Results of Geotechnical Investigation

14 Aquatic Drive, Frenchs Forest

PSM4864-005R Rev 3 30 April 2025

Goodman Property Services Australia Pty Ltd

PSM Consult Pty Limited ABN 47 134 739 496

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1. Introduction

This report has been prepared by PSM on behalf of Goodman Property Services (Aust.) Pty Ltd (Goodman) to accompany a development application for self-storage units and warehouse and distribution centre uses at 14 Aquatic Drive, Frenchs Forest.

This site is located on the southern side of Warringah Road and within the broader Frenchs Forest Business Park. It currently hosts an existing four storey commercial building which is proposed for demolition under this application.

The proposed development comprises construction of a three-storey industrial building including:

- 153 self-storage units at ground floor;
- 72 warehouse units on Levels 1 and 2;
- 123 car parking spaces across all levels;
- outdoor breakout spaces for staff at ground floor and Level 2;
- shared lobby across all levels;
- landscaping; and
- associated infrastructure/servicing works.

Approval is sought for 24/7 operation of the proposed self-storage and warehouse and distribution units.

This report presents the results of a geotechnical investigations undertaken between 14 and 15 November 2022 for the proposed light industrial strata and storage development at 14 Aquatic Drive, Frenchs Forest, herein referred to as **the Site**. The work was undertaken in accordance with 'Item 1' of PSM's proposal (PSM4864-001L, dated 12 August 2022).

The aim of the geotechnical investigation was to assess the subsurface conditions and provide geotechnical advice for the proposed light industrial strata and storage development to be constructed at the Site.

2. Background

PSM has been provided with the following documents to assist with the geotechnical investigation:

- Consultant Briefing Meeting Notes:
  - *"14 Aquatic Drive, Frenches Forest Strata Industrial Development"* dated 10 December 2024
- Architectural drawings by SBA
  - 24103, DA100 P3, DA101 P4 to DA102 P4, DA200 P5 and DA201 P4 to DA204 P4, dated 25 February 2025
- Landscape design by Place Design Group
  - 240307, dated 28 February 2025
- Civil drawings by Costin Roe Consulting:
  - *"CO9431.01-DA43 to 54"* dated 4 February 2025

We understand the following regarding the existing site:

- The existing building comprises:
  - The existing commercial building includes 2 x levels of basement carparking and 4 above ground levels of Commercial Office.
  - The site falls approximately 14.5m from the North to the South.
  - There are several existing mature trees located on site that will need to be retained.
  - The basement carparking extent is intended to be utilised as the perimeter for the basement storage level.

Inset 1: Locality plan of the Site (site marked in red)

3. Geotechnical Investigation

3.1 Fieldwork

The fieldwork was carried out on 14 and 15 November 2022, under the full-time supervision of a PSM geotechnical engineer who undertook the following tasks:

- Directing service locating, concrete coring, drilling and reinstatement of boreholes.
- Preparing engineering logs of material encountered within the boreholes.
- Undertaking point load tests on the recovered cores.
- Collecting soil samples for laboratory testing.

The intrusive testing locations were recorded with a hand-held GPS unit with a horizontal accuracy of approximately +/-5 m. Figure 1 shows the approximate testing locations. Approximate elevations were inferred from the elevation data publicly available by NSW Spatial Data.

Prior to carrying out testing, on-site service location “scans” were undertaken by a certified service locator to ensure the test locations were free from buried utilities. Where encountered, concrete slabs were cored using conventional diatube coring techniques prior to drilling.

Each of the holes were backfilled and fully reinstated on completion of the investigation.

3.1.1 Boreholes

A total of five (5) boreholes: were completed using a truck and track drill rig to a depth of between 3.4 m and 10.5 m: These boreholes comprised the following:

- Three (3) augered boreholes (ABH01 to ABH03)
- Two (2) cored boreholes (CBH01 and CBH02)

Rotary auger technique was undertaken through overlying soil units with rock coring completed using NMLC coring techniques. SPTs were taken at regular interval. Bulk soil samples were retrieved directly from the auger for laboratory testing.

Engineering logs were prepared for each cored borehole and are presented in Appendix B, along with explanation sheets. Photographs of the recovered rock core were taken and are also presented in Appendix B.

Point load tests on the core were performed at approximately one metre intervals. Results are tabulated in Appendix C.

3.1.2 Standpipe Piezometers

Standpipe piezometers were installed in CBH01 to monitor groundwater levels and fluctuations. Construction records for the installed piezometers are included in Appendix D.

4. Site Conditions

4.1 Geological Setting

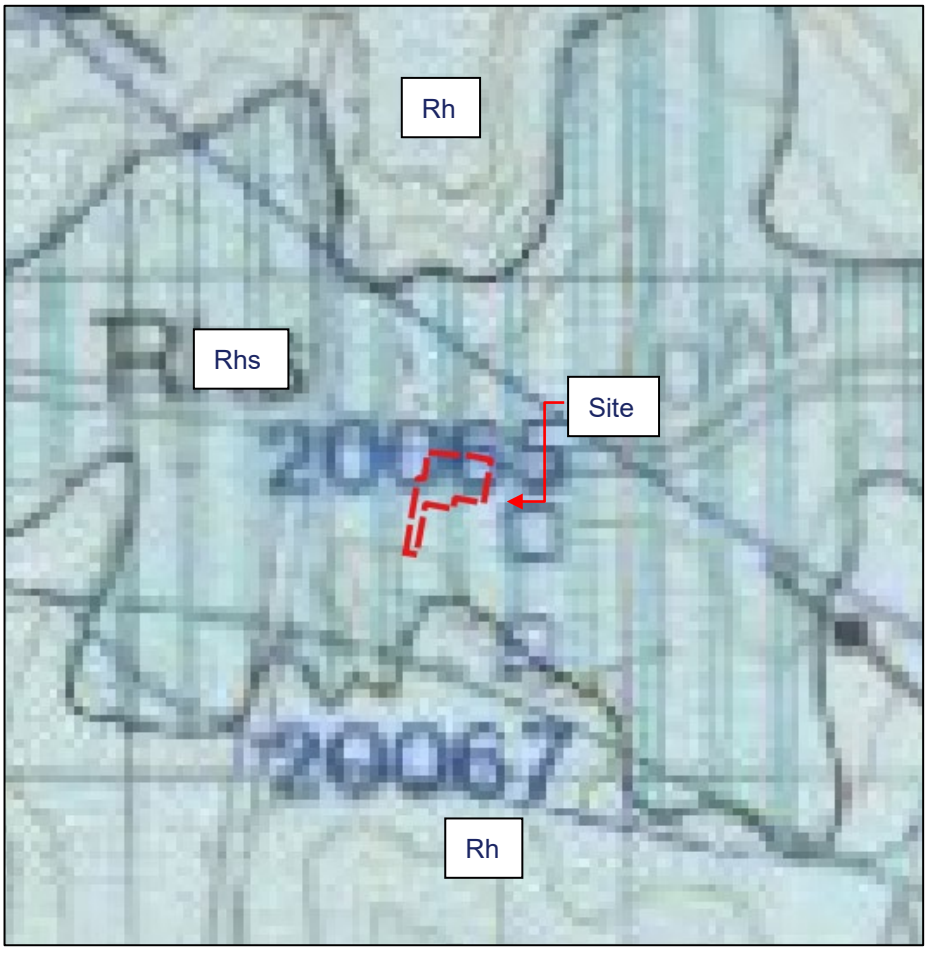
The 1:100,000 Sydney geological map (1983) indicates that the site is underlain by:

- (Rhs) Ashfield Shale of the Wianamatta Group consisting of Laminite and dark-grey siltstone.

The following unit is in close proximity around of the Site:

- (Rh) Hawkesbury Sandstone of the Wianamatta Group consisting of Medium to coarse-grained quartz sandstone, very minor shale and laminate lenses.

Inset 2 below presents the site location with regards to the geological settings.



Inset 2: Sydney 1:100,000 geological map (site marked in red)

4.2 Surface Conditions

The proposed development site covers an area of approximately 15,460 m^2 and currently comprises a commercial building and concrete hardstand.

The Site is roughly rectangular in shape with a small portion of the south-western boundary of the proposed development area extending towards Aquatic Drive as the driveway entrance to site.

Other commercial buildings are located to the east and west of the Site and Warringah Road is adject to the north.

4.3 Inferred Subsurface Conditions

The subsurface conditions encountered within the boreholes are summarised in Table 1. The encountered subsurface conditions were consistent with the published information in the geological maps and PSM's experience on nearby development sites.

Table 1 - Summary of Inferred Subsurface Geotechnical Units Encountered During Investigation

INFERRED UNIT	INFERRED TOP OF UNIT DEPTH BELOW GROUND SURFACE (m)	DESCRIPTION
CONCRETE/ ASPHALT	0	CONCRETE: up to 180 mm thick ASHPALT: up to 50 mm thick
FILL	0.05 to 0.18	Road base: SAND to SAND trace gravel: fine to coarse grained, dark brown, well graded, dry. CLAY to CLAY trace sand: high plasticity, brown to pale grey, sand is fine to coarse grained, brown, dry SAND with clay to clayey SAND: fine to coarse grained, dark brown to brown/orange, clay is highly plastic, brown mottle orange
RESIDUAL SOIL	0.7 to 2.5	Clayey SAND to SAND: fine to coarse grained, brown to pale grey, well graded, clay is highly plastic, brown CLAY: high plasticity, brown mottle orange/ grey
BEDROCK A	1.2 to 3.9	SANDSTONE: fine to coarse grained, pale grey, well graded, extremely to highly weathered, inferred very low to low strength
BEDROCK B	1.6 to 5.1	SANDSTONE: fine to coarse grained, pale grey to brown, thinly laminated with frequent siltstone lenses, pervasive iron staining observed, slightly weathered to fresh, medium to high strength

Table 2 shows the approximate elevation to top of the inferred geotechnical units encountered in PSM boreholes.

Table 2 – Approximate Elevation to Top of Inferred Geotechnical Units Encountered

BOREHOLE	APPROXIMATE ELEVATION TO TOP OF INFERRED GEOTECHNICAL UNITS (m AHD)					
	CONCRETE/ ASPHALT	FILL	RESIDUAL SOIL	BEDROCK A	BEDROCK B	EOH[1]
ABH01	148.4	147.40	146.8	146.6	145.0*	145.0
ABH02	142.2	142.15	140.7	139.7	138.4*	138.4
ABH03	139.5	N/E	138.8	137.4	134.4*	134.4
CBH01	143.3	142.80	140.8	139.5	138.7	132.8
CBH02	149	148.82	N/E	147.8	147.4	138.5

Notes:

[1] EOH = End of Hole

[2] N/E = Not Encountered

* = Inferred from TC bit refusal

Photo 11 to 14 in Appendix A present the exposed BEDROCK unit within the existing basement level.

