68-80 Banks Avenue, Pagewood NSW

Results of Geotechnical Investigation

PSM5745-009R REV2 07 November 2025

JBS&G

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1. Introduction

This report presents the results of the initial geotechnical investigation undertaken by PSM for the proposed residential development at 68-80 Banks Avenue, Pagewood NSW (the Site). The scope of works is detailed in our proposal 'PSM5745-003L Rev 1' dated 7 April 2025.

The purpose of the initial investigation was to:

- Assess the ground conditions to inform the design of the residential development
- Satisfy the Secretary's Environmental Assessment Requirements (SEARs) issued for the project (SSD-83256472) on 12 May 2025, relating to the geotechnical and groundwater aspects for the State Significant Development application (SSDA), in particular, Item 12 of the SEARs, as reproduced below:

12. Ground and Groundwater Conditions • Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site and including soil erosion. • Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies.	Geotechnical Assessment If required: Groundwater Impact Assessment Salinity Management Plan Acid Sulfate Soils Management Plan

Inset 1: Industry SEARs Checklist for Item 12 – Ground and Groundwater Conditions

2. Background

To assist us in our initial geotechnical investigation, we have been provided with transmittal emails providing information with regards to the proposed development, along with the following document:

- Specification document summarising the background and scope of works (ref. LAHC 2025/186 dated September 2024)
- Architectural pack by BVN dated 29 September 2025.

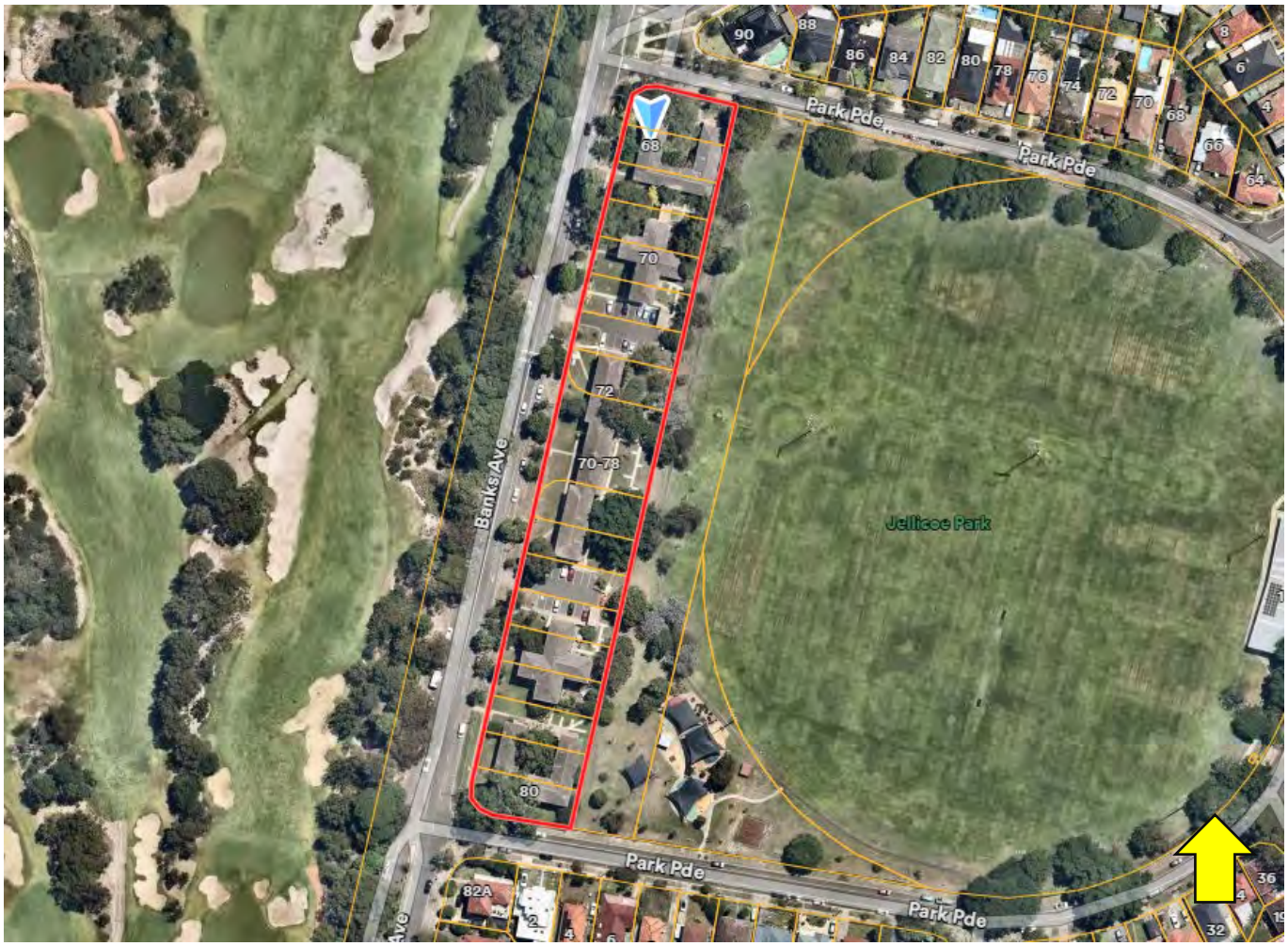
Based on the provided documents, PSM understand the following:

- Homes NSW is undertaking accelerated housing projects as part of the Commonwealth Government's Housing Australia Future Fund (HAFF) and is seeking to progress with the State Significant Development Approvals (SSDA) application
- The SSD application seeks approval for demolition of all existing structures and construction of residential flat buildings comprising a total of 84 social housing dwellings and 140 private market dwellings.
- Site information:
  - The site is located at 68-80 Banks Avenue, Pagewood in the Bayside Local Government Area (LGA) and comprises 18 lots with a combined site area of 9,262 sqm
  - It is currently occupied by five (5) 2-3 storey walk up buildings containing 82 social housing dwellings
  - The site is bound by Banks Road to the west, Park Parade to the north and south, and Jellicoe Park to the east
  - The Bonnie Doon Golf Course is opposite the site on Banks Avenue to the west
  - The site is located within the residential suburb of Pagewood which comprises largely low-rise residential dwellings zoned R2 Low Density Residential and open space
  - Further south is higher density development being undertaken as part of the Pagewood Centro development, with buildings up to 20 storeys

- Westfield Eastgardens is approximately 600m to the south of the site providing extensive local services and amenities and is subject of a Planning Proposal to facilitate expanded retail as well as office uses.

- The SSD application seeks approval for the following development:
  - Demolition of all existing structures on the site, tree removal, excavation and site preparation works
  - Construction of new residential flat buildings comprising:
    - A seven-storey social housing residential flat building with 84 dwellings with a single basement level accessed from Park Avenue to the south
    - Two (2) eight-storey private market housing residential flat buildings with 140 dwellings over a consolidated two-level basement accessed from Park Avenue to the north.
  - Shared servicing access via a lay-by from Banks Avenue
  - Associated landscaping and communal open space
  - Infrastructure servicing
  - Staged delivery to enable relocation of existing tenants and demolition of existing social housing dwellings.

Inset 2 presents a locality plan of the site.



Inset 2: Locality plan with approximate site boundaries shown in red (image from Nearmap on 27 January 2025)

3. Geotechnical Investigation

3.1 Fieldwork

PSM collaborated with JBS&G and undertook fieldwork on the following dates:

- 11 June 2025 to 13 June 2025
- 18 June 2025.

The fieldwork comprised the following:

- Drilling of five (5) augered boreholes up to 10.0 m below the ground surface
- Installation of standpipe piezometers in three (3) boreholes
- Five (5) cone penetrometer tests (CPTs) with a truck mounted drilling rig to depths ranging between 7.1 m and 15.1 m.

The following tasks were performed under the full-time supervision of a PSM geotechnical engineers:

- Directed service locating with JBS&G
- Borehole drilling, piezometer installation and CPTs.
- Prepared logs of the material encountered
- Collected soil samples for laboratory testing.

Prior to intruding the ground, the investigation locations were checked by a certified service locator under the supervision of a PSM geotechnical engineer to detect the presence of underground services.

The borehole locations were recorded with a hand-held GPS device with a horizontal and vertical accuracy of approximately ± 15 mm horizontally and ± 20 mm vertically.

Following the completion of drilling, the test locations were reinstated as follows:

- Boreholes without standpipe: Backfilled with excavated spoil and topped off with a quick-set concrete plug
- Boreholes with a standpipe: A well installed and were fitted with a gatic cover
- CPTs: Backfilled with spoil.

Figure 1 presents a site locality plan showing the investigation locations.

Figures 2 to 8 presents the selected site photographs.

3.2 Boreholes

A total of five (5) augered boreholes were drilled using track mounted drill rigs (Geoprobe 7220R) to depths of between 8.0 m and 10 m below the ground surface. We note that these were environmental holes by JBS&G and the holes were primarily for environmental sampling and groundwater piezometer installation.

Rotatory auger technique was undertaken through overlying soil units with either a VC-bit or TC-bit. The augers were extracted for the first 3 m depth allowing for PSM to assess the encountered material with depth. Beyond 3 m depth, augering was undertaken without extracting the augers. Observation of the soil at depth was only undertaken based on the cuttings advancing to the surface, resulting in limited observations and assessment of the material.

3.3 Groundwater Monitoring Wells

A total of three (3) standpipe piezometers were installed to allow the monitoring of groundwater levels The piezometers were installed in the following boreholes:

- BH-PZ1
- BH-PZ2
- BH-PZ3.

Appendix B presents the piezometer construction records.

3.4 Cone Penetration Tests

A total of five (5) cone penetrometer tests (CPTs) were conducted using a 23-tonne truck to depths of between 7.1 m and 15.2 m below the ground surface. The purpose of the CPTs were to provide a continuous soil profile and inferred soil geotechnical characteristic.

4. Site Conditions

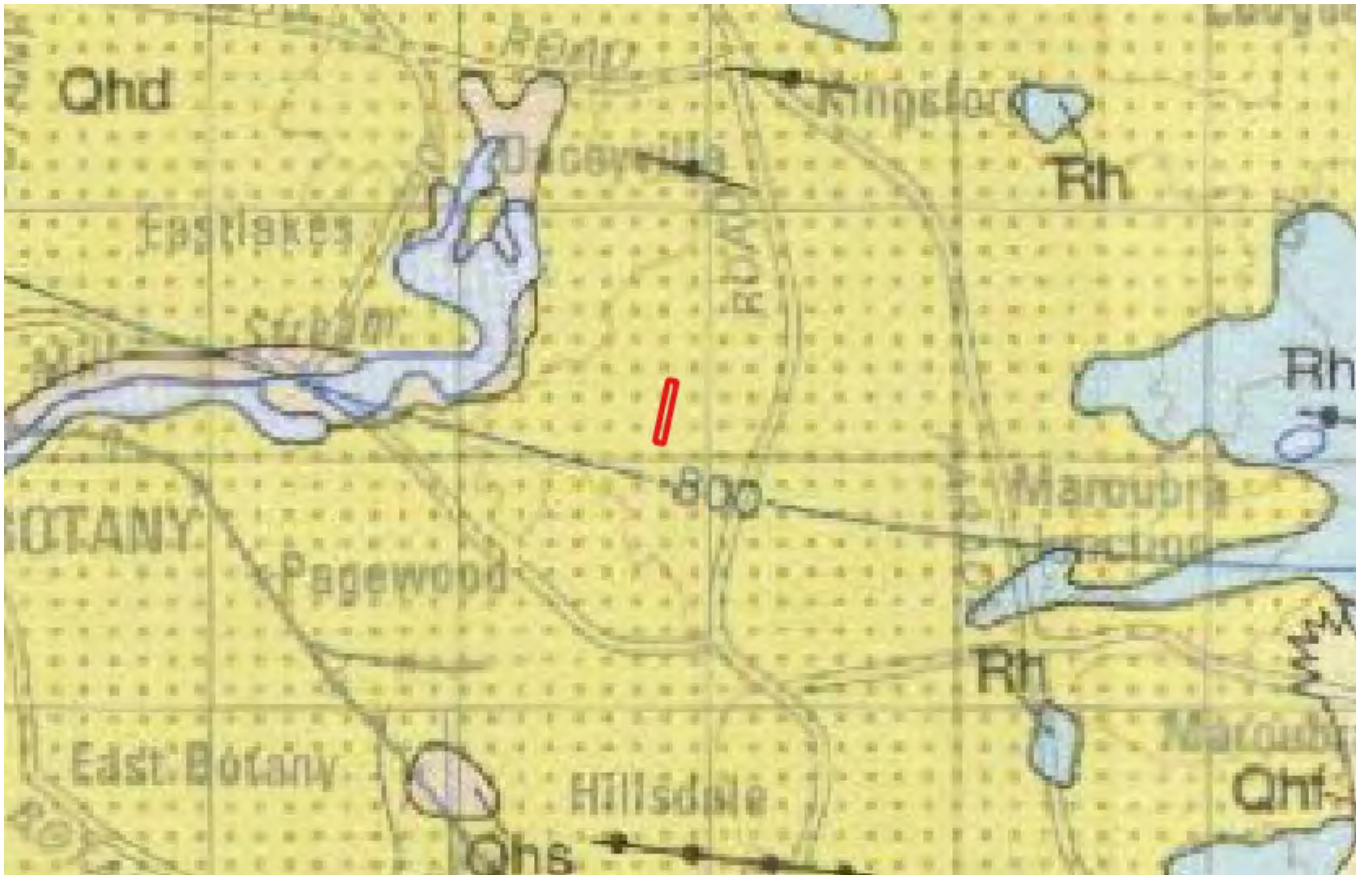
4.1 Geological Setting

The 1:100,000 Sydney Geological Map indicates that the site is underlain by:

- (Qhd) Medium to fine-grained “marine” sand with podsols

The excavated material observed during the investigation was consistent with that shown in the geological map.

Inset 3 presents the geological map of the site.



Inset 3: 1:100,000 Sydney Geological Map (extracted online from NSW Resources). Approximate extents of the Site highlighted in Red

4.2 Surface Conditions

At the time of the fieldwork, the surface conditions comprised of multiple tenanted residential apartments located centrally within the site boundaries. Surrounding the residential apartments, we observed the following:

- Grassed areas and trees around the residential apartments
- Two open-space carparks with asphaltic pavement, dividing the site into three distinct areas.

The overall site topography is generally flat, dipping slightly towards the south.

The Site is bounded by Park Parade to the north and south and Banks Avenue to the west with the Jellicoe Park to the east.

The attached Figure 1 includes an aerial image of the site.

