Geotechnical Desktop Study

# MIXED USE DEVELOPMENT

# 8-10 NEW MCLEAN STREET, EDGECLIFF NSW

Prepared for:

**GEOSYNTEC CONSULTANTS PTY LTD**

**Reference: P2868_ 01**

**17 April 2023**

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# 1 INTRODUCTION

Morrow Geotechnics Pty Ltd has undertaken a Geotechnical Desktop Study (GDS) for the proposed development at 8-10 New Mclean Street, Edgecliff NSW (the site). This GDS report has been prepared to provide advice and recommendations to accompany a development application (DA) to Woollahra Municipal Council for the proposed mixed-use development.

## 1.1 Proposed Development

Morrow Geotechnics has viewed preliminary Architectural drawings prepared by fjcstudio dated 28/03/2023. We understand the proposed development will involve the construction of multi storey towers consisting of mixed use residential and commercial spaces over three levels of basement parking. Excavation is expected to extend to a depth of approximately 10 m below ground level (mBGL).

## 1.2 Purpose of the Desktop Study

The purpose of the GDS is to review available data and to provide geotechnical advice and recommendations addressing the following:

- Description of the anticipated surface and subsurface conditions at the site;
- Building and retaining wall foundation options, including preliminary design parameters;
- Approaches to limit potential impacts on adjacent structures, services and roads;
- Construction constraints including groundwater management requirements, if necessary; and
- The requirement for additional geotechnical investigations.

## 1.3 Scope of Work

The scope of works for the GDS included:

- Review of available information from in-house sources;
- Review readily available plans, images and documents pertinent to the area;
- Review relevant soil landscape and geological maps for the project area;
- Review of any readily available aerial photographs;
- Review hydrogeological plans for the area; and
- Review DBYD plans and any plans provided by the client of existing buried services on site.

## 1.4 Investigation Constraints

The GDS is limited by the preliminary intent of the study and the fact that no intrusive investigations have been undertaken at this stage. The discussions and advice presented in this report are intended for the development of preliminary designs for the development. Further geotechnical investigations should be carried out after DA approval and site clearance to confirm both the geotechnical and groundwater model, and the preliminary design parameters provided in this report.

# 2 SITE DESCRIPTION

## 2.1 Site Description and Identification

The site identification details and associated information are presented in **Table 1.**

**TABLE 1 SUMMARY OF SITE INFORMATION**

| Information | Detail |
|---|---|
| **Local Government Authority** | Municipality of Woollahra |
| **Current Zoning** | R3 - Medium Density Residential Woollahra Local Environmental Plan 2014. See **Figure 2**. |
| **Site Description** | The site is roughly rectangular in shape and comprises one lot. At the time of the study, the site was occupied by two multi storey brick residential buildings with a parking lot and pool. Paved surfaces were found to be in moderate condition. |
| **Site Area** | Approximately 7320 $m^2$ (from Six Maps, maps.six.nsw.gov.au) |

**FIGURE 1: SITE PLAN (SOURCE: MAPS.SIX.NSW.GOV.AU; ACCESSED 28 MARCH 2023)**


**FIGURE 2: CURRENT ZONING (SOURCE: PLANNINGPORTAL.GOV.AU; ACCESSED 28 MARCH 2023)**

## 2.2 Local Land Use

The site is situated within a residential area. Current uses on surrounding land are described in **Table 2**.

**TABLE 2 SUMMARY OF LOCAL LAND USE**

| Direction Relative to Site | Land Use Description |
|---|---|
| **North** | New McLean Street followed by Edgecliff Centre Shopping Mall and Edgecliff Railway Station |
| **East** | Single- and double-storey residential buildings. |
| **South** | Trumper Oval and |
| **West** | A large four storey brick residential building on a lot that connects from New McLean Street back to Glenmore Road. |

The site lies outside of the planning legislation's 25 m impact radius from Edgecliffe Railway Station.

**FIGURE 3: PROXIMITY TO EDGECLIFF RAILWAY STATION (SOURCE: MAPBOX; ACCESSED 13 SEPTEMBER 2023)**

## 2.3 Regional Setting

The site topography, geological and hydrogeological information for the locality is summarised in **Table 3.**

