Geotechnical Investigation Report

RESIDENTIAL DEVELOPMENT

465-469 PRINCES HIGHWAY & 5-7 GEEVES AVENUE, ROCKDALE NSW

Prepared for:

EMAG APARTMENTS PTY LTD

Reference: P3324_01

24 September 2024

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1 PROJECT BACKGROUND

Morrow Geotechnics Pty Ltd has undertaken a Geotechnical Investigation to provide geotechnical advice and recommendations for the proposed development at 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW (the site).

Architectural drawings have been provided by Axel Richter Architects, *Co-Living 465-469 Princes Highway & 5-7 Geeves Avenue Rockdale NSW 2216*, Rev A, dated 30 April 2024, including:

- A100 Site Plan;
- A101 Basement 2;
- A102 Basement 1;
- A200 East Elevation; and
- A201 North Elevation.

From the documentation provided, Morrow Geotechnics understands that the proposed development involves the construction of a six storey multi-dwelling structure over a two level basement. Excavation for the proposed basement is expected to extend to a depth of approximately 6 m below ground level (mBGL).

1.1 Investigation Intent

The purpose of the investigation is to provide geotechnical advice and recommendations for structural design. These recommendations include:

- Expected subsurface conditions;
- Lot classification in accordance with AS2870 and geotechnical parameters for foundation design;
- Excavation support options, including lateral earth pressures and pile design parameters;
- Advice on possible seepage water associated with construction;
- Earthquake site classification in accordance with AS1170.4;
- Advice on geotechnical construction constraints;

1.2 Published Geological Mapping

Information on regional sub-surface conditions, referenced from the Department of Mineral Resources Geological Map Sydney 1:100,000 (Geological Series Sheet 9130) indicates that the site is underlain by (Rh) Hawkesbury Sandstone, which is typically comprised of medium to coarse-grained quartz sandstone, with very minor shale and laminite lenses.

1.3 Published Soil Landscapes

The Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Sheet 9130 (2nd Edition) indicates that the site overlies the Newport Landscape. This landscape type typically includes gently undulating plains of Holocene sands to rolling rises over other soils or bedrock. Soils are generally shallow (< 0.5 m) siliceous sands overlaying moderately deep buried sands (< 1.5m) yellow podzolic soil with sandy topsoil on crests and deep (> 2.0m) podzols in depressions earthy sands. These soils are noted present high soil erosion hazards, localized steep slopes, very low soil fertility and non-cohesive topsoil.

2 OBSERVATIONS

2.1 Investigation Methods

Fieldwork was undertaken by Morrow Geotechnics on 13, 16, 17 & 18 September 2024. Work carried out as part of this investigation includes:

- Review of publicly available information from previous reports in the project area, published geological and soil mapping and government agency websites;
- Site walkover inspection by an experienced Engineering Geologist and Geotechnical Engineer to assess topographical features, condition of surrounding structures and site conditions;
- Drilling of three boreholes (BH1 to BH3). Boreholes were drilled using a man-portable drilling rig using NMLC coring techniques to depths of 18.41, 18.90 and 16.30 mBGL (metres below ground level) respectively. Rock core was boxed and photographed and point load tests were undertaken on selected core sample to assess rock strength;
- Groundwater observations within the borehole during drilling; and
- Installation of three groundwater monitoring wells within the boreholes immediately following drilling.

Borehole locations are shown on **Figure 1** and borehole logs are presented in **Appendix A.**

2.2 Subsurface Conditions

The stratigraphy at the site is characterized by fill and deep alluvial soils overlying weathered sandstone bedrock. Observations taken during the investigation have been used to produce a stratigraphic model of the site. The observed stratigraphy has been divided into four geotechnical units.

A summary of the subsurface conditions across the site, interpreted from the investigation results, are presented in **Table 1** and **Table 2**. More detailed descriptions of subsurface conditions at the test locations are available in the borehole logs presented in **Appendix A**. The details of the method of soil and rock classification, explanatory notes and abbreviations adopted in the borehole logs are also presented in **Appendix A**.

TABLE 1 SUMMARY OF ENCOUNTERED SUBSURFACE CONDITIONS

Unit	Material	Comments
1	Fill	Sandy gravelly FILL, generally loose to medium dense, fine to medium grained, moist with gravels and construction waste. Unit 1 is inferred to be uncontrolled and poorly compacted.
2	Alluvial Soil	Alluvial clayey SAND, low plasticity, dense, fine to medium grained grading to alluvial sandy CLAY with depth, very stiff to hard, high plasticity, fine grained, trace ironstone gravels.
3	Class V Sandstone	Extremely weathered SANDSTONE, extremely low strength, fine to medium grained, iron stained with sandy clay bands.
4	Class IV Sandstone	Moderately to distinctly weathered SANDSTONE, sub horizontal bedding, low to medium strength, fine to medium grained and iron stained. Defects within Unit 4 comprised sub-horizontal bed partings and trace infilled clay seams.
5	Class III Sandstone	Moderately weathered SANDSTONE, sub horizontal bedding, medium strength, fine to medium grained and iron stained. Defects within Unit 3 comprised sub-horizontal bed partings.