4.4 Groundwater

One (1) standpipe piezometer were installed at CBH01 in the completed boreholes during the fieldwork undertaken on the Site. The standpipe piezometer was emptied after its construction. The standpipes were 'dipped' two (2) weeks after the fieldwork, on 30 November 2022. The following depth to groundwater observed:

- CBH01 – 3.6 m below ground level (BGL), i.e., RL 139.7 m.

No groundwater was observed during the drilling of the auger holes.

Based on our observations in the exposed sandstone within the existing basement, some minor water seepage could be observed on BEDROCK unit.

5. Results of Laboratory Testing

5.1 Soil Chemistry

Four (4) disturbed soil samples were retrieved for salinity and aggressivity testing in an analytical laboratory testing. The disturbed soil samples were sent to a NATA accredited analytical laboratory and the following tests indicate the following:

- pH of the soil samples analysed was in the range of 4.8 to 5.5, with an average of 5.125.
- The 1:5 soil to water extraction and subsequent electrical conductivity ($EC_{1:5}$) of the soil samples analysed to be in the range of 38 µS/cm to 143 µS/cm.
- Concentrations of chlorides in samples analysed was in the range of <10 mg/kg to 150 mg/kg.
- Concentrations of soluble sulphate in samples analysed was in the range of 10 mg/kg to 90 mg/kg.
- Cation Exchange Capacity (CEC) in samples analysed was in the range 0.9 meq/100g to 2.5 meq/100g.
- Exchange Sodium Percentage (ESP) in samples analysed was in the range of 5.4 % to 22.4%.

The laboratory result sheets are presented in Appendix F. presents the sampling locations and summary of the results.

5.1.1 Salinity Assessment

Site Investigations for Urban Salinity (DLWC 2002) classify soil salinity based on electrical conductivity (ECe). The method of conversion from EC1:5 to ECe (electrical conductivity of saturated extract) is based on DLWC (2002) and given by ECe = EC1:5 x M, where M is the multiplication factor based on "Soil Texture Group".

The "Soil Texture Group" of the samples tested were assessed during our investigation. The salinity classifications for the soil samples that were tested are presented in Table 3.

Table 3 - Salinity Classification

Sample ID	Sampled Depth (m)	EC1:5 dS/m	Soil Type	M	ECe (dS/m)	Salinity Class
CBH01	0.5	0.047	Sands	17	0.799	Non-saline
CBH01	3.0	0.143	Loams	10	1.430	Non-saline
ABH01	1.5	0.092	Sand loams	14	1.288	Non-saline
CBH02	0.5	0.038	Clay Loam	9	0.342	Non-saline

Soils on site are typically classified as "Non-saline".

We have referred to Clause 4.8.2 of Australian Standard AS3600-2018 "Concrete Structures" and note that the assessed soil electrical conductivity (ECe) is within the "A2" exposure classification.

5.1.2 Corrosivity / Aggressivity

Table 4.8.1 of Australian Standard AS 3600:2018 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 "B1".

Similarly, Table 6.4.2(C) of Australian Standard AS 2159:2009 provides criteria for exposure classification for concrete piles in soil, and here the exposure classification for concrete piles in soils is "Moderate".

Table 6.5.2(C) of AS 2159:2009 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 the resistivity, pH and chloride testing completed we assess the exposure classification for steel piles in the soil to be "Mild to Non-aggressive".

If any material is being imported to Site, it is recommended that additional testing of the imported material be undertaken to confirm the above classifications.

5.1.3 Sodicity

Sodicity provides a measure of the likely dispersion on wetting and to shrink/swell properties of a soil. Soil sodicity is classified based on the Exchangeable Sodium Percentage (ESP) which is the amount of exchangeable sodium as a percentage of the Cation Exchange Capacity (DLWC, 2002).

The Exchangeable Sodium Percentages calculated from these laboratory results, ranging from 5.4% to 22.4%, indicates that the soils on site are sodic to highly sodic when compared to criteria listed in DLWC (2002).

5.2 California Bearing Ratio (CBR)

Three (3) disturbed soil samples were retrieved for California Bearing Ratio (CBR) test with 4-day-soaked and 4.5kg surcharge. Table 4 presents a summary of the CBR test results. The test results are included in Appendix E.

Table 4 – Summary of the CBR Test Results

Sample ID	Approximate Sample Depth (m)	Soaked CBR (%)	OMC (%)	Standard Maximum Dry Density (t/m3)	Swell (%)
ABH01	0.5 - 1.0	25	9.8	2.05	0.0
CBH01	0.2 - 0.5	6	19.8	1.69	0.0
ABH02	0.5 – 2.0	14	10.6	1.98	0.0

6. Discussion

6.1 General

We note that the exact details of the proposed development (such as retention system and foundation loads) are currently not known. The design advice provided in the following sections has been prepared on the details specified in Section 2.

If any of the above basis is not applicable, PSM should be requested to review that the design advice below is still valid. PSM should also be engaged to review the recommendations contained herein should it be used in future for building design purposes.

6.2 Earthquake Site Classification

For earthquake provisions, we assess the site as the following in accordance with AS1170.4-2007:

- The site is classified as Class B_e (Rock)
- The site has a Hazard Design Factor (Z) of 0.08.

Given that the site is also located in a non-active seismic zone and the depth to rock is shallow, the potential for liquefaction is considered unlikely.

6.3 Excavation

We understand from the proposed development drawings that no excavation will be undertaken (eg. no new basement), and the current site profile (surface level) will be maintained for the proposed development.

6.4 Permanent and temporary batters

1. The batter slope angles shown in

Table 5 are recommended for the design of batters up to 4 m height and above the groundwater table, subject to the following recommendations:

1. The batters shall be protected from erosion
2. Permanent batters shall be drained
3. Temporary batters shall not be left unsupported for more than 1 month without further advice, and inspection by a geotechnical engineer should be undertaken following significant rain events
4. Where loads are imposed or structures / services are located within on batter height of the crest of the batter, further advice should be sought.

Table 5 – Design Batter Slope Angles

Unit	Temporary	Permanent
SOIL UNITS, e.g., FILL, RESIDUAL SOIL	2H: 1V	2.5H: 1V
BEDROCK A	0.5H: 1V	1H: 1V
BEDROCK B	Vertical	Vertical

Steeper batters may be possible subject to further advice, typically involving inspection during construction.

The batters should be inspected by an experience geotechnical engineer or engineering geologist during excavation to confirm the batter advice provided and assess the need for localised support.

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 Sandstone units and shotcreting for overall face support. The first inspection should be made when 1 m of BEDROCK A unit is excavated or one month from commencement of the bulk excavation, whichever is earliest.

For vertical cuts in rock, refer to Section 6.5 for support advice.

6.5 Retaining Structures

5. Permanent cuts in the SOIL and BEDROCKS units steeper than the recommended permanent batter slopes in .

Table 5 will need to be supported by some form of retaining 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, and especially construction sequence.

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 20 kPa for vertical cuts in the BEDROCK A unit. This is to allow for blocks and rock. wedges which form due to adverse defects that may exist within the unit.
- Water pressure (depending on the type of structure). Both water pressure acting directly on the structure, and the effect of water pressure on effective stresses with the retained ground.

- Surcharge loads behind the retention.

Table 6 – Engineering Parameters of Inferred Geotechnical Units

Inferred Unit	Bulk Unit Weight (kN/m3)	Soil Effective Strength Parameters		Ultimate Bearing Pressure under Vertical Centric Loading [2] (kPa)	Allowable Bearing Pressure (ABP) under Vertical Centric Loading [3] (kPa)	Ultimate Shaft Adhesion (kPa)	Elastic Parameters	
		c' (kPa)	φ' (deg)				Long Term Youngs Modulus (MPa)	Poisson's Ratio
FILL	18	0	28	300	100(1)	N/A	8	0.3
RESIDUAL SOIL	18	0	30	450	150(1)	N/A	15	0.3
BEDROCK A	22	30	35	3,000	1,000	150	100	0.25
BEDROCK B	22	N/A	N/A	40,000	6,000	1,200	900	0.25

(1) Pad footings should have a minimum horizontal 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)

(3) ABP is an end bearing pressure to cause settlement of <1% of minimum footing.

The designer should consider the information regarding groundwater in this report and the drainage features included in the design of the retention system.

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 or 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. Foundations

6.5.1 Pad footings

Pad footings could be founded on or within the residual SOIL units below the FILL. The design parameters in Table 6 can be adopted. As the building is likely to be founded on piles, shallow footings are expected to only be required for lightweight, ancillary structures.

Pad footings can be proportioned on the basis of an allowable bearing pressure (ABP) for centric vertical loads provided in Table 6. Further advice should be sought if the footings are located adjacent to a batter or wall.

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, and as the load gains eccentricity or becomes inclined, the capacity reduces rapidly.

Settlements in the SOIL units can be estimated using the elastic moduli 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.

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

Where footings are located within the zone of influence of an existing batter or retaining wall, the bearing capacity may need to be reduced and further advice should be sought. The zone of influence is defined as the zone above a 2H:1V line extending from the toe of the batter or the toe of the retaining wall.

6.5.2 Piles

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.

We envisage that piles would be founded within the BEDROCK units. If piles need to be founded within SOIL units, further advice should be sought, but we do not expect this to be practical.

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 and rock units above the bulk excavation level 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.

With regards to the pile design, we recommend that:

- A basic geotechnical strength reduction factor, Φ_{gb} = 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 / pile designers in accordance with the requirements of AS2159.

  We note that according to AS2159 cl. 8.2.4(c), the following pile testing requirements are given:
  - Serviceability: 1% of piles to be tested for ARR 2.5-2.99 (Table 8.2.4(A))
  - Pile shaft integrity: level of testing to be nominated by designer
- 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, Φ_g = 0.40 is adopted then no pile testing will be required (AS2159 Clause 8.2.4 (b)).

Any structural settlement due to shortening (or extension) of the footing element itself should be considered.

Where the founding or loading conditions between footings vary consideration should be given to the effects of differential settlements.

6.6 Grade Slabs

The design of slabs on ground can be based on subgrade with a long-term Young's Modulus (E) presented in Table 6.

6.7 Pavements

Three (3) CBR tests were undertaken within the EXISTING FILL layer and the results are presented in Appendix D and summarised in Table 4.

Subgrade CBR for pavement design depends on the material at the finished subgrade levels.

