
**Specialist Advice
Report on Geotechnical Investigation**

**Proposed Residential Development with
Affordable Housing**

**16-20 Old Castle Hill Road, Castle Hill,
Sydney NSW**

Prepared for UPG Castle Corner Ptd Ltd

Project 235039.00

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature

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Specialist Advice Report on Geotechnical Investigation Proposed Residential Development with Affordable Housing 16-20 Old Castle Hill Road, Castle Hill, Sydney NSW

1. Introduction

This specialist advice report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a geotechnical investigation undertaken for a proposed residential development with affordable housing at 16-20 Old Castle Hill Road, Castle Hill, Sydney NSW (the site). The investigation was commissioned by an email dated 4 August 2025 from Charbel Youseff of UPG Castle Corner Ptd Ltd (Urban) and was undertaken in accordance with Douglas' proposal 235039.00.P.002.Rev2 dated 24 July 2025.

The aim of the investigation was to assess the subsurface conditions across the site to support the State Significant Development Application (SSDA) for the site and assist the planning and design of the proposed development.

Based on the architectural drawings (Reference No. 20240027, dated 3 December 2025) prepared by Studio.SC Pty Ltd, it is understood that the proposed development will include the following:

- Demolition of existing structures on site; and
- Construction of new residential apartment building comprising:
 - approximately 330 apartments over 40 storeys (including 15% affordable housing);
 - Six basement levels with the lowest level having a stepped finished floor level (FFL) of RL 112 mAHD and RL 111 mAHD;
 - Residential lobbies;
 - Communal open space;
 - Car and motorcycle parking for residents;
 - Associated landscaping and public domain works.

The investigation included the drilling of four boreholes, in-situ testing and sampling, installation of three groundwater monitoring wells, and laboratory testing of selected samples. The details of Douglas' field work are presented in this report, together with comments and recommendations relevant to the proposed development.

This report must be read in conjunction with all appendices including the notes provided in Appendix A.

2. Site description

The site comprises 16–20 Old Castle Hill Road, Castle Hill, and is located on a northwest facing hillside. Occupying approximately 3,210 m² the site is irregular in shape and slopes generally westward. The site is bounded by Garthowen Crescent to the north, Old Castle Hill Road to the northwest, and McMullen Avenue to the southwest.

At the time of our investigation the site contained:

- No. 16 - predominantly vegetated with medium to large trees.
- No. 18 - a single-storey rendered dwelling and a fibro shed to the south.
- No. 20 - a two-storey brick dwelling with a rear pool (east).
- Small to medium sized trees and vegetation was consistent across the site.

Adjoining Properties include:

- 8 McMullen Avenue – Located to the southeast containing a one to two-storey commercial building with ground level parking, offset about 5 m from the site boundary. A crib retaining wall (about 11 m long) sits about 0.5 m within the neighbouring property, reducing in height from about 2.2 m (north) to about 1.6 m (south). To the south of the crib wall, a batter slope extends further to the south along the common boundary generally sloping at about 30°; and
- 3 Garthowen Avenue – Located to the northeast containing a two-storey brick residence, offset about 3 m from the boundary. Surface levels appear to be similar across the boundary.

3. Published data

3.1 Geology

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site is underlain by Ashfield Shale, which overlies the Mittagong Formation and then the Hawkesbury Sandstone Formation of the Wianamatta Group as shown in Figure 1.

Ashfield Shale typically comprises black to dark grey shale and laminite with overlying soils typically comprising moderately to highly reactive silty clay and clay.

The Mittagong Formation typically forms a transitional geological sequence between the Ashfield Shale and Hawkesbury Sandstone. The Mittagong Formation is a relatively thin formation of variable thickness, typically less than about 6 m thick. It comprises interbedded shale, laminite and fine-grained quartz sandstone.

Hawkesbury Sandstone characteristics are medium to coarse grained quartz sandstone with minor shale and laminite lenses.

The geological map also indicates the presence of a line feature known as the ‘Dural Dome’ on a southwest to northeast alignment and located approximately 80 m to the southeast of the site. It is reported that a fault associated with the Dural Dome was encountered during excavation of the Castle Hill Metro station box located about 250 m to the southwest of the site. The fault was encountered as a steeply inclined fault plane (approximately 42° below horizontal) that obliquely intersected the eastern end of the southern excavation face daylighting near the base of the excavation. The fault resulted in a rock wedge measuring about 20 m high and 80 m long and indicates the potential for similar faults.

Figure 1 shows the approximate location of the site within the geology including the nearby Dural Dome and Castle Hill Metro Station.



Figure 1: NSW Seamless Geology map with approximate site location

3.2 Soil landscape

Reference to the 1:100 000 Soil Landscapes of Sydney Sheet indicates that the natural soils on the site belong to the Glenorie soil landscape (see Figure 2).

The Glenorie soil landscape (mapping unit ‘gn’) is characterised by topography of undulating to rolling low hills on Wianamatta Group shales, with local relief to 50 m to 80 m and slopes of 5% to 20%, typically represented by narrow ridges, hillcrests and valleys. This is a residual soil landscape, which the mapping indicates comprises multiple soil horizons that range from deep yellow podzolic soils comprising mostly clays on lower slopes; humic gleys, yellow podzolic soils (clays) and gleyed podzolic soils along drainage lines; shallow to moderately deep red podzolic soils on crests; and moderately deep red and brown podzolic soils on upper slopes. These soils typically have a high soil erosion hazard, exhibit localised areas of impermeable highly plastic subsoil and are typically moderately reactive.



Figure 2: Soil landscape mapping with approximate site location

3.3 Acid sulfate soils

Reference to Department of Land and Water Conservation NSW Acid Sulfate Soil Risk Mapping indicates that the site is not within an area mapped as at risk of acid sulfate soil occurrence.

3.4 Salinity

Salinity is caused by the accumulation of soluble salts in the soil profile by surface water or groundwater movement and can produce aggressive soil conditions, which may be detrimental to concrete and steel. Salts occur naturally in soil from sources such as weathering processes, soils formed in marine environments and salt lakes, or from the ocean via wind and rain.

Regional mapping of salinity in Western Sydney was undertaken in 2002 by the former NSW Department of Infrastructure, Planning and Natural Resources, now the NSW Department of Climate Change, Energy, Environment and Water (DCCEEW). The map of “Salinity Potential in Western Sydney, 2002” (2003) indicates that the site is within an area of “moderate” salinity potential.

3.5 Groundwater Bore Database

A groundwater bore search of the WaterNSW database was conducted to identify any bores registered within a 500 m radius of the site. The search was undertaken to assess possible water levels and potential uses of groundwater in the vicinity of the site. Five groundwater bores (GW02182, GW107575 and GW109570 to GW109572) were identified within the search radius to the southwest. From the reports, standing groundwater levels within the wells were recorded between 4.3 m and 5 m below existing ground surface levels.

4. Field work

4.1 Field work methods

The field work for the geotechnical investigation was carried out between 19 and 28 August 2025 and comprised the following:

- Prior to drilling, a specialist sub-consultant reviewed available 'Before You Dig Australia' information, electro-magnetically scanned and used ground penetrating radar (GPR) techniques at the borehole locations for buried services;
- Four boreholes (BH01 to BH04) were drilled to depths ranging between 24.25 m (BH04) and 34 m (BH01) using a tracked drilling rig (Commacchio-Geo305) provided by Gound Test. The borehole locations are presented in Drawing 1 in Appendix B;
- The soil and upper weathered bedrock profiles were spiral auger drilled to depths between 3.35 m (BH02) and 4.7 m (BH01). The augers were fitted with a tungsten carbide (TC) bit. The relative compaction of the fill and the strength of the natural soil profile was assessed from the standard penetration test (SPT) 'N' values, together with hand penetrometer readings on clayey soils recovered in the undisturbed 50 mm diameter (U50) push tube sampler, and by tactile examination. The strength of the underlying bedrock was assessed by observation of auger TC bit resistance, together with examination of recovered cuttings. Groundwater observations were made during and on completion of auger drilling;
- The boreholes were extended into the bedrock to their final depths by rotary diamond coring techniques using HQ triple tube core barrels with water flush. The strength of the cored bedrock was assessed by tactile examination of the recovered rock cores, together with correlations of subsequent laboratory Point Load Strength Index ($I_{s(50)}$) test results;
- On completion of drilling, groundwater monitoring wells were installed within boreholes BH01, BH02 and BH04. The groundwater monitoring wells comprised a 50 mm diameter Class 18 PVC standpipe. The machine slotted length of each standpipe (i.e. the 'response zone') was installed and sealed within the bedrock profile. The annulus between the borehole and the slotted length was backfilled with sand. Above the sand backfill, each monitoring well was sealed with bentonite. Cast-iron 'Gatic' covers were concreted flush with the ground surface to protect the top of the groundwater monitoring wells. The well installation details are presented on the attached borehole logs in Appendix C;
- After installation of each groundwater monitoring well, the three wells were purged and water level data loggers were installed;
- Wireline permeability (Packer) tests were carried out to assess the permeability of the bedrock at various intervals within the borehole during drilling together with rising head infiltration testing in the wells. Long-term monitoring of the wells is currently being carried out including periodic manual groundwater depth measurements to verify the water level data logger plots;
- The recovered rock cores from BH01 to BH04 were photographed and Point Load Strength Index tested;
- Selected soil samples were returned to NATA accredited laboratories in Sydney for shrink-swell testing, soil aggressivity, salinity, sodicity and erodibility; and
- Coordinates for all locations and surface levels for boreholes locations BH01 and BH04 were recorded using a differential Global Positioning System (dGPS) receiver, which typically has

an accuracy of 0.1 m. Coordinates are in GDA2020 / MGA Zone 56 format (Geocentric Datum of Australia 2020 base with Map Grid of Australia projection) and levels are relative to Australian Height Datum (AHD). Where trees prevented accurate surface level readings to be taken by the dGPS, at BH02 and BH03 the locations were set out by tape measurements from existing site features and surface Reduced Level (RL) shown on the attached borehole logs were interpolated between ground contour lines indicated on the provided survey plan (Ref. 9163, Issue B, 3 Sheets, dated 7 August 2024) prepared by SDG Pty Ltd and are therefore approximate.

Douglas geotechnical engineers/geologists were present full-time during the field work to set out the borehole locations, direct the borehole scanning, nominate testing and sampling, prepare the attached borehole logs, and direct the groundwater monitoring well installations.

5. Field work results

5.1 Subsurface conditions

A summary of the subsurface conditions encountered within the boreholes is presented below. Detailed descriptions of the subsurface conditions encountered are given in the borehole logs included in Appendix C, along with photographs of the rock core. Notes defining classification methods and descriptive terms used in the preparation of the borehole logs are included within Appendix A.

Fill / Topsoil

Sandy clay fill was encountered to depths of 0.4 m (BH02) and 0.6 m (BH01). A thin layer (100 mm thick) of gravel and topsoil was encountered within BH03 and BH04, respectively. Clay fill extended to depths of 0.7 m and 1.5 m below the sandy clay in BH03 and from below the gravel fill in BH01. The clay fill was generally assessed to be between low and high plasticity and ranged between poorly and moderately compacted.

Residual Clay Soils

Pale grey, pale brown and red brown residual clays of low to high plasticity, stiff to hard strength with bands of ironstone gravels, extremely weathered and very low siltstone were encountered below the fill at all locations to depths between 2.0 m (BH02) and 3.5 m (BH04).

Extremely Weathered Siltstone

Underlying the residual clays encountered pale grey and brown, extremely weathered siltstone with occasional ironstone and siltstone bands extending to depths of 4.15 m (BH03) and 4.7 m (BH02) and was assessed to be of low to medium plasticity and hard strength.

Siltstone Bedrock (Ashfield Shale)

Siltstone bedrock was encountered below the residual clay within BH01 and BH04 and below the extremely weathered siltstone in BH02 and BH03 to depths between 16.2 m (BH01) and 21.05 m (BH03). The siltstone bedrock was initially highly or moderately weathered and of very low, low or medium strength and generally contained fine grained sandstone lamination with a fractured upper profile containing numerous defects (e.g. inclined joints typically between 25° and 90°). The siltstone typically increased to slightly weathered and fresh, slightly fractured and medium and high strength with depth.

Interbedded Siltstone/Sandstone Bedrock (Mittagong Formation)

A zone of interbedded siltstone/sandstone bedrock was encountered below the siltstone bedrock at all locations to depths between 21.8 m (BH01) and 25.75 m(BH03) and was typically, slightly fractured, fresh and high strength. A very high strength band was encountered within boreholes BH02, BH03 and BH04 up to 1.9 m thickness (BH04).

Sandstone Bedrock (Hawkesbury Sandstone)

Underlying the interbedded siltstone/sandstone bedrock was slightly fractured to unbroken, fresh, high strength sandstone which extended to final drilling depths.

5.2 Groundwater

Free groundwater was not observed during auger drilling in any of the boreholes. Due to the necessary use of water as a drilling fluid during HQ coring preclude the observation of groundwater levels.

Table 1 summarises the response zone interval (slotted PVC and sand filter length) and response zone material within the monitoring wells.

Table 1: Summary of groundwater well details

Borehole	Ground Level (mAHD)	Response Zone Interval (m) [RL mAHD]	Response Zone Material
BH01	130.3	15 – 24 [115.3 – 106.3]	Siltstone / Sandstone
BH02	134.3	12 - 27 [122.3 – 107.3]	Siltstone / Sandstone
BH04	132.3	9.25 – 24.25 [123.05 – 108.05]	Siltstone / Sandstone

Table 2 summarises the manual measured groundwater levels within the monitoring wells.

Table 2: Groundwater level measurements in wells

Borehole	Date Measured	Water Depth (m) [RL mAHD]
BH01	1 September 2025	16.3 [114]
	8 September 2025	19.1 [111.2]
	16 September 2025	22.7 [107.6]
	2 December 2025	23.6 [106.7]
BH02	2 September 2025	19.8 [114.5]
	8 September 2025	20.15 [114.15]
	16 September 2025	20.1 [114.2]
	2 December 2025	20.5 [113.8]
BH04	2 September 2025	7.25 [125.55]
	8 September 2025	7.5 [124.8]
	16 September 2025	7.8 [125]
	2 December 2025	16.8 [116.1]

Groundwater levels have been continuously recorded at hourly intervals within the monitoring wells from 25 August (BH01), 29 August (BH02) and 2 September 2025 (BH03) to 2 December 2025 (three months) using data loggers.

The initial elevated levels within monitoring wells BH01 and BH04 are likely to have been caused by nearby core drilling and packer testing, both of which requires large amounts of induced water to be carried out; some of the rise may be attributed to the rainfall event but this is expected to be less significant. The induced water is then stored within fractures in the bedrock which, over time, can travel into nearby monitoring wells which are then captured by the data loggers.

Hydrographs showing recorded levels in comparison with rainfall data over time are presented in Appendix E. Impacts from rainfall on the groundwater levels are generally negligible.

Maximum, minimum, average and median groundwater levels recorded by the dataloggers are presented in Table 3. Note that data collected during permeability testing (i.e. purging and groundwater recharge) including the sudden increase in groundwater levels within BH01 and BH04 due to nearby drilling and packer testing was omitted from the results; noting that the high level in BH04 may still represent an elevated level due to packer testing and this can be assessed with longer term monitoring.

Table 3: Summary of logger data

Well ID	Groundwater elevation (m AHD)			
	Lowest	Highest	Average	Median
BH01	106.7	108.8	106.8	106.8
BH02	113.1	114.6	114.3	114.3
BH04	115.5	123.2	117.2	116.3

5.3 Permeability Testing

Rising head and packer permeability testing was undertaken at all monitoring well locations to evaluate the mass hydraulic conductivity (or permeability) of the bedrock material.

The rising head test comprised removing water from the well and measuring the corresponding rise in water level at regular time intervals. The results of the rising head permeability tests are calculated using the methods proposed by Hvorslev (1951) to determine a hydraulic conductivity (k) value. A rising head test could not be carried out within BH01 due to the relatively low levels of groundwater within the monitoring well. The rising head test results are summarised in Table 4.

Table 4: Summary of rising head tests

Borehole	Hydraulic Conductivity, k (m/s)
BH02	1.3×10^{-8}
BH04	1.9×10^{-6}
Geometric Mean	1.6×10^{-7}

Wireline permeability (Packer) testing is a method of calculating the permeability and hydraulic conductivity of bedrock formations surrounding a drilled borehole. A rubber packer is inflated using high pressures against the borehole walls creating a watertight seal and isolates sections of the borehole. Water is then injected under pressure directly into the area of interest. During the test, water is injected over three equally stepped increasing pressures, followed by stepping back down over the same pressures. At each pressure step, the corresponding flow rates are recorded and plotted.

A lugeon value is then calculated using the Houlsby (1976) approach based on how the bedrock behaves under the various pressures and is then converted into a hydraulic conductivity (k) (m/s).

The results of the packer testing are summarised in Table 5.

Table 5: Summary of Packer Test Results

Borehole	Packer Test Depth Interval (m) [RL mAHD]	Houlsby Lugeon Value	Estimated Hydraulic Conductivity, k (m/s)
BH01	8 - 14 [124.3 - 118.3]	8.8	1.1×10^{-6}
	14 - 20 [118.3 - 112.3]	5.2	6.8×10^{-7}
BH02	8 - 14 [126.3 - 120.3]	0.2	2.2×10^{-8}
	18 - 24 [116.3 - 110.3]	4.9	6.3×10^{-7}
BH04	6.1 - 12.1 [124.2 - 118.2]	0.4	5.2×10^{-8}
	12.1 - 18.1 [118.2 - 112.2]	> 0.1	2.0×10^{-9}
		Geometric Mean	1.0×10^{-7}

The results of the rising head and packer testing is consistent with ranges of values documented in the available literature for similar lithologies (e.g. Hoek & Bray 1981 and more recently Pells 2019) and previous experience with similar materials.

6. Laboratory testing

6.1 Point Load Strength testing

Point Load Strength Testing ($Is_{(50)}$) testing was carried out on rock core samples at approximately 1 m intervals, to assist rock strength classification. The results of the tests are presented in Figure 3 below and shown on the borehole logs in Appendix C at the relevant test depths.

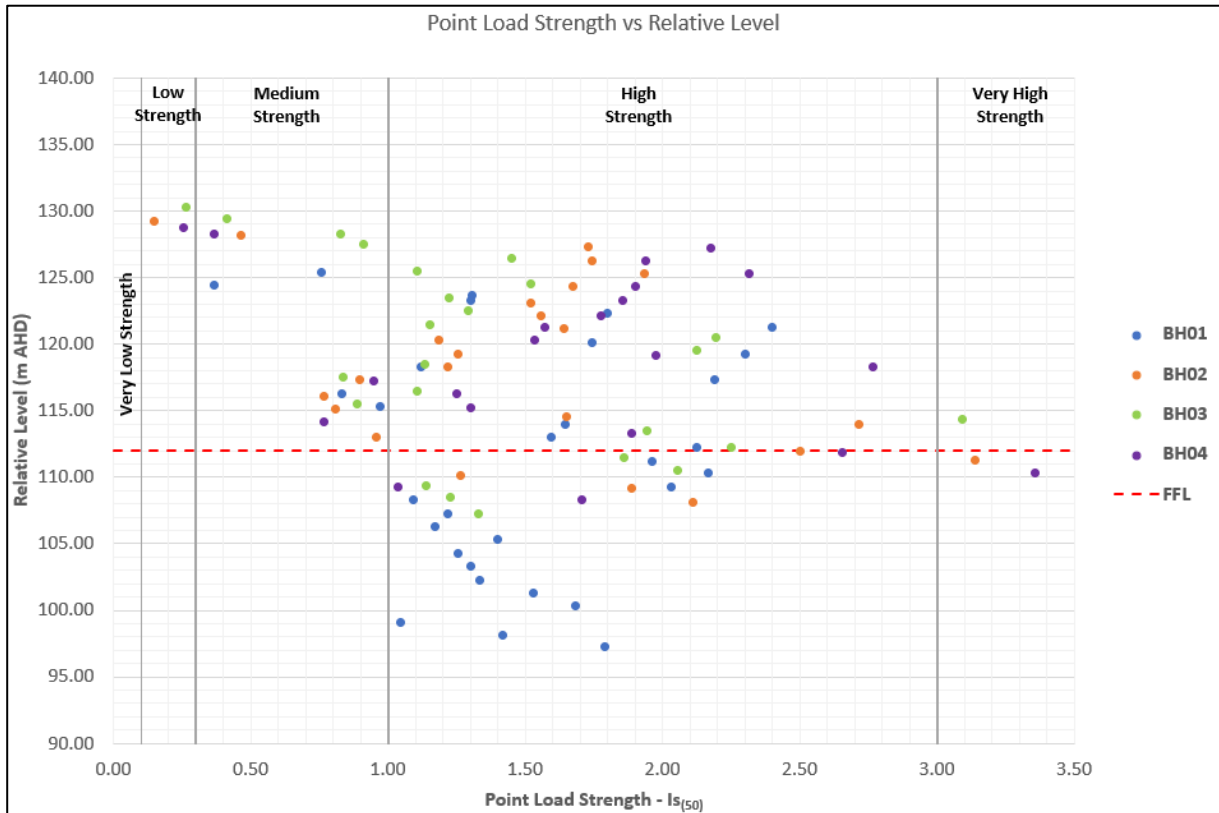


Figure 3: Axial Point Load Strength ($I_{s(50)}$) Values vs RL (m AHD)

6.2 Soil aggressivity

The results of the laboratory testing are provided in detail in the test report sheets in Appendix D and are summarised in Table 6.