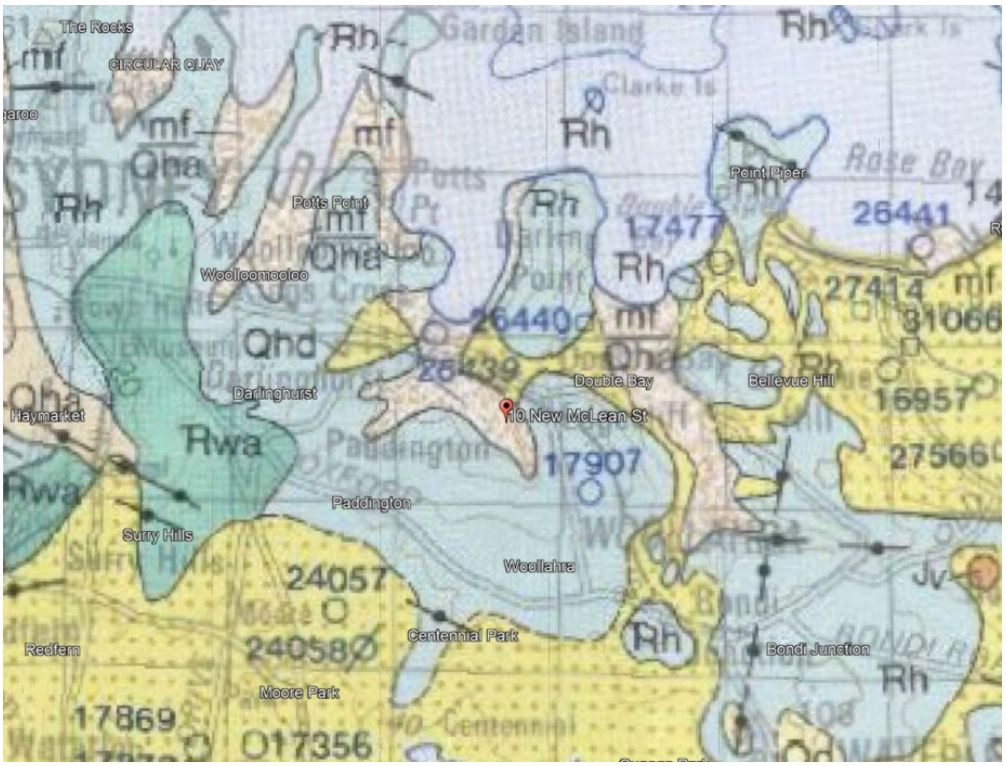
**TABLE 3 TOPOGRAPHIC, GEOLOGICAL AND HYDROGEOLOGICAL INFORMATION**

| Attribute | Description |
|---|---|
| **Topography** | Regional topography grades downwards to the southwest at an approximate gradient of 4-8$^{o}$ across the site. |
| **Soil Landscapes** | The Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Sheet 9029-9030 (2nd Edition) indicates that the erosional landscape at the site likely comprises the Hawkesbury Landscape. This landscape type typically includes rugged, rolling to very steep hills on Hawkesbury Sandstone with slopes of over 25 %. Soils are generally shallow (> 0.5 m) discontinuous lithosols/siliceous sands associated with rock outcrop, earthy sands, yellow earths and some yellow podzolic soils. These soils are noted to present extreme soils erosion hazard, steep slopes, rock outcrop, and shallow, stony, highly permeable soil. See **Figure 4**. |
| **Regional Geology** | Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 Geological Series Sheet 9130 (DMR 1991) indicates the site to be underlain by (mf) man-made fill and (Qha) Quaternary Holocene deposits which are typically comprised of silty to peaty quartz sand, silt, and clay, with common shell layers. See **Figure 5**. |
| **Acid Sulfate Soils (ASS)** | In accordance with the Marrickville Local Environmental Plan 2011 Acid Sulfate Soils Map, the site is not classified for Acid Sulfate Soils. See **Figure 6**. |

