Technical Note – 85-97 Waterloo Road Macquarie Park – Concept Design Stage Impact Assessment

Project Number	**S23030**
Client	**Goodman**
Date	**12 June 2024**
Document Number	**GEO-MEM-001**
Revision	**A**
Prepared By	**Fergus Cheng / Mihimal Kadurugamuwa**
Reviewed By	**Bach Trang**

1 Introduction

This technical note summarises the impact assessment undertaken for the proposed 85-97 Waterloo Road Macquarie Park. The proposed 85-97 Waterloo Road Macquarie Park comprises of six new buildings (Building A to Building F) ranging between 10 to 20 storeys and two levels of basements. An indicative layout of the buildings and the basements are shown in Figure 1 and Figure 2. The development will be home to 736 dwellings, commercial and retail uses at ground level. A site plan with easement boundary is provided in Annex A.

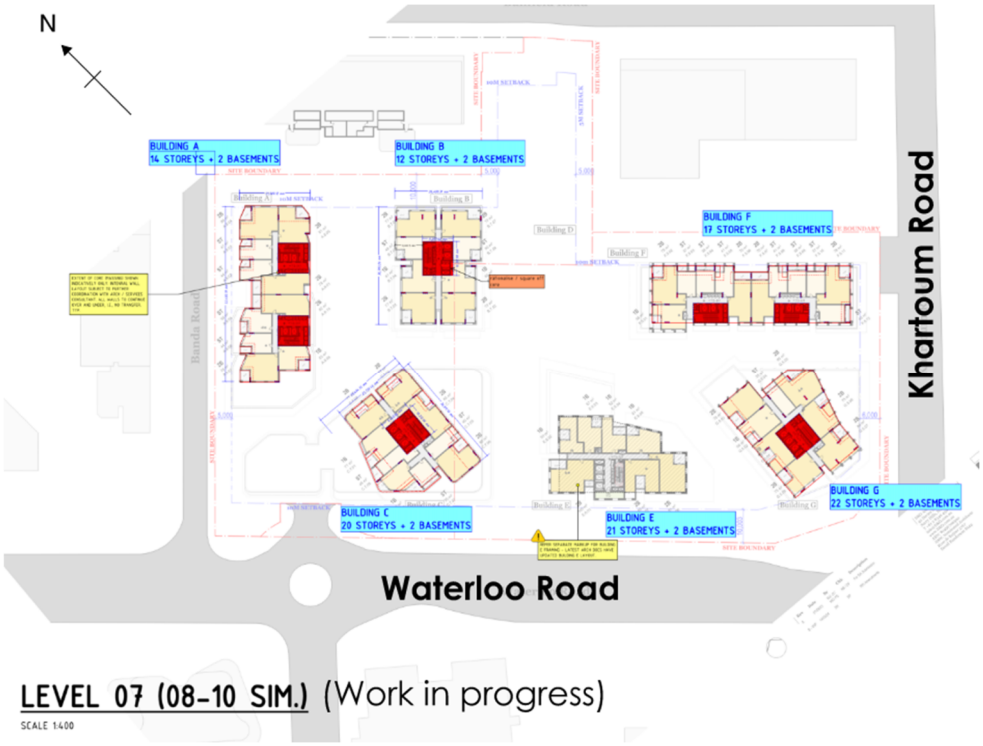


Figure 1: Layout of the Buildings

BG&E Pty Limited
Level 2, 8 Windmill Street, Millers Point NSW 2000 Australia
sydney@bgeeng.com
+61 2 9770 3300

ABN 67 150 804 603

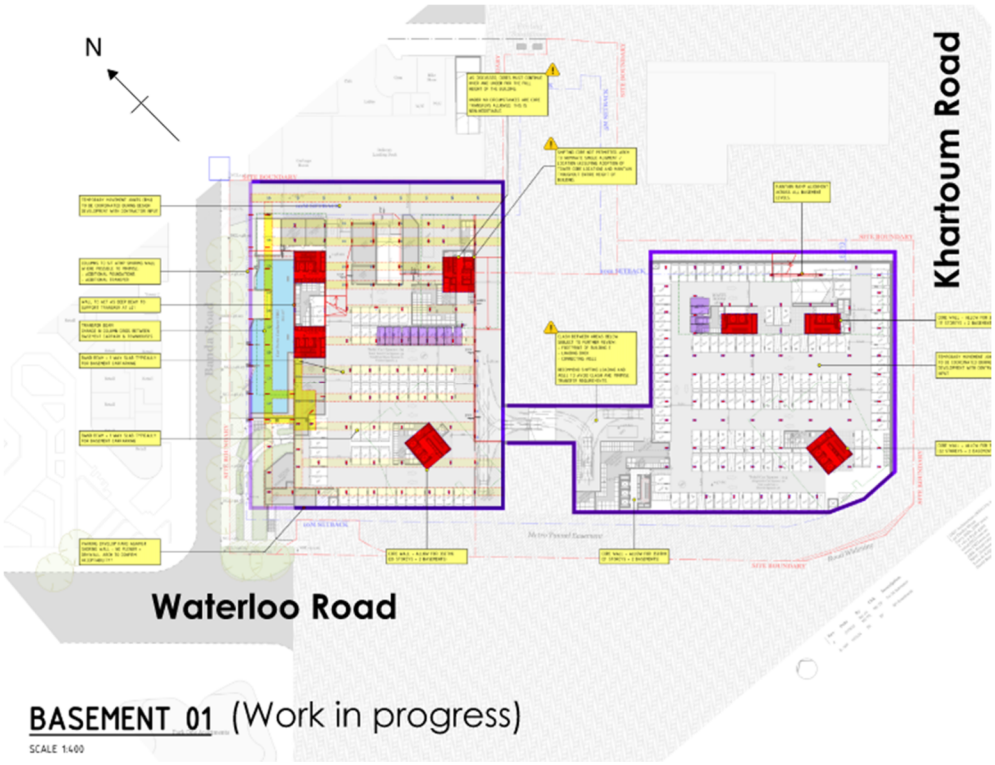


Figure 2: Layout of the Basements

Goodman, the developer on this project, and BG&E are aware that this location is close to an existing Sydney Metro tunnel, which is referred as a part of the Sydney Metro North West line. As a result, an impact assessment is required as per the Sydney Metro Underground Corridor Protection Technical Guidelines (Version 2).

The purpose of this technical memo is to provide a high-level impact assessment based on the concept design of this proposed development to date. Please note a request on information has already been submitted to Sydney Metro. Once the information becomes available, the site plan, section and the associated analysis will be updated to reflect the position of the Sydney Metro tunnels in a relationship to the proposed development.

2 Available Data

BG&E was given the following information to conduct the impact assessment for this project, including:

- Architectural drawings on the proposed development at 85-97 Waterloo Road Macquaire Park
- A geotechnical investigation report for 85 WATERLOO ROAD, MACQUARIE PARK, produced by PSM, dated 6 April 2020.

A copy of the geotechnical investigation report is provided in Annex B.

Based on the information available to BG&E and BG&E project experience in this area, the proposed building and basement are outside the first reserve of the Sydney Metro tunnel, but the proposed retaining wall system may encroach into the second reserve of the Sydney Metro tunnel.

2.1 Reference Paper

- Bertuzzi, R., 2014. Sydney sandstone and shale parameters for tunnel design. Australian Geomechanics, 49(1), pp.1-40.
- McQueen, L.B., 2004. In situ rock stress and its effect in tunnels and deep excavations in Sydney. Australian Geomechanics, 39(3), pp.43-57.

2.2 Topographic Data

- ELVIS, 2020. Elevation and Depth - Foundation Spatial Data, available at https://elevation.fsdf.org.au/

3 Geotechnical Input

3.1 Topography

The site is located at 85-97 Waterloo Road. The site is bounded by the NW-SE running Waterloo Road to the southwest and by the NE-SW running Khartoum Road to the southeast. Based on the LiDAR data (ELVIS, 2020), the site is roughly sitting at 63 mAHD at its eastern edge of the site and it gently sloping towards northwest to 58m AHD at its western edge of the site.

3.2 Ground Conditions

The 1:100,000 Sydney Geological Map indicates the site is underlain by Ashfield Shale of the Wianamatta group (Rwa) which consist of black to dark-grey siltstone, mudstone and interlaminated siltstone, mudstone and sandstone and Hawkesbury Sandstone (Rh) which consist of medium to coarse grained quartz sandstone, very minor shale and lenses of interlaminated siltstone and sandstone. The site is very close to a geological contact between Ashfield Shale and Hawkesbury Sandstone, which implies Ashfield Shale is relatively thin or even absent at this location. This has been proven by some boreholes which encountered sandstone during drilling.

Four deep boreholes and two shallow boreholes were drilled by PSM in 2020. The deep boreholes were terminated between 17 m and 25 m below ground level while the shallow boreholes were terminated at 3 m below ground level. Based on the borehole information, the site is underlain by fill materials ranging from 0.2 to 0.5 m thick, then a very stiff residual soil ranging from 0.6 to 2.5 m thick, then rock material. The rock materials comprise of siltstone and sandstone in various thickness and interbedding.

PSM reported a geological structure was encountered during the drilling of BH03. The geological structure was encountered at around 16 to 17 m depth with an approximate dip 25° to 27° and dip direction 17° to 41°. Since this structure was only encountered at one borehole, the structure cannot be interpolated. Further investigation is recommended to understand the potential impact of this feature to the foundation and retaining wall design for the project.

3.3 Geotechnical Parameters

Soil parameters of the proposed development have been adopted according to GIR for 85-97 Waterloo Road, Macquarie Park, produced by PSM, dated 6 April 2020 and are listed in Table 1. At-rest lateral earth pressure coefficient has been determined based on the effective friction angle of the soil material.

Rock mass classification has been used to characterise the rock material retrieved from the drilling. Given that only Point Load Test is available to characterise the rock strength and there is no other laboratory test available in this project, the geotechnical parameters proposed by Bertuzzi (2014) have been adopted in this analysis. The adopted geotechnical parameters for impact assessment are shown on Table 2.

Table 1: Soil Parameters Adopted for the Analysis (Adopted from Geotechnical Investigation Report for 85-97 Waterloo Road, (PSM, 2020))

Material Type	Unit Weight, Y (kN/m3)	Elastic Modulus, E (kN/m2)	Poisson's Ratio, v	Effective Cohesion, c' (kN/m^2)]	Effective Friction Angle, φ' (^{0})
Fill	18	10000	0.3	0	30
Residual Soil	18	15000	0.3	0	30

Table 2: Rock Mass Parameters Adopted for the Analysis (Adopted from Bertuzzi 2014]

Material Type	Unit Weight, Y (kN/m^3)	Elastic Modulus, E (kN/m^2)	Poisson's Ratio, v	Unconfined Compressive Strength (MPa)	Hoek-Brown parameter, m_i	GSI	Disturbance Factor D	Tensile Strength (kN/m2)
Class V Sandstone	24	100000	0.3	5	12	35	0	-
Class IV Sandstone	24	500000	0.25	10	12	45	0	10
Class III Sandstone	24	1000000	0.25	15	12	55	0	40

3.4 Groundwater level

A standpipe piezometer was installed at BH03 with a slotted screen from 14 m to 23 m below ground level. The slotted screen level corresponds to the rock material. The standpipe piezometer remained dry, i.e. no groundwater, in the monitoring period from 20 February 2020 to 6 March 2020. As such, the actual groundwater level is considered to be more than 23 m below ground level (i.e. < 32.9 mAHD).

A designed groundwater level of 41.7m AHD is adopted for the analysis to simulate potential dewatering at the basement level. This designed groundwater level is higher than the actual groundwater level observed at BH03.

3.5 In-situ stress

Site specific in-situ stress parameters have not been provided in the Geotechnical Investigation Report (PSM, 2020). Therefore, the in-situ stress regime for the Class III or better sandstone is based on McQueen (2004), which provides a reference on the in-situ stress regime in Sydney region. For Class V/IV Sandstone material, the at-rest earth pressure coefficient has been taken as 1, and lock-in stress conditions have not been considered because these materials behave similarly to soil or highly weathered rocks. The in-situ stress adopted in the analysis is shown in Table 3.

Table 3: In-situ Stress

Material	In-situ stress (MPa)
Class V / IV Sandstone	$\sigma_H = \sigma_v$
Class III or better Sandstone	$\sigma_H = \sigma_v + 2.5$

4 Structural Input

4.1 Building Loads

All the building loads have been provided by the structural engineer on the project. For the two existing buildings on site, it was estimated that they are applying building loads of 66 kPa and 44 kPa onto the existing ground. This has been rationised and 66 kPa has been adopted in the analysis. The new buildings will apply an estimated load of 225 kPa at the basement level. A markup showing the existing building and their loads is provided as Figure x.

Figure 3: Loads from the Existing Building

4.2 Retaining System and Basement Structure

As advised by the structural engineer on the project, the retaining system will likely consist of a soldier pile wall consisting of 450 mm piles at a spacing of 2.7 m with two rows of anchors. The embedment length of the piles are assumed as 1.5 times the retaining height. The anchors are assumed to consist of pre-stressed anchors with a free length of 5 m and a bond length of 7 m.

Shotcrete and vertical strip drains are assumed to be installed between the piles.

The basement is assumed to be a drained basement. The proposed three levels of slab from ground to foundation (Ground Level, Level B1 and Level B2) are assumed to have a thickness of 200 mm, 200 mm and 150 mm respectively as advised by the structural engineer. A concrete strength of 40 MPa and stiffness of 32.8 GPa has been used in the assessment.

4.3 Tunnel Lining

For the tunnel liner, the minimum thickness of 0.2 m has been assumed in the analysis. This will be verified when the as-built information of tunnel is received.

4.4 Surcharge

A traffic surcharge of 10 kPa has been allowed on the access roads and a construction surcharge of 20 kPa has been allowed in a numerical analysis.

5 Construction Sequences

The following construction sequences have been provided by the structural engineer on the project and has been adopted in this assessment:

1. Demolish the existing structures.
2. Install shoring wall piles to the perimeter of the basement extent – drilling holes to the set-out and depths shown on plans, elevations, and sections.
3. Construct capping beam. Install survey monitoring targets and take baseline reading.
4. Excavate within site to max. 500 mm below anchor level. Install vertical strip drains and shotcrete wall as required.
5. Install first layer of temporary anchor and pre-stress to 150 kN.
6. Repeat steps 4 and 5 for areas for the second layer of anchors.
7. Excavate to Bulk Excavation Level and complete the excavation.
8. Apply the new building load.
9. De-stress all the rock anchors.

Please note that the construction sequence is still being actively developed as the design progresses. Changes on the construction sequences will be incorporated in the next submission.

6 Methodology – Numerical Assessment

A 2D numerical model has been developed with Plaxis2D on this project. A 2D section has been setup near Building C, where it is at topographic low point and an elevation of 51.4 mAHD. The location of this section is shown in Figure 4. This location has been selected for the analysis as the Northern Basement and the Sydney Metro underground structure are closest vertically compared with other locations of the site. Figure 5 shows an example of the analysis.

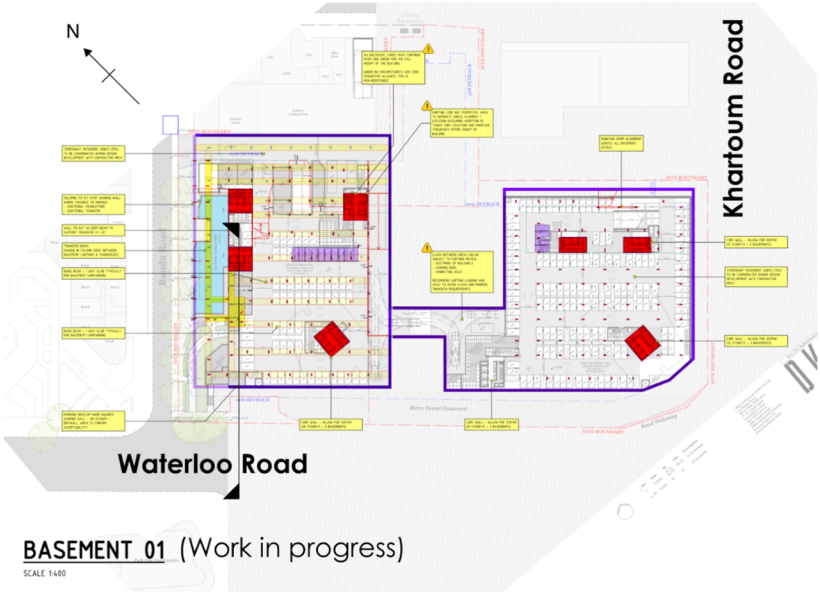


Figure 4: Location of the Analysed Section for Impact Assessment

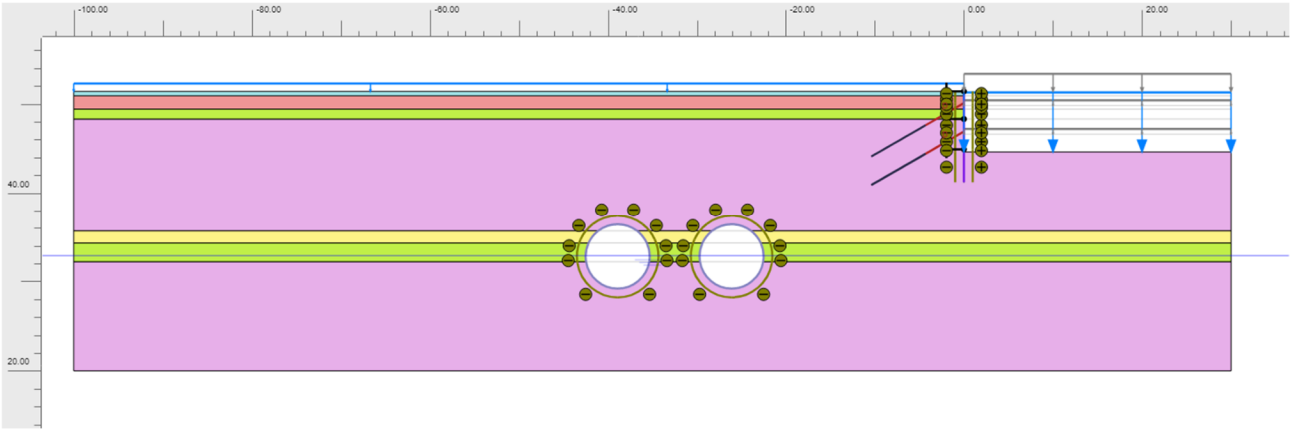


Figure 5: Setup of the Plaxis2D Analysis

7 Result

A preliminary numerical assessment has been completed to assess the change of loads at the tunnel lining before the demolition of the existing buildings and at the completion of the new buildings. The preliminary numerical assessment suggests a slight increase (<8%) of axial load when the new buildings are completed.

Since the preliminary numerical assessment has been built on various assumptions and estimations, all these assumptions and estimations shall be validated when the design is further developed and further information becomes available. This numerical assessment shall be revised as the design on the project progresses.

8 Recommendation and Way Forward

- One 2D assessment at Building C has been provided in this concept design submission. An additional assessment at Building G is recommended to demonstrate the proposed design at Building G does not imply an adverse impact on the Sydney Metro underground structure.

- As the shoring system is developed, two further rounds of submission to Sydney Metro at 50% Design (i.e. Design completed for Tender) and at 90% Design (i.e. Design completed for Construction Certificate application) are recommended, so that Sydney Metro will be aware of the design changes and its potential impact on the existing underground structure.

- The structural input, including loadings from the existing and new building, shoring wall design, anchors etc., provided to date is preliminary and is based on various assumptions and engineering judgement. Some detailed structural analysis on vertical and lateral loads at foundation level is recommended which will improve the accuracy of the loads by the structural engineer to date.

- The current analysis only considers for the axial load provided by the structural engineer. Lateral loads shall be incorporated into the analysis, once they are available after further detailed studies.

- Carry out further site-specific geotechnical investigation and laboratory tests. Currently the boreholes are more than 20m offset from Waterloo Road. Further geotechnical investigation will reduce the uncertainty on the adopted ground profile and geotechnical parameters.

- As if there are any major change on the design, Sydney Metro shall be informed the changes and the associated potential impact due to the building construction.

- BG&E recommends the client to engage with Sydney Metro to obtain feedback on current scheme and to establish a pathway to obtain an approval from Sydney Metro before construction work starts on site. Updating Sydney Metro along the way during approval process is also highly recommended to ensure that they are providing feedback along the development of design.

9 Limitation

Limitations associated with this report are provided in Annex C.