Table 6: Summary of Soil Aggressivity Test Results

Borehole	Depth (m)	Description	pH	Electrical Conductivity ($\mu\text{S/cm}$)	Chloride (mg/kg)	Sulfate (mg/kg)
BH01	0.4 – 0.5	Clay	6.0	140	70	120
BH01	0.9 – 1.0	Clay	4.7	190	150	80
BH01	1.9 – 2.0	Clay	5.5	66	31	41
BH02	0.4 – 0.5	Clay	5.4	65	<10	54
BH02	1.0 – 1.45	Clay	4.7	240	150	140
BH02	1.9 – 2.0	Clay	N/A	220	N/A	N/A
BH04	0.4 – 0.5	Clay	4.8	65	<10	64
BH04	0.9 – 1.0	Clay	5.2	47	<10	32
BH04	1.0 – 1.5	Clay	5.2	59	10	58
BH04	2.5 – 2.95	Clay	4.8	N/A	170	60

6.3 Soil salinity

The results of the laboratory testing are provided in detail in the test report sheets in Appendix D and are summarised in Table 7.

Table 7: Summary of Soil Salinity Test Results

Borehole	Depth (m)	Texture ¹	ECe (dS/m)	Class ²
BH01	0.9 – 1.0	Medium Clay	<2	Non-Saline
BH01	1.9 – 2.0	Medium Clay	<2	Non-Saline
BH02	1.0 – 1.45	Medium Clay	<2	Non-Saline
BH02	1.9 – 2.0	Medium Clay	<2	Non-Saline
BH04	0.4 – 0.5	Medium Clay	<2	Non-Saline
BH04	1.0 – 1.5	Medium Clay	<2	Non-Saline

Notes: 1 – determined according to Table 6.1 of Site Investigations for Urban Salinity (Department of Land and Water Conservation, 2002)
2 – determined according to Table 6.2 of Site Investigations for Urban Salinity (Department of Land and Water Conservation, 2002)

6.4 Soil erodibility and sodicity

The results of the laboratory testing for soil sodicity and erodibility are provided in detail in the test report sheets in Appendix D and are summarised in Table 8.

Table 8: Summary of Soil Erodibility Test Results

Borehole	Depth (m)	Material	ESP (%)	Emerson Class Number	Sodicity ¹
BH01	0.4 – 0.5	Clay	2	5	Non-Sodic soil
BH02	0.4 – 0.5	Clay	2	5	Non-Sodic soil
BH04	0.4 – 0.5	Clay	9	3b	Sodic soil

Notes: ESP – exchangeable sodium percentage
1 – determined according to Site Investigations for Urban Salinity (Department of Land and Water Conservation, 2002)

7. Geotechnical Model

Based on the geotechnical investigation, the site is generally underlain by soils of moderate depths comprising fill, residual clays and extremely weathered siltstone overlying siltstone/sandstone bedrock of varying strength.

The geotechnical model for the site is summarised on four interpreted geotechnical cross-sections A-A' to D-D' in Appendix B (Drawings 2 to 5). The cross-sections show the interpreted geotechnical units across the site and the current development concept for the site has been superimposed onto the cross-sections, with the approximate finished floor levels shown.

Reference should be made to the borehole logs for more detailed information and for descriptions of the soil and rock.

A summary of the typical material descriptions for the geotechnical model is given in Table 9 below. The interpreted depth and RL at the top of the various rock units are shown in Table 10.

Table 9: Summary of Material Description for Geotechnical Model

Unit	Material Name	Description
1	Fill	Typically, sandy clay and clay fill
2	Residual Soil/Extremely Weathered Siltstone	Stiff to hard clay and extremely weathered siltstone in the form of silty clay and hard strength
3	Siltstone - Variable strength ranging from Very Low, Low and Medium Strength	Highly to moderately weathered, variable strength ranging from very low, low and medium, fractured siltstone (Ashfield Shale)
4	Medium to High Strength Siltstone	Moderately weathered to fresh, medium to high strength, fractured to slightly fractured siltstone and laminite (Ashfield Shale) with steeply dipping joints
5	Medium to High Strength Interbedded Siltstone / Sandstone	Fresh, medium to high strength interbedded siltstone / sandstone (Mittagong Formation), slightly fractured to unbroken. Band of very high strength bedrock encountered within BH02, BH03 and BH04
6	High Strength Sandstone	High strength sandstone (Hawkesbury Sandstone), fresh, typically slightly fractured and unbroken

Table 10: Summary of Depths / Reduced Levels of Top of Various Soil and Rock Units

Unit	Depth to Top of Unit							
	BH01		BH02		BH03		BH04	
	(m)	[mAHD]	(m)	[mAHD]	(m)	[mAHD]	(m)	[mAHD]
1	0.0	130.3	0.0	134.3	0.0	135.5	0.0	132.3
2	1.5	128.8	0.4	133.9	0.7	134.8	0.1	132.2
3	4.3	126.0	4.7	129.6	4.15	131.35	3.3	129.0
4	6.8	123.5	5.7	128.65	7.1	128.4	4.45	127.9
5	16.2	114.1	19.4*	114.9*	21.1*	114.5*	18.4*	113.9*
6	21.8	108.5	24.0	110.3	25.8	109.75	22.50	109.8

Note: *Band of very high strength bedrock encountered within unit

The results for the three-month monitoring period indicate that groundwater level varies between RL 106.7 mAHD (BH01) and RL 123.2 mAHD (BH04). We note that groundwater levels after the three-month monitoring period have generally stabilised to around RL 106.8 mAHD, RL 113.7 mAHD and RL 115.5 mAHD within BH01, BH02 and BH04, respectively. The stabilised groundwater levels were observed to be close to the top of Unit 5 rock in BH02 and BH04 and within Unit 6 (below BEL) at BH01.

The measured water levels indicate a groundwater flow in a north westerly direction. It is expected that at least some of the measured groundwater is expected to be from perched water sources rather than regional groundwater table, which is expected to be present in deeper layers. Based on the measured groundwater levels and the proposed basement level, it is anticipated that the basement excavations will intersect groundwater, in form of water seepage. Seepage is anticipated along the soil-rock interface and along bedding planes / joints within the rock mass.

Notwithstanding the above, it should be noted that groundwater levels can vary and may fluctuate over time, particularly, following periods of heavy rainfall.

8. Proposed development

Based on the drawings (Project No. 250319, dated 21 May 2025) prepared by Xavier Knight and our discussions with Urban, it is understood that the proposed development will comprise a 40-storey residential building over 6 levels of basement. The proposed lower basement level has a stepped finished floor level (FFL) of RL 112 mAHD and RL 111 mAHD and will require excavations of up to 25 m with deeper localised excavations required for the lift pits and service trenches. The proposed basement is generally set back approximately 5 metres from the site boundary, although in some locations it extends up to the boundary line.

9. Comments

9.1 Earthworks

9.1.1 Dilapidation Survey

Dilapidation surveys should be carried out on adjacent buildings, pavements and sensitive structures that may be affected by the excavation. A baseline (reference) survey should be carried out before the commencement of any demolition or excavation work in order to document existing defects so that any claims for damage due to construction related activities can be accurately assessed.

Survey points and inclinometers may also be used to monitor the side wall movement of the excavation.

9.1.2 Excavation

Excavation across the site is likely to encounter Units 1 to 5 as outlined within Table 10 and possibly Unit 6 within the localised deeper excavations. Based on the conditions observed in the boreholes, it is expected that the majority of the excavation works will be through either medium or high strength, slightly fractured to unbroken bedrock. The ease of excavation of the bedrock is directly dependent on the defect spacing and rock strength. Based on the expected conditions, productivity in such bedrock may be slow however, the earthworks contractors should make their own assessment of the equipment required and productivity that may be achieved within the rock.

Excavation of soils, extremely weathered siltstone and very low and low strength rock should be achievable using conventional earthmoving equipment, such as a 20t excavator fitted with a toothed bucket. Excavations in medium and high strength rock will likely require the use of hydraulic rock hammers and rock saws fitted to an excavator for effective excavation. Detailed excavation for footings and service trenches/pits should be achievable using rock hammers, hydraulic rotary rock saws, or milling heads. Rock saws may also be required around the boundaries to reduce the risk of vibration induced damage to adjacent structures and also to reduce the risk of overbreak in loose rock.

Bulk excavation works will need regular inspections by a suitably qualified geotechnical engineer or engineering geologist to check for geological hazards that may be present but could not be observed during the investigation borehole drilling. Typical hazards for such an excavation include (but are not limited to) joints and fractures dipping into the excavation, which may form unstable wedges in the bedrock, and, the presence of inclined clay seams, which can again form large blocks which may topple into the excavation.

Consideration should be given to the existing footings of two neighbouring buildings to the northeast and east of the site, as they are within the zone of influence of the proposed excavation at the site. The zone of influence may be taken as a 45° line drawn up from the base of the proposed bulk excavation level. An assessment of the bearing capacity beneath these neighbouring footings should be undertaken to ensure the foundation remains within their serviceability design limits. Progressive inspections of the excavated face below the neighbouring footings will be necessary in 1.5 m drops to check whether there are defects or adversely dipping joints that may affect the neighbouring foundation performance.

9.1.1 Vibration

During excavation, it will be necessary to use appropriate methods and equipment to keep ground vibrations at neighbouring buildings and structures within acceptable limits. The level of acceptable vibration is dependent on various factors including the type of building structure (e.g. reinforced concrete, brick, etc.), its structural condition, founding conditions, the frequency range of vibrations produced by the construction equipment, the natural frequency of the building and the vibration transmitting medium.

Ground vibration can be strongly perceptible to humans at levels above 2.5 mm/s peak particle velocity (PPV). This is generally much lower than the vibration levels required to cause structural damage to most buildings. The Standard AS/ISO 2631.2 – 2014 “Mechanical vibration and shock –

Evaluation of human exposure to whole-body vibration – Vibration in buildings (1 Hz to 80 Hz)” suggests an acceptable daytime limit of 8 mm/s PPV for human comfort.

Based on DP’s experience and with reference to AS/ISO 2631.2, it is suggested that a maximum PPV of 8 mm/s (measured at the first occupied level of neighbouring buildings) be adopted at this site for both architectural and human comfort considerations for ‘modern buildings. Sydney Water and other providers may impose lower vibration levels and this will also need to be confirmed.

As the magnitude of vibration transmission is site specific, it is recommended that a vibration trial be carried out at the commencement of rock excavation. These trials may indicate that smaller or different types of excavation equipment are required to reduce vibration to acceptable levels.

To reduce the effects of vibration from hydraulic rock hammers, the work method should allow for:

- Rock sawing around the perimeter of the excavation;
- Use of rock hammers in short burst to prevent generation of resonant frequencies;
- Positioning the direction of hammering away from adjacent building; and
- Using large size excavators capable of absorbing more energy.

9.1.2 **Disposal of Excavated Material**

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). This includes fill and natural materials that may be removed from the site.

9.2 **Excavation Support**

Given the space limitations, it is likely that there will not be sufficient space to safely batter the sides of the excavation.

Vertical excavations in fill, residual soil and siltstone (Units 1 to 4), will require both temporary and permanent lateral support during and after excavation. While slightly fractured, high strength interbedded siltstone/sandstone (Unit 5) may generally be considered low risk for unsupported vertical excavations, it is still associated with a higher risk of adverse jointing, and given the relatively shallow depth of Unit 5 rock above the base of the proposed basement, it is suggested that shoring should extend full depth.

9.2.1 **Batter Slopes**

Battering of the sides of the bulk excavation will not be feasible as the proposed excavation is designed to generally extend close to the boundaries of the site. The maximum batter slopes provided in Table 11 can be used as a guide for localised excavations during site preparation and/or detailed excavations within the shored excavation.

The maximum batter slopes are recommended for the design of cuts of up to 3 m height. Deeper batter slopes generally require detailed analysis to assess slope stability.

Table 11: Recommended Maximum Batter Slopes for Excavated Slopes

Unit	Material	Temporary Batter Slope (H : V)	Permanent Batter Slope (H : V)
1	Fill	1.5 : 1	2 : 1**
2	Residual Soil/Extremely Weathered Siltstone	1 : 1	2 : 1**
3	Siltstone - Variable Strength Ranging from Very Low, Low and Medium Strength	0.75 : 1*	1.5 : 1*
4,5	Medium Strength or Better Siltstone and Interbedded Siltstone/Sandstone	0.5 : 1*	1 : 1*

Note: *Subject to progressive jointing assessment by experienced Geotechnical Engineer/Engineering Geologist

** Permanent batters in soils and weak rock should be provided with erosion protection using vegetation cover or similar may need to be reduced to 3H:1V to facilitate maintenance of grassed slopes

Excavation should be carried out in a controlled manner, with inspections by a suitably experienced engineering geologist/geotechnical professional every 1.5 m drop in excavation to determine if such wedges are present and whether the support assumptions are valid or if additional support is required. The requirement for regular geotechnical inspections every 1.5 m drop should be explicitly stated on the drawings and the earthworks contractor should be made fully aware of this requirement.

Unsupported vertical excavations are possible within Unit 6 – Sandstone, if encountered, subject to detailed rock face inspections and localised stabilisation where required. Allowance should be made for ground anchors, rockbolt and shotcrete support where adverse joints are encountered.

9.2.1 Shoring Walls

It is expected that shoring walls will be required for the full depth of the proposed bulk excavation. Anchored soldier pile walls with shotcrete infill are considered suitable for the project to provide temporary retaining support to soils and rock. The soldier piles are typically spaced at approximately 2 m to 2.5 m centres, however, more closely spaced piles may be required to reduce wall movements, or prevent collapse of infill materials, particularly where pavements, structures or services are located in close proximity to the excavation.

At no stage should progressive vertical excavation proceed beyond 2 m without infill panel support being constructed. Regular inspections by a geotechnical professional should be carried out following each progressive drop in excavation level to confirm that the conditions encountered are consistent with the design assumptions.

It is recommended that the soldier piles be extended below the proposed bulk excavation level with a suitable socket length within Unit 5 or Unit 6 rock. It may be possible to terminate some piles in Unit 5 rock and take every say third pile to below bulk excavation if a higher risk option is preferred. If adverse joints are encountered below pile toes rock anchor/bolt support or underpinning will be required, and given the shallow depth of Unit 5 rock it is suggested that all piles are taken below bulk level to eliminate this risk.

Suitably powered piling rigs will be required to penetrate the medium and high strength including bands of very high strength bedrock if required and this should be considered by the piling contractor. Consideration should also be given to the potential for groundwater inflow into the piles which may be significant where fractured zones are encountered. This may require the use of cleaning buckets and possibly tremie pouring methods.

9.2.1 Earth Pressures for Shoring Design

It is suggested that the preliminary design of cantilevered shoring systems (or shoring systems with one row of anchors) be based on a triangular earth pressure distribution using the earth pressure coefficients provided in Table 12. 'Active' earth pressure coefficient (K_a) values may be used where some wall movement is acceptable. 'At Rest' earth pressure coefficient (K_o) values should be used where the wall movement needs to be limited. A suitable factor of safety (e.g. 2.5 – 3) should be adopted when using the ultimate passive pressure values, to limit wall movements.

Table 12: Recommended Design Parameters for Shoring Systems

Unit	Material	Unit Weight (kN/m ³)	Earth Pressure Coefficient	
			Active (K_a)	At Rest (K_o)
1	Fill	20	0.4	0.6
2	Residual Soil/Extremely Weathered Siltstone	20	0.3	0.5
3	Siltstone - Variable strength ranging from Very Low, Low and Medium Strength	22	0.2	0.3
4,5	Siltstone and interbedded Siltstone/Sandstone - Medium to High Strength or better	24	0*	0*

Notes: The values above assume a level surface behind the wall.

*It is assumed that the rock mass is free of adverse dipping joints and seams.

*It should also be noted that the K_a and the K_o designs will not prevent stress relief movement.

For braced walls or where two or more rows of anchors are used, the shoring can be designed using a rectangular or trapezoidal earth pressure distribution.

An alternative approach, where the support pressure is related to the height of soil/rock retained, could also be used. Where there are no movement-sensitive structures within the influence zone behind retaining walls, an earth pressure distribution equal to 4H kPa (where H, in metres, equals the depth of Unit 1 to 4 material to be retained) can be used. Where the wall movement is to be minimised (i.e., close to adjacent buildings or services) the lateral earth pressure can be calculated using 6H kPa. These pressures can be applied as rectangular earth pressure distributions. Note these earth pressure distributions are "pressure envelopes", selected to ensure that no row of anchors is overloaded during the temporary support phase. The actual magnitude and distribution of lateral earth pressures for the building in its final (long term) condition may differ from the uniform distributions given above. The final condition earth pressures can be assessed using numerical methods.

The design of the shoring should allow for all surcharge loads, including footings for neighbouring buildings, inclined slopes behind the wall, traffic, site sheds, and construction related activities applied as a rectangular earth pressure distribution over the depth of influence. Detailed design of shoring should preferably be carried out using WALLAP, PLAXIS, FLAC or other accepted computer analysis programs, which are capable of modelling progressive excavation and anchoring, and predicting potential lateral movements, stresses and bending moments.

The design of temporary (and possibly permanent) support will also need to consider the possibility that 45° joints/faults in Unit 4 and 5 bedrock will 'daylight' near the base of the excavation leading to wedges of rock requiring support by the temporary (and permanent) shoring/ retaining structures. Sufficient anchoring of the shoring wall should be undertaken to prevent movements along 45° defects within Units 4 and 5 bedrock, even though there is a low probability that a joint would run the full length and depth of the units, particularly Unit 5, which the associated risks are not considered as significant. It may be possible to refine and reduce the wedge loading by undertaking further investigation using cored boreholes with imaging to identify joint/defect orientations.

The earth pressure loading described above does not include either earthquake loads or hydrostatic pressures. Unless positive drainage measures are incorporated to prevent water pressure build-up behind the walls, full hydrostatic head should be allowed for in design, while at the same time reducing the unit weight to account for the buoyant condition. Drainage could comprise regularly spaced, 150 mm wide strip drains pinned to the face. The base of the strip drains should extend out from the shoring wall to allow any seepage to flow into a perimeter toe drain which is connected to the stormwater drainage system.

It is possible that the influence zone of the proposed bulk excavation will intercept high level footings of the neighbouring buildings to the east of the site. It is recommended that footing investigations be carried out to confirm the type and location of the nearby footings and incorporate this information into the shoring design.

Passive resistance for soldier piles founded in rock below the base of the bulk excavation (including allowance for trenches and/or footings) may be based on the ultimate passive restraint values provided in Table 13. A factor of safety must be applied to these ultimate values, while considering the displacement that is required to mobilise the passive resistance. Additional support will be required if allowable displacements are exceeded or if the rock is adversely affected by faults, bedding or jointing.

Table 13: Recommended Passive Pressures

Unit	Foundation Stratum	Maximum Ultimate Passive Pressure (kPa)
4,5	Medium to High Strength or better Siltstone and interbedded Siltstone/Sandstone	4,000*
6	High Strength or better Sandstone	6,000*

Note: *subject to geotechnical inspection

The first 0.5 m of rock socket below the bulk excavation level should not be taken into account for the purpose of passive restraint due to possible disturbance and over-excavation. The minimum socket depth should be equal to the greater of one pile diameter or 1.0 m below the lowest level of any nearby excavation (including any detailed excavations), but subject to analysis. This is also relevant where anchors are installed. Staged excavation and inspection by a suitably qualified geotechnical engineer will therefore be required to confirm that the rock in front of the piles is not adversely affected by discontinuities, especially where passive resistance is relied upon.

9.2.2 Excavation Induced Ground Movement

Horizontal movements due to stress relief of the rock will occur during the excavation works. Based on published literature and Douglas' experience, the lateral deflections associated with stress relief in rock may be in the order of 0.05% to 0.15% of the excavation height, depending on the various factors such as rock strength, orientation of the face and degree of fracturing. For a 25 m high excavation, around 10 mm to 25 mm of lateral deflection from stress relief could be expected. The predicted deflections would generally be greatest at the centre of the excavated faces and would reduce with distance from the excavation face/boundary.

