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3 July 2024

Proposed Multistorey Residential Building

67 Pacific Parade, Dee Why, NSW

GEOTECHNICAL INVESTIGATION REPORT

BL2093 Pty Ltd

Job No. SYD2022-0051AC | Version Rev 2

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Version Control

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Review and update history

Version	Date	Comments
0	4/10/2022	SYD2020-0066AB Rev 3 updated to include two additional boreholes
1	13/10/2022	SYD2022-0051AC Rev 0 updated to reflect lab testing results: • Lab certificates added (Appendix C) • Section 7.5 (Foundations) updated • Section 7.7 (Soil Aggressivity) added
2	5/07/2024	SYD2022-0051AC Rev 1 updated to consider change in development application from boarding house to standard strata unit development

CONTENTS

1.0 INTRODUCTION

CMW Geosciences (NSW) Pty Ltd (CMW) have previously carried out a geotechnical investigation and provided a geotechnical report for the proposed development of a site located at 67 Pacific Parade, Dee Why, NSW (Ref. SYD2020-0066AB Rev 3). The report recommends additional boreholes to be drilled following demolition of the existing building, given the nature of the site conditions and proposed depth of excavation. By way of a signed authorisation (Ref. SYD2022-0051AA Rev 0) dated 20 May 2022, CMW have been engaged by BL2093 Pty Ltd to carry out an additional geotechnical investigation and update the previous geotechnical report (Ref. SYD2020-0066AB Rev 3). The scope of work and associated terms and conditions of our engagement were detailed in our short form proposal, SYD2022-0051AA Rev 0 dated 14 April 2022.

This report includes results of the previous geotechnical investigation supplemented by the additional investigation and reflects the latest provided architectural drawing prepared by DKO Architecture (Ref. Project Number 000013395 - Layout ID DA000, DA100, DA101, DA200 to DA207, DA300 to DA304, DA400 and DA401, DA500 to DA511 and DA600 - Architectural Drawings Rev A) dated 21 June 2024.

2.0 SITE DESCRIPTION

The proposed development site comprises an area of approximately 697m² and is located on the south side of Pacific Parade, Dee Why, NSW as shown in the Site Location Plan (see Appendix A).

The site has a north-west facing slope with existing ground levels ranging from RL39.0m AHD in the south-east corner to RL30.6m AHD in the north-west corner.

The site is bound by Pacific Parade to the north and to the south, west and east by multistorey residential apartment buildings. The site was occupied with a single storey brick and sandstone residential dwelling at the time of the previous investigation (carried out on 10 June 2020), which had been demolished by the time of this investigation. A near-vertical unsupported 1 to 1.8m high sandstone rock face was observed at the front of the site. Some boulder retaining walls were observed on site. By visual observation these retaining walls did not appear to be an engineered solution. Sandstone outcrop was also observed near the front of the site. An unsupported sandstone block wall was observed on the eastern side of the site. The height of the wall was about 4.0m. The top 3.0m of the wall was leaning forward and generally covered with vegetation. By visual observation, the strength of the sandstone rock appeared to be from high to very high with some bands of low strength rock. Our observation indicates that in the event of rainfall, the water may run down the face of the sandstone rock wall, which could be a sign of a poor drainage system behind the wall. If the wall is to remain, it is recommended that the stability of the wall be inspected by a Structural Engineer.

A large crack was observed in the brick retaining wall at the western end of the southern boundary. The current stability of the wall is unknown and should be investigated by a Structural Engineer if it is to remain.

Site views are shown in Appendix A.

3.0 PROPOSED DEVELOPMENT

The Architectural Drawings prepared by DKO Architecture (Ref. Project Number 000013395) dated 21 June 2024 indicates that the proposed development comprises a multi-level residential building with three levels of car parking and a maximum of five apartment levels. The finished floor level to the proposed basement is shown at RL 28.55m AHD, which would require an excavation within the rock to depths ranging from about 6m to 9m below existing surface levels.

4.0 FIELD INVESTIGATION

4.1 Previous Investigation

Following a dial before you dig search, and onsite service location, the initial field investigation was carried out on 10 June 2020. All fieldwork was carried out under the direction of CMW in general accordance with AS1726 (2017), Geotechnical Site Investigations. The scope of works completed were as follows:

- Undertake a walkover survey of the site to assess the general landform, site conditions and adjacent structures and infrastructure.
- One machine borehole, denoted BH01, was advanced using wash bore techniques to depths of up to 7m with rock coring to assess the ground conditions. An Engineering log of the borehole is provided in Appendix B.
- Two hand auger boreholes, denoted BH 02 and BH 03, were drilled using a 75mm diameter auger to target depths of up to 200mm below existing ground levels to visually observe the near surface soil profile. Engineering logs of the hand auger boreholes are presented in Appendix B.

The borehole locations are shown on the attached Site Investigation Plan in Appendix A. Test locations were measured using handheld GPS. Elevations were inferred from the feature site plan provided (see Architectural Drawing - Site Plan DA101 Rev A).

