

TECHNICAL MEMORANDUM

To: Watchman Capital	From:	Kirstin Brown
Attention: Bill Ritchie	Date:	22 December 2022
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Subject: PRELIMINARY GEOTECHNCIAL ASESSMENT - 31 NGONGOTAHA ROAD, ROTORUA

1 INTRODUCTION

As requested, CMW Geosciences have prepared this Geotechnical Memorandum to assess the geotechnical feasibility of developing the land at 31 Ngongotaha Road, Rotorua into a residential subdivision. The assessment was based on a review of existing geotechnical reports, geotechnical databases, local knowledge, and experience within similar developments in the Rotorua area.

The assessment has been undertaken by:

- Kirstin Brown, Senior Geotechnical Engineer with over 10 years' experience in the Bay of Plenty area BSc, (Hons), MEngSC, MEngNZ
- Dave Morton, Principal Geotechnical Engineer, and Technical Director at CMW, with over 25 years' experience in the Bay Plenty area BSc, (Tech), MSc (Tech), MEngSC, CMEngNZ, CPEng.

This Geotechnical Memorandum is not suitable to support resource consent or building consent applications in its current format. Additional, more specific geotechnical investigations, analysis and assessment would be required to support any future consent applications.

2 LANDFORM

The site is located approximately 1km north of the Ngongotaha township and 680m east of Lake Rotorua. The overall site spans a terrace feature in the east with the landform grading gently to the Waiteti Stream beyond the northern and north-western boundary.

The current preliminary development proposal is to subdivide the eastern portion of the site into 196 residential dwellings, with access via Ngongotaha Road to the east. The landform in this portion of the site comprises an elevated terrace feature at RL295m (Moturiki Datum) in the south which grades onto a lower terrace feature at RL286m which in turn grades to a low-lying valley floor at RL284m.

A review of existing geotechnical investigation data and our experience across similar sites, suggests recent volcanic ash comprising pumiceous sands and gravels underlie the elevated parts of the site, with recent Holocene-aged alluvium underlying the western portion of the development area. The recent volcanic ash and alluvium are underlain by interbedded silts and sands of variable thickness and strength.

The groundwater table depth is approximately 1m to 3.8m below the current ground surface within the development area, being at approximately RL283m to RL286m.

3 GEOTECHNICAL CONSIDERATIONS

Based on the results of a site walkover and a review of existing geotechnical data, several geotechnical hazards have been identified and will need to be considered during the development of 31 Ngongotaha Road, Rotorua, which are summarised as follows:

- Based on local experience, the soils below the groundwater table are likely to be susceptible to liquefaction during an Ultimate Limit State (ULS) earthquake where liquefaction induced settlements are likely to be in the order of, if not greater than, 100mm when adopting a 10m depth limit in accordance with MBIE guidelines¹. Typically, liquefaction induced settlement are not predicted to occur under a SLS seismic event.
- Liquefaction compliant foundation solutions are likely to range from an MBIE Canterbury Rebuild Technical Guidance¹ TC2 or a TC2/TC3 hybrid. As such the site may be separated into liquefaction hazard zones with different foundation solutions to suit the magnitude of predicted settlements.
- Following the onset of liquefaction, the liquefied soils behave as a very weak undrained material, which
 can give rise to lateral spreading where a free face is present within the vicinity of the site or where
 proposed fill embankments are proposed over liquefied soils. Predicted displacements are likely to span
 between TC2 and TC3 foundation solutions. Alternatively, in areas of greatest spread, ground
 improvement along the leading edge to mitigate lateral spread may be considered.
- The alluvium typically has low strength, is compressible and will likely experience settlement in response to filling or future building loads and will therefore require ground improvement to facilitate development. A surcharge or preload fill embankment is the most commonly used ground improvement technique to reduce post construction static settlements to acceptable magnitudes.
- Based on experience with similar ground conditions, the temporary preload fill is likely to remain in place for 6 to 12 months, after which it needs to be removed from the site.
- Within the elevated portion of the site, load induced settlements are anticipated to be relatively minor, with differential settlements anticipated to be within recommended Building Code limits. Due to the granular nature of the subsoils, settlements are expected to be largely elastic and occur relatively quickly.
- The land immediately to the south and southeast of the site has been cut down to accommodate other development and railway construction, which has produced over-steepened cut batters. To provide slope stability factors of safety that comply with current building regulations, development of the site above these batters will require a setback. Based on experience, a building restriction line based on 1(V):2.5(H) projection line from the toe of these batters will likely be adopted.
- Fill embankments constructed over saturated alluvium are susceptible to bearing capacity failure if the embankment is constructed too quickly or too steeply. Based on previous experience with similar ground conditions, maximum fill bater gradients of 1:3 (vertical to horizontal) are recommended.
- Based on predicted liquefaction and load induced settlements, raft foundations are likely to be required. Some areas of the site may be considered suitable for a modified NZ3604 piled foundation system.
- A reduced geotechnical ultimate bearing capacity may be adopted due to the presence of loose sands and firm silts. This will need to be further assessed once the scale of earthworks is known.
- Earthworks requirements have not been considered in detail. However, it is recommended that any earthworks within the site are undertaken in general accordance with NZS 4431 and the requirements of the Rotorua Lakes Council, Regional Technical Infrastructure Standards (RITS).

¹ MBIE. (2012) Revised issue of Repairing and rebuilding houses affected by the Canterbury earthquakes. Ministry of Business, Innovation and Employment.

4 CONCLUSION

In summary, and subject to further geotechnical investigation, analyses and design, the proposed residential development of 31 Ngongotaha Road, Rotorua is considered geotechnically suitable, subject to the identified geohazards being mitigated by adopting appropriate ground improvement works and / or foundation solutions.

5 CLOSURE

This report has been prepared for use by the client, Watchman Capital, and their consultants. Liability for its use is limited to these parties and to the scope of work for which it was prepared as it may not contain sufficient information of other parties or for other purposes.

For and on behalf of CMW Geosciences

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