It is unlikely to be practicable to provide restraint (i.e., anchoring) for the relatively high in-situ horizontal stresses associated with stress relief movements. Therefore, it is recommended that appropriate allowance be made for movements of this order in construction and planning.

Precise survey and/or inclinometer monitoring of excavation faces and nearby buildings/structures should be carried out to assess vertical and horizontal movements during excavation. The survey and/or inclinometer monitoring should commence prior to excavation to provide a baseline and should continue every 1.5 m drop of the excavation. If deflections show an increase in the rate of movement or exceed the predicted movements, then the structural engineer and geotechnical engineer should be contacted for immediate review.

If a more accurate assessment of predicted ground movements at surrounding buildings or infrastructure as a result of the proposed excavations is required then numerical modelling (using Plaxis or FLAC) of the proposed excavation adjacent to the neighbouring buildings and structures may be required.

9.2.3 Anchor Design

Post-stressed ground anchors, rock bolts and dowels (support elements) can be used to laterally support existing walls, new shoring, underpinning works or unstable rock blocks and wedges. Anchors could also be used vertically as hold down anchors. Support elements used for lateral support should be bonded in the stronger rock, inclined as required, but preferably not steeper than 30° below the horizontal. Table 14 provides allowable bond stresses for preliminary anchor design and estimating purposes.

Table 14: Preliminary Bond Stresses for Ground Anchor and Rock Bolt Design

Unit	Material Description	Allowable Bond Stress ⁽¹⁾ (kPa)	Ultimate Bond Stress (kPa)
3	Very Low to Low Strength Siltstone	100	200
4,5	Medium to High Strength or better Siltstone and interbedded Siltstone/Sandstone	500	1000
6	High strength or better Sandstone	800	1600

Notes: Using safety factor of 2, for temporary anchors with service life less than 6 months and no danger to public safety in the event of failure. Higher factor of safety up to 3 is recommended for permanent anchors and/or anchors with serious damage consequences.

These values should be confirmed by pull-out tests prior to installation of support elements. Ultimately, it is the contractor's responsibility to ensure that the correct design values (specific to the support system and method of installation) are used and that the support element holes are carefully cleaned prior to grouting.

The cone pull-out failure mechanism should also be considered for vertical anchors, if required. A 90° cone could be assumed for the Unit 5 and 6 rock.

Ground anchors should be designed to have a free length that extends beyond an imaginary line drawn upwards at an angle of 45° from the top of Unit 5 rock. The parameters outlined in Table 14 assume that the anchor holes are clean and thoroughly flushed, with grouting and other installation procedures carried out carefully and in accordance with normal good anchoring practice.

After temporary support elements have been installed, it is recommended that they are tested to 125% of their nominal working load. Where stress relief or further unavoidable movement of the shoring is expected, it is recommended that the support elements are locked-off at about 80% of their working loads to accommodate the additional movement and subsequent increase in stress in the support elements. Consideration should, however, be given to the immediate design requirements. The capacity of the anchor may have to be increased if a lower initial lock-off is not feasible. Checks should be carried out to confirm that the load in the support elements has been maintained and that losses due to creep effects or other causes have not occurred.

Shorter support elements (i.e., rock bolts, dowels and pins) may be required to support any unstable rock wedges, slivers or blocks between shoring piles. Short dowels and pins may be required to support feather edges where sub-parallel joints intersect the face. Shotcrete with mesh (or fibrecrete) may be required where beds/seams of extremely weathered and very low strength rock are encountered within higher strength rock, secured with anchors, rock bolts, dowels or pins, as required. The siltstone, even Unit 4 and 5 rock, will deteriorate in the long term and should be covered with protective shotcrete.

Care should be exercised to ensure that anchors are installed progressively during excavation and stressed prior to excavation of the next drop to ensure that stability is maintained at all times.

It is anticipated that the new structure will support the shoring walls over the long term and therefore the lateral support elements are expected to be temporary only. The use of permanent rock bolts and ground anchors (e.g. vertical anchors), if required, will need careful attention to corrosion protection. It should be noted that permission will be required from authorities and adjacent property owners prior to installing rock bolts/ground anchors below their land. Due consideration should also be given to below-ground excavations, services, etc.

9.3 Groundwater and Dewatering

Groundwater levels measured in the monitoring wells ranged between RL 107.6 mAHD (BH01) and RL 125.55 mAHD (BH04). It is expected that the proposed bulk excavation level will extend below the measured water level. Seepage should be expected along the top of the rock (particularly after periods of wet weather) and through the rock mass, joints and bedding planes in the rock face. The seepage may be relatively minor during dry periods and will increase following and during wet periods.

During construction it is anticipated that seepage into the excavation could be controlled by perimeter drains connected to a "sump-and-pump" system. A drained basement is considered feasible from geotechnical perspective, however, for SSDA, approval from the Natural Resources Access Regulator (NRAR), will be required prior to design and construction of a drained basement. A drained basement, if approved by NRAR, will require permanent subfloor drainage to direct seepage to the stormwater drainage system.

An inflow assessment will be required to assess impacts and to inform basement design and relevant approvals.

Should approval for a drained basement not be possible, a tanked or partially tanked basement may be required to prevent groundwater inflow during the operational period of the proposed development.

Previous experience in Sydney is that seepage will likely contain relatively high levels of soluble iron that will form a precipitate in the form of a gelatinous 'sludge' when exposed to oxygen. This 'sludge' has the potential to block-up subsoil (gravel) drains and 'seize-up' pumps. Therefore, detailing of subfloor drains, sumps and pumps should incorporate provision for regular maintenance such as flushing and 'rodding' of drains and/or "baffle" pits.

Notwithstanding the above, it should be noted that groundwater levels can vary and may fluctuate over time, particularly, following periods of heavy rainfall.

9.4 Foundations

It is anticipated that bulk excavations for the basement will mostly expose Unit 5 rock. Pad footings on rock could be possible subject to loads and settlement tolerances. Alternatively deepened pads or bored piles may be used to found on Unit 6 rock to achieve higher capacities. The design will need to consider variable foundation materials and differential settlements. Typical parameters for the design of foundations are shown in Table 15. Shaft adhesion values for uplift (tension) in piles may be taken as being equal to 70% of the values for compression,

provided that adequate socket roughness is achieved. Cone pull out will also need to be checked for uplift piles or anchors.

Table 15: Recommended Parameters for Foundation Design

Unit	Foundation Stratum	Maximum Allowable Bearing Pressure (Serviceability)		Maximum Ultimate Bearing Pressure (Ultimate)		Young's Modulus (MPa)
		End Bearing (kPa)	Shaft Adhesion (Compression) (kPa)	End Bearing (kPa)	Shaft Adhesion (Compression) (kPa)	
3	Very Low, Low and Medium Strength Siltstone	1,000	80	3,000	120	100
4	Medium to High Strength Siltstone	3,500	350	30,000	600	700
5	Medium to High Strength Interbedded Siltstone/Sandstone	6,000	500	30,000	1,000	1,000
6	High Strength Sandstone	8,000	800	80,000	1,600	2,000

Note: Shaft adhesion applicable to the design of bored piles, uncased over the rock socket length, where adequate sidewall cleanliness and roughness are achieved

Foundations proportioned on the basis of the allowable bearing pressures in Table 15 would be expected to experience total settlements of less than 1% of the pile diameter or footing width under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value.

To use a bearing pressure value for design of greater than 3.5 MPa, a minimum of six cored bores are required with spoon testing carried out in one third of footings across the site during construction. If bearing pressures greater than 6 MPa are used in design, then additional cored bores and spoon testing will be required. For spoon testing, a 50 mm diameter hole is drilled below the base of the footing to a depth of 1.5 times the footing width, followed by testing to check for the presence of weak layers or clay bands.

For design using the ultimate values provided in Table 15, a geotechnical strength reduction factor (ϕ_g) should be determined by the designer. The serviceability assessment should be based on using geotechnical parameters that are appropriately selected and to which no reduction factor is applied.

Footings (i.e. pads or piles) should be founded below the zone of influence (45 degrees) of nearby excavations. If excavations are above nearby excavations this will be subject to reduced bearing pressures and assessment of jointing in the rock. Examples of where such a scenario could occur include:

- Foundation adjacent to the vertical face of the stepped portion of the lowest basement levels;

- Footings founded outside of basement excavation and near the vertical cut face for the basement excavation; and
- Shoring piles (if adopted) terminated above the bulk excavation level.

All foundations should be inspected by a geotechnical engineer to confirm that foundation conditions are suitable for the design parameters, and proof drilled or spoon tested as appropriate. If weak seams or defects are encountered, footings may need to be deepened until suitable foundation material is reached. Alternatively, the footing can be enlarged or redesigned for a lower bearing pressure.

9.5 Site Classification

The following comments are unlikely to be relevant for this high rise development but are provided as a guide for smaller structures, if proposed, outside the basement footprint.

The subsurface conditions include a layer of fill to depths of up to 1.5 m underlain by stiff to hard residual clays, and then weathered bedrock below depths of up to about 3.3 m.

The existing fill is considered to be 'uncontrolled' fill, that is, it has not been placed and compacted in a controlled manner with the details of the materials and compaction recorded and would have a Site Classification of 'Class P' in accordance with "AS 2870-2011 Design of residential slabs and footings".

To avoid problems of uneven settlement and low bearing capacity, it is recommended that all footings are founded uniformly on the natural residual clays (or weathered rock) below the fill. In local areas of deeper fill, the footings should be supported on piers taken down into the natural clays or weathered rock, unless the fill is removed and replaced in a controlled manner.

The residual clays are moderately to highly reactive, that is moderately to highly susceptible to shrink swell movements due to changes in moisture content. If the fill material were not present, or if the existing fill is removed and replaced with engineered fill, then the site would likely be classified as "M" or "H1", for which maximum 'free' ground surface movements (ys) in the range of between 20 and 45 mm could be expected. Due consideration to the potential for such reactive soil movement should be given in designing footings and floor slabs bearing on grade.

Additional ground surface movement may occur due to the soil-suction effects induced by trees in proximity to the building footings and this should be further assessed once the building locations and mode of foundation support has been confirmed.

9.6 Soil Aggressivity

In accordance with AS2159-2009: Piling-Design and Installation, the results of the soil aggressivity testing indicate that the tested soils are:

- Non-aggressive to Mildly aggressive to buried concrete; and
- Non-aggressive to buried steel.

It is suggested that an exposure classification of at least 'mild' (as per AS2159) is adopted for all buried structural elements.

9.7 Acid Sulfate Soil and Salinity

Based on the review of the published mapping on site and the obtained results from the aggressivity suite, the risks associated with acid sulfate and saline soils are considered to be negligible and as such, acid sulfate and salinity management plans are not required.

9.8 Soil Erodibility

The laboratory test results indicate that the residual site soils are likely to be at least moderately dispersive and are therefore also potentially prone to some erosion in adverse conditions; e.g. from concentrated water flows. It is recommended that the soils are covered wherever possible by either the proposed structures and pavements, or vegetation to reduce the potential for erosion.

9.9 Seismic Loading

In Accordance with AS1170-2007 "Structural Design Actions, Part 4: Earthquake Action in Australia", the site has a hazard factor (z) of 0.08 and a site subsoil Class of C_e .

10. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 16-20 Old Castle Hill Road, Castle Hill, Sydney NSW in accordance with Douglas' proposal (235039.00.P.002.Rev2, dated 24 July 2025) and acceptance received from Charbel Youseff of UPG Castle Corner Ptd Ltd dated 4 August 2025 instructing to proceed. This report is provided for the exclusive use of UPG Castle Corner Ptd Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report. This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope of work for this report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials

Appendix A

About this Report

Terminology, Symbols and Abbreviations

Soil Descriptions

Rock Descriptions (optional)

Sampling, Testing and Excavation Methodology

Introduction

These notes have been provided to amplify Douglas' report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

Douglas' reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Engagement Terms for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather

changes. They may not be the same at the time of construction as are indicated in the report; and

- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, Douglas will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, Douglas cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, Douglas will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, Douglas requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. Douglas would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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Appendix B

Drawings

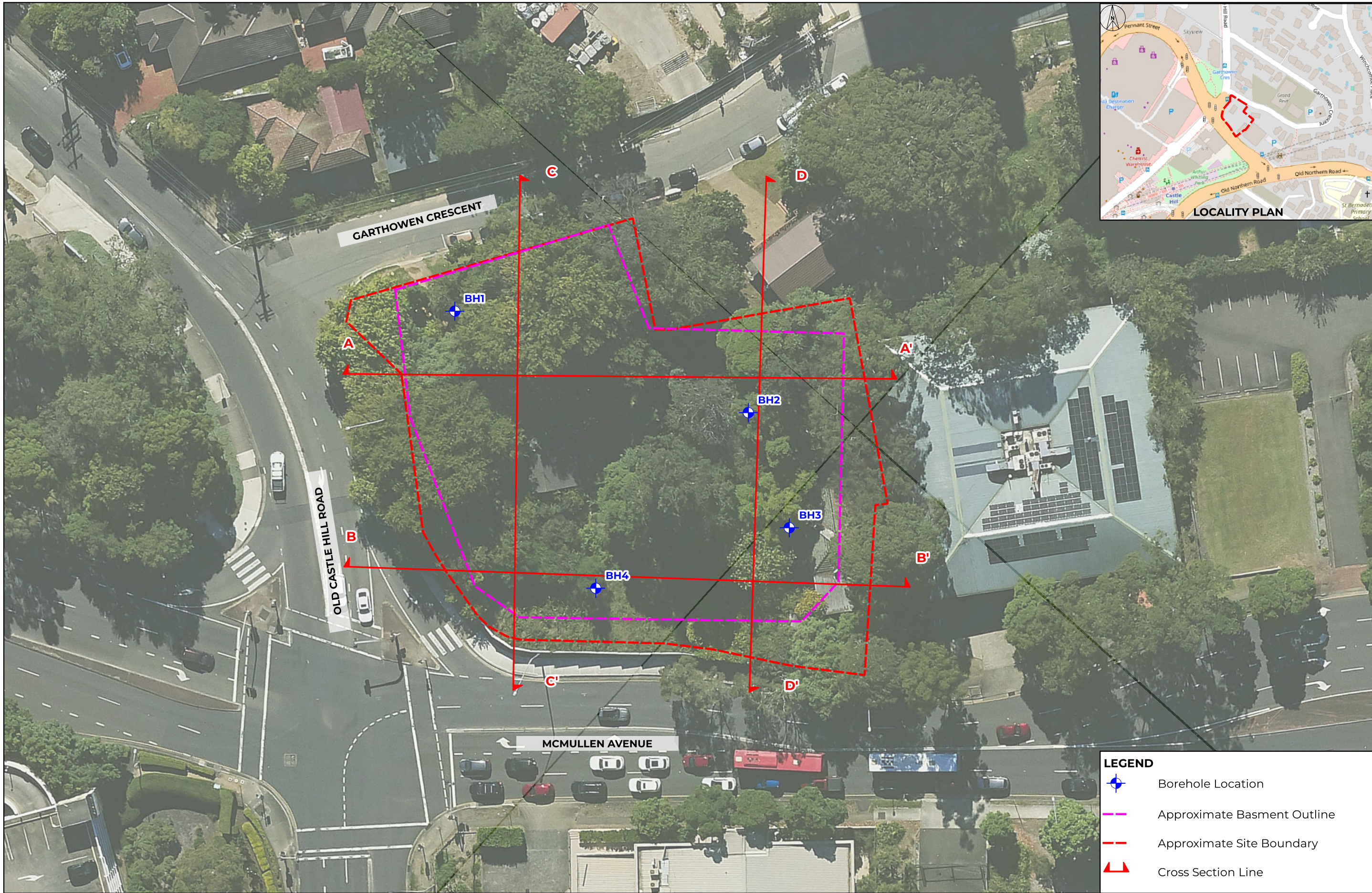
Drawing 1 – Borehole and Cross Section Location Plan

Drawing 2 – Geological Cross Section A-A'

Drawing 3 - Geological Cross Section B-B'

Drawing 4 - Geological Cross Section C-C'

Drawing 5 - Geological Cross Section D-D'



LEGEND

- Borehole Location
- Approximate Basement Outline
- Approximate Site Boundary
- Cross Section Line

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	11.09.2025	MN

SCALE: 0 5 10 15 20 m
1500 @ A3

Douglas
PARTNERS
OFFICE: SYDNEY
96-98 Hermitage Rd, West Ryde NSW 2114
(02)9809 0666

CLIENT:
UPG Castle Corner Ptd Pty

NOTE:
1: Base map from Metromap (Dated 06.04.2025)
2: Basement outline from Studio.SC, Reference No. 20240027, Drawing No. AD-DA11_097 (Dated 21.08.2025)

COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
Residential Development with Affordable Housing
PROJECT ADDRESS:
16-20 Old Castle Hill Road, Castle Hill

DRAWING TITLE:
Test Location Plan

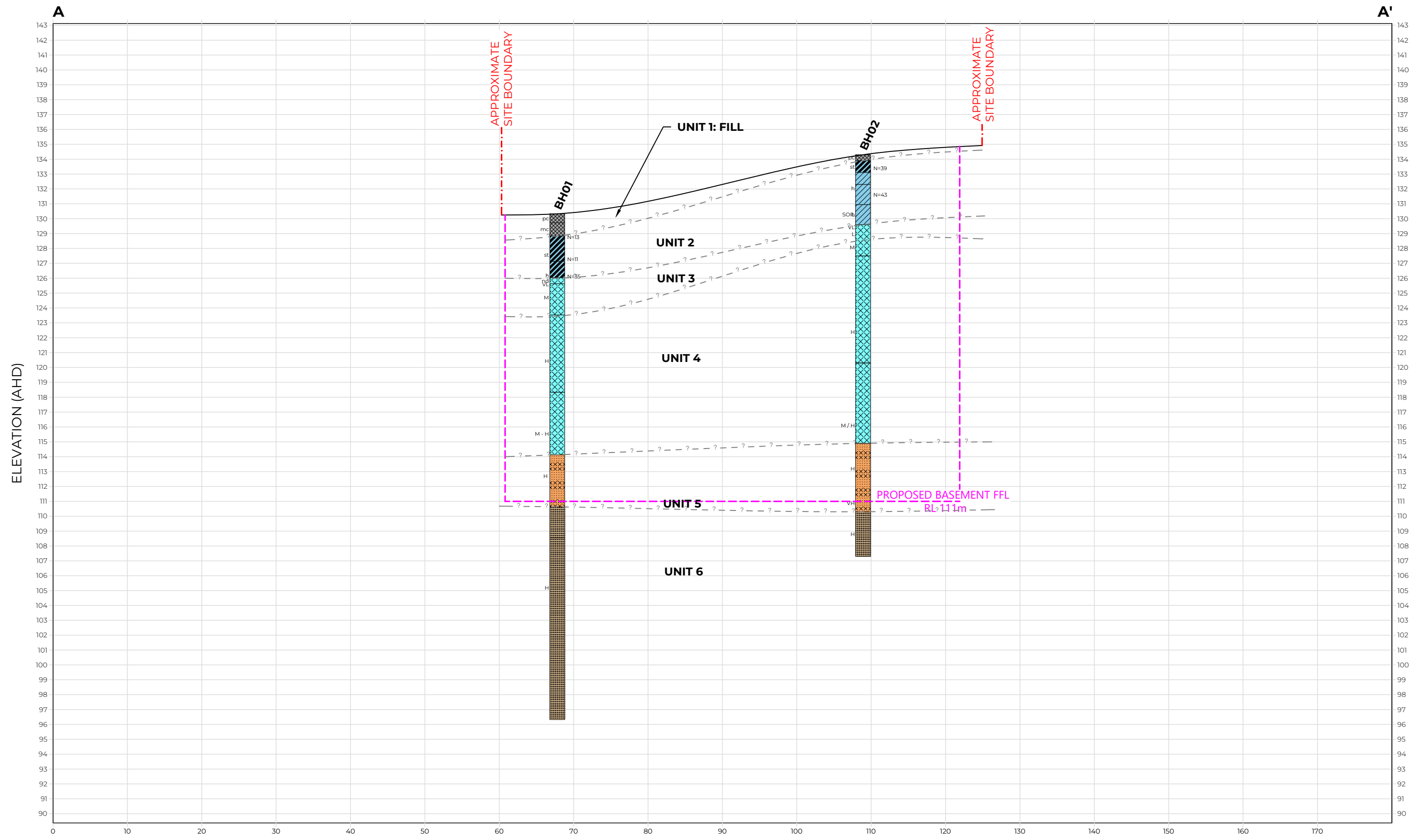
PROJECT NO:
235039.00

DRAWING NO:
1

REVISION:
0

\\dps\hmas02\Projects\235039.00 - CASTLE HILL, 16-20 Old Castle Hill Road\7.0 Drawings\7.3 QGIS\235039.00.00.ggz

