oneelevensix
STRUCTURAL, CIVIL & BRIDGE ENGINEERS

ENGINEERING REPORT

Project:
Proposed Subdivision
373 Maude Road, Korito, Kaimiro, Taranaki

Client:
Rachel Broadmore

JOB NUMBER: 24005
Rev B
31 January 2024

ENGINEERING NEW ZEALAND OFFICIAL MEMBER
nzsee NEW ZEALAND SOCIETY FOR EARTHQUAKE ENGINEERING
SESOC
NEW ZEALAND GEOTECHNICAL SOCIETY INC

PROJECT DETAILS

Project title	Proposed Subdivision
Proposed development	Proposed Lot 1 and Lot 3 being subdivision of Lot 1 DP521015 & Lot 2 DP563612.
Site address	373 Maude Road, Korito, Kaimiro, Taranaki
Legal description	Lot 1 DP 521015
Client	Rachel Broadmore

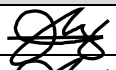
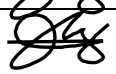
REPORT SUMMARY

Good ground assessment	The completed soil investigation to the proposed Lot 1 building platform has determined that the subsoil on the tested locations **does not meet the definition of "Good ground"** as outlined in the Building Code amendments and NZS3604:2011.
Compressible material	Topsoil and Uncontrolled Fill material.
Subsoil Bearing Capacity	300 kPa can be assumed to the natural Taranaki Ash soil below topsoil and uncontrolled fill.
Subsoil Class	Subsoil Class D in terms of NZS1170
Liquefaction	Low risk (hill site) – Liquefaction damage is Unlikely.
Lateral spread	Low risk based on unlikely liquefaction damage risk.
Technical Category	Technical Category 1 (TC1).
Expansive soil	No expansive soil identified to the tested locations.
Slope Stability	The slope stability risk to the proposed building platform is considered to be low due to its low slope angle of 11 to 14 degrees from horizontal (1V : 5H to 1V : 4H).
Foundation recommendations	The subsoil below the proposed building platform **does not meet the definition of "Good ground"** as outlined in the Building Code amendments and NZS3604:2011. Therefore, specific designed foundation is required.
Future geotechnical works	Earthworks (cut and fill) are required to create level building platform for future developments. Hence, further geotechnical investigations and assessments are required after completion of earthworks.
Earthworks	Earthworks are required to create level building platform. Please refer to Section 7.4 for earthwork requirements.
Flooding	The proposed building platform site is elevated and not within NPDC flood area map. Therefore, there are no flood risks to the site.
Overland flow	The overland flow on the proposed development will be as per existing apart from the overland flows on the proposed building platform and vehicle access. Therefore, the natural drainage pattern on the proposed Lot 1 will not be significantly impacted.
Building Platform	Our geotechnical investigations and assessments identified that stable and flood free building platform suitable for building foundations in accordance with the requirements of SUB-S2 and NZ Building Code can be achieved to the proposed Lot 1 if the recommendations detailed in Section 7of this report are followed.
Stormwater management	Standard soakholes are not suitable to the site. Please refer to Section 7.7 for the stormwater management requirements for compliance with NZBC and SUB-S4.
Wastewater management	The wastewater disposal system shall be designed by a suitably qualified person during the building consent stage. Please refer to Section 7.8 for the wastewater management for compliance with NZBC and SUB-S6.
Subdivision suitability	Our geotechnical assessments identified that the site is unlikely to be subject to geotechnical-related natural hazard in accordance with Section 106 of the Resource Management Act 1991. If the recommendations detailed in Section 7 of this report are followed, we consider that: • the likely subsequent use of the land is unlikely to accelerate, worsen or result in geotechnical-related hazards. • stable and flood free building platform suitable for building foundations in accordance with the requirements of Effects Standards and NZ Building Code can be achieved to the proposed Lot 1. Based on the results of our geotechnical assessments, it can be expected that the site will comply with the relevant Effects Standards, applicable Sections of the Resource Management Act and NZ Building Code. Therefore, the site can be considered suitable for the proposed rural residential subdivision if the recommendations detailed in Section 7 of this report are followed.

REVISION HISTORY

Revision	Description	Rev. version	Date
A	Draft for review/comment	v1	30/01/2024
B	Issued for Resource Consent	v2	31/01/2024

DOCUMENT ACCEPTANCE

Action	Name	Signature	Date
Prepared by	Jeck Icaro I Principal Engineer		31/01/2024
Reviewed by	Jeck Icaro, BSc (Civil), CMEngNZ, CPEng, IntPE(NZ), APEC Engineer		31/01/2024
Approved by	Jeck Icaro I Director at One-Elevensix Ltd		31/01/2024

CONTENTS

1 INTRODUCTION

One-Elevensix Ltd has been engaged by Rachel Broadmore to provide geotechnical engineering assessment to support the proposed rural subdivision.

The subject site is located at 373 Maude Road, Korito, Kaimiro, Taranaki, legally described as Lot 1 DP 521015. The site is within the jurisdiction of the New Plymouth District Council (NPDC) and Taranaki Regional Council (TRC).

This geotechnical investigation and interpretative report summarise the outcome of the geotechnical assessment and provides engineering recommendations for the suitability of the proposed rural residential subdivision development. This report has been prepared for the client Rachel Broadmore to support a Resource Consent application.

2 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 THE SITE

The whole site is consisted of existing Lot 1 (Lot 1 DP 521015 (5.63 Ha)) and Lot 2 (Lot 2 DP563612 (1.28 Ha)) as shown in *Figure 3* with a total land area of 6.91 Hectares (6.91 Ha) (*Source: NPDC GIS*). Both lots are irregular shape with residential dwelling currently occupies the Southern part of Lot 1.

The proposed building platform site (here in known as "the site") is located to the Northern part of the existing Lot 1. This site is moderately sloping and located approximately 100m from the nearest stream, approximately 14.00km away from the Taranaki Coastline and positioned around 360m above sea level. The approximate location and aerial views of the site are shown on *Figure 1, Figure 2 and* Figure 3.

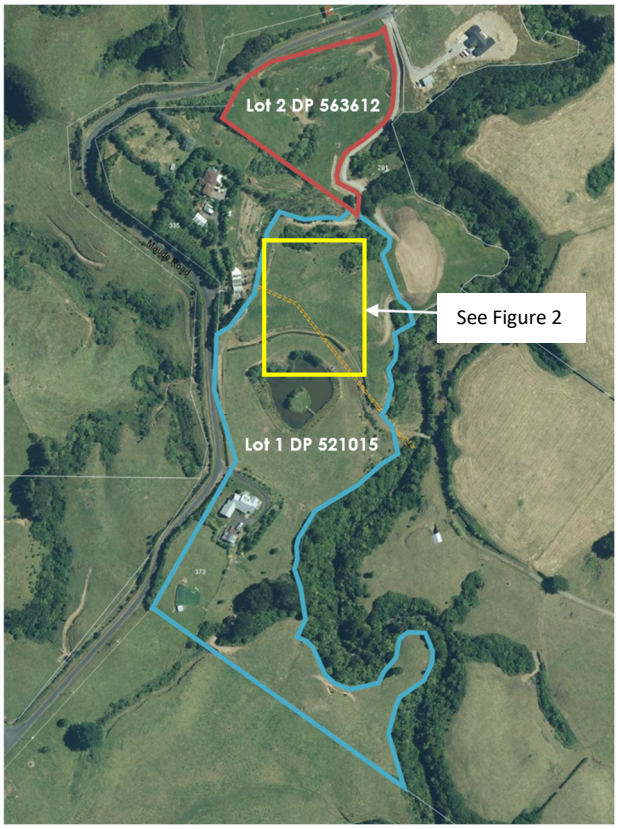


Figure 1: Existing Lot 1 and Lot 2 to be subdivided

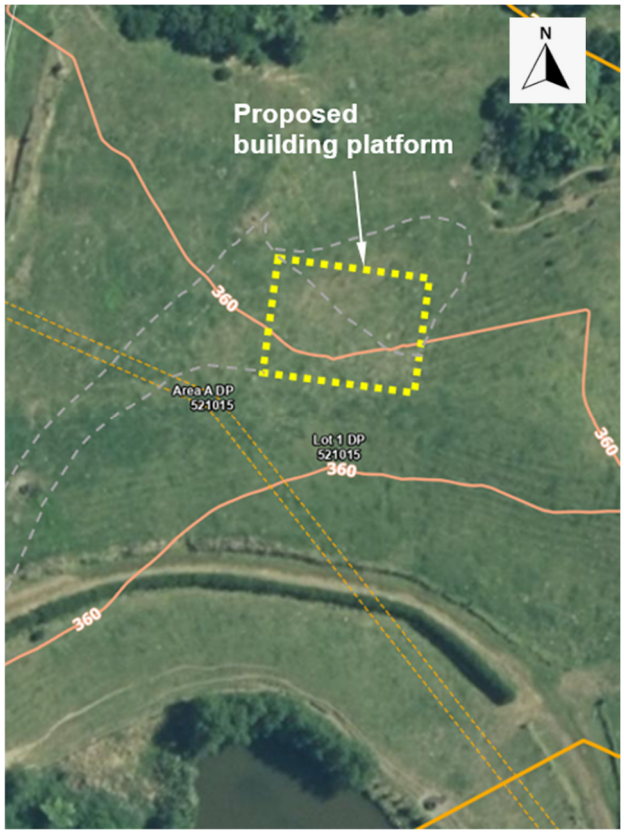


Figure 2: Site location

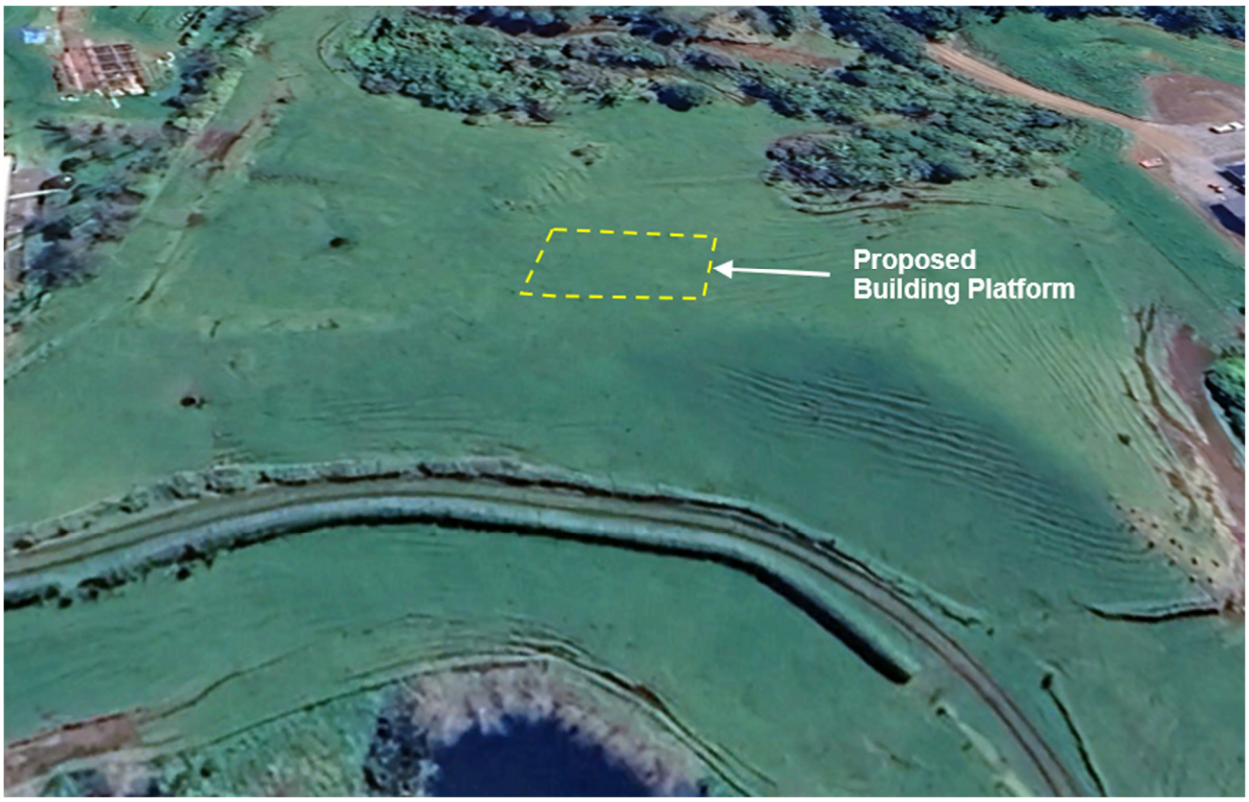


Figure 3: Bird's eye view of the site

2.2 PROPOSED DEVELOPMENT

We understand that the client proposes to subdivide the existing Lot 1 and Lot 2 (Lot 1 DP 521015 and Lot 2 DP563612) into 2 allotments Lots 1 and 3. The proposed Lot 3 will incorporate the existing dwelling and pastoral grazing whilst the proposed Lot 1 will be an empty section for future residential building development to the Southern part and pastoral grazing area to the Northern part. The focus of this soil investigation and geotechnical-related natural hazard assessments will be on the proposed building platform on the proposed Lot 1.