We recommend that specific CBR testing be undertaken at subgrade level when pavement layouts are finalised.

7. General

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

Yours Sincerely

JUNGBIN LEE
GEOTECHNICAL ENGINEER

AGUSTRIA SALIM
PRINCIPAL

Incl.

Figure 1	Site Locality Plan
Appendix A	Selected Site Photos
Appendix B	Borehole Engineering Logs and Core Photos
Appendix C	Point Load Index Test Results
Appendix D	Standpipe Piezometer Installation Records
Appendix E	Geotechnical Laboratory Test Certificates
Appendix F	Environmental Laboratory Test Certificates

Legend

- Approximate Site Boundary
- Approximate BH Locations

Notes:
1. Aerial Imagery was taken from www.Nearmap.com dated 12 September 2022.

Scale 1:1,069

N

0 10 20 30 40 m

Horizontal Datum: GDA2020
Grid: MGA Zone 56

P S M	Created By: PSM	Revision: A	Goodman Property Services Aus Pty Ltd Forestridge Business Park 14 Aquatic Drive, French's Forest
	Date: 01 Dec 2022	Paper Size: A3	Site Locality Plan
		PSM4864-001L	Figure 1

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Appendix A
Selected Site Photographs

Photo 1 - General Site Photo Facing East at CBH01

Photo 2 - General Site Photo Facing West at CBH01

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Forestridge Business Park

Selected Site Photographs (1 of 7)

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Photo 3 - General Site Photo Facing South at CBH02

Photo 4 - General Site Photo Facing East at CBH02

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Forestridge Business Park

Selected Site Photographs (2 of 7)

PSM4864-005R	**Appendix A**

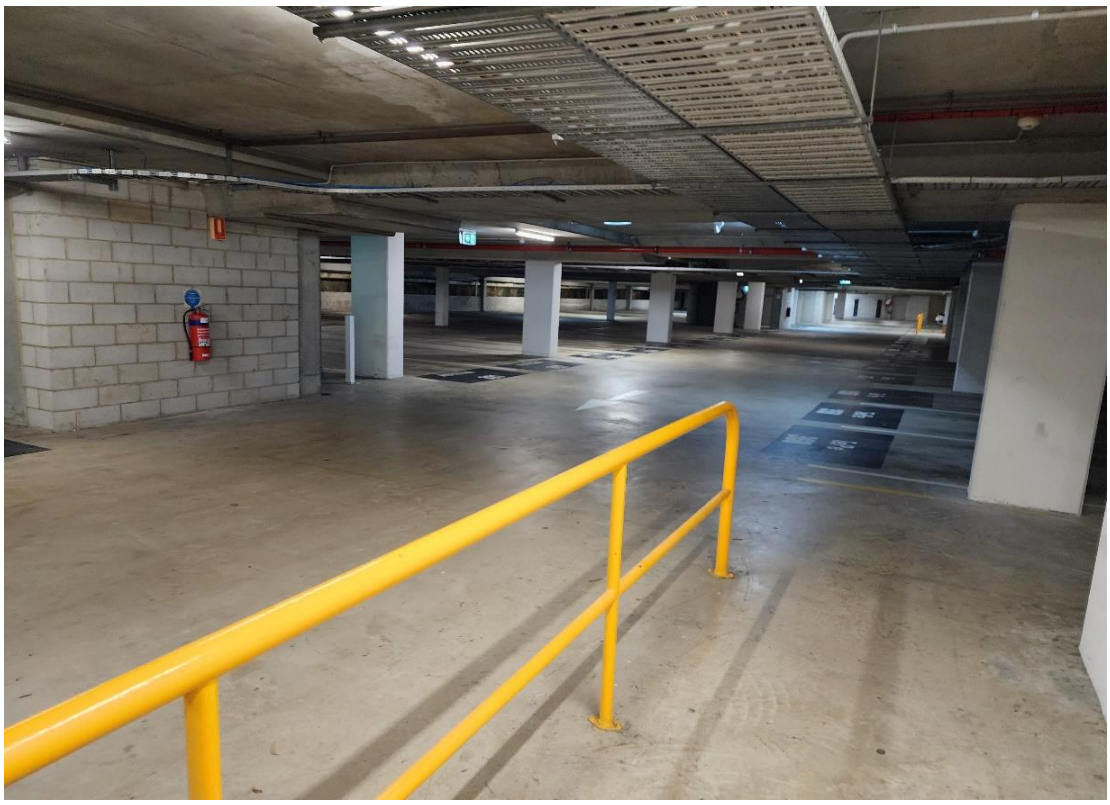

Photo 5 - Existing Basements Level 1 of 2

Photo 6 - Typical JK 400 Truck Set-Up

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Forestridge Business Park

Selected Site Photographs (3 of 7)

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Photo 7 - Soil Profile from CBH01

Photo 8 - Soil Profile from ABH01

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Selected Site Photographs (4 of 7)

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Photo 9 - Soil Profile from ABH02

Photo 10 - Soil Profile from ABH03

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Forestridge Business Park

Selected Site Photographs (5 of 7)

PSM4864-005R	**Appendix A**

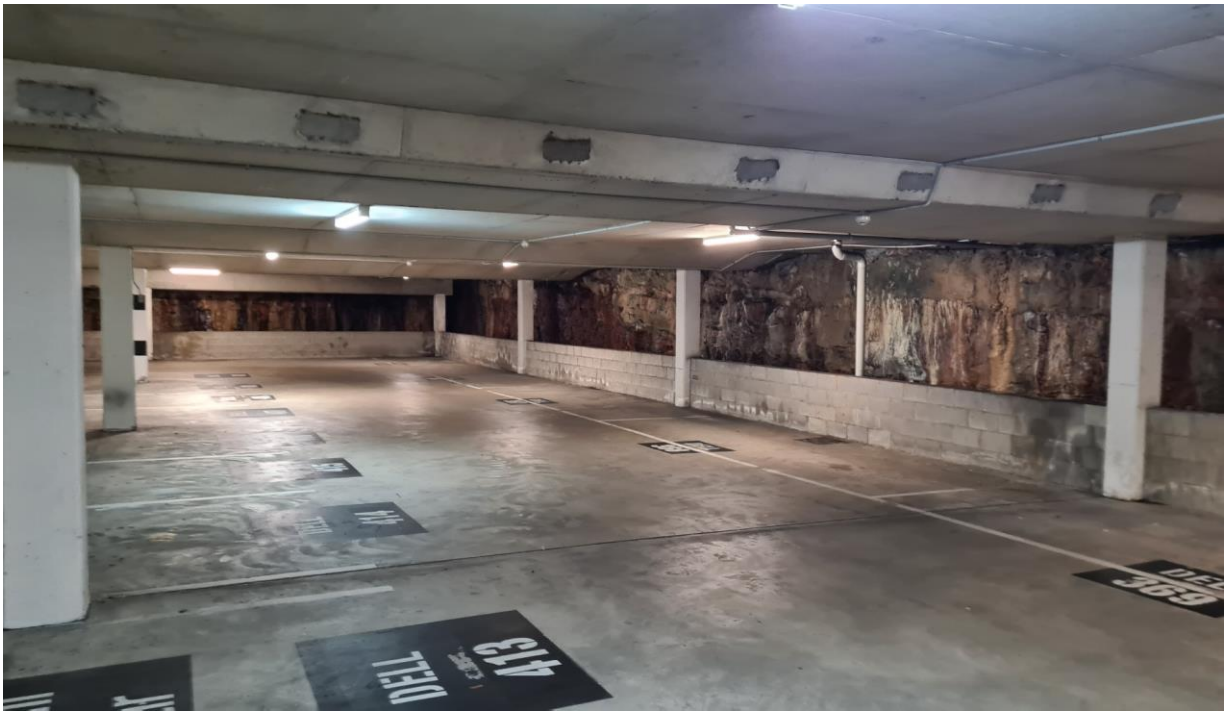

Photo 11 - BEDROCK Unit Observed in B2

Photo 12 - BEDROCK Unit Observed in B2

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Forestridge Business Park

Selected Site Photographs (6 of 7)

PSM4864-005R	**Appendix A**

Photo 13 - BEDROCK Unit Observed in B2

Photo 14 - BEDROCK Unit Observed in B2

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Forestridge Business Park

Selected Site Photographs (7 of 7)

PSM4864-005R	**Appendix A**

Appendix B
Borehole Engineering Logs and Core Photos

GEOTECHNICAL LOGGING EXPLANATION SHEET

This explanation document presents the definitions and details used on PSM borehole logs. It is not intended to replace the details in AS 1726: 2017.

Geotechnical logs are shown as either non-cored, for the soil component, or cored for the rock interval.

The document is divided into three parts: drilling information, soil logging and rock logging.

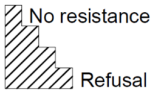
Drilling Information

General

Method	AD/T	Auger drilling TC bit
	AD/V	Auger drilling V bit
	WB	Washbore
	PT	Push tube
	DT	Diatube
	E	Excavator
	CT	Continuous tube
	NQ3	Wireline triple tube core (45.1 mm)
	HQ3	Wireline triple tube core (61.1 mm)
	NMLC	Triple barrel large core (51.2mm)
Core Quality	RQD	Rock Quality Designation (%)
Water	 Inflow	Indicates inflow of groundwater through the base of the borehole observed as net excess drilling fluid return.
	 Partial loss	Indicates an outflow of drilling fluid from the closed drilling system through the base of the borehole observed as net loss of drilling fluid return.
	 Complete loss	Indicates zero drilling fluid return from the borehole. Losses into the soil or rock mass through the base of the borehole.

Penetration

Penetration is a qualitative measure of how easily the auger advances. This varies from no resistance to refusal.



Support

Borehole wall support during drilling will either be listed as casing (C) or where no casing as was required no support (N) or left blank.

Water

Observations of water down the borehole as observed, not observed, not encountered or return as a percentage of the drilling fluid. If not noted then return was 100%.

Sampling and Field Testing

	Abbreviation	Description
Sample	U	Undisturbed tube sample
	D	Disturbed sample
	ES	Environmental sample
	TW	Thin walled
	LB	Large disturbed sample
	B	Bulk disturbed sample
Test	Is(50) – a	Axial point load test result (MPa)
	Is(50) – d	Diametral point load test result (MPa)
	SPT	Standard penetration test
	RW	Rod Weight
	HW	Hammer Weight
	HB	Hammer Bouncing

Hole Positioning

The following geodetic conventions are adopted.

- Map Grid of Australia 1994 (MGA94)
- Geocentric Datum of Australia 1994 (GDA94)
- Australian Height Datum (AHD)
- Bearings relate to magnetic north. Where required, magnetic values have been converted from grid using a magnetic declination of -12°.

