FOUNDATION EARTH SCIENCES

# GEOTECHNICAL INVESTIGATION REPORT

**102 Broomfield Street, Cabramatta NSW 2166**

**Prepared for**

**Broomfield Developments**

**Reference No. G443**

**September 2020**

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# 1.0 INTRODUCTION

Purpose of geotechnical investigation is to assess the site's surface and subsurface conditions and to provide geotechnical recommendations for the design and construction of the proposed development. This report interprets and presents findings of the investigation that was carried out during the fieldwork. Details of the site is summarised in Table 1.

**Table 1: Summary of Details of the Site**

| Site | Details |
|---|---|
| Location | 102 Broomfield Street, Cabramatta NSW 2166 |
| Lot/DP | Lot 7 Section F in DP 4420 |
| Local Council | Fairfield |
| Area | Approximately 885$m^2$ |
| Shape & Slope | Approximately rectangular and gently sloping towards west |
| Existing Structures | During the investigation site was observed with a single storey residential dwelling, garage and associated structures |
| Closest Watercourse | Cabramatta Creek is located approximately 730m south to the site |
| Special Features | Site is located within the vicinity of Main Southern Line railway corridor belongs to Transport for NSW ("TfNSW") |
| Neighbouring Properties | North Residential units type property<br>East Residential units type properties<br>South Bridge Street's road reserve and carriageway<br>West Broomfield Street's road reserve and carriageway |
| Geology Map | Penrith 1:100,000 Geological Series Sheet 9030 Edition 1, dated 1991, by the Geological Survey of New South Wales Department of Minerals and Energy - Sydney |
| Primary Geology | Rwb – Bringelly Shale, Wianamatta Group, Triassic age, described as "Shale, carbonaceous claystone, fine to medium-grained lithic sandstone, rare coal" |
| Secondary Geology | Qpn - Alluvial soils, Quaternary age described as "medium-grained sand, clay, silt" is located approximately 640m south |
| Proposed Development | 5-storey residential boarding house type building with two basement level. Maximum excavation depth is inferred to be 7.3m |

# 2.0 AVAILABLE INFORMATION

Following information were available to Foundation Earth Sciences ("Foundation ES") during the preparation of this report:

- Architectural drawings project titled "Proposed Boarding House, 102 Broomfield St Cabramatta" referenced project No. 19-029, prepared by Urban Link and dated 9/06/2020.
- Site Surveyor Plan project titled "102 Broomfield Street, Cabramatta", drawing tilted "Plan Showing Levels & Detail over Lot 7 in Section F in DP 4420", referenced drawing No. 190439/001, prepared by RGM Property Surveys Pty Ltd and dated 09/05/2019.

# 3.0 FIELDWORK AND LABORATORY TESTING

Following scope of work was carried out during the fieldwork on site:

- Review of Dial-Before-You-Dig ("DBYD") plans and service locating.
- Mechanical drilling of three (3) boreholes, identified as BH1 to BH3 inclusive.
- Installation of one (1) groundwater well identified as GW1 within the borehole BH1.
- Standard Penetration Testing ("SPT") within the augering of boreholes.
- Laboratory testing of Point Load Index ("PLI") on the recovered rock samples.
- Subsequent visit to the site to measure the standing groundwater level.

The approximate locations of the boreholes are located in a "Site Plan" and attached as Appendix A. The engineering borehole logs of ground conditions, photograph of core samples and results of PLI tests are annexed as Appendix B, C and D respectively.

# 4.0 GROUND CONDITION

## 4.1 Ground Profile

Ground profiles encountered within the boreholes are summarised in Table 2. However, reference should be made to engineering logs.

**Table 2: Summary of Ground Profile**

| Unit | Details | Depth (m) | | |
|---|---|---|---|---|
| | | BH1 | BH2 | BH3 |
| | Existing Ground Level (RL m AHD) | 15.2 | 15.8 | 16.5 |
| Fill | FILL, silty clay, low plasticity, dark brown, with grass rootlets, moist | 0.0 – 0.2 | 0.0 – 0.2 | 0.0 – 0.2 |
| Residual Soils | Silty CLAY, medium to high plasticity, brown-yellow becoming grey-brown, moist, very stiff | 0.2 – 2.5 | 0.2 – 2.6 | 0.2 – 3.6 |
| Class V [1] Shale | SHALE, extremely weathered, extremely low strength, dark grey-grey, moist | 2.5 – 4.1 | 2.6 – 6.5 | 3.6 – 6.8 |
| Class III [1] Shale | SHALE, highly to moderately weathered, medium to high strength, grey-dark grey with some brown bands | 4.1 – 9.9 | – | – |

**Note**: [1] Bedrock was classified in accordance with the research paper of Pells P.J.N, Mostyn G. & Walker B.F. Foundations on Sandstone and Shale in the Sydney Region, Australian Geomechanics Journal, December 1998.