**FIGURE 4: SOIL LANDSCAPE**

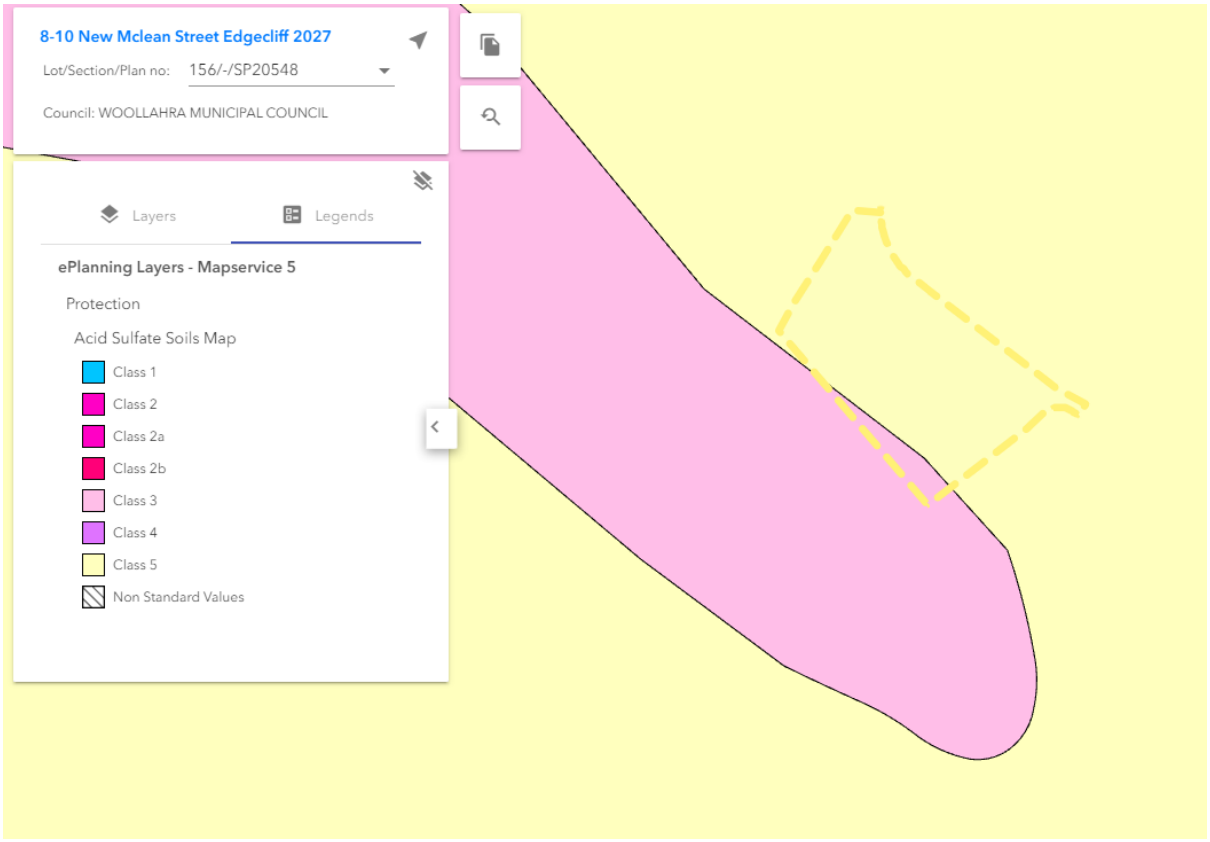

*The soil landscape likely comprises the Hawkesbury Landscape (Source: The Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Sheet 9130 [2nd Edition].)*

**FIGURE 5: LITHOGRAPHY**




*The site likely overlies man-made fill and Quaternary Holocene deposits (Source: Sydney 1:100,000 Geological Series Sheet 9130; minview.geoscience.nsw.gov.au; accessed 23 March 2023)*

**FIGURE 6: ACID SULFATE SOILS**




*The property is in an area zoned as Class 3 and Class 5 Acid Sulfate Soils in accordance with Council mapping. (Source: planningportal.nsw.gov.au; accessed 28 March 2023.)*

An online search was conducted using the NSW Office of Water (NOW) real-time database, which records relevant information pertaining to all licensed water bores for the state of New South Wales did not reveal registered monitoring bores located within 500 m of the site. From previous jobs within similar soil and rock landscapes within the local area our experience is that seepage water may be expected within open excavations from the soil rock interface.

## 2.4 Expected Stratigraphy

Using the subsurface information from previous geotechnical investigations, published data and archived information, our proposed geotechnical units for the site have been developed to characterise the soil and rock strata and are presented in **Table 4** below. Trumper Oval to the south of the site is known to be an area of historic marshland which has been reclaimed through filling. As such the expected depth of fill at the site will deepen towards the south.

**TABLE 4 SUMMARY OF INFERRED SUBSURFACE CONDITIONS**

| Unit | Material | Comments |
|---|---|---|
| 1 | Fill | Generally fine to medium grained sand and gravels, comprising some silt, cobble and construction waste. Unit 1 is inferred to be uncontrolled and poorly compacted. |
| 2 | Loose Sand | Generally fine-grained Aeolian SAND, poorly graded, moist, grading from loose to very dense. |
| 3 | Medium Dense Sand | |
| 4 | Class V Sandstone | Sandstone Bedrock was not encountered during investigation due to the limitation of using hand equipment only. Sandstone has been inferred from regional geology and knowledge of neighbouring sites. The presence and strength of the sandstone bedrock must be confirmed by cored boreholes prior to the finalisation of detailed designs. |
| 5 | Class III-II Sandstone | |

Detailed descriptions of the material likely to be encountered along with the depth of each stratigraphic unit can only be provided following an intrusive geotechnical investigation comprising cored boreholes.

# 3 GEOTECHNICAL RECOMMENDATIONS FOR DESIGN

## 3.1 Overview

Considering the expected subsurface conditions, the proposed development will likely be impacted by the following key geotechnical constraints:

- Soil and weathered rock exposed by excavations will need to be battered back or retained;
- Any uncontrolled fill is likely to have poor engineering properties and be unsuitable for re-use as engineered fill. Unsuitable materials may be removed by screening;
- Basement Excavation and retention to prevent lateral deflections and ground loss as a result of excavations;
- Foundation design for building loads; and
- The possibility of the proposed basement excavation intersecting the groundwater table.

Our preliminary advice and recommendations associated with management of these key geotechnical constraints are provided in the following sections.

## 3.2 Foundation Options

We recommend that proposed buildings are supported by large pad footings or bored piles found on suitable Sandstone bedrock. To transfer column or building loads to more competent strata at depth and to limit the possibility of adverse foundation settlements or excavation movement, a piled foundation system may be considered. This will depend on specific load cases and specific load bearing locations, which can be optimised once intrusive investigations are undertaken.