Annex A – Survey Plan

LEGEND

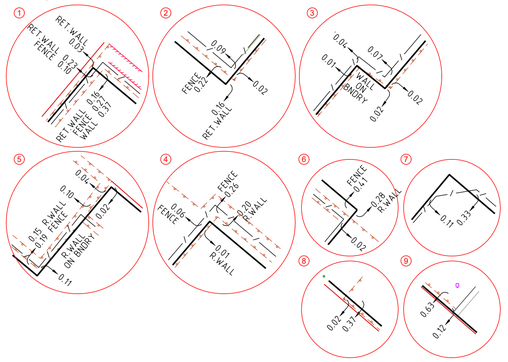
- PK METER
- SEWERAGE INSPECTION SHAFT
- ELECTRICITY UNCLASSIFIED
- COLUMN
- TREE
- LIGHT POLE
- SIGN
- BOOM GATE
- GRATED PIT
- SPOT HEIGHT
- FLAGPOLE
- BOLLARD
- UNCLASSIFIED PIT
- SEWERAGE PIT
- TAP
- BORE HOLE
- MARKER POST (Gas)
- GAS VALVE
- GAS METER
- WATER UNCLASSIFIED
- TELECOM PIT
- DRAINAGE PIT (Other)
- STOP VALVE
- FIRE HYDRANT
- WATER METER

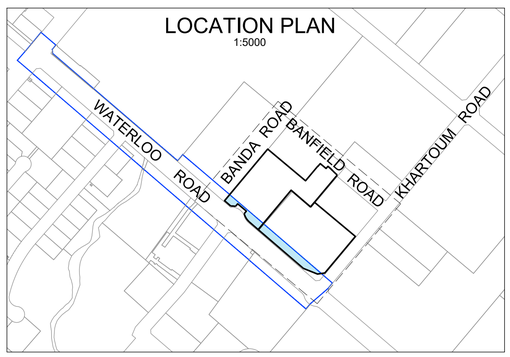
- MAJOR BUILDING
- TOP OF GUTTER
- RETAINING WALL
- RIDGE OF ROOF
- INVERT OF KERB
- VERANDAH CANOPY
- SIGN
- GARDEN BED
- EDGE OF PAVING
- MINOR BUILDING
- EDGE OF CONCRETE
- SPEED HUMP
- FENCE
- CENTRELINE OF BITUMEN
- ELECTRICITY UNCLASSIFIED
- BACK OF KERB
- LIP OF KERB
- STEPS
- WALL
- SPEED HUMP
- GUARD RAIL

- TITLE / BOUNDARY LINE
- LOT 1 DP1046092

- PORTION OF LOTS LIMITED IN DEPTH TO THE LEVEL PLANE RL 40 LOT 1 DP1046092 (SYDNEY METRO) BELOW
- LAND TO BE ACQUIRED FOR THE PURPOSES OF THE ROADS ACT 1993 VIDE DP1262057
- EASEMENT FOR CARRIAGEWAY 10 wide
  EASEMENT OF INSTALLATION OF SERVICES
- RIGHT OF WAY & EASEMENT OF ELECTRICITY PURPOSES
- EASEMENT TO DRAIN WATER 1, 2.5 & 4 wide
- EASEMENT FOR ELECTRICITY PURPOSES
- RIGHT OF WAY

ENLARGMENTS





NOTES:
This plan is prepared for GOODMAN PROPERTY SERVICES from a field survey for the purpose of designing new constructions on the land and to show the relationship between the boundaries and occupation, and should not be used for any other purpose. For clarity, some occupation may not be shown to scale. Possessory Rights may have accrued to occupation location. The Title boundaries have been surveyed.
Above ground services as seen by the surveyor at the time of survey have been shown on this plan. Pits may be larger underground than the size shown on the plan. Footing locations and subsurface structures have not been located. **Prior to any demolition, excavation or construction, current Dial Before You Dig plans must be ordered and examined.**
Any digital data forwarded by Landair Surveys must not be altered in any way without prior approval of Landair Surveys. The data may be copied and then manipulated as required. This note is an integral part of the plan.
Additional Boundaries are indicative only and have been sourced from SIX Maps NSW. Nearmap image dated 07/12/2023
SOME LAYERS ARE TURNED OFF FOR CLARITY OF PRINTED PLAN. SEE AUTOCAD DRAWING FOR COMPLETE INFORMATION

CERTIFICATION BY REGISTERED SURVEYOR FOR PLAN

I, ERIK BIRZULIS of Landair Surveys a surveyor registered under the Surveying and Spatial Information Act 2002,certify that:The land shown in the plan was surveyed in accordance with the Surveying and Spatial Information Regulation 2017, is accurate and the survey was completed on 12/09/2022

Surveyor Identification No. 2521
Surveyor registered under
the Surveying and Spatial Information Act 2002

DATE	UPDATES DETAILS	BY	REV
06/05/2024	INITIAL PLAN	CC	

MAJOR CONTOUR INTERVAL : 1m
MINOR CONTOUR INTERVAL : 0.25m
LEVELS ARE TO AUSTRALIAN HEIGHT DATUM (AHD) VIDE VRSNOW RTK GPS NETWORK
ORIENTATION ON MAP GRID OF AUSTRALIA (MGA2020) VIDE DP1259231 / SSM103444??

GOODMAN PROPERTY SERVICES
FEATURE & IDENTIFICATION PLAN
85-91,97 WATERLOO ROAD,MACQUARIE PARK

0 4 8 12 16 20 LENGTHS ARE IN METRES

SCALE 1:400

JOB NUMBER:	2240501
DATE OF SURVEY:	7-9 & 12/09/2022
FIELD PARTY:	MT, CD, AD
DRAWN BY:	CC
PLAN DATE:	06/05/2024 REVISION: -
SHEET:	SHEET 1 OF 1 SIZE: A1

MGA 2020 ZONE 56

Landair surveys
1/87-91 Heatherdale Rd
Ringwood 3134
info@landair.com.au
www.landair.com.au
1300 130 158

REF: C:\LANDAIR\2240501-DETAIL\2240501-FEATURE.DWG

Annex B – Geotechnical Investigation Report

G3 56 Delhi Road
North Ryde NSW 2113
P +61-2 9812 5000
F +61-2 9812 5001
E mailbox@psm.com.au
www.psm.com.au

Our Ref: PSM3411-104L

06 April 2020

Senior Project Manger
Goodman Property Services (Aust) Pty Ltd
Level 17, 60 Castlereagh St
SYDNEY NSW 2000
david.lai@goodman.com

Attention: David Lai

Dear David

RE: 85 WATERLOO ROAD, MACQUARIE PARK
GEOTECHNICAL INVESTIGATION

1. Introduction

This letter presents the results of the geotechnical investigation undertaken by Pells Sullivan Meynink (PSM) for the proposed re-development of 85 Waterloo Rd, Macquarie Park. The investigation was undertaken in accordance with our proposal PSM3411-101L, dated 10 January 2020. Approval to proceed was provided in an email from David Lai dated 10 February 2020.

The aim of the geotechnical investigation was to assess the subsurface conditions and provide geotechnical advice for the proposed development. The investigation involved assessment and classification of subsurface conditions for the purpose of providing advice on excavation conditions, permanent and temporary batters, retention and foundations.

2. Proposed Development

Based on architectural drawings provided by Goodman (Ref: Drawing PRL GD 02478 Rev B Railcorp.pdf), we understand that the site is located at 85 Waterloo Rd, Macquarie Park. The site is currently occupied by an existing building with an internal access road and carparking areas surrounding the building.

We note the following about the re-development:

- The site currently comprises a commercial warehouse
- The site is approximately 1.3 hectares
- Proposed re-development comprise an office building with 10 to 12 storeys above ground up to 4 levels of basement parking. Further details of the proposed development are not known at this stage to PSM
- The site is adjacent to the existing Epping to Chatswood Railway Line (ECRL) twin tunnels.

A site locality plan is presented in Figure 1.

3. Geotechnical Investigation

3.1 Fieldwork

The fieldwork was undertaken from 16 to 23 February 2019 under the full-time supervision of a Geotechnical Engineer from PSM, who undertook the following tasks:

- Setting out the investigation locations
- Directing the reinstatement of concrete and asphalt surfaces where required
- Preparing engineering logs of the materials encountered
- Collection of disturbed samples for laboratory testing
- Point load testing of recovered core samples.

Prior to the investigation, on-site service location "scans" were undertaken by a licenced service locator under the direction of PSM.

Six (6) boreholes (BH01 to BH06) were drilled at the site, locations presented on Figure 1. Drilling was undertaken by B&G Drilling and Stratacore using a tracked drilling rig. The investigation locations of bore holes were recorded with a hand-held GPS unit with a horizontal accuracy of approximately +/- 5 m. Borehole collar levels were estimated from the survey plan provided by Goodman.

Boreholes were drilled to depths of between 3.0 m and 25.2 m around the perimeter of the existing building in the carpark areas, with augering in soils and low strength rock and coring in rock. Rock coring was undertaken for BH01 to BH04.

A standpipe piezometer was installed within BH03 upon completion to allow ongoing monitoring of groundwater levels. The geotechnical borehole logs prepared as part of the investigation together with core photos are included in Appendix A and Appendix B. Explanation sheets to allow interpretation of the logs are also provided. Point load strength index testing was performed on the recovered core at approximately 1 m intervals with results tabulated in Attachment B and presented on the logs. Piezometer construction record is presented in Appendix C.

At the completion of BH03, based on inspection of the recovered core which indicated the presence of a geological structure (inferred from the presence of multiple seams and core loss), borehole imaging was undertaken to approximately 25 m depth. The borehole imaging log and interpretation is presented in Attachment D.

Figure 2 presents selected photos showing the general conditions of the existing site at the time of the fieldwork.

3.2 Analytical soil testing

Analytical laboratory testing for soil sgressivity was carried out on six (6) samples, one from each of the boreholes. The results are presented in Attachment E and summarised in Table 1.

Table 1 - Summary of Aggressivity Testing Results

Sample ID	Sample Depth	pH	Moisture Content [%]	Chloride by Discrete Analyser [mg/kg]	Soluble Sulphate by ICPAES [mg/kg]
BH01	11.54 m	6.8	5.6	20	<10
BH02	1.65 m	6.0	13.6	<10	20
BH03	4.00 m	5.6	5.4	<10	<10
BH04	0.80 m	6.0	10.6	<50	10
BH05	0.50 m	5.0	13.7	<10	30

BH06	1.50 m	5.6	13.6	<10	100

4. Site Conditions

4.1 Geological Setting

The 1:100,000 Sydney Geological Map indicates the site is underlain by Ashfield Shale of the Wianamatta group (Rwa) which consist of black to dark-grey Shale and Laminite and Hawkesbury Sandstone (Rh) which consist of medium to coarse grained quartz sandstone, very minor shale and laminite lenses. The published information is consistent with the subsurface conditions encountered in the field investigation.

Inset 1 presents an indicative site locality on the geological map.

Inset 1: Sydney geological map indicating approximate site location

4.2 Surface Conditions

The site is currently occupied by a commercial warehouse located centrally with perimeter carparking areas with an asphalt or concrete pavement surface and some garden beds.

The site is bound by Khartoum Road to the southeast, Waterloo Road to the southwest, an existing building to the northeast and a new building which is currently under construction to the northwest (Figure 1). The site is sloped from the southeast boundary towards the northwest from RL 59 mAHD to RL 53 mAHD (based on from the supplied survey drawings).

At the time of fieldwork, the ground surface was dry with minimal traffic. All the boreholes were drilled through asphalt-paved or concrete-paved surface.

4.3 Subsurface Conditions

4.3.1 Soil and Rock Mass

The subsurface conditions are summarised in Table 2. The subsurface conditions comprised fill overlying sandstone/laminate/siltstone bedrock

We note that it is difficult to discriminate between fill and natural insitu material in augered boreholes where the fill is composed of locally excavated natural material; it is possible that the Fill is thicker than interpreted.

Table 2 - Summary of Inferred Subsurface Conditions Encountered in the Boreholes

Inferred Geotechnical Unit		Material Description
ASPHALT/CONCRETE		Current pavement – 30mm to 200mm thick
FILL		Silty GRAVEL to GRAVEL: medium grained up to 20 mm, sub-angular to angular, dark grey & black, dry and dense. Gravelly SAND: coarse grained, pale grey & brown; gravel sub-angular to angular up to 20mm. Silty CLAY to CLAY: low plasticity, pale grey, orange & brown, dry and very stiff.
RESIDUAL		Silty CLAY: low to medium plasticity, pale grey, red & brown, dry to moist, very stiff to hard. Ripped ironstone and siltstone up to 10mm
BEDROCK	A	LAMINITE: dark & pale grey and orange, developed, rock fabric, distinct thinly laminated bedding, iron staining. Extremely weathered to highly weathered. SILTSTONE: pale grey, brown & orange. Extremely weather to highly weathered. SANDSTONE: pale grey & orange, fine to medium grained size, poorly developed to developed rock fabric, distinct to indistinct thinly laminated bedding. Highly weathered.
	B	LAMINITE: dark grey & pale grey, developed to very well-developed rock fabric, thinly laminated bedding. Moderately weathered to fresh. SILTSTONE: dark grey & orange, well-developed rock fabric, distinct thinly laminated bedding. Moderately weathered to fresh. SANDSTONE: pale grey & orange, medium to coarse grained size, developed to well-developed rock fabric, distinct to indistinct thinly laminated bedding and cross bedding. Moderately weathered to slightly weathered.
	C	SANDSTONE: pale grey, medium to coarse grained size, developed to well-developed rock fabric, indistinct thinly laminated bedding. Slightly weathered to fresh.

We note that the site is underlain by Ashfield shale (Rwa), and Hawkesbury sandstone (Rh). This leads to transitions between these geological units with depth. The subsurface conditions and lithology and the depth at which each unit was encountered are summarised in Table 3

Table 3 - Approximate Depth to Top of Inferred Geotechnical Units Encountered in the Boreholes

BH ID	Depth to Top of Inferred Unit (m below surface level)						
	ASPHALT / CONCRETE PAVEMENT	FILL	RESIDUAL	BEDROCK			EOH[1]
				A	B	C	
BH01	0	0.04	0.3	1.0	2.9	-	17.0
BH02	0	0.20	0.3	0.9	4.2	11.5	17.0
BH03	0	0.13	0.5	2.0	3.0[2]	-	25.0
BH04	0	0.04	0.2	2.7	4.4	18.0	25.2
BH05	0	0.03	0.3	-	-	-	3.0
BH06	0	0.15	0.3	-	-	-	3.0

Notes:

1. End of hole
2. Localised BEDROCK B from 11.6 m to 19.2 likely due to geological structures.

4.3.2 Geological Structure

The observed geological structures were extracted from the core of all the boreholes and the borehole imaging of BH03.

Figure 4 presents stereoplots with the orientation of identified geological structures. A large bedding related shear was interpreted to have been encountered in BH03 at approximately 16 to 17 m depth (approx. dip 25° to 27° and dip direction 17° to 41°). Some of the observed geological structures are inferred to be associated with the shear including joints and seams. There is some remaining uncertainty as to the large-scale orientation of this structure which can't be reliably obtained through a single borehole. PSM shall be requested to review the proposed basement (layout, depth, locations, etc.) against the geological structures when the basement details are available. If the geotechnical structure is critical to the design, further investigations may be required.

4.4 Groundwater

Spot measurement of the water level was taken on 20 February 2020 in BH03 following completion of the drilling. The measured water level in BH03 was 14.20 m below surface level.

Measurements of the water level were taken at 1.0-hour intervals from 20 February 2020 to 06 March 2020 in BH03 (standpipe piezometer). The water level in BH03 had changed during this period and no water was found over the monitoring period. Figure 3 presents the results of groundwater level monitoring in the standpipe piezometer (BH03). Monitoring will continue for the next 3 months.

5. Discussion and Recommendations

5.1 Bulk Excavation Conditions

We expect excavation to depths of up to 12 m is required for the proposed development which comprises four (4) basement levels below ground. Based on the geotechnical investigation, excavation in the Asphalt, Concrete, FILL, RESIDUAL SOIL and highly weathered BEDROCK unit, e.g. BEDROCK A, should be achievable using conventional earth moving equipment with minor rock breaking. Excavation of more competent BEDROCK units (BEDROCK B, and BEDROCK C) may require the use of hydraulic impact breakers, rock saws and/or rock grinders and must be undertaken by contractors with suitable experience in rock excavation close to existing structures. Please note that auger refusal using a TC-bit was encountered in most boreholes.

Prospective contractors should make their own assessment of excavatability based on the borehole logs and their site inspection and experience. It is our experience that excavatability is heavily dependent on both the operator and the plant used. Heavy rock breaking equipment will generate vibrations that may impact on neighbouring structures. Where controls on vibrations are required, the contractor should consider the use of smaller hammers, rock saws and grinders to undertake the excavation. The contractor should recognise that there is a potential for damage to adjacent buildings or infrastructure (if any) and consider this in its planning.

5.2 Disposal of Excavated Material

We anticipate that some earthworks may be required as part of the redevelopment. We consider that asphalt is not suited for reuse as engineered fill (but could be potentially blended in small quantities) but may be reused for landscaping purposes. It is our opinion that most of the remaining cut material (i.e., FILL, RESIDUAL SOIL and BEDROCK) would be suitable for reuse on the site as engineered fill.

We envisage that the earthworks proposed at the site will require the preparation of a detailed fill specification developed following the guidelines in AS 3798 (2007), "Guidelines on earthworks for commercial and residential developments". Preparation of this fill specification is outside the scope of this report.

The majority of the basement excavation material is likely to comprise Virgin Excavated Natural Material (VENM). For disposal purposes, it is likely the RESIDUAL and BEDROCK units (Laminate and Siltstone) are able to be validated as VENM. However, the Fill unit encountered can either be disposed as General Solid Waste or validated as Excavated Natural Material (ENM).

The most economical outcome may be to re-use the existing Fill on site as much as possible and dispose the VENM off site. VENM verification would be required during construction for material disposal. Based on the Fill observed during the geotechnical investigation, we consider it likely that the existing fill will be able to be so validated, but this can only be done once the material is stockpiled on site during construction.

The existing fill will be suitable for incorporating in any earthworks on site. We note that the earthwork contractor should go to considerable effort to segregate different materials and not dilute/contaminate the VENM with Fill.

5.3 Permanent and Temporary Batters

The excavation to construct the new building will be in proximity to existing buildings, vehicle and pedestrian pavements and utilities. Subject to the sensitivity and proximity of these elements, the excavation may require support and/or protection. This should be assessed on a case by case basis.

The batter slope angles shown in Table 5 are recommended for the design of batters up to a nominal 5 m height subject to the following recommendations:

- The batters shall be protected from erosion. Permanent batters will require face protection such as vegetation or shotcrete
- Permanent batters shall be drained for a distance behind the faces at least equal to the height
- Temporary batters shall not be left unsupported for more than 3 months without further advice, and inspection by a suitably experienced geotechnical engineer should be undertaken following significant rain events
- No buildings, surcharge loads or services should be located within 1 batter height of the crest.

If the conditions above cannot be met, further advice should be sought.

Where Fill is not engineered/controlled fill, batter slope angles should be assessed by a suitable experienced geotechnical engineer.

Exposed rock faces should be inspected by a geotechnical engineer or engineering geologist to assess the need for localised rock bolting to control adverse jointing in the BEDROCK unit and shotcreting for overall face support and weather protection.

Table 4 - Batter Slope Angles

Unit	Temporary	Permanent
FILL	2H: 1V	2.5H: 1V
RESIDUAL SOIL	1.5H: 1V	2H: 1V
BEDROCK A	1H: 1V	1.5H: 1V
BEDROCK B*	0.5H: 1V	1H: 1V
BEDROCK C*	Vertical (subject to design)	1H:4V with surface protection and drainage (subject to design)

Note: * - Batters to consider the geological structures that are identified from the investigation.

Steeper batters may be possibly subject to further advice, probably including inspection during construction and shotcreting and rock bolting etc.

5.4 Excavation Support

Permanent cuts in the FILL, RESIDUAL SOIL and BEDROCK unit's steeper than the recommended permanent batter slopes in Table 5 will need to be supported by some form of retaining structure.

The selection of the appropriate retention system is a matter of design. The designer should consider the following factors in making its selection:

- Technical factors

  - Performance
  - Ground conditions (this is addressed below with the design parameters)
  - Surcharge loading and
  - Proximity of structures, buildings and roads, etc.
- Non- technical factors
  - Cost (to build and to maintain)
  - Other constraints such as real estate, neighbouring site / boundary, aesthetics, legislation, etc.

The design of these structures should be based on the following geotechnical properties:

- Effective strength parameters in Table 6 when assessing the earth pressure on retaining structures
- A lateral pressure of 10 kPa for vertical cuts in the BEDROCK units (BEDROCK B, and BEDROCK C). This is to allow for blocks and rock wedges formed due to adverse defects that may exist within the unit
- Water pressure (depending on the type of structure)
- Geotechnical structure.

Note that design of retention systems may be based on either K_a or K_o earth pressures. Design using active earth pressures provides the minimum lateral earth pressure that must be supported to avoid failure and requires a wall that can rotate or translate to allow the pressures to reduce to these values (vertical and lateral movements up to 2% of height may occur, typical movements will be much less).