4.3 Inferred Subsurface Conditions

The subsurface conditions encountered within the boreholes are summarised in Table 1. We note that boreholes and cone penetration tests are undertaken at discrete locations only and therefore some variability can be expected between investigation locations (e.g., localised fill and soil characteristics). Table 2 presents depth to the top of the inferred geotechnical units as well as the reduced level (RL) at the top of the geotechnical unit in reference to the Australian Height Datum. Table 3 presents the top of soil units as inferred from the CPT results.

Appendix A presents a detailed log of the materials inferred from each borehole while the CPT plots are presented in Appendix C.

We note that practical refusal was encountered in four CPTs completed on site (out of five). CPT01 was conducted to a depth of 15m and did not reach refusal. The practical refusal for CPTs may be inferred as top of the bedrock. However, this needs to be confirmed by further borehole investigations through geotechnical rock coring.

Table 1 - Depths to top of inferred geological units encountered in boreholes

Inferred Unit	Depth to top of inferred unit (m)	Material Description
TOPSOIL	0.0	TOPSOIL: Silty SAND; fine to medium grained, grey-brown; silt low to medium plasticity; moist, loose, vegetation and rootlets present.
EXISTING FILL	0.2	SAND with Gravel; fine to medium grained, yellow-brown, subangular to subrounded; gravel coarse grained, subrounded to rounded, up to 80mm; moist, medium dense.
SAND A (NATURAL)	0.2 – 0.5	SAND/ SILTY SAND/ SANDY SILT; medium to coarse grained, pale grey, grey-brown-orange, medium to coarse grained; moist, Medium dense.
SAND B (NATURAL)	2.5 – 4.1	SAND/ SILTY SAND; medium to coarse grained, yellow-brown Dense to very dense
Interbedded CLAY/ SAND C (NATURAL)	7.4 to 8.5	SAND/ SILTY SAND/ SANDY SILT; medium to coarse grained, grey, dark grey Loose to medium dense CLAY inferred to be Stiff to Very Stiff. This layer is encountered at all locations; inferred to indicate continuity across the site.
SAND D (NATURAL)	5.1 to 9	SAND/ SILTY SAND; medium to coarse grained, dark grey Very dense

Table 2 - Depth to Top of Inferred Geological Units

Borehole ID	TOPSOIL		EXISTING FILL		NATURAL SOIL		EOH (1, 4)	
	Depth (m bgl)	RL (m AHD)	Depth (m bgl)	RL (m AHD)	Depth (m bgl)	RL (m AHD)	Depth (m bgl)	RL (m AHD)
BH-PZ1	0.0	21.80	0.2	21.6	0.5	21.30	10.0	11.80
BH-PZ2	0.0	21.00	NE (2)	NE (2)	0.3	20.70	10.0	11.00
BH-PZ3	0.0	20.40	NE (2)	NE (2)	0.2	20.20	10.0	10.40
BH-A1	0.0	20.70	NE (2)	NE (2)	0.3	20.40	8.0	12.70
BH-A2	0.0	21.20	NE (2)	NE (2)	0.5	20.70	8.0	13.20
CPT01	0.0	20.60	NA (3)	NA (3)	0.79	19.81	15.2	5.40
CPT02	0.0	20.80	NA (3)	NA (3)	0.44	20.36	13.0	7.80
CPT03	0.0	21.00	NA (3)	NA (3)	0.07	20.93	12.5	8.50
CPT04	0.0	21.20	NA (3)	NA (3)	0.08	21.12	10.2	11.00
CPT05	0.0	21.70	NA (3)	NA (3)	0.04	21.66	7.1	14.60

Notes:
(1) EOH = End of Hole.
(2) NE = Not Encountered.
(3) NA = Not Applicable as we were not able to identify Fill through CPT (shaded grey).
(4) Practical refusal was encountered in CPT (shaded blue).

Table 3 – Depth to top of soil units interpreted form CPT

CPT ID	Top of hole	SAND A		SAND B		Interbedded CLAY/ SAND C		SAND D	
	RL (m AHD)	Depth (m bgl)	RL (m AHD)	Depth (m bgl)	RL (m AHD)	Depth (m bgl)	RL (m AHD)	Depth (m bgl)	RL (m AHD)
CPT01	20.6	0	20.6	3	17.6	8	12.6	9	11.6
CPT02	20.8	0	20.8	3.4	17.40	7.4	13.40	9	11.8
CPT03	21.0	0	21.0	3.5	17.50	7.4	13.60	9	12.0
CPT04	21.2	0	21.2	4.1	17.10	8.5	12.70	9	12.2
CPT05	21.7	0	21.7	2.5	19.20	NE(1)	NE(1)	5.1	16.6

Notes:
(1) NE = Not Encountered.

4.4 Groundwater

Three (3) standpipe piezometers were installed in the completed boreholes.

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

Drilling fluids were used to facilitate the installation of the standpipes, i.e., to prevent collapse. Therefore, the groundwater level recorded on 18 June 2025 may be impacted by drilling fluids. It is noted that JBS&G has pumped out the water following the well installation when they "developed" the well.

HOBO groundwater data loggers were installed within the piezometers for continuous long-term monitoring. The data loggers take an atmospheric and temperature reading at 30-minute intervals.

Ground water monitoring (manual dipping) was undertaken by a PSM geotechnical engineer on the following occasion following well installation:

- 18 June 2025: The groundwater level was between 15.1 m AHD and 16.3 m AHD or 5.3 m bgl to 5.5 m bgl (prior to well development).

Appendix B presents the piezometer construction records.

Table 4 presents the groundwater levels recorded by HOBO data loggers in the standpipes post construction. Appendix B2 presents the continuous groundwater readings from the HOBO data loggers.

We note that BH-PZ1 was clogged with sand following installation from 5.5 m bgl to the base of piezometer. Therefore, the readings obtained would only confirm the presence of water level from 5.5 m bgl and above.

Table 4 - Approximate groundwater level from data loggers in terms of m bgl and m AHD

Borehole ID	Installed	Top of Ground	Screened Interval (1)		Last steady groundwater level up to 9 July 2025	
		m AHD	m bgl	m AHD	m bgl	m AHD
BH-PZ1	13 June 2025	21.8	3.7 - 8.7	18.1 – 13.1	Dry down to 5 (2)	Dry down to 16.3
BH-PZ2	13 June 2025	21.0	4.2 – 10.0	16.8 – 11.0	5.5	15.5
BH-PZ3	18 June 2025	20.4	4.0 – 10.0	16.4 – 10.4	5.6	15.1

Notes:
(1) Screened interval is measured from top of gravel pack to the base of the screen. See Appendix B for details.
(2) No groundwater was encountered down to the level indicated.

4.5 Laboratory Testing

4.5.1 California Bearing Ratio

PSM recovered two (2) bulk soil samples for CBR testing. The following sample preparation was undertaken prior to CBR testing:

- Compact to 98% Standard Maximum Dry Density at optimum moisture content (OMC)
- Four (4) day-soaked sample; and
- 4.5 kg surcharge.

Table 5 presents a summary of the CBR test results. The laboratory test report is included in Appendix D.1.

Table 5 - CBR Test Results

Sample Location and Depth (m)	Inferred Geotechnical Unit	Soaked CBR (%)	Optimum Moisture Content (%)	Standard Maximum Dry Density (t/m^3)	Swell (%)
BH-PZ1 (0.2 – 0.5 m)	EXISTING FILL	7.0	14.7	1.81	0.0
BH-PZ2 (1 – 1.5 m)	NATURAL SOIL	2.5	10.4	1.63	0.0

4.5.2 Aggressivity and Salinity Testing

Three (3) disturbed soil samples were retrieved for aggressivity and salinity testing at a NATA accredited laboratory. The following tests were undertaken:

- Cation Exchange Capacity (CEC) of calcium, magnesium, potassium and sodium
- Exchange sodium percentage
- Salinity (EC 1:5, one part soil to five parts water)
- Soil pH
- Chlorides
- Sulphates
- Resistivity.

Table 6 presents a summary of the results.

The laboratory test report is presented in Appendix D.2.

Table 6 - Summary of Aggressivity and Salinity Testing Results

Sample ID (depth bgl)	Exchangeable Cations [meq/100g]					Exchange Sodium [%]	pH	Electrical Conductivity [µS/cm]	Sulfate [mg/kg]	Chloride [mg/kg]	Resistivity [ohm cm]
	Ca	Mg	K	Na	CEC						
BH-PZ1 (6.0 m)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	6.0	12	<10	<10	83300
BH-PZ2 (3.0 m)	0.7	0.2	<0.1	<0.1	0.8	<0.1	5.7	11	<10	<10	90900
BH-PZ3 (1.0 m)	0.2	<0.1	<0.1	<0.1	0.2	5.1	6.2	8	<10	<10	125000

Notes:

- Sample IDs within 0 correlate to the following:
  BH-PZ1 = PZa
  BH-PZ2 = PZb
  BH-PZ3 = PZc

5. Aggressivity Assessment

5.1 Soil Chemistry

The aggressivity test results, summarised in Table 6 indicate the following:

- pH of the soil samples analysed was in the range of 5.7 to 6.2
- The 1:5 soil to water extraction and subsequent electrical conductivity (EC1:5) of the soil samples analysed to be in the range of 8 µS/cm to 12 µS/cm
- Concentrations of chlorides in samples analysed was less than 10 mg/kg
- Concentrations of soluble sulphate in samples analysed was less than 10 mg/kg
- Cation Exchange Capacity (CEC) in samples analysed was in the range of less than 0.1 meq/100g to 0.8 meq/100g
- Exchange Sodium Percentage (ESP) in samples analysed was in the range of less than 0.1% to 5.1%.

5.2 Salinity Assessment

Site Investigations for Urban Salinity (DLWC 2002)[1] classify soil salinity based on electrical conductivity (EC_e) as per Richards (1954)[2]. The method of conversion from $EC_{1:5}$ to EC_e (electrical conductivity of saturated extract) is based on DLWC (2002) and given by $EC_e = EC_{1:5} \times M$, where M is the multiplication factor based on "Soil Texture Group".

The "Soil Texture Group" of the samples tested has been assessed during our investigation. The salinity classification for the soil samples that were tested are presented in Table 7. It is assessed that the soils on site are classified as "non-saline".

Table 7 - Salinity Classification

Sample ID (Depth)	$EC_{1:5}$ [dS/m]	Soil Type	M	EC_e [dS/m]	Salinity Class
BH-PZ1 (3.0 m)	0.012	Sands	17	0.20	Non-Saline
BH-PZ1 (4.0 m)	0.011	Sands	17	0.19	Non-Saline
BH-PZ2 (1.0 m)	0.008	Sands	17	0.14	Non-Saline

[1] DLWC (2002) Site Investigations for Urban Salinity. Department of Land and Water Conservation, Sydney.

[2] Richards, L.A. (1954) Diagnosis and improvement of saline and alkali soils. Agricultural handbook 60. U.S. Dept. of Agriculture, Washington D.C., 160 p.

5.3 Corrosivity/ Aggressivity Assessment

Table 8 presents the exposure classification for concrete and steel, as assessed in accordance with AS3600 and AS2159.

Table 8 - Exposure classification assessment

Exposure classification element	Reference	Criteria	Exposure Classification
Concrete in sulfate soils	Table 4.8.1 of AS3600 (2018)	Sulfate and pH	A2
Concrete piles in soil	Table 6.4.2 (C) of AS2159 (2009)	Soil sulfate and pH	Non-aggressive to Mild
Steel piles in soil	Table 6.5.2 (C) of AS2159 (2009)	Resistivity, pH and chlorides	Non-aggressive

6. Geotechnical Design Advice

6.1 General

The geotechnical design advice (GDA) provided in the following sections has been prepared on the basis that the subsurface conditions are as described in Section 4.2.

If any of the advice is not applicable, PSM should be requested to confirm that the design advice below is still valid.

6.2 Engineering Parameters

Table 9 below presents the engineering properties of the different geotechnical units.

Table 9 - Engineering Parameters of Inferred Geotechnical Units

Inferred Unit	Bulk Unit Weight (kN/m3)	Soil Effective Strength Parameters		Ultimate Bearing Pressure Under Vertical Centric Loading (kPa)	Allowable Bearing Pressure (ABP) Under Vertical Centric Loading (kPa)	Elastic Parameters	
EXISTING FILL [2]	18	0	30	420	140[1]	10	0.3
SAND A	18	0	30	450	150[1]	20	0.3
SAND B	18	0	33	Note [4]		40	0.3
Interbedded CLAY/ SAND C (3)	18	0	28	Note [3]		10	0.3
SAND D	18	0	37	Note [4]		100	0.3

Notes:

(1) Shallow footings should have a minimum horizontal dimension of 1 m and a minimum embedment depth of 0.5 m.
(2) Parameters for existing fill are applicable after proof roll inspection to remove any soft or loose spots. Dynamic cone penetrometer (DCP) testing may be necessary to confirm fill quality at each location.
(3) Bearing pressure for Sand C unit is not provided as it is NOT recommended to found piles in this unit.
(4) Ultimate bearing pressure and shaft adhesion in these strata are dependent on pile type, installation method, depth of pile, toe etc. Further advice should be sought for piles to be founded withing these soil units.

6.3 Site Classification

The proposed development is out of scope of AS2870-2011 “Residential slabs and footings” given that it is a multi-storey development.

Nevertheless, due to presence of the existing fill / loose layer, we classify the Site as Class “P” in accordance with AS2870.

6.4 Seismic Classification

The depth to bedrock is assessed to exceed 3 m. On this basis, as per AS1170.4-2007 “Earthquake Loads”, we assess the following seismic classification for the Site:

- Site Sub-Soil Class of Ce
- Hazard Design Factor (Z) of 0.08 for Sydney.

6.5 Excavatability

Bedrock was not encountered to depth of 8 m – 10 m in the boreholes. However, CPT refusal was encountered at various depth ranging between 7 m near the north to 13 m on the south, which may indicate presence of bedrock.

Excavation in soil and very low to low strength bedrock is expected to be achievable using conventional earthwork equipment (large dozers, excavators, ripper) with only minor need for rock breaking. The strength of the bedrock should be confirmed through geotechnical rock coring if expected to be intersected by the development, e.g., basement.

It is our experience that excavatability is heavily dependent on factors such as the experience of the operator, the plant used and the area available for excavation activities. The contractor (or designer) should satisfy itself with regard to excavatability, review the borehole logs and consider the advice in this report.

Given the level of groundwater table, excavation may intersect the water table and will thus be wet when excavated. The Contractor will need to develop a methodology to address the wet ground being excavated and whether some drying of the material via spreading and exposure is possible prior to removal.