The proposed Lot 1 will be 2.70 hectares whereas the proposed Lot 3 will be 4.20 hectares. Please refer to the proposed subdivision scheme plan shown on Figure 4. Site development concept plans and survey plan are attached in Appendix 5.

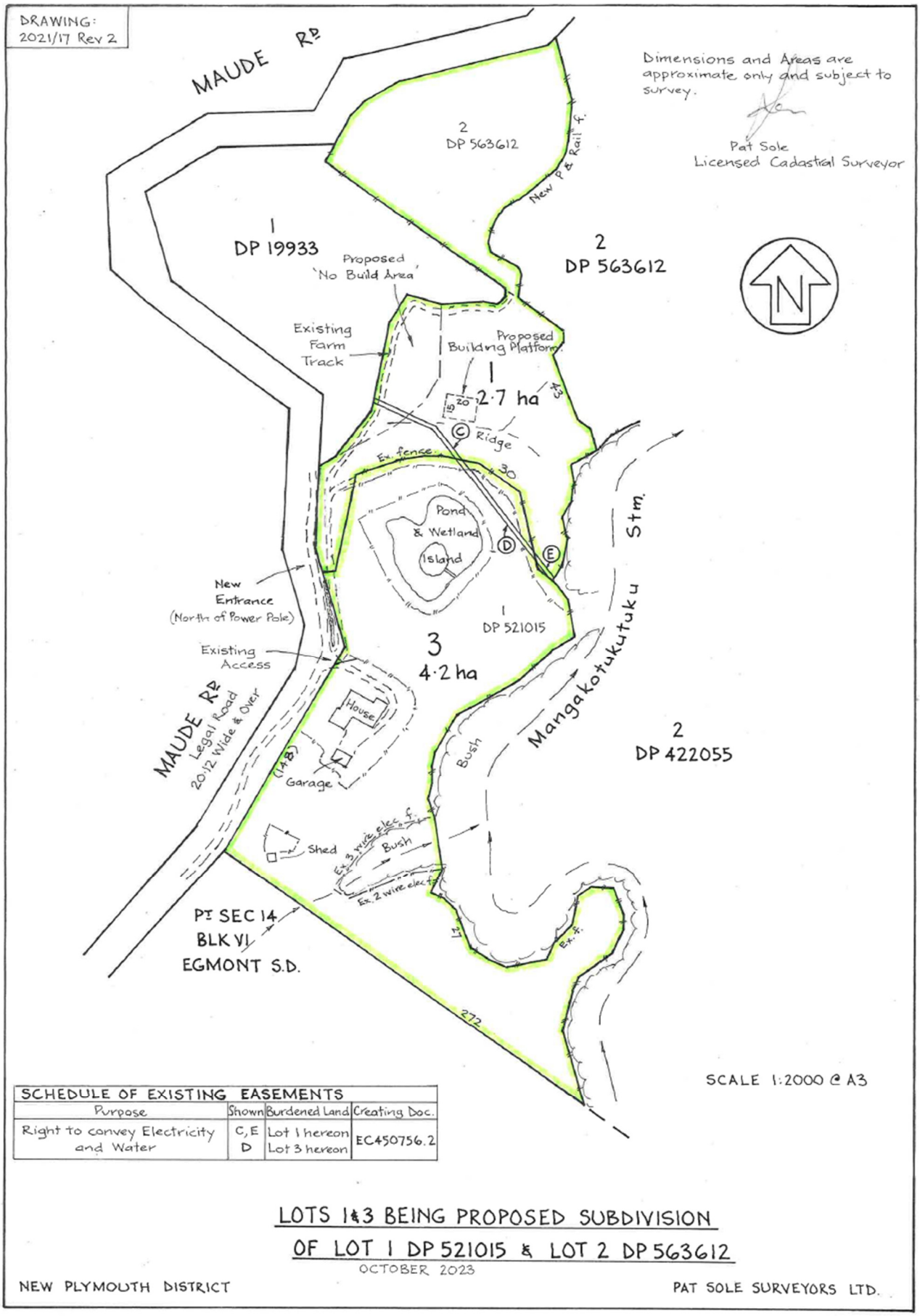


Figure 4: Proposed Subdivision Scheme Plan (Source: Pat Sole Surveyors Ltd)

3 DESKTOP ASSESSMENT

A desktop assessment was undertaken for the site. This assessment reviewed GNS[1] Science and New Zealand Geotechnical Database[2] websites. Historical and latest aerial photographs of the site were reviewed using NPDC GIS system, Retrolens website and Google Earth.

3.1 GEOLOGY AND FAULTING

A geological map published by GNS (Townsend, et al., 2008) indicates that the site is underlain by (Middle Pleistocene) debris avalanche deposits (Maitahi Formation) of Egmont Volcanic Centre described as Laharic breccia of andesite cobbles overlain in places by well sorted dune-bedded tephric sand. Geomorphology mapping undertaken by T+T (Tonkin & Taylor Ltd, 2021) shows that the site is located in the area mapped as Lahar. The nearest mapped active fault to the site is the Inglewood Fault which lies approximately 4.20km East of the site.

3.2 SEISMICITY AND LIQUEFACTION

The liquefaction vulnerability category of the site was assessed by T+T as **Liquefaction Vulnerability Category is Undetermined,** this means at the time of undertaking the assessment, there was *"insufficient information to characterise the expected land performance".* That liquefaction vulnerability assessment was undertaken to a Level A (Basic Desktop Assessment) – level of detail in accordance with the MBIE/MfE Guidance (2017). This report includes review of that liquefaction vulnerability assessment utilising the new site-specific geotechnical investigations undertaken.

3.3 PREVIOUS GEOTECHNICAL REPORTS

There are no previous geotechnical reports supplied to One-Elevensix. We are not aware of any previous geotechnical reports related to the site.

3.4 NEW ZEALAND GEOTECHNICAL DATABASE (NZGD)

A review of the New Zealand Geotechnical Database[3] was undertaken to review any previous soil investigation available within the vicinity of the site. Our review did not identify NZGD soil investigation within the vicinity of the site.

3.5 AERIAL PHOTOGRAPHS

A review of historical photographs is carried out to understand the site's history and identify significant geotechnical alterations and features. The oldest available image and current aerial photo are shown on Figure 5 and Figure 6 respectively. More historical photographs are attached on Appendix 1.

Findings from the Historical imagery review using the Retrolens website, NPDC GIS map and Google map are below:

- 1950 – the site appears having upper gully and lower ridge.
- 1968 – similar to 1950 aerial photo.
- 1982 – some trees along the upper gully area have been removed.
- 2021 – some excavation, shallow bowl like can be seen from photo. Upper gully appears has been filled and the ground profile appear has been recontoured connecting the upper and lower ridges achieving uniformly sloping contour.
- 2005 – similar to 2001
- 2010 - shallow bowl to the cut/excavated area visible in photo
- 2012 – similar to 2010 photo.
- 2017 – dwelling exists on site.

From the above photographs review, we have observed that geotechnical alterations such as site cutting, excavation, backfilling and recontouring occurred in the past. Please refer to Figure 7 and Figure 8 for the location and approximate extent of the observed geotechnical alterations.

[1] https://data.gns.cri.nz/geology/
[2] https://www.nzgd.org.nz/arcgismapviewer/mapviewer.aspx
[3] https://www.nzgd.org.nz/arcgismapviewer/mapviewer.aspx

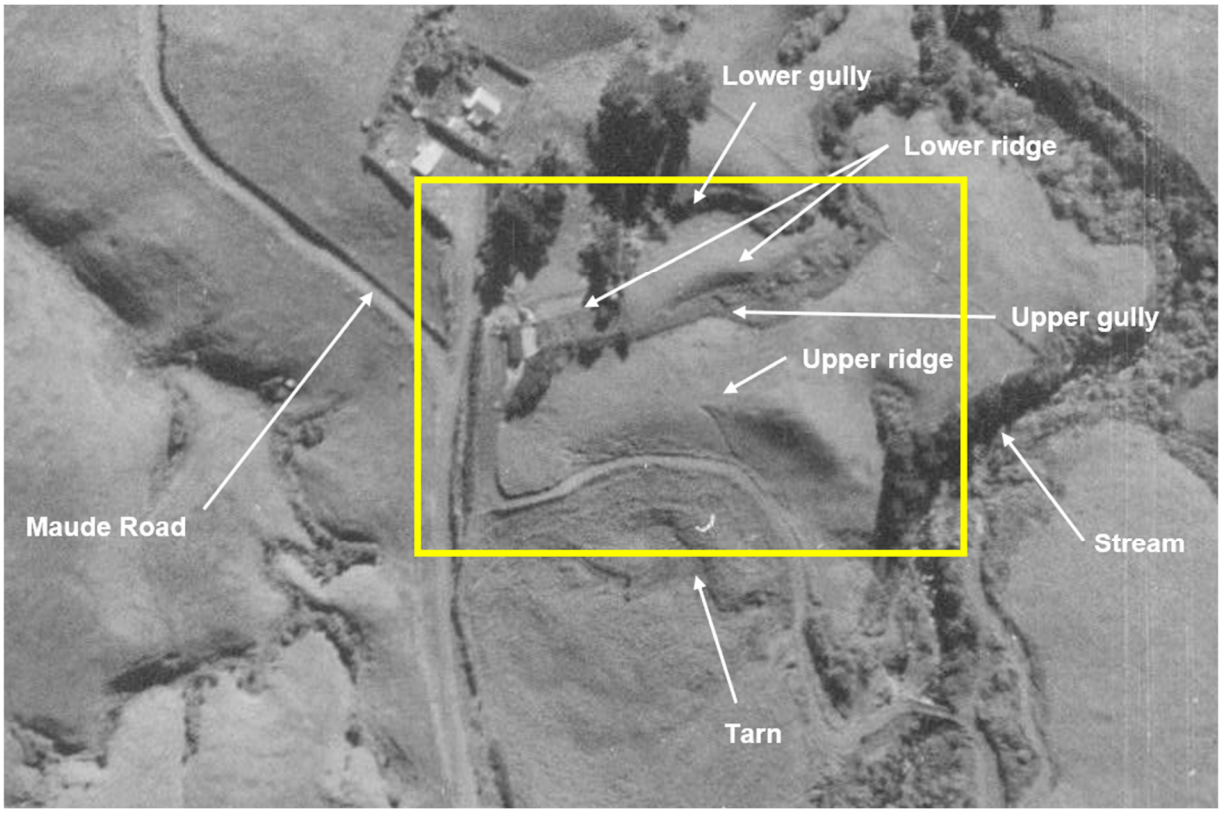


Figure 5: The 1950 aerial photo of the site (Source: Retrolens)

