Mercury Lane – Public Toilets

Geotechnical Desktop Study

Prepared for Auckland Council

Prepared by Beca Limited

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Contents

Revision History

Revision Nº	Prepared By	Description	Date
Rev1	Cameron Burnell-Gray	First Issue	23/04/2024

Document Acceptance

Action	Name	Signed	Date
Prepared by	Cameron Burnell-Gray		23/04/2024
Reviewed by	Jennifer Lo		23/04/2024
Approved by	James Coupe		23/04/2024
on behalf of	Beca Limited		

Executive Summary

A geotechnical assessment for the proposed public toilets on Mercury Lane, Auckland CBD has been undertaken using publicly available information.

Historical aerial images indicate land use immediately around the proposed site has remained constant since 1940, with large urban buildings flanking the site.

The geology of the site is mapped as the boundary between Puketoka Formation and East Coast Bays Formation. Limited geotechnical investigation is available that shows the shallow geology within this area. Available information suggests possibly in situ or reworked Puketoka Formation / East Coast Bay Formation to a depth of 5.3m below ground level.

Geohazards that have been assessed. The near surface soil is considered to be prone to shrink swell behavior and the site has been classified as Class H – highly expansive.

Shallow foundations, in the forms of pads or shallow piles, would be viable solutions for this development Ultimate bearing capacity for a foundation design is assumed to be 300kPa (i.e. 150kPa dependable bearing capacity, with a Strength Reduction Factor of 0.5) for shallow foundations. If deep foundations are required, skin friction shall be ignored and pile end bearing capacity (ultimate, unfactored) of 450kPa may be considered.

1 Introduction

1.1 Object and Scope of this Report

Beca Limited (Beca) has been commissioned by Auckland Council to undertake a geotechnical assessment for the proposed public toilets on Mercury Lane.

This report details the findings of background desktop research and provides a qualitative assessment of geotechnical risks for the proposed development of public toilets.

2 Site Description

The Site is located at the northern end of Mercury Lane, Auckland Central; located on the street approximately outside of 3 Mercury Lane, Auckland CBD, Auckland 1010 on the east side of the street (as shown in Figure 1). The site is sloping to the south, with an elevation of between RL 65m (NZVD2016) at the northern end of Mercury Lane reducing to RL 57m (NZVD2016) at Cross Street intersection.

Figure 1: Auckland Council GEOMAP annotated to show the approximate location of site

Current land use of the site includes the commercial and hospitality buildings with on street parking. The location of the proposed works is currently covered by asphalt pavement and surrounded by a concrete footpath and a building to the west, a tree planter to the north, street parking and Mercury Lane carriageway to the south and the east. It is to be noted that the new Karang-a-Hape Railway Station, part of the City Rail Link, is located at the southern end of Mercury Lane.

2.1 Proposed Development

The proposed development on the site includes the installation of a prefabricated block of Jupiter 42DD Silver Twin Accessible NZ public toilet and the associated service connections, with an approximate footprint of 4404mm x 2342mm.

2.2 Historical Aerials

A review of publicly available historical aerial photographs dating from 1940 to 2024 was undertaken and is summarised in Table 1.

Table 1: Summary of Historical Land Use

Year	Land Use	Source
1940	Built-up urban area with a large building on both side of the Northern end of Mercury Lane with residential housing starting at the southern end.	Retrolens and LINZ
1950	No change.	Retrolens and LINZ
1966	No change.	Retrolens and LINZ
1970	Residential housing that was present to the south of Mercury Lane has been removed and construction for New Zealand State Highways 1 is underway.	Retrolens and LINZ
1974	No change.	Retrolens and LINZ
1984	Construction of New Zealand State Highways 1 has been completed. Footprint of building located at cross street intersection footprint increased.	Retrolens and LINZ
1996	No Change.	Auckland Council GeoMaps
2001	No Change.	Auckland Council GeoMaps
2004	No Change.	Auckland Council GeoMaps
2006	No Change.	Auckland Council GeoMaps
2008	No Change.	Auckland Council GeoMaps
2012	No Change.	Auckland Council GeoMaps
2015	No Change.	Auckland Council GeoMaps
2024	Demolition of building at Cross Street intersection for Karang-a-Hape Railway Station.	Google Maps

2.3 Published Geology

The published 1:250 000 geological map for the Auckland area (Edbrooke, 2001) indicates the site is near the boundary of two geological units with the first being the Puketoka Formation (part of the Tauranga Group), this consists of Pumiceous mud, sand and gravel with muddy peat and lignite; rhyolite pumice including non-welded ignimbrite, tephra and alluvium pumice deposit massive micaceous sand.

The second geological unit is the East Coast Bays Formation (Part of the Waitemata Group) which is described as alternating sandstone and mudstone with variable volcanic content (volcanic-poor lower in the sequence and mixed volcanic content higher) and interbedded volcaniclastic grit beds.

