14 November 2024

Hamish Bassick
hbassick@icloud.com

RE: Geotechnical Investigation for Proposed Subdivision at Lot 6 DP 537061, Mokohinau Drive, Mangawhai.

Wiley Geotechnical Limited (WGL) was requested by Hamish Bassick to provide a geotechnical investigation to support an application for a 2 Lot subdivision. We have received and reviewed a proposed subdivision scheme plan produced by Pacific Coast Surveys (Ref: 4130, dated: September 2024). We have previously completed geotechnical investigations and reporting at the subject site (Ref: 16398, dated: January 2017). We have also reviewed a geotechnical investigation report produced by John Hawley Consulting Ltd to support the original subdivision application (Ref: 1357, dated: March 2010).

WGL visited the site on the 11th of November 2024 and made the following observations:

- The site contains sloping ground generally falling towards the south and east.
- Proposed building locations were indicated on the scheme plan referenced above and found to be suitable from a geotechnical perspective during our investigations.
- A potentially suitable building site was identified towards the middle of the northern boundary of Lot 1 and is located on a gentle south facing slope.
- A potentially suitable building site was identified towards the north-eastern corner of Lot 2 and is located partly on relatively flat ground, and partly on a gentle to moderate south facing slope.
- An overland flow path protected by an existing stormwater covenant flows from the north-west corner of the property towards the southern boundary.
- The overland flow path must be taken into account when constructing driveway access. The culvert infrastructure will require specific engineering design and must conform to KDC 2011 engineering standards.
- No obvious signs of instability were noted in the vicinity of the proposed house sites, some terracing was noted on steeper parts of the site located away from the proposed building platforms.
- Two hand augers were undertaken within potentially suitable building sites to a maximum depth of 3 m below ground level.

Geology

The GNS map for the site indicates that it is underlain by sedimentary rocks of the Pakiri Formation (Waitemata Group) (PF) comprising “alternating thick-bedded, volcanic rich, graded sandstone and siltstone with volcaniclastic grit beds.”

NRC GIS Hazards Map

We have reviewed the Northland Regional Council (NRC) GIS maps in relation to the subject site. There were no hazards indicated by the maps in the vicinity to the subject site.

Seismic Hazards

Since there are no known active faults crossing the property, it is our opinion that ground rupture is unlikely at the subject property. Granular soils, such as sand, are susceptible to liquefaction in the event of future earthquakes. This may result in settlement or lateral deformation. Based on the regional earthquake risk (discussed further below) and depth to groundwater, it is our opinion that there is a relatively low risk of liquefaction induced settlement or lateral movement such that specific liquefaction design is not required.

We recommend that the future structures and improvements are designed to account for seismic shaking and ground motions. For seismic design at the site and in line with NZS 1170.5:2004 the corresponding design peak ground accelerations (PGA) for the site have been calculated from NZS 1170.5:2004 using the recommendations of the New Zealand Geotechnical Society as follows:

$a_h = Z\ R\ C$

In which:

Z = base PGA called “Hazard factor” and is given by Table 3.3 and Figures 3.3 and 3.4 of NZS 1170.5:2004. Z = 0.13 for areas north of Auckland.

R = “Return period factor” and is given by Table 3.5 of NZS 1170.5:2004 (R = 1.0 for 500-year return period and R = 0.25 for a 25 year return period)

C = Site response factor called “Spectral shape factor” in NZS 1170.5:2004 and is based on the seismic site classification. We consider this site to be **Class C**, based on soil depth and therefore C = 1.33.

The design PGA at the site is given as:

ULS: $a_h = 0.13 \times 1.00 \times 1.33 = 0.17$ (i.e. PGA = 0.17 g)

SLS: $a_h = 0.13 \times 0.25 \times 1.33 = 0.04$ (i.e. PGA = 0.04 g)

Field Exploration and Subsurface Conditions

WGL carried out a shallow subsurface investigation consisting of two hand augers with shear vane testing within the approximate areas shown on the site plan below. Suitable wastewater disposal fields are also illustrated in blue and marked relative to the hand auger number for the respective Lot.

