Council Acronym GIS system, Google Earth Pro and Retrolens.

4.1 Geological Setting

The 1:250,000 scale geological map (Leonard, G. S., Begg, J. G., Wilson, C.J.N, 2010) indicates that the site is underlain by Hinuera Formation, which is described as volcanogenic alluvium, comprised of cross-bedded sand, silt and gravel with interbedded peat. The Hinuera Formation is found throughout the Waikato alluvial plain and is typically deposited in a series of levees and swales of differing material composition representing the various depositional environments of the ancient, braided Waikato River system. (Lowe, 2010).

4.1.1 Close Proximity Active Faults

The GNS active fault database indicates that the nearest active fault is the Kerepehi Fault approximately 12km northeast of the site. The risk of fault rupture is considered low based on current information.

4.2 Previous Geotechnical Report

A DB Consulting Engineers (2020)[3] (DB) report for soil suitability was available for review for the neighbouring property (29 Cureton Street). A summary of relevant information is given below.

- The investigations indicate the neighbouring site consisted of clayey silts and silty clay overlaying silts and sands.
- Groundwater was found at a depth of 2.6m to 2.8m at the time of the report in August 2020.
- The Liquefaction desktop assessment indicated that the neighbouring site was on the borderline between TC1 and TC2 as per the MBIE Canterbury Guidance due to the cohesive nature of the site. Note that the MBIE geotechnical modules had since been updated in 2021 which has generally increased the peak ground acceleration (PGA) in the area making liquefaction more likely to occur.
- 'Good ground' conditions were not achieved on the site.

4.3 New Zealand Geotechnical Database

The nearest NZGD data is approximately 100m to the east, which show silts overlaying sands of the Hinuera Formation. BCD has also undertaken testing at 27 Studholme Street, approximately 300m from the site.

The investigations undertaken by BCD in preparing this report have been uploaded to the NZGD.

4.4 Historic Aerial Imagery

BCD has reviewed predevelopment imagery on Retrolens and more recent images on Google Earth Pro. No geological features or obvious ground modification were identified.

4.5 Council GIS

The MPDC GIS does not include geohazard information. However, the WRC regional hazards portal indicates that the liquefaction risk is the most likely hazard to potentially affect the proposed development. The level A liquefaction assessment indicates that liquefaction is 'possible' at the site.

[2] https://www.mpdc.govt.nz/quick-links/maps-and-gis
[3] https://data.gns.cri.nz/af/ (checked on 24/01/2025)

4.6 Buried Services

The MPDC GIS indicates that there is a council 150 diameter wastewater pipe runs across the site. The pipe invert depth from the GIS is unknown. Any buildings that encroach on the wastewater main will need SED design as per Section 5 D5.6 of the CoLAB Regional Infrastructure Technical Specification or setback to where a 45° line does not intersect the pipe.

5 GEOTECHNICAL INVESTIGATIONS

5.1 Walkover Observations

There are no significant geotechnical or geological features beyond those described in the site description in Section 3.

5.2 Investigation Procedure

The following investigations were undertaken by BCD to evaluate the subsurface conditions at the site on 20/01/2025. Investigation data can be found in Appendix C.

- 4x hand augers (HA) up to 3m - 5m depth in area of proposed new lots
- 2x soil permeability tests up to 2m depth for stormwater management

5.3 Subsoil Profile

The subsoil profile encountered at the site is consistent with the mapped regional geology.

5.3.1 Surficial soils

The near surface conditions as encountered in the hand augers consist of 0.2-0.3m of Topsoil.

Beneath the topsoil, the natural soils consist of stiff to hard silts between 0.8m to 1.4m below ground level. A 0.9m to 1.3m thick layer of loose to medium dense sand underlays the surface silts before encountering a soft to very stiff layer of silts through to end of testing.

5.4 Groundwater

Groundwater was encountered at depths of 1.6m to 2.0m bgl, which corresponds to an approximate RL25.9m to RL25.5m, at the time of the investigation in January. This is considered typical of summer levels and is likely to be higher following periods of prolonged or intense rainfall. A groundwater level of 1.6m has been assumed in our assessment to account for winter levels.

6 GEOTECHNICAL ASSESSMENT

The following recommendations and opinions are based upon data from observations made on-site, and the investigations undertaken. Inferences about the nature and continuity of subsoils away from the exploration holes are made but cannot be guaranteed.

This section outlines our assessment of the site with respect to geotechnical natural hazards and the assessment of 'good ground' as defined by MBIE AS/VM B1 (2019) and referred to in NZS3604:2011 and NZS4229:2013.

6.1 Seismic Soil Behaviour

Liquefaction can occur in saturated soils during earthquakes and results in soil strength loss. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded fine-grained cohesionless materials. Loose to medium dense gravels, sands, silty sands, low-plasticity silts, and some low-plasticity clays are also potentially liquefiable.

Soil liquefaction can manifest at the ground surface and result in ground deformation and differential settlement, foundation bearing failure, ground rupture or ejecta of water and soil at the ground surface.

6.1.1 Site Subsoil Class

Based on regional seismic studies by S. Jeong and L. Wotherspoon, the soil class in the Waikato basin may be classified as Class D – deep or soft soils.

6.1.2 Seismic Assessment

The desktop study will be carried out for two circumstances: Serviceability Limit State (SLS) and the Ultimate Limit State (ULS), details are presented in Table 1 below.

Table 1: Seismic assessment parameters

Importance Level	Design Life (years)	Earthquake Magnitude	Limit State	Annual Exceedance Probability (AEP)	Return Period Factor (R_u)	PGA (g)
2	50	5.9	SLS	1/25	0.25	0.7
			ULS	1/500	1.0	0.28

6.1.3 Liquefaction Desktop Assessment

No site-specific CPT was carried out at the preliminary stage; therefore, no detailed liquefaction assessment could be carried out.