The mapped extent of this unit is shown in Figure 2 below.

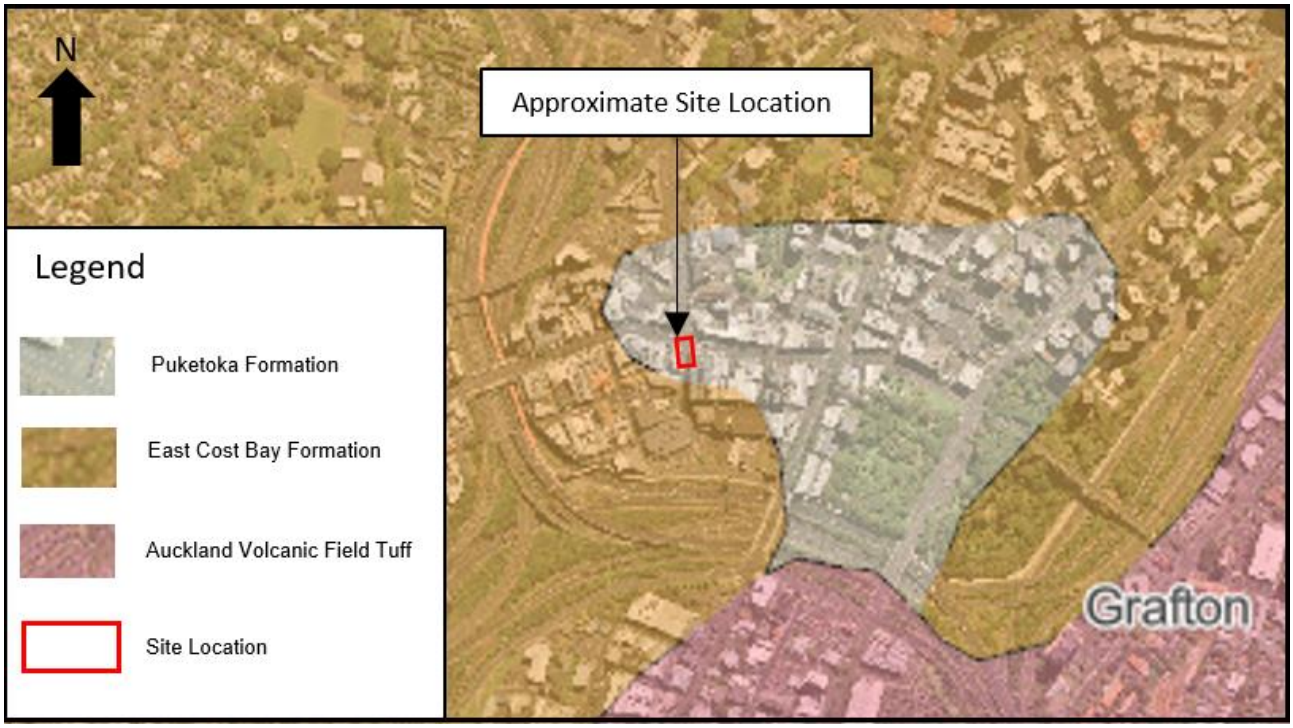

Figure 2: Annotated Site Geological Map Based on Published Geological Map (Edbrooke, 2001) for Mercury Lane

2.4 Publicly Available Geotechnical Information.

2.4.1 Nearby Geotechnical Investigations

A review has been undertaken on the nearest publicly available geotechnical information on the New Zealand Geotechnical Database (NZGD).

Three boreholes are present at the approximate location of the proposed site.

- Two (NZGD ID: BH_71521 and BH_71522) of which was vacuum extracted the top 1.5m of the site with the following geology described as Tauranga Group to 5.5m below ground level (bgl) (approximately 57.5m RL). Followed by completely Weathered to Highly Weathered Waitemata Group to 17.2m bgl. These holes extended to a maximum of 45.5m bgl.
- BH_127880 described fill material being present till 5.98m bgl (56.42m RL). East Coast Bay Formation was noted for the rest of the hole. Water levels that where recorded may have been affected by water used to assist in excavation and localized weather. Engineering judgment has been used to find a ground water level of approximately 2.8m bgl.

A further six boreholes are available within 50m of the site.

- BH_127849 – Fill to termination, 0.6m bgl.
- BH_166993 and BH_166994 – Core loss and gravel down to a maximum of 2m bgl (63.85m RL) followed by a soil described primarily as a Silt is present till 6.5m bgl (57.35m RL) after strata turns into a weathered Sandstone.

- BH_167099, BH_167101 and BH_167101 have been wash drilled beyond 5m bgl.