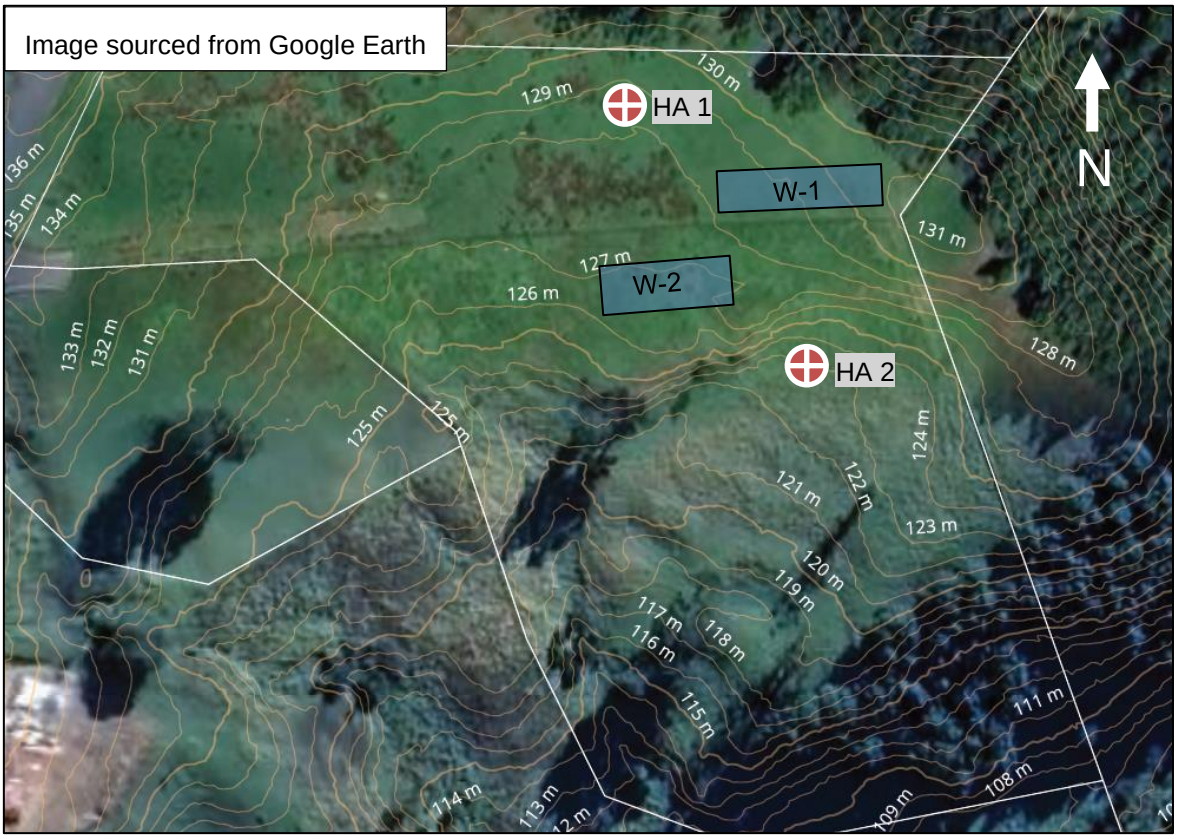


Figure 1: Approximate Subsurface Exploration Locations & Wastewater Disposal Fields

The hand augers were carried out to depths of 2.8 m and 3.0 m. The subsurface material encountered in our hand auger investigation generally consisted of topsoil underlain by slightly to moderately clayey silt with varying amounts of sand. The measured undrained shear strengths ranged from 71 kPa to an inferred >200 kPa, with the majority of readings greater than 80 kPa.

Groundwater was encountered at 2.2 m in HA2 during our testing. The groundwater level may vary from the depth measured at the time of exploration, as a result of seasonal change, recent precipitation and/or irrigation practices.