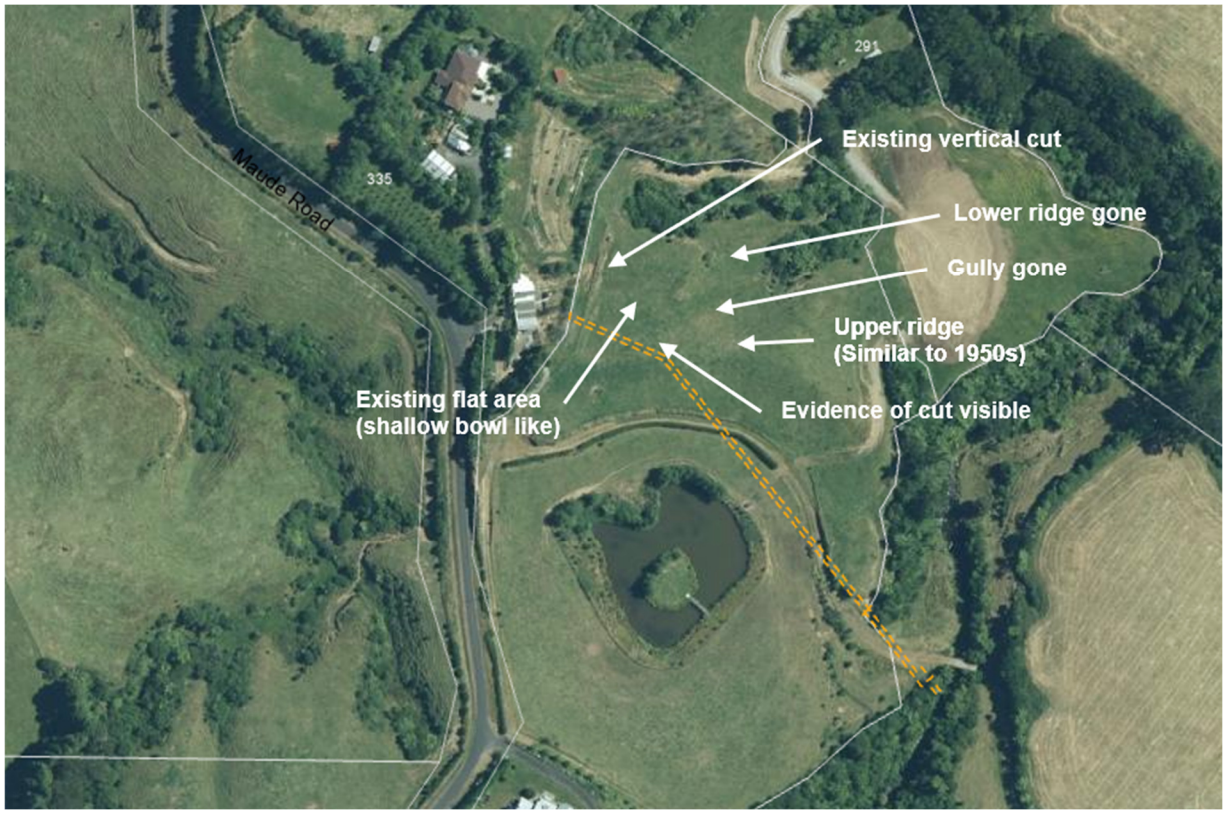


Figure 6: Current aerial photo of the site(Source: NPDC GIS)

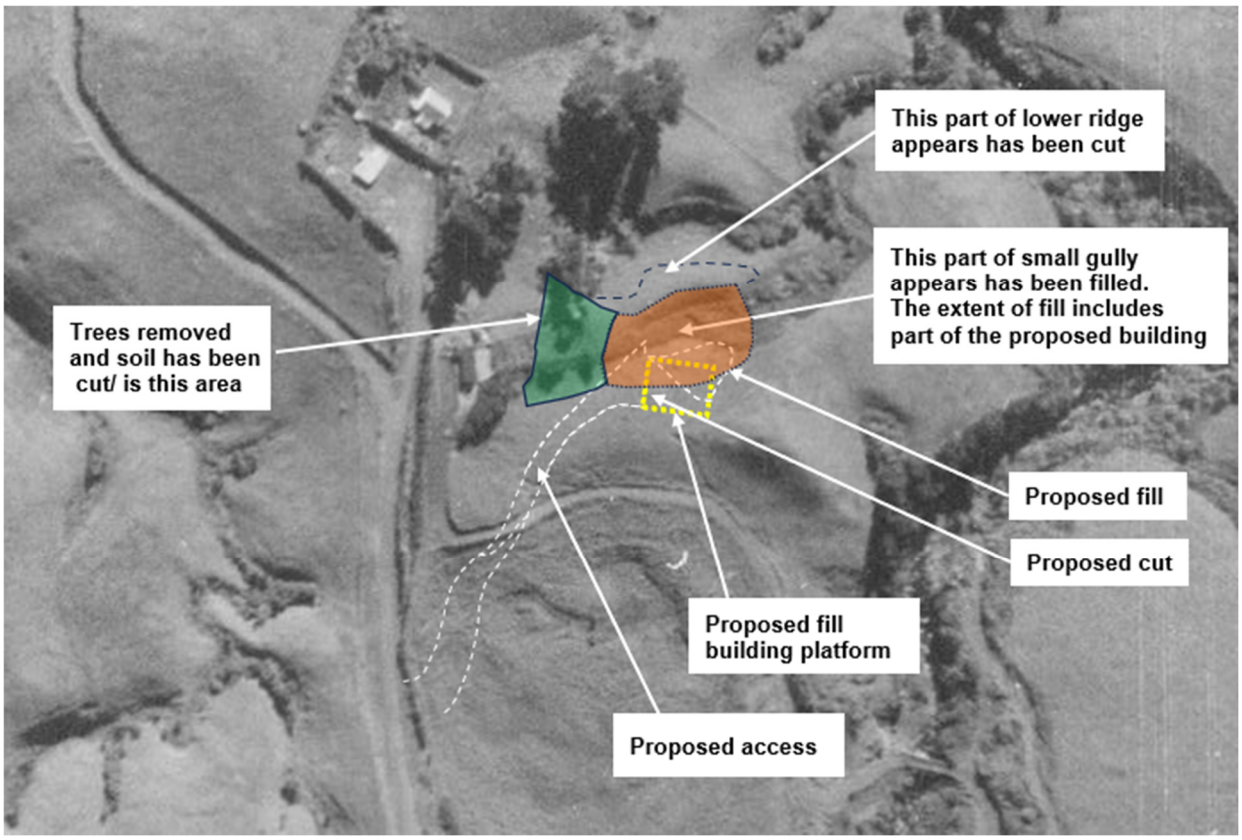


Figure 7: Observed geotechnical alterations.

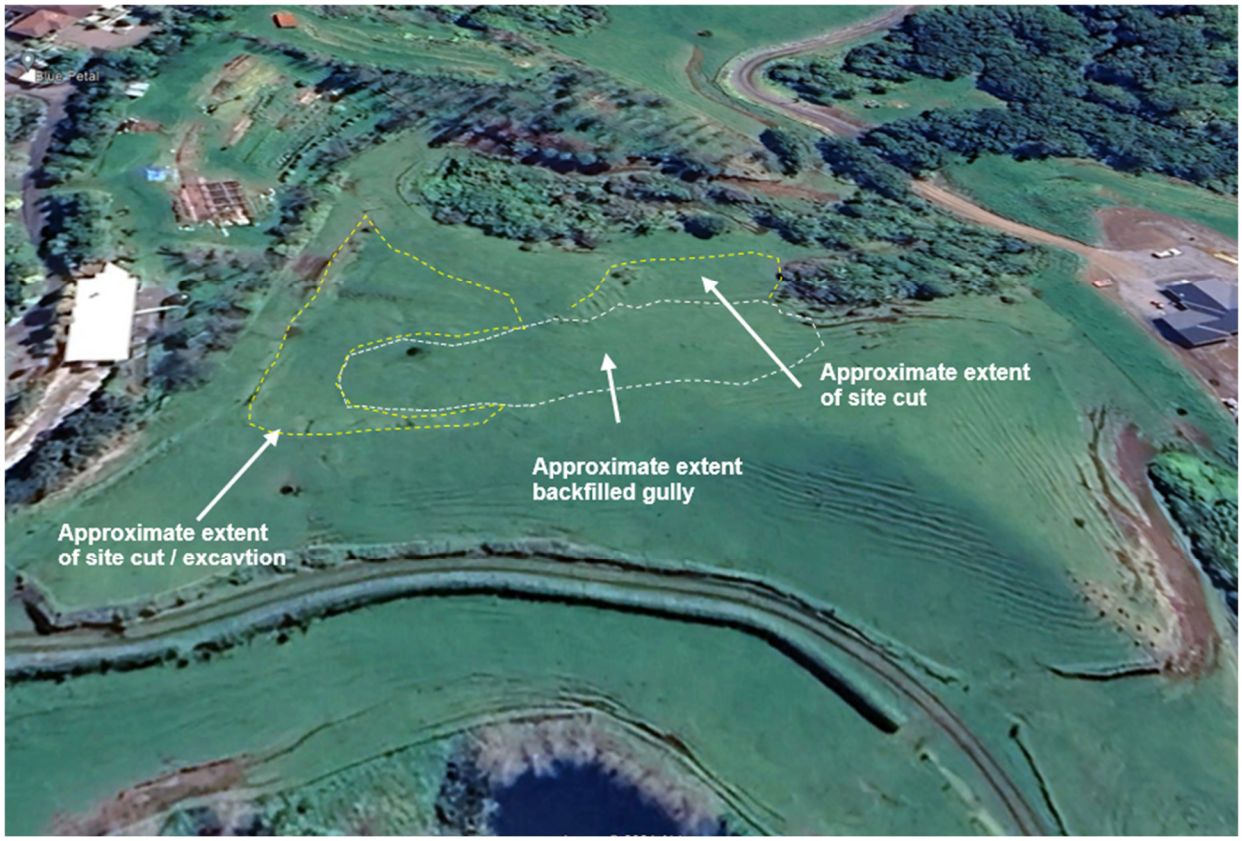


Figure 8: Approximate extent of geotechnical alterations.

4 GEOTECHNICAL INVESTIGATIONS

We visited the site and carried out geotechnical investigations on 24 January 2024. The geotechnical investigations on the site were completed on the approximate location of the building platform on the proposed Lot 1 which comprised of the following:

- Site walkover observation and visual assessment.
- 1 no. hand auger (HA01) borehole x 5.00m depth with in-situ shear vane testing (SV01).
- 2 no. hand auger (HA02 and HA03) boreholes x 2.0m depth with in-situ shear vane testing (SV02, SV03).
- 1 no. scala penetrometer (SP01) testing to 4.0m depth.
- 2 no. scala penetrometer (SP02 and SP03) testing to 2.0m depth.

The test locations and results of these geotechnical investigations are attached in Appendix 2.

4.1 SITE WALKOVER OBSERVATION AND VISUAL ASSESSMENT

The site walkover observation and visual assessment were carried out prior to soil investigation works. We noted the below during our walkover observations and visual assessments.

(a) There is approximately 0.80 to 2.0m historic vertical cut to West property boundary of the proposed Lot 1. Refer to *Figure 9* for the location and *Figure 10* and *Figure 11* for sample photographs.
(b) Historic cut batter (now mostly covered by grass and soil) is also evident to the Northern side of the Western part of the ridge, West of the proposed building platform. Refer to *Figure 9* and *Figure 12* for the location and sample photograph.
(c) There is a soil bund like or lower ridge located North-West of the proposed building platform trapping stormwater to *the flat shallow bowl like area.* Refer to *Figure 9* and *Figure 11* for the location and sample photograph of the trapped stormwater.
(d) There is a dry gully to the Northern property boundary of the existing Lot 1.
(e) The location of the proposed building platform has a moderate slope ranges from 1:5 to 1:4 (11 to 14 degree slope).

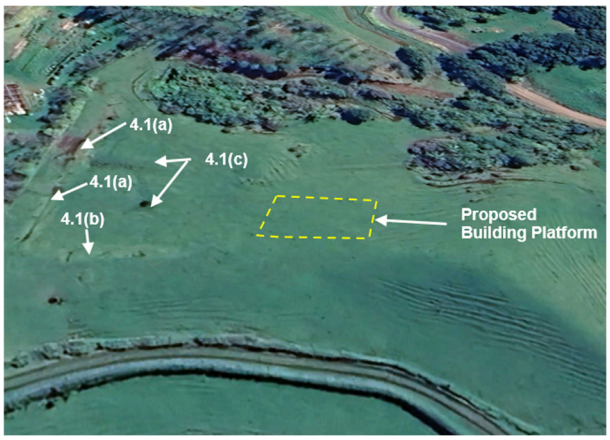


Figure 9: Observation notes location reference


Figure 10: Historic vertical cut


Figure 11: Historic vertical cut and trapped stormwater to the flat shallow bowl like area


Figure 12: Historic cut batter to the north side of the Western part of the ridge

Figure 13: Dry gully photo 1, North property boundary of existing Lot 1

Figure 14: Dry gully photo 2, North property boundary of existing Lot 1

4.2 HAND AUGER BOREHOLES AND SHEAR VANE TESTS

The hand auger borehole investigations and shear vane testing carried out at the site are summarised in *Table 1.* Complete results are attached in Appendix 2. The approximate ground surface elevations were obtained from the supplied Survey data whereas the approximate coordinates are from Google map.