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LEGEND		TESTS / OTHER		ROCK STRENGTH		SOIL CONSISTENCY	
CH - High Plasticity CLAY	FILL	SILTSTONE	N - Standard penetration test value	VL - Very Low	vs - Very Soft	na - Not applicable	
CI - Medium Plasticity CLAY	INTERBEDDED SILTSTONE & SANDSTONE		- ? - - - Interpreted geotechnical boundary	L - Low	s - Soft	nd - No data	
CL-CI - Low to Medium Plasticity CLAY	SANDSTONE			M - Medium	f - Firm	pc - Poorly compacted	
				H - High	st - Stiff	mc - Mostly compacted	
				VH - Very High	vst - Very Stiff	wc - Well compacted	
				EH - Extremely High	h - Hard		

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	24.11.2025	MN

SCALE: Horizontal Scale 1:500
Vertical Exaggeration = 2.0

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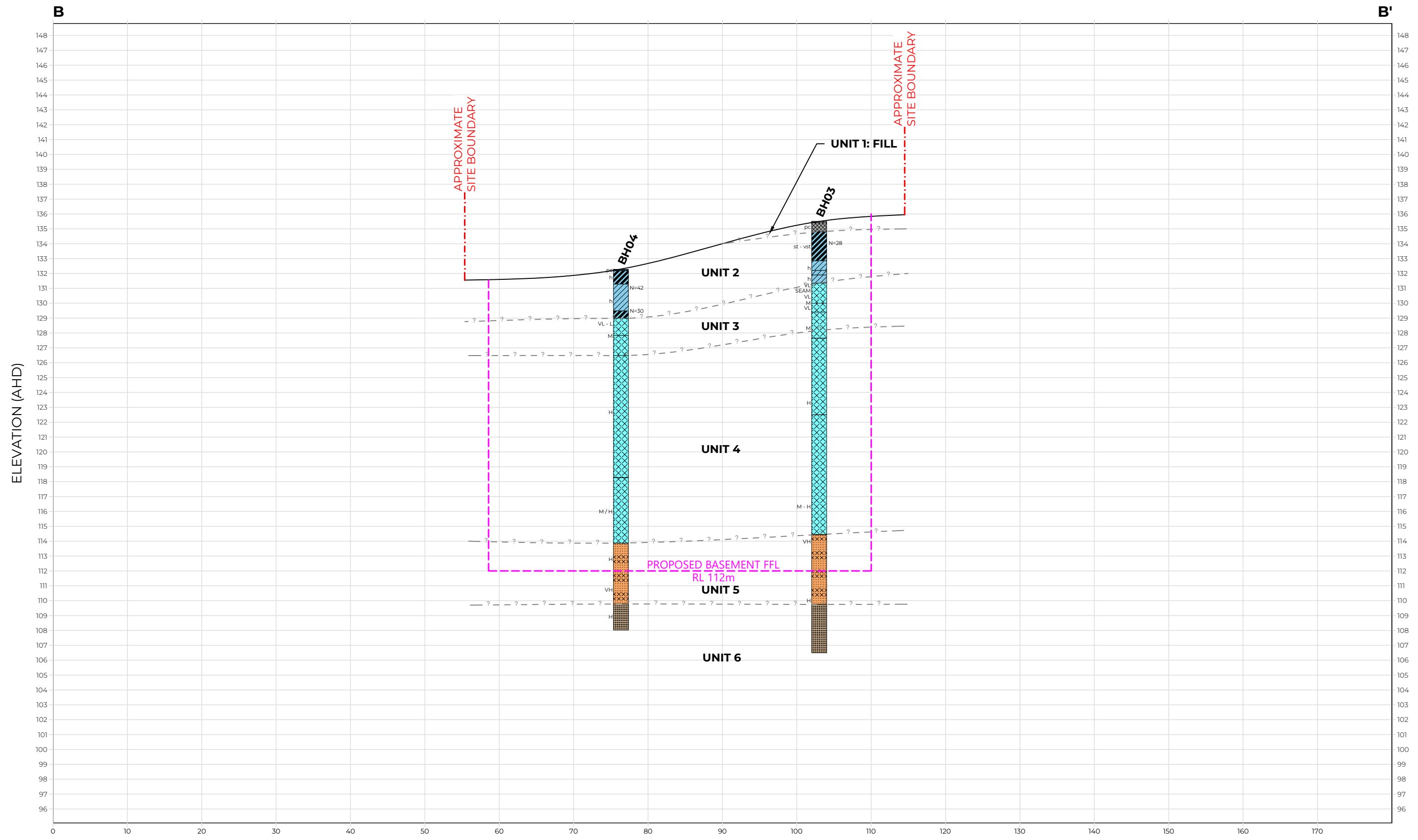
NOTES
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

PROJECT NAME:
Proposed Residential Development with Affordable Housing
PROJECT ADDRESS:
16-20 Old Castle Hill Road, Castle Hill

DRAWING TITLE:
Geological Cross Section A-A'

PROJECT No:	235039.00
DRAWING No:	2
REVISION:	0

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LEGEND 		TESTS / OTHER N - Standard penetration test value - ? - - - Interpreted geotechnical boundary		DISTANCE ALONG PROFILE (m)		ROCK STRENGTH VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High		SOIL CONSISTENCY vs - Very Soft s - Soft f - Firm st - Stiff vst - Very Stiff h - Hard		na - Not applicable nd - No data pc - Poorly compacted mc - Mostly compacted wc - Well compacted	
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REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	12.09.2025	MN

SCALE: Horizontal Scale 1:500
Vertical Exaggeration = 2.0

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NOTES
 1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
 2. Summary logs only and should be read in conjunction with detailed logs.
 3. Horizontal and vertical scales are not equal.

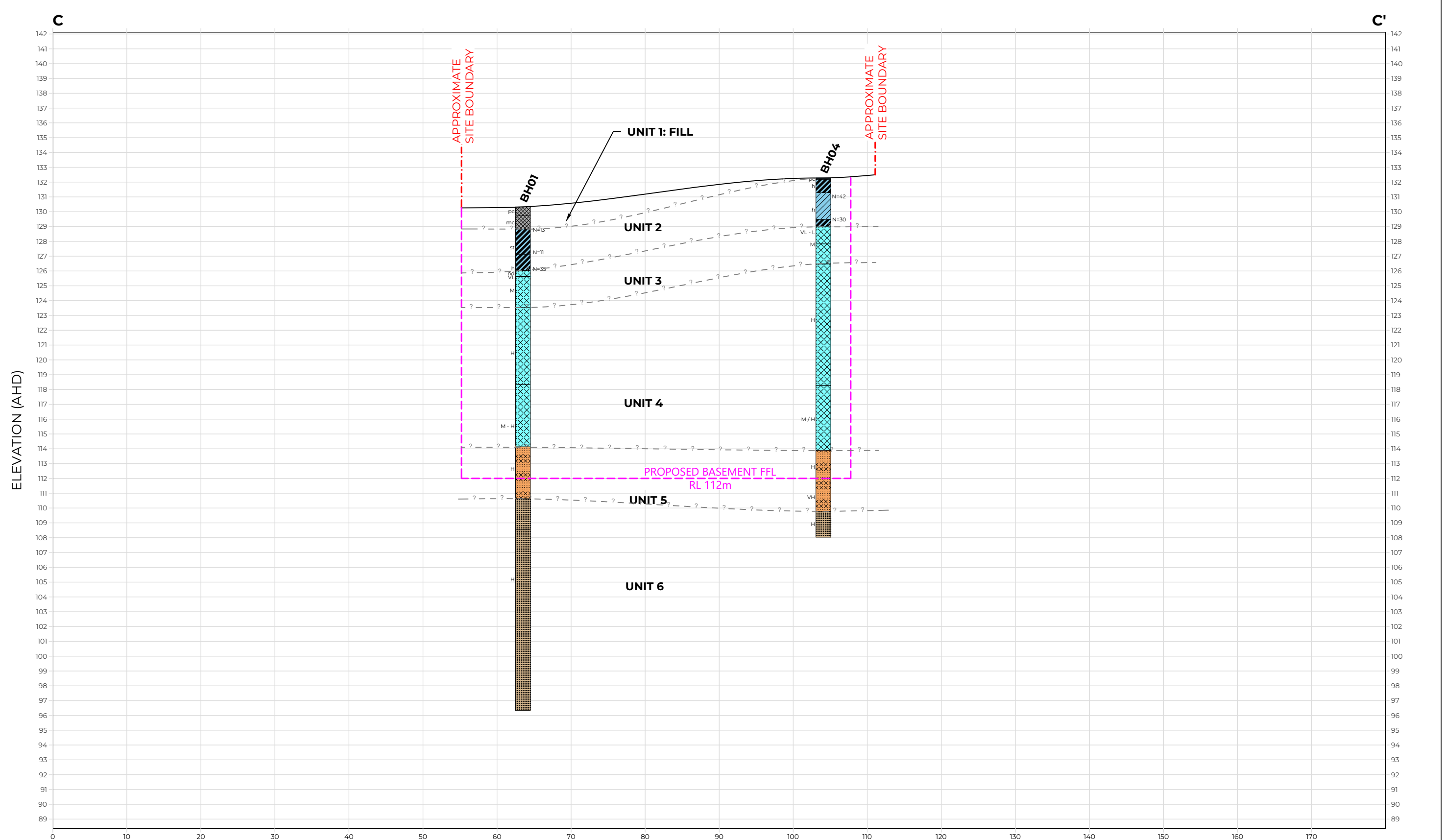
PROJECT NAME:
Proposed Residential Development with Affordable Housing

PROJECT ADDRESS:
16-20 Old Castle Hill Road, Castle Hill

DRAWING TITLE:
Geological Cross Section D-D'

PROJECT No:	235039.00
DRAWING No:	3
REVISION:	0

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LEGEND

TESTS / OTHER
 N - Standard penetration test value
 - ? - - - Interpreted geotechnical boundary

ROCK STRENGTH	SOIL CONSISTENCY	
VL - Very Low	vs - Very Soft	na - Not applicable
L - Low	s - Soft	nd - No data
M - Medium	f - Firm	pc - Poorly compacted
H - High	st - Stiff	mc - Mostly compacted
VH - Very High	vst - Very Stiff	wc - Well compacted
EH - Extremely High	h - Hard	

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	12.09.2025	MN

SCALE:
 Horizontal Scale 1:500
 Vertical Exaggeration = 2.0

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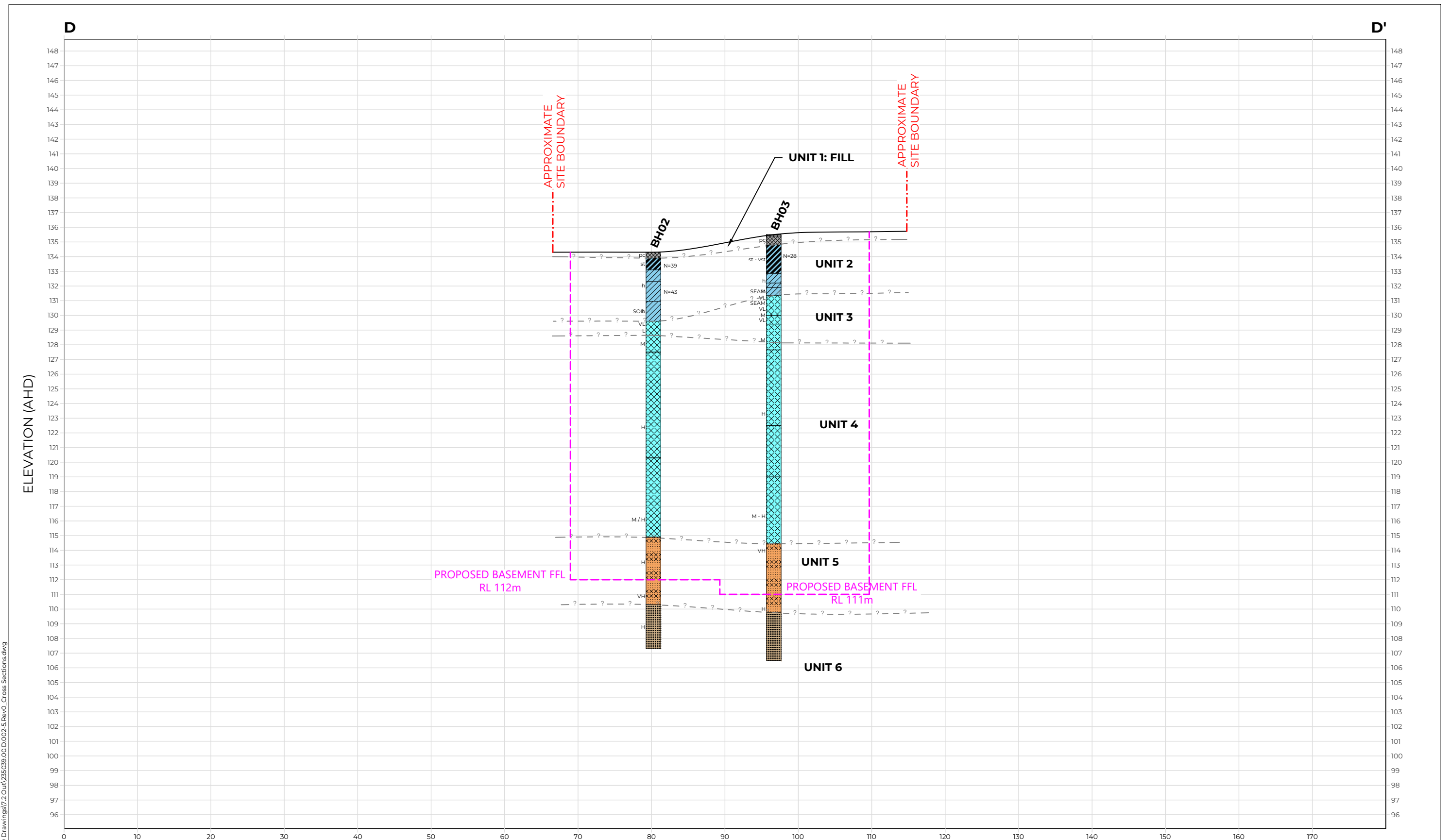
CLIENT:
UPG Castle Corner Ptd Pty

NOTES
 1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
 2. Summary logs only and should be read in conjunction with detailed logs.
 3. Horizontal and vertical scales are not equal.

PROJECT NAME:
Proposed Residential Development with Affordable Housing
 PROJECT ADDRESS:
16-20 Old Castle Hill Road, Castle Hill

DRAWING TITLE:
Geological Cross Section C-C'

PROJECT No:	235039.00
DRAWING No:	4
REVISION:	0



LEGEND

- CH - High Plasticity CLAY
- CI - Medium Plasticity CLAY
- CL-CI - Low to Medium Plasticity CLAY
- FILL
- INTERBEDDED SILTSTONE & SANDSTONE
- SANDSTONE
- SILTSTONE

TESTS / OTHER

- N - Standard penetration test value
- ? - - Interpreted geotechnical boundary

DISTANCE ALONG PROFILE (m)

ROCK STRENGTH

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

SOIL CONSISTENCY

- vs - Very Soft
- s - Soft
- f - Firm
- st - Stiff
- vst - Very Stiff
- h - Hard

- na - Not applicable
- nd - No data
- pc - Poorly compacted
- mc - Mostly compacted
- wc - Well compacted

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	Initial Issue	02.12.2025	MN

SCALE: 0 10
Horizontal Scale 1:500
Vertical Exaggeration = 2.0

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CLIENT:
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NOTES
1. Subsurface conditions are accurate at the borehole locations only. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only and should be read in conjunction with detailed logs.
3. Horizontal and vertical scales are not equal.

PROJECT NAME:
Proposed Residential Development with Affordable Housing
PROJECT ADDRESS:
16-20 Old Castle Hill Road, Castle Hill

DRAWING TITLE:
Geological Cross Section D-D'

PROJECT No:	235039.00
DRAWING No:	5
REVISION:	0

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Appendix C

Borehole Logs (BH01, BH02, BH03 and BH04)



Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style **XW**. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

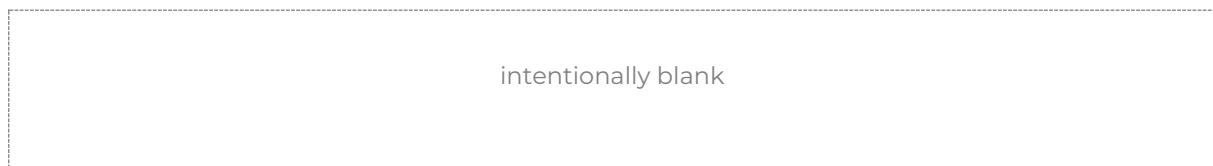
Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	KL
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	UK
No data	Information required to allow classification of the property was not available. For example if drilling is commenced from the base of a hole predrilled by others	ND
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example providing a description of the strength of a concrete pavement	NA

Graphic Symbols

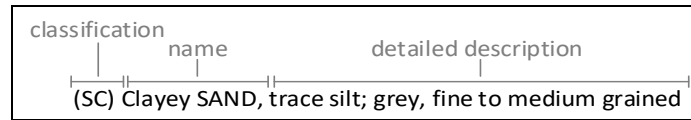
Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.





Introduction

All materials which are not considered to be “in-situ rock” are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:



The “classification” comprises a two character “group symbol” providing a general summary of dominant soil characteristics. The “name” summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either “fine grained” (also known as “cohesive” behaviour) or “coarse grained” (“non cohesive” behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as “oversize”	
Cobble	63 - 200		
Gravel ¹	2.36 - 63	Coarse	>65%
Sand ¹	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

¹ – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer “component proportions” below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a “Sandy CLAY”, this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a “primary”, “secondary”, or “minor” component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition ¹	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor ²	Present in the soil, but not significant to its engineering properties	All other components	All other components

¹ As defined in AS1726-2017 6.1.4.4

² In the detailed material description, minor components are split into two further sub-categories. Refer “identification of minor components” below.

Composite Materials

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, “INTERBEDDED Silty CLAY AND SAND”.

Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component ¹	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

¹ – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type	Particle size (mm)	
	Gravel	Coarse
	Medium	6.7 - 19
	Fine	2.36 - 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code **NDF**, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example **(VS)**.

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as “extremely weathered material” in reports and by the abbreviation code **XWM** on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than ‘very low’ as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Fluvial	Deposited by channel fill and overbank (natural levee, crevasse splay or flood basin)	FLV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be “oversize” may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with “MIXTURE OF”.

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Rock Strength

Rock strength is defined by the unconfined compressive strength, and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $I_{s(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Unconfined Compressive Strength (MPa)	Point Load Index ¹ $I_{s(50)}$ MPa	Abbreviation Code
Very low	0.6 - 2	0.03 - 0.1	VL
Low	2 - 6	0.1 - 0.3	L
Medium	6 - 20	0.3 - 1.0	M
High	20 - 60	1 - 3	H
Very high	60 - 200	3 - 10	VH
Extremely high	>200	>10	EH

¹ Rock strength classification is based on UCS. The UCS to $I_{s(50)}$ ratio varies significantly for different rock types and specific ratios may be required for each site. The point load Index ranges shown above are as suggested in AS1726 and should not be relied upon without supporting evidence.

The following abbreviation codes are used for soil layers or seams of material “within rock” but for which the equivalent UCS strength is less than 0.6 MPa.

Scenario	Abbreviation Code
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The properties of the material encountered over this interval are described in the “Description of Strata” and soil properties columns.	SOIL
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The prominence of the material is such that it can be considered to be a seam (as defined in Table 22 of AS1726-2017) and the properties of the material are described in the defect column.	SEAM

Degree of Weathering

The degree of weathering of rock is classified as follows:

Weathering Term	Description	Abbreviation Code
Residual Soil ¹	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.	RS
Extremely weathered ¹	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible	XW
Highly weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.	HW
Moderately weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MW
Slightly weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.	SW
Fresh	No signs of decomposition or staining.	FR
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.	DW

¹ The parent rock type, of which the residual/extremely weathered material is a derivative, will be stated in the description (where discernible).