Footings should be designed in accordance with AS2870:2011 based on a Site Classification of 'P' with a characteristic surface movement, $y_s$, of 60 mm. The site classification has been provided on the basis that the performance expectations set out in Appendix B of AS2870–2011 are acceptable and that future site maintenance will be undertaken in accordance with CSIRO BTF 18.

For preliminary design purposes, the 'Foundations on Sandstone and Shale in the Sydney Region' by Pells, Mostyn and Walker (1998), provides a suitable basis for design. Foundation design parameters from Pells et.al. have been provided in **Table 5**. The classification system is based on the primary criteria of rock strength, fracture frequency and the extent of weathered seams. The competency of the rock increases as the 'Class' of rock decreases e.g. Class V represents the poorest quality of rock.

**TABLE 5 TYPICAL FOUNDATION PARAMETERS FOR FOUNDATIONS IN SANDSTONE**

| Class of Sandstone | Ultimate End Bearing (MPa)[1] | Allowable End Bearing (MPa)[2] | Ultimate Shaft Adhesions (kPa)[3] |
|---|---|---|---|
| **Class V Sandstone** | >3 | 1 | Min. 100 |
| **Class III Sandstone** | 20 to 40 | 3.5 | Min. 600 |

Notes:
[1] Ultimate values occur at large settlements (>5% of minimum footing dimensions).
[2] End bearing pressure to cause settlement of <1% of minimum footing dimensions
[3] Clean socket of roughness category R2 or better.

Morrow Geotechnics recommends that a Preliminary Geotechnical Strength Reduction Factor (GSRF) of 0.4 is used for the design of piles in accordance with AS 2159:2009 if no allowance is made for pile testing during construction. Should pile testing be nominated, the GSRF may be reviewed and a value of 0.55 to 0.65 may be expected.

Design of bored piles and shoring systems needs to consider the aggressivity of the ground and groundwater.

Shallow footings and/or piles should be found on soil of similar elastic modulus to limit the risk of differential settlement across the development footprint resulting from varying founding conditions.

## 3.3 Excavation Retention and Retaining Walls

Temporary batters may be considered for retention during basement excavation only where adequate room for full batter construction is available. Temporary batter slopes of 1.5V:1H will be possible for all units above the water table provided that surface water is diverted away from the batter faces and batter heights are kept to less than 4m. Where batters extend beyond 4 m height benching may be required and further advice should be sought from a qualified geotechnical engineer. Permanent batters of 2.5H:1V may

be employed for excavation design above the water table. Permanent batters will require surface protection or revegetation to prevent erosion and slaking.

The type of retention system chosen will be influenced by proximity to existing structures, services and pavement, the relative stiffness required to limit deformations to an acceptable level, and the inclusion of the wall as the permanent support for buildings.

Anchored soldier pile walls are typically the most economically viable retention method over 5 m in depth in residual landscapes. Vertical cuts may be considered in competent rock provided that support is provided for overlying weaker strata and geotechnical inspections are undertaken during excavation to assess the need for isolate rock block support. For preliminary design of temporary and permanent support we recommend the following:

- Rigid retaining structures, such as propped or anchored walls, should be adopted to limit lateral and vertical movements when in close proximity to existing buildings, pavements and buried services. A rectangular earth pressure distribution may be used with a maximum pressure of 6H or 8H (kPa), depending on the amount of movement that can be tolerated, where 'H' is the effective vertical height of the wall in metres.
- Static water pressures should be taken into consideration in the design of retaining walls when extending below groundwater level, unless subsoil drainage is provided behind retaining walls. A hydrostatic pressure distribution could be used for this analysis.
- Appropriate surcharge loading from construction equipment and vehicular traffic at finished surface level should be adopted in retaining wall design. Any applicable surcharge loads should be added to earth pressures using a lateral earth pressure coefficient of 0.5. A bulk unit weight of 18 kN/m$^3$ can be assumed for fill and residual soils.

We recommend the use of stress/strain dependent analysis during detailed design to further consider likely deformations and to better model the earth pressures and influence of the excavation on adjacent structures, pavements and buried services.

Consideration will need to be given to monitoring lateral and vertical deflections of retained soil and to monitoring construction induced vibrations.

We recommend an allowance is made for a Geotechnical Engineer to inspect the excavation upon reaching a depth of 1.5 m, 3.0 m, 4.5 m and upon completing the bulk excavation to:

- Confirm inferred geotechnical conditions;
- Assess the suitability of design assumptions; and
- Provide further advice with regards to excavation retention and proposed construction methodologies, if required.

## 3.4 Site Preparation and Earthworks

All earthworks should be carried out in accordance with AS3798:2007, Guidelines on Earthworks for Commercial and Residential Developments. Earthworks compliance testing should be carried out in accordance with AS3798:2007, Table 8.1 with testing to be provided by a National Association of Testing Authority (NATA) accredited testing laboratory.

Working platforms for construction plant and crane pads, placed on in-situ materials or on new fill, should be designed by an experienced and qualified geotechnical engineer.