4.2 Supplementary Investigation

Following demolition of the building, which provides access to the development footprint, a dial before you dig search, and onsite service location, an additional field investigation was carried out on 23 Sep 2022. All fieldwork was carried out under the direction of CMW in general accordance with AS1726 (2017), Geotechnical Site Investigations. The scope of works completed were as follows:

- Two machine boreholes, denoted BH04 and BH05, were advanced using continuous flight augers in soil and NMLC rock coring techniques to depths of up to 12m to assess the ground conditions. Engineering logs of the boreholes are provided in Appendix B.

The borehole locations are shown on the attached Site Investigation Plan in Appendix A. Test locations and Elevations were measured using handheld GPS with an accuracy of ±5m.

5.0 LABORATORY TESTING

Laboratory testing was carried out in accordance with the requirements of the current Australian Standards as per the Table 1 below. The extent of testing carried out to provide the geotechnical parameters required for this study are also presented in Table 1.

Table 1: Laboratory Test Schedule Summary.

Type of Test	Test Method	Quantity
Point Load Test (rock)	AS 4133.4.1	21
Unconfined Compressive Strength	AS 4133.4.2.1	2
Aggressivity Suite (pH, Cl, SO4)	AS 2159	2
Moisture Content	AS 1289.2.1.1	2

6.0 GROUND MODEL

6.1 Geology

Based on review of NSW Geological Map, the site area is underlain by medium to coarse grained quartz sandstone (Hawkesbury Sandstone), very minor shale and laminate lenses.

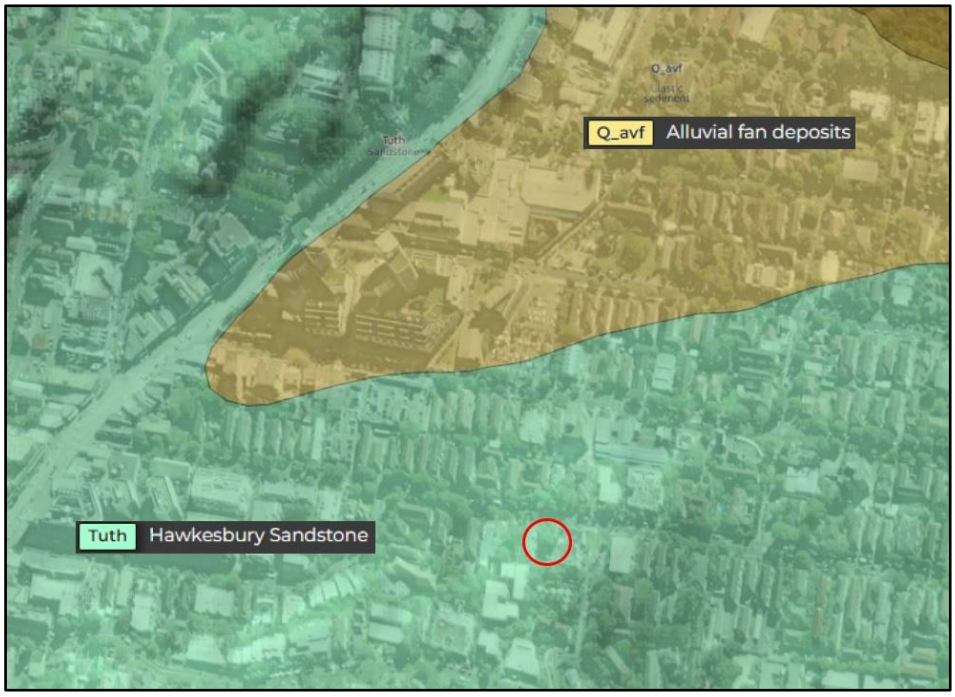

Figure 1: Geology of the site (Sydney's MinView Seamless Geology Map)

6.2 Subsurface Conditions

The ground conditions encountered and inferred from the investigation were generally consistent with the published geology for the area and can be generalised according to the following subsurface sequence and as presented in Table 2. Reference should be made to the attached borehole logs (Appendix B) for a detailed description of encountered subsurface conditions.

- TOPSOIL

  Topsoil of fine to medium grained, dark brown sand with rootlets and organic matter was encountered in BH01, BH02, and BH03 at the time of previous investigation. The topsoil appeared to have been removed during demolition process.

- FILL

  Fill material of fine to medium grained, yellow sand with fine grained gravel and trace of brick fragments was encountered in BH04 and BH05 to a depth of 0.2m and 0.5m, respectively. The fill appeared to have been the result of the demolition process.

- SAND (SP)

  Dense to very dense, poorly graded sand was encountered below the fill material in BH04 and BH05 which extended to a depth ranging from 1.6m to 2.7m.