Shallow ground investigations indicate that the site ground water levels are between 1.6m – 2m below the existing ground level and a subsoil profile composed of stiff to hard cohesive silts overlaying loose to medium dense sand and soft to stiff silts. Based on local experience, the site is not liquefiable in the SLS design conditions, however under a ULS seismic event these soils are susceptible to liquefaction. Therefore, based on the shallow investigation results, the neighbouring DB Consultants geotechnical report, and nearby CPT testing completed by BCD, the liquefaction risk for the site is considered to be mild to moderate.

6.1.4 Site Seismic Performance

We consider the site to be generally equivalent of a TC2 category site and standard MBIE Canterbury guidance TC2 solutions may be adopted.

Site specific CPTs may be completed for the site which may further reduce the liquefaction risk.

6.2 Soil Expansivity

The near surface soils are non-cohesive sands or silts. They are not considered to be expansive as defined in NZS3604:2011.

6.3 Static Settlement

The investigations did not identify any potentially compressible soils as defined by NZS3604 within the influence of the building foundation. For buildings within the scope of NZS3604 (light timber framed buildings) that achieve good ground and no filling greater than 600mm thick occurs, the settlements are anticipated to be acceptable and within 25mm over 6m.

6.4 Bearing Capacity of Natural Soils

An ultimate geotechnical bearing strength of (q_u) 300kPa may be used for design of shallow foundations with vertical central loads.

Piles and SED shallow foundations

Foundations may also need specific engineering design. The following parameters with depth are recommended for design.

Table 2: Design parameters for foundations

Depth	γ (kN/m3)	ϕ (degrees)	c' (kPa)	S_u (kPa)
0.2 – 0.9	16	27	2	100
1.0– 2.0	17	29	-	-
2.0 – 4.5	16	26	1	60
4.5 + (post large seismic event only)	16	27	2	100

Depth to groundwater = 1.6m

7 RECOMMENDATIONS

Once the site is stripped to subgrade level during construction and the subgrade inspected by a suitably qualified person, additional work may be required beyond the recommendations below.

The recommendations below assume that no fill (including hardfill) will be placed within 3m of the buildings that is higher than 0.6m above the existing ground level.

Prior to lodging for Building Consent, the consent plans will need to be reviewed by a geotechnical engineer, any additional assessment required to be completed, and a specification issued for the works.

7.1 Foundations

The building platform is not considered 'good ground' due to the liquefaction risk.

At this resource consent stage, the floor type is undetermined. The following recommendations are to provide a suitable building platform for the proposed development which mitigates or minimises to an acceptable level the geotechnical risks identified. More details on each option follow.

1. Ground remediation for Standard shallow NZS3604 foundations, or
2. Waffle slab foundation (i.e. Ribraft TC2)
3. TC2 relevelable pile foundations for a timber subfloor.

7.1.1 Ground Improvement with NZS3604 foundations

The ground improvement detailed in Figure 5.5 of the MBIE guidance documentation Part A for a reinforced gravel raft could be adopted along with a structural slab. The extent of excavation required is to be a minimum of 800mm below the proposed ground level with a minimum of 600mm below the footings. Geogrid is to be 40/40 biaxial or TX160 triaxial and is to be placed at the base of the excavation (800mm bgl).

Once the ground improvement has been completed, a standard shallow NZS3604 foundation may be used.

7.1.2 Structural Raft

A TC2 raft foundation system can be adopted. The raft systems can be either specifically engineered using the parameters in section 6.1 or a "code-marked system" adopted such as Firth Ribraft. If a Code-Marked system is adopted, the soil logs can be used by a suitably qualified geo-professional to determine the appropriate bearing capacity.

7.1.3 Pile Foundations

An alternative to a concrete slab foundation system is a TC2 piled foundation system. This can be resilient to low amounts of settlement and liquefaction induced damage. Should a seismic event occur, it can also be releveled through jacking and packing. This option would reduce the need for earthworks onsite. The piles will require SED and may use the parameters within Section 6.1.

7.1.4 Council Services near foundations

Due to the proximity to council owned wastewater pipes within Lot 2, it is recommended that the building platform is located outside of the area of influence (1V:1H) from the pipes. If this cannot be achieved due to site constraints, pile bridging in accordance with section 5, drawing 5-6 of the CoLAB RITS may be required. The piles will require specific engineering design in this location and would need to allow for construction below the groundwater table. Parameters for specific design are provided in Section **Error! Reference source not found.**.

8 ON-SITE STORMWATER DISPOSAL ASSESSMENT

The property is serviced by a reticulated stormwater network; however, the client has indicated that soakage to ground is preferred; therefore, all stormwater captured by the proposed development will be managed onsite. Detailed design will be completed in a separate BCD Civil report.

BCD has conducted two falling head permeability test up to 1.4m deep. The permeability test has been completed in general accordance with E1 which indicated that the site is generally suitable for stormwater soakage to ground. The results indicate that a test rate of 100mm/hr should be considered in design. The results have been provided to the civil designer. The following considerations need to be followed when designing a stormwater management system:

- The base of a soakage device is to be no deeper than 1.4m below the existing ground level.
- A soakage device should be setback a minimum of 1.5m from property boundaries and 3m from building foundations.
- The manufacturer's specifications are to be followed.
- Alternatively, detention tanks may be used and designed to attenuate the storm water runoff at pre-development rates.

9 PROFESSIONAL OPINION

Based on the geotechnical assessment, it is our opinion that the proposed development is unlikely to be subject to geotechnical natural hazards in accordance with Section 106 of the Resource Management Act 1991.