Where the design is based on K_o pressures, construction should be carefully controlled to avoid unwanted effects. It should be noted that designing for K_o pressures do not, of themselves, ensure that movement does not occur. Movements are controlled by the construction method, especially sequence.

Both surface and sub-surface drainage needs to be designed and constructed properly to prevent pore water pressures from building up behind the retaining walls and in the retained material. Otherwise, appropriate water pressures must be included in the design.

Where excavations are proposed in the vicinity of existing structures designers shall consider the effects of the excavation including horizontal and vertical deflections on the neighbouring structures.

If relying on passive support from embedment of piles into the BEDROCK units. (e.g. cantilever piled wall or propped or anchored piled wall) the designer shall ignore the support provided in the upper 1.0 m of embedment and can adopt a lateral resistance of one third of the allowable bearing pressure (ABP) in Table 6.

Table 5 - Engineering Parameters of Inferred Geotechnical Units

Inferred Unit	Bulk Unit Weight (kN/m3)	Soil Effective Strength Parameters		Ultimate Bearing Pressure Under Vertical Centric Loading (kPa)1, 2	Allowable Bearing Pressure (ABP) Under Vertical Centric Loading (kPa)1, 3	Ultimate Shaft Adhesion (kPa)4	Elastic Parameters	
		c' (kPa)	ϕ' (deg)				Long Term Young Modulus (MPa)	Poisson's Ratio
FILL	18	0	30	N/A			10	0.3
RESIDUAL SOIL	18	0	30	450	150	N/A	15	0.3
BEDROCK A	22	10	30	3000	700	50	50	0.25
BEDROCK B	22	N/A	N/A	6000	3000	350	200	0.25
BEDROCK C	24	N/A	N/A	60000	12000	1500	900	0.25

Notes: 1. Minimum plan dimension of 1.0 m and a minimum embedment depth of 0.5 m.

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

5.5 Foundations

5.5.1 Preamble

In general, the designer should note the following with regards to foundation design for both piles and shallow pad footings:

- The bearing capacities provided are contingent on piles or footings being vertically and centrally loaded. Further advice should be sought if the footings are not vertically centrically loaded
- Where adjacent foundation details differ (e.g. pile and pad, differing loads or ground conditions) differential settlement will need to be assessed
- Deflections should be checked using the recommended elastic parameters in Table 6.

5.5.2 Shallow pad footings

Pad footings can be proportioned on the basis of an allowable bearing pressure (ABP) for centric vertical loads provided in Table 6.

We note that an allowable bearing pressure (ABP) is not a soil property. It depends on many factors such as the size of the footings, the embedment depth, the load direction and eccentricity, the stiffness of the footing, the adopted factor of safety (FOS), as well as the soil properties. As footings get bigger or deeper the capacity increases rapidly. As the load gains eccentricity or becomes inclined, the capacity reduces rapidly.

Settlements can be estimated using the elastic parameters provided in Table 6. When assessing the settlement of the shallow footings, the designer needs to consider the additional ground settlement due to the total building load on both shallow and deeper units. The differential settlement due to the building load shall also be assessed.

Foundations conditions at the proposed shallow pad footings locations should be inspected by a suitably qualified geotechnical engineer prior to the pouring of concrete.

5.5.3 Piles

We envisage that piles would be founded within the BEDROCK unit.

Piles should be designed in accordance with the requirements in AS 2159 (2009), Piling – Design and Installation. The parameters provided in Table 6 may be adopted in the design of piles founded in Bedrock unit.

The designer should note the following with regards to the pile design:

- The ABP needs to be confirmed by a geotechnical engineer through pile inspections prior to pouring concrete
- Under permanent load, the contribution of side adhesion for soils including FILL and RESIDUAL SOIL should be ignored
- Deflection should be checked using the recommended elastic parameters in Table 6
- Where adjacent foundation details differ (e.g., pile and pad, differing loads or ground conditions), differential settlement should also be assessed.

Should higher bearing capacities be required of the BEDROCK units, this may be available subject to further advice.

With regards to the pile design we recommend that:

- A geotechnical strength reduction factor, Φg = 0.60 (AS2159 CL. 4.3.2) be adopted for a high redundancy system for an assessed average risk rating (ARR) between 2.5 and 3.0. This should be reviewed to suit the

specific design and appropriate pile testing proposed by the structural designers in accord with the requirements of AS2159

- It may be possible to increase the pile reduction factors, if the details of the proposed pile installation procedures indicate a high level of quality control with regards to concrete placement, base cleanliness, etc.
- If a geotechnical strength reduction factor, Φg = 0.40 is adopted then no pile testing will be required (AS2159 Clause 8.2.4 (b)).

5.6 Corrosivity / Aggressivity

Table 4.8.1 of AS3600-2009 "Concrete Structures" provides criteria for exposure classification for concrete in sulphate soils based on sulphates in soil and groundwater, and pH of soil. On the basis of the sulphate and pH testing completed, we assess the exposure classification for concrete in sulphate soils to be A1.

Table 6.4.2(C) of Australian Standard AS2159:2009, Piling – Design and Installation provides criteria for exposure classification for concrete piles based on sulphates in the soil and groundwater, soil and groundwater pH, and chlorides in groundwater. On the basis of the soil sulphates and pH testing completed we assess the exposure classification for concrete piles in the soil to be non-aggressive for the site.

Table 6.5.2(C) of Australian Standard AS2159:2009, Piling – Design and Installation provides criteria for exposure classification for steel piles based on resistivity, soil and groundwater pH, and chlorides in soil and groundwater. On the basis of soil chlorides and pH testing completed we assess the exposure classification for steel piles in the soil to be non-aggressive for the site.

5.7 Dewatering

Where excavation below the water table is proposed for the basement, construction stage dewatering may be required.

We note that recent experience indicates that the New South Wales Office of Water (NoW) have been conditioning approval of basement excavations on the basis of the following:

- Temporary dewatering allowed during excavation. Permits will need to be sought for both extraction of the water and disposal
- No inflows into the basement allowed in the permanent condition. That is the final basement needs to be water tight, i.e. tanked. Such a requirement results in the basement floor slab, and the walls needing to be designed for the full hydrostatic load below a maximum foreseeable water table. This requirement, if enforced by the regulatory authorities, may influence decisions regarding the feasibility of deep basement excavations. It is our experience that NoW may relax the requirement for tanking where monitoring of groundwater levels in combination with analysis of inflows in the permanent condition indicate yearly inflow into the excavation of less than 3 ML/yr and that the extraction of groundwater has no adverse impact on other groundwater users
- The developments are usually conditioned on monitoring of groundwater levels, assessment and estimation of temporary inflows during construction, and assessment of effect on neighbouring structures.

Given the topography, we expect that a decent pump out system should suffice for basements excavation on this site.

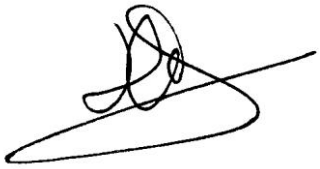
PSM can provide advice on the above, but this is outside the scope of this report.

6. General

If at any time, the conditions are found to vary from those described in this report, further advice should be sought.

Please do not hesitate to contact the undersigned if you have any questions.

For and on behalf of
PELLS SULLIVAN MEYNINK



HARSHAN PANCHALINGAM
SENIOR GEOTECHNICAL ENGINEER

AGUSTRIA SALIM
PRINCIPAL

Encl.

Figure 1	Site Investigation Location Plan
Figure 2	Selected Site Photos
Figure 3	Piezometric Level Monitoring Results
Figure 4	Stereoplots
Attachment A	Engineering Borehole Logs
Attachment B	Core Photography
Attachment C	Point load strength index test results
Attachment D	Borehole Imaging
Attachment E	Aggressivity Lab Testing Results

LEGEND

- CORED BOREHOLE (UP TO 17M)
- CORED BOREHOLE (UP TO 25M)
- AUGERED BOREHOLE (UP TO 3M)
- SITE BOUNDARY

NOTES

1. BOREHOLE LOCATIONS ARE APPROXIMATE

0 25 50
50m

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Goodman Property Services (Aust) Pty Ltd
85 Waterloo Road, Macquarie Park
Geotechnical Investigation

LOCALITY PLAN

PSM3411-104L | Figure 1

Photo 1 - Main internal road of the site looking south-east

Photo 2 - Carpark area in the north-west of the site looking south-west

Goodman
85 Waterloo Road
Macquarie Park, NSW
GEOTECHNICAL INVESTIGATION
GENERAL SITE PHOTOS

PSM3411-104L	**Figure 2.1**

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Photo 3 - Carpark areas in the north of the site looking north-east

Photo 4 - Setting up the drilling rig -Hanjin D8

Goodman

85 Waterloo Road

Macquarie Park, NSW

GEOTECHNICAL INVESTIGATION

GENERAL SITE PHOTOS

PSM3411-104L	**Figure 2.2**

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Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no.: PSM3411.10

PROJECT: 85 Water Loo Road

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER: BH03
PIEZOMETER: BH03
COLLAR EASTING: 326138 m E
COLLAR NORTHING: 6260666 m N
COLLAR RL(m): RL 55.90 m AHD

DRILLING CONTRACTOR: B&G Drilling
RIG: HANJIN - D8
DEPTH OF HOLE (m): 25.00
BOREHOLE INCLINATION: -90°
PIEZO INSTALLATION DATE: 20/02/2020
SUPERVISED BY: NTH

Tick boxes

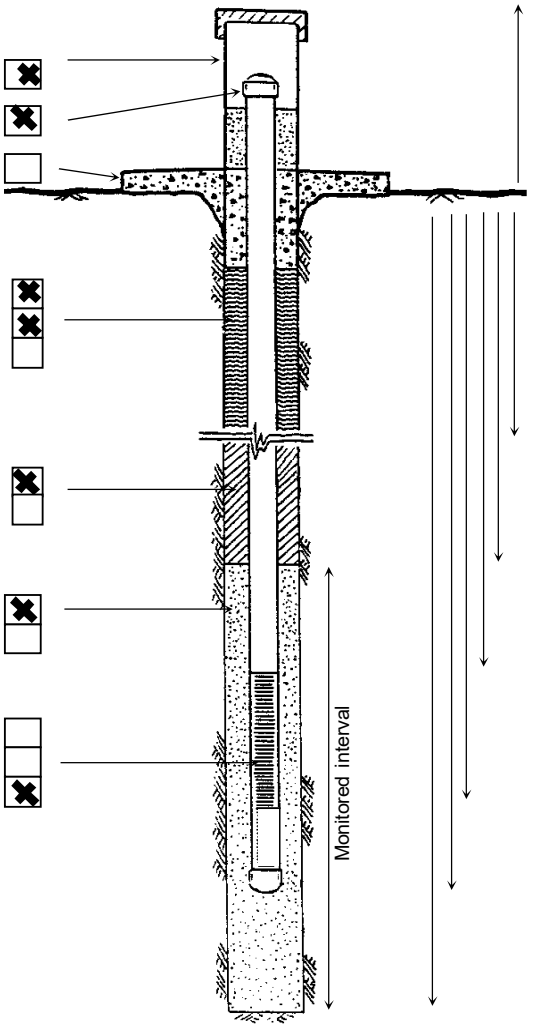
Steel protective well cover [x]
PVC cap [x]
Concrete colar [ ]

Back fill type:
Cement bentonite [x]
Soil [x]
None [ ]

Seal:
Bentonite pellets [x]
Other [ ]

Gravel type:
2-5mm gravel [x]
Other [ ]

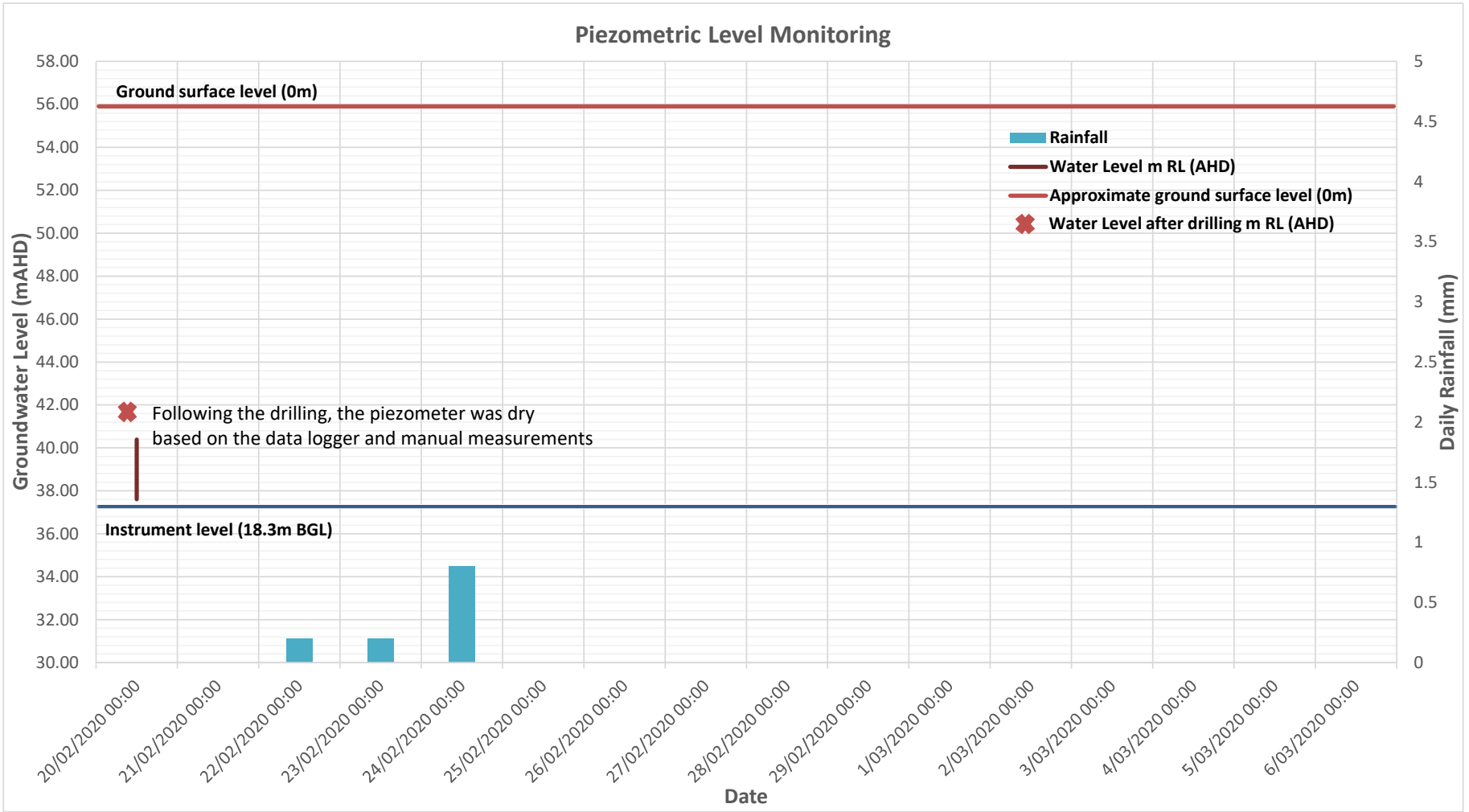
Perforation type:
Drill holes [ ]
Hack saw cuts [ ]
40um machine slots [x]



Complete dimensions if appropriate

Height of stickup (m)	NONE
Diameter of PVC (mm)	60 mm
Depth to top of seal	12m BGL
Depth to top of gravel pack	13m BGL
Depth to top of screen	14m BGL
Depth to base of screen	23m BGL
Depth to base of piezo	23m BGL
Depth to base of gravel	25m BGL

COMMENTS: Water level after installation 20/02/2020 (3.00pm) - depth 14.20 mm (BGL)



Notes:

1. Screened lithology: Hawkesbury Sandstone
2. Instrument RL (m AHD): 37.6 (18.3 m BLG)
3. Measured water level (using tape measure) on 20/02/2020 3:00 AM: RL 41.7 m AHD (14.2 m BLG)
4. Rainfall data source: Macquarie Park (Willandra Village), New South Wales
   Station number: 066156
5. Data logger installed on 20/02/2020 3:00AM

Pells Sullivan Meynink

Goodman Property Services
85 Waterloo Road, Macquarie Park
Geotechnical Investigation
PIEZOMETRIC LEVEL MONITORING
RESULTS IN BH03

PSM3411-104L	Figure 3

C:\Users\ngoctuan.hoang\Desktop\PSM 3411.10\Eng\Ground Water\[BH03 Monitoring.xlsx]BH03 chart

Pells Sullivan Meynink

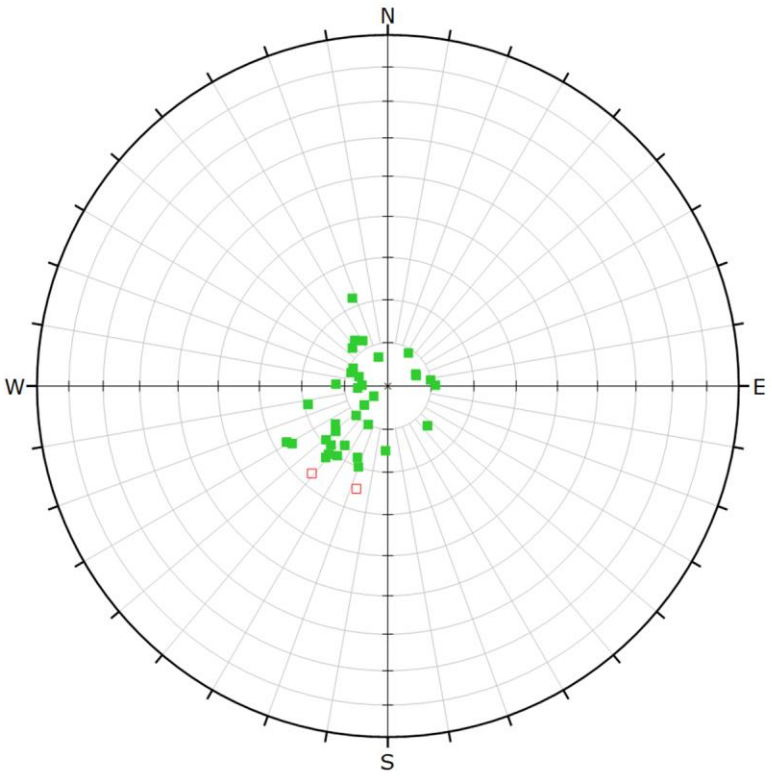
Stereoplot

Job No: PSM3411.10
BOREHOLE TELEVIEWER
BH03 - BEDDING

Project: 85 Waterloo Road
Location: Macquarie Park
Borehole: BH03

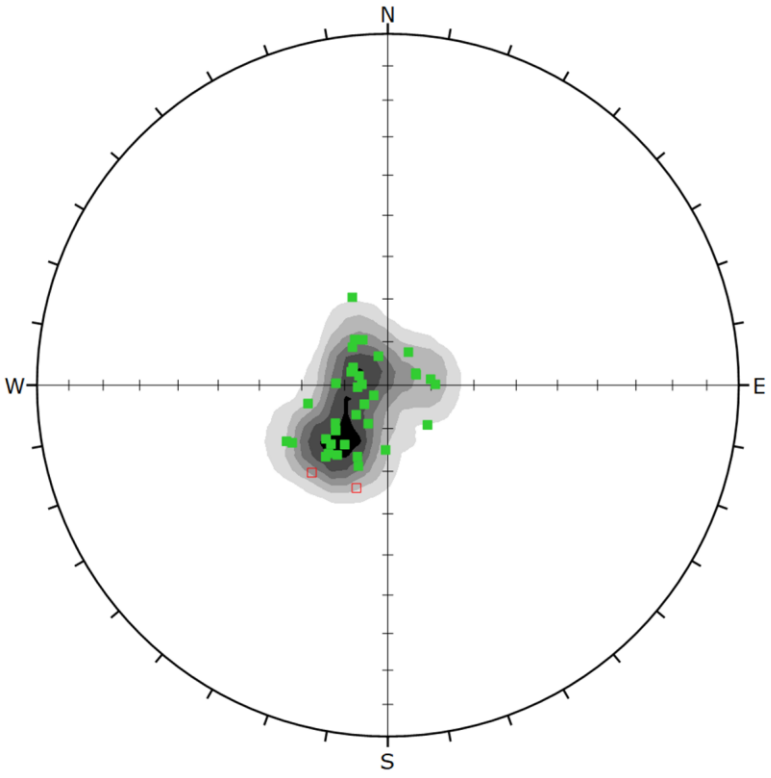
North datum: True North
Borehole Dip/Azi: -90° / -
Defect Type: Bedding, Bedding Shear

Processed by: MAK
Date: 26/03/2020



Symbol	TYPE	Quantity
■	BP	35
□	BSH	2

Plot Mode	Pole Vectors
Vector Count	37 (37 Entries)
Hemisphere	Lower
Projection	Equal Area