TABLE 2 ENCOUNTERED GEOTECHNICAL CONDITIONS

Unit		Approx. Depth Range of Unit [1] mBGL (RL mAHD)		
		BH1	BH2	BH3
1	Fill	0.0 to 0.8 (15.2 to 14.4)	0.0 to 1.9 (15.3 to 13.4)	0.0 to 2.8 (15.6 to 12.8)
2	Alluvial Soil	0.8 to 13.6 (14.4 to 1.6)	1.9 to 16.7 (13.4 to -1.4)	2.8 to 15.0 (12.8 to 0.6)
3	Class V Sandstone	13.6 to 16.1 (1.6 to -0.9)	16.7 to 17.9 (-1.4 to -1.7)	15.0 to 15.4 (0.6 to 0.2)
4	Class IV Sandstone	16.1 to 18.4 (-0.9 to -3.2)	17.0 to 17.9 (-1.7 to -2.6)	15.4 to 16.3 (0.2 to -0.7)
5	Class III Sandstone	-	17.9 to 18.9 (-2.6 to -3.6)	-

Notes:

1 Depths shown are based on material observed within test locations and will vary across the site.
2 The top of Unit 3 is inferred during drilling and may vary across site.
3 Sandstone classed as per Pells (2004)

2.1 Groundwater Observations

Standpipe piezometers were installed within the boreholes as part of the geotechnical investigations, monitoring well construction details are found in **Table 3** below. The monitoring well was constructed using 50mm diameter screw threaded PVC casing, sections of which were machine slotted. The annulus between the casing and boreholes was backfilled using a 5 mm filter gravel pack to above the top of the screen. A bentonite plug with a minimum thickness of 0.5m was then installed above the gravel pack, the remaining annulus was backfilled with drill cuttings. The well was finished with a cement plug and a gatic cover.

The piezometers were purged on 19 August 2024 and a groundwater monitoring event was undertaken on 19 August 2024. The monitoring well location is shown on the attached plan in **Figure 1**.

TABLE 3 PIEZOMETER DETAILS

Piezometer	BH1	BH2	BH3
Top of Piezometer approx. (mAHD)	15.2	15.3	15.6
Piezometer Depth (mBGL)	18.41	18.90	19.77
Bentonite Plug Depth (mBGL)	1.0 to 1.4	4.0 to 5.8	1.5 to 3.0
Screen Depth (mBGL)	1.51 to 18.41	6.90 to 18.90	2.5 to 7.0
Groundwater Measurement mBGL (mAHD)	2.66 (12.54)	2.82 (12.48)	1.19 (14.41)
Well Monitoring Date	18/09/2024	18/09/2024	18/09/2024

3 GEOTECHNICAL RECOMMENDATIONS FOR DESIGN

3.1 Excavation Retention

Proposed excavations may employ temporary batter slopes provided that sufficient space is available for benching/battering of Unit 1 to Unit 3 material. Where sufficient space for batters of Units 1 to 2 materials is not available a shoring system should be installed prior to excavation. Shoring systems in sandstone generally comprise anchored soldier pile walls with piles socketing below bulk excavation level (BEL). Piles can be terminated within Class III Sandstone or better material above BEL if toe anchors are installed for lateral pile restraint.

Geotechnical parameters for input to shoring design have been provided in **Table 4** below.

TABLE 4 EARTH PRESSURE PARAMETERS

Material		Unit 1 Fill	Unit 2 Alluvial Soil	Unit 3 Class V Sandstone	Unit 4 Class IV Sandstone	Unit 5 Class III Sandstone
Unit Weight (kN/m^3)		18	19	23	24	24
Earth Pressure Coefficients	At Rest, K_o	0.58	0.56	0.47	0.44	0.36
	Passive, K_p	2.46	2.56	3.25	3.54	4.60
	Active, K_a	0.41	0.39	0.31	0.28	0.22
Drained Cohesion, c' (kPa)		2	6	40	80	200
Friction Angle, ϕ' (^{o})		25	26	32	36	40
Elastic Modulus (MPa)		5	20	80	200	600
Poisson's Ratio		0.30	0.30	0.25	0.22	0.20

Notes

1 Unit Weight is based on visual assessment only and may vary by ±10%.
2 Earth pressures are provided on the assumption that the ground behind the retaining wall is flat and drained.

In addition, design of retaining walls should consider the following:

- Appropriate surcharge loading from construction equipment, vehicular traffic and neighbouring structures at finished surface level should be considered in the retention design. Surcharge loads on retention structures may be calculated using a rectangular stress block with an earth pressure coefficient of 0.5 applied to surcharge loads at ground surface level.
- Anchor design should ignore the contribution of any bonded length within a wedge which extends upwards at 45^o from the base of Unit 5 material to account for a failure wedge forming behind the shoring system.

3.2 Soil and Rock Excavatability

The expected ability of equipment to excavate the soil and rock encountered at the site is summarised in **Table 5**. This assessment is based on available site investigation data and guidance on the assessment of

excavatability of rock by Pettifer and Fookes (1994). The presence of medium to high strength bands in lower strength rock and the discontinuity spacing may influence the excavatability of the rock mass.

TABLE 5 SOIL AND ROCK EXCAVATABILITY

Unit	Material	Excavatability
1	Fill	Easy digging by 20t Excavator
2	Alluvial Soil	
3	Class V Sandstone	Easy digging by 20t Excavator, moderate to hard ripping required where very low strength sandstone encountered within Unit 3
4	Class IV Sandstone	Hard ripping by 20t Excavator with hydraulic hammering required where medium strength sandstone and ironstone is encountered within Unit 4
5	Class III Sandstone	Hydraulic hammering required within Unit 5

The excavation methodology may also be affected by the following factors:

- Scale and geometry of the excavation;
- Availability of suitable construction equipment;
- Potential reuse of material on site; and
- Acceptable excavation methods, noise, ground vibration and other environmental criteria.