2.5 Existing Foundation Information

No existing information of the current building's foundation is available at the time of writing this report. In the absence of historical records, undercroft structure and shallow foundation are assumed due to site topography.

3 Site Investigation

No site investigation has been undertaken as part of these works.

Hence, site verification is required during construction to confirm geotechnical assumptions are applicable for the design. For information on site verification see Section 6.1.4 for details.

4 Subsurface Profile

The anticipated subsurface profile based on a review of publicly available boreholes from NZGD for the site is presented in Table 2 below:

Table 2: Anticipated subsurface profile.

Material	General Description	Thickness (m)
Asphalt / Concrete	Asphalt / Concrete / Fill	0.20
Fill possibly (reformed Puketoka Formation / East Coast Bay Formation?)	Silty CLAY / Clayey SILT	5.30
East Coast Bay Formation	Highley Weathered to Weathered SANDSTONE	17.00

If the geology described within Table 2 is not encountered on site, the designer is to be contacted.

5 Geotechnical Hazards

Table 3 provides a summary of geohazards identified following the above desktop information review.

Table 3: Summary of Geohazards.

Geohazard	Risk	Comment
Fault rupture/ Ground shaking	Low	No mapped active faults are shown to be passing through or near to the site. The closest fault to the site is Waikopua Fault which is over 25km and has a status of possible active.
Liquefaction/cyclic softening/Lateral spreading	Low	The site soils are unlikely to be susceptible to liquefaction or cyclic softening as the near surface soils are stiff cohesive soils. With Auckland Council GeoMaps classifying the site with a Level B Liquefaction assessment, the site has very low liquefaction and undetermined. It is to be noted that the site is located within a location that is unlikely damage area Vulnerability in accordance with Table 4.4 of MfE (2017) Planning and engineering Guidance for potentially liquefaction-prone land: Resource Management Act and Building Act aspects
Slope Stability/Rockfall	Low	The site consists of a steep paved slope and is located in a developed urban area.
Expansive Soils	High	Publicly available borehole has identified the presence of highly plastic soil. It is recommended to adopt an expansive soil classification of Class H – highly expansive (as per AS 2870:2011).

Geohazard	Risk	Comment
Compressible ground	Low	The strength of the proposed founding layer has been described as stiff to very stiff and no exploratory holes identified in NZGD have identified peat or soft soil being present. Puketoka Formation is dated to the late Pliocene to Middle Pleistocene Pumiceous river deposit, as this is considered an older alluvium, there is a decreased risk of compressibility.
Tsunami/Coastal Hazards	Low	The site is inland and elevated and not expected to be affected by tsunami or coastal hazards.
Flooding	Low	Due to the steep terrain at the site, water is unlikely to pond and hence flooding risk is low. Karangahape Road approximately 65m from the proposed site has been noted as a flood area. In addition, the area to the south of Mercury Lane has been noted to be prone to flooding.

A design class between the proposed toilet block and the existing structure foundation is not anticipated due to the separating distance to the proposed toilet block.

6 Development Recommendations

6.1 Site Development

6.1.1 Foundations

Based on the initial geological review, the ground is deemed appropriate for shallow foundation with the following properties:

- Soil Classification – Class H, highly expansive (Building Code B1 Clause 7.5.13.1.2).
- Subsoil Class – Class C, shallow soil (NZS1170.5).
- The site may be considered as 'good ground' with the exception of expansive properties as recommended above. The in-situ soils are able to provide an ultimate bearing capacity of 300kPa for shallow foundations. A Strength Reduction Factor of 0.5 should be applied (Building Code B1/VM4).
- Based on limited information on groundwater, the design groundwater is prudently assumed to be at 2.5m bgl.

The steep topography of the site is not likely to support a slab on grade without undertaking some earthworks to create a level building platform. Shallow foundations, in the forms of pads or shallow piles, would be viable solutions for this development.

Ultimate bearing capacity for a foundation design is assumed to be 300kPa (i.e. 150kPa dependable bearing capacity, with a Strength Reduction Factor of 0.5) for shallow foundations. Subgrade conditions are to be verified on site by a geotechnical professional before construction of the foundation commences, see Section 6.1.4 for further details.

Congested underground services or other site constraints may restrict the use of shallow foundation. If deep foundations are required, skin friction shall be ignored and pile end bearing capacity (ultimate, unfactored) of 450kPa may be considered, with a Strength Reduction Factor of 0.5. Bored piles are preferable as opposed to driven piles due to a bored piles ability to minimise disturbance to the surrounding area. Subgrade conditions are to be verified on site by a geotechnical professional before construction of the foundation commences, see Section 6.1.4 for further details.

6.1.2 Earthworks and site preparation

Topsoil and unsuitable materials including asphalt, uncontrolled fill, buried structures and other deleterious materials should be removed from all proposed building and pavement areas and replaced with approved engineered fill where levels need to be restored. Any proposed fills and cuts greater than 0.6m in height should be reviewed by an experienced geotechnical engineer.