We do not consider that future residential use of the land is likely to accelerate, worsen or result in material damage to the land or neighbouring properties, provided that proper engineering practices are followed during future development/construction and the development incorporates the recommendations outlined in this report and any subsequent reports.

10 SAFETY IN DESIGN

This section outlines the safety in design considerations with respect to geotechnical matters for our current understanding of the project. We recommend that these are incorporated into the project risk register.

The Principal and Contractor(s) must comply with the Health and Safety at Work Act (2016). If controls are required it is the responsibility of the contractor to implement the controls, or to satisfy the project manager and any applicable consenting authorities that the alternative addresses the Hazard and reduces the Risk to an acceptable level.

Work Safe New Zealand has produced a Good Practice Guideline for Excavation Safety (2016) if the controls in Table 3 differ from the WorkSafe Guideline then Table 3 shall have precedence, unless further assessed by a Chartered Professional Engineer on behalf of the contractor.

Table 3 - Safety in Design Summary

Hazard	Initial Risk	Controls	Residual Risk
Excavations Minimum of 2.4m excavation to install proposed soakage system.	**Medium**	Can be battered at 1V:2H within the property or temporary shoring	**Low**
Heavy Plant / Stockpiles Heavy plant operating next to foundations. Stockpiles of topsoil on-site.	**Medium**	Do not stockpile materials within 1m of the foundations or excavations. Heavy plant not to operate within 1m of the foundations or excavations.	**Low**
Services BCD has obtained service plans which the wastewater pipe enters the site from the southern boundary.	**Medium**	The contractor shall obtain service plans and locate all services prior to commencing works. The existing wastewater pipe may need to be relocated if it interacts with the proposed development. consultation with council required	**Low**

11 SUMMARY

The recommendations are provided for the use of LandHQ and are based on our current understanding of the proposed development. If any changes are made, then BCD should be requested to comment on the on-going relevance of these recommendations. In any case, we recommend that BCD reviews proposed consent plans prior to applying for a consent to ensure the recommendations are accurately captured.

In summary,

- The site is considered to be technical category 2 (TC2) as per the MBIE Canterbury Guidelines due to the mild to moderate liquefaction risk to the site.
- Ultimate geotechnical bearing capacity of 300kPa was not achieved within the underlaying soils beyond 1.3m below ground level.
- Multiple foundation options have been provided within section 7.
- The site is considered to be suitable for onsite stormwater management

12 NEXT STEPS

The next steps that need to be taken are outlined below.

1. Have plans prepared, showing the proposed earthworks in relation to the proposed building. These plans will need to show:
    a) Subdivision and buildings proposed.
    b) Show buildings with the consideration of the underground services.
    c) Chosen TC2 foundation option.
    d) Show any earthworks required.
    e) Undertake stormwater design and locations and proximity to building platforms.
    f)
2. A geotechnical plan review letter may be required.

12.1 Future Building Construction Observations

All lots have been assessed as achieving 'good ground' soil conditions with the exception of the liquefaction risk subject to removal of topsoil and some uncontrolled fill and are considered suitable for building using TC2 foundation solutions. In lieu of a site-specific geotechnical assessment report for individual lots, construction observation and testing are recommended at the construction stage for future buildings.

Subgrade observations should be completed for all future buildings. Fill compaction testing is recommended where the fill depth of subgrade undercuts exceeds 300 mm. This is to ensure that fill is compacted to an engineered standard.

A heavy proof roll is recommended during construction to confirm the subgrade performance of any near surface loose sands beneath the building floor slab. At this time, if any significant soft spots are encountered, it may be necessary to remediate the loose sands present.

13 REFERENCES

MBIE (2012-2015). Ministry of Business, Innovation & Development. Repairing and rebuilding houses affected by the Canterbury earthquakes, Part A - E Technical Guidance.

MBIE (2021). Ministry of Business, Innovation & Development & New Zealand Geotechnical Society (NZGS), Earthquake Geotechnical Engineering Practice, Modules 1 – 6.

MBIE AS/VM B1 (2019). Ministry of Business, Innovation & Employment (MBIE). Acceptable Solutions and Verification Methods for New Zealand Building Code Clause B1 Structure. Amendment 18.

NZS 3604:2011. Timber Framed buildings. Standards New Zealand.

14 REPORT LIMITATIONS

The recommendations and opinions made in this report are based upon data from observations made on-site, conducted hand augers, and in-situ soil strength testing at discrete locations. Inferences about the nature and continuity of subsoils away from the exploration holes are made but cannot be guaranteed. Actual conditions onsite may vary more gradually or abruptly than that inferred from the investigations. Steps can be taken to reduce the likelihood of unexpected conditions arising onsite. As the soil conditions are created and vary by natural processes and human activity, the report is based on soil conditions at the time of the investigation. Soil conditions onsite can change, particularly after long periods of time from the date of investigation.