### 4.2 Groundwater

Except the minor seepage at approximate depth of 4.5m within the borehole BH2, no groundwater seepages were observed during the augering of the boreholes. However, a standing groundwater level was recorded at approximate depths of 3.1m (RL 12.1m AHD) within the installed groundwater well GW1 (BH1) on 10/09/2020.

Standing groundwater levels are also subject to a piezometric head at the drilled locations. Therefore, levels may not be representative of natural groundwater conditions of the site. Further, it should be noted groundwater levels within the site may be subject to seasonal fluctuations, rainfall, prevailing weather conditions and also future developments of the areas and land forms.

# 5.0 DISCUSSIONS AND RECOMMENDATIONS

## 5.1 Excavation Conditions

Bulk excavation for the proposed development is likely to comprise of fill, residual soils and shale bedrock ranging from extremely low to high strength. Excavation can be achieved using a conventional earthmoving equipment such as backhoes or tracked excavators only up to very low strength of bedrock. If any stronger bedrock bands encountered within that level and/or for excavation below the very low strength bedrock, a use of the rock breaking and ripping equipment is required. The rock breaking and ripping equipment will generate noise, vibration and dust during the excavation activities.

Prior to commencement of excavation, contractor should refer to the engineering borehole logs, photograph of core sample and results of PLI tests to identify the strength of the bedrock. Followed by, assessment should be carried out by a qualified contractor to identify a suitable excavation method for the assessed bedrock materials. The ground profile summarised in Table 2 should be used for design of foundation system only.

## 5.2 Vibration Control

Vibration Management Plan ("VMP") is recommended to be developed to monitor the potential vibration effects caused by bulk excavation activities, on the neighbouring properties and road carriageways located along the site boundaries. It is recommended that a suitably qualified consultant (noise and vibration) is engaged to prepare a VMP and monitor excavation at and below the low strength bedrock level.

Table 3 summaries the typical recommendable Peak Particle Velocity ("PPV") for different types of the structures based on their sensitises, and inducted vibrations should not be exceeded throughout the construction stage.

**Table 3: Typical Recommended Peak Particle Velocity**

| Type of the Structure | PPV (mm/sec) |
|---|---|
| Historical or structures in sensitive conditions | 2 |
| Residential and low-rise buildings | 5 |
| Brick or unreinforced structures in good condition | 10 |
| Commercial and industrial buildings or structures of reinforced concrete or steel construction | 25 |

If required, monitoring can be carried out using a suitable vibration monitoring instruction attached with alarm, and appropriate PPV should be selected based on the condition of the subject structure. If vibration on the subject structure is exceed the selected PPV limit, construction activities should cease and the project Geotechnical Engineer should be contacted immediately for review of VMP. Preparation of VMP should constitute as "Hold Point".

## 5.3 Dilapidation Survey

Dilapidation survey report on all structures and road carriageways located within the zone of influence (theoretical failure plan) is recommended to be carried out by a qualified structural engineer prior to commencement of construction. Preparation of dilapidation survey report should constitute as "Hold Point".

## 5.4 Underpinning of Existing Structures

Regardless of whether a suitable shoring system is adopted or not, structures located within the zone of influence (theoretical failure plan) should be assessed with requirement of underpinning by conducting inspections and assessment of their ground condition.

### 5.5 Retaining Walls

Temporary batter slopes can only be considered in the boundaries, where neighbouring structures and road carriageways are located outside the zone of influence (theoretical failure plan) and sufficient space existed in between the site and excavation boundaries. Elsewhere suitable shoring system should be designed and constructed based on the ground condition recommended in this report. Recommendable maximum temporary batter slopes for assessed ground conditions are provided in Table 4.

**Table 4: Maximum Temporary Batter Slope**

| Ground Profile | Temporary Batter Slope (Horizontal: Vertical) |
|---|---|
| Fill | 2 : 1 |
| Residual Soils | 1.5 : 1 |
| Class V Shale | 1 : 1 |
| Class III Shale | Semi vertical |

**Note:** Excavation should be carried out in stages with maximum excavation height of 2.0m. Inspection of batter slope as soon as excavation of each stage should be carried by project Geotechnical Engineer to confirm stability of the batter slope prior to commencement of next stage.