3.3 Excavation Vibration Considerations

As a guide, safe working distances for typical items of vibration intensive plant are listed in **Table 6**. The safe working distances are quoted for both "cosmetic" damage (refer British Standard BS 7385:1993) and human comfort (refer NSW Environmental Protection Agency Vibration Guideline).The safe working distances should be complied with at all times, unless otherwise mitigated to the satisfaction of the relevant stakeholders.

TABLE 6 RECOMMENDED SAFE WORKING DISTANCES FOR VIBRATION INTENSIVE PLANT

Plant Item	Rating/Description	Safe Working Distance	
		Cosmetic Damage (BS 7385:1993) [1]	Human Response (EPA Vibration Guideline)
Vibratory Roller	< 50 kN (typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (typically 2-4 tonnes)	6 m	20 m
	< 200 kN (typically 4-6 tonnes)	12 m	40 m
	< 300 kN (typically 7-13 tonnes)	15 m	100 m
	< 300 kN (typically 13-18 tonnes)	20 m	100 m
	< 300 kN (typically >18 tonnes)	25 m	100 m
Small Hydraulic Hammer	300 kg – 5 to 12 t excavator	2 m	7 m

Plant Item	Rating/Description	Safe Working Distance	
		Cosmetic Damage (BS 7385:1993) [1]	Human Response (EPA Vibration Guideline)
Med Hydraulic Hammer	900 kg – 12 to 18 t excavator	7 m	23 m
Large Hydraulic Hammer	1600 kg – 18 to 34 t excavator	22 m	73 m
Vibratory Pile Driver	Sheet Piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2m (nominal)	N/A
Jackhammer	Handheld	1 m (nominal)	Avoid contact with structure

Notes:

1 More stringent conditions may apply to heritage buildings or other sensitive structures.

In relation to human comfort (response), the safe working distances in **Table 6** relate to continuous vibration and apply to residential receivers. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods are permitted, as discussed in British Standard BS 6472-1:2008.

The safe working distances provided in **Table 6** are given for guidance only. Monitoring of vibration levels may be required to ensure vibrations levels remain below threshold values during the construction period.

3.4 Foundation Design

It is not recommended that shallow footings or slabs found within Unit 1 material due to the potential for differential settlement caused by footings bridging between materials of varying stiffness. Shallow footings and slabs at the site should be designed in accordance with AS2870:2011 based on a Site Classification of 'H1.' The site classification has been provided on the basis that the performance expectations set out in Appendix B of AS2870–2011 are acceptable and that future site maintenance will be undertaken in accordance with CSIRO BTF 18.

The parameters given in **Table 7** may be used for the design of pad footings and bored piles. Morrow Geotechnics recommends that a Preliminary Geotechnical Strength Reduction Factor (GSRF) of 0.4 is used for the design of piles in accordance with AS 2159:2009 if no allowance is made for pile testing during construction. Should pile testing be nominated, the GSRF may be reviewed and a value of 0.55 to 0.65 may be expected.

Ultimate geotechnical strengths are provided for use in limit state design. Allowable bearing pressures are provide for serviceability checks. These values have been determined to limit settlements to an acceptable level for conventional building structures, typically less than 1% of the minimum footing dimension.

TABLE 7 PAD FOOTING AND PILE DESIGN PARAMETERS

Material		Unit 1 Fill	Unit 2 Alluvial Soil	Unit 3 Class V Sandstone	Unit 4 Class IV Sandstone	Unit 5 Class III Sandstone
Allowable Bearing Pressure (kPa)		N/A	150	1000	1500	3500
Ultimate Vertical End Bearing Pressure (kPa)		N/A	450	3600	4500	10500
Elastic Modulus (MPa)		5	20	80	200	600
Ultimate Shaft Adhesion (kPa)	In Compression	0	30	100	300	800
	In Tension	0	15	50	150	400
Susceptibility to Liquefaction		Medium	Low	Low	Low	Low

Notes:

1 Side adhesion values given assume there is intimate contact between the pile and foundation material. Design engineer to check both 'piston' pull-out and 'cone' pull-out mechanics in accordance with AS4678-2002 Earth Retaining Structures.

2 Susceptibility to liquefaction during an earthquake is based on the following definition:
- Low - Medium to very dense sands, stiff to hard clays, and rock
- Medium - Loose to medium dense sands, soft to firm clays, or uncontrolled fill below the water table
- High - Very loose sands or very soft clays below the water table.

3 Allowable Bearing Pressure provided for Unit 5 Class II Sandstone will require on site verification of rock quality by spoon testing of a minimum of 50% of the pad footings to 2 times the minimum pad footing width.

To adopt these parameters, we have assumed that the bases of all pile excavations are cleaned of loose debris and water and inspected by a suitably qualified Geotechnical Engineer prior to pile construction to verify that ground conditions meet design assumptions. Where groundwater ingress is encountered during pile excavation, concrete is to be placed as soon as possible upon completion of pile excavation. Pile excavations should be pumped dry of water prior to pouring concrete, or alternatively a tremmie system could be used.

Selection of footing types and founding depth will need to consider the risk of adverse differential ground movements within the foundation footprint and between high level and deeper footings. Unless an allowance for such movement is included in the design of the proposed development, we recommend that all new structures be found on natural materials with comparable end bearing capacities and elastic moduli.

3.5 AS1170 Earthquake Site Risk Classification

Assessment of the material encountered during the investigation in accordance with the guidelines provided in AS1170.4-2007 indicates an earthquake subsoil class of Class C_e – Shallow Soil for the site.