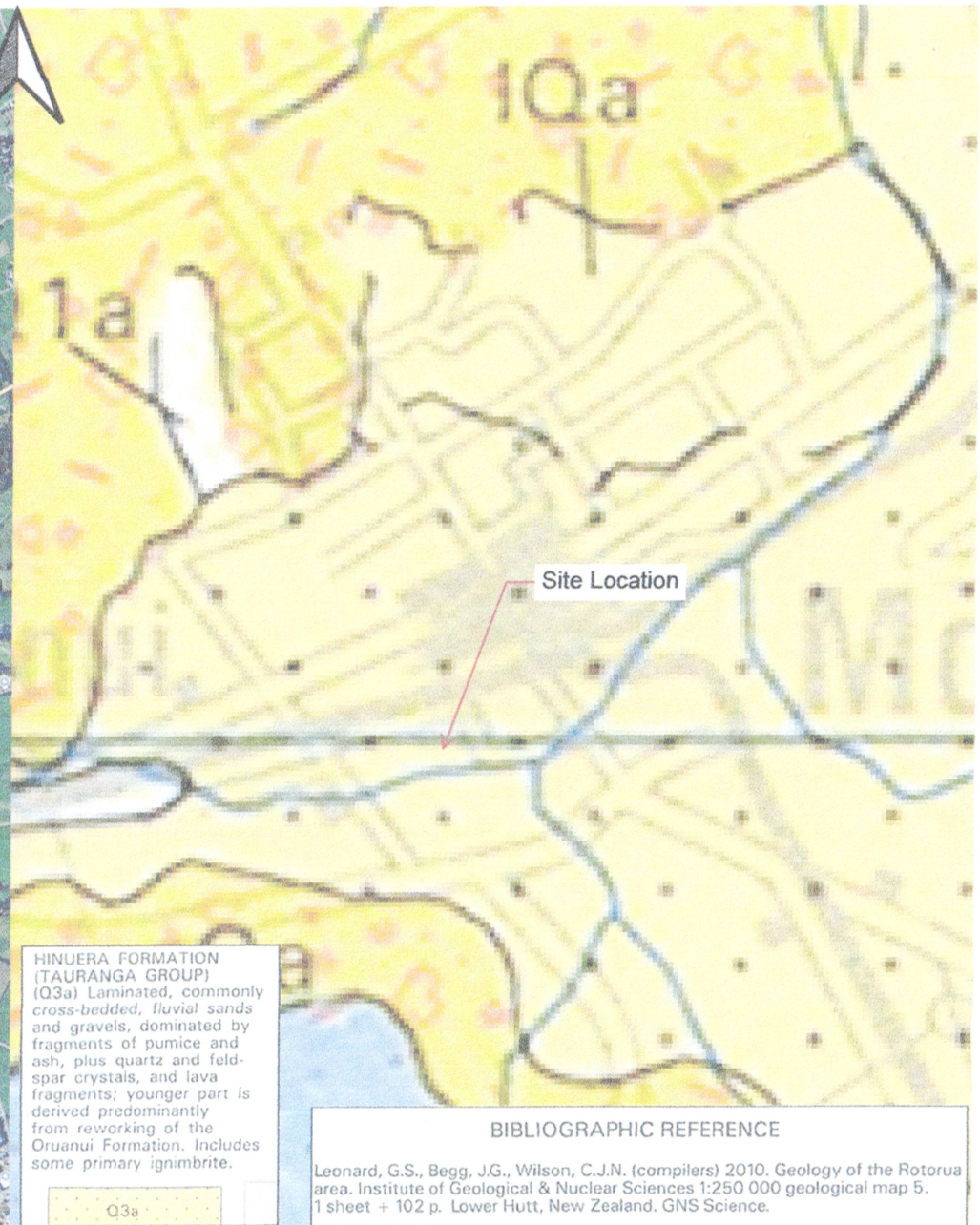
This report has been prepared for our client for their purposes and the regulatory authority in relation to the consent application within the scope of this report. It is based on our understanding of the proposed development. Should any changes to the nature of the development occur, BCD should be asked to provide comment on the ongoing applicability of recommendations made in this report. It is not to be relied upon or used out of context by any other person without reference to BCD Group Ltd. The reliance by other parties on the information or opinions contained in this report shall, without prior review and agreement in writing, be at such parties' sole risk. To avoid misinterpreting this report, we recommend that the assistance of geotechnical professionals familiar with the project and scope of this report is maintained.

Engineering design recommendations have been made based on the information provided to BCD. Should these recommendations be used for construction, BCD are to sight approved Building Consent drawings to ensure compliance with recommendations made within this report. If a Producer Statement 4 or construction observation is required from BCD (see BCD report and/or consent requirements from council), we are to be contacted prior to construction to outline appropriate inspection milestones.

This report covers geotechnical & stormwater considerations only. This report does not assess risk of contamination of soils or provide an assessment of flood risk and FFL recommendation. We recommend the proposed works be checked against current District and Regional Council plans or checked by a registered planner.

Appendix A

Site Details



HINUERA FORMATION (TAURANGA GROUP)
(Q3a) Laminated, commonly *cross-bedded, fluvial sands* and gravels, dominated by fragments of pumice and ash, plus quartz and feldspar crystals, and lava fragments; younger part is derived predominantly from reworking of the Oruanui Formation. Includes some primary ignimbrite.

Q3a

BIBLIOGRAPHIC REFERENCE

Leonard, G.S., Begg, J.G., Wilson, C.J.N. (compilers) 2010. Geology of the Rotorua area. Institute of Geological & Nuclear Sciences 1:250 000 geological map 5. 1 sheet + 102 p. Lower Hutt, New Zealand. GNS Science.

