

Ergo Consulting Limited
116 McLarin Road
Glenbrook
AUCKLAND 1023

Ref: 9484

Date: 25 March 2022

Attention: Mr S Gaskin

Dear Steve,

**RE: PROPOSED SUBSTATION DEVELOPMENT
116 MCLARIN ROAD, GLENBROOK
Geotechnical Assessment**

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation for a proposed Substation development at the above address for our client Ergo Consultants Ltd.

The investigation has been carried out to assess the subsoil conditions and provide geotechnical recommendations for the proposed development. We understand that our report will be used for the foundation design and will be submitted to Auckland Council as part of a Building Consent application.

2.0 SITE DESCRIPTION

The property is party of larger block of land currently titled Lot 5000 DP 562266 and 1/2 SH LOT 2003 DP 562266. The lot has a total area of about 35Ha. It is located 85m south of the intersection of McLarin Road with Orawahi Road. The local topography within the property slopes from the centre of the property outwards at an average slope of about 1H:11V.

The Auckland Council GIS database shows no public underground services located within the property.

3.0 PROPOSED DEVELOPMENT

We understand that it is proposed to construct a new switch room and transformer yard on the site. The new switch room may have a cable basement of up to 2 m depth.

4.0 GEOLOGY

According to the 1:250,000 scale geological map of Auckland published by the Institute of Geological and Nuclear Science the subject site is underlain by the East Coast Bays Formation of the Waitemata Group. These deposits are characterised by a series of inter-bedded mudstone and sandstones deposited around 20 million years ago and are found under much of the Auckland Metropolitan area. In situ weathering of the usually dark-grey bedrock material has created in most locations, an overburden comprising mixtures of silts, clays and sands, being predominantly orange, brown and grey in colour and often containing hard

dark-brown iron oxide (limonitic) concentrations. Ground conditions encountered on site comprised residual soil of the Waitemata Group consistent with the geological map.

5.0 SITE INVESTIGATION

Our fieldwork was carried out on 15th March 2022. The fieldwork comprised an inspection of the site by a geotechnical technician and the drilling of four hand auger boreholes, designated BH1 to BH4. The boreholes were all drilled to a maximum target depth of 4.8m.

The boreholes were 50 mm in diameter and the *in situ*, undrained shear strengths of the subsoils were measured in the boreholes at approximately 0.3m intervals with a hand operated Pilcon shear vane. Soils recovered from the investigation boreholes was logged in general accordance with the New Zealand Geotechnical Societies "Guideline for the Field Description of Soil and Rock" dated 2005.

The location of the boreholes in relation to the proposed building site and the boundaries of the property are shown on Drawing 9484-1. Descriptions of the soils encountered in the boreholes, along with measured shear vane strengths are presented on the attached borehole log sheets.

6.0 SUBSOIL CONDITIONS

Topsoil was encountered to depths of between 0.3 m and 0.5 m across the site. Below the topsoil, the boreholes encountered residual soil down to the base of the boreholes. Shear vane strengths recorded in-situ ranged from a low of 111kPa to a high of 200kPa + (the maximum able to be measured on the dial).

7.0 GROUND WATER

Groundwater was encountered on the day of drilling at 4.3 m in BH1 with BH2, BH3 and BH4 remaining dry. We anticipate that during periods of wetter weather, the static water level may rise within 1-2 m of the ground surfaces. Given the shallow depth of the underlying transitional materials it is also probable that a shallow perched water table may develop following prolonged or heavy rainfall.

8.0 SITE SOIL CLASS (1170)

In accordance with AS/NZS1170.0 the site soils fall within the Class C classification.

9.0 BUILDING IMPORTANCE LEVEL

We understand that the switchboard building has been designated as having an Importance Level 4 (IL4) in accordance with AS/NZS1170.

10.0 LIQUEFACTION AND LATERAL SPREADING RISK

The hand auger boreholes found that the underlying residual soils comprise very stiff to hard silty clays. Due to the age and plastic nature of the soils, we do not anticipate any liquefaction risk.

11.0 DISCUSSION

The soil type encountered on the site comprised East Coast Bays Formation of the Waitemata Group. These soils are known to be particularly susceptible to volume changes due to changes in the moisture content (i.e. shrink/swell). We therefore recommend that shallow foundations may be designed in accordance with AS2870:2011 for class H1 soils. In this case we recommend that shallow strip and pad foundations should be designed in accordance with AS2870:2011 H1 soil having a minimum depth of embedment of 0.9m.

For lightly loaded structures, not exceeding an average distributed ground bearing pressure of 30kPa, settlement is unlikely to be an issue and therefore shallow foundation may be adopted. For structures with larger foundation loadings, piled foundations are required. Foundations should be designed in accordance with the recommendations within this report.