Based on the provided information, temporary batter slopes may not be considered suitable to all of the excavation boundaries. It is therefore recommended a shoring system consisted of a soldier pile wall system with concrete panels with piles spacing of at least 1.0-1.5m is considered suitable to the boundaries where is no suitable offset from the site boundary.

Detailed retaining wall analysis should be carried out and closer spacing of the piles should be adopted based on the analysis to reduce earth movement and prevent collapse of infill materials. Piles should be socketed into a suitable stratum based on the detailed design and at least 2.0m below the bulk excavation level. Suitable drainage system should be installed behind the retaining wall system and should be discharged into site's stormwater system for long term purpose.

If shallow groundwater seepage presences within the site, then soldier pile wall system may cause excessive groundwater inflow into bulk excavation compare to contiguous pile wall systems. It is recommended to conduct a detailed analysis of site's groundwater condition before finalise the shoring wall system. Further it is recommended that suitable shoring wall system should be adapted not only to support the excavation boundaries, but also to limit the groundwater inflow into bulk excavation.

## 5.6 Design of Retaining Walls

The proposed basement cut faces should be supported temporarily during construction and in long term using appropriate retaining structures. These retaining structures should be designed to withstand the applied lateral pressures of the soil and rock strata, the existing surcharges in their zone of influence, such as existing structures, construction related activities, and water pressures if exists.

The pressure distribution on cantilever retaining structures may be assumed to be triangular and estimated as follows:

$$\boldsymbol{\rho_h = \gamma k H + q k}$$

Where,
$\rho_h$ = Horizontal pressure (kN/m$^2$)
$\gamma$ = Wet density (kN/m$^3$)
$k$ = Coefficient of earth pressure ($k_a$ or $k_o$)
$H$ = Retained height (m)
$q$ = Surcharge pressure behind retaining wall (kN/m$^2$)

For the design of flexible retaining structures, where some lateral movement is acceptable, an active earth pressure coefficient is recommended. Should it be critical to limit the horizontal deformation of a retaining structure, use of an earth pressure coefficient at rest should be considered. Recommended parameters for the design of retaining structures are presented in the Table 5.

Preliminary coefficients of lateral earth pressure for the encountered ground profile is provided in Table 6. The coefficients provided are based on horizontal ground surface and fully drained conditions.

**Table 5: Retaining Walls Design Parameters**

| Ground Profile | Unit Weight ($kN/m^3$) | Effective Cohesion c' (kPa) | Angle of Friction $\phi$(°) | Modulus of Elasticity $E_{sh}$ (MPa) |
|---|---|---|---|---|
| Fill | 18 | 0 | 28 | 8 |
| Residual Soils | 20 | 5 | 24 | 15 |
| Class V Shale | 22 | 25 | 30 | 75 |
| Class III Shale | 24 | 100 | 34 | 400 |

**Table 6: Coefficient of Lateral Earth Pressure**

| Ground Profile | Coefficient of Active Lateral Earth Pressure Ka | Coefficient of Active Lateral Earth Pressure at Rest Ko | Coefficient of Passive Lateral Earth Pressure Kp |
|---|---|---|---|
| Fill | 0.39 | 0.56 | 2.56 |
| Residual Soils | 0.42 | 0.59 | 2.37 |
| Class V Shale | 0.3 | 0.5 | 3.0 |
| Class III Shale | 0.2 | 0.4 | 5.0 |

If cantilever retaining structures is considered impractical, then Rectangular or Trapezoidal Pressure Distribution may be considered for tied-back retaining system, as recommended in related standards and technical literature. In this case, temporary anchor or suitable alternative system should be design and constructed.

The active earth pressure distribution on braced retaining structures may be estimated as following equation:

$$\rho_h = 0.65\gamma kH$$

Where,
$\rho_h$ = Horizontal pressure ($kN/m^2$)
$\gamma$ = Wet density ($kN/m^3$)
$k$ = Coefficient of earth pressure ($k_a$ or $k_o$)
$H$ = Retained height (m)

### 5.7 Temporary Anchoring System

If braced retaining structures selected, a temporary anchoring system with a suitable number of anchors requires to provide a lateral support to minimise the lateral movement. It is recommended to carried out geotechnical modelling to find out the required number of anchors.

Anchors should be extended behind the active zone (theoretical failure plan) to allow an effective bonding with suitable bedrock. The basement floor slabs should be designed and constructed to provided permanent lateral support to the retaining wall system, and anchoring should consider as temporary option for construction stage. If anchoring system is impractical, consideration might be given to temporary support options such as installation of props associated with staged excavation or temporary berms in front of the wall with stage excavation.