Should fill placement be proposed over existing ground levels, resulting in additional surcharge of in-situ soils, additional advice should be sought from an experienced and qualified geotechnical engineer regarding potential settlement of the in-situ soils.

## 3.5 Groundwater Management

A hydrogeological report for the site should be prepared in accordance with Department of Planning, Industry and Environment (DPIE) publication, "Minimum Requirements for Building Site Groundwater investigations and Reporting" (January 2021). According to the DPIE Minimum Requirements, a minimum of three monitoring wells should be installed at the site to be monitored for three months. WaterNSW generally allow for drained basement construction where it can be demonstrated on the basis of permeability testing at the site that groundwater seepage inflow to the site will be less than 3 ML/year.

## 3.6 AS1170 Earthquake Site Risk Classification

Assessment of the material encountered during the investigation in accordance with the guidelines provided in AS1170.4-2007 indicates:

- an earthquake subsoil class of Class $C_e$ – Shallow Soil for the site; and
- a hazard factor (z) of 0.08 for Sydney.

# 4 RECOMMENDATIONS FOR FURTHER GEOTECHNICAL SERVICES

We recommend that further intrusive geotechnical investigations are carried out to determine:

- Cored boreholes across the site to assess rock level and soil consistency.
- Observation of the groundwater levels within monitoring wells installed as part of the investigation.
- Soil and groundwater samples should be collected and analysed for pH, chloride, sulphate content and electrical conductivity and compared against criteria in AS 2159-2009 Piling – Design and Installation to assess aggressivity of groundwater on concrete and steel structures.

Intrusive investigations can be used to assess the nature and sequence of the subsurface strata, including physical and mechanical properties for use in specifying geotechnical design parameters.

# 5 STATEMENT OF LIMITATIONS

This Geotechnical Desktop Study is based on reviews of previous geotechnical reports, which included specific searches through relevant, historical databases and numerical data. It was assumed that the historical records were complete at the time of preparing each assessment report. This Geotechnical Desktop Study also relies upon data, measurements and/or results taken at, or under, the particular times and conditions specified in the corresponding report.

No warranties are made as to the information provided in this Geotechnical Desktop Study. All strategies, conclusions and recommendations made in this Geotechnical Desktop Study are the professional opinions of Morrow Geotechnics personnel involved with the project and while normal checking of the accuracy of information has been conducted, any circumstances outside the scope of this Geotechnical Desktop Study or which were not made known to Morrow Geotechnics personnel and which may impact on those opinions are not the responsibility of Morrow Geotechnics.

This report, its associated documentation and the information herein have been prepared solely for use with the project specified. No responsibility is accepted for the use of any part of this report in any other context or for any other purpose or by other third parties. Any ensuing liability resulting from use of the report by third parties cannot be transferred to Morrow Geotechnics. This Geotechnical Desktop Study does not purport to provide legal advice.

# 6 REFERENCES


AS1726:1993, *Geotechnical Site Investigations*, Standards Australia.

AS2159:2009, *Piling – Design and Installation*, Standards Australia.

AS2870:2011, *Residential Slabs and Footings*, Standards Australia.

AS3798:2007, *Guidelines on Earthworks for Commercial and Residential Developments*, Standards Australia.

Chapman, G.A. and Murphy, C.L. (1989), Soil Landscapes of the Sydney 1:100000 sheet. Soil Conservation Services of NSW, Sydney.

NSW Department of Finance and Service, Spatial Information Viewer, maps.six.nsw.gov.au.

NSW Department of Mineral Resources (1983) Sydney 1:100,000 Geological Series Sheet 9130 (Edition 1). Geological Survey of New South Wales, Department of Mineral Resources.

