GROUND TECHNOLOGIES

Geotechnical Testing Services

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GTE1236 – Geotechnical Report
13 June 2017

Client: Andrew Hastie
E-mail: rifin@bigpond.net.au

Dear Sir,

RE: PRELIMINARY GEOTECHNICAL INVESTIGATION at No.19-21 Harvey Avenue, Moorebank

This letter presents a geotechnical report on the inspection and testing services associated with the geotechnical investigation undertaken at the above project.

Should you have any questions related to this report please do not hesitate to contact the undersigned.

For and on behalf of
Ground Technologies Pty Ltd

A. Bennett
Senior Geotechnical Engineer

Reviewed By

J. Harendran
Geotechnical Engineer

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1. INTRODUCTION

Ground Technologies Pty Ltd (Ground Tech) has prepared this report to discuss the results of the geotechnical investigation undertaken for the proposed residential development at Nos. 19-21 Harvey Avenue, Moorebank (herein referred to as the "site"). Ground Tech was engaged to provide professional assistance for this component of the project.

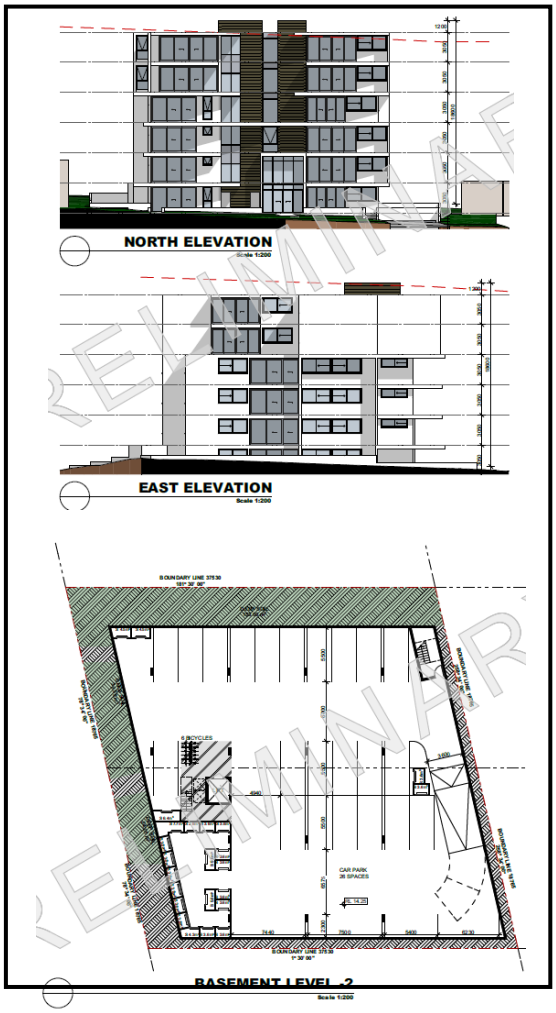
The preliminary geotechnical investigation included drilling two (2) boreholes using a 4WD Toyota Landcruiser Ute mounted drill rig with 100mm diameter solid flight spiral augers at the locations shown on drawing Figure 3. This report provides a geotechnical assessment on the existing soil conditions.

This report is based only on the information provided at the time of this report preparation and may not be valid if changes are made to the site or to the construction method.

1.1 Proposed Development

It is understood that the proposed works will comprise the construction of a six storey apartment building with two levels of basement level car parking. The basement level car park will extend across the whole building envelope to a depth of approximately 6.0m below existing ground surface levels.

Figure 1 – Proposed Development



2. SITE DETAILS

2.1 Site Description

The subject site is the combination of two existing residential parcels of land. The combined site is near rectangular in shape and measures approximately 37m wide along the Harvey Avenue frontage and is up to approximately 1m deep. The site covers an area of approximately 1475m^2 and has a grade of between 2-4° down towards the west.

No.19 Harvey Avenue contains a single storey brick veneer house located centrally within the property. The front and rear yards are predominately grass covered. No.21 Harvey Avenue contains a single storey brick house located centrally within the property. The front and rear yards are predominately grass covered. The surrounding sites contain residential houses of similar construction.