Symbol	TYPE	Quantity
■	BP	35
□	BSH	2

Color	Density Concentrations
	0.00 - 4.50
	4.50 - 9.00
	9.00 - 13.50
	13.50 - 18.00
	18.00 - 22.50
	22.50 - 27.00
	27.00 - 31.50

Contour Data	Pole Vectors
Maximum Density	30.28%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	37 (37 Entries)
Hemisphere	Lower
Projection	Equal Area

Pells Sullivan Meynink

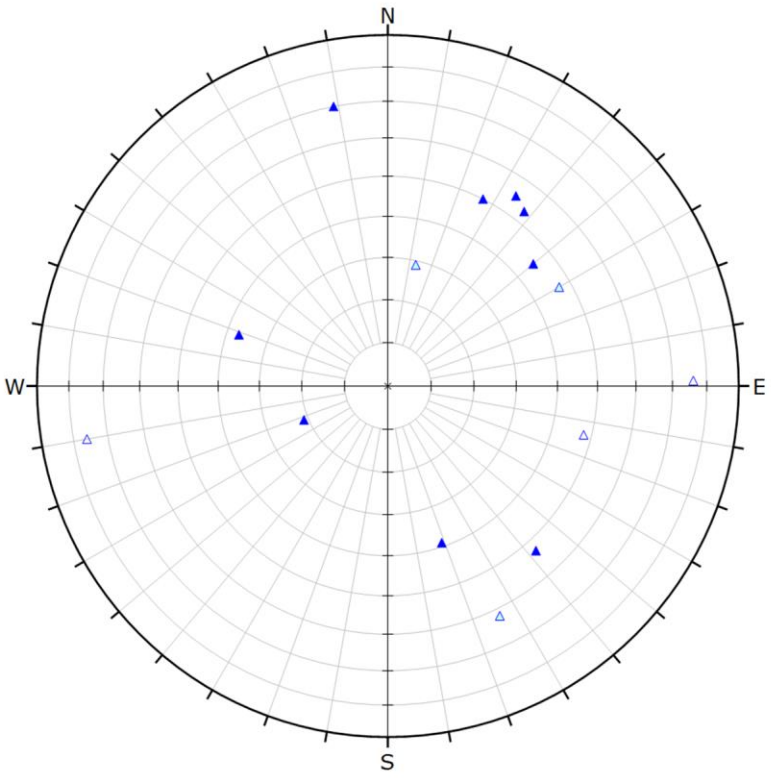
Stereoplot

Job No: PSM3411.10
BOREHOLE TELEVIEWER
BH03 - JOINTS

Project: 85 Waterloo Road
Location: Macquarie Park
Borehole: BH03

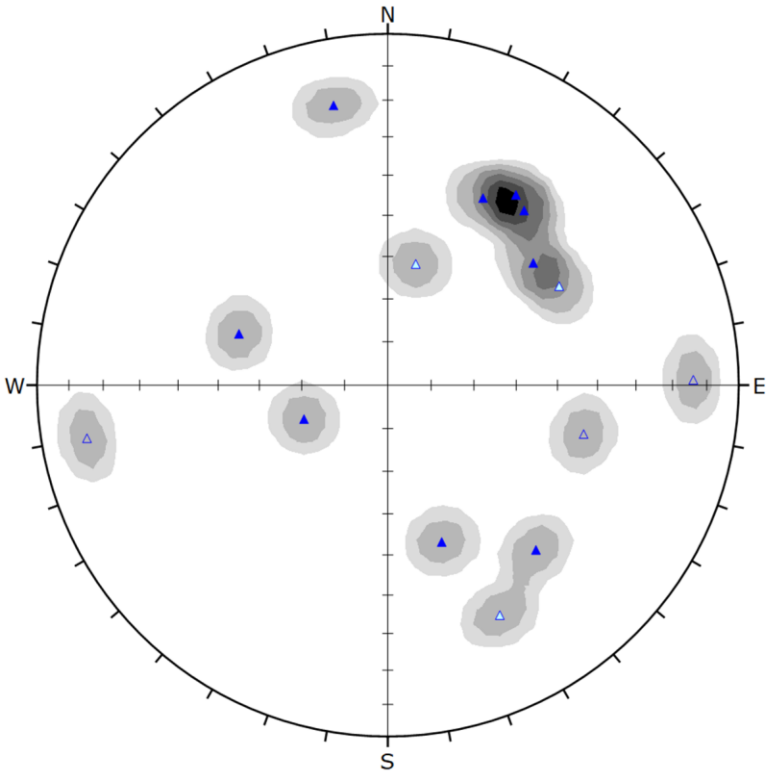
North datum: True North
Borehole Dip/Azi: -90° / -
Defect Type: Joints /Joints Clay Infill /Joints Healed

Processed by: MAK
Date: 26/03/2020



Symbol	TYPE	Quantity
▲	JT	9
△	JTC	3
△	JTH	3

Plot Mode	Pole Vectors
Vector Count	15 (15 Entries)
Hemisphere	Lower
Projection	Equal Area



Symbol	TYPE	Quantity
▲	JT	9
△	JTC	3
△	JTH	3

Color	Density Concentrations
	0.00 - 2.80
	2.80 - 5.60
	5.60 - 8.40
	8.40 - 11.20
	11.20 - 14.00
	14.00 - 16.80
	16.80 - 19.60

Contour Data	Pole Vectors
Maximum Density	18.21%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	15 (15 Entries)
Hemisphere	Lower
Projection	Equal Area

Pells Sullivan Meynink

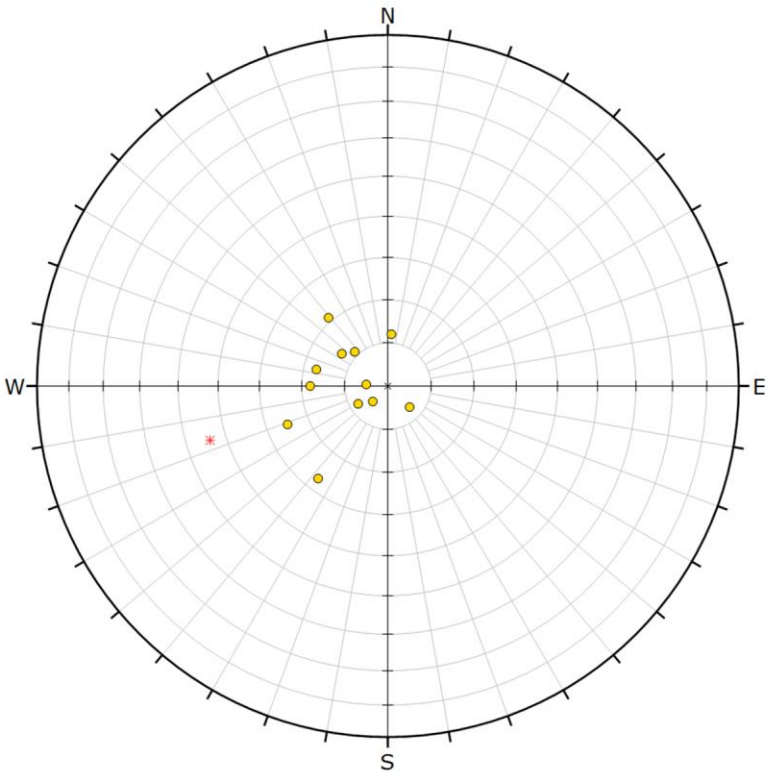
Stereoplot

Job No: PSM3411.10
BOREHOLE TELEVIEWER
BH03 - STRUCTURE

Project: 85 Waterloo Road
Location: Macquarie Park
Borehole: BH03

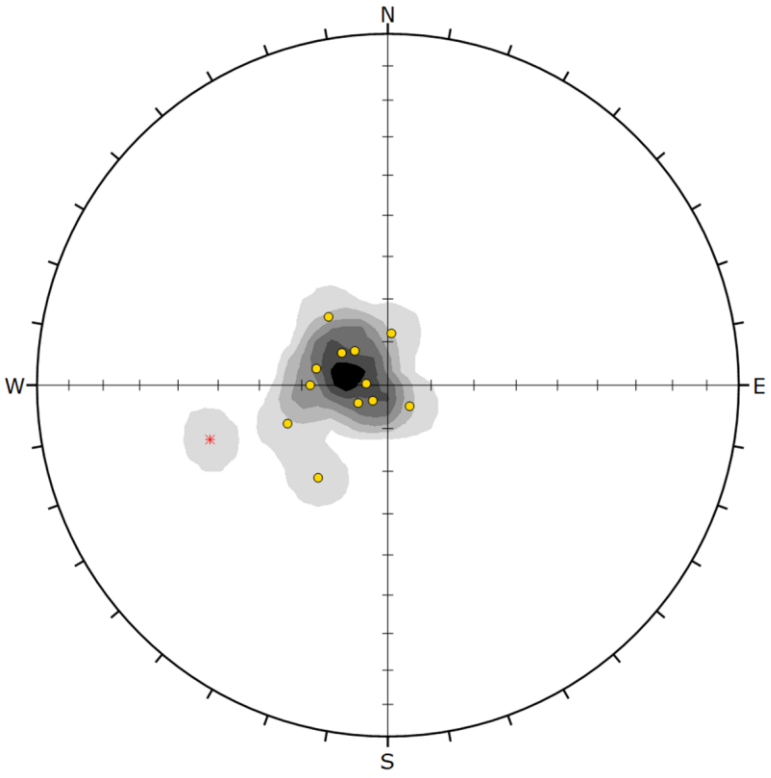
North datum: True North
Borehole Dip/Azi: -90° / -
Defect Type: Seam, Shears

Processed by: MAK
Date: 26/03/2020



Symbol	TYPE	Quantity
○	SM	12
✳	SS	1

Plot Mode	Pole Vectors
Vector Count	13 (13 Entries)
Hemisphere	Lower
Projection	Equal Area



Symbol	TYPE	Quantity
○	SM	12
✳	SS	1

Color	Density Concentrations
	0.00 - 5.00
	5.00 - 10.00
	10.00 - 15.00
	15.00 - 20.00
	20.00 - 25.00
	25.00 - 30.00
	30.00 - 35.00

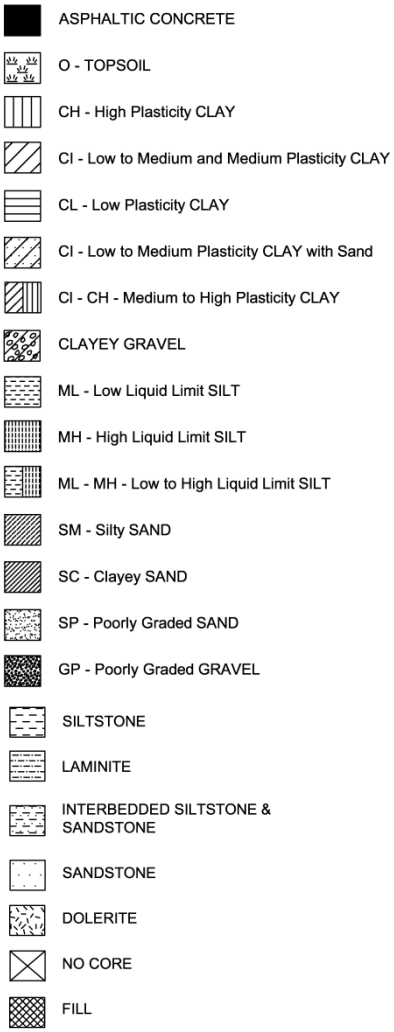
Contour Data	Pole Vectors
Maximum Density	34.14%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	13 (13 Entries)
Hemisphere	Lower
Projection	Equal Area

Appendix A
Geotechnical Engineering Borehole Logs

EXPLANATION SHEET - SOIL DESCRIPTION

GRAPHIC LEGEND



DEFINITIONS

Soil:

In engineering terms, soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

Classification symbol & soil name:

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

Support:

C - Casing
T - Timbering

See rock description for method and samples / field test definitions.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 µm to 2.36 mm
	medium	200 µm to 600 µm
	fine	75 µm to 200 µm

MOISTURE CONDITION

CONDITION	FIELD GUIDE
Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
Moist	Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere
Wet	As for moist but with free water forming on hands when handles

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH SU (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort
Soft	12 – 25	A finger can be pushed into the soil to about 25mm depth
Firm	25 – 50	The soil can be indented about 5mm with the thumb, but not penetrated
Stiff	50 – 100	The surface of the soil can be indented with the thumb, but not penetrated
Very Stiff	100 – 200	The surface of the soil can be marked, but not indented with thumb pressure
Hard	>200	The surface of the soil can be marked only with the thumbnail
Friable	-	Crumbles or powders when scraped by thumbnail

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	<15
Loose	15 – 35
Medium Dense	35 – 65
Dense	65 – 85
Very Dense	>85

Where no SPT data, the following descriptions are used:

Loose: Can be removed from exposure by hand in a disaggregated form.

Compact (C) Only removed from exposure with an implement, material readily disaggregated by physical means.

Cemented (Ce) Only removed from exposure with an implement, material cannot be disintegrated / remoulded in air/ water.

EXPLANATION SHEET - SOIL DESCRIPTION

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

SOIL STRUCTURE

ZONING		CEMENTING	
Layers	Continuous across exposure of sample	**Weakly Cemented**	Easily broken up by hand in air or water
Lenses	Discontinuous layers of lenticular shape	**Moderately Cemented**	Effort is required to break up the soil by hand in air or water
Pockets	Irregular inclusions of different material	**Cemented**	Only removed from exposure by implement, material does not disaggregate
		Compact	Only removed from exposure by implement, material readily disaggregated by physical means

GEOLOGICAL ORIGIN

Weathered in place soils:

Extremely weathered	Structure and fabric of parent rock visible
Residual Soil	Structure and fabric of parent rock not visible

Transported soil:

Aeolian	Deposited by wind
Alluvium	Deposited by streams and rivers
Colluvium	Deposited on slopes (transported downslope by gravity)
Lacustrine	Deposited by lakes
Marine	Deposited in ocean basins, bays, beached and estuaries

Man Made:

Fill	Fill may be significantly more variable between tested locations than naturally occurring soils

COMMON DEFECTS IN SOIL

TERM	DEFINITION
Parting	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (e.g. bedding). May be open or closed.
Joint	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length.
Sheared Zone	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.
Sheared Surface	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.
Softened Zone	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.
Tube	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter
Tube Cast	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases, the soil that makes up the tube cast is cemented.
Infilled Seam	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries that cuts through a soil mass. Formed by infilling of open joints.

EXPLANATION SHEET - SOIL DESCRIPTION

SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 60 mm AND BASING FRACTIONS ON ESTIMATED MASS)*								USC	PRIMARY NAME
COARSE GRAINED SOILS More than 50% of materials less than 63 mm is larger than 0.075 mm	(A 0. 475 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.0 mm	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.				GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing.				GP	GRAVEL
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)				GM	SILTY GRAVEL
				Plastic fines (for identification procedures see CL below)				GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes missing				SW	SAND
				Predominantly one size or a range of sizes with some intermediate sizes missing.				SP	SAND
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).				SM	SILTY SAND
				Plastic fines (for identification procedures see CL below).				SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm			IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.						
		SILTS & CLAYS Liquid limit less than 50	**Dry strength**	**Dilatancy**	**Toughness**				
			None to Low	Quick to slow	None			ML	SILT
			Medium to High	None	Medium			CL	CLAY
			Low to medium	Slow to very slow	Low			OL	ORGANIC SILT
		SILTS & CLAYS Liquid limit greater than 50	Low to medium	Slow to very slow	Low to medium			MH	SILT
			High	None	High			CH	CLAY
			Medium to High	None	Low to medium			OH	ORGANIC CLAY
HIGHLY ORGANIC SOIL Readily identified by colour, odour, spongy feel and frequently by fibrous texture								Pt	PEAT

• Low plasticity – Liquid Limit W_L less than 35%. • Medium plasticity – W_L between 35% and 50%.

*After AS1726 (1993)

EXPLANATION SHEET - ROCK DESCRIPTION

DEFINITIONS

Rock Substance:
In engineering terms rock substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material may be isotropic or anisotropic.

Defect:
Discontinuity or break in the continuity of a substance or substances.

Mass:
A body of material that is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

Method:

AD/T	Auger drilling with tcbit
AD/V	Auger drilling with vbit
AS	Auger screwing
AT	Air track
B	Dozer blade
BH	Backhoe bucket
CT	Cable tool
DB	Washbore drag bit
DT	Diatube
E	Excavator
EH	Excavator with hammer
HA	Hang auger
HMLC	HMLC core barrel
HQ3	Coring 63.5mm diameter, triple tube, wireline
MZ	Mazier
N	Natural exposure
NMLC	NMLC core barrel
NQ3	Coring 45.1mm diameter, triple tube, wireline
PQ3	Coring 83.1mm diameter, triple tube, wireline
Pushed SPT	Pushed SPT
PT	Push tube
R	Ripper
RR	Rock roller
SPT	Driven SPT
WB	Washbore
X	Existing excavation

Core Quality:

TCR	Total Core Recovered (%)
RQD	Rock Quality Designation (%)

Samples and Field Tests:

B	Bulk Disturbed Sample
BLK	Block sample
C	Core sample
CBR	CBR mould sample
D	Small disturbed sample
ES	Soil sample for environmental testing
EW	Water sample for environmental testing
G	Gas sample
LB	Large bulk disturbed sample
M	Mazier type sample
P	Piston sample
SPT	Standard Penetration Test
U	Undisturbed push in sample
W	Water sample

Rock Strength:

A	Axial point load test result (Is50)
D	Diametral point load test result (Is50)

Water:

▻ Inflow
◅ Partial Loss
◄ Complete Loss

SUBSTANCE DESCRIPTIVE TERMS

Rock name:
Simple rock names are used rather than precise geological classification

Particle size (for sandstone):
Coarse - Mainly 0.6mm to 2mm
Medium - Mainly 0.2mm to 0.6mm
Fine - Mainly 0.05mm (just visible) to 0.2mm

Fabric:
Massive - No layering or penetrative fabric
Indistinct - Layering or fabric visible. Little effect on properties
Distinct - Layering or fabric is easily visible. Rock breaks more easily parallel to layering of fabric

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

ROCK SUBSTANCE STRENGTH

ABBR	TERM	POINT LOAD INDEX, IS50 (MPA)	FIELD GUIDE
EL	Extremely Low	≤0.03	Easily remoulded by hand to a material with soil properties
VL	Very Low	>0.03≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces up to 30mm thick can be broken by finger pressure.
L	Low	>0.1≤0.3	Easily scored with a knife; indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	>0.3≤1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
H	High	>1≤3	A piece of core 150mm long by 50mm cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
VH	Very High	>3≤10	Hand specimen breaks after more than one blow of a pick; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break; rock rings under hammer.

EXPLANATION SHEET - ROCK DESCRIPTION

CLASSIFICATION OF WEATHERING

ABBR	TERM	FIELD GUIDE
F	Fresh	Rock substance unaffected by weathering
SW	Slightly Weathered	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance (usually by limonite) has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance
MW	Moderately Weathered	The whole of the rock substance is discoloured, usually by iron staining or bleaching, to the extent that the colour of the fresh rock is no longer recognisable.
HW	Highly Weathered	Rock strength is changed by weathering. The whole of the rock substance is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Some minerals are decomposed to clay minerals. Porosity may be increased by leaching or may be decreased due to the deposition of minerals in pores.
EW	Extremely Weathered	Material is weathered to such an extent that it has soil properties, i.e.; it either disintegrates or can be remoulded in water. Original rock fabric still visible.

COMMON DEFECTS IN ROCK MASS

ABBR	TERM	FIELD GUIDE
FT	Fault	Fracture long which displacement is recognisable
SS	Shear Seam	A fracture along which movement has taken place but no displacement is recognisable. Evidence for movement may be slickensides, polishing and/or clay gouge
SZ	Sheared Zone	Zone of multiple closely spaced fracture planes with roughly parallel planar boundaries usually forming blocks of lenticular or wedge shaped intact material. Fractures are typically smooth, polished or slickensided; and curved
BP	Bedding Parting	Arrangement in layers of mineral grains or crystals parallel to surface of deposition along which a continuous observable parting occurs
SM	Seam	Seam of soil substance, often with gradational boundaries. Formed by weathering of the rock substance in place
IS	Infilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1mm thick may be described as veneer or coating on joint surface
JT	Joint	A single fracture across which rock has little or no tensile strength and is not obviously related to rock fabric
CO	Contact	Surface between two lithologies
CZ	Crushed Zone	Zone with roughly parallel, planar boundaries (commonly slickensided) containing disoriented usually angular rock fragments of variable size often in a soil matrix.
VN	Vein	Fracture in which a tabular or sheet-like body of minerals have been intruded
FZ	Fractured Zone	A zone of closely spaced defects (mainly joints, bedding, cleavage and/or schistosity) comprised of core lengths in the order of 50mm or less.
BSH	Bedding Shear	A shear formed along a bedding plane
DB	Drilling Break	Drilling induced break

SHAPE TERMS

ABBR	TERM	FIELD GUIDE
PR	Planar	The defect does not vary in orientation
CU	Curved	The defect has a gradual change in orientation
UN	Undulating	The defect has a wavy surface
ST	Stepped	The defect has one or more well defined steps
IR	Irregular	The defect has many sharp changes of orientation

ROUGHNESS TERMS

ABBR	TERM	FIELD GUIDE
SL	Slickensided	Grooved or striated surface, usually polished
POL	Polished	Shiny smooth surface
S	Smooth	Smooth to touch. Few or no surface irregularities
RF	Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
VR	Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.