In selecting the plant and methodology, the Contractor shall consider the trafficability of the ground conditions at the base of the excavation during construction. The use of tracked plants and machinery is likely to be required. These could be improved by placement of a layer of compacted crushed rockfill or similar durable material. Such a layer is likely to be required as part of preparation of the excavation floor for placement of structural fill, subfloor drainage etc.

The Contractor should refer to the contamination assessment reports for the Site when considering disposal of the excavated materials. All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines including the Waste Classification Guidelines (EPA 2014).

6.6 Foundation

6.6.1 Shallow Foundations

Pad footings can be proportioned on the basis of an allowable bearing pressure (ABP) for centric vertical loads provided in Table 9. 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/ foundations, the embedment depth, proximity to slope/excavation, the load direction and eccentricity, the stiffness of the footing, the adopted factor of safety (FoS), as well as the soil properties. As footings get bigger or deeper the capacity increases rapidly, as the load gains eccentricity or becomes inclined, the capacity reduces rapidly.

Settlements of the foundations can be estimated using the elastic moduli provided in Table 9. The differential settlement due to the building load shall also be assessed.

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

6.6.2 Piles

Piles should be designed in accordance with the requirements in AS 2159 (2009) '*Piling - Design and Installation*'. The parameters provided in Table 9 may be adopted in the design of piles.

We envisage that piles would be founded within the BEDROCK units. However, further investigation is required to confirm the founding properties of the BEDROCK unit. Further advice should be sought, if piles are designed to be founded in soil units.

The selection of the pile system depends on many considerations and should be undertaken by the designer in conjunction with the principal and contractor/builder. The effects of piling works (e.g., CFA piles or other pile type installation) on adjacent ground and structures should be considered in any design.

- The allowable bearing pressure needs to be confirmed by a geotechnical engineer through pile inspections prior to pouring concrete
- Deflection should be checked using the recommended elastic parameters in Table 9
- Where the design utilises the shaft resistance of socketed piles in rock, Pells (1999)[3] provides guidance on methods to assess settlements for such piles
- Where adjacent foundation details differ (e.g., pile and pad, differing loads or ground conditions), differential settlement should also be assessed.

The bearing capacities provided are contingent on piles or footings being vertically and centrally loaded. Further advice should be sought if the footings are not vertically centrically loaded.

With regards to the pile design, we recommend that:

- A basic geotechnical strength reduction factor, Φ_{gb} = 0.6 (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
- It may be possible to increase the pile reduction factors, if the details of the proposed pile installation procedures indicate a high level of quality control with regards to concrete placement, base cleanliness, etc
- If a geotechnical strength reduction factor, Φg = 0.40 is adopted then no pile testing will be required (AS2159 Clause 8.2.4 (b)).

The actual pile design will be heavily dependent on the pile type, installation method and required loadings. We recommend that piling contractors be provided with the information in this report as a basis for the design.

We note that the designer shall consider influence of Interbedded CLAY/ SAND C on the pile design particularly if the piles are founded above or within the layer. This layer consists of stiff to very stiff clay/ loose to medium dense. Influence on both ultimate and serviceability limit states shall be considered.

6.6.3 Permanent and Temporary Batters

The batter slope angles shown in Table 10 are recommended for the design of batters up to 2 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 one batter height of the crest of the batter, further advice should be sought.

[3] P.J.N. Pells (1999), State of Practice For the Design of Socketed Piles in Rock

Table 10 – Batter Slope Angles

Unit	Temporary	Permanent
SOIL UNITS e.g. EXISTING FILL, AND NATURAL SOIL	2H : 1V	2.5H : 1V

Note:
(1) H = Horizontal
(2) V = Vertical.

Steeper batters may be possible subject to further advice, probably including inspection during construction. If groundwater is encountered during slope formation, further advice shall be requested.

6.7 Preliminary Advice for Excavation below the Groundwater Table

6.7.1 General

This section presents our preliminary advice for excavation below the groundwater table. We understand that the proposed development will comprise:

- Up to two (2) levels of basement to a depth of approximately 6 m (RL 16.1 m)
- Foundation preparation, i.e., pile caps, footings, lift pits etc. will be required.

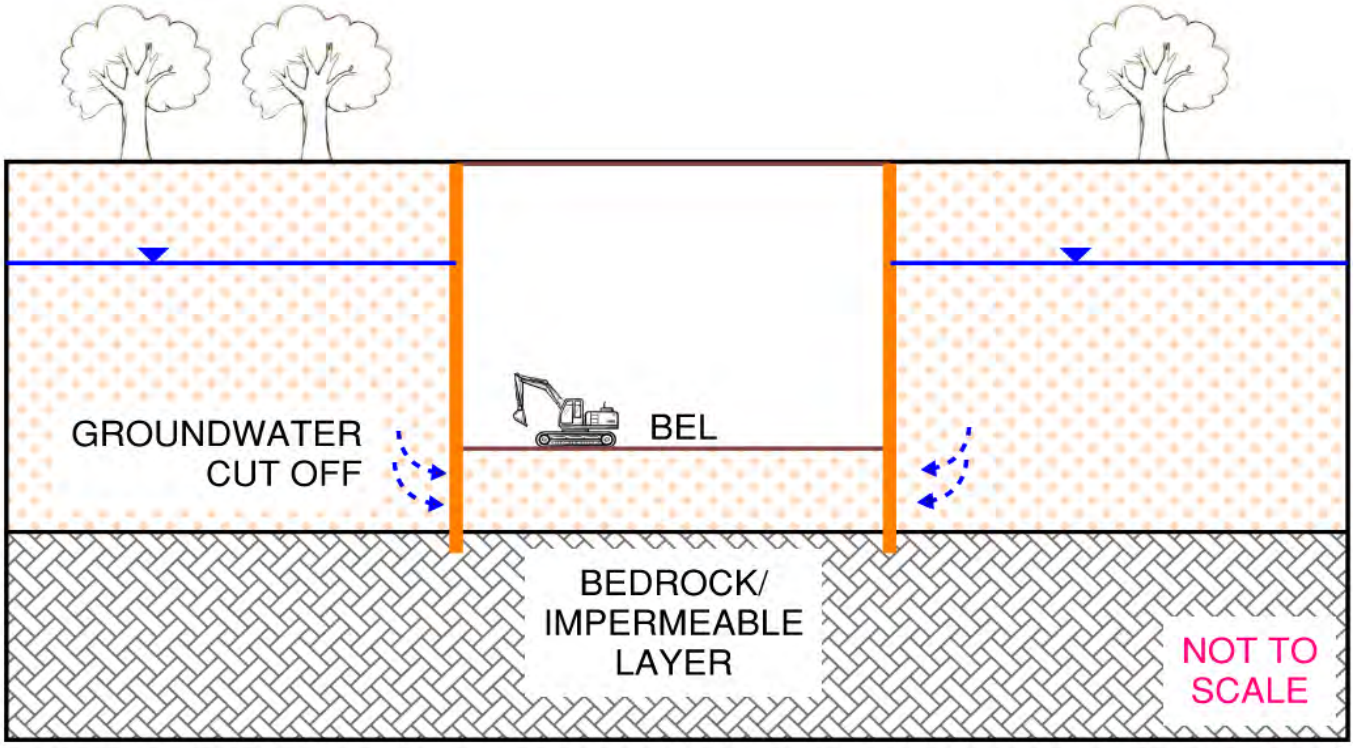
Currently, groundwater across the site was measured between 5 m to 5.6 m below the ground surface level based on the last steady groundwater level reading on 9 July 2025. We note that fluctuations in ground water levels due to storm events and seasonal variations will need to be considered. This can only be confirmed with long-term groundwater monitoring or detailed monitoring, which is not currently available.

As noted above, thick sand units are anticipated at the Site. The presence of a high-groundwater table in thick sand units can cause several issues and the following items need to be considered for the design, construction and operation (perpetuity) phases:

- The material to become saturated, reducing its strength and increasing the risk of instability
- The inflow of materials through non-watertight retaining structures
- Design of basement needs to consider the requirement by WaterNSW around water take / water access licences
- Permanently “tanked or drained” basement and long-term disposal of the extracted water.

6.7.2 Construction Stage

To facilitate the excavation, water-tight shoring walls will need to be designed and constructed around the perimeter of excavation to below bulk excavation level. The site will need to be dewatered, progressively excavated followed by the construction of the basement. To allow plant and machinery to operate on the bulk excavation level, groundwater inflows will need to be limited and groundwater within the excavation should be lowered to at least 1m below the bulk excavation levels and as such, the water-tight shoring system may need to extend to the underlying bedrock/ impermeable layer to cutoff the inflows. The cutoff would also control the groundwater drawdown and mitigate the risk of drawdown induced settlement behind the excavation. The current investigation has not confirmed the depth of bedrock or impermeable layer that is suitable to act as a cut off layer.



Inset 4 Simple Schematic showing the cut off and groundwater flow (support elements not shown)

6.7.3 Permanent Stage (long-term)

Considering the groundwater level measurements relative to the proposed two basement levels, it is recommended that in perpetuity, a fully tanked basement wall and slab be adopted comprising a watertight perimeter wall integrated with a floor slab. The shoring and base slab would need to be designed to withstand hydrostatic pressures and buoyancy forces. Uplift is typically resisted by the building weight and deadload. Any net uplift will need to be designed for, and we envisaged that piles are required to resist the uplift load. In the temporary stage during construction, the net uplift force due to partial building dead load must be considered, or otherwise, pressure relief "valves" shall be installed.

The tanked basement shall also be designed such that there is no long-term pumping requirements or drawdown of the water table surrounding the site. Internal surface drainage and a system to remove minor inflows into the basement through joints and cracks in wall and sab structure from the final basement will be required as a tanked basement typically experiences some residual inflows.

It is not possible to accurately predict all future groundwater levels, so where an elevation lower than the ground surface is adopted, to eliminate the risk of buoyancy issues for the tanked basement and overloading of the slab and walls, the design could incorporate hydrostatic relief 'valves or portals' at the adopted design water level. These would prevent overloading and structural damage to the building should the water levels rise to above the design level. Alternatively, the walls and slabs can be designed for water rising to the existing ground surface.

Dewatering should be in place whenever inflows or relief "valves" are present.

6.7.4 Recommendations

We recommend a groundwater impact report be undertaken to help inform:

- The required depth of the shoring system and likely inflows and drawdown during construction stage
- The design groundwater levels during construction and in perpetuity
- Dewatering methodologies
- Drawdown extents
- Settlements due to dewatering
- Disposal of extracted water
- Monitoring and licencing requirements.

6.8 Excavation Support

6.8.1 Selection criteria

Shallow temporary or permanent cuts above the groundwater table in the EXISTING FILL and NATURAL SOIL steeper than the recommended permanent batter slopes in Table 10 will need to be supported by some form of retaining structure. As such, the basement excavations will need to be supported by appropriately designed shoring walls installed prior to bulk excavation.

Even with good design and construction of the shoring, some vertical and lateral ground movements of the ground beyond the limits of the excavation will occur.

The magnitude of the movements is a function of:

- The shoring type and the associated construction technique and sequence
- The quality of contractor
- The stiffness of the shoring system
- The effects of dewatering during construction and in perpetuity.

It is therefore the responsibility of the shoring wall designer to make an assessment of the likely shoring wall movements and associated adjoining ground movements, so that an assessment of the risk of damage to adjacent buildings, roads and services can be made. This will also require careful consideration of the current condition of the structures and the tolerance of the structures to ground movements.

The shoring designer will then need to select a shoring system (including construction methodology) and design the shoring system to minimise ground movements behind the excavation faces to ensure adjacent buildings, footpaths and in-ground services are not affected as a result of basement construction.

6.8.2 Shoring options

The ground retention system selected will need to control groundwater inflow into the excavation, thus a continuous perimeter wall will be required which should comprise either a diaphragm wall or secant pile wall. Each retention system will have differing abilities to control inflows due to the associated construction limitations of each method.

Contiguous pile walls or soldier pile walls within fill panels do not provide suitable support to the sand and provide no control on groundwater inflows. We consider these to be unsuitable for the proposed development.

Sheet pile walls could also be an alternative if its impact and risk of damage to neighbouring buildings are managed. The primary risk is related to vibrations generated during sheet pile walls installation.

We consider that the most suitable shoring systems will likely include either:

- A sheet pile wall
- A propped cased secant pile wall or
- A propped diaphragm wall.

These walls should be taken down well below the bulk excavation depth to act as a cutoff to reduce groundwater inflows. The aim of the cutoff shoring will be to reduce groundwater inflows during excavation and the risk of groundwater drawdown and associated settlement on adjacent sites beyond the shoring wall.

PSM can advise on the groundwater cutoff and dewatering considerations by undertaking a groundwater impact assessment report.

6.8.2.1 Sheet pile walls

Sheet piles are a series of interlocking steel segments installed in the ground that would act as a retention system and a seal to minimise groundwater inflow. The walls are typically vibrated into the ground. However, there are alternatives in the market which generate minimal vibrations and rely on “push-in” methodology. Installation of sheet piles are generally straight-forward and relatively quicker than other type of retention. However, sheet piles are known to prematurely refuse in dense to very dense sand, which is expected at the Site. This risk should be considered by the designer of shoring system and if required, pre-drilling may be considered as an option.

The effectiveness of the sheet pile wall as a seal is highly dependent on the proper interlocking of the segments. Poorly interlocked segments could result in a risk of seepage and material inflow.

6.8.2.2 Secant pile walls

Secant pile walls rely on drilling 'overlapping' hard and soft piles. For the site, secant piles would need to be drilled as double rotary continuous flight auger (CFA) cased secant piles. Further advice from shoring contractors should be obtained on vertical tolerances for the secant pile system. Bored piles will not be suitable unless cased, as they will collapse in the sandy soils. Alternatively, drilling fluid like bentonite or polymer can be used. Specialist advice from shoring contractor is required.

An appropriately designed and constructed propped secant pile wall can act as an effective seal to minimise material loss and water inflow from behind the wall, and if adequately supported, minimise lateral deflections and ground movements in general. The effectiveness of the secant pile wall as a seal, will depend on the verticality of the piles and ensuring overlap between soft and hard piles. The longer the piles, the more difficult it will be to ensure verticality and thus, effectiveness of the secant pile wall system. Consequently, gaps can develop between piles resulting in higher groundwater inflows, lead to sand material loss, and possibly a drop in groundwater levels at adjacent sites.

The 'hard' (reinforced concrete) piles can be incorporated into the vertical load carrying footing system and can generally form part of the basement structure.