Adoptable allowable bond stress for encountered bedrock layers are provided in Table 7 for designing of an anchoring system.

**Table 7: Allowable Bond Stress for Anchoring**

| Ground Profile | Allowable Bond Stress (kPa) |
|---|---|
| Class V Shale | 50 |
| Class III Shale | 150 |

Adopted allowable bond stresses recommended above is typical recommendable bond stress. Therefore, anchors should be installed with bond length of at least 3.0m and proof tested with 1.3 times the design working load before they lock off at working load.

Inspection and monitoring of the construction of shoring piles and temporary anchoring system should be carried out under supervision of the project Geotechnical Engineer and should constitute as “Hold Points”.

### 5.8 Groundwater Management

It should be noted groundwater conditions of a site might change with climate and development variations. Based on the encountered ground conditions, it is anticipated that groundwater seepage is likely to be encountered during the bulk excavation.

It is recommended to carry out detailed continues monitoring to assess the fluctuation of groundwater and selection of suitable dewatering system within the bulk excavation, before finalise the shoring system and this should be constituted as “Hold Point”.

A groundwater modelling using a commercial software may consider to carry out to the proposed shoring system during the construction stage. Based on the modelling, groundwater impact to the neighbouring infrastructures should be assessed to ensure that the impact is within the acceptable limits. It is recommended to implement a Groundwater Management Plan (“GMP”) during the construction stage. Continues inspection and monitoring of the GMP should be required throughout the construction and should constitute as “Hold Points”.

The basement floor slabs and walls with adequate drainage system should be designed by a suitably qualified engineer and constructed in accordance with local council specification. Verification of drainage system by a qualified geotechnical engineering is required and should constitute as “Hold Point”.

## 5.9 Foundations

The foundation level of the proposed development is anticipated to be within the shale bedrock ground profiles. It is therefore considered foundation system of proposed development are likely to be reinforced concrete raft slab with combination of shallow foundations placed at a minimum depth of 0.5m below the bulk excavation level within the shale bedrock area. Table 8 provides design parameters recommended for shallow and pile foundations.

**Table 8: Foundation Design Parameters**

| Ground Profile | Allowable End Bearing Capacity (kPa) | Allowable Shaft Adhesion Compression (kPa) |
|---|---|---|
| Fill | N/A | N/A |
| Residual Soils | 200 | N/A |
| Class V Shale | 700 | 30 |
| Class III Shale | 2,500 | 250 |

Note:

- With a minimum embedment depth of 0.5m for deep foundations and 0.4m for shallow foundations.
- Clean rock socket of roughness of at least grooves of depth 1mm to 4mm and width greater than 5mm at spacing of 50mm to 200mm.
- Shaft Adhesion in Tension is 50% of Compression, applicable to piles only.

It is recommended to carried out detailed geotechnical modelling of proposed foundation system to determine the magnitude and distribution of settlement occurring under working load. Where additional bearing pressure is required and/or excessive settlement is occurred, consideration should be given to adoption of pile foundation socking into stronger stratum.

Piles will also be used to increase the resistance against the lateral seismic and wind loads. Shallow and pile foundation can be designed in accordance with Australian Standards AS2870-2011 and AS2159-2009, respectively.

It is recommended that all footings are to be founded on the same stratum to minimise and avoid potential future differential settlement. Detail design of the foundation system should be carried out by the project structural engineer and reviewed by project geotechnical engineer.

A qualified geotechnical engineer should inspect the footing excavations to confirm appropriate foundation materials, and to ensure the serviceability bearing pressures could be met. Foundation excavations should be cleaned; and wet and debris should be removed prior to the concrete placement. Verification of the capacity of the shallow and pile foundations by inspections would be required and inspections should constitute as “Hold Points”.

### 5.10 Site Earthquake Classification

Based on the ground condition and in accordance with Australian Standard AS 1170.4-2007, the proposed development be classified as “Rock” (Class Be) for design of foundations and retaining walls embedded in the underlying bedrock. The Hazard Factor (Z) is considered to be 0.08.

### 5.11 Earthwork and Subgrade Preparation

Earthwork and subgrade preparation should be carried out in accordance with local council specification and Australian Standard 3798-2007. However, a general procedure is provided below for the development areas:

- Fill materials or topsoils or unsuitable materials should be removed from the site.
- Excavated materials for reuse as engineering fill or remove to spoil should be stockpiled separately.
- Exposed surface after excavation should be treated to adjust its moisture condition to not to vary more than 2% from its Optimum Moisture Content (“OMC”) and then compacted using at least 12tonnes vibrating compacter to design density ratio.
- Exposed surface should be tested with appropriate density testing and proof rolling with a smooth drum roller.
- Soft or loose areas should be excavated, treated with moisture and then recompacted or replaced with appropriate imported fill material.