Hole location relates to the street or project area the borehole was drilled on.

Depth is the downhole depth in metres below the borehole collar (i.e. surface level).

RL shows the elevation relative to AHD.

WPT (Lugeon)

The Water Pressure Test (usually using packers) measures water pressure and flow rate over time to assess the Lugeon value - an empirical measure of the hydraulic conductivity.

RQD

Rock quality designation is a measure of the quality of cored rock. The sum of intact intervals more than 100 mm in length are given as a percentage of the total drill run recovered.

Termination Details

Hole terminated means the hole was discontinued at a depth that corresponds to the downhole depth in metres. How the borehole was completed is also stated. This includes the following main categories:

- Grouted to surface using a cement grout mix.
- Instrumented by construction of groundwater (open standpipe, screened piezometer, grout in place vibrating wire piezometer (VWP)) or geotechnical (inclinometer, extensometer).
- Any other details such as if a hole was abandoned.

Soil Logging

General

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 is described in accordance with the Unified Soil Classification System (USCS) with the following prefix

O	organic soils
C	inorganic fine-grained soils behaving as clays
M	inorganic fine-grained soils behaving as silts
G	coarse grained soils behaving as gravel
S	coarse grained soils behaving as sand

These are defined by the particle size limits shown in the grading table below.

The above group symbols are appended with minor component modifiers, for coarse grained soils.

W	well graded, little or no fines
P	poorly graded, little or no fines
G	gap graded
M	silty mixtures
C	clayey mixtures

For fine grained soils, with plasticity or liquid limit

L	low plasticity or liquid limit
I	medium plasticity or liquid limit
H	high plasticity or liquid limit.

Material Description

Soil Name

Soil name is based on the identifiable primary component of the soil and is given in block letters, thereafter is a description based on secondary components.

Plasticity

Non-plastic	3 mm thread cannot be rolled at any moisture content (cannot conduct toughness or dry strength tactile tests), slow to rapid dilatancy.
Low plasticity silt/clay mixtures	A 3 mm thread can barely be rolled; lump cannot be formed when drier than plastic limit (PL); low to medium dry strength, medium toughness; none to slow dilatant behaviour
Medium plasticity silt/clay mixtures	3 mm thread is easy to roll, little time required to reach PL; thread cannot be rerolled after reaching PL; lump crumbles when drier than PL; medium to high dry strength, medium toughness; no to slow dilatant behaviour; slightly tacky feel when wet
High plasticity clays	It takes considerable time rolling and kneading to reach PL; thread can be rolled several times after reaching PL; high toughness, high to very high dry strength; non-dilatant; tacky/sticky feel when moisture content >PL.

Graphic Log

		ASPHALT
		CONCRETE
		FILL
	CH	High plasticity CLAY
	CI	Medium plasticity CLAY
	CL	Low plasticity CLAY
	GC	clayey GRAVEL
	GP	Poorly graded GRAVEL
	MH	High liquid limit SILT
	ML	Low liquid limit SILT
	OH	High plasticity ORGANIC CLAY and SILTS
	OL	Low plasticity ORGANIC CLAY and SILTS
	SC	Clayey SAND
	SM	Silty SAND
	SP	Poorly graded SAND
	SW	Well graded SAND

Grading (coarse grained soils)

Where possible for coarse grained soils, include particle shape: equidimensional - rounded, sub-rounded, sub-angular, angular; two- dimensional - flaky/ platy; one dimensional - elongated.

Well graded	Having good representation of all particle sizes from largest to smallest
Poorly graded	One or more intermediate sizes poorly represented
Gap graded	Absence of one or more intermediate sizes
Uniform	Most particles are about the same size

Particle Size Descriptive Terms

Fraction	Coarse-Grained								Fine-grained		Organic
	Boulders	Cobbles	Gravel			Sand			Silt	Clay	Organic soils
			Coarse	Medium	Fine	Coarse	Medium	Fine			
Particle size limits [mm]	200	60	20	6.0	2.0	0.6	0.2	0.06	0.002		
AS Sieve equivalent [mm]	-	63	19	6.7	2.36	0.6	0.15	0.075	-		

Colour

Described in a moist condition, using simple colour terms such as green, red, orange, etc. These may have been modified using 'pale', 'dark' or 'mottled'. 'Light' is avoided as it can be confused with mass.

Secondary Component Modifiers

Term	Coarse grained soil		Fine grained soil
	Percentage of fines in a granular soil	Percentage of coarse in a granular soil (i.e. other than the primary component)	Percentage of coarse grained component (sand or gravel) in a fine-grained soil
Add trace	≤ 5	≤ 15	≤ 15
Add with	> 5 and ≤ 12	> 15 and ≤ 30	> 15 and ≤ 30
Add prefix to name	> 12	> 30	> 30

Moisture Condition

Coarse grained soil	
Dry (D)	Looks and feels dry; dusty; dry to the touch, non-cohesive, free running
Moist (M)	Soil feels cool; soil tends to stick together; damp but no visible water, darkened in colour
Wet (W)	Visible free water when handled, soil feels cool, darkened in colour
Fine grained soil	
Judge based on the soil's moisture condition relative to the plastic limit or liquid limit for soils with high moisture contents, refer to plasticity table above	

Consistency/Relative Density

Consistency - Cohesive soils (fine grained)

Consistency	Field Guide to Consistency	Indicative Undrained Shear Strength (Su, kPa)
Very soft (VS)	Exudes between the fingers when squeezed in hand	≤ 12
Soft (S)	Moulded by light finger pressure	> 12 & ≤ 25
Firm (F)	Moulded by strong finger pressure	>25 & ≤ 50
Stiff (St)	Cannot be moulded by fingers	>50 & ≤ 100
Very stiff (VSt)	Readily indented by thumb nail	>100 & ≤ 200
Hard (H)	Indented with difficulty by thumbnail	>200
Friable (Fr)	Easily crumbled by hand	-
Compact (C)	Material readily disaggregated by physical means	-
Cemented (Ce)	Material cannot be disintegrated/remoulded in air or water	-

Relative density - Non-cohesive soils (coarse grained)

Term	Symbol	Density Index %
Very Loose	VL	<15
Loose	L	>15 & ≤ 35
Medium Dense	MD	>35 & ≤ 65
Dense	D	>65 & ≤ 85
Very Dense	VD	>85

The relative density of coarse-grained soils is inherently difficult to assess by visual or tactile means. Relative density assessment should be carried out using penetration test procedures.

Hand Penetrometer

Refers to pocket penetrometer tests, results shown in kPa.

Structure, Zoning

Soil *in situ* or in samples may consist of separate zones differing in colour, grain size or other properties.

Zoning[1]		Cementing[2]	
Layer	Continuous across exposure or sample	Weakly	Soil fractured by hand in air/water
Lens	Discontinuous layer with lenticular shape	Strongly	Difficulty fracturing by hand in air/water
Pocket	Irregular inclusion		
Homogenous	Same colour/texture/ structure throughout		

[1] Record the orientation, contact character (sharp regular/ irregular, gradual/ gradational). Use interlaminated or inter- bedded if too thin to describe individually

[2] If unable to be disaggregated, treat as rock. Note cementing agent by appearance, strength or reaction to water/acid.

Origin, Additional Observations

Where there is doubt, the terms 'possibly' or 'probably' are used (as per AS1726:2017).

Origin		
Anthorpogenic	Fill	placed by human activity (controlled versus uncontrolled)
Formed in place	Topsoil	upper surface layer of soil with high proportion of organic material
Transported	Alluvial	deposited by streams and rivers
	Colluvial	deposited on slopes chiefly by gravity
	Aeolian	deposited by wind
	Lacustrine	deposited in lakes/still bodies of water
	Marine	deposited in oceans, bays, beaches & estuaries
Formed in place	Residual soils	structure and fabric of parent rock not visible
	Extremely weathered	structure and fabric of parent rock visible

Rock Logging

General

Rock Substance is defined in engineering terms as 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.

Defects are defined as discontinuities or breaks in the continuity of a substance or substances

Rock mass is defined as 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

Rock substance and mass characteristics are shown on the logs as rock substance and rock mass defect categories and are presented in this document in the same order

Rock substance

Graphic Log


BRECCIA


CONCRETE


CONGLOMERATE


NO CORE


DOLERITE


INTERBEDDED SILTSTONE & SANDSTONE


SANDSTONE


SHALE


SHALE BRECCIA


SILTSTONE

Material Description

Rock Name	Simple rock names are used rather than precise geological classification		
Particle/grain Characteristics	Grains of rock described in terms of type, size and shape;		
	sedimentary rocks:	Coarse	0.6 - 2 mm
		Medium	0.2 - 0.6 mm
		Fine	0.06 - 0.2 mm
	igneous rocks	Coarse	>2 mm
		Medium	0.06 – 2 mm
		Fine	<0.06 mm (just visible)
Colour	Simple terms such as white, red, orange etc. modify using pale of sark; describe in moist condition; use combinations of these when necessary		
Inclusions/ Minor components	Record isolated inclusions within the rock substance such as vesicles, nodules, phenocrysts, concretions, veins, ironstone bands; Indicate proportion – trace or minor (include thickness)		

Texture/Fabric

Term	Description	Spacing
Massive	No stratification visible	-
Bedded	Very thickly bedded	>2 m
	Thickly bedded	0.6 m to 2 m
	Medium bedded	0.2 m to 0.6 m
	Thinly bedded	60 mm to 200 mm
	Very thinly bedded	20 mm to 60 mm
Laminated	Laminated	6 mm to 20 mm
	Thinly laminated	<6 mm

Bedding Development

Term	Description
Massive / poorly	No obvious development; rock homogeneous
Developed	Barely obvious; faint mineralogical layering or banding; planes poorly defined
Well developed	Apparent in outcrops or drill core as distinct layers/lines marked by mineralogical or grain-size layering
Very well developed	Often marked by distinct colour banding or mineralogical /grain size layering

Weathering

Term		Description
Residual Soil (RS)		Soil derived from insitu weathering of rock; structure and substance fabric of parent rock no longer evident; soil has not been transported; log using soil descriptive terms
Extremely Weathered (XW)		Rock exhibits soil properties; mass texture/structure of original rock still visible; log using soil descriptive terms
Highly weathered (HW)	(DW)[3]	Iron staining or bleaching affects the entire rock substance and parent rock colour no longer recognisable; porosity may be increased or less than original rock substance by leaching or deposition of minerals; substance strength altered by weathering. Primary minerals may have weathered to clay
Moderately weathered (MW)		Iron staining or bleaching extends throughout the entire rock substance; original rock colour of fresh rock no longer recognisable
Slightly weathered (SW)		Partial staining or bleaching along joints; colour and texture of fresh rock is recognisable; little or no change of strength from fresh rock
Fresh (FR)		No sign of mineral decomposition or colour change

[3] The terms Highly weathered (HW) or Moderately weathered (MW) are preferred to Distinctly weathered (DW).