Based on this, it is our opinion that the material encountered in our subsurface investigation is broadly consistent with published geologic mapping. The bore logs are presented as an appendix to this report and are written in general accordance with the New Zealand Geotechnical Society field classification guidelines (NZGS, 2005).

Expansive Soils

Expansive clay and silt soils are common in the wider Northland region and have the tendency to shrink and swell, particularly with seasonal fluctuations of soil water content. This behavior has implications for foundation design and surface structures and should be incorporated during foundation design.

Based on our visual and field assessment of the soils encountered onsite, and our experience in the area, we consider that the Expansive Site Class for this site is “M - moderate” - in accordance with AS 2870. Accordingly, the minimum footing depth is 600 mm below cleared ground level.

Conclusions and Recommendations

It is our opinion that the proposed development is feasible from a geotechnical point of view, provided the recommendations presented in this report and standard development practices are incorporated in the design and construction of the project.

The results of the geotechnical investigation indicate a suitable bearing capacity is available for future residential development, with readings generally greater than 80 kPa.

We consider the site to be suitable for the proposed subdivision in accordance with the provision of Section 106 of the Resource Management Act 1991, and that standard earthwork and construction practises will not result significant increase or risk of erosion, subsidence, falling debris, slippage or inundation by soil or rock.

Foundations

We anticipate that wooden piles designed in accordance with NZS3604 (2011) would likely provide a suitable foundation for future dwellings with anchor piles embedded to a minimum depth of 0.9 m, and all other piles are embedded to a minimum depth of 0.6 m. Piles on a sloping building pad should be embedded to have a toe level extending at least 600 mm below the lowest ground surface within 2 m. Additional evaluation may be required if the building site is sloped at greater than 3:1 (H:V).

A concrete foundation may also be feasible. We would expect that a minimum 300 mm layer of compacted hard fill is placed prior to applying blinding sand for any reinforced concrete slab and foundation elements having a minimum embedment depth of 0.6 m.

We expect that a geotechnical ultimate bearing capacity of 300 kPa would be available; however, further geotechnical investigations and design **must** be carried out at the building consent stage.

This report is not to be used for the purposes of any building consent applications regarding the foundations of future structures.

Onsite Wastewater Disposal

We consider the site would be suitable for a Secondary wastewater system and depending on your requirement for the land that will be used as a disposal field the effluent field to be fenced if the land intends to be grazed.

The final onsite wastewater disposal system must meet all the relevant requirements from the Proposed Regional Plan for Northland, section C.6.1 (PRPN), Kaipara District Council as outlined in AS/NZS 1547:2012 and G13 of the NZ building code. There are a number of proprietary systems available to suit the requirements of future residential development, which are a function of the building footprint and total number of occupants.

Any treated material must be dispersed in a controlled manner across a relatively level discharge area in order to maximise the efficient infiltration of material without compromising the stability of any slopes. To this end, we recommend that the effluent disposal fields be located clear of the building locations.

In terms of AS/NZS: 1547-2012) a Soil Category of 5 (i.e. “Light Clays – poorly drained”) should be adopted. This is based on the findings of the geotechnical investigation and the assessment of the soil regarding its relevant soil category, as per the guidance document.

Considering the results of the geotechnical investigation we consider Category 5 with a DIR of 3.0 mm/day. Based on a standard 4-bedroom house with an occupancy of 6 persons with roof supply water and standard water fixtures this would require 6 x 180L = 1080L/day/3.0 = 360m2 effluent field.

We have illustrated above suitable areas for a standard wastewater disposal field with sufficient area included for 30% reserve. There are other locations upon each of the Lot which may also be suitable to utilise as a wastewater disposal field.

The Northland Regional Council rules refer to a winter ground water level and require the following;

- Primary systems - The lowest point of the disposal system is not less than 1.2 metres above winter (June, July or August) groundwater table.
- Secondary systems – The lowest point of the disposal system is not less than 0.6 metres (600 millilitres) above the winter (June, July or August) groundwater table.

WGL have assessed the spring ground water levels at 2.2 m in proposed Lot 2, and at greater than 3 m depth in proposed Lot 1. We do not expect groundwater to exceed a depth of 0.6 m for a secondary system.