Final surface of the cut areas and every layer of the fill areas should be treated with moisture and compacted to design parameters in order to achieve the adequate strength for the proposed development. The general recommendation for the compaction of fill layers is listed below:

- Moisture content of fill materials should be treated to ±2% of OMC of the material.
- Minimum density ratio of 98% of the maximum dry density for the proposed development area.
- Placement of loose thickness of fill layers should not exceed 200mm during the compaction.

General recommendation for suitability of imported materials for the fill layers are provided below:

- The materials should be clean (i.e. free of contaminants, deleterious or organic material), free of inclusions of >120mm in size.
- Material with excessive moisture content should not be used.
- The materials should satisfy the Australian Standard AS 3798-2007.

## 6.0 CONCLUSIONS

This report presents the findings of the geotechnical investigation and recommendations for the proposed development at 102 Broomfield Street, Cabramatta NSW 2166. It considers that the proposed development is feasible in this site if the recommendations provided in this report are considered in design and construction of this development.

For and on behalf of Foundation Earth Sciences

**Prepared by**

M Muralitharan

**Murali Muralitharan**

Senior Geotechnical Engineer

**Reviewed by**

Ben Buckley

**Ben Buckley**

Director

# 7.0 LIMITATIONS

The assessment of the sub-surface profile within the proposed development area and the recommendations presented in this report are based on limited information available to date.

The recommendations and advice presented in this report on soil and rock condition is considered to be indicative only as only very limited areas were assessed on site to date. Site inspection by a consulting Geotechnical Engineer or Engineering Geologist are to be undertake when further investigation works are to be carried out to confirm the condition of founding materials in which this geotechnical assessment recommends.

Anecdotal evidence and Information provided by client is assumed to be relevant and to the best of knowledge be appropriate for its interpretation.

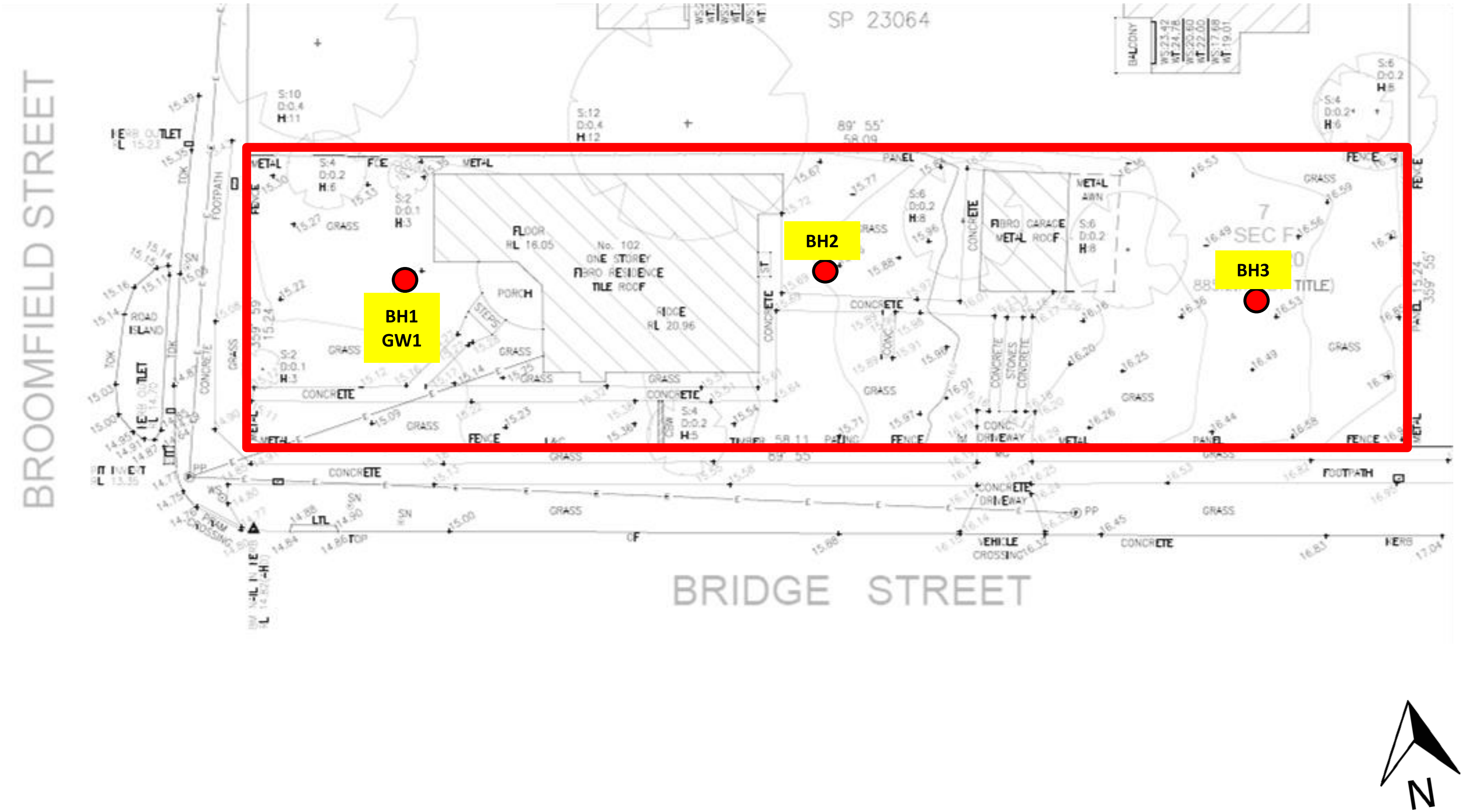
There is a possibility that the actual geotechnical and groundwater conditions across the site could differ from the inferred geotechnical assumptions and derivations on which our recommendations are presented in this report. In that case, Foundation Earth Sciences should be contacted for further advise and review of the information provided in this report. Foundation Earth Sciences does not accept any liabilities for the conditions not provided and/or accessible during the preparation of this report. Any ensuring liability resulting from use of this report by third parties cannot be transferred to Foundation Earth Sciences.