6.8.2.3 Diaphragm walls

A diaphragm wall is a continuous wall formed via grab excavating trench panels which are temporarily held open by drilling fluid, i.e., bentonite or polymer prior to concreting. The panels interlock using a key to form a continuous wall. A diaphragm wall could be constructed around the perimeter of the site to support the excavation faces and could be incorporated into the final structure. A guide wall needs to be constructed first prior to the construction of the diaphragm walls. Separately a processing plant for the recycling of bentonite or polymer is envisaged.

6.8.2.4 Over-excavation, sand mining and decompression

Attention will need to be given during any shoring wall construction such that excess spoil is not removed from the pile hole or shoring excavation during installation (termed over-excavation, sand mining or decompression). Decompression can cause a settlement bowl in the ground around the piles. Experience indicates that where this effect is not controlled, this settlement bowl can extend some metres from the pile location. The piling contractor should be required to submit a proposed methodology that addresses this risk of decompression.

Where the shoring is within a few metres of neighbouring structures, in our experience, the risk of damage due to decompression is high and very specialised construction methods and construction monitoring will be required to minimise the risk of ground movements resulting in damage. The presence of cemented layers of sand that provide additional resistance increase the risk of sand mining during pile installation. Appropriate use of double rotary cased secant piles can decrease the likelihood of sand mining and decompression.

6.8.2.5 Anchors and propping

We understand that the proposed development will have up to two levels of basement, which requires approximately 6 m deep excavation.

Given the significant earth pressures from the assumed minimum 6 m deep excavation, it is expected that multiple rows of anchors or internal propping will be required to support the wall sections to ensure stability, reduce wall deflections and bending moments.

Where anchors are adopted, permission will need to be obtained from the adjacent property owners where anchors extend below their property. We recommend that the process of obtaining permission for anchors be commenced at an early stage, as it is our experience that it can take a considerable time for permission to be granted.

Consideration will also need to be given to the extent of any adjacent basements, foundations and possible ground movements associated with anchor installation below neighbouring structures. Even with good control of the anchor installation, it is our experience that anchors in sand can result in decompression of the material around the anchor hole and settlement above the anchor location.

Anchors are also less stiff than internal propping and will result in increased movements of the wall and ground during excavation as the anchor extends to 'take up' the load. This can be managed if the anchors are pre-tensioned prior to excavation. De-commissioning of the anchors following construction shall be considered such that they do not pose a risk to external developments in the future. These anchors are typically bonded in the bedrock strata. Given the variability in rock levels at the Site, this could be challenging, i.e., significantly long anchors may be required in particular in the southern portion of the Site.

For the above reasons we consider that internal propping is preferable to anchors in the temporary condition. Any internal propping would preferably be able to be pre-loaded to reduce wall movements. Top-down construction, where the permanent structure is used to restrain the work as excavation continues below can also be considered. Bottom-up construction could result in space constraints due to the presence of anchors and thus space-proofing is critical to optimise the construction process. Similarly, wall movements may also be induced during the removal of the internal props. This shall be carefully staged together with the permanent slab construction.

The shoring walls (if structurally designed as permanent walls) will then be able to be propped in the long term by the floor slabs.

6.8.3 Shoring design

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

- Proposed wall geometry
- Effective strength parameters in Table 9 when assessing the earth pressure on retaining structures
- Surcharge loads behind retention
- Water pressure (depending on the type of structure)
- Careful consideration of the ground movements and their effect on neighbouring structures and services. As previously stated, even with good design and construction of the shoring, some vertical and lateral ground movements of the ground beyond the limits of the excavation will occur.

Further we note that the advice given in this report is in terms of working pressures and actions, and the designer needs to apply appropriate load and strength reduction factors, etc., in its design.

Note that design of retention systems may be based on either K_a or K_0 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_0 pressures, construction should be carefully controlled to avoid unwanted effects. It should be noted that designing for K_0 pressures does not, of itself, ensure that movement does not occur. Movements are controlled by the construction method, especially sequence.

Temporary anchors/ props may be required to minimise ground movement (i.e., ensuring that movement meets guidelines/ requirements) and for stability purposes. Designers and contractors should also consider the deformations induced during construction and installation of the support when assessing the effect of the proposed support system on neighbouring structures. When relying on passive support from embedment of the shoring below the bulk excavation level the designer shall ignore the support provided in the upper 0.5 m of embedment.

Both surface and sub-surface drainage needs to be designed and constructed properly to prevent pore water pressure from building up behind the retailing walls or appropriate water pressures must be included in the design.

6.8.4 Shoring Contractors

It is recommended that only reputable, specialist shoring and anchor contractors be engaged to construct and/or install the shoring works at this site. The contractor(s) shall be asked to confirm that the proposed construction methodology has considered designer nominated allowable ground movements at the location of adjacent buildings and services and that its method is not expected to result in such ground movements.

Finally, the shoring designer/ contractor(s) should provide details of how they propose to monitor ground movements during the works and the proposed response should such ground movements exceed the limits stated by the designer.

6.9 Effects on neighbouring buildings and infrastructure

6.9.1 Dilapidation surveys

We recommend that prior to commencing work on site, dilapidation surveys of the surrounding structures, buildings, services and pavements be undertaken to document the existing conditions of these assets.

The aims of the dilapidation surveys are to:

- Assist in accurately responding to future claims for damage due to construction related activities (at the Site)
- Assist the designer of the shoring system to assess the allowable ground deformation and vibration criteria so as to minimise risk of damage to neighbouring structures. These criteria will need to in turn inform the shoring system selection, groundwater cutoff requirements, construction methodologies and survey and vibration monitoring and response plan.

The level of detail and extent of the dilapidation surveys required shall be assessed by the designer and contractor to achieve the above aims.

6.9.2 Ground deformation sources

Even with good design and construction of the shoring, some vertical and lateral ground movements of the ground beyond the limits of the excavation will occur.

The designer and contractor responsible for the shoring and excavation works shall consider at least the following possible sources of ground deformations:

- Deformation associated with shoring construction, including those due to:
  - Vibration resulting in densification of the loose sand and fill
  - Overexcavation, sand mining, decompression and ground loss through shoring as discussed in Section 6.8.2.4
  - Anchor installation as discussed in Section 6.8.2.5.
- Deformations associated with excavation. The extent of movement will depend on the final design, stiffness of the shoring elements, sequencing of the support and construction methods used. As a guide, well designed shoring walls in sand supported by anchors may experience lateral wall movements in the order 2 mm for each metre of excavation height, and possibly up to 5 mm. These shall be assessed by detailed analysis as recommended in Section 6.8.3
- Settlements associated with dewatering.

6.9.3 Survey Monitoring Plan

A survey monitoring plan shall be developed and implemented during construction and excavation. The monitoring plan shall as a minimum:

- Require a programme of precise survey monitoring of adjacent buildings, services, pavements and the shoring wall itself
- Consider the need for installation of inclinometers within the shoring system to monitor the deformations below the ground during excavation
- Nominate tolerable limits including trigger levels based on assessment of the structure types and existing condition. Associated actions/ contingencies are to be proposed based on trigger levels
- Have a monitoring frequency and accuracy to ensure that tolerable limits are not exceeded and to provide an early indication of whether changes to the construction methodology or additional support is required.

6.10 Slabs

The design of slabs on ground can be based on:

- The subsurface conditions as described in Section 4.3,
- The site classification described in Section 6.3
- A subgrade with a long-term Young's modulus provided in Table 9.

We note that the environmental effects (e.g., drying or wetting up of the finished surface) affecting the land prior to development should be taken into account by the various designers of the proposed development.

We note that the final bulk earthworks subgrade will require proof rolling and plate load testing to confirm the properties provided and may require some boxing out and refilling, etc.

6.11 Pavement

Two (2) CBR tests were undertaken on samples collected from boreholes BH-PZ1 and BH-PZ2.

Subgrade CBR for pavement design depends on the material at the finished subgrade levels. The CBR test undertaken by PSM (refer to Table 5) indicates a CBR value of between 2.5% and 7%.

For insitu material, a soaked CBR value of 3% could be adopted for preliminary pavement design.

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

7. Geotechnical Risks

We have not identified any geotechnical conditions at the site which are particularly unusual for typical residential development. We consider this site suitable for typical residential development subject to appropriate design considerations.

The following geotechnical risks should be considered. Note that these do not include any risks relating to contamination or environmental concerns.

7.1 Depth to Bedrock

Based on the *For Information* drawings by BVN, we understand that the development would comprise six blocks of seven storey residential flats with up to two levels of basement. As such, to support the loads of the proposed development, we envisage that piles founded on bedrock are likely to be required.

No bedrock was encountered in the boreholes that were drilled to 8 m to 10 m below the surface. However, CPT refusal was encountered between 7 m to 13 m below the surface. We infer that this could indicate the top of bedrock. CPT01 was conducted to a depth of 15m and did not reach refusal. Localised deeper bedrock may be encountered which needs to be considered in design of the foundations. Further intrusive investigations are required once the building layout and structural details are developed.

We recommend conducting additional geotechnical investigations to determine the depth of bedrock and assess its characteristic across the site. Engineering parameters such as Young Modulus, Poisson's Ratio, Allowable Bearing Pressure etc can be provided following rock coring and assessment of the bedrock engineering properties.

7.2 Presence of Interbedded Clay and Loose Sand Layer

The encountered sand units exhibit a variable character through the investigated depth and across the investigated area. Lenses of loose sand / or fine-grained material are interpreted to be present specifically between depth of approximately 7.4 m (36 m AHD) and 8.5 m (35.1 m AHD) The design of proposed development shall consider variation of engineering properties of the sand units and presence of loose lenses.

7.3 Excavation in Urban Area

We understand that the development with comprise up to two levels of basement. Given this, the impact of the excavation works on the ground movement and the adjacent structures/ utilities must be assessed and considered by the designer. The magnitude and extent of movement are related to the ground conditions and type of retention system adopted. The design shall consider the acceptance limits of the different structures such as roads, buildings, utilities within the zone of influence of works. Different acceptable limits are applicable for the various types of structures and utilities.

7.4 Buried Services

There is a potential for buried services within the site that might be affected by the redevelopment.

Should decommissioning of services result in excavations deeper than 2 m, methodologies should consider the possible presence of perched and groundwater tables. Staged excavation and backfilling with inert materials (sandstone VENM, recycled concrete or DGB) may be necessary.

7.5 Variable groundwater

We note that fluctuations in ground water levels due to storm events and seasonal variations can pose a geotechnical and structural risks to the development. Groundwater will have an impact on the design of the basement structure including appropriate foundations to resist uplift, wall and slab design, pump systems if removal of water is required etc.

This can only be confirmed with long-term groundwater monitoring, detailed monitoring and modelling, which is not currently available. The currently measured groundwater levels only provide a representation of the levels at the present time. Generally, the measured groundwater levels are associated with the climate / weather patterns in recent years. For instance, a period of wet weather following a dry period could increase the groundwater level further and vice versa.

8. Further Works

As discussed above, there are geotechnical uncertainties in relation to the depth of bedrock. For concept stage, we recommend undertaking at least two (2) cored holes, cored at least 2 m into medium strength bedrock below the proposed basement level. Additional boreholes could be undertaken during detailed design stage to confirm the depth of bedrock and quality at the Site.

9. Assessment of SEARS

The following Secretary's Environmental Assessment Requirements (SEARs) relating to the geotechnical and groundwater aspects for the State Significant Development application (SSDA), in particular, Item 12 of the SEARs have been identified.

12. Ground and Groundwater Conditions • Assess potential impacts on soil resources and related infrastructure and riparian lands on and near the site and including soil erosion. • Where required provide a Groundwater Impact Assessment in accordance with relevant Groundwater Guidelines. If the proposed development is on land identified as having high salinity or acid sulfate soil potential in an EPI provide a Salinity Management Plan or Acid Sulfate Soil Management Plan that includes appropriate management measures and strategies.	Geotechnical Assessment If required: Groundwater Impact Assessment Salinity Management Plan Acid Sulfate Soils Management Plan

9.1 Assessment of potential impacts on soil resources and related infrastructure and riparian lands on and near the site and including soil erosion

Minimal earthworks are typically the case for residential development. We understand that a two-level basement is considered for the development.

From a geotechnical perspective, we do not consider the proposed development to have any impact on soil resource. However, the disposal of the excavated material in the case of basement excavation shall be managed according to NSW EPA guidelines.

No developments are proposed within the riparian area, hence there will be no impact to riparian lands.

Similarly, soil erosion shall be appropriately managed during construction through establishment of erosion control. We understand that the civil designer will design the stormwater system, surface gradients and landscaping requirements to control surface flows and minimise soil erosion and effects of soil erosion. Typical for residential development, vast majority of the soil would be sealed, and appropriate surface runoff collection and disposal system should be included.

9.2 Groundwater Impact Assessment, Soil Salinity and Acid Sulfate Soil Management

We understand the development will comprise up to two levels of basement approximately 6 m below the ground. Therefore, it is expected that the development will intersect the groundwater table which was measured at approximately 5 m to 6 m below ground. It is recommended that a fully tanked basement design is adopted in perpetuity.

Groundwater impact assessments commensurate with the development application stage should be undertaken. We have not undertaken such assessments at this stage.

The Site is not expected to be located within area with saline soil.

A qualified person(s) shall be engaged to address matters related to acid sulfate soil. This is not considered by PSM.

10. Closing

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

Should there be any queries, please do not hesitate to contact the undersigned.