COATING TERMS

ABBR	TERM	FIELD GUIDE
CN	Clean	No visible coating
SN	Stained	No visible coating but surfaces are discoloured
VR	Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
CT	Coating	A visible coating up to 1mm thick. Thicker soil material is usually described using appropriate defect terms (e.g., infilled seam). Thicker rock strength material is usually described as a vein

INFILLING MATERIAL

ABBR	TERM
CA	Calcite
Clay	Clay
Fe	Iron Oxide
Fe Clay	Iron Oxide Clay
KT	Chlorite
MS	Secondary Mineral
MU	Unidentified Mineral
Qz	Quartz
X	Carbonaceous
RF	Rock fragments
G	Gravel
S	Sand
Z	Silt

Borehole ID

BH01

Engineering Log - Non Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	23/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	24/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326210.0 m E 6260738.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting:	Comacchio Geo205	Inclination:	-90°	RL Surface:	53.90 m		
Hole Diameter:	51.9 mm	Bearing:		Datum:	AHD	Operator:	Stratacore

Drilling Information								Soil Description				Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/T		N	Not Observed	SPT 1.00-1.10 m 19, Refusal N=R		52.9	1		GC-GM	ASPHALT				0.00: PAVEMENT 0.04: INFERRED FILL
										Silty GRAVEL: medium grained, to 10 mm, sub-angular to angular, dark grey & black.		D		
									CL-ML	Silty CLAY: low plasticity, pale grey, red & brown; ripped siltstone and ironstone up to 10 mm.	D to M	VSt to H		0.30: INFERRED NATURAL
										LAMINITE: dark, pale grey & orange, extremely weathered, very low strength, iron staining.				1.00: INFERRED BEDROCK SPT recovery 100mm
						51.9	2			Continued on cored borehole sheet				
						50.9	3							
						49.9	4							

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
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
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	23/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	24/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326210.0 m E 6260738.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: Comacchio Geo205 | Inclination: -90° | RL Surface: 53.90 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: Stratacore

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
					52.9	1						
					51.9	2		Continued from non-cored borehole sheet				
NMLC	Not Observed	56	Is(50) d=1.112 a=1.193 MPa					SANDSTONE: medium grained, pale grey, orange & red, developed rock fabric and indistinct thinly laminated cross bedding (28°), iron staining.				CZ, 0°, RF, PR, =70 mm BP, 2°, CN, PR, RF BP, 10°, CN, PR, RF
								2.35m - Becomes well developed rock fabric and distinctly laminated bedding				BP, 6°, FE, PR, RF BP, 12°, FE, CU, RF BP, 11°, FE, PR, RF
								LAMINITE: dark grey & orange, developed rock fabric and distinct thinly laminated bedding (50%-60% siltstone, 40%-50% sandstone - medium-grained size), iron staining.				SM, 0°, CL, PR, =30 mm SM, 2°, CL+FE, PR, =10 mm BP, 7°, FE SN, PR, RF SM, 0°, CL, PR, =130 mm
					50.9	3		NO CORE: 140mm				BP, 4°, CL, PR, S BP, 5°, CL, PR, S
		78	Is(50) d=1.348 a=1.412 MPa					3.19m - Becomes well developed rock fabric and indistinctly thinly laminated bedding				BP, 2°, CN, PR, S BP, 3°, CL+FE, PR, RF BP, 5°, FE, PR, RF BP, 0°, FE SN, PR, RF BP, 2°, FE, PR, S BP, 4°, CL, PR, S BP, 7°, CN, PR, S BP, 8°, FE SN, PR, RF
								SANDSTONE: fine to medium grained, pale grey & orange, developed rock fabric and indistinct thinly laminated cross bedding (20°), iron staining.				
					49.9	4		3.93m - Becomes pale grey only				BP, 7°, FE SN, PR, RF
			Is(50) d=0.94 a=1.058 MPa									BP, 10°, CN, UN, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	23/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	24/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326210.0 m E 6260738.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: Comacchio Geo205 Inclination: -90° RL Surface: 53.90 m
Barrel Type and Length: Bearing: Datum: AHD Operator: Stratacore

Drilling Information							Rock Substance			Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	78	Is(50) d=0.712 a=1.51 MPa					LAMINITE: pale & dark grey, well developed rock fabric and indistinct thinly laminated bedding (30%-40% siltstone, 60%-70% sandstone - medium-grained size).				BP, 12°, CN, PR, RF BP, 12°, CN, PR, RF BP, 0°, CN, PR, RF
								NO CORE: 80mm				
					47.9	6		SANDSTONE: medium grained, pale grey, developed rock fabric and indistinct thinly laminated bedding.				SZ, 0°, CN, =80 mm BP, 7°, CN, PR, RF BP, 10°, CN, PR, RF FZ, 0°, FZ, =50 mm BP, 7°, CN, PR, RF CO, 5°, CN, PR, RF BP, 4°, CN, PR, RF
			Is(50) d=0.1 a=0.3 MPa					LAMINITE: pale & dark grey, well developed rock fabric and distinct laminated bedding (60%-70% siltstone, 30%-40% sandstone - medium to coarse-grained size), iron staining.				FZ, 0°, FZ, PR, =30 mm BP, 2°, CN, PR, RF BP, 5°, CN, PR, RF BP, 5°, CN, PR, RF BP, 0°, CN, PR, RF BP, 4°, CZ, PR, RF CZ, 0°, CN, =90 mm BP, 0°, FE SN, PR, RF
		58			46.9	7		SANDSTONE: medium to coarse grained, pale grey, orange & red, developed rock fabric and indistinct laminated crossbedding (20°), iron staining.				BP, 5°, FE SN, PR, RF BP, 7°, FE, PR, RF BP, 10°, CN, PR, RF BP, 5°, FE SN, PR, RF BP, 5°, FE, PR, RF BP, 6°, FE SN, PR, RF BP, 10°, FE SN, PR, RF JT, 45°, FE SN, PR, RF
			Is(50) d=0.2 a=0.8 MPa		45.9	8						BP, 7°, FE SN, PR, RF JT, 42°, FE, PR, RF BP, 12°, FE SN, PR, RF BP, 10°, FE SN, PR, RF
		99	Is(50) d=0.6 a=0.6 MPa Is(50) d=0.9 a=1.4 MPa		44.9	9		9.45m - Becomes pale grey 9.65m - 9.75m: Small band of laminite (dark grey, 70% siltstone and 30% sandstone)				JT, 37°, healed JT BP, 2°, CN, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

PSM

Borehole ID
BH01

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	23/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	24/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326210.0 m E 6260738.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: Comacchio Geo205 | Inclination: -90° | RL Surface: 53.90 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: Stratacore

Drilling Information | **Rock Substance** | **Rock Mass Defects**

Method: NMLC
Water: Not Observed

RQD (%)	Samples and Field Tests	RL (m)	Depth (m)	Material Description	Defect Descriptions / Comments
99	Is(50) d=1.2 a=1.2 MPa			SANDSTONE: medium to coarse grained, pale grey, orange & red, developed rock fabric and indistinct laminated crossbedding (20°), iron staining.*(continued)*	BP, 7°, FE, PR, RF BP, 7°, FE, PR, RF
				10.50m - Becomes pale grey and yellow, very well developed rock fabric and indistinctly thinly laminated cross bedding (14°)	
		42.9	11		
	11.54m ES. Is(50) d=1.3 a=1.3 MPa				BP, 7°, FE SN, PR, RF
91				11.70m - Becomes developed rock fabric and indistinctly thinly laminated bedding	BP, 10°, healed BP BP, 12°, FE, PR, RF BP, 10°, FE SN, UN, RF BP, 12°, healed BP BP, 5°, FE SN, PR, RF
		41.9	12		BP, 5°, CN, PR, RF BP, 6°, CN, PR, RF BP, 6°, CN, PR, RF
	Is(50) d=1 a=0.8 MPa				BP, 2°, CN, PR, RF BP, 3°, CN, PR, RF
		40.9	13		BP, 10°, CN, PR, RF BP, 5°, CN, PR, RF BP, 5°, CN, PR, RF
	Is(50) d=0.8 a=1.2 MPa				BP, 12°, CN, PR, RF BP, 14°, CN, UN, RF BP, 2°, CN, PR, RF
		39.9	14		BP, 7°, FE SN, PR, RF BP, 5°, FE SN, PR, RF
	Is(50) d=1.3 a=1.1 MPa				BP, 7°, FE SN, PR, RF
84					

Column headings: Method; Water; RQD (%); Samples and Field Tests; WPT (Lugeons); RL (m); Depth (m); Graphic Log; Material Description — ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration; Weathering (XW HW MW SW FR); Strength Is(50) ● - Axial ○ - Diametral (VL 0.1 L 0.3 M 1 H 3 VH 10 EH); Defect Spacing (mm) (<20 60 200 600 1000); Defect Descriptions / Comments — Description, alpha/beta, infilling or coating, shape, roughness, thickness, other

Method
AD/T - Auger drilling TC bit
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HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
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Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
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MW - Moderately Weathered
SW - Slightly Weathered
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Strength
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L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	23/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	24/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326210.0 m E 6260738.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: Comacchio Geo205 | Inclination: -90° | RL Surface: 53.90 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: Stratacore

Drilling Information | **Rock Substance** | **Rock Mass Defects**

Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description (ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration)	Weathering (XW HW MW SW FR)	Strength Is(50) (● - Axial, ○ - Diametral) (VL 0.1 L 0.3 M 1 H 3 VH 10 EH)	Defect Spacing (mm) (<20 60 200 600 1000)	Defect Descriptions / Comments (Description, alpha/beta, infilling or coating, shape, roughness, thickness, other)
NMLC	Not Observed	84	Is(50) d=1 a=1 MPa; Is(50) d=0.7 a=0.7 MPa; Is(50) d=1.7 a=1.1 MPa		37.9	16		SANDSTONE: medium to coarse grained, pale grey, orange & red, developed rock fabric and indistinct laminated crossbedding (20°), iron staining.*(continued)*				BP, 0°, FE SN, PR, RF SM, 0°, CL, PR, =30 mm BP, 5°, FE SN, PR, RF JT, 70°, FE SN, PR, RF BP, 10°, CN, PR, RF BP, 6°, FE SN, PR, RF BP, 7°, FE SN, PR, RF BP, 9°, FE SN, PR, RF BP, 15°, FE SN, PR, RF BP, 12°, FE SN, PR, RF BP, 5°, CN, PR, RF BP, 3°, CN, PR, RF
					36.9	17		Hole Terminated at 17.00 m Target depth, hole grouted to surface and reinstated				
					35.9	18						
					34.9	19						

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Borehole ID

BH02

Engineering Log - Non Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	20/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	21/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326181.0 m E 6260702.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting:	HANJIN DB8	Inclination:	-90°	RL Surface:	54.30 m		
Hole Diameter:	125 mm	Bearing:		Datum:	AHD	Operator:	BG

Drilling Information								***Soil Description***				***Observations***
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/T		N	Not Observed	SPT 1.50-1.59 m 25+,Refusal N=R ES 1.65 m		53.3 52.3 51.3 50.3	1 2 3 4			CONCRETE				0.00: PAVEMENT 200mm
									GW	GRAVEL: medium grained, to 20 mm, sub-angular to angular, dark grey & black.	D	D		0.20: INFERRED FILL 0.30: INFERRED NATURAL
									CL-ML	Silty CLAY: low plasticity, pale grey & red; ripped sandstone and ironstone up to 10 mm.	D	St to VSt		
										LAMINITE: pale grey, brown & orange, extremely weathered, very low strength. Some hard clay bands (dark grey and medium plasticity), iron staining.				0.90: INFERRED BEDROCK SPT recovery 90mm
										Continued on cored borehole sheet				

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
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
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	20/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	21/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326181.0 m E 6260702.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 54.30 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
					53.3	1						
					52.3	2		Continued from non-cored borehole sheet				
NMLC	Not Observed	93	Is(50) d=0.05 a=0.05 MPa		51.3	3		LAMINITE: dark grey, brown & orange, developed rock fabric and distinct thinly laminated bedding (70%-80% siltstone, 20%-30% sandstone - fine to medium-grained size), iron staining.				CO, 0°, CL, PR, S BP, 3°, CL, PR, S BP, 5°, CL, PR, S BP, 7°, CL, PR, S SM, 0°, CL, PR, =20 mm SM, 0°, RF, PR, =10 mm JT, 42°, CL, PR, S
		93	Is(50) d=0.3 a=0.6 MPa		50.3	4		SANDSTONE: medium grained, pale grey, orange & red, well developed rock fabric and distinct thinly laminated cross bedding (15°), iron staining. 3.85m - 4.06m - Some carbonaceous distinct bedding 4.20m - 5.60m - Becomes pale grey, developed rock fabric and indistinct thinly laminated bedding				CO, 0°, CL, PR, S SM, 2°, CL+FE, PR, =10 mm SM, 3°, FE, PR, =10 mm BP, 3°, FE SN, PR, RF SM, 12°, CL, PR, =10 mm BP, 7°, X, PR, RF SM, 6°, CL, PR, =10 mm JT, 40°, CL, PR, S BP, 10°, FE SN, PR, RF JT, 60°, healed JT
			Is(50) d=1.4 a=1.6 MPa									

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	20/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	21/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326181.0 m E 6260702.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 54.30 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information							Rock Substance					Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	93	Is(50) d=0.5 a=1.1 MPa		48.3	6		SANDSTONE: medium grained, pale grey, orange & red, well developed rock fabric and distinct thinly laminated cross bedding (15°), iron staining.*(continued)*				BP, 8°, FE SN, PR, RF BP, 5°, CN, PR, RF CO, 0°, CL, PR, S
								LAMINITE: dark & pale grey, very well developed rock fabric and distinct laminated bedding (60%-70% siltstone, 30%-40% sandstone - medium to coarse-grained size).				BP, 6°, CN, PR, S
			Is(50) d=0 a=0.1 MPa									BP, 5°, CN, PR, S
		88			47.3	7		SANDSTONE: medium grained, pale grey, orange & yellow, developed rock fabric and indistinct thinly laminated bedding, iron staining.				CO, 0°, FE SN, PR, S BP, 5°, FE SN, IR, RF BP, 7°, FE SN, PR, RF BP, 10°, FE SN, PR, RF JT, 47°, healed JT JT, 35°, healed JT JT, 30°, healed JT
			Is(50) d=0.7 a=1.1 MPa									BP, 10°, FE SN, PR, RF
					46.3	8						
			Is(50) d=0.6 a=0.8 MPa									
					45.3	9		8.90m - 9.30m - Becomes pale grey only				JT, 47°, FE SN, IR, RF
		86	Is(50) d=0.4 a=0.5 MPa					9.30m - 10.40m - Becomes pale grey, red & orange, extremely weathered to highly weathered and some faults. Possible structures.				SM, 0°, CL, PR, =30 mm BP, 2°, FE SN, PR, RF
												FZ, 0°, FZ, =50 mm BP, 5°, FE, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	20/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	21/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326181.0 m E 6260702.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 54.30 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	86	Is(50) d=0.9 a=1 MPa		43.3	11		SANDSTONE: medium grained, pale grey, orange & yellow, developed rock fabric and indistinct thinly laminated bedding, iron staining.*(continued)*				JT, 60°, FE SN, PR, RF FT, 70°, FE SN, PR, RF FT, 70°, FE SN, PR, RF JT, 75°, healed JT JT, 60°, healed JT SM, 0°, CL+FE, PR, =20 mm BP, 0°, CL+FE, PR, RF JT, 70°, FE, PR, RF BP, 5°, FE SN, PR, RF
								10.90m - 11.30m - Becomes red, orange & yellow and indistinct laminated crossbedding (20°)				
		96	Is(50) d=0.3 a=0.4 MPa		42.3	12						BP, 10°, FE+X, IR, RF BP, 5°, FE+X, PR, RF BP, 7°, RF+X, PR, RF BP, 10°, FE SN, UN, RF BP, 25°, X, PR, RF BP, 10°, FE+X, PR, RF SM, 0°, CL, PR, =40 mm
			Is(50) d=1.3 a=0.9 MPa		41.3	13		12.4m - Becomes pale grey only				BP, 10°, CN, UN, RF
			Is(50) d=1.6 a=1.3 MPa									
		99	Is(50) d=0.8 a=1.4 MPa		40.3	14						BP, 20°, CN, PR, RF BP, 8°, FE+X, PR, RF BP, 12°, FE, UN, RF BP, 5°, CN, PR, RF BP, 10°, CN, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	20/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	21/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326181.0 m E 6260702.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 54.30 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Material Description	Defect Descriptions / Comments
NMLC	Not Observed	99	Is(50) d=2 a=1.6 MPa		38.3	16	SANDSTONE: medium grained, pale grey, orange & yellow, developed rock fabric and indistinct thinly laminated bedding, iron staining.*(continued)*	
		100	Is(50) d=2.3 a=2 MPa					BP, 25°, CN, PR, RF
					37.3	17	Hole Terminated at 17.00 m Target depth, hole grouted to surface and reinstated	BP, 12°, CN, PR, RF
					36.3	18		
					35.3	19		

Weathering: FR. Strength: H. Defect Spacing: 600–1000.