Table 1 - Summary of Site Details

Site Address	19-21 Harvey Avenue, Moorebank
Lot / DP	Lots 29 & 30 DP236405

Figure 2 – Site Location

2.2 Geology

The 1:100,000 scale Geological Series Map of the Penrith region indicates that the subject site is underlain by Ashfield Shale of the Wianamatta Group dating back to the Middle Triassic period and generally comprise *Claystone / Siltstone and fine Sandstone / Siltstone laminite*.

3. GEOTECHNICAL INVESTIGATION

Fieldwork were undertaken on the 8th of June 2017 and included the drilling of two (2) boreholes using a 4WD Toyota Landcruiser Ute mounted drill rig with 100 mm solid flight spiral augers at locations shown on Figure 3.

Figure 3 – Borehole Locations

3.1 Subsurface Profile

A number of distinct geological units were encountered during the field investigation. A generalised description and summary of encountered depths is provided in Table 2. Detailed borehole logs are provided in Appendix A.

Table 2: Generalised Summary Geological Units

UNIT	DESCRIPTION	BOREHOLE INTERCEPT DEPTHS (m)	
		BH1	BH2
Unit A	Sandy SILT / Clayey SILT	0-0.2m	0-0.3m
Unit B	Gravelly Sandy Clayey SILT	0.2-0.5m	-
Unit C	Silty CLAY, with minor ironstone gravels and sand	0.5-2.2m	0.3-1.8m
Unit D	SILTSTONE / MUDSTONE, minor sandstone, completely weathered	2.2-2.8m	1.8-2.3m
Unit E	SILTSTONE / MUDSTONE, minor sandstone, completely weathered	2.8-7.2m	2.3-6.0m

3.2 Groundwater

No groundwater was encountered at the time of the field investigation.

4. RECOMMENDATIONS

4.1 Retaining Wall Design Parameters

For the design of flexible retaining structures, where some lateral movement is acceptable, an active earth pressure co-efficient is recommended. If it is critical to limit the horizontal deformation of a retaining structure, use of an earth pressure co-efficient at rest should be considered. Recommended parameters for the design of retaining structures are presented in table 3.

Table 3: Retaining Wall Design Parameters for each Geological Unit

	Fill, Natural Clay Soils and Completely Weathered Shale	Siltstone / Mudstone Bedrock
Units	A-D	E
Ka	0.4	0.2
Ko	0.6	0.3
Kp	-	300kPa
Unit Weight (kg/m^3)	18	20

The retaining wall designs should also allow for any additional surcharge loads from adjoining structures, vehicles etc, which should be calculated separately. Appropriate drainage systems and free draining backfill should be provided to prevent the build-up of hydrostatic pressures behind all retaining walls.

4.2 Bored Pier Footings

For concrete bored piers, socketing can be designed in accordance with the end bearing capacities detailed in Table 4.

Table 4: Allowable Bearing Capacity for Bored Piers

Soil Type	Allowable Bearing Capacity	Shaft Adhesion
Low Strength Bedrock	700 kPa	70kPa

The quality of the founding stratum in all footing excavations is to be assessed by a structural or geotechnical engineer to confirm that the design parameters recommended in this report are appropriate. Footing excavations are to be cleaned out and inspected by a geotechnical engineer or the structural engineer prior to concrete placement. Concrete is to be placed within 24 hours of excavation, since the weathered bedrock may deteriorate rapidly upon exposure.

4.3 Basement Level Footings

Excavations for the basement level of the development will extend to approximately 6.0m below existing ground surface levels. Material exposed at the base of this excavation will comprise a low to medium strength bedrock. Strip and Pad footings constructed within the low to medium strength bedrock at basement level may be designed with the following maximum allowable end bearing capacities.

Isolated Pad Footings - 700kPa
Strip Footings - 700kPa

It is recommended that all footing excavations be inspected by a geotechnical engineer from Ground Tech to confirm that founding conditions are consistent with design recommendations. The footing size and the founding level may need to be adjusted, if required founding material is not encountered at the design founding level.