- BEDROCK (SANDSTONE)

Hawkesbury Sandstone was encountered at a depth ranging from 0.4m to 2.7m. The sandstone was predominantly medium to coarse grained with medium rock strength from point load testing. From the assessment of the defect spacing and rock core strength, the rock underlying this site can be classified as SS-II to SS-III according to Pells et al. (2019). An SS-II and SS-III rock mass class represents a Class II and Class III sandstone which has a defect spacing of greater than 600mm and 200mm and an unconfined compressive strength of greater than 12 and 7 MPa, respectively.

Table 2: Summary of Strata Encountered.

Unit	Depth to top (m)		Thickness (m)	
	Min	Max	Min	Max
Point Load Test (rock)	Surface		0	0.2
Unconfined Compressive Strength	Surface		0	0.5
Aggressivity Suite (pH, Cl, SO4)	0.2	0.3	0.3	2.2
Moisture Content	1.6	4.5	4.5	> 10.4
* Base of unit not encountered				

6.3 Laboratory Test Results

Results of laboratory testing are provided in Appendix C.

7.0 GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

7.1 Geotechnical Constraints

Based on the provided architectural drawings, it is understood that the site works include:

- Excavation to the depths of up to about 10m.
- Construction of a multi storey residential building.

The following constraints may be identified in relation to excavation of the proposed basement.

- Excavation near unsupported sandstone rock wall on the eastern side.
- Excavation to achieve the proposed design level and potential vibration effects from excavation machinery.

7.1.1 Rear Retaining Wall

The concrete block wall at the rear of the property was visibly cracked at the time of our field investigation. We recommend a suitably qualified structural engineer assess the current stability of the wall prior to undertaking any of the proposed works on site, so that suitable stabilisation measures can be installed should they be required. We note the potential for vibrations associated with excavation may further reduce the wall stability.

7.2 Dilapidation Surveys

Dilapidation surveys should be carried out on surrounding buildings, retaining walls and other nearby structures that may be affected because of the proposed excavation. The dilapidation survey should be undertaken both inside and outside of the surrounding building before the commencement of demolition of the existing structures on site. Dilapidation surveys should be used to set vibration limits for site works so as not to damage

nearby structures. Dilapidation surveys can also document any existing defects so that any claims for the damage due to construction related activities can be accurately measured.

7.3 Excavation Characteristics

The excavation recommendations provided below should be complemented by reference to the Safe Work Australia Code of Practice 'Excavation Work', dated January 2020. Additionally, we recommend the use of excavation contractors with appropriate experience and a competent supervisor who is aware of vibration damage risks, etc. The contractor should have all appropriate statutory and public liability insurances and should be provided with a full copy of this report.
The proposed excavation is expected to extend through the shallow soil and extremely weathered rock profile into sandstone bedrock, which we infer will be predominantly at least medium strength.
Excavation of soil and extremely low strength rock should be achievable using buckets fitted to hydraulic excavators. Excavation of low and higher strength bedrock will present 'hard rock' excavation conditions and would most effectively be excavated using rock hammers. The rock hammers would also be required for detailed rock excavations such as for footings, trenches, lift pits etc. Grid sawing techniques in conjunction with ripping or hammering will help facilitate excavation. We recommend the sides of the main excavation be saw cut as this results in a face with less overbreak and instability and helps reduce transmission of vibration across the boundaries. Dust suppression by spraying water should be carried out whenever rock hammering and sawing techniques are being used.

7.3.1 Vibrations

During excavation, it will be necessary to use appropriate methods and equipment to keep ground vibrations within acceptable limits to avoid any damage to the adjacent buildings and structures. Ground vibrations can be perceptible to humans at levels above 2mm/s component peak particle velocity (PPV). This is generally much lower than the vibration levels required to cause structural damage to buildings.
Allowable vibration limits should be determined by the Structural Engineer following review of the dilapidation reports. As a guide the German Standard DIN4150-3:1999-02, would indicate that vibrations should be limited to a peak particle velocity of 5mm/s (for frequencies up to 10Hz) for nearby residential buildings in good condition, however lower limits are expected to be required for the existing rear retaining wall in poor condition.

We recommend that continuous vibration monitoring be carried out whenever hydraulic hammers are used during demolition or excavation on site. Vibration monitors should be connected to suitable alarm systems so that site staff become aware immediately if vibration thresholds are exceeded.

If monitoring confirms that vibration limits are being exceeded, alternative excavation techniques (such as grinding) may be required.

7.3.2 Groundwater Seepage

Groundwater was not noted during our field investigation, nevertheless, we recommend that all cut faces and retaining wall incorporate spoon drains of subsoil drains to intercept any potential seepage which could occur along the soil-bedrock interface or open defects within the bedrock profile (if present). If seepage occurs, it is expected to be of limited volume and readily controlled by sump and pump techniques or gravity grained systems. In the unlikely event that excessive seepage is encountered whilst excavating and licence may be required to dispose of groundwater.

The temporary excavation should be monitored by the site foreman and geotechnical engineer as excavation progresses to confirm the drainage requirements. We expect permanent drainage requirements would be identified and designed by the drainage engineer.