Table 1: Summary of Hand Auger Investigations

Test ID	Coordinates	Ground Surface Elevations (m)	Target depth (m)	Termination Depth (m)	Reason for termination
HA01/SV01	-39.190247, 174.098510	359.50	5.00	5.00	Target depth
HA02/SV02	-39.190356, 174.098629	360.75	2.00	2.00	Target depth
HA03/SV03	-39.190250, 174.098742	357.20	2.00	2.00	Target depth

4.3 SCALA PENETROMETER TESTS

The Scala Penetrometer (SP) investigations carried out at the site are summarised in Table 2. Complete results are attached in Appendix 2. The approximate ground surface elevations were obtained from the supplied Survey data whereas the approximate coordinates are from Google map.

Table 2: Summary of Scala Penetrometer Tests

Test ID	Coordinates	Ground Surface Elevations (m)	Target depth (m)	Termination Depth (m)	Reason for termination
SP01	-39.190365, 174.098492	361.20	4.00	4.00	Target depth
SP02	-39.190258, 174.098618	358.10	2.00	2.00	Target depth
SP03	-39.190357, 174.098744	359.60	2.00	2.00	Target depth

4.4 CONE PENETROMETER TESTS

We did not carry out the Cone Penetrometer Test (CPT) as it is outside our scope. We consider the soil investigation and available information sufficient for the proposed subdivision.

4.5 GROUNDWATER

The groundwater is not encountered during hand auger investigations.

4.6 GEOTECHNICAL MODEL

The geological profile presented in this report and in associated appendices is based upon information obtained from the recently completed hand-auger boreholes, shear vane and scala penetrometer tests. The nature and continuity of the subsoil profile away from these locations is inferred but it must be appreciated that actual conditions may vary from the assumed model.

A summary of the generalised geological profile is presented in *Table 3.*

Table 3: Generalised geological profile.

Geological Unit	Soil Description	Typical depth to base of layer (m)	Typical layer thickness (m)	Scala Penetrometer (blows/100 mm)	Undrained shear strength range (kPa)	Ultimate Bearing Capacity range (unfactored) (kPa)
Topsoil	TOPSOIL; brown, dry	0.10 - 0.40	0.10 – 0.40	-		
Uncontrolled fill	SILT, clayey SILT and silty CLAY mixture with traces of fine sand and coarse sand, light brown, brown to dark brown	0.50 – 3.40	0.30 – 2.90	1 - 6	32 – 85+	150 – 300+
Taranaki Brown Ash	SILT with clay content and traces of sand; brown, moist, stiff to very stiff; non plastic to; moderately plastic; moderately sensitive to sensitive.	> 4.0	> 4.0	3 - 13	95 – 190	>300
Maitahi Formation (source: GNS geological map)	Laharic breccia of andesite cobbles overlain in places by well sorted dune-bedded tephric sand (source: GNS geological map)	unknown				

5 NATURAL HAZARD ASSESSMENT

Section 106 of the RMA (1991) includes subdivision consent provisions relating to risk from natural hazards. This includes a combined assessment of likelihood, material damage and subsequent use, and the option of specifying consent conditions for the purpose of avoiding, remediating or mitigating the effects of natural hazards. This geotechnical report is intended to help inform a Section 106 assessment by providing information about geotechnical-related natural hazards to the proposed building platform on the proposed Lot 1.

5.1 EARTHQUAKE

5.1.1 Liquefaction Assessment

Liquefaction to the proposed building platform (the Site) on the proposed Lot 1 has been assessed using the recently released "Simplified liquefaction vulnerability flow diagram for New Plymouth District". This assessment method takes into account, the results from the site investigation, the geomorphic setting, underlying geology and the depth to groundwater.

Below is the list of assessment parameters we have considered in the liquefaction assessment.

From the simplified liquefaction method,

- The liquefaction vulnerability category - ***undetermined***
- Proposed development category – ***small rural residential setting***
- Applicable liquefaction assessment method – ***option 3, Simplified screening assessment***
- Geomorphic terrain category assigned in Tonkin+Taylor report is – ***Lahar***
- Non-liquefiable crust thickness - ***more than 4.0m thick of non-liquefiable stiff to very stiff Taranaki Brown Ash***

From the simplified liquefaction assessment above, it has been determined that the ***'Liquefaction damage is Unlikely*** *(typical for hill sites).*

5.1.2 Lateral Spread

The lateral spread risk is very low based on the unlikely liquefaction damage category.

5.2 EROSION

Sloping site may be susceptible to erosion from poorly controlled stormwater and surface water runoff. All water flow paths on the site must be appropriately designed and managed to minimise potential erosion. Erosion and sediment control measures are to be implemented during earthworks/construction.

5.3 SLOPE STABILITY

The proposed building platform site is moderately sloping. The slope angle approximately ranges from 11 to 14 degrees (1V : 5H to 1V : 4H) from horizontal. This is significantly less than the 26-degree slope (1V : 2H) that is considered safe (long term) for sandy clay or clayey silt soils. Therefore, the slope stability risk to the proposed building platform is considered to be low.

5.4 SUBSIDENCE

The test results for the proposed building platform revealed that good strength soil is generally available below the uncontrolled fill. All future foundations shall be founded to the good strength natural soil and the design shall be specifically designed by a suitable qualified engineer to mitigate subsidence or settlement risk.

5.5 EXPANSIVE SOILS

There are no expansive soils identified during soil investigations.

5.6 FLOODING

5.6.1 Flood risk

The proposed building platform site is elevated and not within NPDC flood area map. Therefore, there are no flood risks to the site.

5.6.2 Overland Flow

The existing overland flows on the proposed Lot 1 are:

- towards North to the natural dry Gully within the property boundary
- towards East to the natural waterway outside the property boundary
- towards South to the natural watercourse to the proposed Lot 3.

The existing overland flow paths are shown on *Figure 15*.

The overland flow on the proposed development will be as per existing apart from the overland flows on the proposed building platform and vehicle access. Therefore, the natural drainage pattern on the proposed lot 1 will not be significantly impacted. The overland flow paths for the proposed development are shown on *Figure 16*.

All overland flow paths in future developments shall be appropriately designed and managed to prevent any water ponding, soil erosion or scouring issues.

Figure 15: Existing overland flow paths

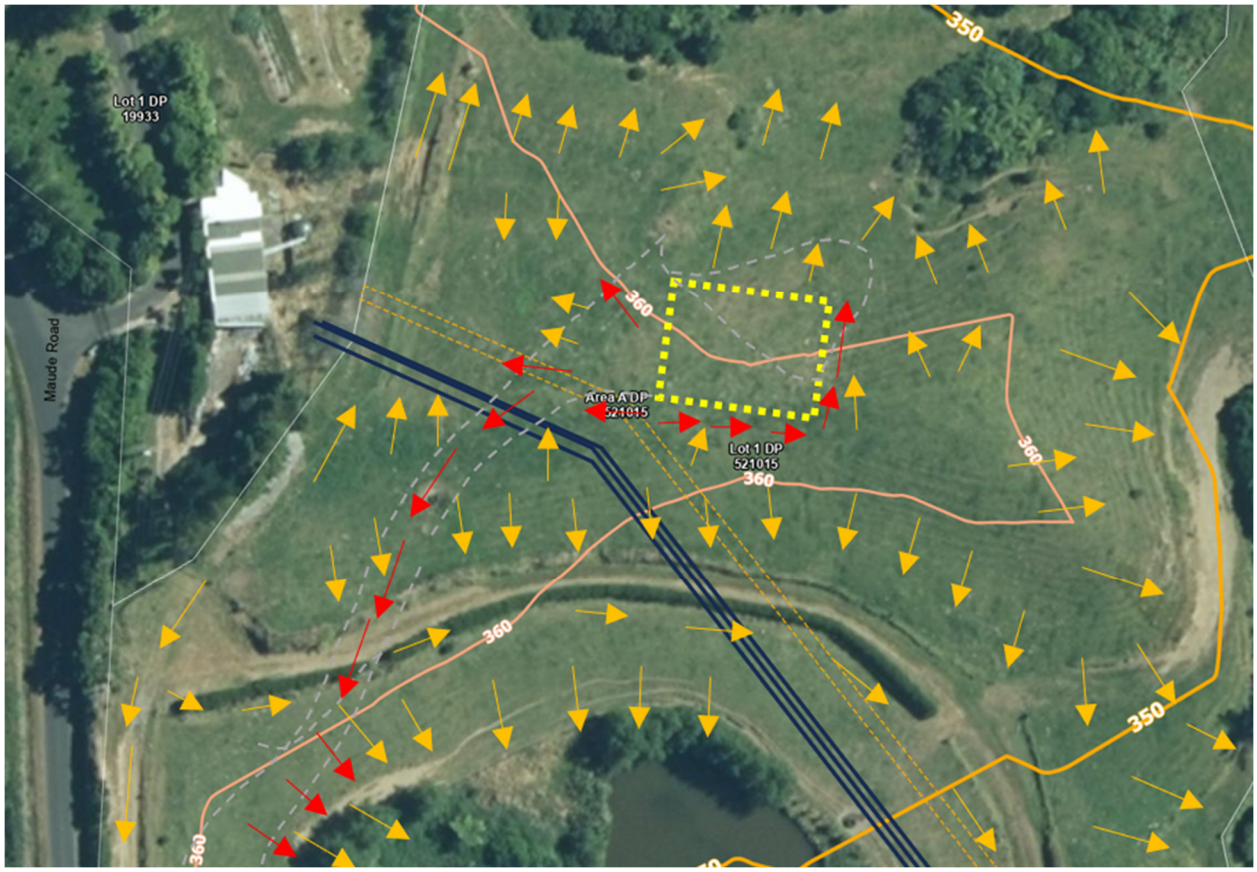


Figure 16: Proposed overland flow paths

6 CONCLUSIONS

6.1 RELEVANT EFFECTS STANDARDS

6.1.1 Building Platform

Our geotechnical investigations and assessments identified that stable and flood free building platform suitable for building foundations in accordance with the requirements of SUB-S2 and NZ Building Code can be achieved to the proposed Lot 1 if the recommendations detailed in Section 7.1 to Section 7.7 of this report are followed.

6.1.2 Stormwater treatments, catchment and disposal

The stormwater management will comply with the SUB-S4 if the recommendations detailed in Section 7.7 of this report are followed.

6.1.3 Sewage disposal

The wastewater management will comply with the SUB-S6 if the recommendations detailed in Section 7.8 of this report are followed.

6.2 RESOURCE MANAGEMENT ACT

Our geotechnical assessments identified that the proposed building platform on the proposed Lot 1 is unlikely to be subject to geotechnical-related natural hazard in accordance with Section 106 of the Resource Management Act 1991.

It is our opinion that:

- The proposed development at the site is considered feasible from a geotechnical perspective.
- If the recommendations detailed in Section 7 of this report are followed, we consider that the likely subsequent use of the land is unlikely to accelerate, worsen or result in geotechnical-related hazards.

6.3 SUBDIVISION SUITABILITY

Based on the results of our geotechnical assessments, it can be expected that the site will comply with the relevant Effects Standards, applicable Sections of the Resource Management Act and NZ Building Code. Therefore, the site can be considered suitable for the proposed rural residential subdivision if the recommendations detailed in Section 7 of this report are followed.

7 RECOMMENDATIONS

7.1 BUILDING PLATFORM AREA

The building platform for the future development shall be as shown on either bluemarble drawing numbers L1.0 dated July 2023 and L2.0 dated August 2023 file no 3424 or DELACO topographical survey (for Pat Sole Surveyors Ltd) project no. 23043. The building platform plans are attached on Appendix 5.

7.2 FOUNDATIONS

The completed soil investigation has determined that the subsoil on the proposed building platform of the proposed Lot 1 does not meet the definition of "good ground" as outlined in the Building Code amendments and NZS3604:2011. Therefore, specific designed foundations are required for all future developments. Preliminary foundations can be designed using the soil parameters interpreted by a suitably qualified engineer from this report. The finalised foundation design at Building Consent stage shall be based on the soil parameters interpreted from the further soil investigation required in Section 7.3 and applicable sections of this report.