BCD GROUP

Site Details

PROJECT TITLE
New Three Lot Subdivition
27 Cureton Road, Morrinsville

REV	DATE	BY	REASON
01	22/01/2025	BB	Resource Consent

DRAWN:	SCALE:	AT:
BB	1:20,000	A3
JOB NUMBER:	SHEET NUMBER:	REVISION
25-0008	G-01	01

Appendix B

Investigation Plan and Data

NOTES:

1. GENERAL

1.1. Existing subject property boundaries source
1.1.1. Survey accurate (calculated);

1.2. Areas and measurements are approximate and subject to survey;

1.3. All easements may not be shown.

1.4. Sizing of Stormwater infrastructure is indicative and will be determined in Civil report.

1.5. Services have been obtained from Council GIS and may not have been verified.

2. SURVEY

2.1. Datum
2.1.1. Horizontal datum: Mount Eden 2000
2.1.2. Vertical datum: NZVD2016

SITE COVERAGE	
Existing dwelling	105m²
TOTAL	105m²
SITE AREA (net)	456m²
SITE COVERAGE	23.0%

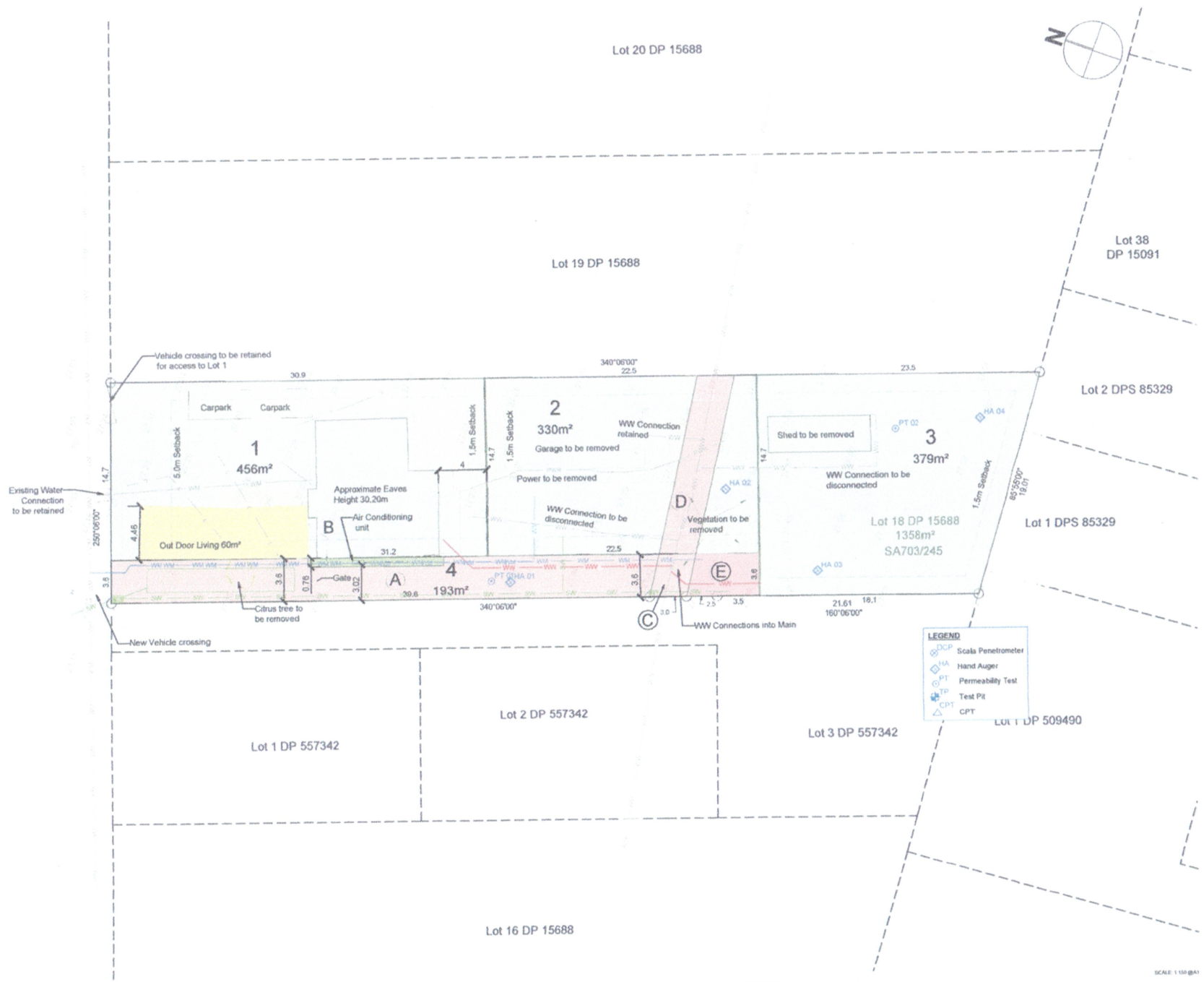
Impervious Surfaces	
Existing Dwelling	105m²
Concrete	150m²
TOTAL	255m²
SITE AREA	456m²
Impervious Surfaces	55.9%

Proposed Schedule of Easements

Purpose	Shown	Burdened Land (Servient Tenement)	Benefited Land (Dominant Tenement)
Right to Drain Sewage	A,C,E	Lot 3 hereon	Lots 1, 2 Hereon
Eaves Overhang	B	Lot 3 Hereon	Lot 1 Hereon
Right of Way	C	Lot 3 Hereon	Lots 2 Hereon
Right to Convey Electricity Telecommunication & and water	A,C,E	Lot 3 hereon	Lots 2 hereon

Proposed Schedule of Easements (In Gross)

Purpose	Shown	Burdened Land (Servient Tenement)	Grantee
Right to Drain Sewage	D	Lot 2 hereon	Matamata Piako District Council
Right to Drain Sewage	C	Lot 3 hereon	Matamata Piako District Council



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project status

25-0008	FOR INFO	LOT 18 DP 15688 27 Cureton Street, Morrinsville	SCHEME PLAN C-010 rev 1	DRAWN: DL 28/01/2025	BCD GROUP