7.4 Excavation Support

Excavations through the expected relatively shallow soil profile may be temporarily battered to slopes no steeper than 1 Vertical (V) in 2 Horizontal (H), provided surcharge loads are kept well clear of the crest of the temporary batters. Retaining walls can then be constructed along the toe of the temporary batters and subsequently backfilled.

The sandstone bedrock can be cut vertically but must be progressively inspected by a geotechnical engineer at not more than 1.5m depth increments, to assess the need for localised temporary support (e.g., rock bolts, dowels, shotcrete etc) of potentially unstable rock wedges or extremely weathered bands. Based on the results of our field investigation we expect that some stabilisation measures will be required, including 'dental' treatment for clay bands/seams, extremely weathered bands/seams etc. A provision should be made in the budget and program for the above inspections and stabilisation measures.

7.4.1 Design Parameters

It is suggested that design of permanent retaining structures be based on an average bulk unit weight for the retained material of 20kN/m³ using appropriate design method in accordance with AS4678-2002. To maximise rigidity of these walls, 'at rest' (K_o) earth pressure conditions may be considered.

Earth pressure coefficients and geotechnical parameters for retaining wall design are presented in Table 3 and Table 4 below. Surcharge loads from the adjacent properties should be included in the wall design by multiplying vertical loads by the appropriate coefficient given in Table 4.

Table 3: Earth Pressure Coefficients (non-sloping crest surface).

Geological Unit	Unit Weight (kN/m³)	φ' (degrees)	Earth Pressure Coefficients		
			Ko (at rest)	Ka (Active)	Kp (Passive)
Dense sand	19	36	0.41	0.26	3.85
Sandstone (SS-III)	23	36	1.0	0. 26	3.85

Table 4: Geotechnical Parameters for the Design of Retaining Wall.

Material Description	C' (kPa)	E (MPa)
Dense sand	0	70
Sandstone (SS-III)	250	1500

Notes:

C': Drained cohesion; Ø': Drained angle of friction; E: Young's modulus

Application of hydrostatic pressure should not be ignored to the lateral earth pressures unless a permanent drainage system of the ground behind the walls is installed. We advise all wall drainage to comprise a proper subsoil drainage system incorporating a slotted pipe surrounded by a free draining single sized crushed aggregate or alternatively, a proprietary drainage system designed by an experienced groundwater engineer. The aggregate should be appropriately protected using non-woven materials, geotextile, or filter fabric.

7.4.2 Excavation Impacts

Assuming the excavation is carried out in accordance with the advice provided above, and that all supports, and structures are designed by suitably qualified engineers then we expect the proposed excavation to have negligible impact on adjoining properties, drainage patterns and soil stability.

The adjoining properties appear to be founded on competent bedrock and are not expected to be undermined by the proposed excavation which is offset from the site boundary.

Drainage patterns are not expected to be affected, as the sandstone recovered is of high quality and expected to be of low permeability.

7.5 Foundations

Based on the investigation and the proposed finished levels for the lower basement level, it is anticipated that at the base of the proposed excavation, sandstone bedrock (of at least Class III) would be exposed. Pad/strip footings founded in at least Class III sandstone (as described in section 6.2) bedrock below bulk excavation level may be designed for a maximum allowable bearing pressure of 3,500kPa, provided at least the initial footing excavations are inspected by a geotechnical engineer prior to pouring concrete, and following the inspection of the completed excavation by a geotechnical engineer.

Footings found at, or near, the crest of a vertical cut face (that is within a distance equal to the depth of excavation) should be designed for a maximum allowable bearing pressure of 600kPa, provided the rock immediately below the base of the footing is inspected by a geotechnical engineer to identify possible adverse defects or weathered bands, which may impact stability of the footing above. It is possible that deeper footings or additional bolting may be required locally subject to the geotechnical inspection and design check.

The settlement of foundations proportioned on the basis of the above allowable parameters would be expected to not exceed 1% of the footing width/diameter, as per Classification of Sandstones and Shales in the Sydney Region: A forty-year review, P.J.N. Pells1, G. Mostyn2, R. Bertuzzi2 and P. K. Wong3, Volume 54: No.2 June 2019.

7.6 Site Classification

Although not relevant to the proposed multi-story building development for this site, a site classification of Class P to AS2870 is recommended due to the potentially abnormal moisture conditions created by the presence of trees and existing structures.

7.7 Soil Aggressivity

The results of the aggressivity tests show that pH, sulphate, and chloride levels indicate a “mild” exposure classification for the soil aggressivity. Refer to Appendix C for the tests results.