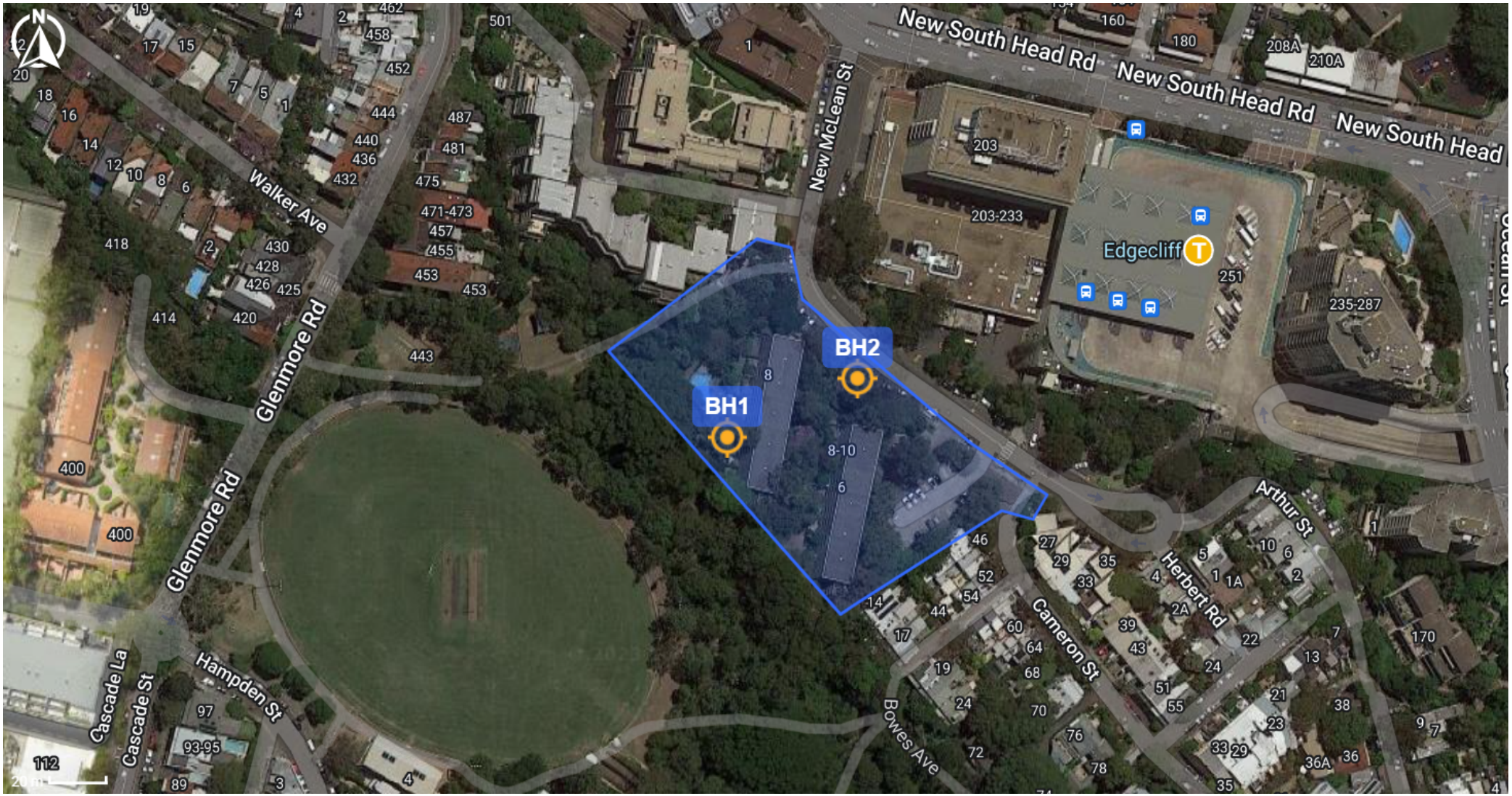
Pells (2004) Substance and Mass Properties for the Design of Engineering Structures in the Hawkesbury Sandstone, Australian Geomechanics Journal, Vol 39 No 3

# 7 CLOSURE

Please do not hesitate to contact Morrow Geotechnics if you have any questions about the contents of this report.

For and on behalf of Morrow Geotechnics Pty Ltd,

Alan Morrow
Principal Geotechnical Engineer




morrow
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| | | | |
|---|---|---|---|
| **Map description** | Site Plan | | |
| **Site location** | 8-10 New McLean St, Edgecliff NSW | | |
| **Client** | Geosyntec Consultants Pty Ltd | | |
| **Project name** | Edgecliff | | |
| **Project No** | P2868 | **Scale** | Not to scale |

Appendix A

# BOREHOLE LOGS AND EXPLANATORY NOTES

**Morrow Geotechnics**
Bellambi, NSW
Phone: 0405 843 933

# Engineering Log - Borehole

## Borehole No: BH1

| | | | | | |
|---|---|---|---|---|---|
| UTM | : 56H | Driller Rig | : Hand Auger | Job Number | : P2868 |
| Easting | : 336733.6 | Driller Supplier | : MG | Client | : Geosyntec Consultants Pty Ltd |
| Northing | : 6249751.0 | Logged By | : Feby Markose | Project | : Edgecliff |
| RL | : N/A | Reviewed By | : Rhiannon Mckeon | Location | : 8-10 New McLean St, Edgecliff NSW |
| Total Depth | : 2.5m | Date | : 12/04/2023 | | |