Soil Description

Log Identification: PT02

R.L.	Coordinates:
NZVD2016: 27m	-37.663165, 175.527523

Investigation method	Depth (meters)	Field Description	Geological Unit
Hand Auger (100mm)	0.0	**Topsoil**; dark brown. Dry.	TS
	0.5	**SILT** with trace sand; light brown. Dry. Some plasticity. Sand is fine grained. - at 1.5m, Soil becomes moist.	Hinuera Formation
	1.0	Silty **SAND**; light brown. Moist. Some plasticity.	
	1.5	**End of Test pit** - Target depth reached	
	2.0		
	2.5		
	3.0		
	3.5		
	4.0		
	4.5		
	5.0		
	5.5	Groundwater not encountered during testing	

Field Test Data

Depth (meters)	Peak Vane Shear Strength (kPa)	Residual Vane Shear Strength (kPa)	Sensitivity	Scala Penetrometer (blows per 100mm drop) Blow count	Plot of Scala results: Very loose / Loose / Medium Dense / Dense (0 1 2 3 4 5 6 7 8 9 10)	Groundwater Level
0.0						
0.5						
1.0						
1.5						
2.0						
2.5						
3.0						
3.5						
4.0						
4.5						
5.0						
5.5						

Notes:
1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
2. OB refers to hand auger over bored. HW refers to scala falling under the weight of the hammer. TS refers to topsoil.
3. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", December 2005
4. Vane shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "Guideline for Hand Held Shear Vane Test", August 2001.
5. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.
6. Coordinates (where reported) are presented in NZTM2000 to an accuracy of ±5m.
7. Shear vane results are multiplied by factor A and plus factor B where applicable

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Job Number: 25-0008	**Shear Vane ID:N/A**
Client: Land Consultancy Group	**Calibration Expiry Date: #N/A**
	Shear Vane Factors: #N/A #N/A
Location: 27 Cureton Street, Morrinsville	
Date Of Investigation: 20/01/2025	**Logged By: BB** **Checked By: MC**

Soil Description

Log Identification: PT01

Investigation method	Depth (meters)	Field Description	Geological Unit	Depth (meters)
		R.L. NZVD2016: 27m; **Coordinates:** -37.663100 , 175.527328		
Hand Auger (100mm)		**Topsoil**; dark brown. Dry.	TS	
	0.5	Sandy **SILT**; light orange brown. Dry. Sand is fine.	Hinuera Formation	0.5
	1.0	Clayey **SILT**; light greyish brown with orange mottling. Dry.		1.0
	1.5	Silty **SAND**; light orange grey. Dry to moist. Sand is fine to medium. - at 1.1m, Soil becomes wet. Silty **SAND**;light orange brown. Wet to saturated.		1.5
	2.0	**End of Test pit** - Target depth reached		2.0
	2.5			2.5
	3.0			3.0
	3.5			3.5
	4.0			4.0
	4.5			4.5
	5.0			5.0
	5.5	Groundwater not encountered during testing		5.5

Field Test Data

Peak Vane Shear Strength (kPa)	Residual Vane Shear Strength (kPa)	Sensitivity	Scala Penetrometer (blows per 100mm drop) Blow count	Plot of Scala results: Very loose 0 1 / Loose 2 3 4 / Medium Dense 5 6 7 / Dense 8 9 10	Groundwater Level

Notes:
1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
2. OB refers to hand auger over bored. HW refers to scala falling under the weight of the hammer. TS refers to topsoil.
3. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", December 2005
4. Vane shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "Guideline for Hand Held Shear Vane Test", August 2001.
5. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.
6. Coordinates (where reported) are presented in NZTM2000 to an accuracy of ±5m.
7. Shear vane results are multiplied by factor A and plus factor B where applicable

BCD GROUP

Job Number: 25-0008
Client: Land Consultancy Group

Shear Vane ID:N/A
Calibration Expiry Date: #N/A
Shear Vane Factors: #N/A #N/A

Location: 27 Cureton Street, Morrinsville

Date Of Investigation: 20/01/2025

Logged By: IC **Checked By: MC**

Soil Description

Log Identification: HA04

R.L. NZVD2016: 27m
Coordinates: -37.663335, 175.527590

Investigation method	Depth (meters)	Field Description	Geological Unit	Depth (meters)	Peak Vane Shear Strength (kPa)	Residual Vane Shear Strength (kPa)	Sensitivity	Field Test Data: Scala Penetrometer (blows per 100mm drop) — Blow count	Groundwater Level
Hand Auger (50mm)		**TOPSOIL**; dark brown. Dry.	TS					6	
		SILT with trace sand; light brown. Hard, dry, slightly plastic, sensitive. Sand is fine grained.			214+			5	
	0.5			0.5	214+			6	
		- at 0.6m, Soil becomes moist			199	31	6.5	6	
								5	
		Sandy **SILT**; light brown. Stiff, moist, slightly plastic, sensitive. Sand is fine grained.						4	
	1.0			1.0	76	15	5.0	2	
								5	
					214+			2	
								3	
								7	
	1.5	Silty **SAND**; brown. Medium dense, moist. Sand is fine to medium.		1.5				5	
		- at 1.5m, Soil becomes moist to wet.						5	
		- at 1.7m, Soil becomes wet.						6	
								4	
		- at 1.9m, Soil becomes saturated.						3	
	2.0			2.0				3	
								2	
		SILT with trace clay; light brown. Firm, wet to saturated, moderatly plastic, moderately sensitive.	Hinuera Formation						
	2.5			2.5	46	15	3.0		
		- at 2.9m, Soil becomes moist to wet.			61	8	8.0		
	3.0			3.0					
		- at 3.1m, Soil becomes saturated. No sample retrieved			53	15	3.5		
	3.5			3.5					
	4.0			4.0	25.5	6	4.2		
		Sandy **SILT**; grey. Very stiff, saturated, moderatley plastic, moderately sensitive. Sand is fine to coarse.		4.5	130	53	2.4		
		End of Hand Auger at 4.5m - No sample retrieved							
	5.0			5.0					
	5.5			5.5					
		Groundwater encountered at 1.9m during testing.							