Where weaker soils are encountered in the foundations, undercut maybe required and the footing brought back to invert level either with well compacted hardfill or with Site Concrete.

We understand that a cable basement may be required. Due to possible shallow groundwater table, any basement excavation should be designed as fully tanked and make provision for buoyancy. For design purposes, the groundwater table depth should be assumed to be approximately 1m from the ground surface. Due to the depth of the groundwater table measured in excess of the proposed basement excavation, it is not anticipated that groundwater drawdown in either the temporary or permanent cases will be an issue and do not require an assessment with respect to the Auckland Councils Unitary Plan.

The basement cut should be adequately retained or battered back to a slope of no greater than 1V:1H as per our recommendations below. It is considered that where batter slopes can't be formed due to proximity to the boundary, then temporary retaining may be required.

12.0 GEOTECHNICAL RECOMMENDATIONS

Based on our discussion above, our geotechnical recommendations for the proposed development are as follows:

- 1) Prior to construction on site the final building foundation and earthwork plans should be reviewed and approved by a Geotechnical Engineer to ensure that our recommendations have been correctly interpreted.
- 2) All foundations, floor slabs and services into the building must be designed for class H1 soils in terms of AS2870:2011.
- 3) Foundations may generally comprise conventional shallow strip or pad footings designed under Ultimate Limit State design for a dependable bearing pressure of 150 kPa (300 kPa ultimate). Footings should be designed as per recommendation 3 above and taken down at least 0.9m below cut ground levels as a precaution against settlement affects associated with seasonal soil shrinkage. If weak ground (such as that encountered within BH6) is encountered in footing excavations, they should be undercut to competent ground and brought back to footing invert level with either well compacted hard fill or mass concrete, subject to specific recommendations by a Geotechnical Engineer.
- 4) Floor slabs on level cut ground may be cast-on-grade provided all vegetation, topsoil and any weak soils are removed and subject to the review and approval of the sub-grade by a Geotechnical Engineer and should be designed for the special provisions of Class H1 soils. The subgrade surface under any foundation and floor slab should not be allowed to dry out or be remoulded by construction work and should be protected with a layer of basecourse, or similar, immediately following excavation and trimming to the design profile. Floor slabs should not be poured on subgrades which have been allowed to dry out and desiccate. Should cracking of clay subgrades of more than 10mm be observed, the advice of a Geotechnical Engineer should be obtained before placing hardfill or pouring slabs.

- 5) Care should be taken with disposal of storm water to prevent any uncontrolled concentrated discharge of water which could exacerbate shrinkage and swell movement. Stormwater from roofs, footpaths and the driveway should be piped to discharge into existing public services, in accordance with Auckland Council requirements.
- 6) The soils on the site are considered to be highly susceptible to seasonal shrinkage and swelling. The effects of which can be exacerbated by trees (especially exotic varieties), hedges and plants having a high-water demand, which, should not be planted near the building as they can withdraw moisture from the soil and cause any shallow foundations and ground bearing floor slabs to settle. As a guide to class H1 soils, trees should be planted no closer to the building than the mature height of the tree.
- 7) Our experience with the soils in this area indicates that when they are exposed to the weather or heavy machinery trafficking their strengths may be significantly compromised, particularly during wet site conditions. We recommend that a CBR value of 3% is adopted for the design of pavements within the site. We also recommend that the carpark and building platform areas are only trimmed to final levels immediately prior to metalling and that at all times the site is shaped to avoid water ponding during rain.
- 8) During building excavation, earthworks and foundation construction the site should be examined by a Geotechnical Engineer or Engineering Geologist to confirm the nature of the subgrade and measure foundation and soil strengths, test fill compaction as well as to provide advice on any other geotechnical issues which may become apparent during construction.

Where Engineering Geology Ltd is required to carry out site inspections during construction and provide certification or a Producer Statement – Construction Review, it is requested that we be supplied a copy of the Building Consent Conditions. We request that a minimum notification of 24 hours be given for any site inspections and note that we will be unable to issue a Producer Statement without site inspections at the appropriate stages during construction.

We note that site inspections during construction and associated certification are not included within the budget for the preparation of the geotechnical report and will be subject to additional costs

13.0 LIMITATIONS

Recommendations and opinions in this report are based on the data from four hand auger boreholes. While the nature and continuity of the subsoil conditions away from the boreholes is inferred it is possible that actual conditions could vary from those assumed. Should variations in subsoil conditions from those described in this report be found to exist, then it is essential that Engineering Geology Ltd be contacted as it may affect the design parameters recommended above.

This report has been prepared solely for the benefit of Ergo Consultants Limited as our client with respect to the brief to assess the subsoil conditions for the proposed development and Engineering Geology Ltd accepts no liability to any other party in relation to this report. The reliance by other parties on the information or opinions contained in this report shall, without our prior review and agreement in writing, be at such parties' sole risk.