Degree of Alteration

The degree of alteration of the rock material (physical or chemical changes caused by hot gasses or liquids at depth) is classified as follows:

Term	Description	Abbreviation Code
Extremely altered	Material is altered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.	XA
Highly altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be increased by leaching or may be decreased due to precipitation of secondary materials in pores.	HA
Moderately altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MA
Slightly altered	Rock is slightly discoloured but shows little or no change of strength from fresh rock	SA
Note: If HA and MA cannot be differentiated use DA (see below)		
Distinctly altered	Rock strength usually changed by alteration. The rock may be highly discoloured, usually by staining or bleaching. Porosity may be increased by leaching or may be decreased due to precipitation of secondary minerals in pores.	DA

Degree of Fracturing

The following descriptive classification apply to the spacing of natural occurring fractures in the rock mass. It includes bedding plane partings, joints and other defects, but excludes drilling breaks. These terms are generally not required on investigation logs where fracture spacing is presented as a histogram, and where used are presented in an unabbreviated format.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$RQD \% = \frac{\text{cumulative length of 'sound' core sections} > 100 \text{ mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e., drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

These terms may be used to describe the spacing of bedding partings in sedimentary rocks. Where used, these terms are generally presented in an unabbreviated format

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Defect Descriptions

Defect Type

Term	Abbreviation Code
Bedding plane	B
Cleavage	CL
Crushed seam	CS
Crushed zone	CZ
Drilling break	DB
Decomposed seam	DS
Drill lift	DL
Extremely Weathered seam	EW
Fault	F
Fracture	FC
Fragmented	FG
Handling break	HB
Infilled seam	IS
Joint	JT
Lamination	LAM
Shear seam	SS
Shear zone	SZ
Vein	VN
Mechanical break	MB
Parting	P
Sheared Surface	S

Rock Defect Orientation

Term	Abbreviation Code
Horizontal	H
Vertical	V
Sub-horizontal	SH
Sub-vertical	SV

Rock Defect Coating

Term	Abbreviation Code
Clean	CN
Coating	CT
Healed	HE
Infilled	INF
Stained	SN
Tight	TI
Veneer	VNR

Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLAY
Iron oxide	FE
Manganese	MN
Pyrite	Py
Secondary material	MS
Silt	M
Quartz	Qz
Unidentified material	MU

Rock Defect Shape/Planarity

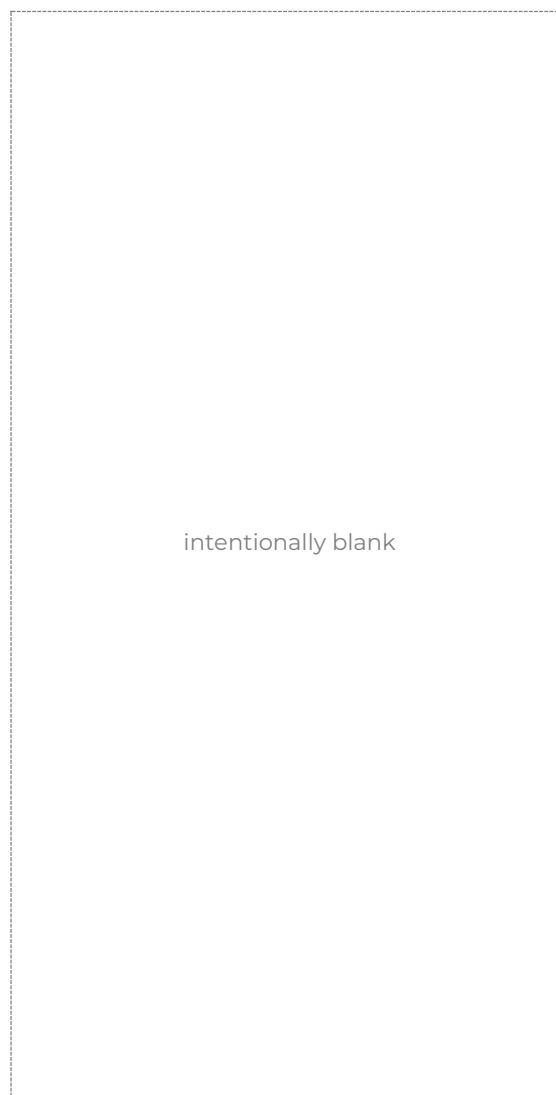
Term	Abbreviation Code
Curved	CU
Discontinuous	DIS
Irregular	IR
Planar	PR
Stepped	ST
Undulating	UN

Rock Defect Roughness

Term	Abbreviation Code
Polished	PO
Rough	RF
Smooth	SM
Slickensided	SL
Very rough	VR

Defect Orientation

The inclination of defects is always measured from the perpendicular to the core axis.





Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing appearing to the right of the scale, as illustrated below:

SAMPLE			DEPTH (m)	TESTING	
SAMPLE REMARKS	TYPE	INTERVAL		TEST TYPE	RESULTS AND REMARKS
	SPT		1.0 1.45	SPT	4,9,11 N=20

Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Acid Sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Environmental sample	ES
Driven Tube sample	DT
Gas sample	G
Piston sample	P
Sample from SPT test	SPT
Undisturbed tube sample	U ¹
Water sample	W
Material Sample	MT
Core sample for unconfined compressive strength testing	UCS

¹ – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y = x blows for y mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V

Unconfined compressive strength, (MPa)	UCS
--	-----

Field and laboratory testing (continued)

Test Type	Code
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(L)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP9/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150

Groundwater Observations

▷	seepage/inflow
▽	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Direct Push	DP
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD ¹
Air Track	AT
Diatube	DT ¹
Hand auger	HA ¹
Hand tools (unspecified)	HAND
Existing exposure	X
Hollow flight auger	HSA ¹
HQ coring	HQ3
HMLC series coring	HMLC
NMLC series coring	NMLC
NQ coring	NQ3
PQ coring	PQ3
Predrilled	PD
Push tube	PT ¹
Ripping tyne/ripper	R
Rock roller	RR ¹
Rock breaker/hydraulic hammer	EH
Sonic drilling	SON ¹
Mud/blade bucket	MB ¹
Toothed bucket	TB ¹
Vibrocore	VC ¹
Vacuum excavation	VE
Wash bore (unspecified bit type)	WB ¹

¹ – numeric suffixes indicate tool diameter/width in mm

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 1 of 5

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS					
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°) DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
130	0.60	FILL / Sandy CLAY trace gravel: pale grey and grey-brown; low to medium plasticity; fine sand.		FILL	(PC)			A	0.10 - 0.20					
	1	FILL / CLAY trace silt trace gravel: pale grey-brown; low to medium plasticity; ironstone gravel.		FILL	(MC)	M		A	0.40 - 0.50					
	1.50	CLAY (CH): pale grey; high plasticity.						A	0.90 - 1.00	PP	500kPa			
	2							U50	1.40					
	2			RS	St	w=PL		SPT	1.90 - 2.00	SPT	4,5,8 N=13			
	3							A	2.50	PP	200kPa			
	3.20	CLAY (CH): mottled red-brown and pale grey; high plasticity.		RS				U50	2.90 - 3.00					
	4							A	3.35	SPT	2,4,7 N=11			
	4.30	SILTSTONE: grey-brown; distinctly weathered; very low strength. Ashfield Shale.			ND	NA		SPT	4.00 - 4.45	SPT	6,15,20 N=35			
	4.70	Continued as rock log												
	5													
	6													
	7													
	8													
	9													

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 2 of 5

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
130	1													1				
129	2													2				
128	3													3				
127	4													4				
126	5	Continued from soil log SILTSTONE: grey and brown, laminated; 25% fine sandstone interlaminated with 75% siltstone; fractured. Ashfield Shale.			4.70 4.80	VL	100	75		4.70-4.80m: B x3, 0-5°, CT Clay, 1-2mm				5	PLT	PL(A)=0.76MPa		
125	6					M	100	93		5.25m: JT, 85°, PR, CN, RF, SV 5.70m: JT, 45°, UN, SN Fe, RF 5.93m: JT, 30°, PR, CN, RF				6	PLT	PL(A)=0.37MPa		
124	7	SILTSTONE: pale grey and grey, laminated; 10% fine grained sandstone laminations. Ashfield Shale.			6.50 6.80		100	100		6.00m: JT, 45°, PR, SN Fe, RF 6.15m: JT, 80°, UN, CN, RF 6.25m: JT, 45-85°, ST, SN Fe, RF 6.40m: JT, 30°, UN, CN, RF 6.50-6.80m: B x3, 0°, SN Fe 6.80m: B, 0°, CT Clay 5mm				7	PLT	PL(A)=1.3MPa		
123	8						100	100		7.67m: F, 45°, TI 7.80m: JT, 45°, TI				8	PLT	PL(A)=1.8MPa		
122	9					H				8.10m: JT, 60°, TI				9	PLT	PL(A)=2.4MPa		
121							100	100										

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m



Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 3 of 5

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
	12.0	[CONT] SILTSTONE: pale grey and grey, laminated; 10% fine grained sandstone laminations. Ashfield Shale.								10.02m: JT, 50°, PR, CN, SM					PLT	PL(A)=1.8MPa		
	11						100	100							PLT	PL(A)=2.3MPa		
	12.00	SHALE: grey; trace fine sandstone laminations. Ashfield Shale.								11.75-11.85m: JT, 70°, PR, CN, SM					PLT	PL(A)=1.1MPa		
	13						100	100		12.10m: JT, 80°, UN, CN, RF					PLT	PL(A)=2.2MPa		
	14									13.25m: JT, 45-70°, CU, TI					PLT	PL(A)=0.83MPa		
	15			FR			100	100		13.35m: JT, 45-80° 13.52m: JT, 60°, UN, CN, RF					PLT	PL(A)=0.97MPa		
	16.20	INTERBEDDED SILTSTONE AND SANDSTONE: SILTSTONE: grey and pale grey; 50% interbedded and laminated with 50% siltstone SANDSTONE: fine grained. Mittagong Formation.					100	100		14.52m: JT, 45°, PR, CN, SM					PLT	PL(A)=1.6MPa		
	17									15.30m: JT, 45°, PR, CN, SM					PLT	PL(A)=1.6MPa		
	18									15.85m: JT, 85°, PR, CN, SM					PLT	PL(A)=2.1MPa		
	19						100	100		18.10-18.13m: DS					PLT	PL(A)=2.0MPa		
	19.70									19.70-19.73m: FG, 0°, 30mm					PLT	PL(A)=2.2MPa		

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 4 of 5

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
110	21	SANDSTONE: fine grained, laminated; 20% siltstone laminations; cross bedded. Mittagong Formation.								20.80m: B, 0°, CT Clay 5mm				21	PLT	PL(A)=2.0MPa		
109	22	SANDSTONE: medium to coarse grained, 10 to 20°; cross bedded. Hawkesbury Sandstone.								21.80m: B, 10°, PR, VNR Clay				22	PLT	PL(A)=1.1MPa		
108	23													23	PLT	PL(A)=1.2MPa		
107	24									23.75m: B, 15°, PR, VNR Clay				24	PLT	PL(A)=1.2MPa		
106	25			FR										25	PLT	PL(A)=1.4MPa		
105	26													26	PLT	PL(A)=1.2MPa		
104	27									26.60m: B, 10°, CT CBS 1mm				27	PLT	PL(A)=1.3MPa		
103	28													28	PLT	PL(A)=1.3MPa		
102	29													29	PLT	PL(A)=1.5MPa		
101										29.50m: B, 0°, 5mm, siltstone fragments					PLT	PL(A)=1.7MPa		

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 5 of 5

CONDITIONS ENCOUNTERED										SAMPLE			TESTING								
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	SOIL STRENGTH (Where encountered) SOIL MOISTURE	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		BACKFILL	WELL PIPE	
																	RESULTS AND REMARKS	RESULTS AND REMARKS			
100		[CONT] SANDSTONE: medium to coarse grained, 10 to 20°; cross bedded. Hawkesbury Sandstone.						100	100												
99	31															PLT	PL(A)=1.1MPa				
98	32				FR		H		100	100							PLT	PL(A)=1.4MPa			
97	33																PLT	PL(A)=1.8MPa			
	34	Borehole discontinued at 34.00m depth. Target depth reached.																			
96																					
95																					
94																					
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NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 4m, then WB to 4.7m, then HQ3 to 34m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 4.7m

Refer to explanatory notes for symbol and abbreviation definitions

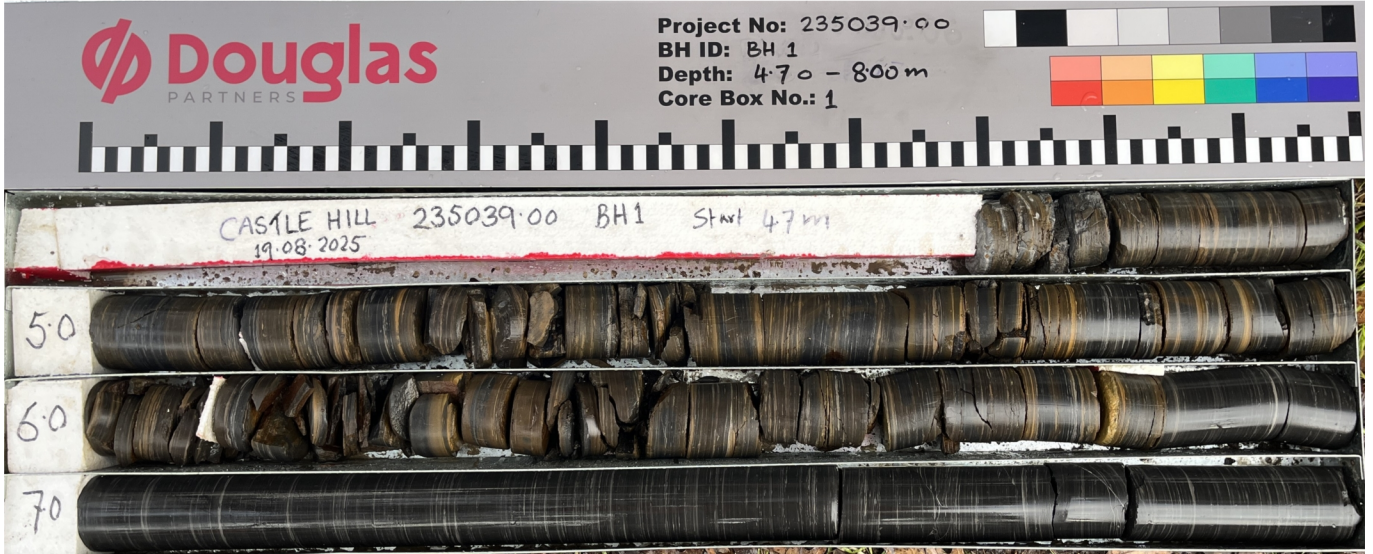


CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 1 of 4



4.70-8.00 m depth



8.00-12.00 m depth

CORE PHOTO LOG

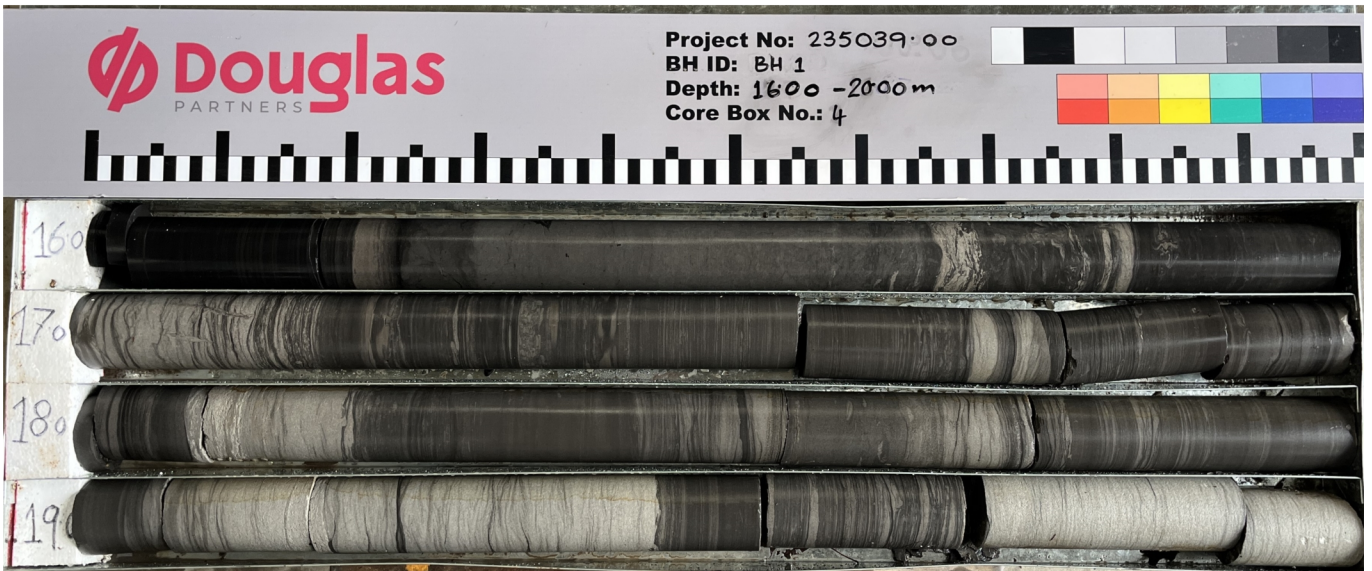
CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 2 of 4



12.00-16.00 m depth



16.00-20.00 m depth

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 3 of 4



20.00-24.00 m depth



24.00-28.00 m depth

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 130.3 AHD
COORDINATE: E:315564.1, N:6266019.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH01
PROJECT No: 235039.00
DATE: 19/08/25 - 20/08/25
SHEET: 4 of 4



28.00-32.00 m depth



32.00-34.00 m depth

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 1 of 4

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS					
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY (%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
134.4	0.40	FILL / Sandy CLAY: grey-brown; medium plasticity; fine sand; trace of concrete bricks and tree roots.		FILL	(PC)	M		A	0.10 - 0.20					
	0.40 - 0.50	CLAY (CH): red-brown and pale grey; high plasticity.		RS	St	w=PL		A	0.40 - 0.50		PP	180kPa		
	0.50 - 0.90							U50	0.50 - 0.90					
	0.90 - 1.00							A	0.90 - 1.00					
	1.00 - 1.45	CLAY (CI) trace gravel: pale grey-brown; medium plasticity; ironstone gravel.		RS				SPT	1.00 - 1.45		SPT	5,15,24 N=39		
	1.45 - 1.90													
	1.90 - 2.00							A	1.90 - 2.00					
	2.00 - 2.50	CLAY (CL-CI): pale grey and brown; low to medium plasticity; ironstone bands; extremely weathered shale / siltstone.		RS	H	w<PL								
	2.50 - 2.95							SPT	2.50 - 2.95		SPT	8,18,25 N=43		
	2.95 - 3.35	Continued as rock log												
	3.35 - 4.0													
	4.0 - 5.0													
	5.0 - 6.0													
	6.0 - 7.0													
	7.0 - 8.0													
	8.0 - 9.0													
	9.0 - 10.0													

NOTES: #Soil origin is "probable" unless otherwise stated. %Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Comacchio Geo 305

OPERATOR: Ground Test (LC)

LOGGED: S. Islam

METHOD: AD/T to 2.5m, then WB to 3.35m, then HQ3 to 27m

CASING: HW to 3.3m

REMARKS:

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 2 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING						
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	SOIL STRENGTH (where encountered)	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
RL (m)					RS XW HW MW FR														
	134																		
	133																		
	132																		
	131	Continued from soil log CLAY (CL-CI): [AS ABOVE].																	
	130				XW		SOIL	100	0	SOIL									
	129				HW	4.70	VL				4.70-5.05m: B x6, 0-5°, CT Clay, 1-5mm; SN; Fe					PLT	PL(A)=0.15MPa		
	128				MW	5.05	L	100	80		5.30m: JT, 45°, PR, SN Fe, SM 5.45m: JT, 25°, HE 5.60m: JT, 30°, PR, SN Fe, VR 5.65m: B, 0°, CT Clay 2mm					PLT	PL(A)=0.46MPa		
	127				FR	6.85		100	100		6.75m: JT, 40°, PR, CN, SM 6.85m: JT, 45°, PR, CT Clay, RF					PLT	PL(A)=1.7MPa		
	126										8.10m: JT x2, 30-80°, ST, CN, RF 8.15m: JT, 35°, PR, CN, RF					PLT	PL(A)=1.7MPa		
	125										8.60m: JT, 70°, TI 8.70m: JT, 45°, TI					PLT	PL(A)=1.9MPa		
											9.40m: JT, 45°, PR, CN, SM 9.67m: JT, 30°, TI					PLT	PL(A)=1.7MPa		

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.35m, then HQ3 to 27m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 3 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING							
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE		
RL (m)	124	[CONT] INTERLAMINATED SILTSTONE (70%) AND SANDSTONE (LAMINITE) (30%): SILTSTONE: pale grey and grey, laminated; approximately 30% fine sandstone interlaminated with 70% siltstone SANDSTONE (LAMINITE). Ashfield Shale.		FR	11	H	100	100	10.68-10.85m: JT, 80°, PR, CN, SM					11	PLT	PL(A)=1.5MPa				
123	12																		PLT	PL(A)=1.6MPa
122	13	SHALE: grey, indistinct, bedded. Ashfield Shale.		FR	13	H	100	100	13.60m: JT, 50°, HE CA, Si					14	PLT	PL(A)=1.2MPa				
121	14																		PLT	PL(A)=1.2MPa
120	15																		PLT	PL(A)=1.2MPa
119	16			FR	16	H	100	100	14.60m: JT, 30°, PR, CN, SM					15	PLT	PL(A)=1.2MPa				
118	17																		PLT	PL(A)=1.2MPa
117	17			FR	17	H	100	100	15.35m: JT, 45°, PR, CN, SM					16	PLT	PL(A)=1.2MPa				
116	18			FR	18	M			16.10m: B, 0°, 2mm, ash					17	PLT	PL(A)=1.2MPa				
115	19			FR	19	H	100	100	16.66m: JT, 30°, PR, CN, SM					18	PLT	PL(A)=0.90MPa				
19.40	19.40			FR	19.40	H			16.66m: JT, 30°, PR, CN, SM					19	PLT	PL(A)=0.77MPa				
				FR		H			19.25m: JT, 40°, PR, CN, SM						PLT	PL(A)=0.81MPa				
				FR		H									PLT	PL(A)=1.6MPa				

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305

OPERATOR: Ground Test (LC)

LOGGED: S. Islam

METHOD: AD/T to 2.5m, then WB to 3.35m, then HQ3 to 27m

CASING: HW to 3.3m

REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 4 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING							
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	SOIL STRENGTH (Where encountered) SOIL MOISTURE	GRAPHIC	WEATH. LRS XW HW SW FR	DEPTH (m)	STRENGTH VL L M H VH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		BACKFILL	WELL PIPE
																	RESULTS AND REMARKS	RESULTS AND REMARKS		
114	21	INTERBEDDED SANDSTONE AND SILTSTONE: pale grey and grey; interbedded and laminated; approximately 60% fine grained sandstone interbedded / laminated with 40% siltstone. Mittagong Formation.						100	100		20.25m: JT, 25°, PR, CN, SM				20.25	PLT	PL(A)=2.7MPa			
113	22														21	PLT	PL(A)=0.96MPa			
112	23								100	100						22	PLT	PL(A)=2.5MPa		
111	23.85															23	PLT	PL(A)=3.1MPa		
110	24.00	SANDSTONE: pale grey, medium to coarse grained; trace of carbonaceous laminations; cross bedded (10°-25°). Hawkesbury Sandstone.			FR		VH				23.70-23.83m: JT, 70-80°, CU, CN, RF				24.00	PLT	PL(A)=1.3MPa			
109	25														25	PLT	PL(A)=1.9MPa			
108	26							H	100	100						26	PLT	PL(A)=2.1MPa		
107	27		Borehole discontinued at 27.00m depth. Target depth reached.																	