7.3 FUTURE GEOTECHNICAL INVESTIGATIONS

Earthworks (cut and fill) are required to create level building platform for future developments. Therefore, further geotechnical investigations and assessments after completion of earthworks are required. It is recommended that all future soil investigations for foundation design purposes shall be within the proposed building footprint.

7.4 EARTHWORKS

All earthworks, including excavation, preparation of subgrade and backfill should be performed in accordance with the recommendations presented within this report and applicable portions of the NZS 4431:2022 and NZS 4404:2010.

7.4.1 Site preparations

The site shall be cleared of grass, vegetation, tree stumps, organics, miscellaneous debris and other deleterious materials.

7.4.2 Cut Slopes

All cut slopes over 1.0 m high, either temporary or permanent, may require an appropriate hard barrier installed at the crest of the slope in order to prevent public access. All cut slopes shall be not more than 3.0m high (total height) and shall be inspected on site either by Council Inspectorate or by a suitably qualified engineer confirm the cut slope angle or batter are not steeper than the below.

- 1H : 3V - Stiff, very stiff to hard natural Taranaki Ash soil
- 1H : 2V - Firm natural Taranaki Ash soil
- No vertical cut allowed to filled areas (except preparation for engineered fill or retaining wall construction).

All cut slopes away from the proposed building shall be either hydroseeded or covered with suitable surface erosion protection. All cut slopes within the building platform shall be protected either by facing wall or retaining wall.

Should cut slopes are more than 3.0m high, it shall be designed, inspected and approved by a suitably qualified geotechnical engineer.

7.4.3 Fill and compaction

The location of the proposed fill to create level building platform is moderately sloping and contain uncontrolled fill materials. Therefore, the fill and compaction within the influence line of the proposed building platform shall be specifically designed by a suitably qualified engineer.

Fill and compaction outside the influence line of the proposed building platform can be undertaken in accordance with the applicable sections of the NZS 4431:2022 and NZS 4404:2010.

7.4.4 Surface drainage

Positive surface gradients should be provided adjacent to buildings to direct surface run-off away from the building footprint toward suitable discharge facilities.

7.5 RETENTION STRUCTURES

All cut slopes within the building platform or within less than 2x height away from the building shall be protected either by adequately designed facing wall or retaining wall.

Fill on non-good ground site and fill on good ground but with additional load will require specific engineering design or adequately designed retaining wall.

7.6 FLOOR LEVEL

The proposed site is not within NPDC flood area map. Therefore, there are no minimum floor level requirement, and the site can achieve flood free building platform.

7.7 STORMWATER MANAGEMENT

Based on the site topography (hill site), site walkover inspections and hand auger investigations, it is our opinion that a standard soakhole or discharge of the stormwater to the ground is not suitable for the future development.

It is recommended that the stormwater from the roof of future development shall be collected and piped to a suitable size storage tank for rural residential water supply system.

The stormwater from the hard surfaces to the building platform of the future development shall be collected and to be discharged via drainage pipe to the natural dry Gully on the property as per NPDC and TRC requirements. The end of the drainage pipe shall be laid flat on the dry Gully ground discharging to rock fill to prevent scouring. A resource consent from Taranaki Regional Council may be required to comply with the Effects Standards SUB-S4.

The surface water from the driveway shall be collected and piped to the existing catchment area/natural watercourse on the proposed Lot 3 with sufficient scour protection to the discharge point as per the above or similar.

The overland flow from the lawn or surface water from the proposed building platform shall be collected via surface drainage and discharge to the natural dry Gully as mentioned above.

All other overland flows on the proposed Lot 1 are unchanged.

7.8 WASTEWATER MANAGEMENT

It is recommended that the wastewater from the future development on the proposed Lot 1 shall be collected and piped to an adequately designed septic tank complying to SUB-S6.

Due to the topography and the ground conditions encountered on site, we recommend that the effluent bed shall be subject to specific engineering design at the building consent stage. Engineer shall ensure effluent bed compliance to AS/NZS 1547:2012 and SUB-S6.

8 LIMITATIONS

This report is prepared for the client and their agents for the purpose stated and cannot be used for any other purpose or by others unless authorized by One-Elevensix Ltd.

The opinions and recommendations in this report are based on the site conditions as they presently exist, and it is assumed that the test pits are representative of the subsurface conditions throughout the site. We should be notified of any ground conditions that appear to be different from our investigation findings so we may review our recommendations where necessary.

9 REFERENCES

MBIE/MfE, 2017. Planning and engineering guidance for potentially liquefaction-prone land, Wellington: Ministry of Business, Innovation and Employment & Ministry for the Environment.

MBIE/NZGS, 2021a. Earthquake geotechnical engineering practice - Module 1: Overview of the guidelines, Wellington: s.n.

MBIE/NZGS, 2021c. Earthquake geotechnical engineering practice - Module 3: Identification, assessment and mitigation of liquefaction hazards, Wellington: s.n.

MBIE, 2022a. Ensuring new buildings can withstand liquefaction effects. (Online) Available at: https://www.building.govt.nz/building-code-compliance/geotechnicaleducation/ensuring-new-buildings-can-withstand-liquefaction-risks/#jumpto-changes-tofoundation-design (Accessed 03 March 2022).

NZGS, 2005. Field description of soil and rock, guideline for the field classification and description of soil and rock for engineering purposes, New Zealand: New Zealand Geotechnical Society.

Tonkin & Taylor Ltd, 2021. New Plymouth District Liquefaction Vulnerability Assessment. Report reference 1016765.v1, Tauranga, New Zealand: Tonkin & Taylor Ltd.

Townsend, D., Vonk, A. & Kamp, P. J. J., 2008. Geology of the Taranaki area. 1:250 000 geological map 7, Lower Hutt, New Zealand: Institute of Geological & Nuclear Sciences.

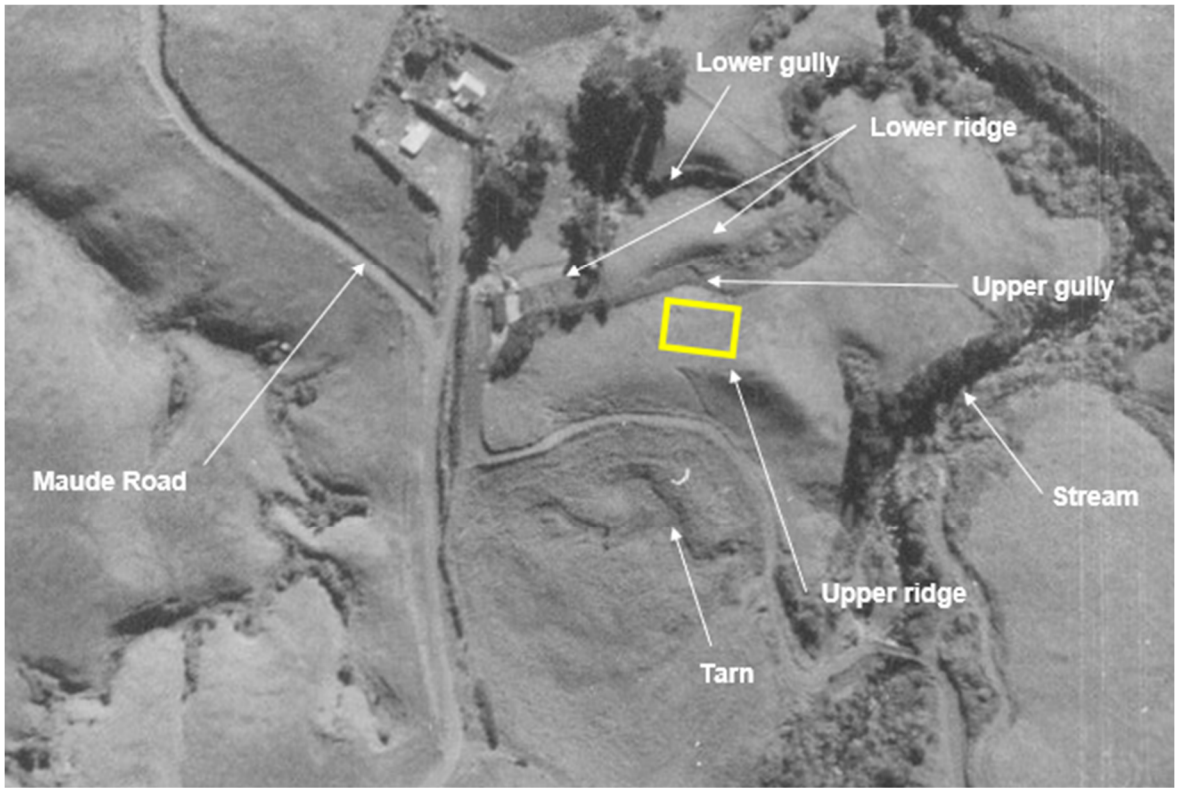
GIS Viewer (npdc.govt.nz); (https://districtplan.npdc.govt.nz/eplan/property/115344/0/150?_t=property)

nzgd.org.nz/ARCGISMapViewer/mapviewer.aspx

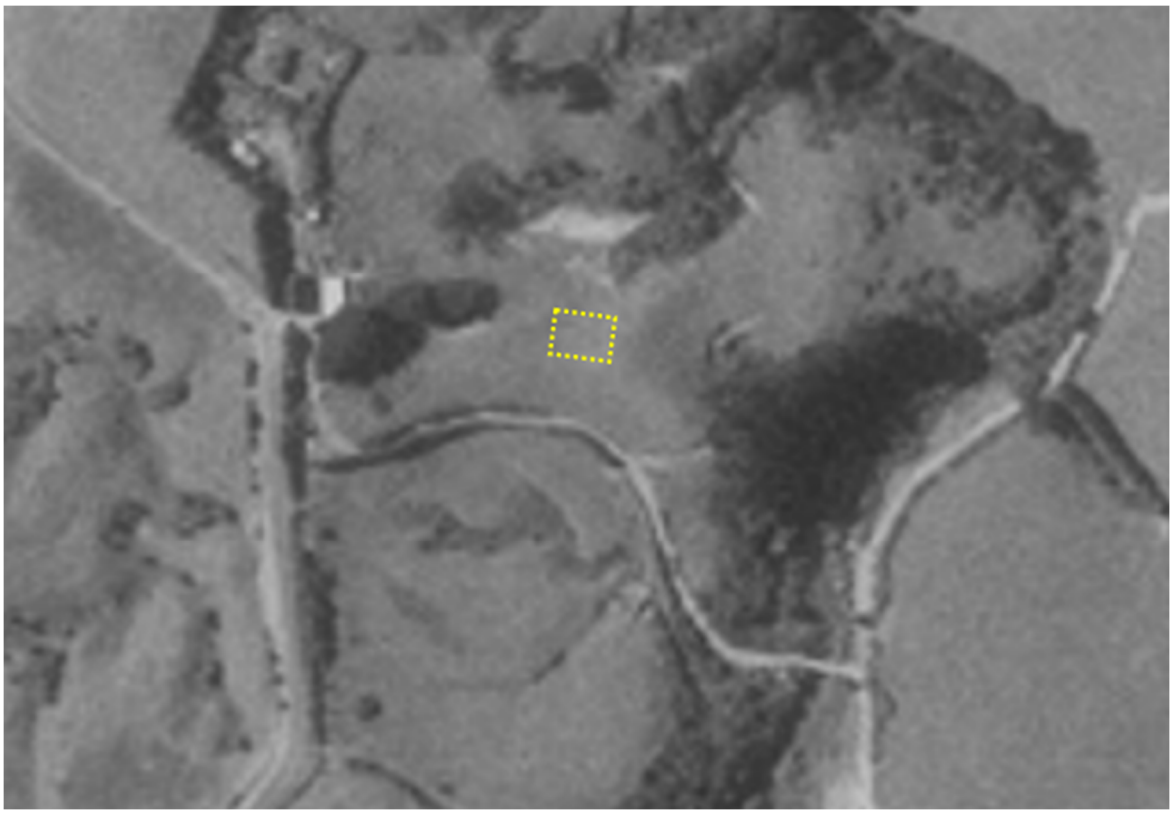
Retrolens - Historical Imagery Resource

Geology 2.0.0 (gns.cri.nz)