Scala Penetrometer (blows per 100mm drop) — Plot of Scala results: Very loose 0 1 | Loose 2 3 4 | Medium Dense 5 6 7 | Dense 8 9 10

Notes:
1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
2. OB refers to hand auger over bored. HW refers to scala falling under the weight of the hammer. TS refers to topsoil.
3. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", December 2005
4. Vane shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "Guideline for Hand Held Shear Vane Test", August 2001.
5. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.
6. Coordinates (where reported) are presented in NZTM2000 to an accuracy of ±5m.
7. Shear vane results are multiplied by factor A and plus factor B where applicable

BCD GROUP

Job Number: 25-0008
Client: Land Consultancy Group

Shear Vane ID:3844 (19mm blade)
Calibration Expiry Date: 10/07/2025
Shear Vane Factors: A: 1.528

Location: 27 Cureton Street, Morrinsville

Date Of Investigation: 20/01/2025
Logged By: BB
Checked By: MC

Soil Description

Log Identification: HA03

R.L.	Coordinates:
NZVD2016: 27m	37.663294, 175.527438

Investigation method	Depth (meters)	Field Description	Geological Unit	Depth (meters)
Hand Auger (50mm)		**TOPSOIL**; dark brown. Dry.	TS	
		SILT with trace sand; light brown. Hard, dry, slightly plastic, moderately sensitive. Sand is fine grained.	Hinuera Formation	
	0.5	- at 0.6m, Soil becomes moist.		0.5
	1.0	Silty **SAND**; light brown. Medium dense, moist. Sand is fine to medium.		1.0
	1.5	- at 1.8m, Soil becomes wet.		1.5
	2.0	- at 2.0m, Soil becomes saturated.		2.0
	2.5	**SILT;** light orange brown. Firm, wet, moderatly plastic, moderately sensitive. - at 2.6m, Soil becoms saturated.		2.5
	3.0	**End of Hand Auger at 2.7m** - No sample retrieved.		3.0
	3.5			3.5
	4.0			4.0
	4.5			4.5
	5.0			5.0
	5.5	Groundwater encountered at 2m during testing.		5.5

Field Test Data

Depth (meters)	Peak Vane Shear Strength (kPa)	Residual Vane Shear Strength (kPa)	Sensitivity	Scala Penetrometer (blows per 100mm drop) Blow count	Groundwater Level
	214+			6 5 5 5	
0.5	168	31	5.5	5	
	53	15	3.5	3 2 1 3	
1.0				3 5 5 3 2	
1.5				2 3 3 2 2	
2.0				3 4 4 3 3	
2.5	34	10	3.4		
3.0	25.5	7	3.6		

Plot of Scala results: Very loose 0 1 | Loose 2 3 4 | Medium Dense 5 6 7 | Dense 8 9 10

Notes:
1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
2. OB refers to hand auger over bored. HW refers to scala falling under the weight of the hammer. TS refers to topsoil.
3. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", December 2005
4. Vane shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "Guideline for Hand Held Shear Vane Test", August 2001.
5. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.
6. Coordinates (where reported) are presented in NZTM2000 to an accuracy of ±5m.
7. Shear vane results are multiplied by factor A and plus factor B where applicable

BCD GROUP

Job Number: 25-0008
Client: Land Consultancy Group

Shear Vane ID:3844 (19mm blade)
Calibration Expiry Date: 10/07/2025
Shear Vane Factors: A: 1.528

Location: 27 Cureton Street, Morrinsville

Date Of Investigation: 20/01/2025

Logged By: BB **Checked By: MC**

Soil Description

Log Identification: HA02

Investigation method	Depth (meters)	Field Description	Geological Unit	Depth (meters)	Peak Vane Shear Strength (kPa)	Residual Vane Shear Strength (kPa)	Sensitivity	Blow count	Scala Penetrometer (blows per 100mm drop)	Groundwater Level
		R.L. NZVD2016: 27m **Coordinates: -37.663219, 175.527487**								
Hand Auger (50mm)		**TOPSOIL**; dark brown. Dry.	TS					2		
		Clayey **SILT**; light orange brown. Stiff, dry, slightly plastic, moderately sensitive.	Hinuera Formation		95	28	3.3	3		
	0.5			0.5				0.33		
								0.33		
		Sandy **SILT**; light greyish brown with orange mottling. Stiff, dry to moist, moderately sensitive. Sand was fine to medium.			76	38	2.0	0.33		
		Silty **SAND** with trace gravel; dark orange brown. Medium dense, dry to moist, moderately sensitive. Sand is medium to coarse.						1		
	1.0			1.0				3		
		- at 1.1m, Soil becomes moist.						4		
								6		
								7		
								3		
								3		
	1.5			1.5				3		
								4		
		Silty **SAND**; orange brown. Medium dense, wet, moderately sensitive. Sand is fine to medum grained.						4		
								4		
								5		
	2.0			2.0				4		
								5		
		Clayey **SILT**; light orange brown. Stiff, saturated, slightly plastic, insensitive.								
	2.5			2.5	110		5.0			
		Clayey **SILT**; light brownish grey. Stiff, saturated, slightly plastic, moderately sensitive.			95	44	2.1			
	3.0			3.0	82	44	1.9			
		End of Hand Auger at 3.0m - Target depth.			63	32	2.0			
	3.5			3.5						
	4.0			4.0						
	4.5			4.5						
	5.0			5.0						
	5.5			5.5						
		Groundwater encountered at 2m during testing.								