Stormwater

We recommend that stormwater overflow from newly developed dwelling water tanks is directed downslope via closed conduit towards the existing overland flow path. The outlet of the stormwater pipe should not be positioned above sloping ground where the risk of slope instability would be increased. We recommend the outlet pipe directs water in to rip rap erosion protection. This should consist of geotextile cloth placed upon insitu soil with clean rock of 150-300 mm in diameter. This area should be a minimum of 1 m wide and 3 m in length.

If a suitable overland flow path is not available, we recommend implementing suitable subsoil level spreader to disperse stormwater runoff from future water tank overflow pipe(s). This should consist of a 0.5 m wide by a 0.5 m deep excavation with a perforated 110 mm novacoil pipe backfilled with clean

drainage rock. The base and side should be wrapped with a geotextile cloth (Bidim A29, Cirtex AS410 or similar approved product) and fold over the top of the drainage metal enclosing it. The subsoil level spreader should be designed relative to the proposed impervious area.

If the total impervious area being developed on any lot (roofs, driveways, paving etc.) is greater than 10% of the entire lot area (15% if not in any Overlay), then specific stormwater design shall have to be carried out with regards to attenuation in order to offset the increase in stormwater runoff up to the 100-year storm event.

Specific design must reach Kaipara District Council standards. This shall be determined at the building consent stage once final impervious areas are known.

Earthworks

For the development scheme provided we anticipate the majority of the earthworks will be limited to site clearing and construction for the roadway and driveway access. We recommend that any site concept plans be discussed with WGL or suitably qualified Geotechnical Engineer familiar with the site and the contents of this report.

In addition, we suggest the following:

- All cut surfaces should be inspected by WGL (or suitably qualified Geotechnical Engineer) prior to placing any fill to ensure founding conditions are as anticipated;
- All excavated soil to be removed from site or placed in an engineered stockpile that is strategically placed such that it would not trigger slope instability. If there is any soil to be placed permanently on site, we suggest contacting WGL for further guidance;
- In areas of tree removal where planned structures or roadways are located, the full root ball should be removed;
- Any proposed earthworks and drainage plans should be approved by a suitably qualified Geotechnical Engineer familiar with both the site and the recommendations within this report for review and comment;
- Fill placement, should be placed in accordance NZS 4431 – Code of practice for Earth Fills for Residential development. Fill should be placed on a suitably stripped and prepared subgrade including the removal of any non-engineered fill;
- Additional design-level earthwork recommendations are required if cut and fills are greater than 600mm; and
- All proposed batter slopes should be restricted to gradients no steeper than 1v:3h.

Drainage

We recommend that a concrete lined cut off or simple v-drain is constructed upslope of the proposed house sites to help catch stormwater run-off from the upslope areas. The drain should have a minimum width of 500 mm and depth of 300 mm, and discharge downslope clear of the proposed dwelling. The outlet should have a 3 m section of rock rip rap to protect against any scour. The rip-rap apron should have a minimum width of 1 m and depth of 0.3 m, and be filled with 150-300 mm clean rock.

A counterfort/subsoil drain may be required to intercept groundwater from effecting the building sites and help improve the overall stability. The requirement and/or final location shall be confirmed by the geotechnical engineer on site during site preparation works.

LIMITATIONS

(i) This report has been prepared for the use of our client, Hamish Bassick and their professional advisers and the relevant Regional Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

(ii) Assessments made in this report are based on the ground conditions indicated from published sources, site inspections and subsurface investigations described in this report based on accepted normal methods of site investigations. Variations in ground conditions may exist between test locations and therefore have not been taken into account in the report. If variations are found during excavation or at foundation preparation stage WGL should be notified immediately so we can amend our recommendations.

(iii) This Limitation should be read in conjunction with the ENZ/ACENZ Standard Terms of Engagement.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned at matt@wileygeotechnical.co.nz if you require any further information.