7.8 Slope Risk Assessment

7.8.1 Overview

The site is located on a north-west facing hillside, with the slope broken by retaining walls at all site boundaries. Brick retaining walls and cut sandstone faces support the neighbouring property to the east (1 The Crescent) and south (7 The Crescent) above the subject site, while a retaining wall supports the subject site above the neighbouring property to the west (65 Pacific Parade). Based on our visual assessment the existing retaining walls appeared to be in good condition except for the brick and sandstone block retaining wall located at the south-western corner of the site. The brick work has a vertical crack extending the full height of the bricks (i.e., 0.9m) and some slumping of the sandstone blocks was observed immediately above the location of the crack in the brickwork.

The subsurface profile comprises a shallow layer of soil underlain by competent sandstone bedrock.

No evidence of mass soil and/or rock slope instability was observed during our site visits.

7.8.2 Potential Landslide Hazards

Based on our assessment, we consider the potential landslide hazards associated with the proposed development to be as follows:

A. Instability of proposed retaining walls and/or supports.

B. Instability of the existing retaining wall in the south-western corner.

C. Deep movement of rock.

7.8.3 Risk Analysis

The attached Table A and Table B summarise our qualitative assessment of each potential landslide hazard and the consequences of property and life should the landslide hazard occur (see Appendix A). The duration of use and the temporal and spatial probabilities have been estimated based on the expected use of the building from review of the provided architectural drawings. Due to the unknowns in regard to the number of persons using the building we have limited our risk to life to the risk for the person most at risk.

Our risk assessment indicates that the risk to property varies between "Very Low" and "Low", which would be considered 'acceptable' in accordance with the criteria given in Australian Geomechanics Society (2007c) *'Practice Note Guidelines for Landslide Risk Management'* March 2007 (AGS 2007c).

For the risk to life, we estimate that the risk for the person most at risk is about $1.1x10^{-8}$. This would be considered 'acceptable' in accordance with the criteria in AGS 2007c.

8.0 CLOSURE

The findings contained within this report are the result of limited discrete investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, can it be considered that these findings represent the actual state of the ground conditions away from our investigation locations.
If the ground conditions encountered during construction are significantly different from those described in this report and on which the conclusions and recommendations were based, then we must be notified immediately. This report has been prepared for use by BL2093 Pty Ltd in relation to the proposed multi-level residential building, 67 Pacific Parade, Dee Why NSW project in accordance with generally accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report. Use of this report by parties other than BL2093 Pty Ltd and their respective consultants and contractors is at their risk as it may not contain sufficient information for any other purposes.

USING YOUR CMW GEOTECHNICAL REPORT

Geotechnical reporting relies on interpretation of facts and collected information using experience, professional judgement, and opinion. As such it generally has a level of uncertainty attached to it, which is often far less exact than other engineering design disciplines. The notes below provide general advice on what can be reasonably expected from your report and the inherent limitations of a geotechnical report.

Preparation of your report

Your geotechnical report has been written for your use on your project. The contents of your report may not meet the needs of others who may have different objectives or requirements. The report has been prepared using generally accepted Geotechnical Engineering and Engineering Geology practices and procedures. The opinions and conclusions reached in your report are made in accordance with these accepted principles. Specific items of geotechnical or geological importance are highlighted in the report.

In producing your report, we have relied on the information which is referenced or summarised in the report. If further information becomes available or the nature of your project changes, then the findings in this report may no longer be appropriate. In such cases the report must be reviewed, and any necessary changes must be made by us.

Your geotechnical report is based on your project's requirements

Your geotechnical report has been developed based on your specific project requirements and only applies to the site in this report. Project requirements could include the type of works being undertaken; project locality, size and configuration; the location of any structures on or around the site; the presence of underground utilities; proposed design methodology; the duration or design life of the works; and construction method and/or sequencing.

The information or advice in your geotechnical report should not be applied to any other project given the intrinsic differences between different projects and site locations. Similarly geotechnical information, data and conclusions from other sites and projects may not be relevant or appropriate for your project.

Interpretation of geotechnical data

Site investigations identify subsurface conditions at discrete locations. Additional geotechnical information (e.g. literature and external data source review, laboratory testing etc) are interpreted by Geologists or Engineers to provide an opinion about a site specific ground models, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist due to the variability of geological environments. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. Interpretation of factual data can be influenced by design and/or construction methods. Where these methods change review of the interpretation in the report may be required.

Subsurface conditions can change

Subsurface conditions are created by natural processes and then can be altered anthropically or over time. For example, groundwater levels can vary with time or activities adjacent to your site, fill may be placed on a site, or the consistency of near surface conditions might be susceptible to seasonal changes. The report is based on conditions which existed at the time of investigation. It is important to confirm whether conditions may have changed, particularly when large periods of time have elapsed since the investigations were performed.

Interpretation and use by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical report. To help avoid misinterpretations, it is important to retain the assistance of CMW to work with other project design professionals who are affected by the contents of your report. CMW staff can explain the report implications to design professionals and then review design plans and specifications to see that they have correctly incorporated the findings of this report.