4 STATEMENT OF LIMITATIONS

The adopted investigation scope was limited by site access restrictions due to presence of structures at the site at the time of our investigation and by the investigation intent. Further geotechnical inspections should be carried out during construction to confirm both the geotechnical model and the design parameters provided in this report.

Your attention is drawn to the document "Important Information", which is included in **Appendix B** of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Morrow Geotechnics, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

5 REFERENCES

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

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

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

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

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

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

NSW Department of Mineral Resources (1985) Wollongong-Port Hacking 1:100,000 Geological Series Sheet 9029-9129 (Edition 1). Geological Survey of New South Wales, Department of Mineral Resources.

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

6 CLOSURE

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

For and on behalf of Morrow Geotechnics Pty Ltd,

Mark Peach
Engineering Geologist

Alan Morrow
Principal Geotechnical Engineer

morrow

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Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155	P: 02 8599 7579 F:
P3324 - Borehole Location Plan	
Client No:	Job No: P3324
Client: Emag Apartments Pty Ltd	
Project: Rockdale	
Address: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW	
Legend: Borehole Locations	
Image Source: NearMap	Viewed: 2024-09-23

Drawn By: Mark Peach	Checked By: Rhiannon McKeon	Date: 2024-09-23	Figure: 1

Appendix A

BOREHOLE LOGS AND EXPLANATORY NOTES

Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

Geotechnical Log - Borehole

BH1

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,952.36	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,658.76	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.2 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.41 m BGL	Date	: 13/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Diatube		A	x x	Non-Soil		CCT	0.2	Concrete	15.0			
ADT	GWNE		2 14 11 6 5 5	FILL		SW	0.8	FILL Gravelly SAND SW: medium dense to dense, dark grey brown, fine to medium grained, fine sized gravel, trace low plasticity clay, moist, low resistance .	0.2 14.4		MD-D	M
			7 5 5 5 6 6 6 6 5 6 6 6 6	Alluvial		SC	1 2 2.1	Alluvial Clayey SAND SC: dense, low plasticity clay, pale grey orange red, medium grained, with fine sized gravel, moist, low resistance, ironstone gravels .	0.8 13.1		D	
			8 6 7 8 7			CI	2.6	Alluvial Sandy CLAY CI: very stiff, medium plasticity, pale grey, fine to medium grained sand, trace fine sized gravel, w ≈ pl, low resistance.	2.1 12.6		VSt	w ≈ PL
			8 7 7 7 10 12 11 15 21 21			CH	3	As above, but CH: very stiff to hard, high plasticity, fine grained sand.	2.6		VSt-H	

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Geotechnical Log - Borehole

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Easting (m)	: 327,952.36	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
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Total Depth	: 18.41 m BGL	Date	: 13/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
ADT	Seepage							As above, but CH: very stiff to hard, high plasticity, fine grained sand.				
Washbore						CH	6				VSt-H	

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Total Depth	: 18.41 m BGL	Date	: 13/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Washbore						CH	9 10 11 12	As above, but CH: very stiff to hard, high plasticity, fine grained sand.			VSt-H	

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Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Washbore						CH	13	As above, but CH: very stiff to hard, high plasticity, fine grained sand.			VSt-H	
							13.57	**Commenced Coring at 13.57m**	1.6 / 13.57			

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Geotechnical Log - Borehole

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Total Depth	: 18.41 m BGL	Date	: 13/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	RQD% and TCR%	Testing: Is(50)	Estimated Strength (VLS, LS, MS, HS, VHS, EHS)	Depth (m)	Graphic Log	Classification Code	Material Description	Elevation / Depth (m)	Weathering	Defect Spacing (mm) (30, 100, 300, 1000, 3000)	Defect Description
						13			**Commenced Coring at 13.57m**				
NMLC Coring	No Water Loss	50mm PVC Slotted	RQD = 0% TCR = 100%			14		SST	Extremely weathered, rock Sandy CLAY SST: hard, low plasticity, pale grey red, fine grained sand, w < pl, iron stained, with sandy clay bands.		XW		
			RQD = 0% TCR = 100%			15							
			RQD = 59% TCR = 100%										