Yours Sincerely

BRENDAN TA
GEOTECHNICAL ENGINEER

KELVIN LIM
ASSOCIATE GEOTECHNICAL ENGINEER

MOHAMMAD POURNAGHIAZAR
PRINCIPAL

Legend

- Pagewood Site Boundaries
- CPT locations
- BH locations
- Groundwater Monitoring Wells

Notes

1. Aerial photo from 'Nearmap' dated 05/06/2025.

N

Scale 1:1,500

0 10 20 30 40 50 m

Map Projection:
GDA2020 / MGA zone 56

P S M	Created By: PSM	Revision:
	Date: 23 Jul 2025	Paper Size: A3

JBS&G
Homes NSW
68-80 Banks Avenue, Pagewood NSW

LOCALITY PLAN
GEOTECHNICAL INVESTIGATION

PSM5745-009R | Figure 1

M:\PSM5745\Eng\QGIS\01_Projects\PSM5745.qgz Layout: PSM5745-009R - SI report Figure 1

Photo 1 - General Site Conditions Facing South-West near BH-A1

Photo 2 - General Site Conditions Facing North-West near CPT05

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Homes NSW

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SELECTED SITE PHOTOGRAPHS (1 OF 7)

PSM5745-009R	Figure 2

Photo 3 - Typical Setup of a Geoprobe 7720R Track-Mounted Drill Rig

Photo 4 - JK Cone Penetration Testing Rig

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Homes NSW

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SELECTED SITE PHOTOGRAPHS (2 OF 7)

PSM5745-009R	Figure 3

Photo 5 - Soil Profile in BH-PZ1

Photo 6 - Soil Profile in BH-PZ2

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SELECTED SITE PHOTOGRAPHS (3 OF 7)

PSM5745-009R	Figure 4

Photo 7 - Soil profile in BH-PZ3

Photo 8 - Soil Profile in BH-A1

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Homes NSW

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SELECTED SITE PHOTOGRAPHS (4 OF 7)

PSM5745-009R	Figure 5

Photo 9 - Soil Profile in BH-A2

Photo 10 - Top Soil from BH-A1

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Homes NSW

68-80 Banks Avenue, Pagewood NSW

SELECTED SITE PHOTOGRAPHS (5 OF 7)

PSM5745-009R	Figure 6

Photo 11 - Soil Profile up to 1.5m in BH-PZ1

Photo 12 - Typical medium to coarse grained SAND (NATURAL SOIL)

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Homes NSW

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SELECTED SITE PHOTOGRAPHS (6 OF 7)

PSM5745-009R	Figure 7

Photo 13 - NATURAL SOIL sampling from BH-PZ2

Photo 14 - Groundwater monitoring well (BH-PZ3)

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Homes NSW

68-80 Banks Avenue, Pagewood NSW

SELECTED SITE PHOTOGRAPHS (7 OF 7)

PSM5745-009R	Figure 8

Brisbane

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Geelong

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Perth

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West Perth WA 6005
+61 8 9462 8400

Appendix A
Borehole Logs

Borehole ID

BH-A1

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	18/06/2025
Project Name:	Proposed Residential Development	Completed:	18/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335908.2 m E 6243290.3 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting:	Geoprobe 7822DT	Inclination:	-90°	RL Surface:	20.70 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/T		N	Not Observed			19.7	1			TOPSOIL; Silty SAND: fine to medium grained, grey-brown, subangular to subrounded; silt low to medium plasticity; observed some vegetation and rootlets.	M	VL		0.00: TOPSOIL Consistency and relative density inferred from nearest CPT
										SAND: medium to coarse grained, grey-brown, subangular to subrounded.				0.30: Inferred NATURAL
										Becomes pale grey.				
						18.7	2			Becomes grey-brown to pale yellow.				
											M	L to MD		
						17.7	3							3.00: Material inferred from drill cuttings at the surface during continuous auger from this depth onwards
						16.7	4							

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

Penetration
No resistance through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	18/06/2025
Project Name:	Proposed Residential Development	Completed:	18/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335908.2 m E 6243290.3 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting: Geoprobe 7822DT | Inclination: -90° | RL Surface: 20.7 m
Hole Diameter: 100 mm | Bearing: | Datum: AHD | Operator: Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/T		N	Not Observed			14.7	6			SAND: medium to coarse grained, grey-brown, subangular to subrounded. *(continued)*	M	L to MD		6.50: Becomes more damp. Encountered drop in penetration resistance.
						13.7	7			Becomes dark grey.				
						12.7	8			Hole Terminated at 8.00 m Target depth				
						11.7	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

Penetration
No resistance through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

Borehole ID

BH-A2

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	13/06/2025
Project Name:	Proposed Residential Development	Completed:	13/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335960.4 m E 6243395.8 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting:	Geoprobe 7822DT	Inclination:	-90°	RL Surface:	21.20 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Not Observed			20.2	0			TOPSOIL; Silty SAND: fine to medium grained, grey-brown, subangular to subrounded; silt low to medium plasticity; observed vegetation and rootlets.	M	VL		0.00: TOPSOIL Consistency and relative density inferred from nearest CPT
										SAND: medium to coarse grained, grey-brown, subangular to subrounded.				0.50: Inferred NATURAL
						19.2	1			Becomes pale grey.	M	L to MD		
						18.2	2			Becomes grey-brown-yellow.				3.00: Material inferred from drill cuttings at the surface during continuous auger from this depth onwards
						17.2	3			Becomes pale yellow.				
							4							

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

Penetration
No resistance through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	13/06/2025
Project Name:	Proposed Residential Development	Completed:	13/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335960.4 m E 6243395.8 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting:	Geoprobe 7822DT	Inclination:	-90°	RL Surface:	21.20 m		
Hole Diameter:	100 mm	Bearing:		Datum:	AHD	Operator:	Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Not Observed			15.2	6			SAND: medium to coarse grained, grey-brown, subangular to subrounded. *(continued)*	M	L to MD		6.00: Becomes more damp. Encountered drop in penetration resistance.
						14.2	7			Becomes grey.				
						13.2	8			Hole Terminated at 8.00 m Target depth				
						12.2	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

Penetration
No resistance through to 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
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M - Moist
W - Wet

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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

Borehole ID

BH-PZ1

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	13/06/2025
Project Name:	Proposed Residential Development	Completed:	13/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335977.0 m E 6243479.9 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting:	Geoprobe 7822DT	Inclination:	-90°	RL Surface:	21.80 m		
Hole Diameter:	150 mm	Bearing:		Datum:	AHD	Operator:	Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa)	Structure, Zoning, Origin, Additional Observations
AD/V		N	Not Observed	CBR 0.20 m		20.8	1			TOPSOIL; Silty SAND: fine to medium grained, grey-brown, subangular to subrounded; silt low to medium plasticity; observed vegetation and rootlets.	M	VL		0.00: TOPSOIL Consistency and relative density inferred from nearest CPT 0.20: Existing FILL
										SAND with Gravel: fine to medium grained, yellow-brown, subangular to subrounded; gravel coarse grained, subrounded to rounded, up to 80mm.				0.50: Inferred NATURAL
										SAND: medium to coarse grained, grey-brown, subangular to subrounded.				
						19.8	2			Becomes pale grey.				
										Becomes grey-brown-orange.	M	L to MD		
						18.8	3			Becomes yellow-brown.				3.00: Material inferred from drill cuttings at the surface during continuous auger from this depth onwards
						17.8	4			Becomes pale yellow.				

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

Penetration
No resistance through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	13/06/2025
Project Name:	Proposed Residential Development	Completed:	13/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335977.0 m E 6243479.9 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting:	Geoprobe 7822DT	Inclination:	-90°	RL Surface:	21.80 m		
Hole Diameter:	150 mm	Bearing:		Datum:	AHD	Operator:	Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Not Observed	D 6.00 m		15.8	6			SAND: medium to coarse grained, grey-brown, subangular to subrounded. *(continued)*				6.00: Becomes more damp. Encountered drop in penetration resistance.
						14.8	7			Becomes grey.	M	L to MD		
						13.8	8			Becomes dark grey.				
						12.8	9			Hole Terminated at 10.00 m Target depth				

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

Penetration
No resistance through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

Borehole ID

BH-PZ2

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	13/06/2025
Project Name:	Proposed Residential Development	Completed:	13/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335919.4 m E 6243348.9 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting:	Geoprobe 7822DT	Inclination:	-90°	RL Surface:	21.00 m		
Hole Diameter:	150 mm	Bearing:		Datum:	AHD	Operator:	Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Not Observed	CBR 1.00 m		20.0	1			TOPSOIL; Silty SAND: fine to medium grained, grey-brown, subangular to subrounded; silt low to medium plasticity; observed vegetation and rootlets.	M	VL		0.00: TOPSOIL Consistency and relative density inferred from nearest CPT
										SAND: medium to coarse grained, grey-brown, subangular to subrounded.				0.30: Inferred NATURAL
										Becomes pale grey.				
						19.0	2							
										Becomes dark brown.	M	L to MD		
				D 3.00 m		18.0	3							3.00: Material inferred from drill cuttings at the surface during continuous auger from this depth onwards
						17.0	4			Becomes pale yellow.				

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

Penetration
No resistance through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	13/06/2025
Project Name:	Proposed Residential Development	Completed:	13/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335919.4 m E 6243348.9 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting:	Geoprobe 7822DT	Inclination:	-90°	RL Surface:	21.00 m		
Hole Diameter:	150 mm	Bearing:		Datum:	AHD	Operator:	Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Not Observed			15.0	6			SAND: medium to coarse grained, grey-brown, subangular to subrounded. *(continued)*				6.00: Becomes more damp. Encountered drop in penetration resistance.
						14.0	7				M	L to MD		
						13.0	8			Becomes grey.				
						12.0	9			Becomes dark grey.				
										Hole Terminated at 10.00 m Target depth				9.80: Observed saturated material

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

Penetration
No resistance through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

Borehole ID

BH-PZ3

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	18/06/2025
Project Name:	Proposed Residential Development	Completed:	18/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335922.5 m E 6243236.6 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting:	Geoprobe 7822DT	Inclination:	-90°	RL Surface:	20.40 m		
Hole Diameter:	150 mm	Bearing:		Datum:	AHD	Operator:	Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Not Observed			19.4	1			TOPSOIL; Silty SAND: fine to medium grained, grey-brown, subangular to subrounded; silt low to medium plasticity; observed vegetation and rootlets.	M	VL		0.00: TOPSOIL Consistency and relative density inferred from nearest CPT 0.20: Inferred NATURAL
										SAND: medium to coarse grained, grey, subangular to subrounded.				
										Becomes grey-brown to pale yellow.				
						18.4	2							
										Becomes pale grey.	M	L to MD		
						17.4	3							3.00: Material inferred from drill cuttings at the surface during continuous auger from this depth onwards
										Becomes grey-brown to yellow.				
						16.4	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

Penetration
No resistance through to 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

See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

Engineering Log - Non Cored Borehole

Project No.: PSM5745

Client:	JBS&G	Commenced:	18/06/2025
Project Name:	Proposed Residential Development	Completed:	18/06/2025
Hole Location:	Pagewood	Logged By:	BTA
Hole Position:	335922.5 m E 6243236.6 m N MGA2020 Zone 56	Checked By:	KL

Drill Model and Mounting:	Geoprobe 7822DT	Inclination:	-90°	RL Surface:	20.40 m		
Hole Diameter:	150 mm	Bearing:		Datum:	AHD	Operator:	Legion 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: Colour, structure, plasticity, additional	Moisture Condition	Consistency / Relative Density	Hand Penetrometer UCS (kPa) 100 200 300 400 500	Structure, Zoning, Origin, Additional Observations
AD/V		N	Not Observed			14.4	6			SAND: medium to coarse grained, grey, subangular to subrounded. *(continued)*	M	L to MD		6.50: Becomes more damp. Encountered drop in penetration resistance.
						13.4	7							
						12.4	8							
						11.4	9			Becomes grey.				
										Hole Terminated at 10.00 m Target depth				

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

Penetration
No resistance through to refusal

Water
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
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Moisture Condition
D - Dry
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Consistency/Relative Density
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See Explanatory Notes for details of abbreviations and basis of descriptions.

Soil and rock descriptions in accordance with AS 1726:2017

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.

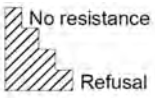
Drilling Information

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

Appendix B
Piezometer Construction Records and Results

Appendix B.1
Piezometer construction record

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no: **PSM5745**

PROJECT: **Homes NSW**
68-80 Banks Avenue, Pagewood

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER: BH-PZ1
PIEZOMETER: BH-PZ1
COLLAR EASTING: 335977
COLLAR NORTHING: 6243480
COLLAR RL(m): 21.80
DATUM: AHD GDA2020/MGA56

DRILLING CONTRACTOR: Legion Drilling
RIG: Geoprobe 7720R
DEPTH OF HOLE (m): 10
BOREHOLE INCLINATION: -90
PIEZO INSTALLATION DATE: 13/06/2025
SUPERVISED BY: BTA

Tick boxes

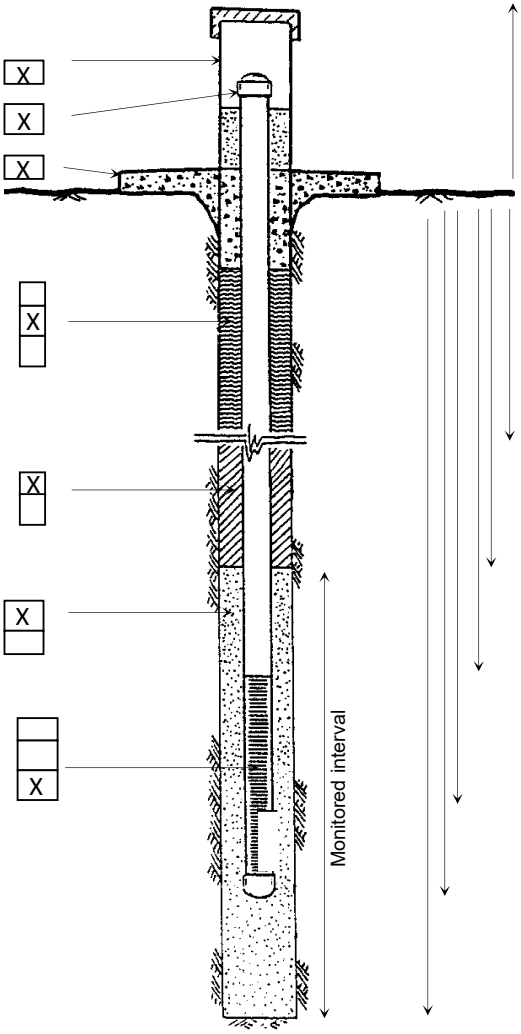
Steel protective well cover [X]
PVC cap [X]
Concrete colar [X]

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

Seal:
Bentonite pellets [X]
Other [ ]

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

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



Complete dimensions if appropriate

Height of stickup (m)	0
Diameter of PVC (mm)	50
Depth to top of seal (m)	2.7
Depth to top of gravel pack (m)	3.7
Depth to top of screen (m)	4.2
Depth to base of screen (m)	8.7
Depth to base of piezo (m)	8.7
Depth to base of gravel (m)	10

COMMENTS:
Sandy material was encountered within the standpipe at 5.5m bgl.
HOBO placed within the standpipe at approximately 5.0 m bgl for long term groundwater monitoring.