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.35m, then HQ3 to 27m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions



CORE PHOTO LOG

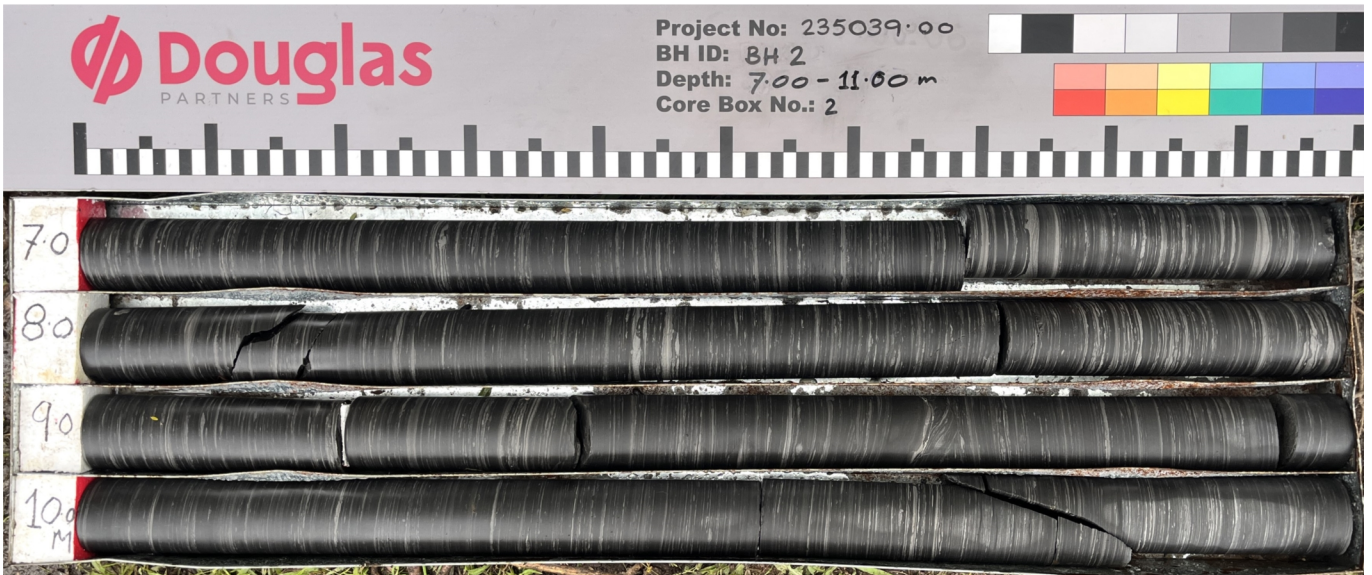
CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 1 of 3



3.35-7.00 m depth



7.00-11.00 m depth

CORE PHOTO LOG

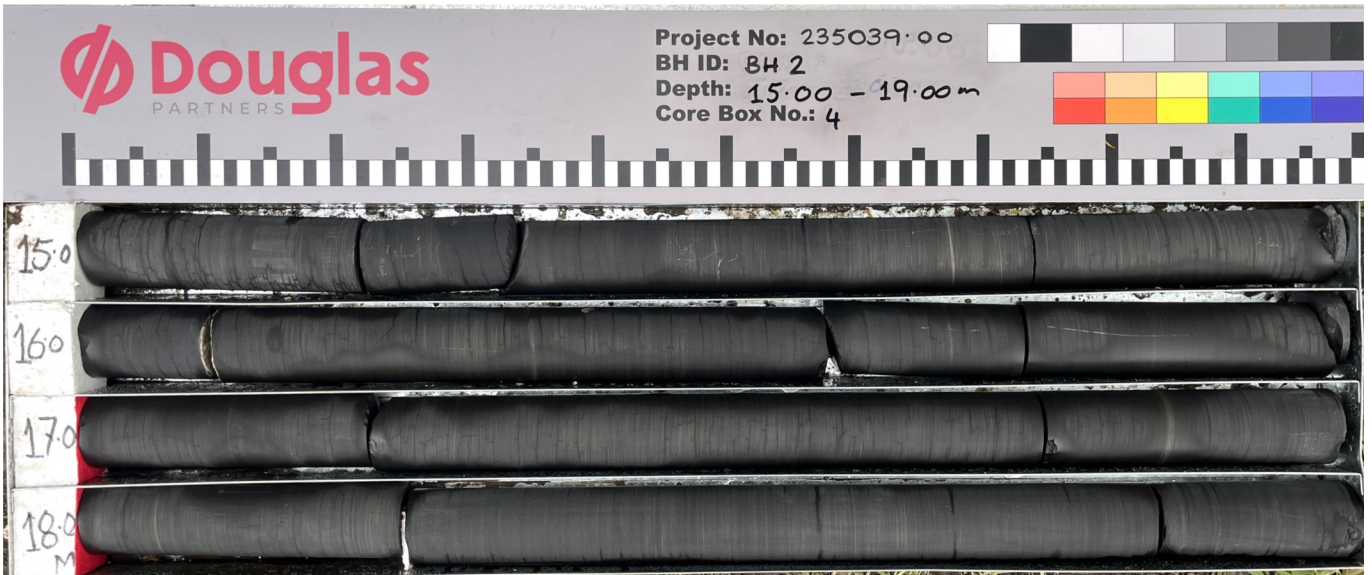
CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 2 of 3



11.00-15.00 m depth



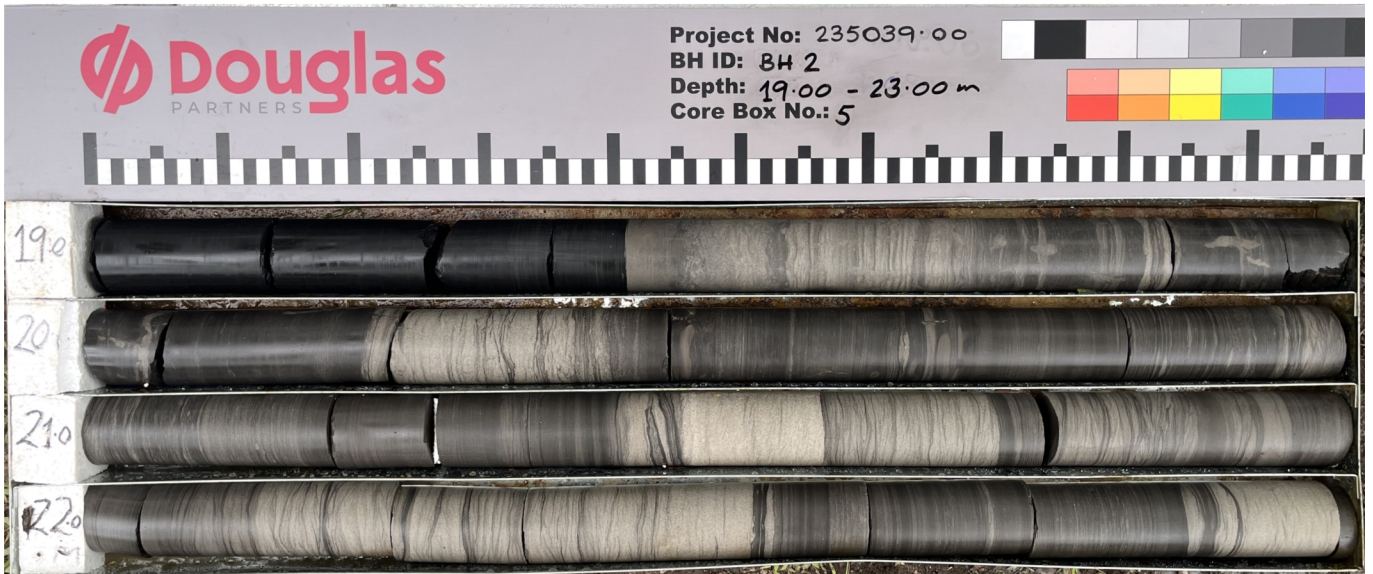
15.00-19.00 m depth

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 134.3 AHD
COORDINATE: E:315580.9, N:6265979.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH02
PROJECT No: 235039.00
DATE: 26/08/25
SHEET: 3 of 3



19.00-23.00 m depth



23.00-27.00 m depth

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 1 of 4

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE			TESTING AND REMARKS			
		RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (%) DENSITY, (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE
22/08/25 No Free Groundwater Observed Whilst Augering	0.10	0.10	FILL / GRAVEL; fine to medium, sub-angular to rounded, river gravel.	FILL	FILL	(PC)	M		A	0.10 - 0.20			
	0.70	0.40	FILL / Silty CLAY trace sand trace gravel: grey to dark grey; fine sand; fine to medium, igneous gravel.	FILL	FILL	(PC)	M		A	0.40 - 0.50			
	1	0.90	CLAY (CH): pale grey and brown; high plasticity.	CH	RS	St - VSt	w=PL		A	0.90 - 1.00			
	2	1.40							U50	1.40 - 1.50	PP	320kPa	
	2	1.50							SPT	1.50 - 1.95	SPT	7,11,17 N=28	
	2.65	2.50	CLAY (CI) with gravel: pale grey-brown; medium plasticity; ironstone gravel; Extremely weathered siltstone.	CI	RS	H	w<PL		SPT	2.50 - 2.85	SPT	7,25,25/50 R	
	3	2.85											
	3.30	3	CLAY (CL-CI) with gravel: pale grey and brown; low to medium plasticity; ironstone gravel; Extremely weathered siltstone.	CL-CI	RS	H	w<PL						
	3.60	3											
	4	4	Continued as rock log										

NOTES: #Soil origin is "probable" unless otherwise stated. %Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Comacchio Geo 305

OPERATOR: Ground Test (LC)

LOGGED: S. Islam

METHOD: AD/T to 2.5m, then WB to 3.6m, then HQ3 to 29m

CASING: HW to 3m

REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 2 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING					
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
RL (m)																		
135	1																	
134	2																	
133	3																	
132	4	Continued from soil log																
131	4.15	CLAY (CL-CI) with gravel: pale grey and brown; low to medium plasticity; ironstone gravel; Extremely weathered siltstone.		XW	3.60	SEAM				SEAM								
	4.45			HW	4.15	VL												
	4.90	SILTSTONE: pale grey and grey-brown, indistinct, bedded; 30% clay; fractured. Ashfield Shale.		XW	4.45	SEAM				SEAM								
	5.20			HW	4.90	VL	100	26										
	5.50	SILTSTONE: brown, indistinct, bedded. Ashfield Shale.		MW	5.20	M									PLT	PL(A)=0.27MPa		
	6.10	SILTSTONE: grey; trace of fine sandstone laminations. Ashfield Shale.			5.80													
	6.10				6.10										PLT	PL(A)=0.41MPa		
	7.10				7.10										PLT	PL(A)=0.83MPa		
	7.85	INTERLAMINATED SILTSTONE AND SANDSTONE (LAMINITE): SILTSTONE : pale grey and grey, laminated; approximately 30% fine sandstone interlaminated with 70% siltstone SANDSTONE (LAMINITE). Ashfield Shale.		FR	7.85	H	100	100							PLT	PL(A)=0.91MPa		
	9				9										PLT	PL(A)=1.4MPa		
															PLT	PL(A)=1.1MPa		

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.6m, then HQ3 to 29m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 3 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING								
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	SOIL STRENGTH (Where encountered)	SOIL MOISTURE	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE	
	11.25	[CONT] INTERLAMINATED SILTSTONE AND SANDSTONE (LAMINITE); SILTSTONE : pale grey and grey, laminated; approximately 30% fine sandstone interlaminated with 70% siltstone SANDSTONE (LAMINITE). Ashfield Shale.															11	PLT	PL(A)=1.5MPa		
	12.4									100	100							12	PLT	PL(A)=1.2MPa	
	13.00	SILTSTONE: grey; trace of fine sandstone laminations (approximately 10%). Ashfield Shale.															13	PLT	PL(A)=1.3MPa		
	14.2									100	100							14	PLT	PL(A)=1.1MPa	
	15.0	SHALE: grey, indistinct, bedded. Ashfield Shale.				FR											15	PLT	PL(A)=2.2MPa		
	16.50												15.40-15.48m: F, 45°, HE				16	PLT	PL(A)=2.1MPa		
	17.0								100	100							17	PLT	PL(A)=1.1MPa		
	18.0						17.30					17.45m: JT, 80°, PR, Py, SM, (17.32-17.60mm)					18	PLT	PL(A)=0.84MPa		
	19.0								100	95		19.10m: JT, 50°, PR, CN, SM					19	PLT	PL(A)=1.1MPa		
	19.85-19.98m											19.85-19.98m: JT, 75°, PR,						PLT	PL(A)=0.89MPa		

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305

OPERATOR: Ground Test (LC)

LOGGED: S. Islam

METHOD: AD/T to 2.5m, then WB to 3.6m, then HQ3 to 29m

CASING: HW to 3m

REMARKS:

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 4 of 4

CONDITIONS ENCOUNTERED										SAMPLE			TESTING							
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE		
	115	[CONT] SHALE: grey, indistinct, bedded. Ashfield Shale.		FR		M	100	95		CN, SM										
	21.05	INTERBEDDED SANDSTONE AND SILTSTONE: pale grey and grey; interbedded / laminated; approximately 50% fine sandstone interbedded with 50% siltstone. Mittagong Formation.		FR		VH				20.40-20.55m: JT x2, 45-70°, SL, SM, FG, 20mm, SZ 20.70-20.75m: JT, 45°, SL, SM, FG, 50mm, SZ				21	PLT	PL(A)=3.1MPa				
	22									100	100					22	PLT	PL(A)=1.9MPa		
	23															23	PLT	PL(A)=2.2MPa		
	24															24	PLT	PL(A)=1.9MPa		
	25	SANDSTONE: pale grey, medium to coarse grained, 10 to 25°; cross bedded; trace siltstone laminations. Hawkesbury Sandstone.		FR		H	100	100						25	PLT	PL(A)=2.0MPa				
	26															26	PLT	PL(A)=1.1MPa		
	27												27.25m: B, 0°, 10mm, siltstone 27.58m: B, 0°, 15mm, siltstone			27	PLT	PL(A)=1.2MPa		
	28						100	100						28	PLT	PL(A)=1.3MPa				
	29	Borehole discontinued at 29.00m depth. Target depth reached.																		

Generated with CORE-GS by Geoc - Split Soil-Rock Log

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.6m, then HQ3 to 29m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3m

Refer to explanatory notes for symbol and abbreviation definitions



CORE PHOTO LOG

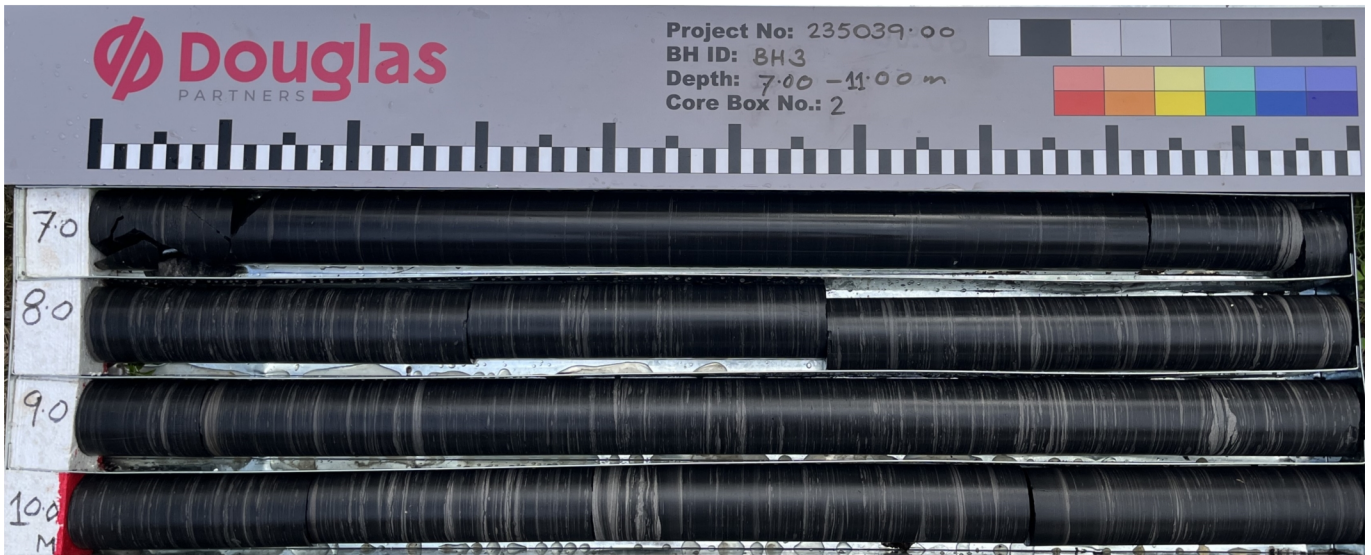
CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 1 of 4