Prepared By:



Michael Davis - Engineering Technician

Reviewed By:



Matt Wiley - MSc(Hons), MEngNZ

Principal Engineer



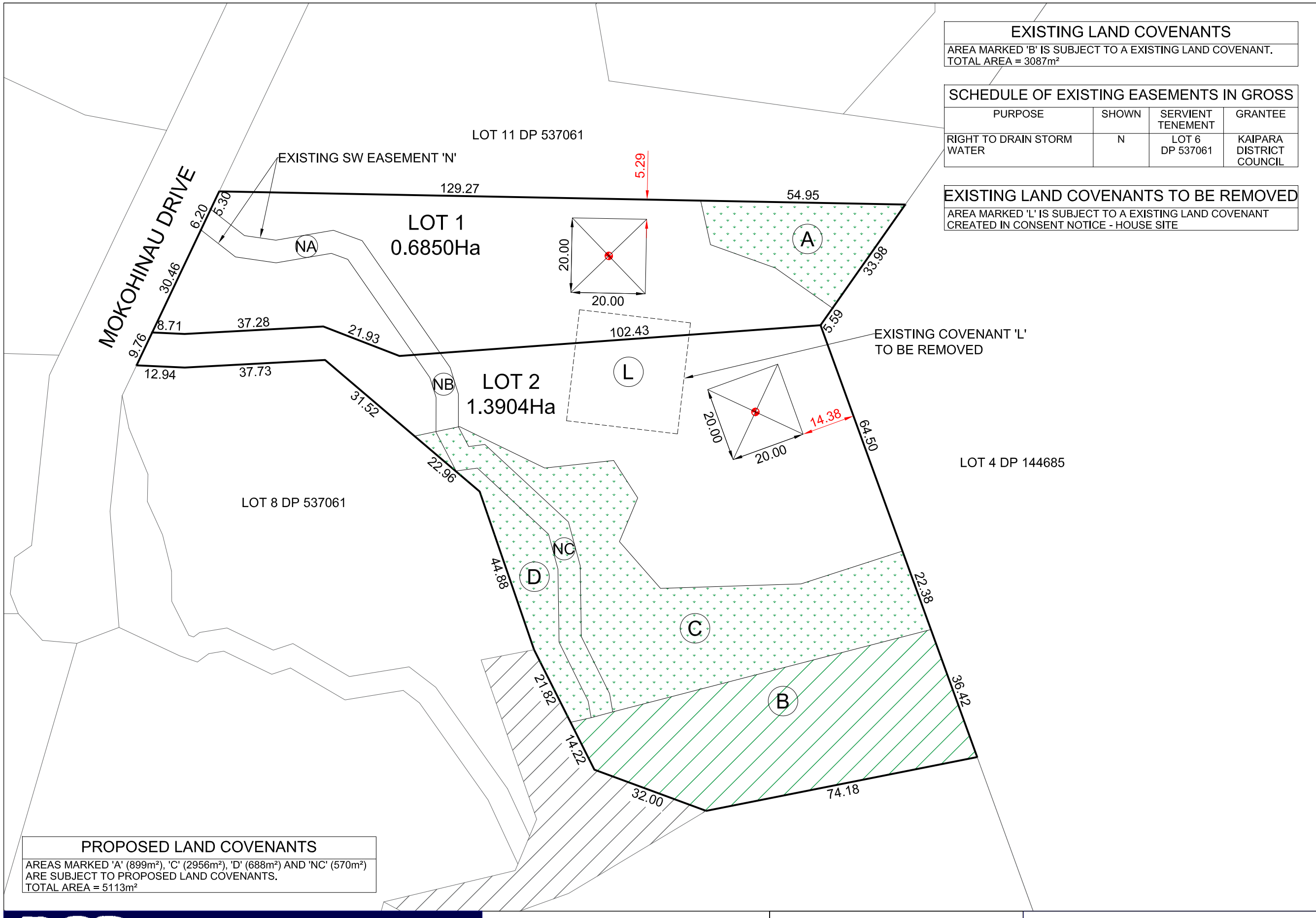
Raymond Su - BE(Hon), MEngSc(Geotechnical), CMEngNZ, CPEng