Strength

Rock strength is based on UCS (MPa), point load strength index testing (Is(50) in MPa) and field estimated strengths. Is(50) values from axial and/or diametral point load tests and field estimated strengths are plotted in the strength column.

Term / Abbreviation		Point load index, Is(50) (UCS (MPa))	Field guide to strength
Very low	VL	0.03 to ≤0.1; (0.6-2)	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm thick can be broken by finger pressure.
Low	L	>0.1 to ≤0.3; (2-6)	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium	M	>0.3 to ≤1.0; (6-20)	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
High	H	>1 to ≤3; (20-60)	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very high	VH	>3 to ≤10 (60-200)	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely high	EH	> 10 (>200)	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Rock Mass Defects

General

Sequence of terms: defect type, orientation, shape, roughness, infill type/width, number, spacing/length/aperture.

Defect Description

Symbol	Description
BF	bedding fabric
BP	Bedding parting – surface crack across which there is little to no tensile strength, parallel to bedding fabric, maybe open or closed
BSH	Bedding Shear
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
DB	Drilling Break – breaks caused by the drilling process, including handling breaks when boxing core
FL	Foliation
FT	Fault – fracture along which displacement is recognisable, may be open or closed
FZ	Fractured Zone – a zone of closely spaced defects comprising core lengths < 50 mm
IS	Infilled Seam – seam of soil substance formed by migration of soil into an open cavity or defect
JT	Joint – a single fracture across which rock has little or no tensile strength, is not obviously related to rock fabric and no shearing, maybe open or closed
SM	XW seam of soil material formed by weathering of the parent rock material in situ
SS	Sheared seam– fracture along which movement has taken place; no displacement recognisable; slickensides, polishing and/or clay gouge may suggest movement
SZ	Sheared Zone – zone of multiple closely spaced shears
VN	Vein – intrusion of tabular or sheet-like minerals
VO	void

Orientation

Field mapping: defect dip/dip direction recorded in degrees, noting datum.

Infill

CN	Clean	RF	Rock fragments
CA	Calcite	G	Gravel
X	Carbonaceous	S	Sand
FE	Iron	Z	Silt
QZ	Quartz	CL	Clay

For infills <1 mm thick:

Stained (SN) – no visible coating but defect surfaces are discoloured

Veneer (VR) – visible uniform or patchy coating too thin to measure

Coating (CO)

Shape

Planar (PR)	No variation in orientation
Curved (CU)	Gradual change in orientation
Undulating (UN)	Wavy surface shape
Stepped (ST)	One or more well defined steps
Irregular (IR)	Many sharp changes of orientation

Surface Roughness

Slickensided (SL)	Grooved or striated surface, usually polished
Polished (POL)	Shiny smooth surface
Smooth (S)	Smooth to touch, few or no surface irregularities
Rough (RF)	Many small surface irregularities (ampl. <1mm) feels like fine to coarse sandpaper
Very rough (VR)	Many large mall surface irregularities (ampl. >1mm) feels like (or coarser than) very coarse sandpaper

Borehole ID

ABH01

Engineering Log - Non Cored Borehole

Project No.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	14/11/2022
Project Name:	Forestridge Business Park	Completed:	14/11/2022
Hole Location:		Logged By:	JBL/GW
Hole Position:	336699.0 m E 6263794.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 400 Truck Mounted	Inclination:	-90°	RL Surface:	148.40 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	JK Drilling

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/V		N		SPT 0.50-0.95 m 4,5,5 N=10		147.4	1		SW	ASPHALT: 30mm thick				0.03: Road base
									SW	SAND: fine to coarse grained, dark brown, well graded		L to MD		
									SW	SAND with clay, fine to coarse grained, dark brown, well graded, clay is highly plastic, brown to orange				0.50: Ironstone observed INFERRED FILL
				SPT 1.50-1.83 m 6,9,3/30mm HB N=R								D		
										Becoming reddish brown				
									SC	Clayey SAND: fine to coarse grained, brown to pale grey well graded, clay is highly plastic, brown	D to M	D to VD		1.60: INFERRED RESIDUAL SOIL
AD/T		N				146.4	2			SANDSTONE: fine to coarse grained, pale grey, well graded, extremely to highly weathered, inferred very low to low strength				1.78: V-Bit Refusal INFERRED BEDROCK
						145.4	3							
										Hole Terminated at 3.40 m Refusal				3.40: TC-Bit Refusal
						144.4	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
CT - Continuous push tube 1.5m long 76mm diameter

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

ABH02

Page 1 of 1

Engineering Log - Non Cored Borehole

Project No.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	15/11/2022
Project Name:	Forestridge Business Park	Completed:	15/11/2022
Hole Location:		Logged By:	GW
Hole Position:	336678.0 m E 6263714.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 308 Track mounted	Inclination:	-90°	RL Surface:	142.20 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	JK Drilling

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/V		N							SW	ASPHALT: 50mm thick SAND with silt, fine to coarse grained, dark brown, well graded		L		0.05: Road base
				SPT 0.50-0.95 m 4,3,2 N=5		141.2	1		CH	CLAY with sand, high plasticity, brown, sand is fine to coarse grained, brown	D	F		0.50: INFERRED FILL
				SPT 1.50-1.95 m 3,2,2 N=4		140.2	2		SW	SAND: fine to coarse grained, brown to orange, well graded Becoming brown to grey		L		1.50: INFERRED RESIDUAL SOIL
AD/T		N				139.2	3			SANDSTONE: fine to coarse grained, brown to grey, well graded, extremely to highly weathered, inferred very low to low strength	M W			2.50: V-Bit Refusal INFERRED BEDROCK
						138.2	4			Hole Terminated at 3.80 m Refusal				3.80: TC-Bit Refusal

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
CT - Continuous push tube 1.5m long 76mm diameter

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

ABH03

Engineering Log - Non Cored Borehole

Project No.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	15/11/2022
Project Name:	Forestridge Business Park	Completed:	15/11/2022
Hole Location:		Logged By:	GW
Hole Position:	336670.0 m E 6263674.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 308 Track mounted	Inclination:	-90°	RL Surface:	139.50 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	JK Drilling

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
										CONCRETE: 140mm thick				
AD/V		N		SPT 0.50-0.95 m 2,1,2 N=3					SW	SAND trace gravel: fine to coarse grained, pale brown to grey, well graded, gravel is sub-rounded, brown to pale grey, up to 15mm	D to M	L		0.14: Road base
				SPT 1.50-1.95 m 2,3,5 N=8		138.5	1		CH	CLAY: high plasticity, brown mottle orange		St		0.70: INFERRED RESIDUAL SOIL
AD/T		N				137.5	2			SANDSTONE: fine to coarse grained, pale grey to brown, well graded, extremely to highly weathered, inferred very low to low strength	D			2.10: V-Bit Refusal INFERRED BEDROCK
						136.5	3			Becoming grey to red brown, possible iron staining				
						135.5	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
CT - Continuous push tube 1.5m long 76mm diameter

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

ABH03

Engineering Log - Non Cored Borehole

Project No.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	15/11/2022
Project Name:	Forestridge Business Park	Completed:	15/11/2022
Hole Location:		Logged By:	GW
Hole Position:	336670.0 m E 6263674.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 308 Track mounted	Inclination:	-90°	RL Surface:	139.50 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	JK Drilling

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
		N								Becoming pale grey	D			5.10: TC-Bit Refusal
						133.5	6			Hole Terminated at 5.10 m Refusal				
						132.5	7							
						131.5	8							
						130.5	9							

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
CT - Continuous push tube 1.5m long 76mm diameter

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

CBH01

Engineering Log - Non Cored Borehole

Project No.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	14/11/2022
Project Name:	Forestridge Business Park	Completed:	14/11/2022
Hole Location:		Logged By:	JBL/GW
Hole Position:	336722.0 m E 6263731.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 400 Truck Mounted	Inclination:	-90°	RL Surface:	143.30 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	JK Drilling

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
DT		N								CONCRETE: 160mm thick				
AD/V		N		SPT 0.50-0.95 m 4,4,5 N=9		142.3	1		SW	SAND: fine to coarse grained, pale brown	D	L		0.16: Road base
									SC	Clayey SAND: fine to coarse grained, pale brown, clay is highly plastic, dark brown				0.50: INFERRED FILL
				SPT 1.50-1.95 m 2,1,1 N=2		141.3	2		CH	CLAY: high plasticity, brown to dark grey		S to F		
									CH	CLAY: high plasticity, pale grey				2.50: INFERRED RESIDUAL
				SPT 3.00-3.45 m 11,12,8 N=20		140.3	3					VSt		
AD/T		N				139.3	4			SANDSTONE: fine to coarse grained, pale grey, well graded, extremely to highly weathered, inferred very low to low strength.				3.85: V-Bit Refusal INFERRED BEDROCK
										Continued on cored borehole sheet				4.60: TC-Bit Refusal

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
CT - Continuous push tube 1.5m long 76mm diameter

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.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	14/11/2022
Project Name:	Forestridge Business Park	Completed:	14/11/2022
Hole Location:		Logged By:	JBL/GW
Hole Position:	336722.0 m E 6263731.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 400 Truck Mounted	Inclination:	-90°	RL Surface:	143.30 m		
Barrel Type and Length:	3 m	Bearing:		Datum:	AHD	Operator:	JK Drilling

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
					142.3	1						
					141.3	2						
					140.3	3						
					139.3	4						
								Continued from non-cored borehole sheet				
NMLC		95	Is(50) d=0.08 a=0.51 MPa					SANDSTONE: fine to coarse grained, grey to brown, thinly laminated sub-horizontally		○ ●		SM, CL, 100 mm BP, 5°, Fe & Clay, PR, RF, 5 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.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	14/11/2022
Project Name:	Forestridge Business Park	Completed:	14/11/2022
Hole Location:		Logged By:	JBL/GW
Hole Position:	336722.0 m E 6263731.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 400 Truck Mounted	Inclination:	-90°	RL Surface:	143.30 m		
Barrel Type and Length:	3 m	Bearing:		Datum:	AHD	Operator:	JK Drilling