3.60-7.00 m depth



7.00-11.00 m depth

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 2 of 4



11.00-15.00 m depth



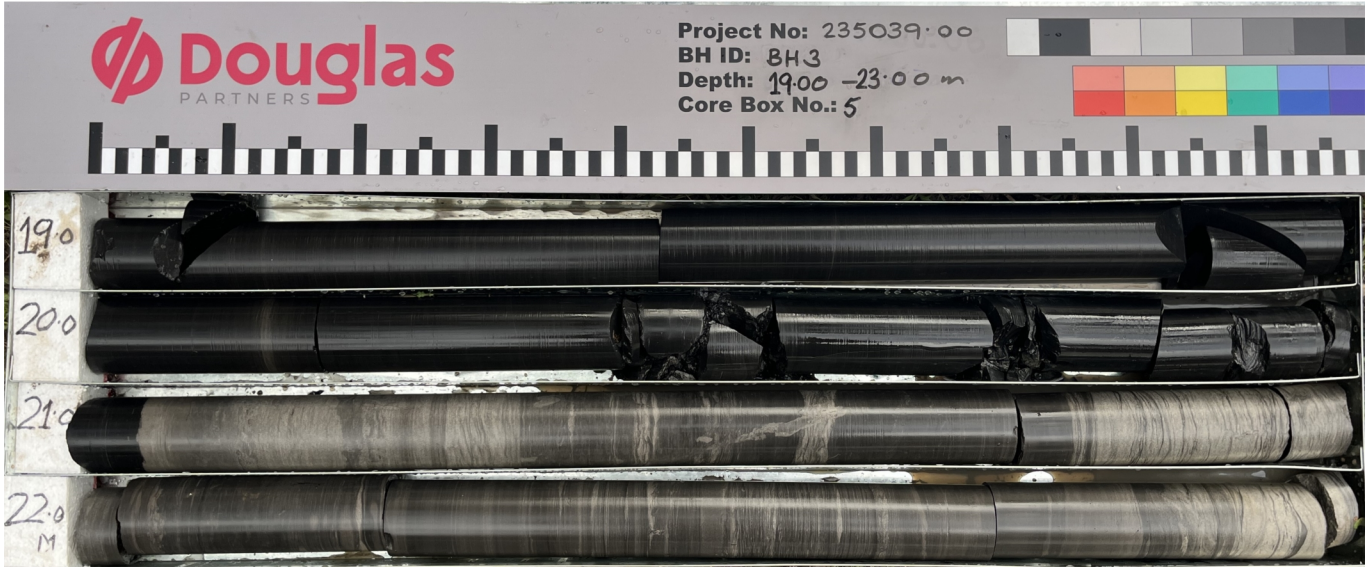
15.00-19.00 m depth

CORE PHOTO LOG

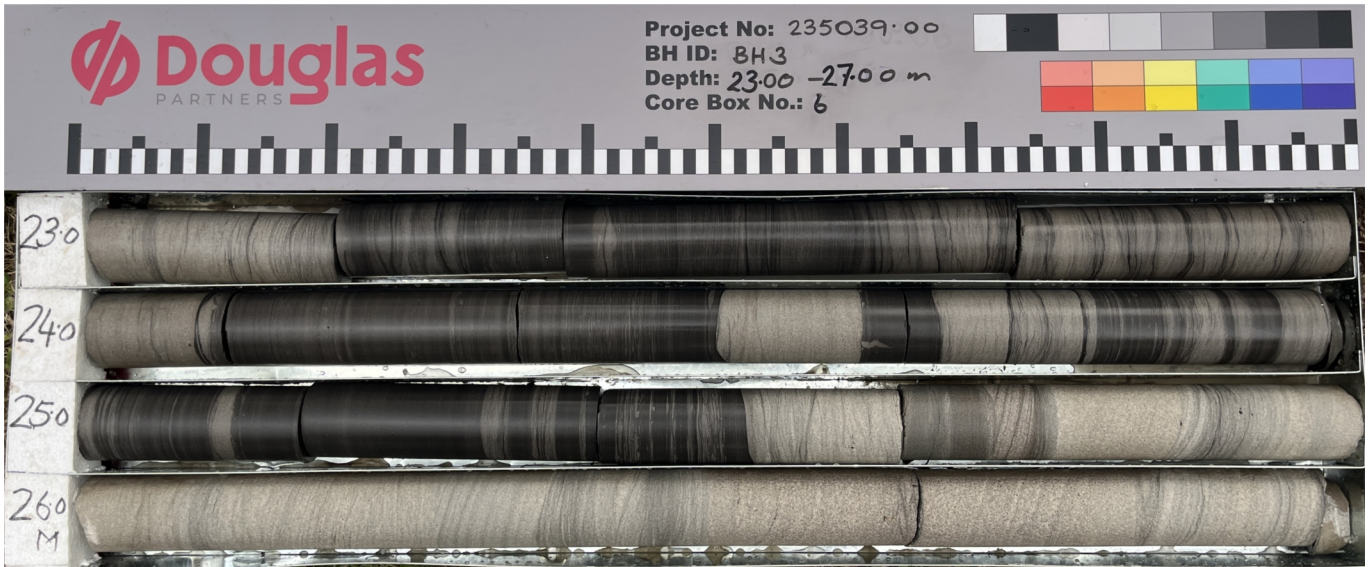
CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 3 of 4



19.00-23.00 m depth



23.00-27.00 m depth

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 135.5 AHD
COORDINATE: E:315572.8, N:6265964.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH03
PROJECT No: 235039.00
DATE: 22/08/25 - 25/08/25
SHEET: 4 of 4



27.00-29.00 m depth

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 1 of 4

CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS						
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN (#)	CONSIS. (°) DENSITY (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE	
27/08/25 No Free Groundwater Observed Whilst Augering	0.10	TOPSOIL / Silty CLAY: grey and dark grey; trace of tiles fragments and root fibres.	X	TOP	(PC)	M		A	0.10 - 0.20						
	0.40	CLAY (CH): brown then pale grey-brown; high plasticity.	/	RS	H	w=PL		A	0.40 - 0.50		PP	>600kPa			
	1.00	CLAY (CL-CI) trace gravel: pale brown; low to medium plasticity; ironstone gravel.	\					U50	0.80 - 1.00						
	1.45							A	1.45 - 1.90						
	2.00							SPT	1.90 - 2.00		SPT	15,18,24 N=42			
	2.50							A	2.50 - 2.95						
	2.80	CLAY (CH) with siltstone: pale grey and red-brown; high plasticity; trace of iron cemented siltstone bands.	/	RS			w=PL		SPT	2.50 - 2.95		SPT	7,12,18 N=30		
	3.30	Continued as rock log													
	4.00														
	5.00														
6.00															
7.00															
8.00															
9.00															

NOTES: #Soil origin is "probable" unless otherwise stated. °Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Comacchio Geo 305 **OPERATOR:** Ground Test (LC) **LOGGED:** S. Islam
METHOD: AD/T to 2.5m, then WB to 3.3m, then HQ3 to 24.25m **CASING:** HW to 3.3m
REMARKS:



Refer to explanatory notes for symbol and abbreviation definitions

BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 2 of 4

CONDITIONS ENCOUNTERED										SAMPLE				TESTING				
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE
RL (m)																		
132	0																	
131	1																	
130	2																	
129	3																	
128	4	Continued from soil log SILTSTONE: pale grey brown, indistinct, bedded; fractured; 20% clay. Ashfield Shale.	HW	VL	3.30					3.50m: JT, 45°, PR, Clay, SM 3.60m: JT, 35°, TI 3.70m: JT, 30°, HE Clay 3mm 3.70-3.90m: FG, SN Fe 3.90-4.00m: DS 4.20m: JT, 70°, PR, SN Fe, RF 4.38-4.41m: FG, SN Fe 4.45-4.60m: JT, 80°, PR, CN, SM					PLT	PL(A)=0.25MPa		
127	5	SILTSTONE: grey; trace of fine sandstone laminations. Ashfield Shale.		M	4.00		100	92							PLT	PL(A)=0.36MPa		
126	6	INTERLAMINATED SILTSTONE AND SANDSTONE (LAMINITE); SILTSTONE: pale grey and grey, laminated; approximately 30% fine sandstone interlaminated with 70% siltstone SANDSTONE (LAMINITE). Ashfield Shale.			4.45					5.50m: JT, 80°, TI					PLT	PL(A)=2.2MPa		
125	7		FR		5.00					6.90m: JT, 45-60°, ST, CN, RF					PLT	PL(A)=2.3MPa		
124	8						100	100		8.15m: JT, 45-70°, CU, CN, RF, UN 8.30m: JT, 80°, UN, CN, RF 8.45-8.55m: JT x2, 45-70°, UN, RF, SI 8.90m: JT, 45°, UN, CN, RF					PLT	PL(A)=1.9MPa	Bentonite	
123	9									9.50m: JT, 45-80°, CU, CN, RF 9.82-9.95m: JT, 75°, CU, RF, UN, SI					PLT	PL(A)=1.9MPa	Gravel	

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.3m, then HQ3 to 24.25m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 3 of 4

CONDITIONS ENCOUNTERED										SAMPLE				TESTING															
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	WEATH.	DEPTH (m)	STRENGTH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	BACKFILL	WELL PIPE											
	12.2	[CONT] INTERLAMINATED SILTSTONE AND SANDSTONE (LAMINITE); SILTSTONE: pale grey and grey, laminated; approximately 30% fine sandstone interlaminated with 70% siltstone SANDSTONE (LAMINITE). Ashfield Shale.		FR	H	●	100	98	10.00m: JT, 45°, PR, RF, SI					11	PLT	PL(A)=1.8MPa													
	12.1													11	PLT	PL(A)=1.6MPa													
	12.0													12	PLT	PL(A)=1.5MPa													
	11.9													13	PLT	PL(A)=2.0MPa													
	14.00													SHALE: grey, indistinct, bedded. Ashfield Shale.		FR			H	●	100	100	14.22m: JT, 45°, PR, CN, SM				14	PLT	PL(A)=2.8MPa
	11.8																										15	PLT	PL(A)=0.95MPa
	11.7																										16	PLT	PL(A)=1.2MPa
	11.6																										17	PLT	PL(A)=1.3MPa
	11.5													INTERBEDDED SANDSTONE AND SILTSTONE: SANDSTONE: pale grey and grey; interbedded / laminated; 50% fine sandstone interbedded / laminated with 50% siltstone SILTSTONE. Mittagong Formation.		FR			H	●	100	97	16.80m: JT, 80°, PR, CN, SM, TI				17	PLT	PL(A)=1.3MPa
	17.08m: JT, 45°, PR, CN, SM																										17.18-17.23m: JT, 45-70°, CU, CN, SM	17.25m: JT, 30°, PR, CN, SM	17.80m: JT, 80°, PR, CN, SM
	11.4	18.40	19	PLT	PL(A)=1.9MPa																								

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.3m, then HQ3 to 24.25m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions



BOREHOLE LOG

CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 4 of 4

CONDITIONS ENCOUNTERED											SAMPLE			TESTING						
GROUNDWATER RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	SOIL STRENGTH (Where encountered) SOIL MOISTURE	GRAPHIC	WEATH. LRS XW LW HW SW FR	DEPTH (m)	STRENGTH VL L M H VH EH	RECOVERY (%)	RQD	FRACTURE SPACING (m)	DEFECTS & REMARKS	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		BACKFILL	WELL PIPE
																	PLT	PL(A)		
112		[CONT] INTERBEDDED SANDSTONE AND SILTSTONE: SANDSTONE: pale grey and grey; interbedded / laminated; 50% fine sandstone interbedded / laminated with 50% siltstone SILTSTONE. Mittagong Formation.				20.60	H	100	100						20.60	PLT	PL(A)=2.6MPa			
21							VH				21.42m: F, 45°, TI			21	PLT	PL(A)=3.5MPa				
22												22.25m: JT, 45°, PR, CN, RF			22	PLT	PL(A)=3.4MPa			
22.50			SANDSTONE: pale grey, medium to coarse grained, 10 to 25°; cross bedded; trace of siltstone laminations. Hawkesbury Sandstone.				22.50		100	100		22.40m: JT, 25°, PR, 40mm, SM, FG				23	PLT	PL(A)=1.0MPa		
23							H				22.65m: JT, 75°, PR, CN, RF									
24															24	PLT	PL(A)=1.7MPa			
108		Borehole discontinued at 24.25m depth. Target depth reached.																		
105																				
107																				
106																				
104																				
103																				

NOTES: #Soil origin is "probable" unless otherwise stated.

PLANT: Comacchio Geo 305
METHOD: AD/T to 2.5m, then WB to 3.3m, then HQ3 to 24.25m
REMARKS:

OPERATOR: Ground Test (LC)

LOGGED: S. Islam
CASING: HW to 3.3m

Refer to explanatory notes for symbol and abbreviation definitions

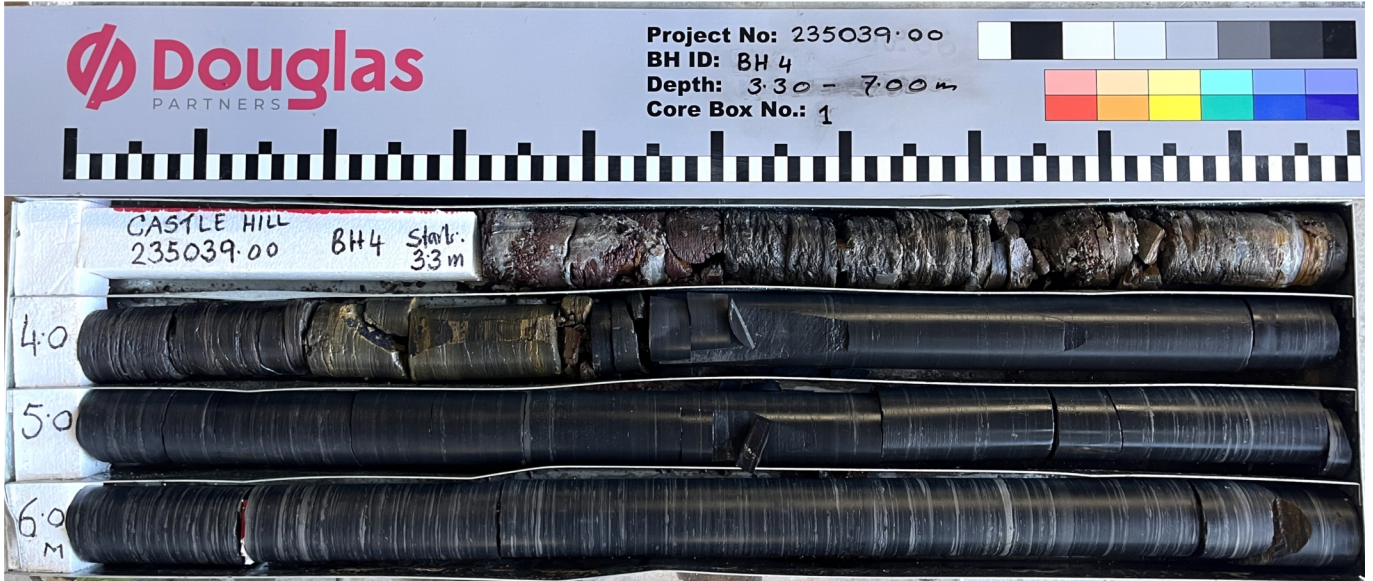


CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 1 of 3



3.30-7.00 m depth



7.00-11.00 m depth

CORE PHOTO LOG

CLIENT: UPG Castle Corner Ptd Pty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 2 of 3



11.00-15.00 m depth



15.00-19.00 m depth

CORE PHOTO LOG

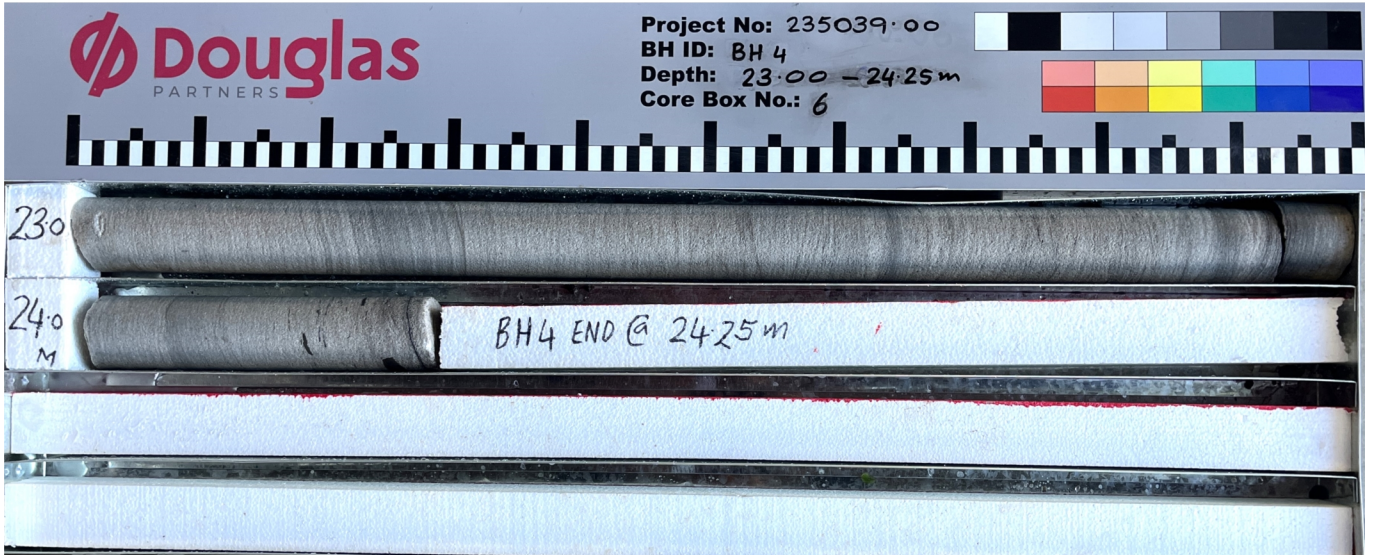
CLIENT: UPG Castle Corner Ptd Lty
PROJECT: Proposed Residential Development with Affordable Housing
LOCATION: 16-20 Old Castle Hill Road, Castle Hill, Sydney, NSW 2154

SURFACE LEVEL: 132.3 AHD
COORDINATE: E:315548.7, N:6265978.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: BH04
PROJECT No: 235039.00
DATE: 27/08/25 - 28/08/25
SHEET: 3 of 3



19.00-23.00 m depth



23.00-24.25 m depth

Appendix D

Laboratory Results

Material Test Report

Report Number: 235039.00-1
Issue Number: 1
Date Issued: 18/09/2025
Client: UPG Castle Corner Ptd Lty
 Suite 110, Level 1, Burwood NSW
Contact: Matthew Choi
Project Number: 235039.00
Project Name: 16-20 Old Castle Hill Road
Project Location: 16-20 Old Castle Hill Road, Castle Hill, Sydney NSW
Work Request: 12564
Sample Number: SY-12564A
Date Sampled: 03/09/2025
Dates Tested: 03/09/2025 - 10/09/2025
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: BH4 (0.5-0.8m)
Material: CLAY: brown and pale grey-brown



Douglas Partners Pty Ltd
 Sydney Laboratory
 96 Hermitage Road West Ryde NSW 2114
 Phone: (02) 9809 0666

Email: andrew.hutchings@douglaspartners.com.au

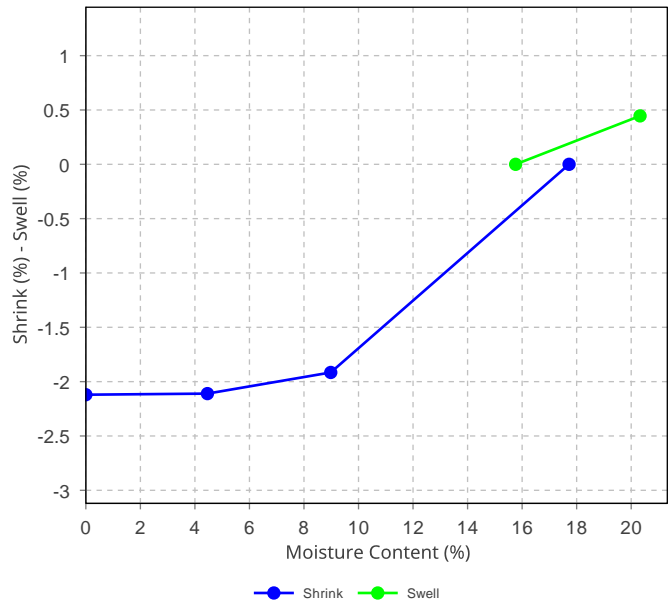


Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
 Associate / Laboratory Manager
 Laboratory Accreditation Number: 828

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	1.3
Visual Description	CLAY: brown and pale grey-brown
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	
Slight crumbling during preparation. Partial remoulding of voids in swell specimen.	
Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	2.1
Estimated % by volume of significant inert inclusions	15
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	17.7
Swell Test	
Initial Pocket Penetrometer (kPa)	>400
Final Pocket Penetrometer (kPa)	250
Initial Moisture Content (%)	15.8
Final Moisture Content (%)	20.3
Swell (%)	0.4
* Accreditation does not cover the performance of pocket penetrometer readings.	