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Borehole ID

BH03

Engineering Log - Non Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	17/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	19/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH/MB
Hole Position:	326142.0 m E 6260665.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting:	HANJIN DB8	Inclination:	-90°	RL Surface:	55.90 m		
Hole Diameter:	125 mm	Bearing:		Datum:	AHD	Operator:	BG

Drilling Information							***Soil Description***					***Observations***
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/T		N	Not Observed	SPT 1.00-1.26 m 19,22+,Refusal N=R		54.9	1			ASPHALT				0.00: PAVEMENT 200mm
									CL-ML	Silty CLAY: low plasticity, orange & brown.		VSt		0.13: INFERRED FILL
									CL-ML	Silty CLAY: low plasticity, pale grey, red & brown; ripped sandstone and ironstone up to 20mm.				0.50: INFERRED NATURAL
											D	VSt to H		1.00: SPT recovery 260mm
						53.9	2							1.90: Rootlets observed
										SANDSTONE: fine grained, pale brown & red, extremely weathered, low strength. Some hard clay bands (dark grey and medium plasticity), iron staining.				2.00: INFERRED BEDROCK
				SPT 2.50-2.59 m 18+,Refusal N=R										2.50: SPT recovery 90mm
						52.9	3			Continued on cored borehole sheet				
						51.9	4							

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
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
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	17/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	19/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH/MB
Hole Position:	326142.0 m E 6260665.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 55.90 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information							Rock Substance					Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
					54.9	1						
					53.9	2		Continued from non-cored borehole sheet				
NMLC	Not Observed	93	Is(50) d=1.4 a=2.1 MPa 4.00m ES-. Is(50) d=1.2 a=0.7 MPa Is(50) d=0.9 a=0.9 MPa		52.9 51.9	3 4		SANDSTONE: medium grained, pale grey, brown & orange, poorly developed rock fabric and indistinct thinly laminated bedding, iron staining. 4.80m - 6.00m - Becomes well developed rock fabric				SM, 0°, CL, PR, =25 mm BP, 0°, FE SN, PR, RF BP, 0°, FE SN, PR, RF BP, 2°, CL, PR, RF JT, 80°, CL, PR, S JT, 45°, FE SN, PR, RF BP, 2°, FE SN, UN, RF BP, 0°, CN, UN, RF BP, 5°, FE SN, CU, RF BP, 0°, FE SN, PR, RF BP, 3°, FE SN, PR, RF SM, 0°, CL, PR, =20 mm

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	17/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	19/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH/MB
Hole Position:	326142.0 m E 6260665.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 55.90 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information							Rock Substance			Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	93						SANDSTONE: medium grained, pale grey, brown & orange, poorly developed rock fabric and indistinct thinly laminated bedding, iron staining.*(continued)* 5.30m - 5.50m - Some cacbonaceous distinct bedding				BP, 0°, X, PR, RF BP, 0°, X, PR, RF SM, 0°, CL, PR, =3 mm
		89	Is(50) d=0.3 a=0.5 MPa		49.9	6						BP, 2°, CN, PR, S BP, 8°, CN, PR, RF BP, 5°, CL, PR, S SM, 7°, CL, PR, =2 mm
			Is(50) d=0.3 a=0.5 MPa		48.9	7						BP, 3°, CL, PR, S SM, 10°, CL, PR, =5 mm BP, 0°, CL, PR, S
								LAMINITE: dark & pale grey, well developed rock fabric and distinct laminated bedding (60%-70% siltstone, 30%-40% sandstone - medium-grained size), iron staining.				BP, 0°, CL, PR, S BP, 0°, CL, PR, S JT, 80°, CL+FE SN, PR, RF JT, 2°, CL+FE SN, PR, S, =4 mm
			Is(50) d=0.3 a=0.6 MPa		47.9	8		SANDSTONE: medium grained, pale grey, brown & orange, poorly developed rock fabric and indistinct laminated bedding, iron staining.				JT, 60°, healed SM, 0°, FE SN, PR, =20 mm JT, 90°, FE SN, IR, RF
		91	Is(50) d=0.7 a=1.1 MPa		46.9	9		8.80m - 9.40m - Becomes well developed rock fabric and distinct laminated cross bedding (20°)				JT, 40°, CL, PR, S JT, 70°, healed SM, 0°, CL, PR, S, =3 mm JT, 60°, healed
			Is(50) d=0.4 a=0.5 MPa									BP, 0°, CL, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	17/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	19/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH/MB
Hole Position:	326142.0 m E 6260665.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 55.90 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information							Rock Substance					Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	91	Is(50) d=0.7 a=0.6 MPa		44.9	11		LAMINITE: dark & pale grey, developed rock fabric and indistinct laminated bedding (70%-80% siltstone, 20%-30% sandstone - medium-grained size).*(continued)*				BP, 0°, CL, PR, S JT, 80°, CN, PR, S BP, 0°, X, PR, S BP, 0°, CL, PR, S
								SANDSTONE: medium grained, pale grey, brown & orange, developed rock fabric and indistinct laminated bedding, iron staining.				JT, 70°, healed JT, 40°, healed BP, 0°, FE SN, PR, RF
												BP, 3°, CL, PR, S JT, 90°, healed
		86	Is(50) d=0.2 a=1.2 MPa		43.9	12						JT, 90°, healed SM, 0°, CL, PR, =3 mm SM, 0°, CL, PR, =5 mm SM, 0°, CL, PR, =5 mm SM, 0°, CL, PR, =10 mm JT, 50°, FE SN, PR, RF JT, 50°, FE SN, PR, RF BP, 0°, FE SN, PR, RF
			Is(50) d=1.5 a=1.6 MPa		42.9	13		13.30m - 13.90m - Becomes well developed rock fabric and indistinct laminated cross bedding (20°)				SM, 0°, CL+FE SN, PR, =3 mm SM, 0°, CL, PR, =15 mm JT, 70°, FE SN, PR, R JT, 70°, FE SN, PR, RF BP, 10°, CL, PR, S
		53	Is(50) d=0.6 a=0.7 MPa		41.9	14						BP, 0°, CL, PR, RF SM, 2°, CL, PR, =30 mm BP, 20°, FE SN, PR, RF BP, 20°, FE SN, PR, RF SM, 0°, CL, PR, =20 mm
			Is(50) d=0.8 a=0.6 MPa									BP, 10°, FE SN, PR, RF BP, 10°, FE SN, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	17/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	19/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH/MB
Hole Position:	326142.0 m E 6260665.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting:	HANJIN DB8	Inclination:	-90°	RL Surface:	55.90 m
Barrel Type and Length:		Bearing:		Datum: AHD	Operator: BG

Drilling Information							Rock Substance															Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW	HW	MW	SW	FR	Strength Is(50) ● - Axial ○ - Diametral VL	0.1	L	0.3	M	1	H	3	VH	10	EH	Defect Spacing (mm) <20	60	200	600	1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	53			39.9	16		SANDSTONE: medium grained, pale grey, brown & orange, developed rock fabric and indistinct laminated bedding, iron staining.*(continued)*																			BP, 0°, FE SN, PR, RF JT, 90°, FE SN, PR, S SM, 0°, CL, PR, =40 mm ~~JT, 70°, PR, healed~~
					38.9	17		NO CORE: 1350mm																			
		58						SANDSTONE: medium grained, pale grey, brown & orange, developed rock fabric and indistinct thinly laminated crossbedding (20°), iron staining.																			BP, 26°, FE SN, PR, RF BP, 8°, FE SN, PR, RF BP, 29°, FE SN, PR, RF SM, 10°, FE + S SN, PR, =10 mm JT, 45°, FE SN, PR, RF BP, 7°, FE SN, PR, RF SM, 0°, FE + RF, PR, =80 mm
		52	Is(50) d=0.3 a=0.3 MPa		37.9	18		17.65m - 17.73m - Some sub angular to rounded sandstone and iron stone fragments.																			BP, 10°, FE SN, IR, RF BP, 20°, FE SN, PR, RF BP, 24°, FE SN, PR, RF JT, 46°, healed JT, 47°, healed BP, 6°, FE SN, PR, RF JT, 42°, healed JT, 47°, healed JT, 70°, FE SN, PR, RF SM, 2°, RF + S, PR, =110 mm
		80	Is(50) d=0.7 a=1.1 MPa		36.9	19		18.70m - 19.30m - Becomes well developed rock fabric and indistinct laminated cross bedding (15°)																			BP, 5°, FE SN, PR, RF BP, 4°, FE SN, PR, RF SM, 0°, FE + S, PR, =10 mm BP, 10°, FE SN, PR, RF BP, 12°, FE SN, PR, RF BP, 9°, FE SN, PR, RF SM, 2°, S, PR, =10 mm BP, 3°, CN, PR, RF
			Is(50) d=1.3 a=1 MPa					19.80m - 20.00m - Becomes well developed rock fabric and indistinct laminated bedding																			BP, 0°, CN, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube

WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	17/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	19/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH/MB
Hole Position:	326142.0 m E 6260665.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 55.90 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information / Rock Substance / Rock Mass Defects

Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description (ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration)	Weathering (XW HW MW SW FR)	Strength Is(50) ● Axial ○ Diametral (VL 0.1 L 0.3 M 1 H 3 VH 10 EH)	Defect Spacing (mm) (<20 60 200 600 1000)	Defect Descriptions / Comments (Description, alpha/beta, infilling or coating, shape, roughness, thickness, other)
NMLC	Not Observed	80						SANDSTONE: medium grained, pale grey, brown & orange, developed rock fabric and indistinct thinly laminated crossbedding (20°), iron staining.*(continued)*				SM, 5°, FE + S, =10 mm
			Is(50) d=1.6 a=1.6 MPa		34.9	21		20.65m - Becomes coarse grain size sandstone				BP, 12°, FE VN, PR, RF
								21.00m - 21.05m - Some carbonaceous distinct bedding				BP, 10°, FE SN, PR, RF BP, 13°, FE SN, PR, RF IS, 6°, X, =30 mm BP, 5°, FE SN, PR, RF FZ, 2°, FE + RF, =80 mm
								21.30m - 21.90m - Becomes well developed rock fabric				BP, 0°, FE SN, PR, RF BP, 10°, FE SN, PR, RF
			Is(50) d=1.5 a=1.8 MPa									BP, 14°, FE SN, PR, RF
		84			33.9	22						JT, 66°, FE SN, PR, RF BP, 12°, FE SN, PR, RF BP, 14°, FE SN, IR, RF
												JT, 45°, healed BP, 12°, FE SN, PR, RF JT, 40°, healed BP, 10°, CN, PR, RF
			Is(50) d=0.5 a=0.6 MPa									BP, 3°, FE SN, PR, RF JT, 42°, healed
					32.9	23						BP, 12°, FE, PR, RF BP, 20°, FE, PR, RF
												BP, 12°, CN, PR, RF JT, 40°, healed
		90	Is(50) d=1.9 a=1.7 MPa		31.9	24						BP, 2°, FE, PR, RF BP, 15°, FE SN, PR, RF BP, 12°, FE SN, PR, RF BP, 17°, FE SN, PR, RF
												BP, 12°, FE SN, CU, RF BP, 5°, FE SN, PR, RF
			Is(50) d=1.3 a=1.5 MPa					24.50m - 24.80m - Becomes pale grey, well developed rock fabric and indistinct laminated bedding. Some rounded sandstone gravels at 24.5m				BP, 3°, CN, PR, RF BP, 6°, FE, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube

WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
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RF - Rock fragments
G - Gravel
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Z - Silt
CA - Calcite
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FE - Iron
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Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	17/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	19/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH/MB
Hole Position:	326142.0 m E 6260665.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting:	HANJIN DB8	Inclination:	-90°	RL Surface:	55.90 m
Barrel Type and Length:		Bearing:		Datum:	AHD

Operator: BG

Drilling Information							***Rock Substance***			***Rock Mass Defects***	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
								Hole Terminated at 25.00 m Target depth. ATV survey conducted. Standpipe installed. Hole grouted to surface and reinstated				JT, 80°, healed SM, 0°, S, PR, RF, =10 mm
					29.9	26						
					28.9	27						
					27.9	28						
					26.9	29						

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
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CA - Calcite
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FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Borehole ID

BH04

Engineering Log - Non Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	16/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	17/02/2020
Hole Location:	Macquarie Park	Logged By:	MB
Hole Position:	326236.0 m E 6260610.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting:	HANJIN DB8	Inclination:	-90°	RL Surface:	58.40 m		
Hole Diameter:	125 mm	Bearing:		Datum:	AHD	Operator:	BG

Drilling Information								***Soil Description***				***Observations***
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/T		N	Not Observed	ES 0.80 m SPT 0.80-1.25 m 11,18,21 N=39		57.4	1		SW	ASPHALT Gravelly SAND: coarse grained, pale grey & brown; gravel sub-angular to angular up to 20mm.	M	MD		0.00: PAVEMENT 40mm 0.04: INFERRED FILL 0.20: INFERRED NATURAL 0.80: SPT recovery 450mm
									CL-ML	Silty CLAY: low plasticity, pale grey & brown; ripped siltstone up to 20mm.				
						56.4	2				D	VSt to H		
				SPT 2.50-2.95 m 11,21,27 N=48										2.50: SPT recovery 450mm 2.70: INFERRED BEDROCK
						55.4	3			SILTSTONE: pale grey, brown & red, extremely weathered, very low strength strength, iron staining.				
						54.4	4							4.00: SPT recovery 80mm
				SPT 4.00-4.08 m 15+, Refusal N=R						Continued on cored borehole sheet				

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
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
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	16/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	17/02/2020
Hole Location:	Macquarie Park	Logged By:	MB
Hole Position:	326236.0 m E 6260610.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 Inclination: -90° RL Surface: 58.40 m
Barrel Type and Length: Bearing: Datum: AHD Operator: BG

Drilling Information							Rock Substance																		Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
					57.4	1						
					56.4	2						
					55.4	3						
					54.4	4						
								Continued from non-cored borehole sheet				
NMLC	Not Observed	51	Is(50) d=0 a=0.2 MPa					SILTSTONE: dark grey & orange, well developed rock fabric and distinct thinly laminated bedding. Some orange bandings, iron staining.				SM, 0°, CL, UN, =3 mm SM, 0°, CL, UN, =8 mm BP, 0°, FE SN, PR, S BP, 2°, FE SN, PR, RF BP, 0°, CL+FE SN, PR, S BP, 0°, FE SN, PR, S

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	16/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	17/02/2020
Hole Location:	Macquarie Park	Logged By:	MB
Hole Position:	326236.0 m E 6260610.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 58.40 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	51						SILTSTONE: dark grey & orange, well developed rock fabric and distinct thinly laminated bedding. Some orange bandings, iron staining.*(continued)*				BP, 4°, CL+FE SN, PR, S SM, 0°, CL, UN, =5 mm BP, 0°, CL, PR, RF BP, 0°, FE SN, PR, S BP, 0°, FE SN, PR, S BP, 0°, FE SN, PR, S JT, 40°, healed
			Is(50) d=0.8 a=0.9 MPa		52.4	6		LAMINITE: dark & pale grey, well developed rock fabric and distinct thinly laminated bedding (70%-80% siltstone, 20%-30% sandstone - fine-grained size), iron staining.				BP, 0°, FE SN, PR, S JT, 20°, FE SN, PR, S BP, 0°, FE SN, PR, S SM, 2°, FE SN, PR, =3 mm BP, 0°, FE SN, PR, S BP, 0°, FE SN, PR, S BP, 0°, FE SN, PR, S
		87	Is(50) d=0.2 a=0.4 MPa		51.4	7						SM, 0°, FE SN, PR, =3 mm BP, 4°, FE SN, PR, RF JT, 40°, FE SN, PR, RF SM, 0°, CL, PR, =5 mm
								SANDSTONE: fine grained, pale grey, brown & yellow, developed rock fabric and indistinct laminated bedding, iron staining.				BP, 0°, FE SN, PR, S JT, 70°, healed BP, 0°, FE SN, PR, RF BP, 2°, FE SN, PR, VR
			Is(50) d=0.5 a=0.5 MPa		50.4	8		LAMINITE: dark & pale grey, very well developed rock fabric and indistinct thinly laminated bedding (50%-60% siltstone, 40%-50% sandstone - fine-grained size).				BP, 2°, CN, PR, S BP, 0°, FE SN, PR, S
			Is(50) d=1.3 a=2.1 MPa		49.4	9						BP, 2°, CN, PR, S BP, 2°, CN, PR, S BP, 0°, CN, ST, S BP, 2°, CN, UN, S BP, 1°, CN, PR, S JT, 70°, CN, PR, RF BP, 0°, CN, PR, S
		87	Is(50) d=0.1 a=1.9 MPa									BP, 4°, CN, PR, S BP, 2°, CN, UN, S

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	16/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	17/02/2020
Hole Location:	Macquarie Park	Logged By:	MB
Hole Position:	326236.0 m E 6260610.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 58.40 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information							Rock Substance							Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL L M H VH EH 0.1 0.3 1 3 10	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	87	Is(50) d=0.5 a=2.6 MPa		47.4	11		LAMINITE: dark & pale grey, very well developed rock fabric and indistinct thinly laminated bedding (50%-60% siltstone, 40%-50% sandstone - fine-grained size).*(continued)*				BP, 1°, CN, PR, S BP, 6°, CN, PR, S BP, 0°, CN, PR, S BP, 0°, CN, PR, S BP, 5°, CN, PR, S JT, 20°, CN, PR, S
		93	Is(50) d=1.4 a=1.6 MPa Is(50) d=0.6 a=1 MPa		46.4	12		SANDSTONE: fine grained, pale grey, brown & yellow, developed rock fabric and indistinct laminated bedding, iron staining. 12.65m - Some sub angular to rounded gravels up to 10mm				SM, 0°, CL+FE SN, PR, =5 mm BP, 3°, CN, PR, RF BP, 2°, CN, PR, RF BP, 2°, CN, PR, RF BP, 0°, CN, PR, RF BP, 10°, CN, PR, RF BP, 0°, CN, PR, RF SM, 0°, CL, PR, =100 mm
			Is(50) d=0.7 a=2.4 MPa		45.4	13		LAMINITE: dark & pale grey, very well developed rock fabric and distinct thinly laminated bedding (70%-80% siltstone, 20%-30% sandstone - medium-grained size).				
					44.4	14						BP, 0°, CN, PR, S
		97	Is(50) d=0.5 a=2.4 MPa									BP, 1°, CL, UN, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	16/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	17/02/2020
Hole Location:	Macquarie Park	Logged By:	MB
Hole Position:	326236.0 m E 6260610.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 Inclination: -90° RL Surface: 58.40 m
Barrel Type and Length: Bearing: Datum: AHD Operator: BG

Method	Water	RQD (%)	Samples and Field Tests	RL (m)	Depth (m)	Material Description	Defect Descriptions / Comments
NMLC	Not Observed	97				SANDSTONE: medium to coarse grained, pale grey, well developed rock fabric and indistinct laminated cross bedding (20°).*(continued)*	BP, 3°, CN, PR, S
			Is(50) d=1.8 a=1.5 MPa	42.4	16		BP, 0°, CN, UN, RF BP, 1°, CN, CU, VR BP, 1°, CN, PR, RF BP, 0°, CN, PR, RF SM, 0°, CL, PR, =60 mm
			Is(50) d=1.2 a=1.3 MPa	41.4	17		BP, 20°, CN, PR, RF BP, 0°, CN, PR, S
		100	Is(50) d=1.5 a=1.5 MPa	40.4	18		
			Is(50) d=0.8 a=1.4 MPa	39.4	19		BP, 1°, CL, PR, RF BP, 1°, CL, PR, S
			Is(50) d=1.5 a=2.2 MPa				BP, 2°, CL, PR, RF

Weathering: FR. Strength: H. Defect Spacing: 600–1000.

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	16/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	17/02/2020
Hole Location:	Macquarie Park	Logged By:	MB
Hole Position:	326236.0 m E 6260610.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 Inclination: -90° RL Surface: 58.40 m
Barrel Type and Length: Bearing: Datum: AHD Operator: BG

Drilling Information							Rock Substance								Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
NMLC	Not Observed	100						SANDSTONE: medium to coarse grained, pale grey, well developed rock fabric and indistinct laminated cross bedding (20°).*(continued)*				BP, 0°, CL, PR, RF
			Is(50) d=1.6 a=2 MPa		37.4	21		20.70m - 23.10m - Becomes indistinct laminated bedding				
		100	Is(50) d=1.4 a=1.6 MPa		36.4	22						BP, 0°, CN, PR, RF BP, 2°, CL, PR, S
			Is(50) d=1.8 a=1.4 MPa		35.4	23						BP, 1°, CL, PR, S
		93	Is(50) d=1.5 a=1.6 MPa		34.4	24						BP, 2°, CL, CU, S BP, 1°, CL, PR, S
			Is(50) d=1.9 a=1.8 MPa									BP, 20°, CL, PR, RF

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Engineering Log - Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	16/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	17/02/2020
Hole Location:	Macquarie Park	Logged By:	MB
Hole Position:	326236.0 m E 6260610.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting: HANJIN DB8 | Inclination: -90° | RL Surface: 58.40 m
Barrel Type and Length: | Bearing: | Datum: AHD | Operator: BG

Drilling Information							Rock Substance																		Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteration	Weathering XW HW MW SW FR	Strength Is(50) ● - Axial ○ - Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Defect Spacing (mm) <20 60 200 600 1000	Defect Descriptions / Comments Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
		93						SANDSTONE: medium to coarse grained, pale grey, well developed rock fabric and indistinct laminated cross bedding (20°).*(continued)*				
					32.4	26		Hole Terminated at 25.18 m Target depth, hole grouted to surface and reinstated				
					31.4	27						
					30.4	28						
					29.4	29						

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
HQ3- Wireline core (63.5 mm)
PQ3- Wireline core (85.0 mm)
SPT- Standard penetration test
PT - Push tube
WPT - Water pressure test

Water
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
No core recovery

Weathering
XW - Extremely Weathered
HW - Highly Weathered
MW - Moderately Weathered
SW - Slightly Weathered
FR - Fresh

Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

Infilling/Coating
CN - Clean
SN - Stain
VN - Veneer
CO - Coating
RF - Rock fragments
G - Gravel
S - Sand
Z - Silt
CA - Calcite
CL - Clay
FE - Iron
QZ - Quartz
X - Carbonaceous

Roughness
SL - Slickensided
POL - Polished
S - Smooth
RF - Rough
VR - Very Rough

Shape
PR - Planar
CU - Curved
UN - Undulating
ST - Stepped
IR - Irregular

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Borehole ID

BH05

Engineering Log - Non Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	21/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	21/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326191.0 m E 6260669.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting:	HANJIN DB8	Inclination:	-90°	RL Surface:	57.50 m	
Hole Diameter:	125 mm	Bearing:		Datum:	AHD	Operator: BG

Drilling Information								Soil Description					Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/T		N	Not Observed	ES 0.50 m SPT 0.50-0.95 m 14,24,17 N=41		56.5	1		CL-ML	ASPHALT Silty CLAY: low plasticity, pale grey & red.		VSt		0.00: PAVEMENT 30mm 0.03: INFERRED FILL
									CL-ML	Silty CLAY: low plasticity, pale grey, red & brown; ripped siltstone and ironstone up to 10mm.	D	VSt to H		0.30: INFERRED NATURAL 0.50: SPT recovery 450mm
				SPT 2.00-2.30 m 21,25,Refusal N=R		55.5	2			SILTSTONE: pale grey, brown & red, extremely weathered, very low strength strength, iron staining.				1.50: INFERRED BEDROCK 2.00: SPT recovery 300mm
						54.5	3			Hole Terminated at 3.00 m Target depth, hole grouted to surface and reinstated				
						53.5	4							

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
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
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Borehole ID