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	75-100% Water RETURN	95	Is(50) d=0.28 a=0.36 MPa		137.3	6		SANDSTONE: fine to coarse grained, grey to brown, thinly laminated sub-horizontally *(continued)*				BP, 5°, FE SN, PR, RF BP, 10°, FE SN, PR, RF
								Becoming grey				BP, 0°, Fe & Clay, PR, RF, 3 mm SM, CL, 20 mm
			Is(50) d=0.78 a=0.75 MPa		136.3	7						SM, CL, 40 mm
			Is(50) d=0.05 a=0.69 MPa					Siltstone laminations observed				JT, 75°, CN, UN, RF, healed BP, 0°, CN, PR, RF
		97	Is(50) d=0.74 a=0.58 MPa		135.3	8		Pervasive iron staining observed				BP, 5°, FE SN, PR, RF
					134.3	9						BP, 0°, CL VN, PR, RF
			Is(50) d=0.68 a=0.63 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.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	14/11/2022
Project Name:	Forestridge Business Park	Completed:	14/11/2022
Hole Location:		Logged By:	JBL/GW
Hole Position:	336722.0 m E 6263731.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 400 Truck Mounted	Inclination:	-90°	RL Surface:	143.30 m		
Barrel Type and Length:	3 m	Bearing:		Datum:	AHD	Operator:	JK Drilling

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		97	Is(50) d=0.87 a=0.43 MPa					SANDSTONE: fine to coarse grained, grey to brown, thinly laminated sub-horizontally *(continued)*				
					132.3	11		Hole Terminated at 10.50 m Target depth				
					131.3	12						
					130.3	13						
					129.3	14						

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

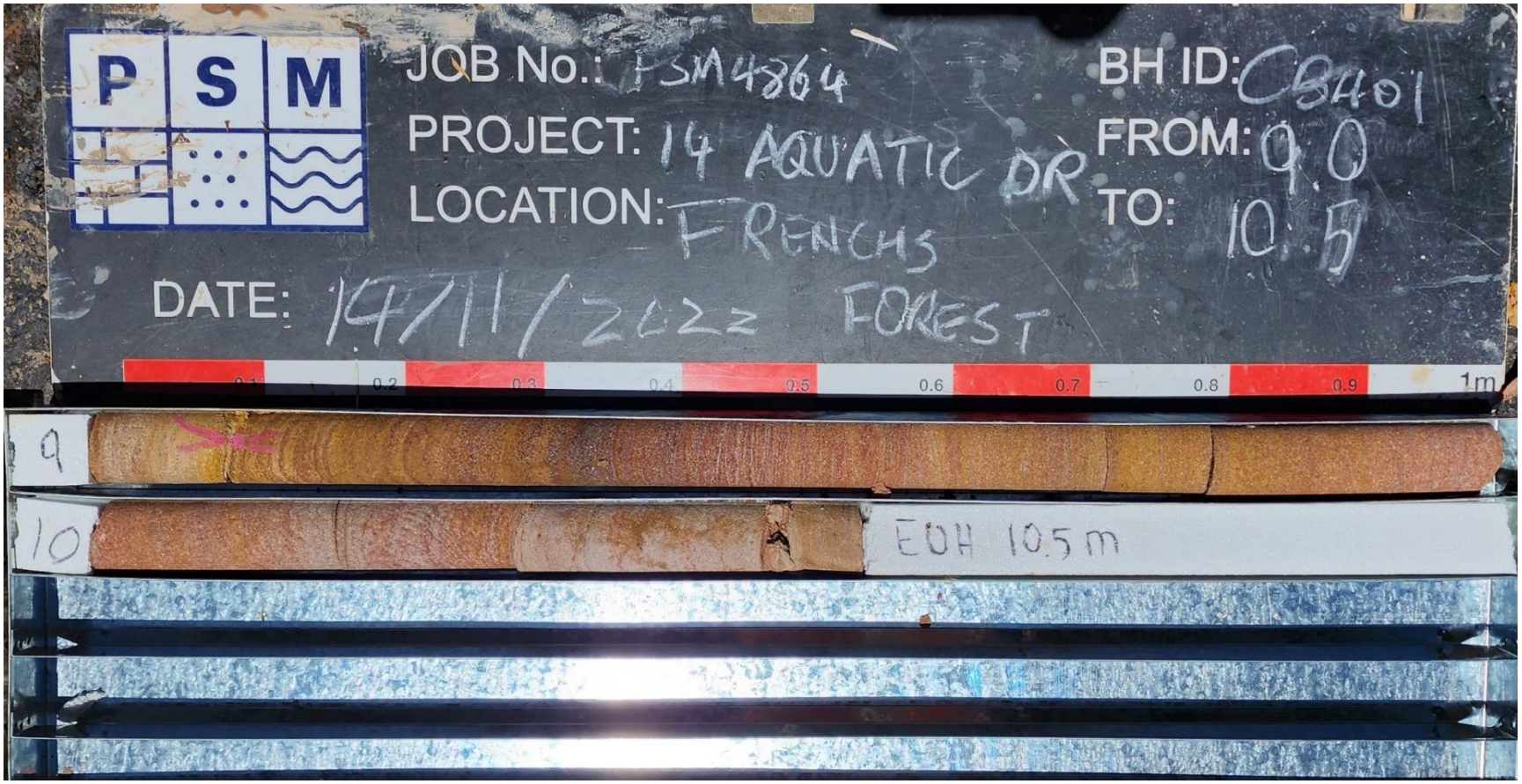
Logged in accordance with AS 1726:2017 Geotechnical site investigations

CBH01 - 4.6 - 9.0 m

Note:

Defects are marked in red

Goodman Property Services Australia Pty Ltd Forestridge Business Park 14 Aquatic Drive, Frenchs Forest Geotechnical Investigation Core Photograph	
PSM4864-005R	Appendix B



CBH01 - 9.0 - 10.5 m

Note:

Defects are marked in red

Goodman Property Services Australia Pty Ltd Forestridge Business Park 14 Aquatic Drive, Frenchs Forest Geotechnical Investigation Core Photograph	
PSM4864-005R	Appendix B

Borehole ID

CBH02

Engineering Log - Non Cored Borehole

Project No.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	15/11/2022
Project Name:	Forestridge Business Park	Completed:	15/11/2022
Hole Location:		Logged By:	JBL/GW
Hole Position:	336720.0 m E 6263828.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 308 Track mounted	Inclination:	-90°	RL Surface:	149.00 m		
Hole Diameter:	110 mm	Bearing:		Datum:	AHD	Operator:	JK Drilling

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
										CONCRETE: 180mm thick				
AD/V		N		SPT 0.50-0.95 m 2,4,5 N=9					CH	CLAY trace sand: high plasticity, red brown, sand is find to coarse grained, brown		F to St		0.18: INFERRED FILL
						148.0	1		CH	CLAY trace sand: high plasticity, dark brown, sand is fine to coarse grained, brown	D			0.90: INFERRED RESIDUAL SOIL
AD/T		N								SANDSTONE: fine to coarse grained, pale brown, well graded, extremely to highly weathered, inferred very low to low strength				1.18: V-Bit Refusal INFERRED BEDROCK
										Continued on cored borehole sheet				1.63: TC-Bit Refusal
						147.0	2							
						146.0	3							
						145.0	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
CT - Continuous push tube 1.5m long 76mm diameter

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.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	15/11/2022
Project Name:	Forestridge Business Park	Completed:	15/11/2022
Hole Location:		Logged By:	JBL/GW
Hole Position:	336720.0 m E 6263828.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 308 Track mounted	Inclination:	-90°	RL Surface:	149.00 m		
Barrel Type and Length:	3 m	Bearing:		Datum:	AHD	Operator:	JK Drilling

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
					148.0	1		Continued from non-cored borehole sheet				
NMLC		90	Is(50) d=0.23 a=0.63 MPa		147.0	2		SANDSTONE: fine to coarse grained, pale brown to grey, thinly laminated sub-horizontally Becoming pale grey				BP, 0°, CL, PR, RF, 5 mm
								Becoming reddish brown, iron staining observed				BP, 0°, FE SN, PR, RF
			Is(50) d=0.11 a=0.19 MPa					Becoming pale grey				
					146.0	3						BP, 0°, CL, PR, RF, 5 mm
		94	Is(50) d=0.15 a=0.09 MPa					Becoming reddish brown, iron staining observed				JT, 75°, CN, PR, RF SM, S, PR, RF, 10 mm
					145.0	4						SM, CL, PR, RF, 15 mm
			Is(50) d=0.26 a=0.83 MPa									SM, CL, PR, RF, 25 mm BP, 0°, FE SN, PR, RF BP, 0°, 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.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	15/11/2022
Project Name:	Forestridge Business Park	Completed:	15/11/2022
Hole Location:		Logged By:	JBL/GW
Hole Position:	336720.0 m E 6263828.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 308 Track mounted	Inclination:	-90°	RL Surface:	149.00 m		
Barrel Type and Length:	3 m	Bearing:		Datum:	AHD	Operator:	JK Drilling

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		94	Is(50) d=1.14 a=1.05 MPa		143.0	6		SANDSTONE: fine to coarse grained, pale brown to grey, thinly laminated sub-horizontally *(continued)*				
			Is(50) d=0.62 a=1.64 MPa					SANDSTONE: fine to coarse grained, pale brown to grey, thinly laminated sub-horizontally with lenses of siltstone laminations				
		100	Is(50) d=0.16 a=0.6 MPa		142.0	7						
					141.0	8						JT, 60°, CN, PR, RF
			Is(50) d=0.94 a=0.9 MPa									
		100	Is(50) d=0.41 a=0.72 MPa		140.0	9						

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.: PSM4864

Client:	Goodman Property Services Aus Pty Ltd	Commenced:	15/11/2022
Project Name:	Forestridge Business Park	Completed:	15/11/2022
Hole Location:		Logged By:	JBL/GW
Hole Position:	336720.0 m E 6263828.0 m N MGA2020 Zone 56	Checked By:	

Drill Model and Mounting:	JK 308 Track mounted	Inclination:	-90°	RL Surface:	149.00 m		
Barrel Type and Length:	3 m	Bearing:		Datum:	AHD	Operator:	JK Drilling

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		100	Is(50) d=0.65 a=1.05 MPa					SANDSTONE: fine to coarse grained, pale brown to grey, thinly laminated sub-horizontally with lenses of siltstone laminations*(continued)*				
					138.0	11		Hole Terminated at 10.50 m Target depth				
					137.0	12						
					136.0	13						
					135.0	14						