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no: **PSM5745**

PROJECT: **Homes NSW**
60-80 Banks Avenue, Pagewood

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER: BH-PZ2
PIEZOMETER: BH-PZ2
COLLAR EASTING: 335919
COLLAR NORTHING: 6243349
COLLAR RL(m): 21.00
DATUM: AHD GDA2020/MGA56

DRILLING CONTRACTOR: Legion Drilling
RIG: Geoprobe 7720R
DEPTH OF HOLE (m): 10
BOREHOLE INCLINATION: -90
PIEZO INSTALLATION DATE: 13/06/2025
SUPERVISED BY: BTA

Tick boxes

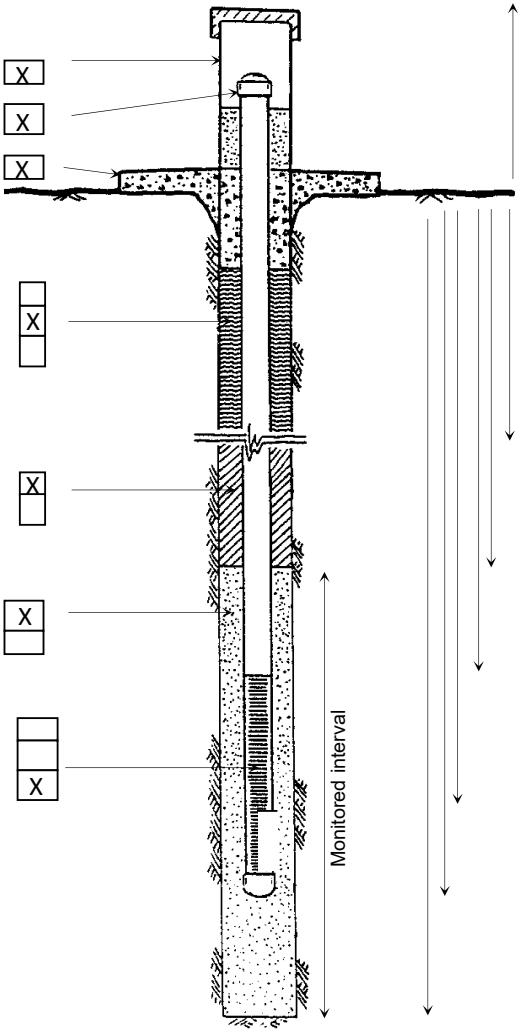
Steel protective well cover [X]
PVC cap [X]
Concrete colar [X]

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

Seal:
Bentonite pellets [X]
Other [ ]

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

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



Complete dimensions if appropriate

Height of stickup (m)	0
Diameter of PVC (mm)	50
Depth to top of seal (m)	2.6
Depth to top of gravel pack (m)	4.2
Depth to top of screen (m)	5.5
Depth to base of screen (m)	10
Depth to base of piezo (m)	10
Depth to base of gravel (m)	10

COMMENTS:
HOBO placed within the standpipe at approximately 9.70 m bgl for long term groundwater monitoring.

Pells Sullivan Meynink
Engineering Consultants
Rock - Soil - Water

JOB no: **PSM5745**

PROJECT: **Homes NSW**
68-80 Banks Avenue, Pagewood

PIEZOMETER CONSTRUCTION RECORD

HOLE NUMBER: BH-PZ3
PIEZOMETER: BH-PZ3
COLLAR EASTING: 335923
COLLAR NORTHING: 6243237
COLLAR RL(m): 20.40
DATUM: AHD GDA2020/MGA56

DRILLING CONTRACTOR: Legion Drilling
RIG: Geoprobe 7720R
DEPTH OF HOLE (m): 10
BOREHOLE INCLINATION: -90
PIEZO INSTALLATION DATE: 18/06/2025
SUPERVISED BY: BTA/VNK

Tick boxes

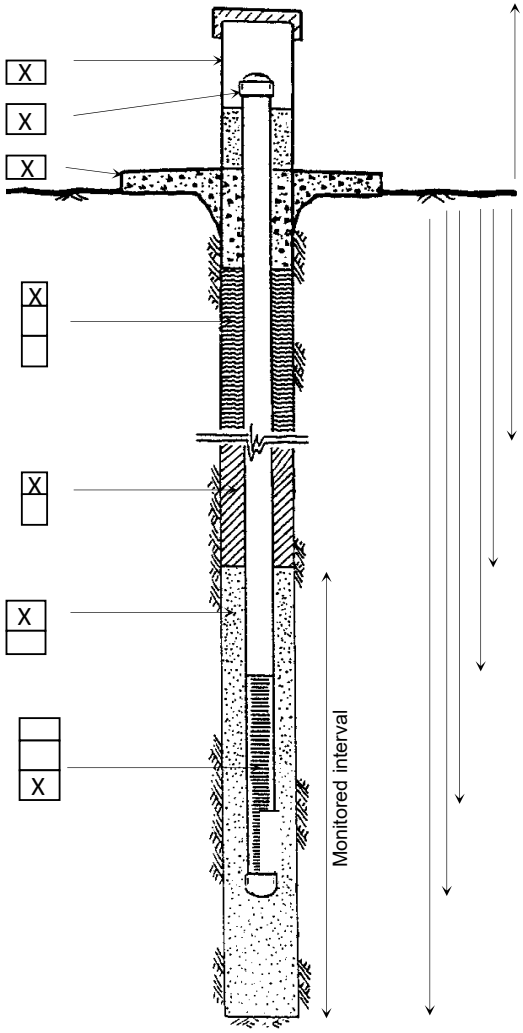
Steel protective well cover [X]
PVC cap [X]
Concrete colar [X]

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

Seal:
Bentonite pellets [X]
Other [ ]

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

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

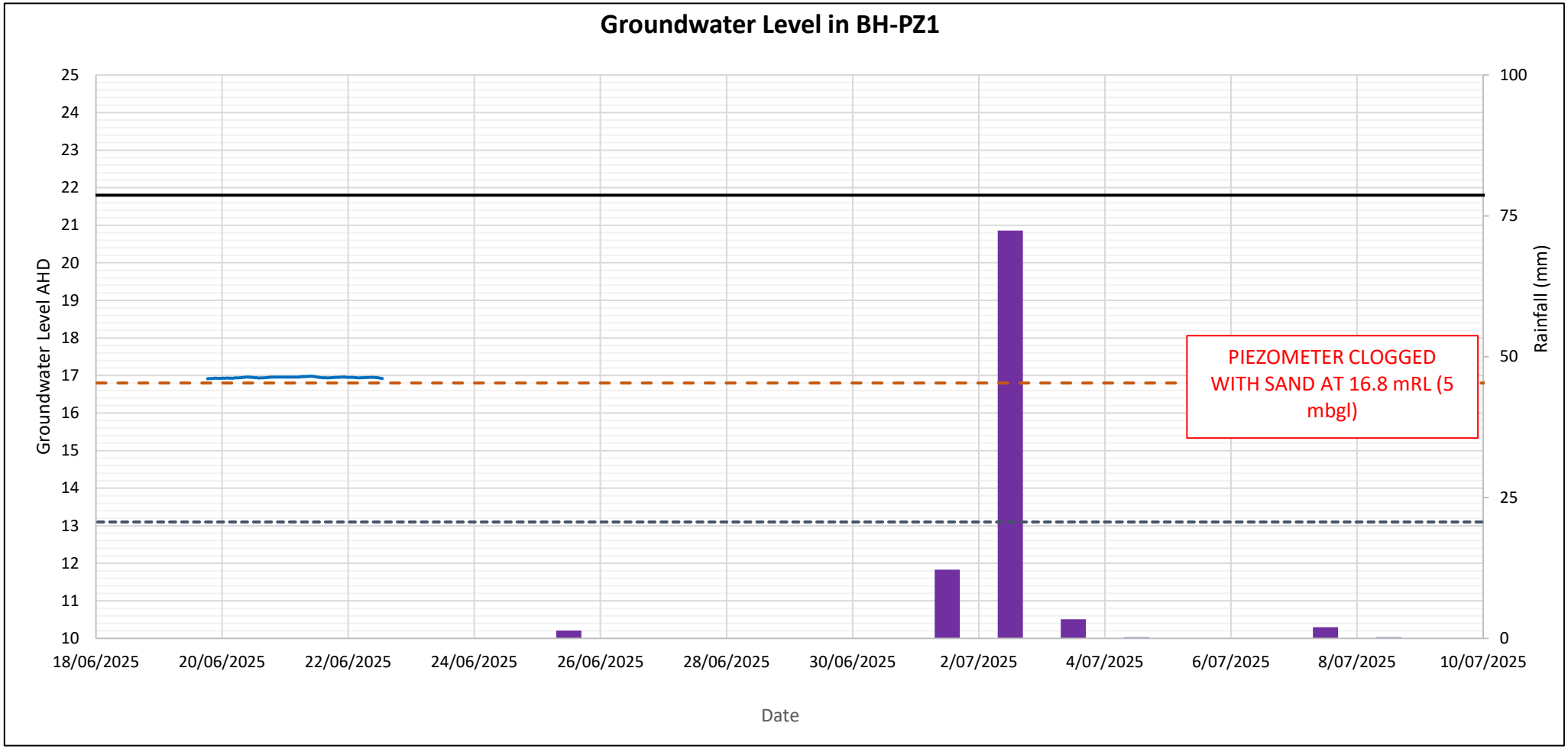


Complete dimensions if appropriate

Height of stickup (m)	0
Diameter of PVC (mm)	50
Depth to top of seal (m)	3
Depth to top of gravel pack (m)	4
Depth to top of screen (m)	5.5
Depth to base of screen (m)	10
Depth to base of piezo (m)	10
Depth to base of gravel (m)	10

COMMENTS:
HOBO placed within the standpipe at approximately 9.15 m bgl for long term groundwater monitoring

Appendix B.2
Groundwater Levels



Notes:

1. Ground Surface Elevation (m AHD) 21.8
2. Instrument Elevation (m AHD) 16.8
3. Data Logger Instrument Installed on 19/06/2025
4. Bottom of Seal (m AHD) 18.1
5. Bottom of Screen (m AHD) 13.1
6. Rainfall data from BOM station 066037 , downloaded 15/07/2025

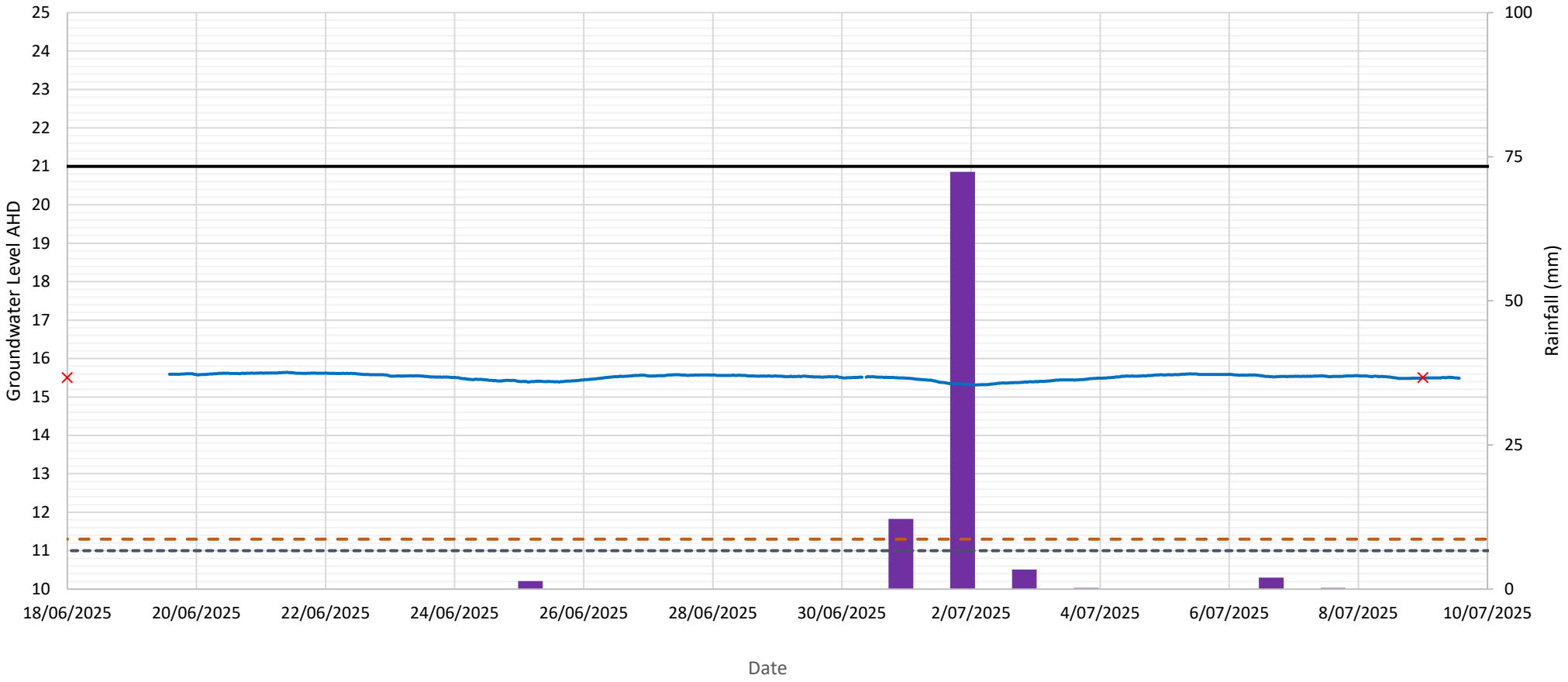
Rainfall
GW Level
Ground Surface
Instrument Level
Bottom of Screen
Manual Water Reading

JBS&G
Homes NSW
68-80 Banks Avenue Pagewood
BH-PZ1

Groundwater Levels

PSM5745-009R	Appendix B.2

Groundwater Level in BH-PZ2



Notes:

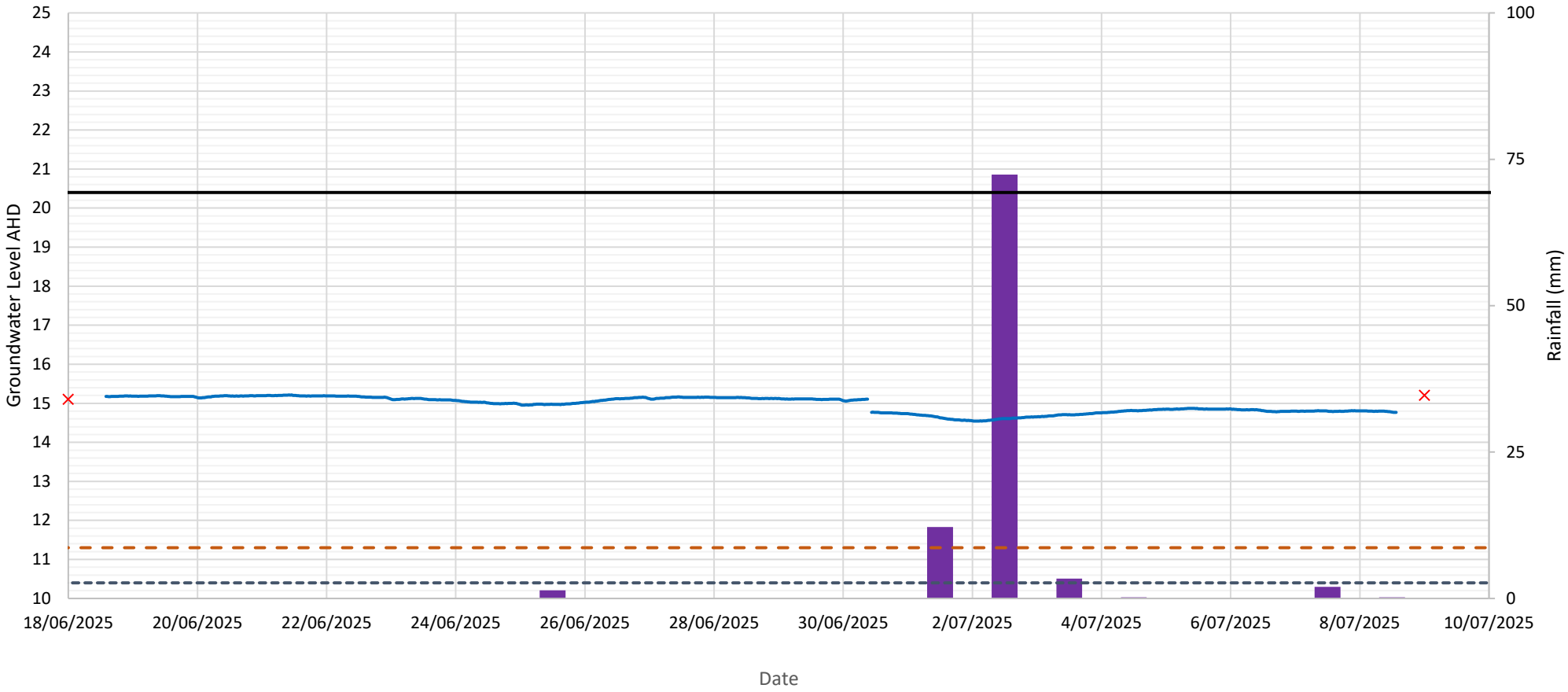
1. Ground Surface Elevation (m AHD) 21
2. Instrument Elevation (m AHD) 11.3
3. Data Logger Instrument Installed on 19/06/2025
4. Bottom of Seal (m AHD) 16.8
5. Bottom of Screen (m AHD) 11
6. Rainfall data from BOM station 066037 , downloaded 15/07/2025

Rainfall
GW Level
Ground Surface
Instrument Level
Bottom of Screen
Manual Water Reading

JBS&G
Homes NSW
68-80 Banks Avenue, Pagewood
BH-PZ2
Groundwater Levels

PSM5745-009R | Appendix B.2

Groundwater Level in BH-PZ3



Notes:

1. Ground Surface Elevation (m AHD) 20.4
2. Instrument Elevation (m AHD) 11.3
3. Data Logger Instrument Installed on 18/06/2025
4. Bottom of Seal (m AHD) 16.4
5. Bottom of Screen (m AHD) 10.4
6. Rainfall data from BOM station 066037 , downloaded 15/07/2025

Rainfall
GW Level
Ground Surface
Instrument Level
Bottom of Screen
Manual Water Reading

JBS&G
Homes NSW
68-80 Banks Avenue, Pagewood
BH-PZ3
Groundwater Levels

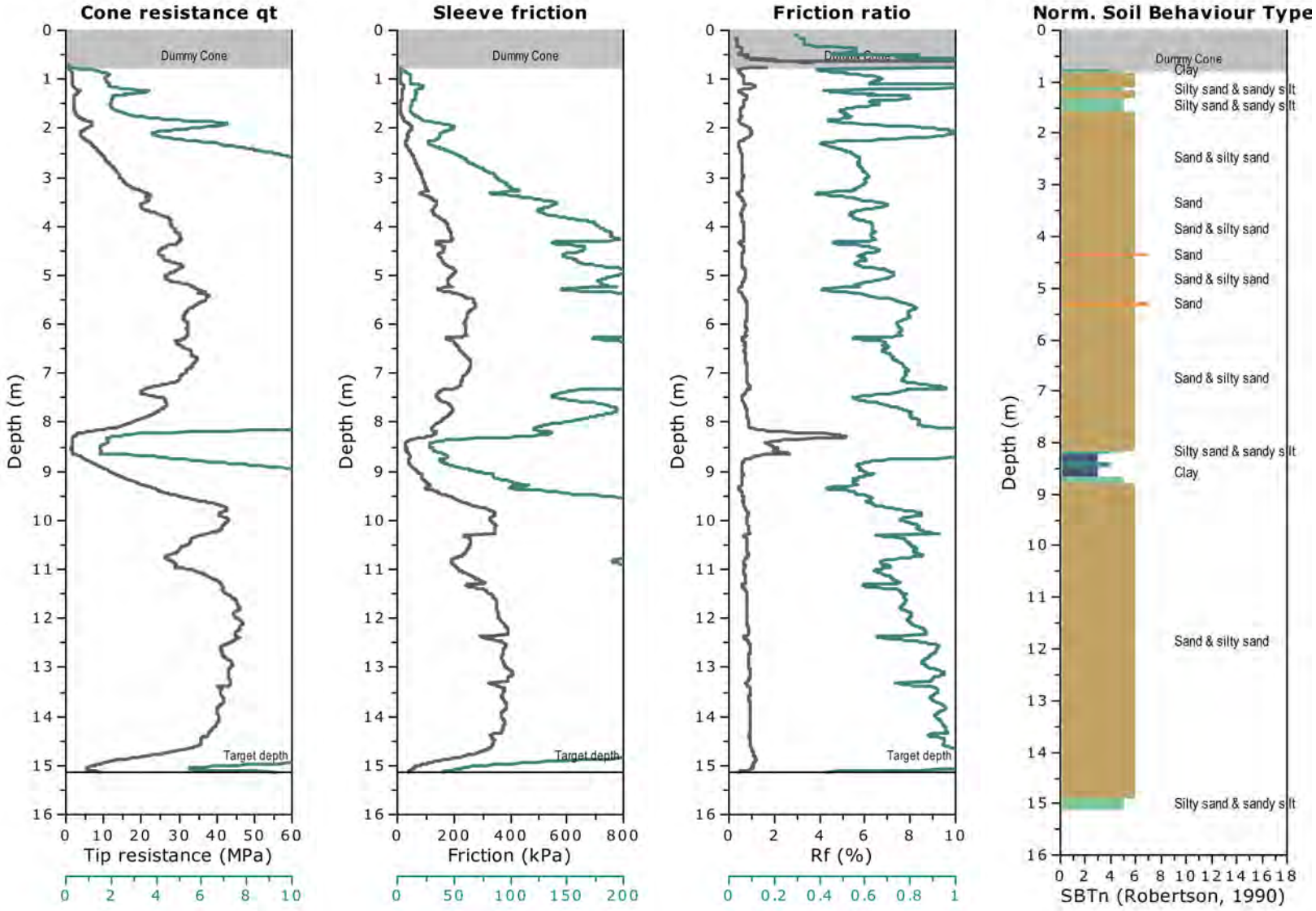
PSM5745-009R | Appendix B.2

Appendix C
Cone Penetrometer Test Results

PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

Project: Homes NSW
Location: 68-80 Banks Avenue, Pagewood NSW

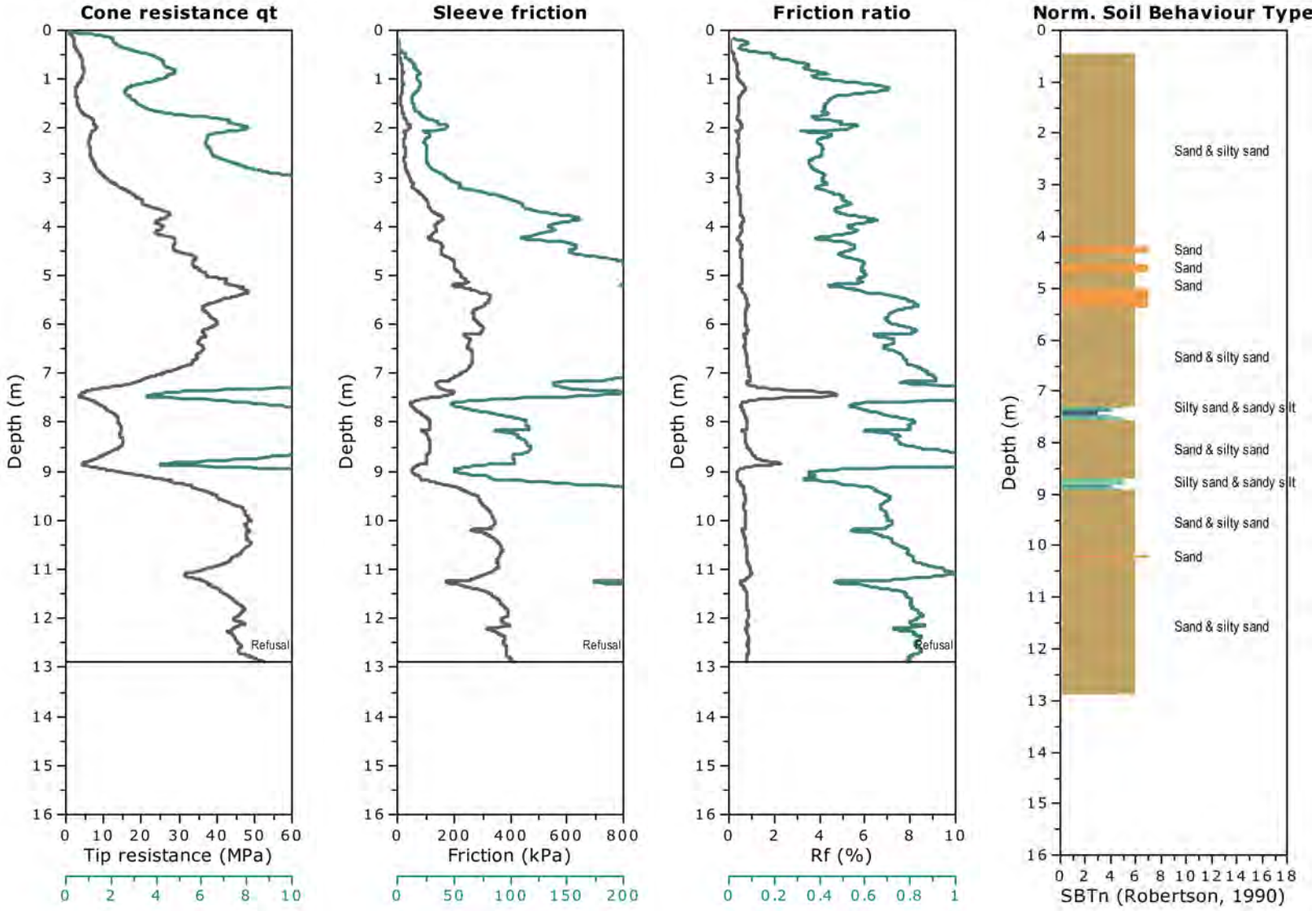
CPT: CPT01
Total depth: 15.13 m, Date: 19/06/2025
Surface Elevation: 20.60 m
Coords: X:335901.05, Y:6243256.47
Cone Type: CPTu
Cone Operator: JK Drilling



PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

Project: Homes NSW
Location: 68-80 Banks Avenue, Pagewood NSW

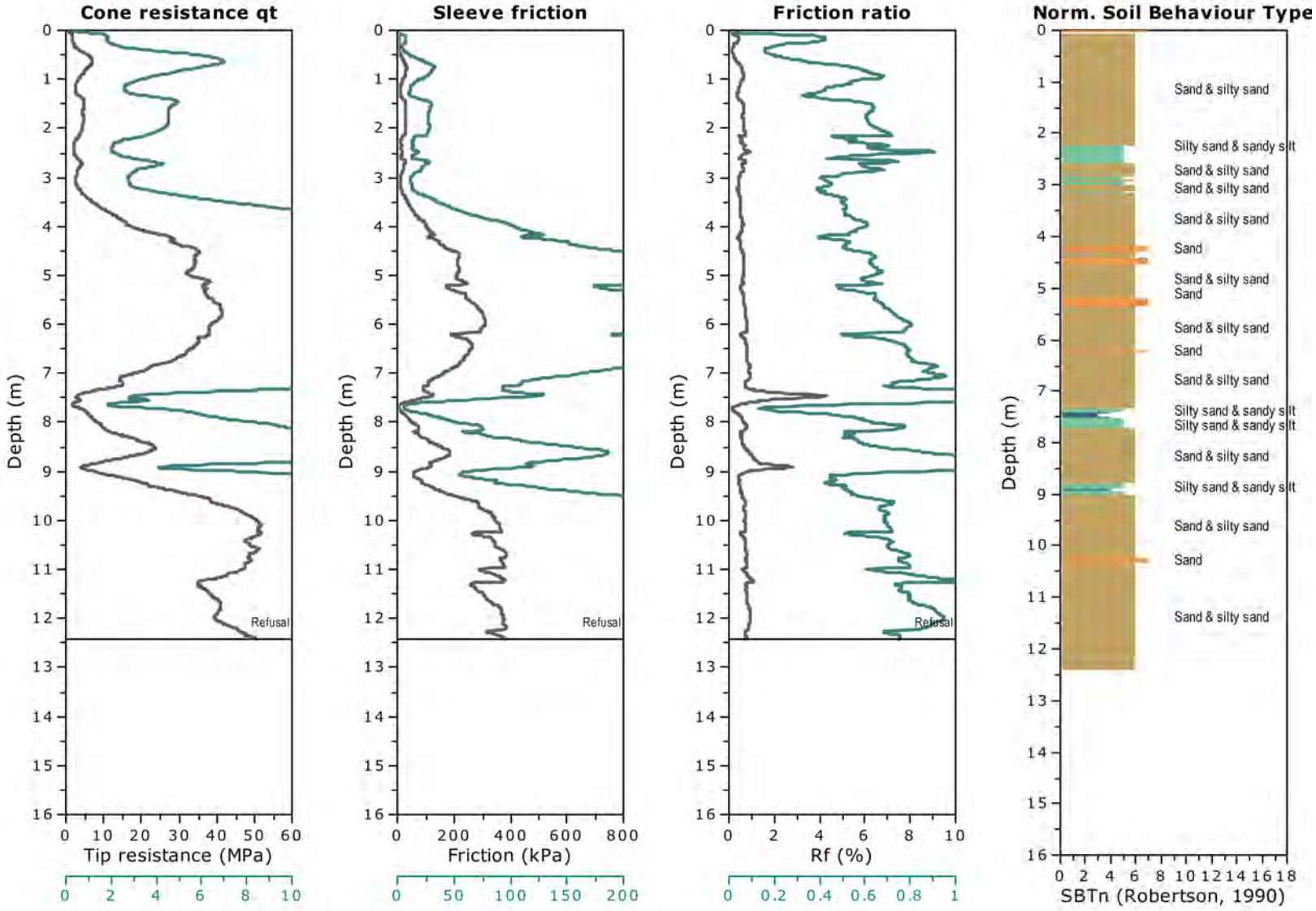
CPT: CPT02
Total depth: 12.88 m, Date: 19/06/2025
Surface Elevation: 20.80 m
Coords: X:335940.86, Y:6243323.49
Cone Type: CPTu
Cone Operator: JK Drilling



PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

Project: Homes NSW
Location: 68-80 Banks Avenue, Pagewood NSW

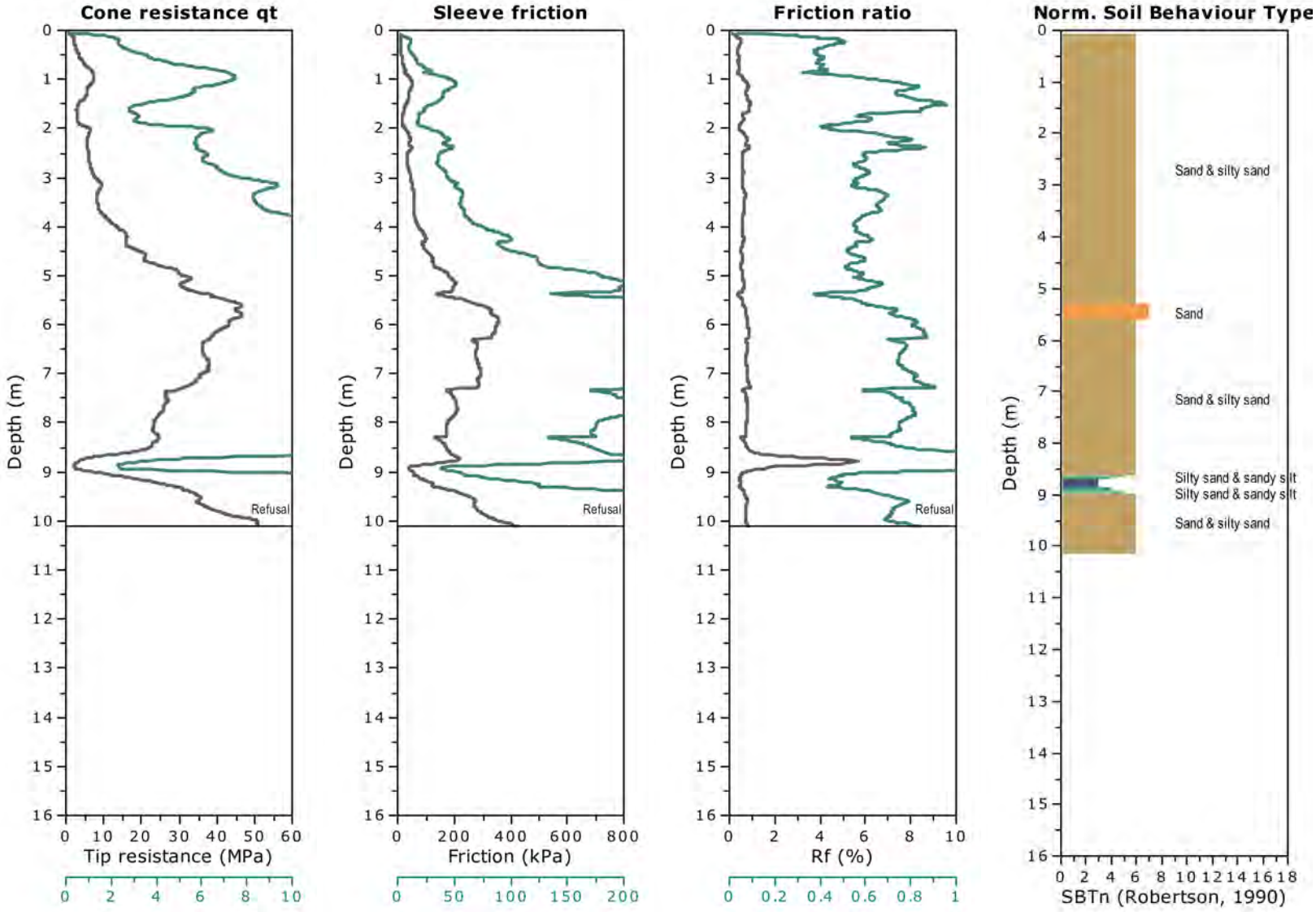
CPT: CPT03
Total depth: 12.42 m, Date: 19/06/2025
Surface Elevation: 21.00 m
Coords: X:335918.63, Y:6243340.69
Cone Type: CPTu
Cone Operator: JK Drilling



PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

Project: Homes NSW
Location: 68-80 Banks Avenue, Pagewood NSW

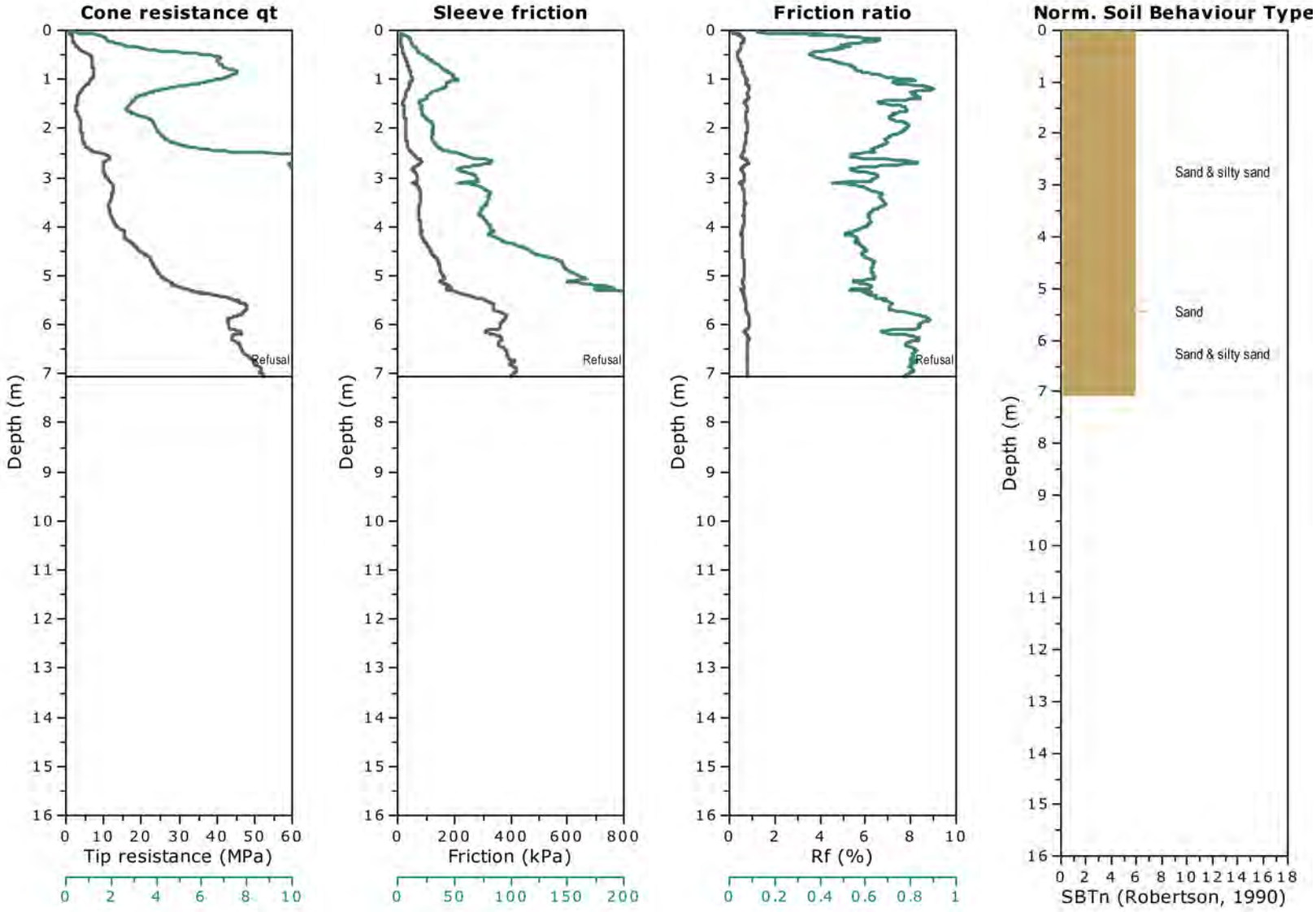
CPT: CPT04
Total depth: 10.11 m, Date: 19/06/2025
Surface Elevation: 21.20 m
Coords: X:335934.45, Y:6243411.84
Cone Type: CPTu
Cone Operator: JK Drilling



PSM
Engineering Consultants | Rock Soil Water
G3 56 Delhi Road, North Ryde NSW 2133 Australia
www.psm.com.au

Project: Homes NSW
Location: 68-80 Banks Avenue, Pagewood NSW

CPT: CPT05
Total depth: 7.06 m, Date: 19/06/2025
Surface Elevation: 21.70 m
Coords: X:335967.37, Y:6243480.57
Cone Type: CPTu
Cone Operator: JK Drilling



Appendix D
Laboratory Test Results

Appendix D.1
California Bearing Ratio Test Results

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: PSM Holdings Aust. Pty Limited
PSM Job No.: PSM5745
Location: 68 Banks Avenue, Pagewood, NSW

Report No.: L5127 - 1
Report Date: 8/07/2025
Page 1 of 1

SAMPLE NUMBER	BH-PZ1	BH-PZ2
DEPTH (m)	0.20 - 0.50	1.00 - 1.50
Surcharge (kg)	4.5	4.5
Maximum Dry Density (t/m^3)	1.81 STD	1.63 STD
Optimum Moisture Content (%)	14.7	10.4
Moulded Dry Density (t/m^3)	1.77	1.59
Sample Density Ratio (%)	98	98
Sample Moisture Ratio (%)	99	103
Moisture Contents		
Insitu (%)	8.7	5.4
Moulded (%)	14.5	10.7
After soaking and		
After Test, Top 30mm(%)	19.3	21.4
Remaining Depth (%)	18.9	19.6
Material Retained on 19mm Sieve (%)	3*	0
Swell (%)	0.0	0.0
C.B.R. value:		
@5.0mm penetration	7	2.5

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: 27/06/2025.
- * Denotes not used in test sample.
- CBRb had insufficient material supplied to complete a 4-point compaction curve.

NATA Accredited Laboratory Number:1327

08/07/2025
Authorised Signature / Date
(D. Treweek)

Appendix D.2
Salinity and Aggressivity Test Results

CERTIFICATE OF ANALYSIS

Work Order	: **ES2519711**	Page	: 1 of 4
Client	: **PSM Holdings Aust Pty Limited**	Laboratory	: Environmental Division Sydney
Contact	: Kelvin Lim	Contact	: Customer Services ES
Address	: G3, 56 Delhi Road North Ryde 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: PSM5745	Date Samples Received	: 27-Jun-2025 08:30
Order number	: PSM5745	Date Analysis Commenced	: 02-Jul-2025
C-O-C number	: ----	Issue Date	: 04-Jul-2025 18:05
Sampler	: BRENDAN TA		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 9		
No. of samples analysed	: 9		

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
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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.

- ED041G: LOR raised for Chloride due to sample matrix.
- 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+).
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Relevant test for the Site (Pagewood)

Tests from other Site

Analytical Results

Sub-Matrix: SOIL
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Sample ID	PZa @ 6.0m	PZb @ 3.0m	PZc @ 1.0m	PZd @ 3.0m	PZd @ 4.0m
				Sampling date / time	13-Jun-2025 00:00	13-Jun-2025 00:00	18-Jun-2025 00:00	20-Jun-2025 00:00	20-Jun-2025 00:00
					ES2519711-001	ES2519711-002	ES2519711-003	ES2519711-004	ES2519711-005
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		6.0	5.7	6.2	7.4	7.2
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		12	11	8	28	16
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		6.1	4.6	2.6	3.2	5.6
EA080: Resistivity									
Resistivity at 25°C	----	1	ohm cm		83300	90900	125000	35700	62500
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		<0.1	0.7	0.2	1.7	0.3
Exchangeable Magnesium	----	0.1	meq/100g		<0.1	0.2	<0.1	<0.1	<0.1
Exchangeable Potassium	----	0.1	meq/100g		<0.1	<0.1	<0.1	<0.1	<0.1
Exchangeable Sodium	----	0.1	meq/100g		<0.1	<0.1	<0.1	<0.1	<0.1
Cation Exchange Capacity	----	0.1	meq/100g		<0.1	0.8	0.2	1.9	0.3
Exchangeable Sodium Percent	----	0.1	%		<0.1	<0.1	5.1	1.6	4.5
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		<10	<10	<10	10	<10
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		<10	<10	<10	<10	<10

Tests from other Site

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	PZe @ 1.0m	PZg @ 2.0m	PZh @ 1.0m	PZi @ 3.0m	----
			Sampling date / time	20-Jun-2025 00:00	24-Jun-2025 00:00	24-Jun-2025 00:00	24-Jun-2025 00:00	----
Compound	CAS Number	LOR	Unit	ES2519711-006	ES2519711-007	ES2519711-008	ES2519711-009	--------
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.4	7.0	6.4	7.1	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	35	16	27	32	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	3.0	7.4	5.2	5.5	----
EA080: Resistivity								
Resistivity at 25°C	----	1	ohm cm	28600	62500	37000	31200	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	1.7	1.5	0.9	1.7	----
Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.1	<0.1	0.2	----
Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	----
Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	<0.1	<0.1	----
Cation Exchange Capacity	----	0.1	meq/100g	1.7	1.7	1.1	2.1	----
Exchangeable Sodium Percent	----	0.1	%	<0.1	0.8	4.0	2.0	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	<10	<10	10	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	<50	<50	<50	----