For the excavation of services/ pavement, to reduce the effects of rain, surface desiccation, and construction plant trafficking we recommend that a working course of aggregate be placed immediately following site excavations or that subgrade be left at least 100mm proud of final level until made ready for sub-base placement. Subgrade should be brought to a moisture content similar to that inferred to be the long-term condition prior to placement of concrete.

6.1.3 Underground Services

Live services have been shown on Auckland Councial GEOMAPS within the development footprint, including Wastewater, Stormwater and Water. A full utility search shall be undertaken with all assets being located on site before commencement of any work. All excavation and backfilling with hardfill shall be compacted to appropriate engineering standards. CAT scanning and potholing is recommended to located all buried services before work commences.

Any loading of the superstructure should not add additional loading onto the existing structures or services.

The proposed City Rail Link is planned to be located under the proposed site area. The impact of the proposed toilet block is negligible. It is to be confirmed at detailed design.

6.1.4 Construction Monitoring and Testing

Construction monitoring and testing should be undertaken according to technical specifications issued with design drawings to confirm soil and founding conditions are consistent with those summarised within this report.

The following are some of the main items that should be inspected, tested, and approved by an experienced geotechnical professional:

- Founding conditions
- Suitability of in-situ ground at final cleared ground level, prior to placement of any fill, pavement or foundation materials.
- Any site observations inconsistent with the assumptions made in this report such as unforeseen ground conditions encountered.
- In situ testing, but is not limited to the below, shall be undertaken to confirm the anticipated strength of the soil:
  - In cohesive soils, Hand shear vane tests are to be undertaken across the footprint of the proposed toilets. These are to achieve a minimum Su of 50kPa. Testing to be carried out in line with ASTM D2573M-15 and NZGS (2001). Additional rods can be added to facilitate a hand shear vane for a bored pile. This is to be adopted as deep as reasonably practicable.
  - In granular soils, Dynamic Cone Penetration testing (DCP) / Scala Penetrometer are to be carries out to achieve a minimum 3 blows/100mm.Testing is to be carried out in line with NZS 4402.6.5.2:1988.

7 Applicability Statement

This report has been prepared by *Beca Limited* **(BECA)** on the specific instructions of *Auckland Council* **(Client)**. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

Should you be in any doubt as to the applicability of this report and/or its recommendations for the proposed development as described herein, and/or encounter materials on site that differ from those described herein, it is essential that you discuss these issues with the authors before proceeding with any work based on this document.

In preparing this report Beca has relied on key information including the following:

- Auckland Council GeoMaps via https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html on 12/04/2024
- Google Maps via https://www.google.com/maps on 12/04/2024
- New Zealand Geotechnical Database (NZGD) via https://www.nzgd.org.nz on 12/04/2024
- Published Geological Map Geology of the Auckland area: scale 1:250,000 (Edbrooke, 2001)
- Retrolens and LINZ via https://retrolens.co.nz/map/ website on 12/04/2024

Unless specifically stated otherwise in this report, Beca has relied on the accuracy, completeness, currency and sufficiency of all information provided to it by, or on behalf of, the Client, including the information listed above, and has not sought independently to verify the information provided.

This report should be read in full, having regard to all stated assumptions, limitations and disclaimers. No part of this report shall be taken out of context and, to the maximum extent permitted by law, no responsibility is accepted by Beca for the use of any part of this report in any context, or for any purpose, other than that stated herein.

8 References

ASTM. (2018). D2573M-15. Standard Test Method for Field Vane Shear Test in Saturated Fine-Grained Soils.

Edbrooke, S.W. (compiler) 2001: Geology of the Auckland area: scale 1:250,000. Lower Hutt: Institute of Geological & Nuclear Sciences Limited. Institute of Geological & Nuclear Sciences 1:250,000 geological map 3. 74 p. + 1 folded map

Ministry of Business, Innovation and Employment. (2021). Acceptable Solutions and Verification Methods for New Zealand Building Code Clause B1 Structure.

New Zealand Standard. (2011). NZ3604:2011 Timber-framed buildings

Ministry of Environment. (2017). Guidance Planning and engineering Guidance for potentially liquefaction-prone land: Resource Management Act and Building Act aspects

Standards Australia. (2011). AS 2870:2011 Residential slabs and footings

Standards New Zealand. (2004). NZS1170.5 - Structural Design Action Part 5: Earthquake Actions – New Zealand

New Zealand Geotechnical Society. (2001). NZGS, 2001 Guideline for Hand Held Shear Vane Test

New Zealand Geotechnical Society. (2005). Field Description of soil and Rock: Guideline for Field Classification and Description of Soil and Rock for Engineering Purpose.