Field Test Data

Plot of Scala results: Very loose 0 1 | Loose 2 3 4 | Medium Dense 5 6 7 8 | Dense 9 10

Notes:
1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
2. OB refers to hand auger over bored. HW refers to scala falling under the weight of the hammer. TS refers to topsoil.
3. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", December 2005
4. Vane shear strengths (where reported) have been corrected in general accordance with NZ Geotech Society Inc. "Guideline for Hand Held Shear Vane Test", August 2001.
5. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.
6. Coordinates (where reported) are presented in NZTM2000 to an accuracy of ±5m.
7. Shear vane results are multiplied by factor A and plus factor B where applicable

BCD GROUP

Job Number: 25-0008
Client: Land Consultancy Group

Shear Vane ID:1791
Calibration Expiry Date: 27/03/2024
Shear Vane Factors: A: 1.577

Location: 27 Cureton Street, Morrinsville

Date Of Investigation: 20/01/2025

Logged By: IC **Checked By: MC**

Soil Description

Log Identification: HA01

Investigation method	Depth (meters)	R.L. NZVD2016: 27m / Coordinates: 37.663115, 175.527340 Field Description	Geological Unit	Depth (meters)	Peak Vane Shear Strength (kPa)	Residual Vane Shear Strength (kPa)	Sensitivity	Blow count	Scala Penetrometer (blows per 100mm drop) Plot of Scala results (Very loose / Loose / Medium Dense / Dense)	Groundwater Level
Hand Auger (50mm)		**TOPSOIL**; dark brown. Dry.	TS					3		
								6		
		SILT with trace of sand; orange brown with light brown mottling. Hard, dry, slightly plastic, moderatley sensitive. Sand is fine to medium.	Hinuera Formation		183	47	3.9	6		
	0.5			0.5				3		
					164	32	5.2	4		
								4		
								3		
								3		
	1.0	Silty **CLAY** with traces of sand; light brown. Stiff, moist, slightly plastic, moderately sensitive.		1.0	95	22	4.3	4		
								2		
								2		
					91	19	4.8	3		
								4		
	1.5	Silty **SAND**; light brownish grey. Medium dense, wet, slightly plastic, moderately sensitive. Sand is fine to medium.		1.5				2		
								2		
		SAND with trace silt; light brownish grey. Medium Dense, saturated, moderately sensitive. Sand is fine to medium.						3		
								3		
								4		
	2.0			2.0				6		
		Sandy **SILT**; light brownish grey. Stiff, saturated, insensitive. Sand is fine to medium.			69	41	1.7			
	2.5			2.5	57	41	1.4			
		Clayey **SILT** with trace gravel; light brownish orange. Firm, moist, insensitive. Gravel is medium								
	3.0			3.0	16	16	1.0			
		SILT with trace sand; light grey. Firm, saturated, plastic, insensitive. Sand in fine to medium			16	13	1.3			
	3.5			3.5	14	14	1.0			
					19	25	0.8			
	4.0			4.0	95	54	1.8			
	4.5			4.5	170	114	1.5			
	5.0	**End of Hand Auger at 5.0m** - Target depth		5.0	173	142	1.2			
	5.5	Groundwater encountered at 1.6m during testing.		5.5						

Notes:
1. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
2. OB refers to hand auger over bored. HW refers to scala falling under the weight of the hammer. TS refers to topsoil.
3. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes", December 2005
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6. Coordinates (where reported) are presented in NZTM2000 to an accuracy of ±5m.
7. Shear vane results are multiplied by factor A and plus factor B where applicable

BCD GROUP

Job Number: 25-0008
Client: Land Consultancy Group

Shear Vane ID:1791
Calibration Expiry Date: 27/03/2024
Shear Vane Factors: A: 1.577

Location: 27 Cureton Street, Morrinsville

Date Of Investigation: 20/01/2025

Logged By: IC **Checked By: MC**

4.6 Buried Services

The MPDC GIS indicates that there is a council 150 diameter wastewater pipe runs across the site. The pipe invert depth from the GIS is unknown. Any buildings that encroach on the wastewater main will need SED design as per Section 5 D5.6 of the CoLAB Regional Infrastructure Technical Specification or setback to where a 45° line does not intersect the pipe.

5 GEOTECHNICAL INVESTIGATIONS

5.1 Walkover Observations

There are no significant geotechnical or geological features beyond those described in the site description in Section 3.

5.2 Investigation Procedure

The following investigations were undertaken by BCD to evaluate the subsurface conditions at the site on 20/01/2025. Investigation data can be found in Appendix C.

- 4x hand augers (HA) up to 3m - 5m depth in area of proposed new lots
- 2x soil permeability tests up to 2m depth for stormwater management

5.3 Subsoil Profile

The subsoil profile encountered at the site is consistent with the mapped regional geology.

5.3.1 Surficial soils

The near surface conditions as encountered in the hand augers consist of 0.2-0.3m of Topsoil.

Beneath the topsoil, the natural soils consist of stiff to hard silts between 0.8m to 1.4m below ground level. A 0.9m to 1.3m thick layer of loose to medium dense sand underlays the surface silts before encountering a soft to very stiff layer of silts through to end of testing.

5.4 Groundwater

Groundwater was encountered at depths of 1.6m to 2.0m bgl, which corresponds to an approximate RL25.9m to RL25.5m, at the time of the investigation in January. This is considered typical of summer levels and is likely to be higher following periods of prolonged or intense rainfall. A groundwater level of 1.6m has been assumed in our assessment to account for winter levels.