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

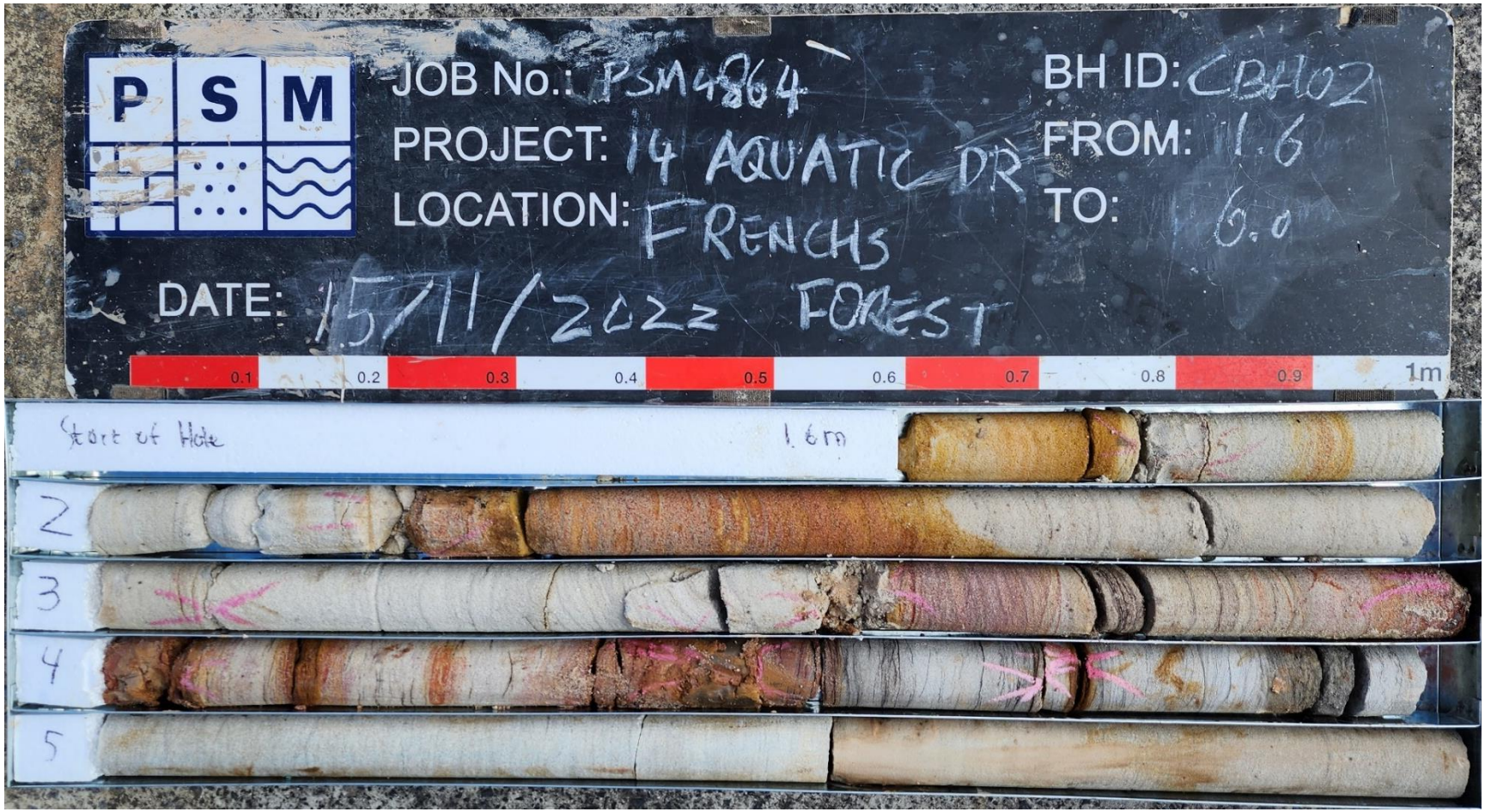
Defect Type
FT - Fault
SS - Shear Surface
SZ - Shear Zone
BP - Bedding parting
SM - Seam
IS - Infilled Seam
JT - Joint
CO - Contact
CZ - Crushed Zone
VN - Vein
FZ - Fracture Zone
BSH - Bedding Shear
DB - Drilling Break

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



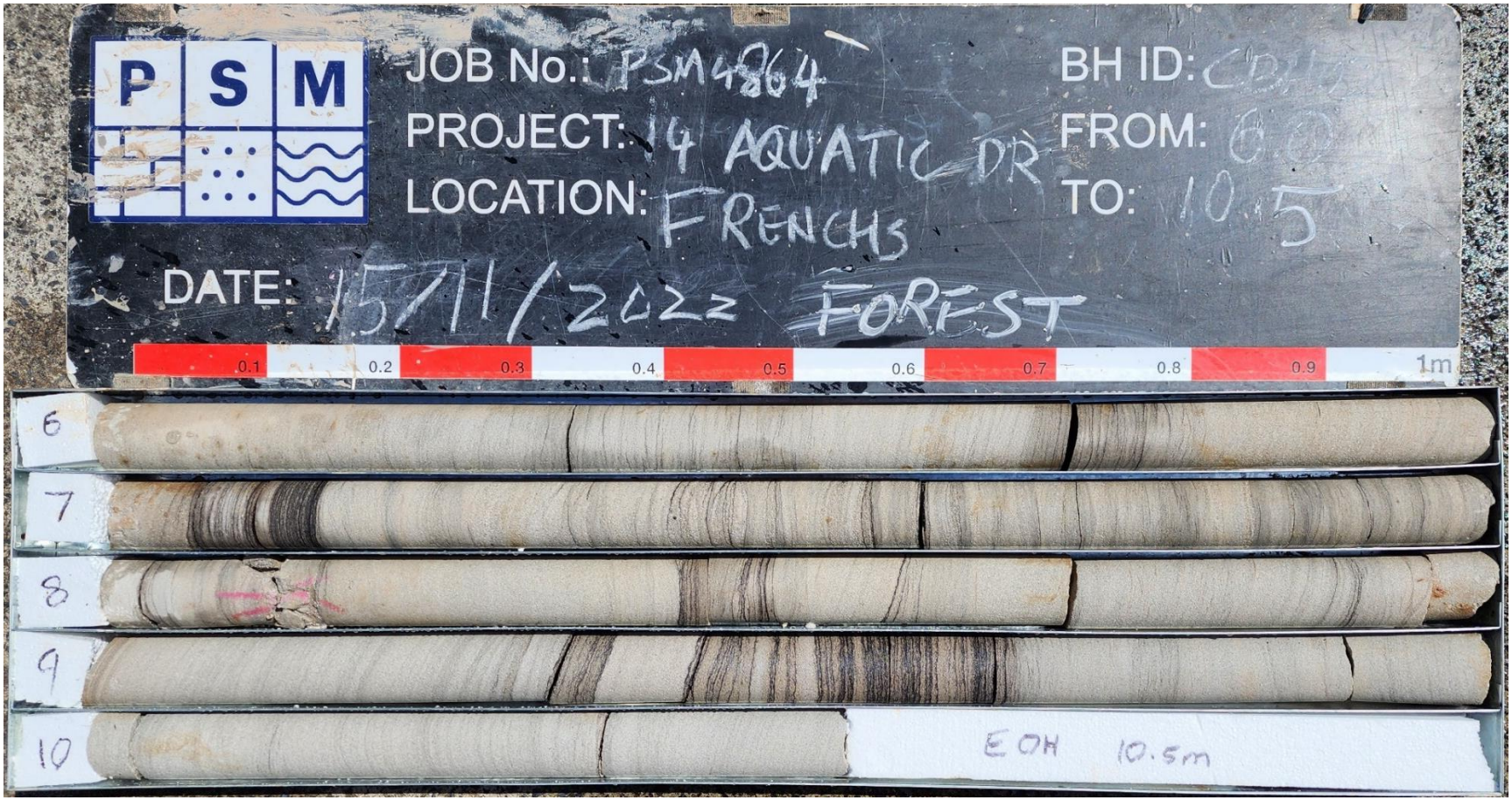
CBH02 - 1.6 - 6.0 m

Note:

Defects are marked in red

Goodman Property Services Australia Pty Ltd Forestridge Business Park 14 Aquatic Drive, Frenchs Forest Geotechnical Investigation Core Photograph	
PSM4864-005R	Appendix B

N:\PSM4864\Eng\SI\Core Photo\[Core.xlsx]PSM_BH2



CBH02 - 6.0 - 10.5 m

Note:

Defects are marked in red

Goodman Property Services Australia Pty Ltd Forestridge Business Park 14 Aquatic Drive, Frenchs Forest Geotechnical Investigation Core Photograph	
PSM4864-005R	Appendix B

Appendix C
Point Load Index Test Results

Pells Sullivan Meynink

POINT LOAD STRENGTH INDEX TEST RESULTS

Job No. *PSM4864-005R* **Sheet of 1**

Project *Forestridge Business Park*

Test Method	*AS 4133.4.1-2007 Methods of testing rocks for engineering purposes - Determination of point load strength index*	Sampling Technique	*NLMC*
		Storage History	*North Ryde office storage*
Test Machine	*GSA 6510-0704*	Moisture Condition	*Natural*
Calibration Date	*14/1/2021*	Loading Rate	*< 30 seconds*