APPENDIX 1 – HISTORICAL IMAGERY



1950 Aerial photo (Source: Retrolense) – upper gully is visible



1982 Aerial photo (Source: Retrolens) – unclear photo

2001Aerial photo (Source: NPDC GIS) – The upper dry Gully appears has been filled

2010 Aerial photo (Source: NPDC GIS) – House is present on existing Lot 1

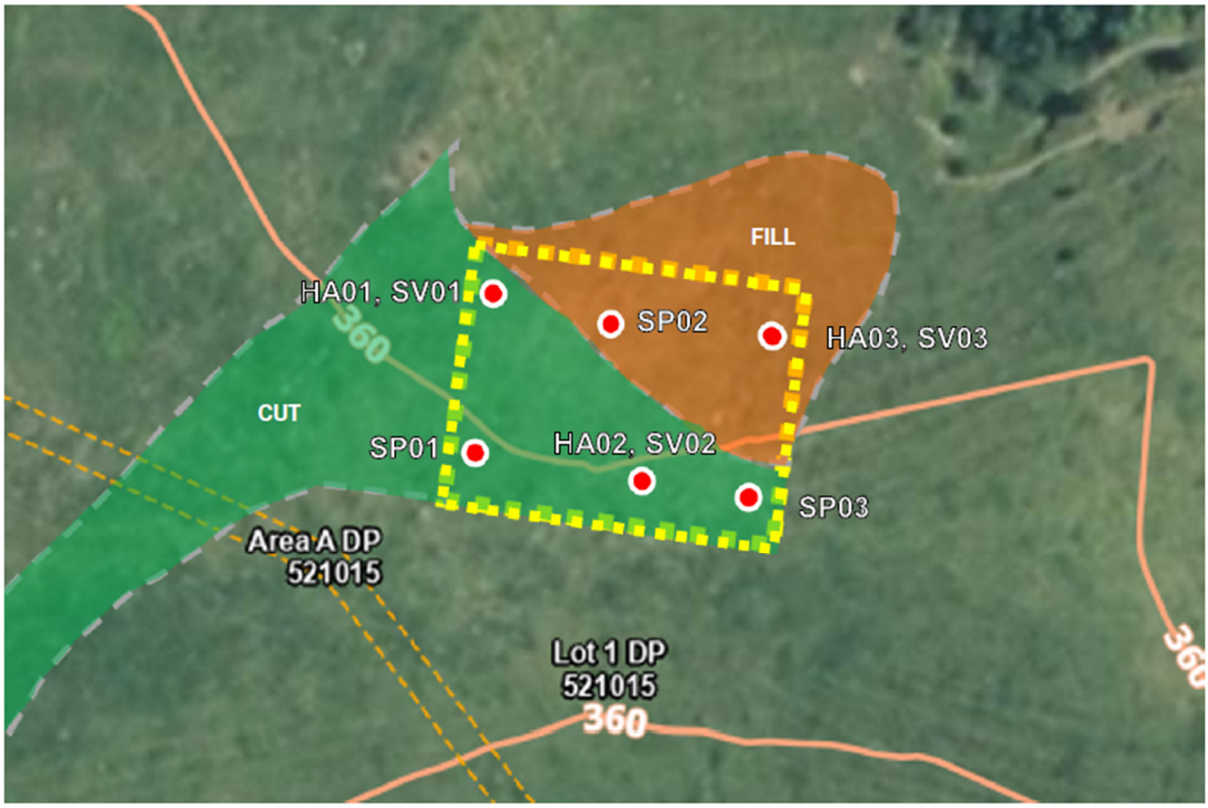
APPENDIX 2 – SOIL INVESTIGATION LOGS

oneelevensix
STRUCTURAL, CIVIL & BRIDGE ENGINEERS

Soil Investigation Plan and photos

Project	: New subdivision	Coordinates	:	Job No.	: 24005
Site address	: 373 Maude Road	Ground surface elevation (m)	:	Logged by	: OEL
Client	: Rachel Broadmore	Date of Investigation	: 24/01/2024	Reviewed by	: JCI

AERIAL VIEW OF THE SITE



BUILDING PLATFORM AREA and SOIL INVESTIGATION PLAN

oneelevensix
STRUCTURAL, CIVIL & BRIDGE ENGINEERS

Soil Investigation photos

Project : New subdivision	Coordinates :	Job No. : 24005
Site address : 373 Maude Road	Ground surface elevation (m) :	Logged by : OEL
Client : Rachel Broadmore	Date of Investigation : 24/01/2024	Reviewed by : JCI

oneelevensix STRUCTURAL, CIVIL & BRIDGE ENGINEERS

Soil Investigaion Log

Log Identification: **HA01**

Project	: New subdivision	Coordinates	: -39.190247, 174.098510
Site address	: 373 Maude Road	Groun surface elevation (m)	: 359.50
Client	: Rachel Broadmore	Date of Investigation	: 24/01/2024
		Job No.	: 24005
		Logged by	: OEL
		Reviewed by	: JCI

Field Description - HA01	Geological unit	Depth (m)	Graphic symbol	Shear Vane ID SV01 Peak Vane Shear Strength	Residual Vane Shear Strength	Sensitivity	Scala Penetrometer ID — Scala blow / 100mm: 1 2 3 Very Loose; 4 5 6 7 Medium dense; 8 9 10 11 12 13 14 15 16 17 Dense; >17 Very dense	Groundwater level
TOPSOIL, dark brown, 0.10 thick	TS	0.20						
SILT with traces of sand, brown, dark brown and blackish brown mixture	Uncontrolled fill	0.40		32	11	2.9		
becoming moist at 1.0m		1.00		80	19	4.2		
		1.40		77	24	3.2		
SILT with traces of fine sand, brown, dark brown mixture		2.00		80	19	4.2		
Clayey SILT / silty clay mixture, moist, brown with light brown mix		2.40		85	19	4.4		
Becoming wet at 3.20m, possibly pore water discharging along the base of the original gully		3.00		48	14	3.3		
SILT, with traces of clay, moist, stiff, non plastic to moderately plastic, moderately sensitive		3.60		177	32	5.5		
		4.00		161	48	3.3		
		4.60		169	50	3.4		
End of scala at 5.0m - target depth		5.00		185	64	2.9		
		5.20						

Notes:

1. HA = Hand Augers, SV = Shear Vane, SP = Scala Penetrometer, TL = Test Location
2. Elevation where indicated refers to approximate ground surface elevation from NPDC GIS map or Google Earth.
3. Coordinates where indicated refers to approximate coordinates obtained from Google Map.
4. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock
5. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.
6. 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.

oneelevensix STRUCTURAL, CIVIL & BRIDGE ENGINEERS

Soil Investigaion Log

Log Identification: **HA02**

Project	: New subdivision	Coordinates	: -39.190356, 174.098629
Site address	: 373 Maude Road	Ground surface elevation (m)	: 360.75
Client	: Rachel Broadmore	Date of Investigation	: 24/01/2024
		Job No.	: 24005
		Logged by	: OEL
		Reviewed by	: JCI

Field Description - HA02	Geological unit	Depth (m)	Graphic symbol	Shear Vane ID SV02 Peak Vane Shear Strength	Residual Vane Shear Strength	Sensitivity	Scala Penetrometer ID / Scala blow / 100mm (1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 >17)	Groundwater level
TOPSOIL, brown, dark brown	TS	0.20						
SILT with traces of fine sands and organics, brown with light mixture	FILL	0.40						
				64	24	2.7		
SILT, brown, non-plastic	Taranaki Ash	0.60		95	32	3.0		
		0.80						
traces of coarse sand at 0.90m		1.00		145	40	3.6		
		1.20						
		1.40						
SILT, brown, moist, non-plastic		1.60		145	35	4.1		
		1.80						
trace coarse sand at 1.90m		2.00		190	48	3.9		
End of auger at 2.0m - target depth		2.20						
		2.40						
		2.60						
		2.80						
		3.00						
		3.20						
		3.40						
		3.60						
		3.80						
		4.00						
		4.20						
		4.40						
		4.60						
		4.80						
		5.00						
		5.20						
Ground water not encountered during testing								

Notes:

1. HA = Hand Augers, SV = Shear Vane, SP = Scala Penetrometer, TL = Test Location
2. Elevation where indicated refers to approximate ground surface elevation from NPDC GIS map or Google Earth.
3. Coordinates where indicated refers to approximate coordinates obtained from Google Map.
4. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock
5. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.
6. 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.

oneelevensix STRUCTURAL, CIVIL & BRIDGE ENGINEERS

Soil Investigaion Log

Log Identification: **HA03**

Project	: New subdivision	Coordinates	: -39.190250, 174.098742
Site address	: 373 Maude Road	Groun surface elevation (m)	: 357.20
Client	: Rachel Broadmore	Date of Investigation	: 24/01/2024
		Job No.	: 24005
		Logged by	: OEL
		Reviewed by	: JCI

Field Description - HA03	Geological unit	Depth (m)	Graphic symbol	Shear Vane ID SV03 Peak Vane Shear Strength	Shear Vane ID SV03 Residual Vane Shear Strength	Shear Vane ID SV03 Sensitivity	Scala Penetrometer ID: Scala blow / 100mm (1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 >17)	Groundwater level
TOPSOIL, dark brown, 0.10 thick								
SILT with sand, brown, light blrown mixture	Uncontrolled FILL	0.20						
		0.40						
				64	29	2.2		
		0.60						
		0.80						
SILT with fine sand, brown to dark brown		1.00		67	48	1.4		
		1.20						
		1.40						
Clayey SILT, brown, moist, stiff, moderately plastic	Taranaki Ash			112	29	3.9		
		1.60						
		1.80						
		2.00		169	48	3.5		
End of Auger at 2.0 - Target depth		2.20						
		2.40						
		2.60						
		2.80						
		3.00						
		3.20						
		3.40						
		3.60						
		3.80						
		4.00						
		4.20						
		4.40						
		4.60						
		4.80						
		5.00						
		5.20						
Ground water not encountered during testing								

Notes:

1. HA = Hand Augers, SV = Shear Vane, SP = Scala Penetrometer, TL = Test Location
2. Elevation where indicated refers to approximate ground surface elevation from NPDC GIS map or Google Earth.
3. Coordinates where indicated refers to approximate coordinates obtained from Google Map.
4. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock
5. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.
6. 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.

Soil Investigaion Log

oneelevensix STRUCTURAL, CIVIL & BRIDGE ENGINEERS

Log Identification: **SP01**

Project	: New subdivision	Coordinates	: -39.190365, 174.098492
Site address	: 373 Maude Road	Ground surface elevation (m)	: 361.20
Client	: Rachel Broadmore	Date of Investigation	: 24/01/2024
		Job No.	: 24005
		Logged by	: OEL
		Reviewed by	: JCI

Field Description	Geological unit	Depth (m)	Graphic symbol	Shear Vane ID: Peak Vane Shear Strength	Shear Vane ID: Residual Vane Shear Strength	Shear Vane ID: Sensitivity	Scala Penetrometer ID: SP01 — Scala blow / 100mm	Groundwater level
		0.20					1	
		0.40					2 2	
		0.60					2 1 1	
		0.80					1 2	
		1.00					2 2 2	
		1.20					2 3	
		1.40					4 4	
		1.60					5 6	
		1.80					7 5	
		2.00					4 4	
End of Scala at 2.0m - target depth		2.20						
		2.40						
		2.60						
		2.80						
		3.00						
		3.20						
		3.40						
		3.60						
		3.80						
		4.00						
		4.20						
		4.40						
		4.60						
		4.80						
		5.00						
		5.20						

Notes:

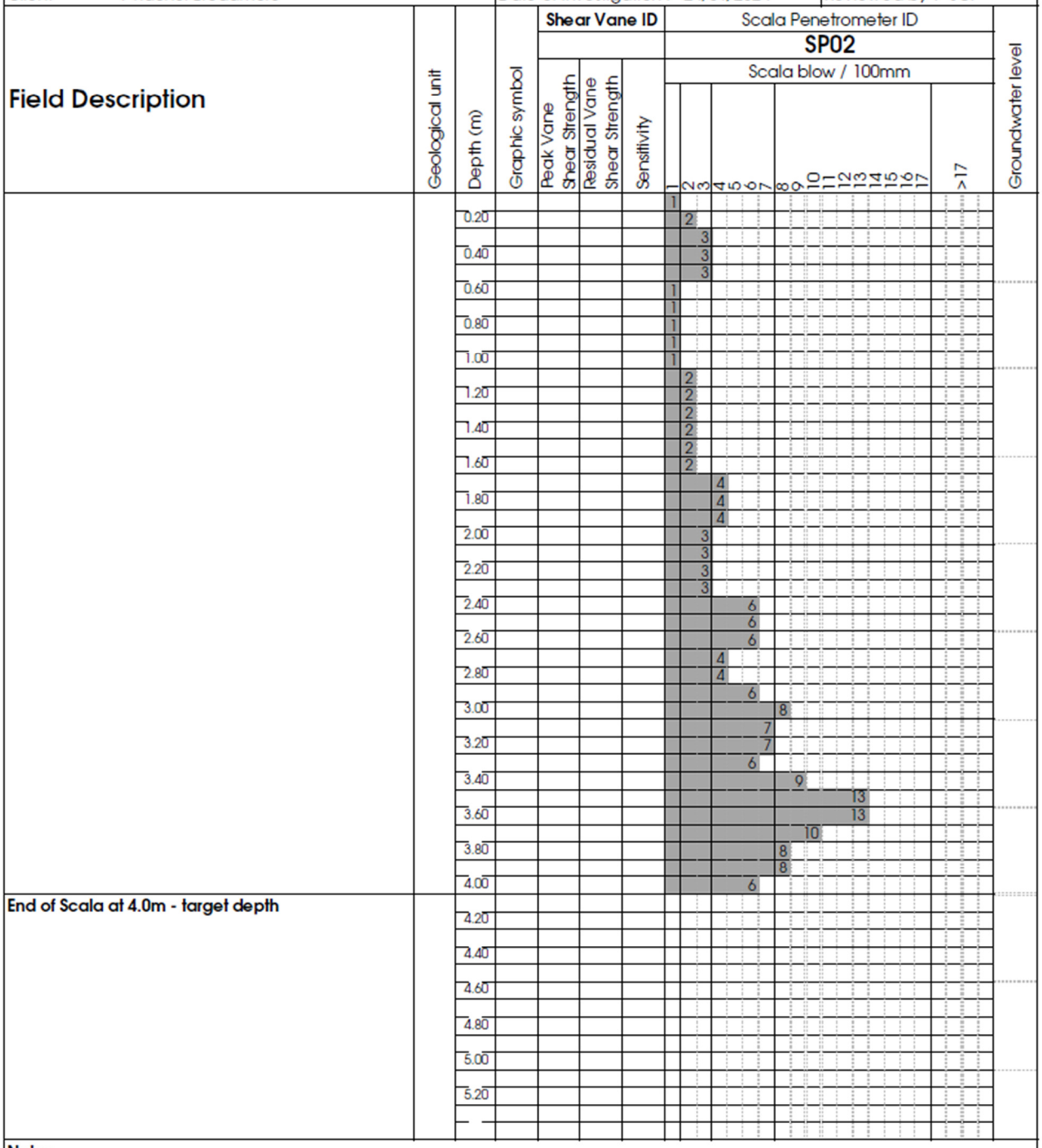
1. HA = Hand Augers, SV = Shear Vane, SP = Scala Penetrometer, TL = Test Location
2. Elevation where indicated refers to approximate ground surface elevation from NPDC GIS map or Google Earth.
3. Coordinates where indicated refers to approximate coordinates obtained from Google Map.
4. Soils have been described in general accordance with NZ Geomechanics Society "Guideline for the Field Classification and Description of Soil and Rock
5. Scala Penetrometer testing (where reported) has been carried out in general accordance with NZS 4402 Test 6.5.2.
6. 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.

oneelevensix STRUCTURAL, CIVIL & BRIDGE ENGINEERS

Soil Investigaion Log

Log Identification: **SP02**

Project	: New subdivision	Coordinates	: -39.190258, 174.098618
Site address	: 373 Maude Road	Ground surface elevation (m)	: 358.10
Client	: Rachel Broadmore	Date of Investigation	: 24/01/2024
		Job No.	: 24005
		Logged by	: OEL
		Reviewed by	: JCI



Notes:

1. HA = Hand Augers, SV = Shear Vane, SP = Scala Penetrometer, TL = Test Location
2. Elevation where indicated refers to approximate ground surface elevation from NPDC GIS map or Google Earth.
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6. 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.

Soil Investigaion Log

oneelevensix STRUCTURAL, CIVIL & BRIDGE ENGINEERS

Log Identification: **SP03**

Project	: New subdivision	Coordinates	: -39.190357, 174.098744
Site address	: 373 Maude Road	Ground surface elevation (m)	: 359.60
Client	: Rachel Broadmore	Date of Investigation	: 24/01/2024
		Job No.	: 24005
		Logged by	: OEL
		Reviewed by	: JCI

Field Description	Geological unit	Depth (m)	Graphic symbol	Shear Vane ID: Peak Vane Shear Strength	Shear Vane ID: Residual Vane Shear Strength	Shear Vane ID: Sensitivity	Scala Penetrometer ID: SP03 — Scala blow / 100mm: 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	>17	Groundwater level
		0.20					1	1	1																
		0.40						2	2																
		0.60					1	1																	
		0.80					1	1																	
		1.00					1																		
		1.20						2	2																
		1.40							3	3															
		1.60							3	3															
		1.80							3	3															
		2.00							3	3															
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Notes:

1. HA = Hand Augers, SV = Shear Vane, SP = Scala Penetrometer, TL = Test Location
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6. 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.

APPENDIX 3 – PREVIOUS REPORTS

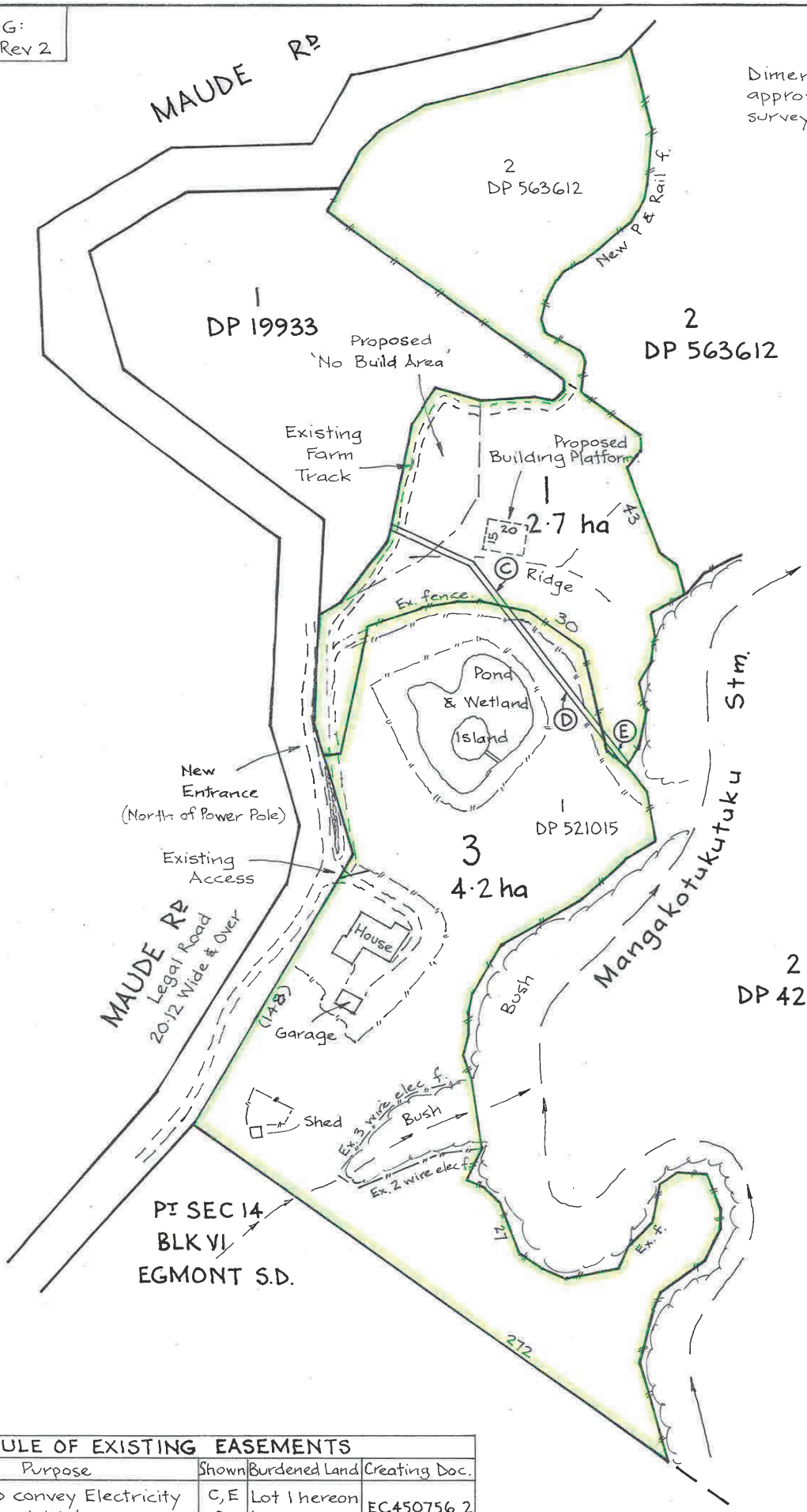
No previous reports available.

APPENDIX 4 – NEW ZEALAND GEOTECHNICAL DATABASE

No relevant NZGD data available.

APPENDIX 5 – PROPOSED DEVELOPMENT DRAWINGS

DRAWING:
2021/17 Rev 2



Dimensions and Areas are approximate only and subject to survey.

Pat Sole
Licensed Cadastral Surveyor

SCALE 1:2000 @ A3

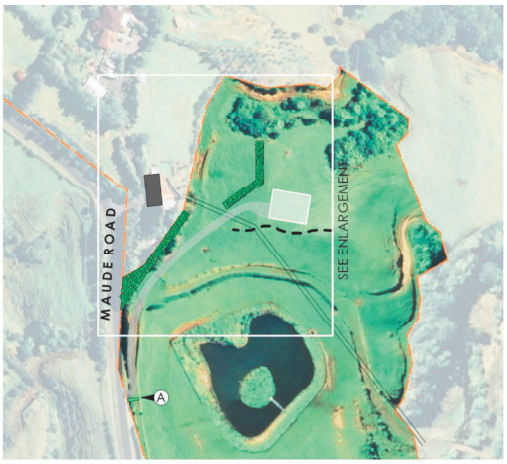
SCHEDULE OF EXISTING EASEMENTS			
Purpose	Shown	Burdened Land	Creating Doc.
Right to convey Electricity and Water	C, E D	Lot 1 hereon Lot 3 hereon	EC450756.2

LOTS 1 & 3 BEING PROPOSED SUBDIVISION OF LOT 1 DP 521015 & LOT 2 DP 563612

OCTOBER 2023

NEW PLYMOUTH DISTRICT

PAT SOLE SURVEYORS LTD.