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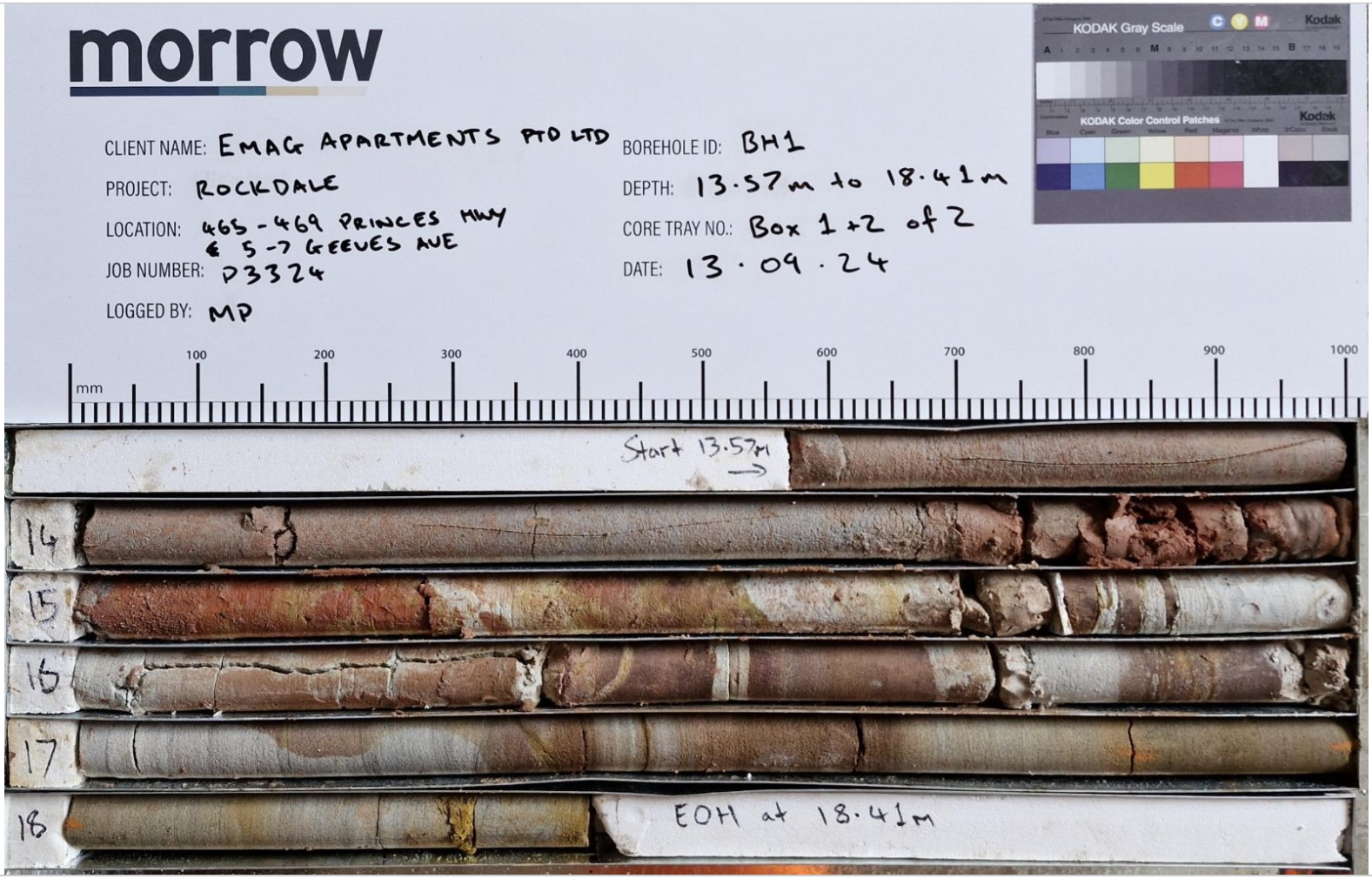
Drilling Method	Water	Well Diagram	RQD% and TCR%	Testing: Is(50)	Estimated Strength (VLS, LS, MS, HS, VHS, EHS)	Depth (m)	Graphic Log	Classification Code	Material Description	Elevation / Depth (m)	Weathering	Defect Spacing (mm) (30, 100, 300, 1000, 3000)	Defect Description
NMLC Coring	Loss - 10%	50mm PVC Slotted	RQD = 59% TCR = 100%	d: 0.22, a: 0.32 d: 0.39, a: 0.31 d: 0.33, a: 0.61 d: 0.29, a: 0.28		16.05 17 17.7 18 19		SST SST SST	Extremely weathered, rock Sandy CLAY SST: hard, low plasticity, pale grey red, fine grained sand, w < pl, iron stained, with sandy clay bands. Rock SANDSTONE: distinctly to highly weathered, low to medium strength, grey orange pale grey, fine grained, sub horizontal bedding with infilled clay bedding partings, iron staining. . As above, but moderately weathered, pale grey red, generally massive, with sub horizontal bedding and infilled clay bedding partings. **BH1 Reached Target Depth at 18.41m (Target Depth Reached.)**	-0.9 / 16.05 -2.5 / 17.7	XW DW-HW MW		16.06-16.36, J, 88°, UN, RO, CT, OP, clay coating., 16.38-16.39, P, 2°, PL, RO, CT, I, infilled clay , 16.42, J, 45°, CV, RO, STN, C, 16.52, P, 1°, PL, RO, CT, OP, 16.73-16.75, IS, 2°, PL, RO, CT, I, infilled clay , 16.96-17, XWS, 2°, PL, Very Rough, CT, OP, 17.34-17.38, J, 50°, UN, RO, STN, C, 17.4, P, 2°, PL, RO, STN, OP, 17.45, P, 3°, PL, RO, STN, C, 17.62, P, 3°, UN, Very Rough, STN, OP, 18.25, P, 2°, UN, RO, CL, OP, 18.31, P, 1°, PL, RO, CT, I, clay infilled ,



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02 8599 7579

Sydney Gadigal Land,
2/5-7 Malta Steet, Fairfield
East NSW 2155

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Photo description	BH1 Box 1 & 2 of 2		
Client	Emag Apartments Pty Ltd		
Location	465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW		
Project name	Rockdale		
Project No	P3324	**Scale**	Not to Scale
BH No	BH1	**BH Depth**	13.57m to 18.41m

Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Diat ube		B	x	Non-Soil		CCT	0.1	Concrete	15.2			
ADT			1	FILL		SW		FILL Gravelly SAND SW: medium dense, grey brown, fine to medium grained, fine sized gravel, with low plasticity clay, moist, low resistance..	0.1		MD	M
			1									
			5									
			9									
			11									
			11									
			4									
			11									
			12									
			4				1					
			10									
			6									
			5									
			5									
			7									
			7									
			8									
			11				1.9		13.4			
			7	Alluvial		SC		Alluvial Clayey SAND SC: medium dense to dense, low plasticity clay, grey red, fine to medium grained, with fine sized gravel, moist, low resistance..	1.9		MD-D	
			9				2					
			7									
			7									
			8									
			13				2.5		12.8			
			18			SC		As above, but pale grey.	2.5			
			18									
			25+									
							3		12.3			
						SC		As above, but medium plasticity clay.	3			
							3.3		12.0			
						CH		Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..	3.3		H	w ≈ PL