Sampling D *14 and 15 Nov 2022*
Testing Da *18/11/2022*
Tested By *HZ*

Rock Type	Location	Depth (m)	Diametral Tests D (mm)	L (mm)	P (kN)	$I_{s(50)}$ (MPa)	Failure Mode	Axial Tests W (mm)	D (mm)	P (kN)	I_s (MPa)	$I_{s(50)}$ (MPa)	Failure Mode	AS 1726:2017 Strength Class
Sandstone	***CBH01***	***4.75***	*50*	*95*	*0.2*	***0.1***	*Parallel to bedding*	*50*	*30*	*1.0*	*0.5*	***0.5***	*Through substance*	***VL / M***
Sandstone	***CBH01***	***5.50***	*50*	*50*	*0.7*	***0.3***	*Parallel to bedding*	*50*	*40*	*0.9*	*0.4*	***0.4***	*Through substance*	***L / M***
Sandstone	***CBH01***	***6.45***	*50*	*380*	*2.0*	***0.8***	*Parallel to bedding*	*50*	*34*	*1.7*	*0.8*	***0.7***	*Through substance*	***M***
Sandstone	***CBH01***	***7.36***	*50*	*80*	*0.1*	***0.1***	*Parallel to bedding*	*50*	*35*	*1.6*	*0.7*	***0.7***	*Through substance*	***VL / M***
Sandstone	***CBH01***	***8.60***	*50*	*580*	*1.9*	***0.7***	*Parallel to bedding*	*50*	*30*	*1.2*	*0.6*	***0.6***	*Through substance*	***M***
Sandstone	***CBH01***	***9.67***	*50*	*600*	*1.7*	***0.7***	*Parallel to bedding*	*50*	*30*	*1.3*	*0.7*	***0.6***	*Through substance*	***M***
Sandstone	***CBH01***	***10.24***	*50*	*130*	*2.2*	***0.9***	*Parallel to bedding*	*50*	*32*	*0.9*	*0.5*	***0.4***	*Through substance*	***M***
Sandstone	***CBH02***	***1.70***	*50*	*120*	*0.6*	***0.2***	*Parallel to bedding*	*50*	*33*	*1.4*	*0.7*	***0.6***	*Through substance*	***L / M***
Sandstone	***CBH02***	***2.40***	*50*	*450*	*0.3*	***0.1***	*Parallel to bedding*	*50*	*32*	*0.4*	*0.2*	***0.2***	*Through substance*	***L***
Sandstone	***CBH02***	***3.60***	*50*	*170*	*0.4*	***0.1***	*Parallel to bedding*	*50*	*30*	*0.2*	*0.1*	***0.1***	*Through substance*	***VL / L***
Sandstone	***CBH02***	***4.55***	*50*	*140*	*0.7*	***0.3***	*Parallel to bedding*	*50*	*40*	*2.1*	*0.8*	***0.8***	*Through substance*	***L / M***
Sandstone	***CBH02***	***5.50***	*50*	*130*	*2.9*	***1.1***	*Parallel to bedding*	*50*	*30*	*2.1*	*1.1*	***1.1***	*Through substance*	***H***
Sandstone	***CBH02***	***6.40***	*50*	*350*	*1.5*	***0.6***	*Parallel to bedding*	*50*	*35*	*3.7*	*1.7*	***1.6***	*Through substance*	***M / H***
Sandstone	***CBH02***	***7.60***	*50*	*120*	*0.4*	***0.2***	*Parallel to bedding*	*50*	*40*	*1.5*	*0.6*	***0.6***	*Through substance*	***L / M***
Sandstone	***CBH02***	***8.52***	*50*	*230*	*2.3*	***0.9***	*Parallel to bedding*	*50*	*32*	*1.9*	*0.9*	***0.9***	*Through substance*	***M***
Sandstone	***CBH02***	***9.40***	*50*	*50*	*1.0*	***0.4***	*Parallel to bedding*	*50*	*33*	*1.6*	*0.7*	***0.7***	*Through substance*	***M***
Sandstone	***CBH02***	***10.40***	*50*	*160*	*1.6*	***0.7***	*Parallel to bedding*	*50*	*32*	*2.2*	*1.1*	***1.0***	*Through substance*	***M / H***

By: *HZ* **Checked:** *JBL* **Date:** *30/11/2022*

Appendix D
Standpipe Piezometer Installation Records

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no.: PSM4864

PROJECT: Forestridge Business Park

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER:	CBH01	DRILLING CONTRACTOR:	JK Drilling
PIEZOMETER:		RIG:	JK 400 Truck
COLLAR EASTING:	336722	DEPTH OF HOLE (m):	10.50
COLLAR NORTHING:	6263731	BOREHOLE INCLINATION:	-90
COLLAR RL(m):	143.3	PIEZO INSTALLATION DATE:	14/11/2022
DATUM:	AHD	SUPERVISED BY:	JBL/GW

Tick boxes

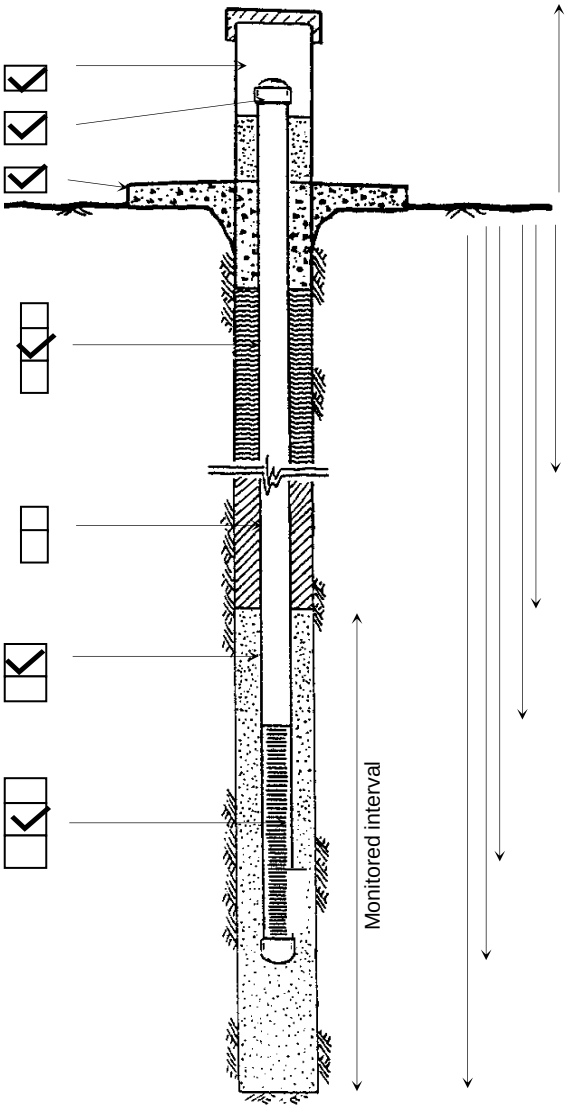
Steel protective well cover ☑
PVC cap ☑
Concrete colar ☑

Back fill type:
Cement bentonite ☐
Soil ☑
None ☐

Seal:
Bentonite pellets ☐
Other ☐

Gravel type:
2-5mm gravel ☑
Other ☐

Perforation type:
Drill holes ☐
Hack saw cuts ☑
40um machine slots ☐



Complete dimensions if appropriate

Height of stickup (m)	0
Diameter of PVC (mm)	63
Depth to top of seal	N/A
Depth to top of gravel pack	0.2m
Depth to top of screen	1m
Depth to base of screen	10m
Depth to base of piezo	10m
Depth to base of gravel	10.5m

COMMENTS:

Appendix E
Geotechnical Laboratory Test Certificates

115 Wicks Road
Macquarie Park, NSW 2113
PO Box 976
North Ryde, Bc 1670
Telephone: 02 9888 5000
Facsimile: 02 9888 5001

SOIL TEST SERVICES

ABN 43 002 145 173

FOUR DAY SOAKED CALIFORNIA BEARING RATIO TEST REPORT

Client: Pells Sullivan Meynink
PSM Job No.: PSM4864

Report No.: L4847 - 1
Report Date: 23/11/2022
Page 1 of 1

SAMPLE NUMBER		ABH01	CBH02	ABH02
DEPTH (m)		0.50 - 1.00	0.20 - 0.50	0.50 - 2.00
Surcharge (kg)		4.5	4.5	4.5
Maximum Dry Density (t/m^3)		2.05 STD	1.69 STD	1.98 STD
Optimum Moisture Content (%)		9.8	19.8	10.6
Moulded Dry Density (t/m^3)		2.01	1.66	1.94
Sample Density Ratio (%)		98	98	98
Sample Moisture Ratio (%)		94	100	96
Moisture Contents				
Insitu (%)		10.4	20.8	13.0
Moulded (%)		9.2	19.9	10.2
After soaking and				
After Test, Top 30mm(%)		13.7	23.8	14.3
Remaining Depth (%)		12.0	20.9	12.6
Material Retained on 19mm Sieve (%)		0	0	0
Swell (%)		0.0	0.0	0.0
C.B.R. value:	@2.5mm penetration	25	6	
	@5.0mm penetration			14

NOTES: Sampled and supplied by client. Samples tested as received.

- Refer to appropriate notes for soil descriptions
- Test Methods : AS 1289 6.1.1, 5.1.1 & 2.1.1.
- Date of receipt of sample: 15/11/2022 & 16/11/2022.
- ABH02 0.2-0.5m had insufficient material supplied to complete a 4-point compaction curve.

NATA

NATA Accredited Laboratory Number:1327

23/11/2022
Authorised Signature / Date
(D. Treweek)

Appendix F
Environmental Laboratory Test Certificates

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2241203**	Page	: 1 of 4
Amendment	: **1**		
Client	: **PELLS SULLIVAN MEYNINK T/A PSM Admin PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: JEFF LEE	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	: PSM4864	Date Samples Received	: 15-Nov-2022 11:30
Order number	: ----	Date Analysis Commenced	: 16-Nov-2022
C-O-C number	: ----	Issue Date	: 24-Nov-2022 17:55
Sampler	: Jungbin Lee		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 4		
No. of samples analysed	: 4		

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, unless the sampling was conducted by ALS. 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	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 Contract 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.

- Amendment (24/11/2022): This report has been amended and re-released to allow the reporting of additional analytical data, specifically method EA010 for all samples.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	CBH01 0.5m	CBH01 3.0m	ABH01 1.5m	CBH02 0.5m	----
			Sampling date / time	14-Nov-2022 00:00	14-Nov-2022 00:00	14-Nov-2022 00:00	14-Nov-2022 00:00	----
Compound	CAS Number	LOR	Unit	ES2241203-001	ES2241203-002	ES2241203-003	ES2241203-004	--------
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	5.2	4.8	5.0	5.5	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	47	143	92	38	----
EA014 Total Soluble Salts								
Total Soluble Salts	----	5	mg/kg	159	486	311	130	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	9.9	13.2	13.1	18.8	----
EA080: Resistivity								
Resistivity at 25°C	----	1	ohm cm	21300	6990	10900	26300	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	0.4	----	----	1.0	----
Exchangeable Magnesium	----	0.1	meq/100g	0.3	----	----	1.3	----
Exchangeable Potassium	----	0.1	meq/100g	<0.1	----	----	<0.1	----
Exchangeable Sodium	----	0.1	meq/100g	0.2	----	----	0.1	----
Cation Exchange Capacity	----	0.1	meq/100g	1.1	----	----	2.5	----
Exchangeable Sodium Percent	----	0.1	%	22.4	----	----	5.4	----
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	0.3	0.4	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	0.5	0.5	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	<0.1	<0.1	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	<0.1	<0.1	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	1.0	0.9	----	----
Exchangeable Sodium Percent	----	0.1	%	----	6.9	5.4	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	70	90	10	40	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	150	110	10	----
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	<10	<10	<10	<10	----
Magnesium	7439-95-4	10	mg/kg	<10	<10	<10	<10	----
Sodium	7440-23-5	10	mg/kg	40	130	70	20	----
Potassium	7440-09-7	10	mg/kg	<10	<10	<10	<10	----