Principal Engineer

Attachments:

- Scheme Plan produced by Pacific Coast Surveys (Ref: 4130, dated: September 2024)

- Bore Logs



EXISTING LAND COVENANTS

AREA MARKED 'B' IS SUBJECT TO A EXISTING LAND COVENANT.
TOTAL AREA = 3087m²

SCHEDULE OF EXISTING EASEMENTS IN GROSS

PURPOSE	SHOWN	SERVIENT TENEMENT	GRANTEE
RIGHT TO DRAIN STORM WATER	N	LOT 6 DP 537061	KAIPARA DISTRICT COUNCIL

EXISTING LAND COVENANTS TO BE REMOVED

AREA MARKED 'L' IS SUBJECT TO A EXISTING LAND COVENANT CREATED IN CONSENT NOTICE - HOUSE SITE

PROPOSED LAND COVENANTS

AREAS MARKED 'A' (899m²), 'C' (2956m²), 'D' (688m²) AND 'NC' (570m²) ARE SUBJECT TO PROPOSED LAND COVENANTS.
TOTAL AREA = 5113m²

N
W
E
S

LEGEND

- MAJ CONTOUR
- MIN CONTOUR
- PROPERTY BDY
- FENCE
- RETAINING WALL
- TOP OF BANK
- BOTTOM OF BANK
- SANITARY SEWER
- STORMWATER
- FLOWLINES
- DRAIN
- GRAVEL
- CONCRETE/SEAL
- PLANTINGS
- NOMINAL BUILDING SITE
- EXISTING LAND COVENANTS
- TREES / GARDEN

NOTE:

- ANY QUERIES SHOULD BE DIRECTED TO PACIFIC COAST SURVEYS LTD.
- COORDINATES ARE IN TERMS OF MOUNT EDEN CIRCUIT 2000.
- VERTICAL DATUM ASSUMED.
- MAJOR CONTOUR LINES ARE AT 1m INTERVALS.
- ALL AREAS AND MEASUREMENTS ARE SUBJECT TO FINAL LT SURVEY.

PACIFIC COAST SURVEYS
09 431 5353 | 0800 PACIFIC | 0800 722 4342
info@pacificcoastsurvey.co.nz
www.pacificcoastsurvey.co.nz