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Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
ADT	Seepage							Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..				
Washbore						CH	5 6 7 8				H	w ≈ PL

Morrow Geotechnics
Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155
Phone: 02 8599 7579

Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Washbore						CH	9 10 11 12	Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..			H	w ≈ PL

Morrow Geotechnics
Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155
Phone: 02 8599 7579

Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Washbore						CH	13 14 15 18	Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..			H	w ≈ PL

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Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Washbore						CH	16.74	Alluvial Sandy CLAY CH: hard, high plasticity, pale grey, fine grained sand, trace fine sized gravel, w ≈ pl, low resistance..	-1.4		H	w ≈ PL
								Commenced Coring at 16.74m	16.74			

Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

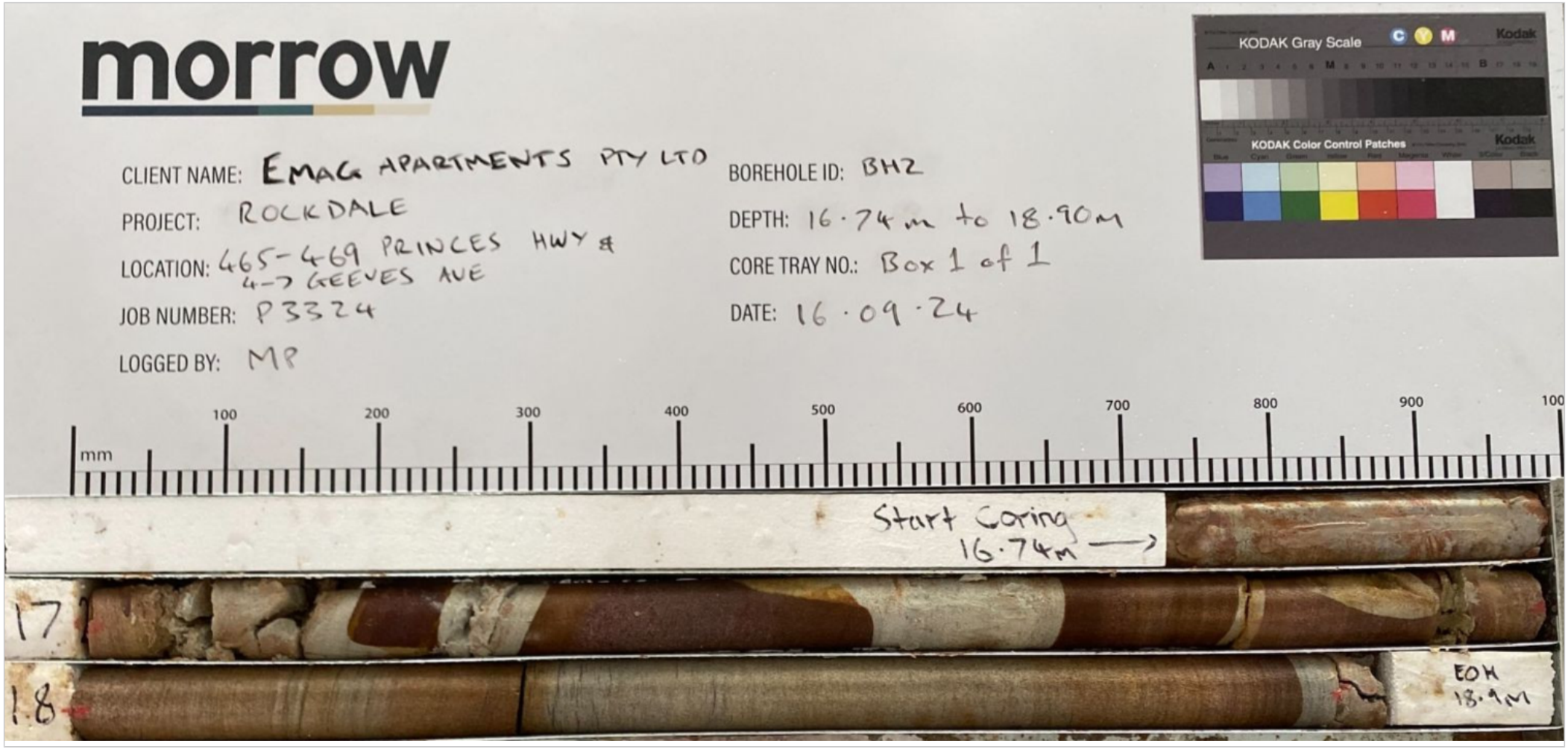
Phone: 02 8599 7579

Geotechnical Log - Borehole

BH2

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,976.13	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,690.16	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.3 (m)	Reviewed By	: Rhiannon McKeon	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 18.9 m BGL	Date	: 16/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	RQD% and TCR%	Testing: Is(50)	Estimated Strength (VLS, LS, MS, HS, VHS, EHS)	Depth (m)	Graphic Log	Classification Code	Material Description	Elevation / Depth (m)	Weathering	Defect Spacing (mm) (30, 100, 300, 1000, 3000)	Defect Description
									Commenced Coring at 16.74m				
NMLC Coring	No Water Loss	50mm PVC Slotted	RQD = 71% TCR = 100%	d: 0.50, a: 0.43		17		SST	Extremely weathered, rock Sandy CLAY SST: hard, high plasticity, red pale grey, fine to medium grained sand, with fine to medium sized gravel, w ≈ pl, iron stained.	-1.7 / 17	XW		
								SST	Rock SANDSTONE: highly weathered, low to medium strength, pale grey red grey, fine grained, iron staining, generally massive with infilled clay bedding partings.		HW		17.06-17.1, IS, 2°, UN, Very Rough, CT, I, Infilled clay, 17.13, J, 45°, UN, Very Rough, CL, OP, 17.15, P, 15°, UN, Very Rough, CT, OP, clay coating , 17.26-17.29, IS, 20°, UN, Very Rough, CT, I, Infilled clay, 17.57-17.66, XWS, PL, RO, CT, I,
				d: 0.34, a: 0.54		17.95 / 18		SST	Rock SANDSTONE: moderately weathered, medium strength, grey orange red, fine to medium grained, iron staining, sub horizontal bedding .	-2.6 / 17.95	MW		17.8, P, 5°, UN, RO, STN, OP, 17.9, J, 80°, PL, RO, CL, C, 17.92-17.95, XWS, PL, Very Rough, CT, I, 18.3, P, 2°, PL, RO, STN, OP, Carbonaceous staining , 18.85-18.89, XWS, PL, Very Rough, CT, I,
						19			**BH2 Reached Target Depth at 18.9m (Target Depth Reached)**				



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Sydney Gadigal Land,