## 8.0 REFERENCES


1. Australian Standard – AS1726-1993 "Geotechnical Site Investigation".
2. Australian Standard – AS 1170.4-2007 "Structural Design Actions – Part 4: Earthquake actions in Australia".
3. Australian Standard – AS 2870-2011 "Residential slabs and footings".
4. Australian Standard – AS 2159-2009 "Piling - Design and installation".
5. Pells, P.J.N, Mostyn, E and Walker, B F – Foundations on Sandstone and Shale in the Sydney Region, Australian Geomechanics Journal, Dec 1998.
6. Pells, P.J.N, Douglas D.J, Rodway, B, Thorne C, McManon B.K – Design Loadings for Foundations on Shale and Sandstone in the Sydney Region. Australian Geomechanics Journal, 1978.

# Appendix A

# Site Plan




**Key**

Approximate Test Locations

Not to scale



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| Ref # | Site Plan |
|---|---|
| G443 | Broomfield Developments |
| MM | 102 Broomfield Street, Cabramatta NSW 2166 |

# Appendix B

# Engineering Borehole Logs

# BOREHOLE : BH1



FOUNDATION EARTH SCIENCES

**CLIENT NAME:** Platino Properties Pty Ltd **JOB NUMBER:** G443

**SITE ADDRESS:** 314-316 West Street, Cammeray NSW 2062 **PROJECT:** Geotechnical Investigation

**Date Started :** 9/09/2020 **Completed :** 9/09/2020 **Logged By :** EY **Checked By :** MM

**Borehole Location :** Refer to Site Plan **Surface RL :** 15.2 **Datum :** m AHD

**Equipment :** Drilling Rig **Borehole Size :** 100mm **Slope :** -90°

| Method | Water | Well Details | RL (m) | Depth (m) | Graphic Log | Classification Symbol | Material Description | Moisture | Consistence | Samples Tests Remarks | Additional Observations |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ADT | Not encountered during auger | | | | | | FILL, silty clay, low plasticity, dark brown, with grass rootlets | M | F | | Fill |
| | | | 15.0 | 0.20 | | CH | Silty CLAY, medium to high plasticity, brown-yellow becoming grey-brown | M | VSt | SPT 5, 12, 16 N=28 | Residual Soils |
| | | | 12.7 | 2.50 | | | SHALE, extremely weathered, extremely low strength, dark grey-grey | M | | SPT Bouncing N>50 | Bedrock<br>TC bit refusal |
| | | | 11.2 | 4.05 | | | Borehole BH1 continued as cored hole from 4.05m | | | | |

Comments:

D - Dry
M - Moist
W - Wet

VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

# BOREHOLE : BH1



FOUNDATION EARTH SCIENCES

**CLIENT NAME:** Platino Properties Pty Ltd
**JOB NUMBER:** G443
**SITE ADDRESS:** 314-316 West Street, Cammeray NSW 2062
**PROJECT:** Geotechnical Investigation