| Drilling Method | Water | DCP | Soil Origin | Graphic Log | Classification Code | Depth (m) | Elevation (m) | Material Description | Consistency | Moisture | Observations |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hand Auger | | 1 | Fill | | SM | 0.5 | | Fill silty to gravelly SAND (SM) : very loose to loose, brown, fine to medium grained, medium to coarse sized gravel, moist, ( construction waste ) . | VL-L | M | |
| | | 1 | Natural | | SM | 0.9 | | Natural silty SAND (SM) : loose, yellow orange, fine to medium grained, with fine to medium sized gravel, ( sandstone gravels ) . | L | | |
| | | 2 | | | | 1 | | | | | |
| | | 1 | | | | | | | | | |
| | | 2 | | | | | | | | | |
| | | 1 | | | | 1.5 | | | | | |
| | | 1 | | | | | | | | | |
| | | 1 | | | | | | | | | |
| | | 1 | | | | | | | | | |
| | | 1 | | | | 1.8 | | | | | |
| | | 1 | Natural | | SM | | | AS ABOVE:orange grey, ( poorly graded ) . | L | | |
| | | 1 | | | | 2 | | | | | |
| | | 1 | | | | | | | | | |
| | | 1 | | | | | | | | | |
| | | 1 | | | | | | | | | |
| | | 1 | | | | | | | | | |
| | | 1 | | | | | | | | | |
| | | 1 | | | | 2.5 | | **BH1 Terminated at 2.5m (Target depth reached)** | | | |
| | | 2 | | | | | | | | | |
| | | 2 | | | | 3 | | | | | |
| | | 5 | | | | | | | | | |
| | | 8 | | | | | | | | | |
| | | 7 | | | | | | | | | |
| | | 6 | | | | | | | | | |
| | | 3 | | | | | | | | | |
| | | 5 | | | | | | | | | |
| | | 3 | | | | 3.5 | | | | | |
| | | 3 | | | | | | | | | |
| | | 3 | | | | | | | | | |
| | | 3 | | | | | | | | | |
| | | 3 | | | | | | | | | |
| | | | | | | 4 | | | | | |

**Morrow Geotechnics**
Bellambi, NSW
Phone: 0405 843 933

# Engineering Log - Borehole

## Borehole No: BH2

| | | | | | |
|---|---|---|---|---|---|
| UTM | : 56H | Driller Rig | : Hand Auger | Job Number | : P2868 |
| Easting | : 336778.8 | Driller Supplier | : MG | Client | : Geosyntec Consultants Pty Ltd |
| Northing | : 6249772.5 | Logged By | : Feby Markose | Project | : Edgecliff |
| RL | : N/A | Reviewed By | : Rhiannon Mckeon | Location | : 8-10 New McLean St, Edgecliff NSW |
| Total Depth | : 1.3m | Date | : 16/04/2023 | | |

| Drilling Method | Water | DCP | Soil Origin | Graphic Log | Classification Code | Depth (m) | Elevation (m) | Material Description | Consistency | Moisture | Observations |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Hand Auger | | | Fill | | SM | 0.5<br>1 | | Fill silty to gravelly SAND (SM) : very loose to loose, brown black, fine to medium grained, medium to coarse sized gravel, moist, ( poorly graded ) . | VL-L | M | |
| | | | | | | 1.5<br>2<br>2.5<br>3<br>3.5<br>4 | | **BH2 Terminated at 1.3m (End of Hole)** | | | |

# Soil and Rock Logging Explanatory Notes

## GENERAL

Information obtained from site investigations is recorded on log sheets. The "Cored Drill Hole Log" presents data from an operation where a core barrel has been used to recover material - commonly rock. The "Non-Core Drill Hole - Geological Log" presents data from an operation where coring has not been used and information is based on a combination of regular sampling and insitu testing. The material penetrated in non-core drilling is commonly soil but may include rock. The "Excavation - Geological Log" presents data and drawings from exposures of soil and rock resulting from excavation of pits, trenches, etc.

The heading of the log sheets contains information on Project Identification, Hole or Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material substance description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The common depth scale is 8m per drill log sheet and about 3-5m for excavation logs sheets.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is inevitable in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures. Material description and classifications are based on SAA Site Investigation Code AS 1726 - 1993 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

## DRILLING

**Drilling & Casing**

| | |
|---|---|
| ADV | Auger Drilling with V-Bit |
| ADT | Auger Drilling with TC Bit |
| WB | Wash-bore drilling |
| RR | Rock Roller |
| NMLC | NMLC core barrel |
| NQ | NQ core barrel |
| HMLC | HMLC core barrel |
| HQ | HQ core barrel |

**Drilling Fluid/Water**

The drilling fluid used is identified and loss of return to the surface estimated as a percentage.

**Drilling Penetration/Drill Depth**

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

| | |
|---|---|
| VE | Very Easy |
| E | Easy |
| M | Medium |
| H | High |
| VH | Very High |

**Groundwater Levels**

Date of measurement is shown.

Standing water level measured in completed borehole

Level taken during or immediately after drilling

| | |
|---|---|
| D | Disturbed |
| B | Bulk |
| U | Undisturbed |
| SPT | Standard Penetration Test |
| N | Result of SPT (sample taken) |
| PBT | Plate Bearing Test |
| PZ | Piezometer Installation |
| HP | Hand Penetrometer Test |

## EXCAVATION LOGS

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the "Structure and other Observations" column. The depth of the base of excavation (for the logged section) at the appropriate depth in the "Material Description" column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added.