Your report's recommendations require confirmation during construction

Your report is based on site conditions as revealed through selective point sampling. Engineering judgement is then applied to assess how indicative of actual conditions throughout an area the point sampling might be. Any assumptions made cannot be substantiated until construction is complete. For this reason, you should retain geotechnical services throughout the construction stage, to identify variances from previous assumption, conduct additional tests if required and recommend solutions to problems encountered on site.

A Geotechnical Engineer, who is fully familiar with the site and the background information, can assess whether the report's recommendations remain valid and whether changes should be considered as the project develops. An unfamiliar party using this report increases the risk that the report will be misinterpreted.

Environmental matters are not covered

Unless specifically discussed in your report environmental matters are not covered by a CMW Geotechnical Report. Environmental matters might include the level of contaminants present of the site covered by this report, potential uses or treatment of contaminated materials or the disposal of contaminated materials. These matters can be complex and are often governed by specific legislation.

The personnel, equipment, and techniques used to perform an environmental study can differ significantly from those used in this report. For that reason, our report does not provide environmental recommendations. Unanticipated subsurface environmental problems can have large consequences for your site. If you have not obtained your own environmental information about the project site, ask your CMW contact about how to find environmental risk-management guidance.

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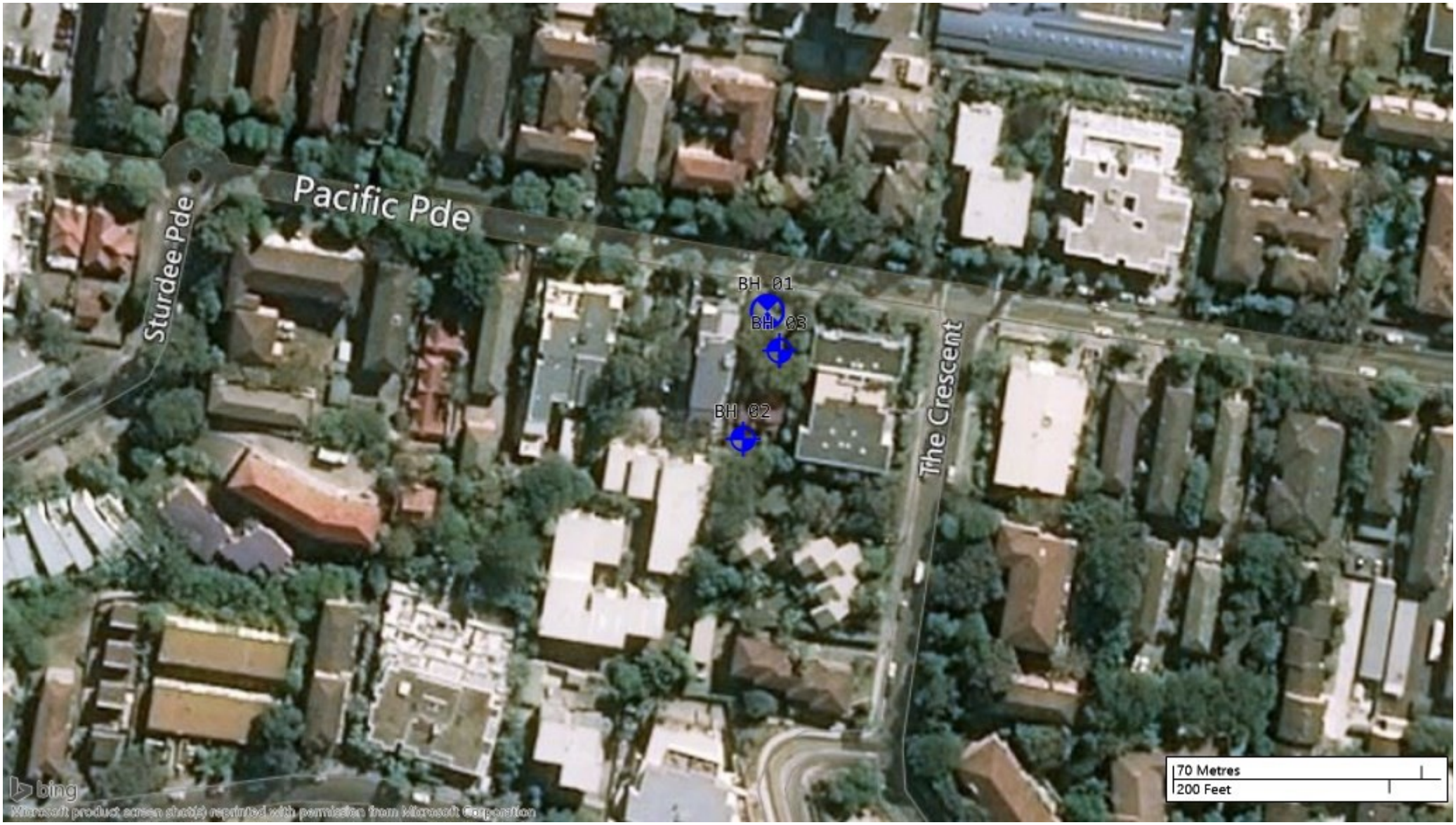
APPENDIX A
Drawings and Site View