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Photo description	BH2_Box 1 of 1		
Client	Emag Apartments Pty Ltd		
Location	465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW		
Project name	Rockdale		
Project No	P3324	**Scale**	Not to Scale
BH No	BH2	**BH Depth**	16.74m to 18.90m

Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Diatube		C	x	Non-Soil		CCT	0.2	Concrete	15.4			
			x									
ADT			2	FILL		SW		FILL SAND SW: loose to medium dense, grey yellow, fine to medium grained, trace fine sized gravel, moist, low to medium resistance, construction waste (bricks, concrete), strong hydrocarbon odour.	0.2		L-MD	M
			3									
			5				1					
			4									
			3									
			3				2					
			6									
			4 HB									
Washbore							2.8		12.8			
				Alluvial		SC		Alluvial Clayey SAND SC: medium dense, low plasticity clay, grey red, fine to medium grained, trace fine sized gravel, moist, trace ironstone gravels .	2.8		MD	
							3					
							4					

Morrow Geotechnics
Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155
Phone: 02 8599 7579

Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Washbore				Alluvial		SC	5 6 7 8	Alluvial Clayey SAND SC: medium dense, low plasticity clay, grey red, fine to medium grained, trace fine sized gravel, moist, trace ironstone gravels .			MD	

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Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Washbore				Alluvial		SC	10	Alluvial Clayey SAND SC: medium dense, low plasticity clay, grey red, fine to medium grained, trace fine sized gravel, moist, trace ironstone gravels .			MD	

Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	Testing: DCP	Soil Origin	Graphic Log	Classification Code	Depth (m)	Material Description	Elevation / Depth (m)	Weathering	Consistency	Moisture
Washbore				Alluvial		SC	13 14 15 15.43	Alluvial Clayey SAND SC: medium dense, low plasticity clay, grey red, fine to medium grained, trace fine sized gravel, moist, trace ironstone gravels .	0.2		MD	
								Commenced Coring at 15.43m	15.43			

Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

Phone: 02 8599 7579

Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	RQD% and TCR%	Testing: Is(50)	Estimated Strength (VLS, LS, MS, HS, VHS, EHS)	Depth (m)	Graphic Log	Classification Code	Material Description	Elevation / Depth (m)	Weathering	Defect Spacing (mm) (30, 100, 300, 1000, 3000)	Defect Description
						13							
						14							
						15			**Commenced Coring at 15.43m**				
NMLC Coring	No Water Loss		RQD = 26% TCR = 100%					SST	Rock SANDSTONE: distinctly to highly weathered, low to medium strength, grey red, fine grained, iron stained, infilled clay seams. sub horizontal bedding.		DW-HW		15.48, P, 2°, UN, Very Rough, STN, OP, Iron stained., 15.53-15.73, IS, UN, Very Rough, CT, I, Infilled sandy clay., 15.75, P, 2°, PL, RO, STN, OP, Iron stained., 15.82, P, 2°, UN, RO, CT, OP, Iron Stained., 15.93, P, 2°, PL, RO, STN, OP, Iron stained Sandy Clay infill.,