BH06

Engineering Log - Non Cored Borehole

Project No.: PSM3411.10

Client:	Goodman	Commenced:	24/02/2020
Project Name:	85 Waterloo Road, Macquarie Park	Completed:	24/02/2020
Hole Location:	Macquarie Park	Logged By:	NTH
Hole Position:	326223.0 m E 6260646.0 m N MGA94 Zone 56	Checked By:	HP

Drill Model and Mounting:	Comacchio Geo205	Inclination:	-90°	RL Surface:	57.60 m	
Hole Diameter:		Bearing:		Datum:	AHD	Operator: Stratacore

Drilling Information								***Soil Description***				***Observations***
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, behaviour or particle characteristics of primary component, colour, secondary components, additional observations	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/T		N	Not Observed	ES 1.50 m SPT 1.50-1.61 m 21,Refusal N=R		56.6 55.6 54.6 53.6	1 2 3 4		CL-ML CL-ML	CONCRETE Silty CLAY: low plasticity, pale grey & red. Silty CLAY: low plasticity, pale grey, red & brown; ripped siltstone and ironstone up to 10mm. SILTSTONE: pale grey, brown & red, extremely weathered, very low strength strength, iron staining. Hole Terminated at 3.00 m Target depth, hole grouted to surface and reinstated	D	VSt VSt to H		0.00: PAVEMENT 150mm 0.15: INFERRED FILL 0.30: INFERRED NATURAL 1.50: INFERRED BEDROCK SPT recovery 110mm

Method
AD/T - Auger drilling TC bit
AD/V - Auger drilling V bit
WB - Washbore
SPT - Standard penetration test
PT - Push tube
AS - Auger Screwing

Penetration
No resistance
Refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
ES - Environmental Sample
TW - Thin Walled
LB - Large Disturbed Sample

Moisture Condition
D - Dry
M - Moist
W - Wet

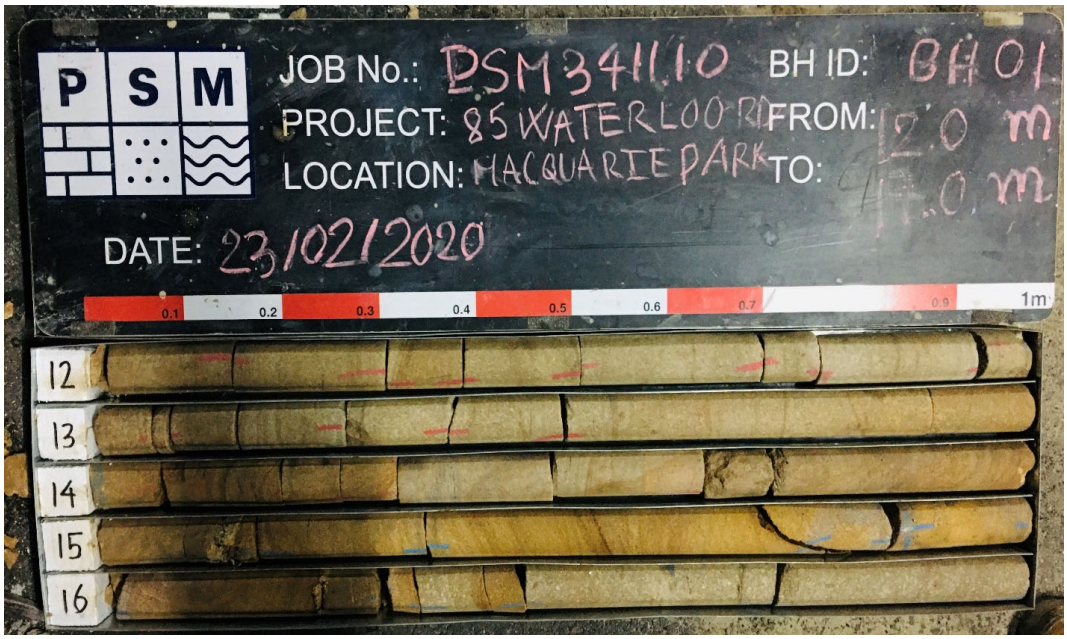
Consistency/Relative Density
VS - Very soft
S - Soft
F - Firm
St - Stiff
VSt - Very stiff
H - Hard
VL - Very loose
L - Loose
MD - Medium dense
D - Dense
VD - Very dense
Ce - Cemented
C - Compact

Logged in accordance with AS 1726:2017 Geotechnical site investigations

Appendix B
Core Photography

Goodman
85 Waterloo Road
Macquarie Park, NSW
GEOTECHNICAL INVESTIGATION
CORE PHOTOGRAPHY - BH01_(1)

Pells Sullivan Meynink	**PSM3411-104L** / **Appendix B**



Goodman **85 Waterloo Road** **Macquarie Park, NSW** **GEOTECHNICAL INVESTIGATION** **CORE PHOTOGRAPHY - BH01_(2)**	
PSM3411-104L	**Appendix B**

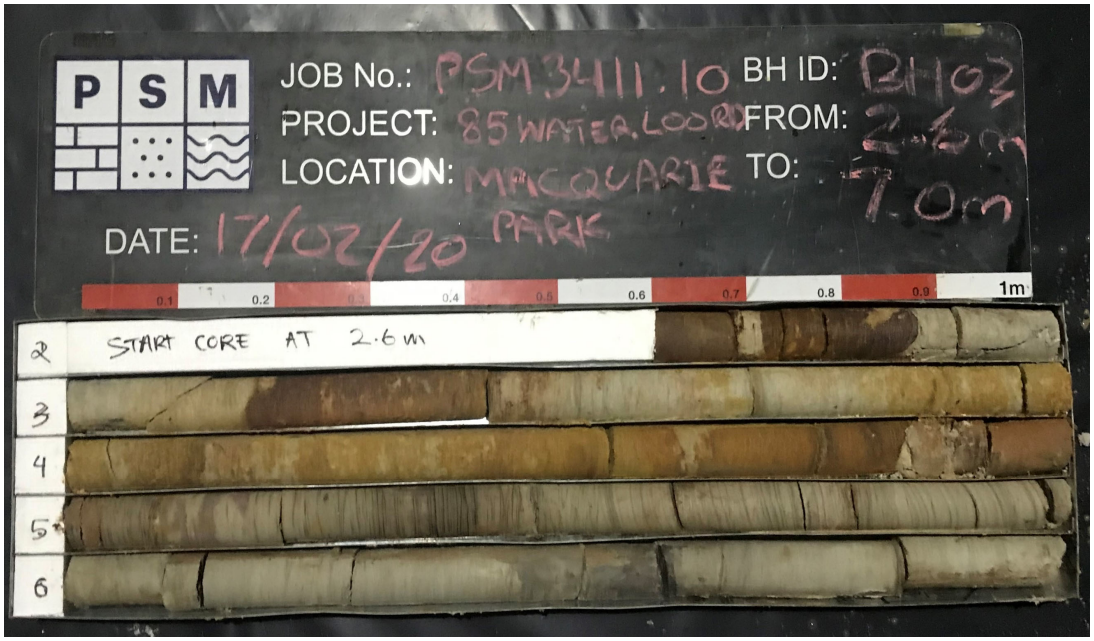
Pells Sullivan Meynink

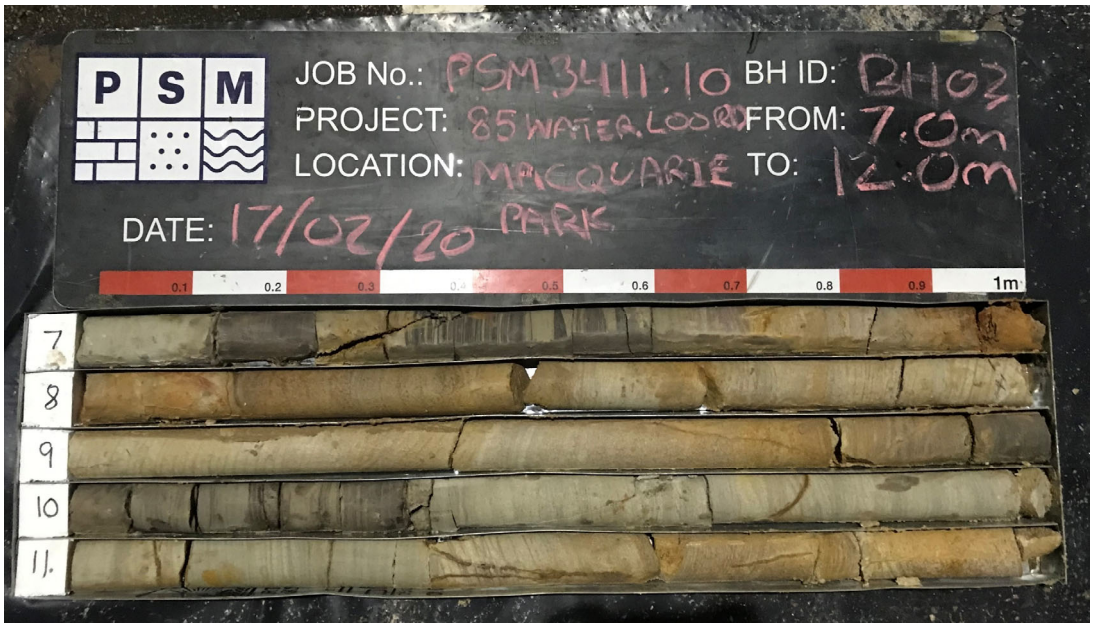
Goodman	
85 Waterloo Road	
Macquarie Park, NSW	
GEOTECHNICAL INVESTIGATION	
CORE PHOTOGRAPHY - BH02_(1)	
PSM3411-104L	**Appendix B**

Pells Sullivan Meynink

Goodman 85 Waterloo Road Macquarie Park, NSW GEOTECHNICAL INVESTIGATION CORE PHOTOGRAPHY - BH02_(2)	
PSM3411-104L	Appendix B

Pells Sullivan Meynink





Goodman **85 Waterloo Road** **Macquarie Park, NSW** **GEOTECHNICAL INVESTIGATION** **CORE PHOTOGRAPHY - BH03_(1)**	
PSM3411-104L	**Appendix B**

Pells Sullivan Meynink

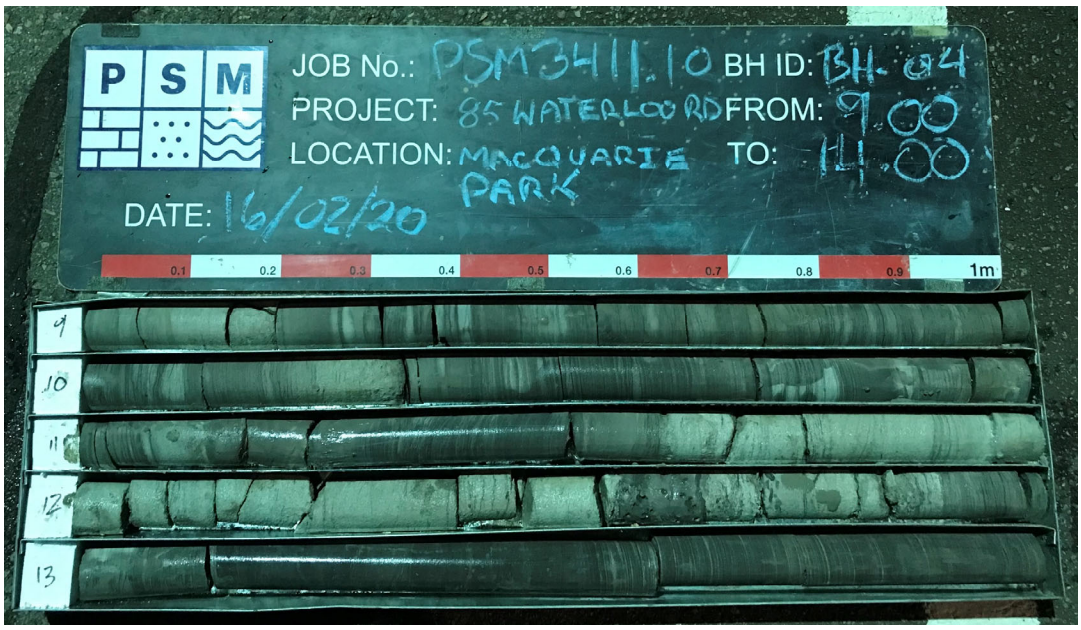
Goodman **85 Waterloo Road** **Macquarie Park, NSW** **GEOTECHNICAL INVESTIGATION** **CORE PHOTOGRAPHY - BH03_(2)**	
PSM3411-104L	**Appendix B**

Pells Sullivan Meynink

Goodman	
85 Waterloo Road	
Macquarie Park, NSW	
GEOTECHNICAL INVESTIGATION	
CORE PHOTOGRAPHY - BH03_(3)	
PSM3411-104L	Appendix B

Pells Sullivan Meynink

C:\Users\ngoctuan.hoang\Desktop\PSM 3411.10\Eng\Core photos\[PSM3411.10 Core Photos.xlsx]BH04_3

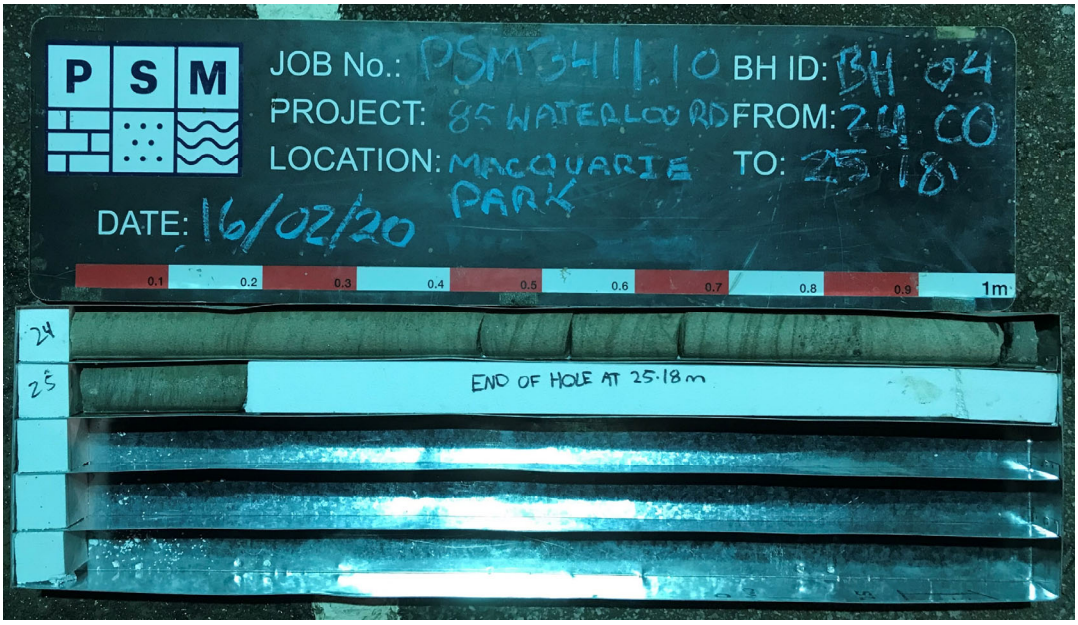


Goodman **85 Waterloo Road** **Macquarie Park, NSW** **GEOTECHNICAL INVESTIGATION** **CORE PHOTOGRAPHY - BH04_(1)**	
PSM3411-104L	**Appendix B**

Pells Sullivan Meynink

Goodman **85 Waterloo Road** **Macquarie Park, NSW** **GEOTECHNICAL INVESTIGATION** **CORE PHOTOGRAPHY - BH04_(2)**	
PSM3411-104L	**Appendix B**

Pells Sullivan Meynink



Goodman **85 Waterloo Road** **Macquarie Park, NSW** **GEOTECHNICAL INVESTIGATION** **CORE PHOTOGRAPHY - BH04_(3)**	
PSM3411-104L	**Appendix B**

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Appendix C
Point Load Strength Index Test Results

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POINT LOAD STRENGTH INDEX TEST RESULTS

Job No.	***PSM3411.10***	**Sheet**	**1 of 3**
Project	***85 Waterloo Rd Macquarie Park***		**85 Waterloo Rd Macquarie Park**

Test Method	*AS 4133.4.1 - 1993 Methods of Testing Rocks for Engineering Purposes, Determination of Point Load Strength Index*	Sampling Technique	*Coring*	Sampling Date	*16/02/2020*
		Storage History	*At Rig*	Testing Date	*16/02/2020*
Test Machine	*GSA 6500*	Moisture Condition	*Field Moisture*	Tested By	*NTH*
Calibration Date	*16/8/2018*	Loading Rate	*< 30 seconds*		

Rock Type	Location	Depth	Diametral Tests					Axial, Block, and Irregular Lump Tests							AS 1726 Strength Class
		(m)	D (mm)	L (mm)	P (kN)	$I_{s(50)}$ (MPa)	Failure Mode	W (mm)	D (mm)	L (mm)	P (kN)	I_s (MPa)	$I_{s(50)}$ (MPa)	Failure Mode	
Sandstone	***BH01***	***2.26***	*50*	*100*	*2.8*	***1.112***	*parallel to bedding*	*50*	*43*	*50*	*3.2*	*1.2*	***1.193***	*Through substance*	***H***
Laminite	***BH01***	***3.37***	*50*	*88*	*3.4*	***1.348***	*parallel to bedding*	*50*	*39*	*50*	*3.5*	*1.4*	***1.412***	*Through substance*	***H***
Sandstone	***BH01***	***4.65***	*50*	*115*	*2.4*	***0.94***	*parallel to bedding*	*50*	*39*	*50*	*2.6*	*1.1*	***1.058***	*Through substance*	***M / H***
Laminite	***BH01***	***5.51***	*50*	*120*	*1.8*	***0.712***	*parallel to bedding*	*50*	*36*	*50*	*3.5*	*1.5*	***1.51***	*Through substance*	***M / H***
Laminite	***BH01***	***6.37***	*50*	*81*	*0.2*	***0.1***	*parallel to bedding*	*50*	*36*	*50*	*0.6*	*0.3*	***0.3***	*Through substance*	***VL / L***
Sandstone	***BH01***	***7.22***	*50*	*96*	*0.6*	***0.2***	*parallel to bedding*	*50*	*47*	*50*	*2.2*	*0.7*	***0.8***	*Through substance*	***L / M***
Sandstone	***BH01***	***8.95***	*50*	*105*	*1.4*	***0.6***	*parallel to bedding*	*50*	*43*	*50*	*1.7*	*0.6*	***0.6***	*Through substance*	***M***
Sandstone	***BH01***	***9.17***	*50*	*100*	*2.4*	***0.9***	*parallel to bedding*	*50*	*45*	*50*	*4*	*1.4*	***1.4***	*Through substance*	***M / H***
Sandstone	***BH01***	***10.40***	*50*	*84*	*3.1*	***1.2***	*parallel to bedding*	*50*	*38*	*50*	*3*	*1.3*	***1.2***	*Through substance*	***H***
Sandstone	***BH01***	***11.54***	*50*	*98*	*3.3*	***1.3***	*parallel to bedding*	*50*	*44*	*50*	*3.6*	*1.3*	***1.3***	*Through substance*	***H***
Sandstone	***BH01***	***12.45***	*50*	*120*	*2.5*	***1***	*parallel to bedding*	*50*	*36*	*50*	*1.9*	*0.8*	***0.8***	*Through substance*	***M / H***
Sandstone	***BH01***	***13.21***	*50*	*110*	*2*	***0.8***	*parallel to bedding*	*50*	*49*	*50*	*3.6*	*1.2*	***1.2***	*Through substance*	***M / H***
Sandstone	***BH01***	***14.45***	*50*	*120*	*3.2*	***1.3***	*parallel to bedding*	*50*	*44*	*50*	*2.9*	*1*	***1.1***	*Through substance*	***H***
Sandstone	***BH01***	***15.55***	*50*	*90*	*2.4*	***1***	*parallel to bedding*	*50*	*34*	*50*	*2.3*	*1.1*	***1***	*Through substance*	***M / H***
Sandstone	***BH01***	***16.38***	*50*	*80*	*1.7*	***0.7***	*parallel to bedding*	*50*	*39*	*50*	*1.7*	*0.7*	***0.7***	*Through substance*	***M***
Sandstone	***BH01***	***16.82***	*50*	*118*	*4.2*	***1.7***	*parallel to bedding*	*50*	*47*	*50*	*3.1*	*1*	***1.1***	*Through substance*	***H***
Siltstone	***BH02***	***2.86***	*50*	*98*	*0*	***0***	*parallel to bedding*	*50*	*42*	*50*	*0*	*0*	***0***	*Through substance*	
Sandstone	***BH02***	***3.48***	*50*	*99*	*0.9*	***0.3***	*parallel to bedding*	*50*	*42*	*50*	*1.6*	*0.6*	***0.6***	*Through substance*	***M***
Sandstone	***BH02***	***4.90***	*50*	*89*	*3.6*	***1.4***	*parallel to bedding*	*50*	*38*	*50*	*2.3*	*1*	***0.9***	*Through substance*	***M / H***
Sandstone	***BH02***	***5.37***	*50*	*98*	*1.4*	***0.5***	*parallel to bedding*	*50*	*34*	*50*	*2.5*	*1.2*	***1.1***	*Through substance*	***M / H***
Sandstone	***BH02***	***6.59***	*50*	*115*	*0.1*	***0***	*parallel to bedding*	*50*	*32*	*50*	*0.2*	*0.1*	***0.1***	*Through substance*	***VL / L***
Laminite	***BH02***	***7.13***	*50*	*100*	*1.9*	***0.7***	*parallel to bedding*	*50*	*46*	*50*	*3.1*	*1.1*	***1.1***	*Through substance*	***M / H***
Sandstone	***BH02***	***8.10***	*50*	*98*	*1.6*	***0.6***	*parallel to bedding*	*50*	*46*	*50*	*2.3*	*0.8*	***0.8***	*Through substance*	***M***
Sandstone	***BH02***	***9.11***	*50*	*120*	*1*	***0.4***	*parallel to bedding*	*50*	*45*	*50*	*1.4*	*0.5*	***0.5***	*Through substance*	***M***
Sandstone	***BH02***	***10.68***	*50*	*100*	*2.4*	***0.9***	*parallel to bedding*	*50*	*42*	*50*	*2.5*	*0.9*	***1***	*Through substance*	***M***
Sandstone	***BH02***	***11.44***	*50*	*91*	*0.8*	***0.3***	*parallel to bedding*	*50*	*41*	*50*	*1*	*0.4*	***0.4***	*Through substance*	***M***