**MATERIAL DESCRIPTION - SOIL**

Classification Symbol - In accordance with the Unified Classification System (AS 1726-1993, Appendix A, Table A1)

Material Description - In accordance with AS 1726-1993, Appendix A2.3

**Moisture Condition**

| | |
|---|---|
| D | Dry, looks and feels dry |
| M | Moist, No free water on remoulding |
| W | Wet, free water on remoulding |

Consistency - In accordance with AS 1726-1993, Appendix A2.5

| | | |
|---|---|---|
| VS | Very Soft | < 12.5 kPa |
| S | Soft | 12.5 – 25 kPa |
| F | Firm | 25 – 50 kPa |
| St | Stiff | 50 – 100 kPa |
| VSt | Very Stiff | 100 – 200 kPa |
| H | Hard | > 200 kPa |

Strength figures quoted are the approximate range of undrained shear strength for each class.

Density Index. (%) is estimated or is based on SPT results.

| | | |
|---|---|---|
| VL | Very Loose | < 15 % |
| L | Loose | 15 – 35 % |
| MD | Medium Dense | 35 – 65 % |
| D | Dense | 65 – 85 % |
| VD | Very Dense | > 85 % |

## MATERIAL DESCRIPTION -ROCK

**Material Description**

Identification of rock type, composition and texture based on visual features in accordance with AS 1726-1993, Appendix A3.1-A3.3 and Tables A6a, A6b and A7.

**Core Loss**

Is shown at the bottom of the run unless otherwise indicated.

**Bedding**

| | |
|---|---|
| Thinly Laminated | < 6 mm |
| Laminated | 6 - 20 |
| Very Thinly Bedded | 20 - 60 |
| Thinly Bedded | 60 - 200 |
| Medium Bedded | 200 – 600 |
| Thickly Bedded | 600 – 2000 |
| Very Thickly Bedded | > 2000 |

**Weathering** - No distinction is made between weathering and alteration. Weathering classification assists in identification but does not imply engineering properties.

| | |
|---|---|
| Fresh (F) | Rock substance unaffected by weathering |
| Slightly Weathered (SW) | Rock substance partly stained or discoloured. Colour and texture of fresh rock recognisable. |
| Moderately Weathered (MW) | Staining or discolouration extends throughout rock substance. Fresh rock colour not recognisable. |
| Highly Weathered (HW) | Stained or discoloured throughout. Signs of chemical or physical alteration. Rock texture retained. |
| Extremely Weathered (EW) | Rock texture evident but material has soil properties and can be remoulded. |

**Strength** - The following terms are used to described rock strength:

| Rock Strength Class | Abbreviation | Point Load Strength Index, Is(50) (MPa) |
|---|---|---|
| Extremely Low | EL | < 0.03 |
| Very Low | VL | 0.03 to 0.1 |
| Low | L | 0.1 to 0.3 |
| Medium | M | 0.3 to 1 |
| High | H | 1 to 3 |
| Very High | VH | 3 to 10 |
| Extremely High | EH | ≥ 10 |

Strengths are estimated and where possible supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical estimated strength by using:

° Diametral Point Load Test

Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown.

## MATERIALS STRUCTURE/FRACTURES

**ROCK**

Natural Fracture Spacing - A plot of average fracture spacing excluding defects known or suspected to be due to drilling, core boxing or testing. Closed or cemented joints, drilling breaks and handling breaks are not included in the Natural Fracture Spacing.

Visual Log - A diagrammatic plot of defects showing type, spacing and orientation in relation to core axis.

| | | |
|---|---|---|
| Defects | ——— | Defects open in-situu or clay sealed |
| | – – – – – | Defects closed in-situ |
| | ..... | Breaks through rock substance |

Additional Data - Description of individual defects by type, orientation, in-filling, shape and roughness in accordance with AS 1726-1993, Appendix A Table A10, notes and Figure A2.

Orientation - angle relative to the plane normal to the core axis.

| | | |
|---|---|---|
| Type | BP | Bedding Parting |
| | JT | Joint |
| | SM | Seam |
| | FZ | Fracture Zone |
| | SZ | Shear Zone |
| | VN | Vein |
| | FL | Foliation |
| | CL | Cleavage |
| | DL | Drill Lift |
| | HB | Handling Break |
| | DB | Drilling Break |
| Infilling | CN | Clean |
| | X | Carbonaceous |
| | Clay | Clay |
| | KT | Chlorite |
| | CA | Calcite |
| | Fe | Iron Oxide |
| | Qz | Quartz |
| | MS | Secondary Mineral |
| | MU | Unidentified Mineral |
| Shape | PR | Planar |
| | CU | Curved |
| | UN | Undulose |
| | ST | Stepped |
| | IR | Irregular |
| | DIS | Discontinuous |
| Rougness | POL | Polished |
| | SL | Slickensided |
| | S | Smooth |
| | RF | Rough |
| | VR | Very Rough |

**SOIL**

Structures - Fissuring and other defects are described in accordance with AS 1726-1993, Appendix A2.6, using the terminology for rock defects.

Origin - Where practicable an assessment is provided of the probable origin of the soil, eg fill, topsoil, alluvium, colluvium, residual soil.

Appendix B

# IMPORTANT INFORMATION

# Important Information

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