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Morrow Geotechnics

Sydney Gadigal Land: 2/5-7 Malta Steet, Fairfield East NSW 2155

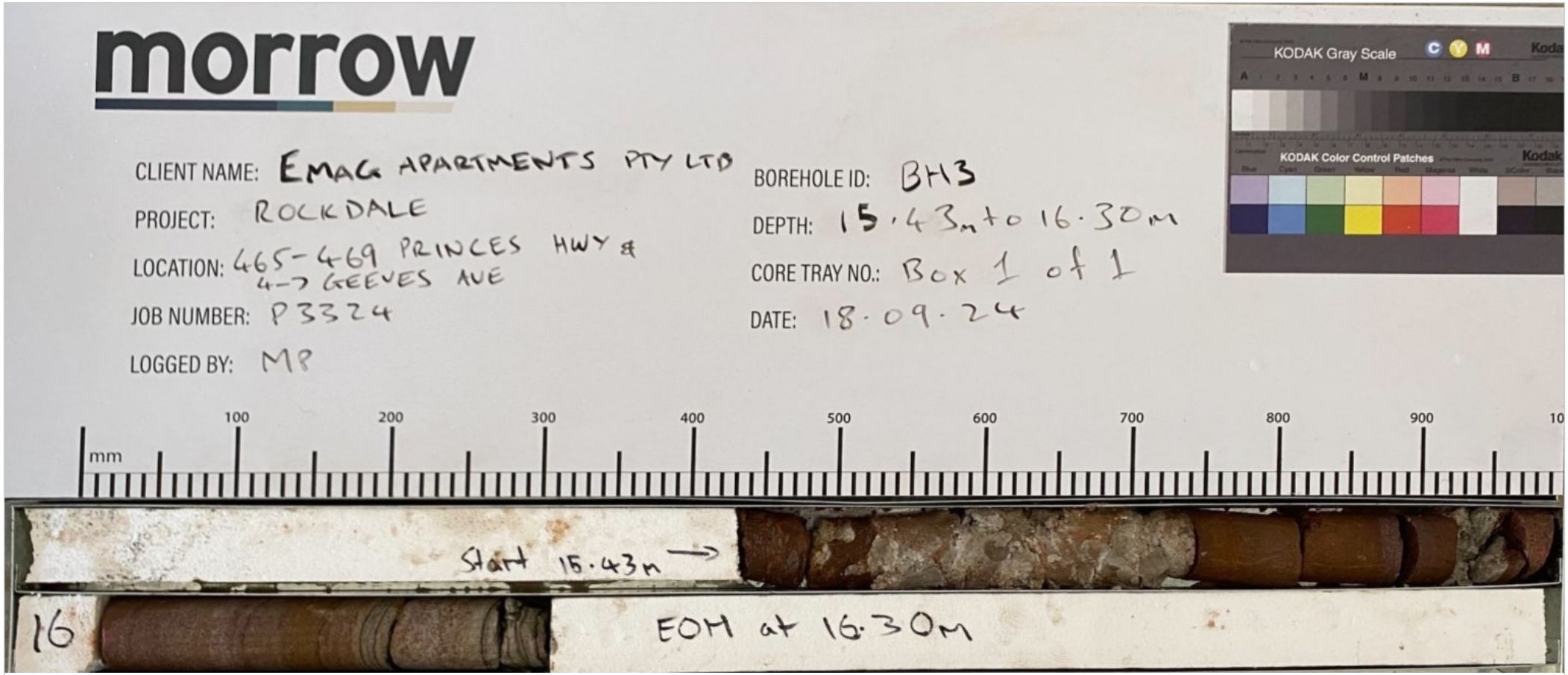
Phone: 02 8599 7579

Geotechnical Log - Borehole

BH3

UTM	: 56H	Drill Rig	: Man-Portable	Job Number	: P3324
Easting (m)	: 327,955.71	Driller Supplier	: Hard Access Drilling	Client	: Emag Apartments Pty Ltd
Northing (m)	: 6,241,677.81	Logged By	: Mark Peach	Project	: Rockdale
Ground Elevation	: 15.6 (m)	Reviewed By	:	Location	: 465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW
Total Depth	: 16.3 m BGL	Date	: 17/09/2024	Loc Comment	:

Drilling Method	Water	Well Diagram	RQD% and TCR%	Testing: Is(50)	Estimated Strength (VLS, LS, MS, HS, VHS, EHS)	Depth (m)	Graphic Log	Classification Code	Material Description	Elevation / Depth (m)	Weathering	Defect Spacing (mm) (30, 100, 300, 1000, 3000)	Defect Description
NMLC Coring			RQD = 26% TCR = 100%	d: 0.37, a: 0.50				SST	Rock SANDSTONE: distinctly to highly weathered, low to medium strength, grey red, fine grained, iron stained, infilled clay seams. sub horizontal bedding.		DW-HW		16.19, P, 5°, PL, RO, STN, OP, Carbonatious staining , 16.26, P, 3°, UN, Very Rough, CT, OP, Carbonaceous staining, Clay coating.,
						17			**BH3 Reached Target Depth at 16.3m (Target Depth reached.)**				
						18							
						19							



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02 8599 7579

Sydney Gadigal Land,
2/5-7 Malta Steet, Fairfield
East NSW 2155

info@morrowgeo.com.au

Photo description	BH3 Box 1 of 1		
Client	Emag Apartments Pty Ltd		
Location	465-469 Princes Highway & 5-7 Geeves Avenue, Rockdale NSW		
Project name	Rockdale		
Project No	P3324	**Scale**	Not to Scale
BH No	BH3	**BH Depth**	15.43m to 16.30m

Soil and Rock Logging Explanatory Notes

GENERAL

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

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

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

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

DRILLING

Drilling & Casing

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

Drilling Fluid/Water

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

Drilling Penetration/Drill Depth

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

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

Groundwater Levels

Date of measurement is shown.

Standing water level measured in completed borehole

Level taken during or immediately after drilling

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

EXCAVATION LOGS

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

MATERIAL DESCRIPTION - SOIL

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

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

Moisture Condition

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

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

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

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

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

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

MATERIAL DESCRIPTION -ROCK

Material Description

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

Core Loss

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

Bedding

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

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

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

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

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

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

° Diametral Point Load Test

Axial Point Load Test

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

MATERIALS STRUCTURE/FRACTURES

ROCK

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

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

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

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

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

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

SOIL

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

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

Appendix B

IMPORTANT INFORMATION

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Important Information

This Document has been provided by Morrow Geotechnics Pty Ltd subject to the following limitations:

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