**Date Started :** 9/09/2020 **Completed :** 9/09/2020 **Logged By :** EY **Checked By :** MM
**Borehole Location :** Refer to Site Plan **Surface RL :** 15.2 **Datum :** m AHD
**Equipment :** Drilling Rig **Borehole Size :** 100mm **Slope :** -90°

| Method | Water | Well Details | RL (m) | Depth (m) | Graphic Log | Material Description | Weathering | Estimated Strength | $Is_{(50)}$ (MPa) | RQD % | Defect Spacing (mm) | Defect Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 0–4.05 | | Continued from non-cored borehole | | | | | | |
| NMLC | | | 11.2 | 4.05 | | SHALE, grey-dark grey with some brown bands | HW-MW | M–H | D 1.6, A 2.43; D 1.12, A 0.42 | 69 | | 4.07m, B, P, R, 0-5°<br>4.15m, B, P, R, 5-10°<br>4.27m, B, P, R, 0-5°<br>4.31m, B, P, R, 5-10°<br>4.35m, J, Ir, R, 15-20°<br>4.47m, B, P, R, 5-10°<br>4.57m, B, P, R, 5-10°<br>4.68m, J, Ir, R, 15-20°<br>4.71m, B, P, R, 0-5°<br>4.88m, B, P, R, 0-5°<br>4.96m, HB<br>5.00m, HB<br>5.03m, B, Ir, R, 0-5°<br>5.17m, FZ, 60mm<br>5.29m, FZ, 30mm<br>5.37m, B, P, R, 5-10°<br>5.39m, B, P, R, 5-10°<br>5.78m, B, P, R, 5-10°<br>5.94m, B, P, R, 5-10°<br>6.00m, HB<br>6.12m, B, Ir, R, 5-10°<br>6.16m, B, Ir, R, 5-10°<br>6.19m, J, Ir, R, 40-45°<br>6.34m, Core Loss, 60mm<br>6.40m, FZ, 50mm<br>6.51m, J, P, R, 85-90°<br>6.57m, J, P, R, 85-90°<br>6.61m, J, P, R, 85-90° |
| | | | | | | | MW | M–H | D 0.3, A 0.43; D 0.3, A 0.61; D 0.05, A 0.51; D 0.96, A 1.29 | 78 | | 6.65m, J, P, R, 85-90°<br>6.69m, J, P, R, 85-90°<br>6.73m, B, P, R, 10-15°<br>6.91m, MB<br>6.99m, HB<br>7.00m, HB<br>7.55m, B, P, R, 0-5°<br>7.61m, B, P, R, 10-15°<br>7.73m, B, P, R, 5-10°<br>7.90m, FZ, 80mm<br>8.00m, HB<br>8.06m, B, P, R, 5-10°<br>8.14m, B, P, R, 5-10°<br>8.26m, B, P, R, 5-10°<br>8.35m, B, I, R, 5-10°<br>8.46m, B, P, R, 5-10°<br>8.48m, B, P, R, 5-10°<br>8.49m, B, P, R, 5-10°<br>8.85m, B, P, R, 5-10°<br>9.00m, HB<br>9.05m, B, P, R, 5-10°<br>9.19m, B, P, R, 5-10°<br>9.28m, B, P, R, 5-10°<br>9.60m, B, P, R, 5-10°<br>9.69m, B, P, R, 5-10°<br>9.85m, B, P, R, 5-10° |
| | | | 5.3 | 9.90 | | BH1 terminated at 9.90m | | | | | | |

Estimated Strength scale: EL VL L M H VH EH
Defect Spacing scale: 20 60 180 540 1620 4860

Comments:

| Weathering | | | | | | |
|---|---|---|---|---|---|---|
| EW - Extremely | EL - Extremely Low | D - Diametral | J - Joint | MB - Mechanical Break | | S - Smooth |
| HW - Highly | VL - Very Low | A Axial | B - Bedding Plan | HB - Handling Break | | R - Rough |
| MW - Moderately | L - Low | | CS - Clay Seams | | | P - Polished |
| SW - Slightly | M - Medium | | FZ - Fractured Zone | | Pl - Planar | |
| Fr - Fresh | H - High | | IS - Infill Seam | | Ir - Irregular | Qz - Quartz |
| | VH - Very High | | SS - Sheared Seam | | Cu - Curved | Fe - Iron Stain |
| | EH - Extremely High | | CZ - Crushed Zone | | St - Stepped | |