We would be pleased to provide any further advice you may require.

Yours faithfully

ENGINEERING GEOLOGY LIMITED

Prepared by:

A handwritten signature in black ink, appearing to be 'C. Lee', with a stylized, cursive script.

C. Lee (Geotechnical Engineer)

Reviewed by:

A handwritten signature in blue ink, appearing to be 'P. Carter', with a stylized, cursive script.

P. Carter (CPEng)

Enclosure: Borehole log Terminology
Borelogs – BH's 1 to 4
Drawings 9484-1



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HAND AUGER LOG

BOREHOLE No.: BH1

SHEET 1 OF 1

Job No.: 9484

PROJECT: 116 Mclarin Road
LOCATION: 116 Mclarin Road, Glen Brook
RL GROUND:
DATUM: Auckland 1946

DATE: 15/03/2022
HOLE DEPTH: 4.8m
COORDINATES: East 1752329.3 North 5886166.0
GRID: NZTM 2000

GEOLOGICAL UNIT	SOIL MATERIAL DESCRIPTION	DEPTH / RL	GRAPHIC LOG	DEPTH (m)	MOISTURE CONDITION	CONSISTENCY / DENSITY	SAMPLES	WATER CONTENT (%)	SEEPAGE / WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Field Vane (BS 1377) ○ Remoulded Field Vane	FIELD TESTS
TS	Organic SILT; light brown. Hard, moist, low plasticity.	0.0									
Waitemata Group	Silty CLAY; dark brown. Hard, moist, moderate plasticity.	0.3									SV: 0.3m, UTP
		-0.3									SV: 0.6m, UTP
											SV: 0.9m, UTP
	light brown	1.1		1		H					SV: 1.2m, 200+ kPa
	light grey, orange	1.4									SV: 1.5m, 200+ kPa
	trace sand (f)	1.6									SV: 1.8m, 179 / 69 kPa (2.6)
	very stiff	1.8									
	Clayey SILT; light grey, orange. Very stiff, moist, low plasticity.	1.9		2		M					SV: 2.1m, 166 / 62 kPa (2.7)
											SV: 2.4m, 168 / 75 kPa (2.2)
	light grey	2.5									SV: 2.7m, 145 / 74 kPa (2.0)
		-2.5									SV: 3.0m, 139 / 79 kPa (1.8)
				3		VSt					SV: 3.3m, 146 / 72 kPa (2.0)
	light grey, orange	3.4									SV: 3.6m, 142 / 63 kPa (2.3)
	light grey	3.8									SV: 3.9m, 132 / 54 kPa (2.4)
	wet	4.0		4							SV: 4.2m, 126 / 60 kPa (2.1)
	saturated, seepage encountered @4.3m	4.3									SV: 4.5m, 120 / 46 kPa (2.6)
		4.8									SV: 4.8m, 123 / 49 kPa (2.5)
EOH: 4.80 m											

NOTES:
E.O.B 4.8m (Target Depth). Coordinates gathered from Google Earth.

LOGGED: SK

CHECKED:

DRILL TYPE: 50mm Hand Auger



BOREHOLE No.: BH2
SHEET 1 OF 1
Job No.: 9484

DATE: 15/03/2022
HOLE DEPTH: 4.8m
COORDINATES: East 1752363.9 North 5886190.0
GRID: NZTM 2000

NOTES: E.O.B 4.8m (Target Depth). Coordinates gathered from Google Earth.	LOGGED: SK
	CHECKED: DRILL TYPE: 50mm Hand Auger



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HAND AUGER LOG

BOREHOLE No.: BH3

SHEET 1 OF 1

Job No.: 9484

PROJECT: 116 Mclarin Road
LOCATION: 116 Mclarin Road, Glen Brook
RL GROUND:
DATUM: Auckland 1946