SCHEME PLAN

MOKOHINAU DRIVE, MANGAWHAI

CLIENT HAMISH BASSICK
FILE 4130
REVISION REV 1
DATE SEPTEMBER 2024
SCALE 1:1000 @ A3
COUNCIL FILE RM
PAGE 1 OF 2

PROPOSED SUBDIVISION OF LOT 6 DP 537061



EXISTING LAND COVENANTS

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SCHEME PLAN

MOKOHINAU DRIVE, MANGAWHAI

CLIENT
HAMISH BASSICK

FILE	4130
REVISION	REV 1
DATE	SEPTEMBER 2024
SCALE	1:1000 @ A3
COUNCIL FILE	RM
PAGE	2 OF 2

PROPOSED SUBDIVISION OF LOT 6 DP 537061

WILEY GEOTECHNICAL LTD

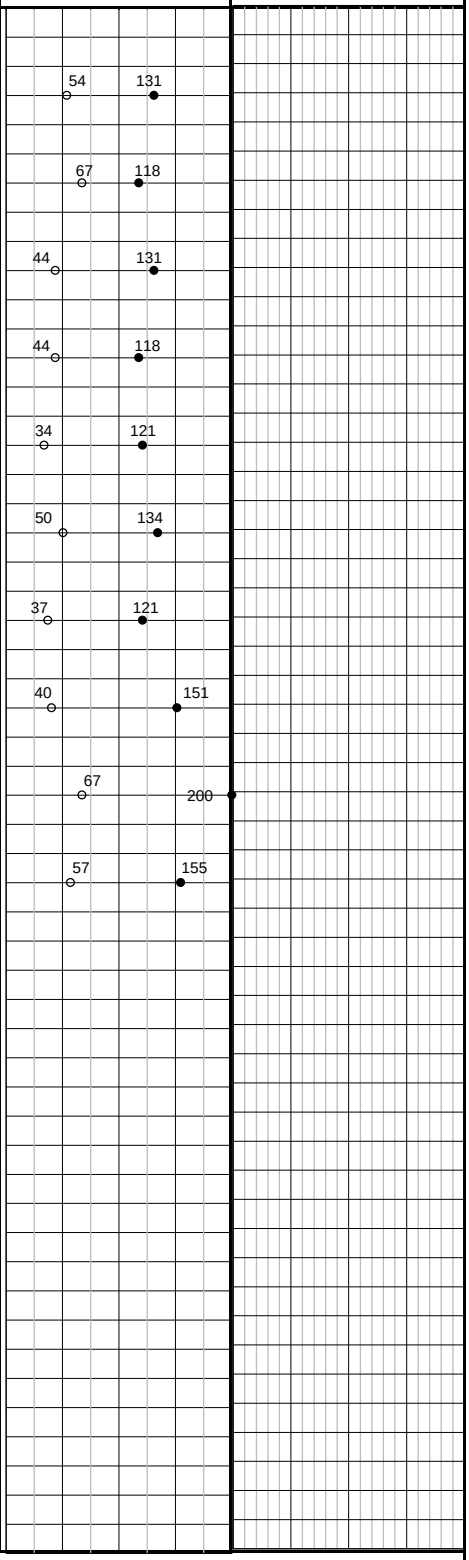
BOREHOLE No. 1

SITE: Mokohinau Drive, Mangawhai (Lot 6 DP 537061)

REF: 24135

Sheet 1 of 1

REDUCED LEVEL (RL) / INFERRED GEOLOGY	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLE TYPE	WATER CONTENT (%	WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Peak Field Vane ○ Remoulded Field vane 50 100 150	SCALA PENETROMETER BLOWS / 100 mm 5 10 15
T	TOPSOIL dark brown to 150 mm							
Pakiri Formation of the Waitemata Group	SILT grey with orange brown mottling, slightly clayey, slightly plastic, trace sand							
	light brown with orange brown streaks, slightly to moderately clayey, slightly to moderately plastic, trace sand							
	moist, decreased clay and plasticty, increased sand		1					
	increased orange brown		2					
	E.O.B: 3.0 m		3					
			4					
			5					



NOTES: Groundwater was not encountered.
Hand auger reached target depth at 3.0 m

LOGGED BY: MD
DATE DRILLED: 11-Nov-24
DRILL METHOD: 50 mm Hand Auger

WILEY GEOTECHNICAL LTD

BOREHOLE No. 2

SITE: Mokohinau Drive, Mangawhai (Lot 6 DP 537061)

REF: 24135

Sheet 1 of 1

REDUCED LEVEL (RL) / INFERRED GEOLOGY	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLE TYPE	WATER CONTENT (%	WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Peak Field Vane ○ Remoulded Field vane	SCALA PENETROMETER BLOWS / 100 mm
T	TOPSOIL dark brown, to 150 mm							
Pakiri Formation of the Waitemata Group	SILT grey with orange brown specks, slightly clayey, slightly plastic, trace sand							
	light brown with orange brown streaks, slightly to moderately clayey, slightly to moderately plastic, trace sand		1					
	occasional organic fragments, rootlets							
	decreased caly and plasticity							
	moist to wet		2					
	water at 2.2 m					V		
	saturated, falling off auger							
	E.O.B: 2.8 m		3					
			4					
			5					

Vane shear strength axis: 50, 100, 150

Scala penetrometer axis: 5, 10, 15

○	●
57	144
67	134
40	94
40	87
47	101
50	84
34	71
50	77
60	81

NOTES: Groundwater was not encountered.
Hand auger reached target depth at 3.0 m

LOGGED BY: MD
DATE DRILLED: 11-Nov-24
DRILL METHOD: 50 mm Hand Auger