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# BOREHOLE : BH2



**CLIENT NAME:** Platino Properties Pty Ltd
**JOB NUMBER:** G443
**SITE ADDRESS:** 314-316 West Street, Cammeray NSW 2062
**PROJECT:** Geotechnical Investigation

**Date Started :** 9/09/2020 **Completed :** 9/09/2020 **Logged By :** EY **Checked By :** MM
**Borehole Location :** Refer to Site Plan **Surface RL :** 15.8 **Datum :** m AHD
**Equipment :** Drilling Rig **Borehole Size :** 100mm **Slope :** -90°

| Method | Water | RL (m) | Depth (m) | Graphic Log | Classification Symbol | Material Description | Moisture | Consistence | Samples Tests Remarks | Additional Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| ADT | Not encountered during auger | | | | | FILL, silty clay, low plasticity, dark brown, with grass rootlets | M | F | | Fill |
| | | 15.6 | 0.20 | | CH | Silty CLAY, medium to high plasticity, brown-yellow becoming grey-brown | M | VSt | SPT 4, 19, 20 N=39 | Residual Soils |
| | | 13.2 | 2.60 | | | SHALE, extremely weathered, extremely low strength, dark grey-grey | M | | SPT Bouncing N>50 | Bedrock |
| | | 11.3 | 4.50 | | | Minor seepage was observed at approximate depth of 4.5m | | | | TC bit refusal |
| | | 9.3 | 6.50 | | | Borehole BH2 terminated at 6.50m | | | | |

Comments:

D - Dry
M - Moist
W - Wet

VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

FOUNDATION EARTH SCIENCES

# BOREHOLE : BH3



**CLIENT NAME:** Platino Properties Pty Ltd **JOB NUMBER:** G443

**SITE ADDRESS:** 314-316 West Street, Cammeray NSW 2062 **PROJECT:** Geotechnical Investigation

**Date Started :** 9/09/2020 **Completed :** 9/09/2020 **Logged By :** EY **Checked By :** MM

**Borehole Location :** Refer to Site Plan **Surface RL :** 16.5 **Datum :** m AHD

**Equipment :** Drilling Rig **Borehole Size :** 100mm **Slope :** -90°

| Method | Water | RL (m) | Depth (m) | Graphic Log | Classification Symbol | Material Description | Moisture | Consistence | Samples Tests Remarks | Additional Observations |
|---|---|---|---|---|---|---|---|---|---|---|
| ADT | Not encountered during auger | | | | | FILL, silty clay, low plasticity, dark brown, with grass rootlets | M | F | | Fill |
| | | 16.3 | 0.20 | | CH | Silty CLAY, medium to high plasticity, brown-yellow becoming grey-light brown | M | VSt | SPT 5, 9, 15 N=24<br>SPT 9, 18, 22 N=40 | Residual Soils |
| | | 12.7 | 3.80 | | | SHALE, extremely weathered, extremely low strength, dark grey-grey | M | | | Bedrock<br>TC bit refusal |
| | | 9.7 | 6.80 | | | Borehole BH3 terminated at 6.80m | | | | |

Comments:

D - Dry
M - Moist
W - Wet

VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

# Appendix C

# Photograph of Core Samples

## PHOTOGRAPH OF CORE SAMPLES

| Borehole | Drilled Date | Start Depth (m) | End Depth (m) |
|---|---|---|---|
| BH1 | 10/09/2020 | 4.05 | 9.9 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |

# Appendix D

# Results of Laboratory Testing

FOUNDATION EARTH SCIENCES

# Results of Point Load Index Tests

| | | | |
|---|---|---|---|
| **Client:** | Broomfield Developments | **Ref No:** | G443 |
| **Project:** | Geotechnical Investigation | **Test:** | AS 4133.4.1 |
| **Location:** | 102 Broomfield Street, Cabramatta NSW 2166 | **Date:** | 10/09/2020 |

| Borehole | Depth (m) | Materials | Moisture Content | $I_{s50}$ (MPa) | |
|---|---|---|---|---|---|
| | | | | Diametral | Axial |
| BH1 | 4.60 | Shale, dark grey to grey | Moist | 1.60 | 2.43 |
| BH1 | 5.80 | Shale, dark grey to grey | Moist | 1.12 | 0.42 |
| BH1 | 6.85 | Shale, dark grey to grey | Moist | 0.30 | 0.43 |
| BH1 | 7.50 | Shale, dark grey to grey | Moist | 0.30 | 0.61 |
| BH1 | 8.40 | Shale, dark grey to grey | Moist | 0.05 | 0.51 |
| BH1 | 9.40 | Shale, dark grey to grey | Moist | 0.96 | 1.29 |
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