LEGEND:

- Locations By Type - HA
- Locations By Type - RC

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CLIENT: BL2093 Pty Ltd		DRAWN: CS	PROJECT: SYD2020-0066
PROJECT: 67, Pacific Parade, Dee Why, NSW		CHECKED: RS	FIGURE: 1
		REVISION: 0	SCALE: 1:1500
TITLE: Site Location and Previous Investigation Plan		DATE: 16/06/2020	SHEET:

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CLIENT:	BL2093 Pty Ltd	DRAWN:	AM	PROJECT:	SYD2022-0051
PROJECT:	67 Pacific Parade, Dee Why, NSW	CHECKED:	AB	Drawing:	2
		REVISION:	0	SCALE:	
TITLE:	Site Investigation Plan	DATE:	30/09/2022	SHEET:	

Table A: Summary or Risk Assessment to Property

Potential Landslide Hazard	After Completion of Proposed development and Implementation of Recommendations outlined in this Report		
	A Instability of proposed retaining walls and/or supports.	**B** Instability of the existing retaining wall in the south-western corner.	**C** Deep movement of rock.
Assessed Likelihood	Rare	Unlikely	Barely Credible
Assess Consequence	Major	Minor	Major
Risk	Low	Low	Very Low
Comments	Assumes walls are properly engineer designed and constructed	Assumes existing retaining wall is safely demolished by competent contractors who replace it with an engineer designed retaining wall.	

Table B: Summary or Risk Assessment to Life

Potential Landslide Hazard	After Completion of Proposed development and Implementation of Recommendations outlined in this Report		
	A Instability of proposed retaining walls and/or supports.	**B** Instability of the existing retaining wall in the south-western corner.	**C** Deep movement of rock.
Assessed Likelihood	Rare	Unlikely	Barely Credible
Indicative Annual Probability	10^{-5}	10^{-4}	10^{-6}
Persons at Risk	Persons within building	Persons near to south-western corner retaining wall	Persons within building
Duration of Use of Area Affected (Temporal Probability)	Assume 20hr/day = 0.83	Assume 5hr/day = 0.21	Assume 20hr/day = 0.83
Probability of not evacuating area	0.01 (warning likely in the form of cracking)	0.01 (warning likely in the form of cracking)	0.01 (warning likely in the form of cracking)
Spatial Probability	1	1	1
Vulnerability to Life if Failure occurs whilst Person present	0.1	0.01	0.1
Risk for Person at Risk	8.3×10^{-9}	2.1×10^{-9}	8.3×10^{-10}
Total Risk for Person Most at Risk	1.1×10^{-8}		

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APPENDIX B

Explanatory notes and borehole logs

ROCK CORE LOGGING

AS1726-2017

ROCK DESCRIPTION AND CLASSIFICATION	
A	**DESCRIPTION**
1	Rock name (BLOCK LETTERS)
2	Grain size and Type
3	Colour
4	Fabric and Texture
5	Inclusions or minor components
6	Moisture Content
B	**CLASSIFICATION**
1	Strength
2	Weathering and/or alteration
C	**DEFECTS**
1	Type
2	Orientation
3	Surface roughness
4	Surface shape
5	Coating
6	Aperture
D	**STRATAGRAPHIC UNIT**
E	**CORE DRILLING PARAMETERS**
1	Core recovery and rock quality
2	Fracture Index

A1-A2

TABLE 16

GUIDE TO THE NAMING OF IGNEOUS ROCKS

Grain size mm	Massive crystalline		
	Much quartz, pale (felsic)	⟺	Little quartz, dark (mafic)
Coarse (>2)	GRANITE	DIORITE	GABBRO
Medium (0.06–2)	MICROGRANITE	MICRODIORITE	DOLERITE
Fine (<0.06)	RHYOLITE	ANDESITE	BASALT

A1-A2

TABLE 15

GUIDE TO THE NAMING OF SEDIMENTARY ROCKS

Grain size mm	Deposited rock type		At least 90% of rock is carbonate(Note 3)		Ejected from a volcano
			Low porosity, indurated	Porous, core can be broken by hand	
>2	CONGLOMERATE (larger rounded grains in a finer matrix) BRECCIA (angular or irregular rock fragments in a finer matrix)		LIMESTONE or DOLOMITE(Note 4)	CALCIRUDITE	AGGLOMERATE (rounded grains in a finer matrix or VOLCANIC BRECCIA (angular fragments in a finer matrix)
0.06–2	SANDSTONE(Notes 1,2)			CALCARENITE	TUFF
0.002–0.06	MUDSTONE(Note 5) silt and clay	SILTSTONE(Note 5) mostly silt		CALCISILTITE	Fine grained TUFF
<0.002		CLAYSTONE(Note 6) mostly clay		CALCILUTITE	