DATE: 15/03/2022
HOLE DEPTH: 4.8m
COORDINATES: East 1752389.6 North 5886198.8
GRID: NZTM 2000

GEOLOGICAL UNIT	SOIL MATERIAL DESCRIPTION	DEPTH / RL	GRAPHIC LOG	DEPTH (m)	MOISTURE CONDITION	CONSISTENCY / DENSITY	SAMPLES	WATER CONTENT (%)	SEEPAGE / WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Field Vane (BS 1377) ○ Remoulded Field Vane	FIELD TESTS
TS	Organic SILT; light brown. Hard, moist, low plasticity.	0.0									SV: 0.3m, UTP
Waitemata Group	Silty CLAY; light brown. Hard, moist, moderate plasticity.	0.5				H					SV: 0.6m, UTP
		-0.5		1							SV: 0.9m, 200+ kPa
	very stiff	1.2									SV: 1.2m, 169 / 80 kPa (2.1)
		-1.2									SV: 1.5m, 157 / 72 kPa (2.2)
	Clayey SILT; light brown. Very stiff, moist, low plasticity.	1.6		2							SV: 1.8m, 154 / 69 kPa (2.2)
		-1.6									SV: 2.1m, 151 / 57 kPa (2.6)
	light grey	2.2		M							SV: 2.4m, 139 / 60 kPa (2.3)
		-2.2									SV: 2.7m, 129 / 54 kPa (2.4)
				3		VSt					SV: 3.0m, 119 / 48 kPa (2.5)
	Silty CLAY; light grey. Very stiff, moist, low plasticity.	3.1									SV: 3.3m, 123 / 51 kPa (2.4)
		-3.1									SV: 3.6m, 128 / 49 kPa (2.6)
	Clayey SILT; light grey. Very stiff, moist, low plasticity.	3.5		4							SV: 3.9m, 136 / 54 kPa (2.5)
		-3.5									SV: 4.2m, 142 / 57 kPa (2.5)
											SV: 4.5m, 137 / 54 kPa (2.5)
		4.8									SV: 4.8m, 126 / 51 kPa (2.5)

EOH: 4.80 m

NOTES:
E.O.B 4.8m (Target Depth). Coordinates gathered from Google Earth.

LOGGED: SK

CHECKED:

DRILL TYPE: 50mm Hand Auger



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HAND AUGER LOG

BOREHOLE No.: BH4

SHEET 1 OF 1

Job No.: 9484

PROJECT: 116 Mclarin Road
LOCATION: 116 Mclarin Road, Glen Brook
RL GROUND:
DATUM: Auckland 1946

DATE: 15/03/2022
HOLE DEPTH: 4.8m
COORDINATES: East 1752374.6 North 5886213.2
GRID: NZTM 2000

GEOLOGICAL UNIT	SOIL MATERIAL DESCRIPTION	DEPTH / RL	GRAPHIC LOG	DEPTH (m)	MOISTURE CONDITION	CONSISTENCY / DENSITY	SAMPLES	WATER CONTENT (%)	SEEPAGE / WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Field Vane (BS 1377) ○ Remoulded Field Vane	FIELD TESTS
TS	Organic SILT; light brown. Hard, moist, low plasticity.	0.0									
	Silty CLAY; light brown. Hard, moist, moderate plasticity.	0.3									SV: 0.3m, UTP
Waitemata Group		-0.3									SV: 0.6m, UTP
											SV: 0.9m, UTP
	light grey, orange	1.1		1		H					SV: 1.2m, 200+ kPa
		-1.1									
	very stiff	1.5									SV: 1.5m, 169 / 80 kPa (2.1)
	light brown, orange	1.6									
											SV: 1.8m, 165 / 72 kPa (2.3)
	Clayey SILT; orange, red. Very stiff, moist, low plasticity.	1.9				VSt					
		-1.9									SV: 2.1m, 200+ kPa
	hard	2.1		2							SV: 2.4m, 200+ kPa
	orange	2.3				M					SV: 2.7m, 157 / 54 kPa (2.9)
		-2.3									SV: 3.0m, 139 / 59 kPa (2.4)
	very stiff	2.7									SV: 3.3m, 134 / 54 kPa (2.5)
		-2.7									SV: 3.6m, 128 / 46 kPa (2.8)
	light grey	2.9		3							SV: 3.9m, 136 / 49 kPa (2.8)
		-2.9									SV: 4.2m, 119 / 42 kPa (2.8)
											SV: 4.5m, 122 / 48 kPa (2.5)
				4		VSt					SV: 4.8m, 112 / 38 kPa (2.9)
		4.8									
EOH: 4.80 m											
											112 / 38 kPa (2.9)

NOTES:
E.O.B 4.8m (Target Depth). Coordinates gathered from Google Earth.


LOGGED: SK

CHECKED:


DRILL TYPE: 50mm Hand Auger




Notes:
1. This drawing is for information only and it is not issued for Construction.
2. The location and alignment of the structures, boundaries and the underground and above ground services shown in this drawing are approximate only and shall be verified and confirmed on site prior to any excavation and construction work.


BH1

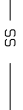
Hand Auger Borehole


Lot Boundary

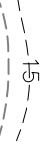
Lot Boundary


SV

Stormwater Line


SS

Wastewater Line


1.5

Contours 0.5m Interval



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116 McLaren Road, Borehole Location Plan

Reference: ???
Site Plan
Job No: ???
Date: ?? 2013
Drawing No. 9484-1
Date: Mar 2022
Drawn: SK/CL
Scale: 1:600 (A3)
Filename: 9484.dwg