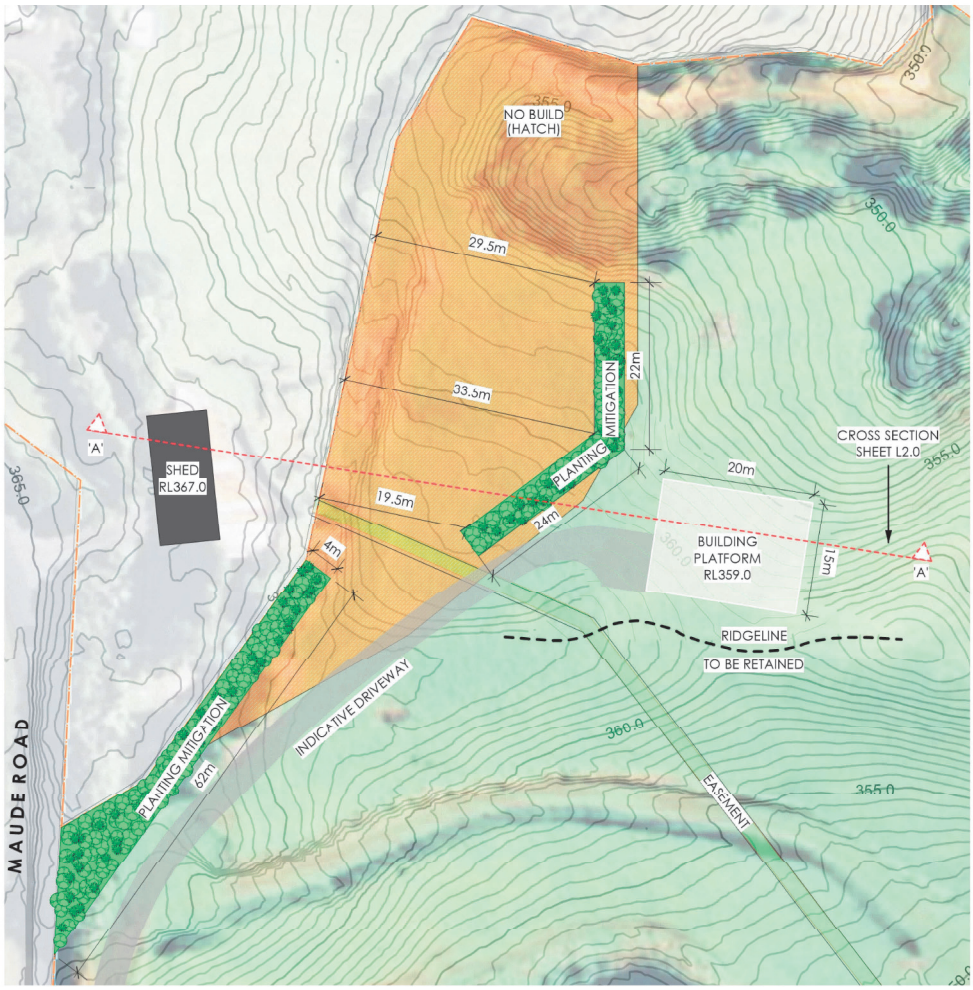


MITIGATION PLANTING

Native evergreen specimens are to be planted within both areas labeled 'Planting Mitigation'.
80% of these specimens must reach a minimum mature height of 4m within six years. This species mix allows for infill and lower specimens to fill in the understory (such as flax).
The 4m strips will contain 3 lines of planting (widening out to the south near the road)
Specimens are to be planted at a maximum of 1m centres.
No specimens to be planted over the easement.
Planting to be a mix of (a minimum seven species) from the following list:

Phormium cookianum	Mountain Flax. Wharariki
Phormium tenax	Flax, Harakeke
Cordyline australis	Cabbage tree,Ti kouka
Griselinia littoralis	Broadleaf
Chamaecytisus palmensis	Tree lucerne
Prumnopitys ferruginea	Miro
Vitex lucens	Puriri
Leptospermum scoparium	Manuka
Weinmannia racemosa	Kamahi
Pseudopanax arboreus	Five-Finger
Pittosporum tenuifolium	Kohuhu
Pittosporum eugenioides	Lemonwood,Tarata

One additional area of planting is to extend to the south of the driveway entry as a single row of specimen trees, 6 m long to screen driveway headlights from the road. Specimens to be *Griselinia littoralis* and maintained at a height no lower than 3m - (Area marked 'A' on the plan above)



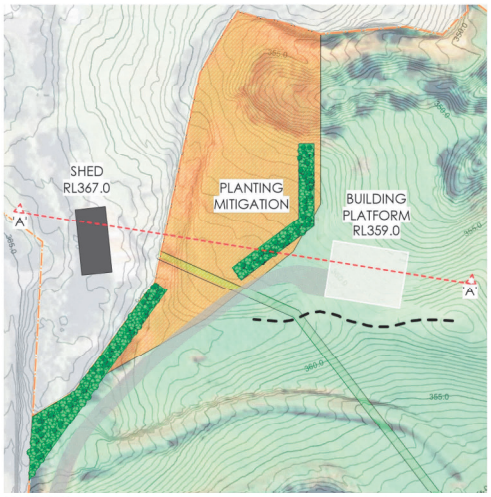
Broadmore Property
Maude Road

Landscape Mitigation Plan

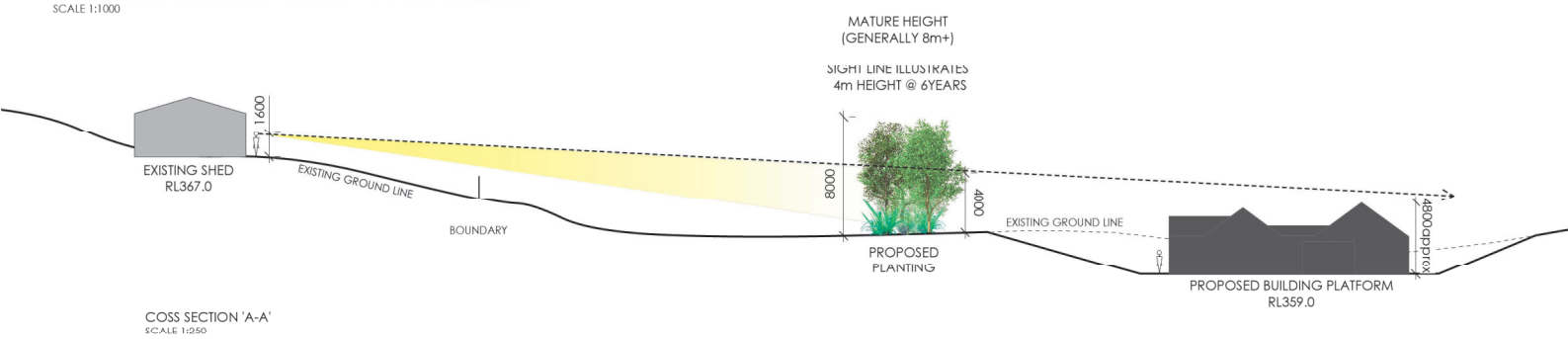
DRAWING NO: L1.0
REVISION: 01

SCALE: 1: 500 @A3
DATE: 28 July 2023
FILE NO.: 3424

bluemarble®
A world of difference



SCALE 1:1000



COSS SECTION 'A-A'
SCALE 1:250

Broadmore Property
Maude Road

Landscape Mitigation Plan
Cross Section

DRAWING NO: L2.0
REVISION: 01

SCALE: 1: 250 @A3
DATE: 2 August 2023
FILE NO.: 3424

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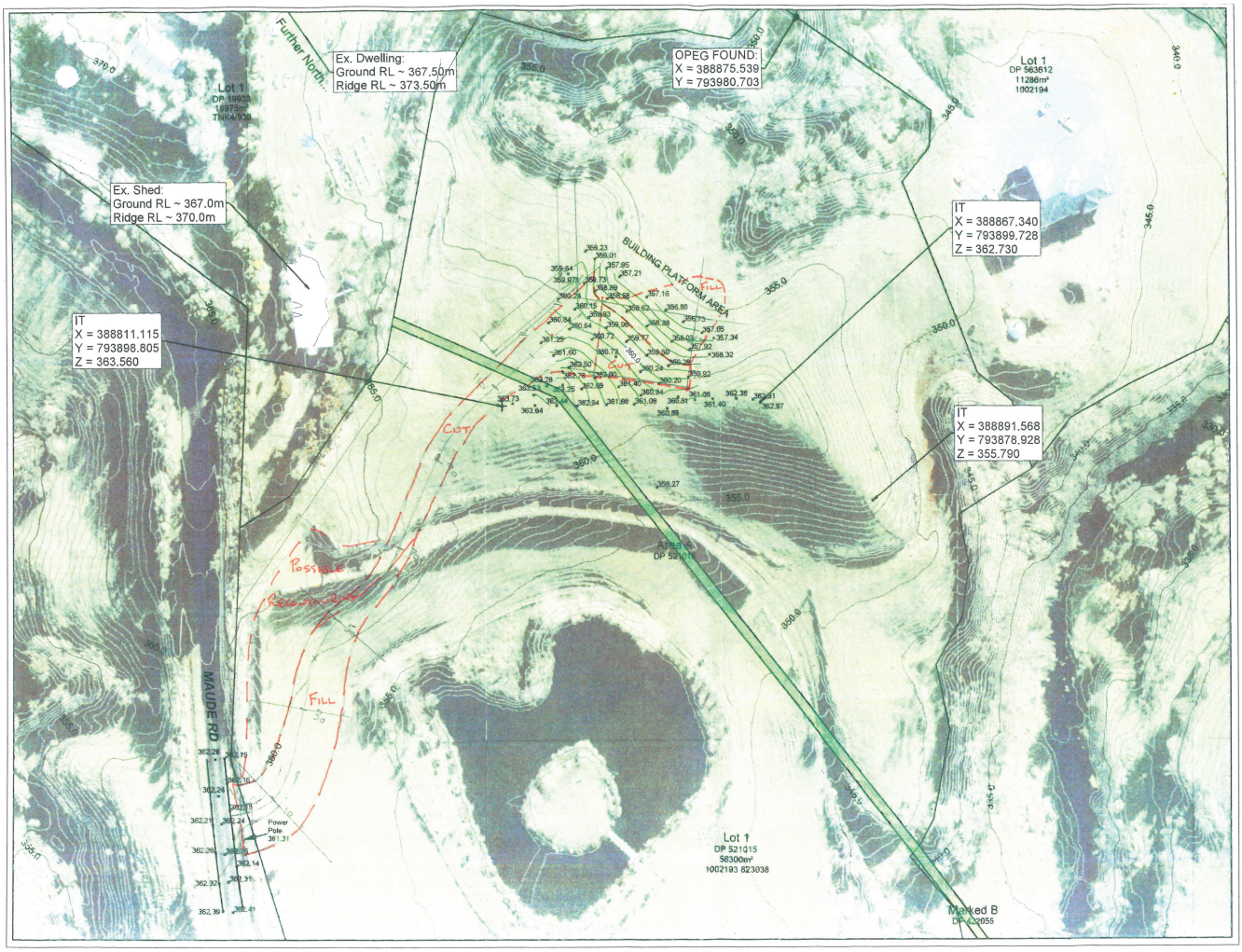
A world of difference



GENERAL NOTES:

- This indicative plan has been produced for a simple boundary marking and/or set out survey and shall not be used for any other purpose.
- All areas and boundary dimensions are subject to a formal and final cadastral survey if not already surveyed by Delaco Ltd. All boundary information prior to this is indicative only and shall not be used for any other pu
- For clarity survey calculations have not been shown on this plan.
- Copyright Delaco Ltd. All rights reserved. Any third users shall gain approval from Delaco for any change information in relation to the drawings.

LEGAL DESCRIPTION:

Address : 373 Maude Road
Lot Number: : Lot 1 DP 521015
RT :
Site Area :

DEVELOPMENT RULES:

District Zone :

Roading Hierarchy :
Building Height :
Road Setback :
Side Setback :
Outdoor Living Space :
Permeable Area :
Site Coverage :
Minimum Lot Size :

PROPERTY INFORMATION:

House Area :
Site Coverage % :

Foundation Type :
Cladding :
Roofing :
Stories :

SITE SURVEY:

Topographical Information obtained:
Vertical Datum:
Origin of Levels:
Reduced Level:

SOIL REPORT:

Soil Report data from:
Phone:
Date Completed:
'Good Ground' Achieved:

SHEET SPECIFIC NOTES:

I hereby certify that the information shown on this pla to be true, correct, and accurate for it's intended purp

GJ Pike
Licensed Cadastral Surveyor

Grey contours are sourced from LINZ Lidar Database Delaco accepts no responsibility for accuracy and this must not be used for any other purpose than indicative reasons only.

Aerial photo and adjoining building ridge levels were surveyed using photogrammetry and accuracy is +/- 200mm in the vertical

Spot levels shown on the building platform and road areas have been surveyed by GNSS and accuracy is +/- 30mm in the vertical

230717

DELACO
SURVEYING + ARCHITECTURE

Topographical Survey
Lot 1 DP 521015
373 Maude Road
New Plymouth

Sheet:
Topographical Survey

Client:
Pat Sole Surveyors Ltd

Scale 1:750

Do not scale off drawings. Contractor shall verify and be responsible for all dimensions on site and locate all existing services. Contractor shall verify discrepancies between information on the drawings and conditions on site. Delaco must be notified immediately.

Ref.	Description	Date

Drawn
GJ
Project no.
23043
Scale @ A3