4.4 Basement Level Slabs

The proposed floor slab can be constructed at bulk excavation level designed on a Sub-grade Reaction Modulus (k) of 90 kPa/mm or CBR of 30.

4.5 Excavation

Excavations within the fill, natural clay soils and completely weathered rock (Units A-D) should be achieved with bucket attachment to a mid sized excavator. Excavations within the siltstone / mudstone may require pre-loosening using rock breaking or ripping attachments.

If vibratory rock breaking equipment is required for the proposed excavations in sandstone bedrock we recommend that, prior to the use of vibratory equipment, the excavation perimeter is saw cut with the aid of an excavator mounted rock saw or by drill and split techniques so as to minimise transmission of vibrations to adjoining structures. Following sawing of the perimeter of the excavation, sandstone bedrock may be broken up using a vibratory hammer suited to an excavator. Induced vibrations in structures adjacent to the excavation are to be examined to ensure that they do not exceed a peak particle velocity (PPV) of 5mm/sec.

As a guide, safe working distances for typical items of vibration intensive plant are listed in Table 5. The safe working distances are quoted for “cosmetic” damage (refer BS 7385) and are detailed in the Construction Noise Strategy (2010) prepared by the NSW Transport Construction Authority.

Table 5: Recommended Safe Working Distances for Vibration Intensive Plant

Plant Item	Rating / Description	Safe Working Distance
Small Hydraulic Hammer	250kg – 1.5 tonne excavator	2m
Small Hydraulic Hammer	300kg - 5 to 12tonne excavator	2m
Medium Hydraulic Hammer	900kg - 12 to 18tonne excavator	7m
Large Hydraulic Hammer	1600kg - 18-34 tonne excavator	22m

Ground vibrations induced by excavations should be monitored and recorded by specialist contractors. Monitoring equipment / data loggers should be installed at the closest point of the adjacent structures to ensure that the excavation contractor does not exceed the recommended level. We recommend the operation of hydraulic hammers should include:

- Excavation of loose or rippable sandstone blocks by bucket or single ripper attachments prior to the commencement of rock hammering;
- Use of saw cutting around the perimeter
- Progressive breakage from open excavated faces;
- Selective breakage along open joints where these are present;
- Use of rock hammers in short bursts to prevent generation of resonant frequencies;
- Orientation of the rock hammer pick away from property boundaries and into existing open excavation;
- The movement of large blocks away from the structures prior to breaking up for transport from the site.

Excavation works should be carried out by an experienced operator who is aware of factors affecting vibration and transmission of vibration such as orientation of the hammer, duration of hammering and speed of the vibration of the hammer.

Prior to the excavation works, it is recommended that dilapidation surveys be undertaken out on the surrounding properties as a means of protecting all parties involved in or affected by the proposed works.

5. CONDITIONS OF THE RECOMMENDATIONS AND LIMITATIONS

This type of investigation (as per our commission) is not designed or capable of locating all ground conditions, (which can vary even over short distances). The advice given in this report is based on the assumption that the test results are representative of the overall ground conditions. However, it should be noted that actual conditions in some parts of the site might differ from those found. If excavations reveal ground conditions significantly different from those shown in our findings, Ground Tech must be consulted.

The foundation depths quoted in this report are measured from the surface during our testing and may vary accordingly if any filling or excavation works are carried out. The description of the foundation material for has been provided for its easy recognition over the whole building site.

Any sketches in this report should be considered as only an approximate pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions or slope information should not be used for any building cost calculations and/or positioning of the building. Dimensions on logs are correct.

The scope and the period of Ground Tech services are described in the report and are subject to restrictions and limitations. Ground Tech did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Ground Tech in regards to it.

Where data has been supplied by the client or a third party, it is assumed that the information is correct unless otherwise stated. No responsibility is accepted by Ground Tech for incomplete or inaccurate data supplied by others.

6. REFERENCES

- Geological Series Sheet 9130 (EDITION 1) 1983, Map of the Sydney region, scale 1:100,000
- “Foundations of Sandstone and Shale in the Sydney Region” by P.J.N Pells, G.Mostyn & B.F Walker.

APPENDIX A

Borehole Logs