Shrink Swell Index



Material Test Report

Report Number: 235039.00-1
Issue Number: 1
Date Issued: 18/09/2025
Client: UPG Castle Corner Ptd Lty
 Suite 110, Level 1, Burwood NSW
Contact: Matthew Choi
Project Number: 235039.00
Project Name: 16-20 Old Castle Hill Road
Project Location: 16-20 Old Castle Hill Road, Castle Hill, Sydney NSW
Work Request: 12564
Sample Number: SY-12564B
Date Sampled: 03/09/2025
Dates Tested: 03/09/2025 - 09/09/2025
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location: BH3 (1-1.4m)
Material: CLAY: pale grey and brown



Douglas Partners Pty Ltd
 Sydney Laboratory
 96 Hermitage Road West Ryde NSW 2114
 Phone: (02) 9809 0666

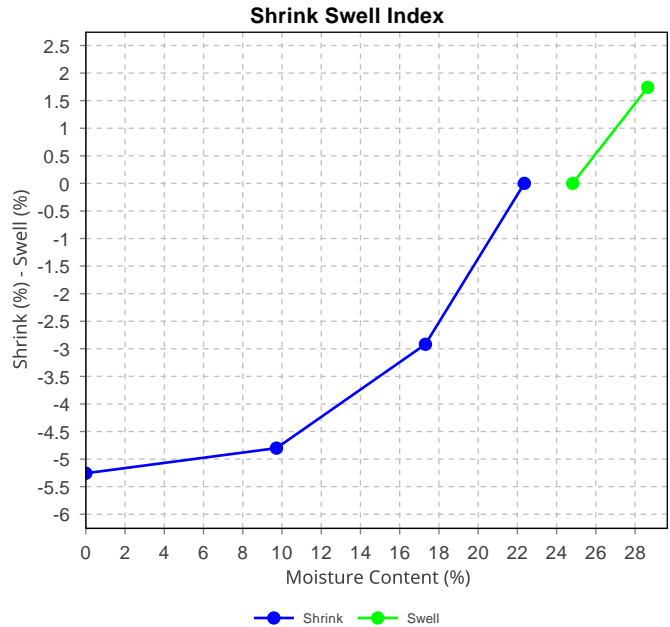
Email: andrew.hutchings@douglaspartners.com.au



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Andrew Hutchings
 Associate / Laboratory Manager
 Laboratory Accreditation Number: 828

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	3.4
Visual Description	CLAY: pale grey and brown
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	
Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	5.3
Estimated % by volume of significant inert inclusions	0
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	22.4
Swell Test	
Initial Pocket Penetrometer (kPa)	250
Final Pocket Penetrometer (kPa)	200
Initial Moisture Content (%)	24.8
Final Moisture Content (%)	28.6
Swell (%)	1.7
* Accreditation does not cover the performance of pocket penetrometer readings.	



CERTIFICATE OF ANALYSIS 390007

Client Details

Client	Douglas Partners Pty Ltd
Attention	Warren Smith
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	<u>235039.00 Castle Hill</u>
Number of Samples	10 Soil
Date samples received	03/09/2025
Date completed instructions received	03/09/2025

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client unless as indicated below in the method summaries. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	10/09/2025
Date of Issue	11/09/2025
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Diego Bigolin, Inorganics Supervisor
 Giovanni Agosti, Group Technical Manager
 Stuart Chen, Asbestos Approved Identifier/Report coordinator

Authorised By

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		390007-1	390007-2	390007-3	390007-4	390007-5
Your Reference	UNITS	BH1	BH1	BH1	BH2	BH2
Depth		0.4-0.5	0.9-1	1.9-2	0.4-0.5	1-1.45
Date Sampled		19/08/2025	19/08/2025	19/08/2025	26/08/2025	26/08/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Date analysed	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
pH 1:5 soil:water	pH Units	6.0	4.7	5.5	5.4	4.7
Chloride, Cl 1:5 soil:water	mg/kg	70	150	31	<10	150
Sulphate, SO4 1:5 soil:water	mg/kg	120	80	41	54	140
Emerson Aggregate Test	-	5.0	[NA]	[NA]	5.0	[NA]

Misc Inorg - Soil					
Our Reference		390007-7	390007-8	390007-9	390007-10
Your Reference	UNITS	BH4	BH4	BH4	BH4
Depth		0.4-0.5	0.9-1	1-1.5	2.5-2.95
Date Sampled		27/08/2025	27/08/2025	27/08/2025	27/08/2025
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Date analysed	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025
pH 1:5 soil:water	pH Units	4.8	5.2	5.2	4.8
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	10	170
Sulphate, SO4 1:5 soil:water	mg/kg	64	32	58	60
Emerson Aggregate Test	-	3b	[NA]	[NA]	[NA]

Client Reference: 235039.00 Castle Hill

Texture and Salinity*						
Our Reference		390007-1	390007-2	390007-3	390007-4	390007-5
Your Reference	UNITS	BH1	BH1	BH1	BH2	BH2
Depth		0.4-0.5	0.9-1	1.9-2	0.4-0.5	1-1.45
Date Sampled		19/08/2025	19/08/2025	19/08/2025	26/08/2025	26/08/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Date analysed	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Electrical Conductivity 1:5 soil:water	µS/cm	140	190	66	65	240
Texture Value	-	[NA]	7.0	7.0	[NA]	7.0
Texture	-	[NA]	MEDIUM CLAY	MEDIUM CLAY	[NA]	MEDIUM CLAY
ECe	dS/m	[NA]	<2	<2	[NA]	<2
Class	-	[NA]	NON SALINE	NON SALINE	[NA]	NON SALINE

Texture and Salinity*						
Our Reference		390007-6	390007-7	390007-8	390007-9	390007-10
Your Reference	UNITS	BH2	BH4	BH4	BH4	BH4
Depth		1.9-2	0.4-0.5	0.9-1	1-1.5	2.5-2.95
Date Sampled		26/08/2025	27/08/2025	27/08/2025	27/08/2025	27/08/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Date analysed	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Electrical Conductivity 1:5 soil:water	µS/cm	220	65	47	59	[NA]
Texture Value	-	7.0	7.0	[NA]	7.0	[NA]
Texture	-	MEDIUM CLAY	MEDIUM CLAY	[NA]	MEDIUM CLAY	[NA]
ECe	dS/m	<2	<2	[NA]	<2	[NA]
Class	-	NON SALINE	NON SALINE	[NA]	NON SALINE	[NA]

ESP/CEC				
Our Reference		390007-1	390007-4	390007-7
Your Reference	UNITS	BH1	BH2	BH4
Depth		0.4-0.5	0.4-0.5	0.4-0.5
Date Sampled		19/08/2025	26/08/2025	27/08/2025
Type of sample		Soil	Soil	Soil
Date prepared	-	08/09/2025	08/09/2025	08/09/2025
Date analysed	-	08/09/2025	08/09/2025	08/09/2025
Exchangeable Ca	meq/100g	5.5	2.7	0.9
Exchangeable K	meq/100g	0.2	0.7	0.2
Exchangeable Mg	meq/100g	5.3	2.2	1.5
Exchangeable Na	meq/100g	0.2	0.1	0.2
Cation Exchange Capacity	meq/100g	11	5.7	2.8
ESP	%	2	2	9

Method ID	Methodology Summary
Ext-062	Analysed by East West Enviroag
Inorg-001	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
INORG-123	Determined using a "Texture by Feel" method.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.

Client Reference: 235039.00 Castle Hill

QUALITY CONTROL: Misc Inorg - Soil				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			04/09/2025	2	04/09/2025	04/09/2025		04/09/2025	[NT]
Date analysed	-			04/09/2025	2	04/09/2025	04/09/2025		04/09/2025	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	2	4.7	4.7	0	100	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	150	150	0	82	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	2	80	81	1	90	[NT]

Client Reference: 235039.00 Castle Hill

QUALITY CONTROL: Texture and Salinity*				Duplicate				Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			04/09/2025	2	04/09/2025	04/09/2025		04/09/2025	[NT]
Date analysed	-			04/09/2025	2	04/09/2025	04/09/2025		04/09/2025	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	2	190	190	0	103	[NT]
Texture Value	-		INORG-123	[NT]	2	7.0	7.0	0	[NT]	[NT]

Client Reference: 235039.00 Castle Hill

QUALITY CONTROL: ESP/CEC					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			08/09/2025	[NT]	[NT]	[NT]	[NT]	08/09/2025	[NT]
Date analysed	-			08/09/2025	[NT]	[NT]	[NT]	[NT]	08/09/2025	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	85	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Air volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volumes) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

For Dust Deposit Gauge (DDG) analysis the sampling, sampling period and funnel exposure area do not fall under Envirolab's NATA accreditation (unless the Newcastle laboratory where responsible for the sampling), hence the annotation on the DDG units of reporting.

Urine Analysis - The BEI values listed are taken from the 2022 edition of "TLVs and BEIs Threshold Limits" by ACGIH.

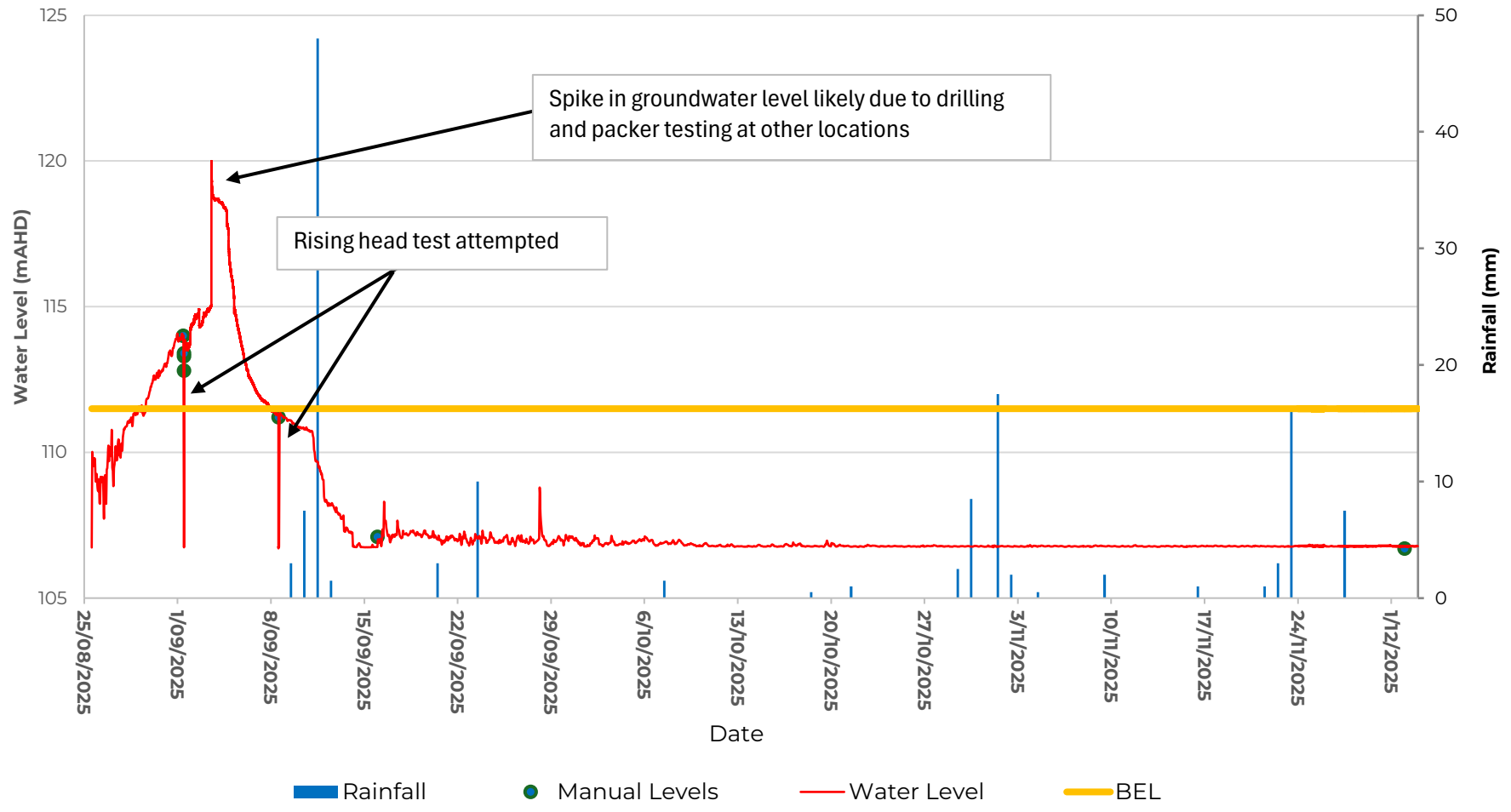
Report Comments

Emerson Aggregate Test analysed by GSG Laboratories. Report no. EW251743.

Appendix E

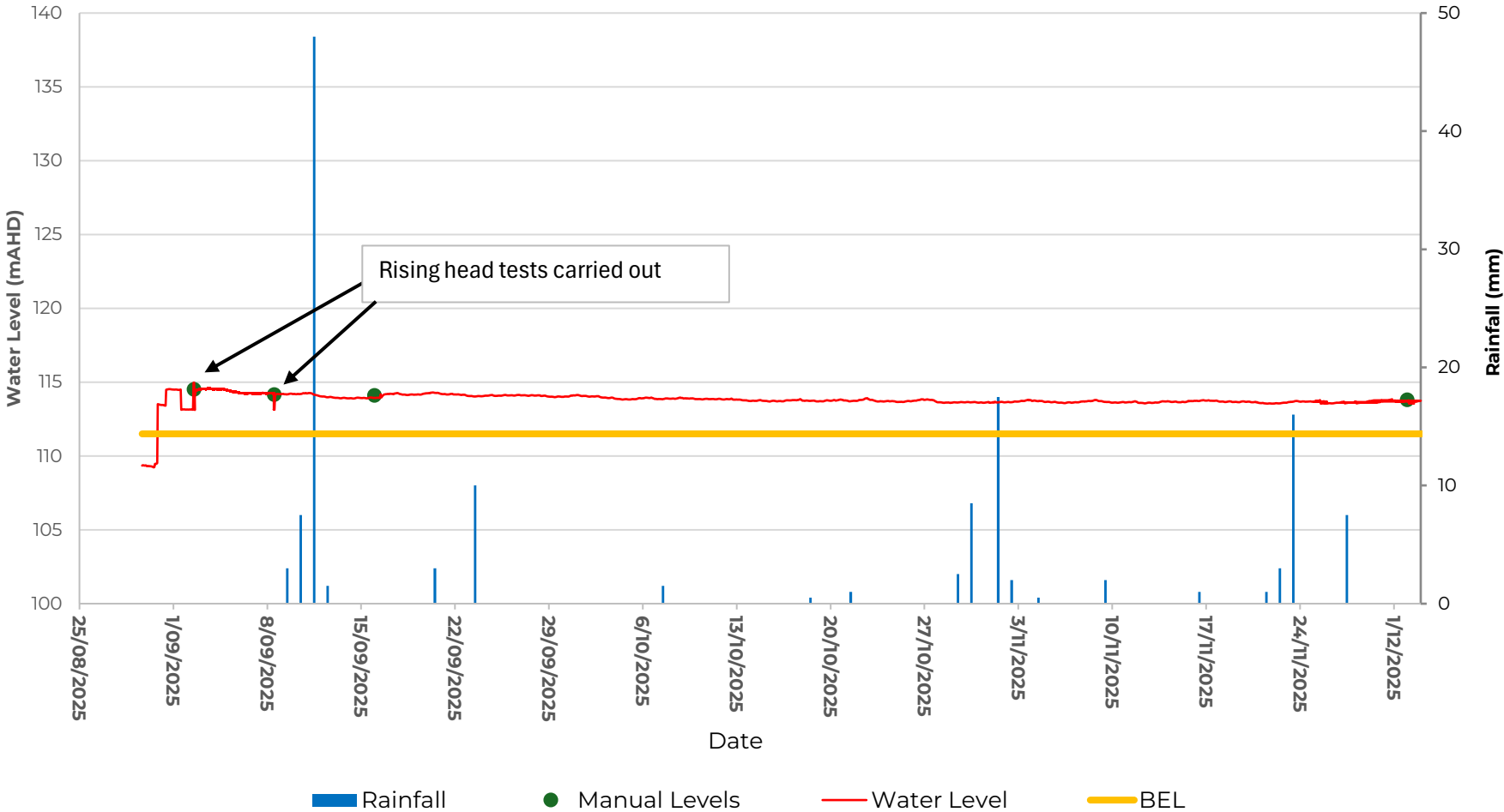
Hydrographs

BH01 - Rainfall vs Groundwater Monitoring



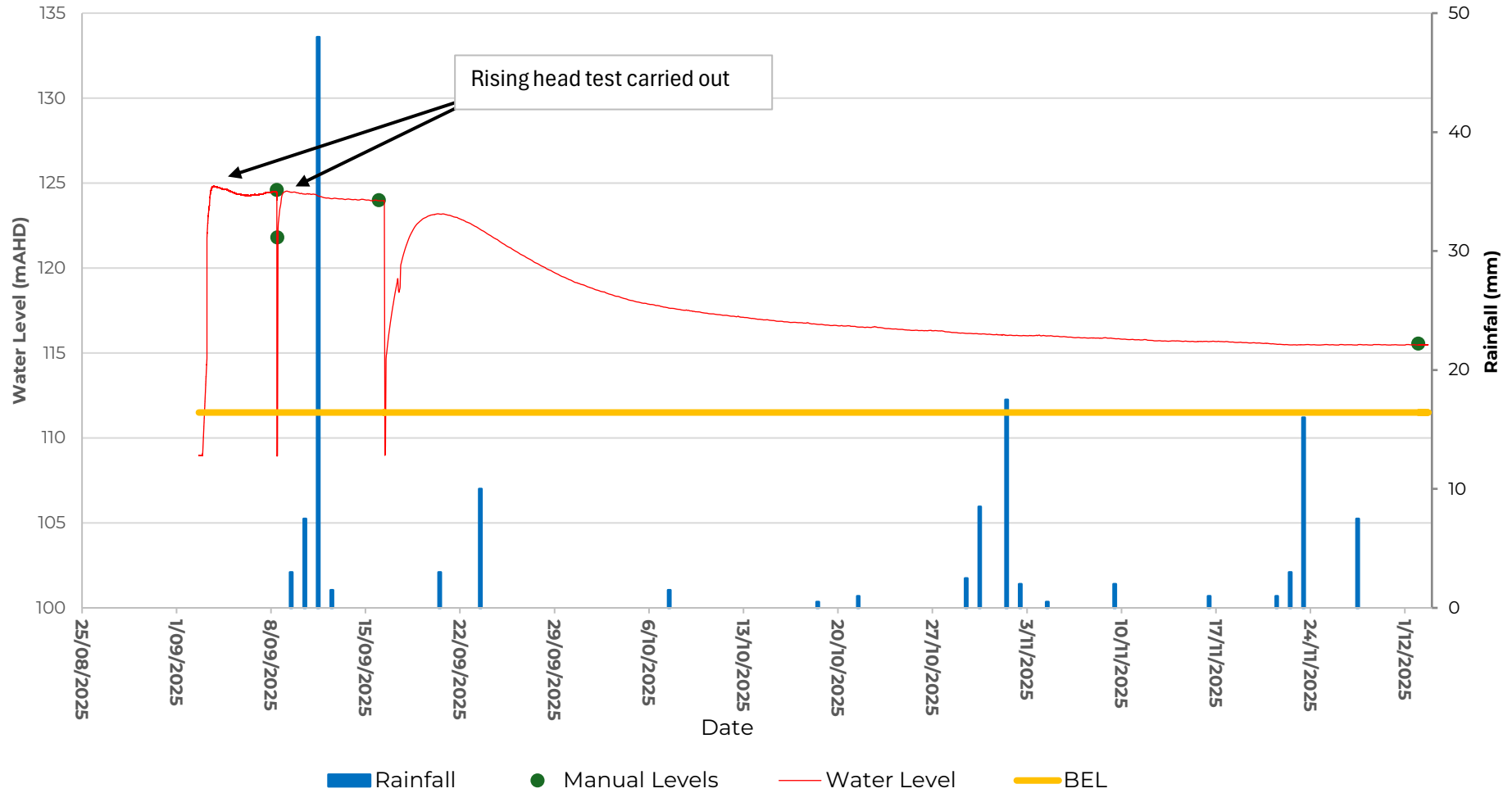
 GROUNDED EXPERTISE	Client	UPG Castle Corner Pty Ltd	Borehole:
	Project	Proposed Residential Development with Affordable Housing	BH01
	Location	16 - 20 Castle Hill Road, Castle Hill, Sydney, NSW 2154	Project:
			235039.00

BH02 - Rainfall vs Groundwater Monitoring



 <small>GROUNDLED EXPERTISE</small>	Client	UPG Castle Corner Pty Ltd	Borehole:
	Project	Proposed Residential Development with Affordable Housing	BH02
	Location	16 - 20 Castle Hill Road, Castle Hill, Sydney, NSW 2154	Project:
			235039.00

BH04 - Rainfall vs Groundwater Monitoring



 GROUNDED EXPERTISE	Client	UPG Castle Corner Pty Ltd	Borehole:
	Project	Proposed Residential Development with Affordable Housing	BH04
	Location	16 - 20 Castle Hill Road, Castle Hill, Sydney, NSW 2154	Project:
			235039.00