By:	***NTH***	**Checked:**	***HP***	**Date:**	***30/3/2020***

Pells Sullivan Meynink

POINT LOAD STRENGTH INDEX TEST RESULTS

Job No.	***PSM3411.10***	**Sheet**	**2 of 3**
Project	***85 Waterloo Rd Macquarie Park***		**85 Waterloo Rd Macquarie Park**

Test Method	*AS 4133.4.1 - 1993 Methods of Testing Rocks for Engineering Purposes, Determination of Point Load Strength Index*	Sampling Technique	*Coring*	Sampling Date	*16/02/2020*
		Storage History	*At Rig*	Testing Date	*16/02/2020*
Test Machine	*GSA 6500*	Moisture Condition	*Field Moisture*	Tested By	*NTH*
Calibration Date	*16/8/2018*	Loading Rate	*< 30 seconds*		

Rock Type	Location	Depth	Diametral Tests					Axial, Block, and Irregular Lump Tests							AS 1726 Strength Class
		(m)	D (mm)	L (mm)	P (kN)	$I_{s(50)}$ (MPa)	Failure Mode	W (mm)	D (mm)	L (mm)	P (kN)	I_s (MPa)	$I_{s(50)}$ (MPa)	Failure Mode	
Sandstone	***BH02***	***12.92***	*50*	*120*	*3.3*	***1.3***	*parallel to bedding*	*50*	*42*	*50*	*2.3*	*0.8*	***0.9***	*Through substance*	***M / H***
Sandstone	***BH02***	***13.38***	*50*	*100*	*4.1*	***1.6***	*parallel to bedding*	*50*	*45*	*50*	*3.7*	*1.3*	***1.3***	*Through substance*	***H***
Sandstone	***BH02***	***14.38***	*50*	*120*	*2*	***0.8***	*parallel to bedding*	*50*	*39*	*50*	*3.5*	*1.4*	***1.4***	*Through substance*	***M / H***
Sandstone	***BH02***	***15.09***	*50*	*110*	*5*	***2***	*parallel to bedding*	*50*	*30*	*50*	*3.3*	*1.7*	***1.6***	*Through substance*	***H***
Sandstone	***BH02***	***16.54***	*50*	*120*	*5.6*	***2.3***	*parallel to bedding*	*50*	*41*	*50*	*5.1*	*2*	***2***	*Through substance*	***H***
Sandstone	***BH03***	***2.76***	*50*	*89*	*3.6*	***1.4***	*bad break*	*50*	*45*	*50*	*5.7*	*2*	***2.1***	*Through substance*	***H***
Sandstone	***BH03***	***3.87***	*50*	*100*	*2.9*	***1.2***	*parallel to bedding*	*50*	*28*	*50*	*1.3*	*0.7*	***0.7***	*Through substance*	***M / H***
Sandstone	***BH03***	***4.75***	*50*	*90*	*2.2*	***0.9***	*parallel to bedding*	*50*	*36*	*50*	*2.1*	*0.9*	***0.9***	*Through substance*	***M***
Sandstone	***BH03***	***5.91***	*50*	*69*	*0.7*	***0.3***	*parallel to bedding*	*50*	*32*	*50*	*1.2*	*0.6*	***0.5***	*Through substance*	***L / M***
Sandstone	***BH03***	***6.75***	*50*	*75*	*0.8*	***0.3***	*parallel to bedding*	*50*	*20*	*50*	*0.7*	*0.5*	***0.5***	*Through substance*	***M***
Sandstone	***BH03***	***7.83***	*50*	*100*	*0.7*	***0.3***	*parallel to bedding*	*50*	*25*	*50*	*1*	*0.6*	***0.6***	*Through substance*	***L / M***
Sandstone	***BH03***	***8.84***	*50*	*90*	*1.7*	***0.7***	*parallel to bedding*	*50*	*32*	*50*	*2.3*	*1.1*	***1.1***	*Through substance*	***M / H***
Sandstone	***BH03***	***9.90***	*50*	*120*	*1*	***0.4***	*parallel to bedding*	*50*	*45*	*50*	*1.4*	*0.5*	***0.5***	*Through substance*	***M***
Sandstone	***BH03***	***10.92***	*50*	*65*	*1.8*	***0.7***	*parallel to bedding*	*50*	*35*	*50*	*1.3*	*0.6*	***0.6***	*Through substance*	***M***
Sandstone	***BH03***	***11.80***	*50*	*70*	*0.6*	***0.2***	*parallel to bedding*	*50*	*27*	*50*	*2.3*	*1.3*	***1.2***	*Through substance*	***L / H***
Sandstone	***BH03***	***12.70***	*50*	*80*	*3.8*	***1.5***	*parallel to bedding*	*50*	*22*	*50*	*2.6*	*1.9*	***1.6***	*Through substance*	***H***
Sandstone	***BH03***	***13.85***	*50*	*105*	*1.6*	***0.6***	*parallel to bedding*	*50*	*35*	*50*	*1.6*	*0.7*	***0.7***	*Through substance*	***M***
Sandstone	***BH03***	***14.91***	*50*	*90*	*2*	***0.8***	*parallel to bedding*	*50*	*35*	*50*	*1.3*	*0.6*	***0.6***	*Through substance*	***M***
Sandstone	***BH03***	***17.82***	*50*	*90*	*0.8*	***0.3***	*parallel to bedding*	*50*	*36*	*50*	*0.8*	*0.3*	***0.3***	*Through substance*	***M***
Sandstone	***BH03***	***18.81***	*50*	*120*	*1.7*	***0.7***	*parallel to bedding*	*50*	*39*	*50*	*2.8*	*1.1*	***1.1***	*Through substance*	***M / H***
Sandstone	***BH03***	***19.93***	*50*	*110*	*3.3*	***1.3***	*parallel to bedding*	*50*	*38*	*50*	*2.4*	*1*	***1***	*Through substance*	***M / H***
Sandstone	***BH03***	***20.70***	*50*	*115*	*4.1*	***1.6***	*parallel to bedding*	*50*	*47*	*50*	*4.5*	*1.5*	***1.6***	*Through substance*	***H***
Sandstone	***BH03***	***21.51***	*50*	*120*	*3.9*	***1.5***	*parallel to bedding*	*50*	*35*	*50*	*4.1*	*1.9*	***1.8***	*Through substance*	***H***
Sandstone	***BH03***	***22.55***	*50*	*81*	*1.3*	***0.5***	*parallel to bedding*	*50*	*37*	*50*	*1.5*	*0.6*	***0.6***	*Through substance*	***M***
Sandstone	***BH03***	***23.74***	*50*	*81*	*4.8*	***1.9***	*parallel to bedding*	*50*	*36*	*50*	*3.9*	*1.7*	***1.7***	*Through substance*	***H***
Sandstone	***BH03***	***24.63***	*50*	*110*	*3.3*	***1.3***	*parallel to bedding*	*50*	*33*	*50*	*3.4*	*1.6*	***1.5***	*Through substance*	***H***

By:	***NTH***	**Checked:**	***HP***	**Date:**	***30/3/2020***

Pells Sullivan Meynink

POINT LOAD STRENGTH INDEX TEST RESULTS

Job No.	***PSM3411.10***	**Sheet**	**3 of 3**
Project	***85 Waterloo Rd Macquarie Park***		**85 Waterloo Rd Macquarie Park**

Test Method	*AS 4133.4.1 - 1993 Methods of Testing Rocks for Engineering Purposes, Determination of Point Load Strength Index*	Sampling Technique	*Coring*	Sampling Date	*16/02/2020*
		Storage History	*At Rig*	Testing Date	*16/02/2020*
Test Machine	*GSA 6500*	Moisture Condition	*Field Moisture*	Tested By	*NTH*
Calibration Date	*16/8/2018*	Loading Rate	*< 30 seconds*		

Rock Type	Location	Depth	Diametral Tests					Axial, Block, and Irregular Lump Tests							AS 1726 Strength Class
		(m)	D (mm)	L (mm)	P (kN)	$I_{s(50)}$ (MPa)	Failure Mode	W (mm)	D (mm)	L (mm)	P (kN)	I_s (MPa)	$I_{s(50)}$ (MPa)	Failure Mode	
Sandstone	***BH04***	***4.73***	*45*	*120*	*0*	***0***	*parallel to bedding*	*50*	*25*	*50*	*0.4*	*0.2*	***0.2***	*Through substance*	***L***
Sandstone	***BH04***	***5.82***	*45*	*98*	*1.6*	***0.8***	*parallel to bedding*	*50*	*27*	*50*	*1.6*	*0.9*	***0.9***	*Through substance*	***M***
Siltstone	***BH04***	***6.81***	*45*	*76*	*0.5*	***0.2***	*parallel to bedding*	*50*	*26*	*50*	*0.8*	*0.5*	***0.4***	*Through substance*	***L / M***
Siltstone	***BH04***	***7.87***	*45*	*100*	*1.1*	***0.5***	*parallel to bedding*	*50*	*16*	*50*	*0.6*	*0.6*	***0.5***	*Through substance*	***M***
Laminite	***BH04***	***8.69***	*50*	*78*	*3.2*	***1.3***	*parallel to bedding*	*50*	*29*	*50*	*4.2*	*2.2*	***2.1***	*Through substance*	***H***
Laminite	***BH04***	***9.64***	*50*	*80*	*0.3*	***0.1***	*parallel to bedding*	*50*	*35*	*50*	*4.3*	*1.9*	***1.9***	*Through substance*	***L / H***
Laminite	***BH04***	***10.83***	*50*	*105*	*1.4*	***0.5***	*parallel to bedding*	*50*	*22*	*50*	*4.1*	*2.9*	***2.6***	*Through substance*	***M / H***
Laminite	***BH04***	***11.70***	*50*	*75*	*3.5*	***1.4***	*parallel to bedding*	*50*	*31*	*50*	*3.4*	*1.7*	***1.6***	*Through substance*	***H***
Laminite	***BH04***	***12.45***	*50*	*70*	*1.5*	***0.6***	*parallel to bedding*	*50*	*39*	*50*	*2.5*	*1*	***1***	*Through substance*	***M / H***
Sandstone	***BH04***	***13.68***	*50*	*63*	*1.8*	***0.7***	*parallel to bedding*	*50*	*25*	*50*	*4.3*	*2.7*	***2.4***	*Through substance*	***M / H***
Sandstone	***BH04***	***14.73***	*50*	*59*	*1.3*	***0.5***	*parallel to bedding*	*50*	*18*	*50*	*3.3*	*2.9*	***2.4***	*Through substance*	***M / H***
Laminite	***BH04***	***15.78***	*50*	*82*	*4.5*	***1.8***	*parallel to bedding*	*50*	*26*	*50*	*2.8*	*1.7*	***1.5***	*Through substance*	***H***
Laminite	***BH04***	***16.79***	*50*	*105*	*3.1*	***1.2***	*parallel to bedding*	*50*	*35*	*50*	*3*	*1.3*	***1.3***	*Through substance*	***H***
Sandstone	***BH04***	***17.76***	*50*	*75*	*3.7*	***1.5***	*parallel to bedding*	*50*	*30*	*50*	*3*	*1.6*	***1.5***	*Through substance*	***H***
Sandstone	***BH04***	***18.88***	*50*	*55*	*2.1*	***0.8***	*parallel to bedding*	*50*	*25*	*50*	*2.4*	*1.5*	***1.4***	*Through substance*	***M / H***
Sandstone	***BH04***	***19.92***	*50*	*80*	*3.6*	***1.5***	*parallel to bedding*	*50*	*30*	*50*	*4.4*	*2.3*	***2.2***	*Through substance*	***H***
Sandstone	***BH04***	***20.84***	*50*	*115*	*4.1*	***1.6***	*parallel to bedding*	*50*	*44*	*50*	*5.4*	*1.9*	***2***	*Through substance*	***H***
Sandstone	***BH04***	***21.92***	*50*	*80*	*3.4*	***1.4***	*parallel to bedding*	*50*	*46*	*50*	*4.6*	*1.6*	***1.6***	*Through substance*	***H***
Sandstone	***BH04***	***22.91***	*50*	*90*	*4.5*	***1.8***	*parallel to bedding*	*50*	*39*	*50*	*3.6*	*1.4*	***1.4***	*Through substance*	***H***
Sandstone	***BH04***	***23.93***	*50*	*75*	*3.8*	***1.5***	*parallel to bedding*	*50*	*34*	*50*	*3.6*	*1.7*	***1.6***	*Through substance*	***H***
Sandstone	***BH04***	***24.51***	*50*	*85*	*4.7*	***1.9***	*parallel to bedding*	*50*	*26*	*50*	*3.2*	*1.9*	***1.8***	*Through substance*	***H***

By:	***NTH***	**Checked:**	***HP***	**Date:**	***30/3/2020***

Appendix D
Borehole Imaging

Televiewer Interpretation Log

Hole I.D.	BH03	Inclination	-90°
Client	Goodman	Azimuth	-
Location	85 Waterloo Rd	Total Depth	24.8m
	Macquarie Park	Commenced	17/2/2020
		Completed	19/2/2020

Structure Key

Shear Surface, Bedding Parting, Seam, Cross Bedding Fabric, Cross Bedding Parting, Joint, Joint Clay Infill, Joint Healed, Bedding Plane Shear

Tadpole body represents dip, tail represents dip direction relative to Magnetic North

Depth (1m:20m)	Raw OTV Data: Caliper (70 mm 110) / Azimuth (MAG) (0 deg 360)	Raw OTV Data: ATV Image	Raw OTV Data: ATV Travel Time Image	Interpretation: Processed ATV Image / Structure Apparent Orientation (Sinewaves)	Interpretation: Structure True Orientation (MAGNETIC NORTH)	Interpretation: Stereoplot (Lower hemisphere, equal area)

Appendix E
Aggressivity Lab Testing Results

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2006663**	Page	: 1 of 4
Client	: **PELLS SULLIVAN MEYNINK T/A PSM Admin PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MATIAS BRAGA	Contact	: Customer Services ES
Address	: G3, 56 DELHI ROAD NORTH RYDE NSW, AUSTRALIA 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 85 Waterloo Rd, Macquarie	Date Samples Received	: 25-Feb-2020 15:00
Order number	: ----	Date Analysis Commenced	: 27-Feb-2020
C-O-C number	: ----	Issue Date	: 04-Mar-2020 09:35
Sampler	: MATIAS BRAGA		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 6		
No. of samples analysed	: 6		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Ashesh Patel	Senior Chemist	Sydney Inorganics, Smithfield, NSW
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED045G: LOR raised for Chloride on sample 1 due to sample matrix.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH04-0.8m	BH03-4.0m	BH05-0.5m	BH06-1.5m	BH02-1.65m
			Client sampling date / time	16-Feb-2020 20:28	17-Feb-2020 12:30	20-Feb-2020 04:35	20-Feb-2020 05:00	20-Feb-2020 11:00
Compound	CAS Number	LOR	Unit	ES2006663-001	ES2006663-002	ES2006663-003	ES2006663-004	ES2006663-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.0**	**5.6**	**5.0**	**5.6**	**6.0**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**10.6**	**5.4**	**13.7**	**13.6**	**13.6**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**10**	<10	**30**	**100**	**20**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<50	<10	<10	<10	<10

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH01-11.54m	----	----	----	----
			Client sampling date / time	23-Feb-2020 13:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2006663-006	--------	--------	--------	--------
				Result	----	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.8**	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**5.6**	----	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	**20**	----	----	----	----

Annex C – Limitation

IMPORTANT INFORMATION ABOUT YOUR BG&E DOCUMENT

The purpose of the document and any associated documentation is expressively stated in the document. Whilst this document is intended to reduce geotechnical risk, no level of detail or scope of work can eliminate risk entirely due to inherent uncertainties in geotechnical engineering including the interpretation of data.

These notes are intended to provide the basis of BG&E's document regarding classification and characterisation methods, field procedures and comments/recommendations.

BG&E's documents are based on information gained from point-based subsurface investigations, sampling and testing. or information provided by other geotechnical consultants undertaking investigations and interpretation. Subsurface conditions are a result of various natural processes and can be altered by human activities and time. For this reason, they must be regarded as interpretive rather than factual documents, limited in extent by the scope of information on which they rely.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by BG&E and the document are excluded unless they are expressively stated to apply in the document.

THE DOCUMENT IS PROJECT AND SITE-SPECIFIC

This document was prepared to address geotechnical issues relating to the specific project and site based on BG&E's understanding of the Scope of Works. The findings presented in this document are based on the factual information current at the time of the investigations. Therefore, they should not be applied to any other site(s) or any other project(s) without a written consent from BG&E.

DATA SOURCES

In preparing this document, or providing any consulting services during the commission, BG&E may have relied upon information from third parties including, but not limited to; sub-consultants, published data, and the Client including its employees or representatives. Unless specifically stated in the document, BG&E have not verified any data from third part sources and as such BG&E assumes no responsibility for the adequacy, completeness, accuracy, or reliability of this information.

BG&E does not assume any responsibility for assessments made partly, or entirely based on information provided by third parties.

SOIL AND ROCK DESCRIPTION

The information pertaining to the soil and rock description including but not limited to boreholes, test pits, soil or rock exposures etc.) is based on a visual and tactile assessment, except at the discrete locations where test information is available (field and/or laboratory results). The soil and rock description includes both factual data and inferred information, subject to the interpretation of the BG&E's site representatives. Whilst BG&E have applied, to the best of our knowledge, relevant industry practices and standards to characterise the ground conditions, interpretation can vary at discretions of the site representative.

Reference should also be made to the relevant Australian standards for definitions unless advised otherwise.as agreed with the client on the Scope of Work.

GROUNDWATER

Where groundwater levels are measured on site or included in the document, it is important to note that it only represents the phreatic level at the time of the measurement, which may not be representative being a frequency-dependent event.

FOUNDATIONS

Any information pertaining to soil or rock quality, or the recommended depth of any foundation (piles, caissons, footings etc.) is an engineering estimate which is dependent on the investigation-type and its extent.

The bearing material quality and/or foundation depth required may be subject to change, based on the actual material observed on site during construction. Foundation drawings, designs and specifications should provide for variations in the final depth and make an allowance for geotechnical verification to account for ground conditions at each point of support.

CHANGE IN CONDITIONS

The geotechnical interpretation is based on discrete point-wise investigation locations, geophysical survey profiles or available observations, either relied as third party information or as conducted within the project. Local variations or anomalies in ground conditions do occur in the natural environment between these discrete test locations and between survey profiles. Further, geological processes, design or construction procedures may have been assumed in the analysis and design. Conditions may also change from those encountered at the time of the geotechnical investigation through construction activities, constantly changing natural processes as well as short and long term exposure conditions.

Any change in design, in construction methods, or in ground conditions as noted during construction, from those assumed or documented should be referred to BG&E for appropriate assessment and comment.

CONTAMINATION

Unless specifically stated, this document does not address the environmental or geo-environmental issues including the presence of contaminants or hazardous material at the site. For such advice, suitably accredited personnel shall be engaged by the client as considered appropriate.

VERIFICATION

Geotechnical information, by nature, represents an opinion and is based on judgment of both data and interpretive assessments or observation. This document is explicitly based on BG&E's opinion of the site at the time of inspection.

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