A1-A2

TABLE 17

GUIDE TO THE NAMING OF METAMORPHIC ROCKS

Grain size mm	Foliated	Non-foliated
Coarse (>2)	GNEISS—well developed but often widely spaced foliation sometimes with schistose bands	MARBLE—crystalline calcium carbonate
Medium (0.06–2)	SCHIST—well developed foliation with much mica, some micas larger than 2 mm	QUARTZITE—fused quartz grains
Fine (<0.06)	PHYLLITE—slightly undulose foliation sometimes spotted. SLATE—well developed planar cleavage	SERPENTINITE—usually a grey and green rock formed by the alteration of mafic igneous rocks HORNFELS—usually a fine grained rock formed by thermal metamorphism

NOTE: Foliated metamorphic rocks normally form by regional metamorphism and non-foliated metamorphic rocks form by contact or thermal metamorphism.

A4: Texture and fabric

INDISTINCT: little effect on strength properties DISTINCT: easily breaks along the fabric	**Igneous**	Flow banding	Layering of partially solidified rock or orientated crystals
	Metamorphic	Foliation	Parallel arrangement of mineral
		Cleavage	Foliation in fine grained metamorphic rocks
	Sedimentary	Bedding	<20mm Changes in sedimentation defined by grainsize
		Lamination	>20mm Similar to bedding

A5: Features inclusions and minor components

- Thickness - Size - Orientation - Coverage %	**Igneous**	Vesicles (empty) Amygdules (mineralised)
		'Floater' boulder size rock in residual to extremely weathered matrix
	Sedimentary	Cross stratification
		Clast or matrix support
		Nodules, pyrite crystals, iron stones, carbonates
		Mineral veins

B1: ROCK MATERIAL STRENGTH

Symbol	Term	Uniaxial Compressive Strength - UCS (MPa)	Point Load Index - $I_{s(50)}$ (MPa) - GUIDE ONLY	Field Guide
EL	Extremely Low	Less than 0.6	Less than 0.03	Easily remoulded by hand to a material with soil properties (logged as soil).
VL	Very Low	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
L	Low	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	6 to 20	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	20 to 60	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
VH	Very High	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	More than 200	More than 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

B2: WEATHERING CLASSIFICATION

Symbol	Term	Definition
RS	Residual Soil	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.
XW	Extremely weathered rock	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.
HW (or DW)	Highly Weathered	Rock strength usually changed by weathering. The rock may be highly discoloured. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
MW (or DW)	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 recognizable, but shows little or no change of strength from fresh rock.
SW	Slightly weathered rock	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
FR	Fresh rock	Rock shows no sign of decomposition or staining.

C4

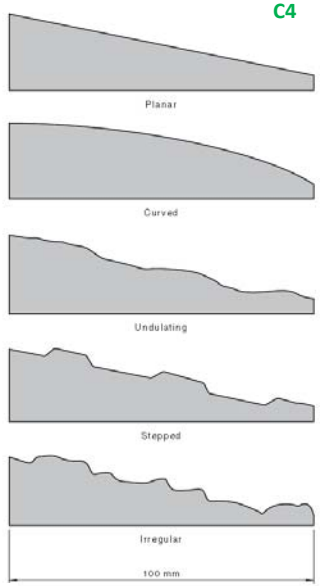
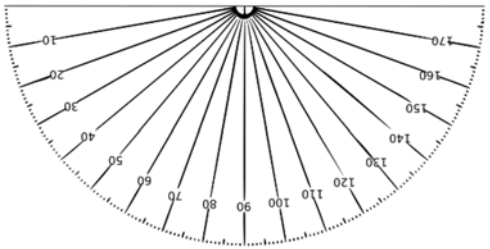


FIGURE 7 DEFECT SHAPES ILLUSTRATED AT MEDIUM SCALE

C1: Defect Type

ABBREVIATION	TERM	DEFINITION	DIAGRAM
PT	Parting	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.	
JT	Joint	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed.	
SS	Sheared Surface	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.	
SZ	Sheared Zone	Zone of rock material with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.	
CS	Crushed Zone / Seam	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.	
SM	Seam	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface.	

C2



C6: Aperture

ABBREVIATION	TERM
DIS	Discontinuous
CL	Closed
5mm	Measured width between joint surfaces

C2: Orientation

ABBREVIATION	TERM
SH	Sub Vertical
SV	Sub Horizontal
10°	Angle from horizontal

C3: Surface Roughness

ABBREVIATION	TERM	Description
VR	Very Rough	Many large irregularities generally > 1 mm
RO	Rough	Many small irregularities generally > 1 mm
SM	Smooth	Few or no surface irregularities
PO	Polished	Shiny smooth surface
SI	Slickensided/Striated	Grooved/striated surface, usually polished

C4: Surface Shape

ABBREVIATION	TERM	Description
PL	Planar	Does not vary in orientation
CU	Curved	gradual change in orientation
UN	Undulating	wavy surface
ST	Stepped	one or more well defined steps
IR	Irregular	many sharp changes in orientation

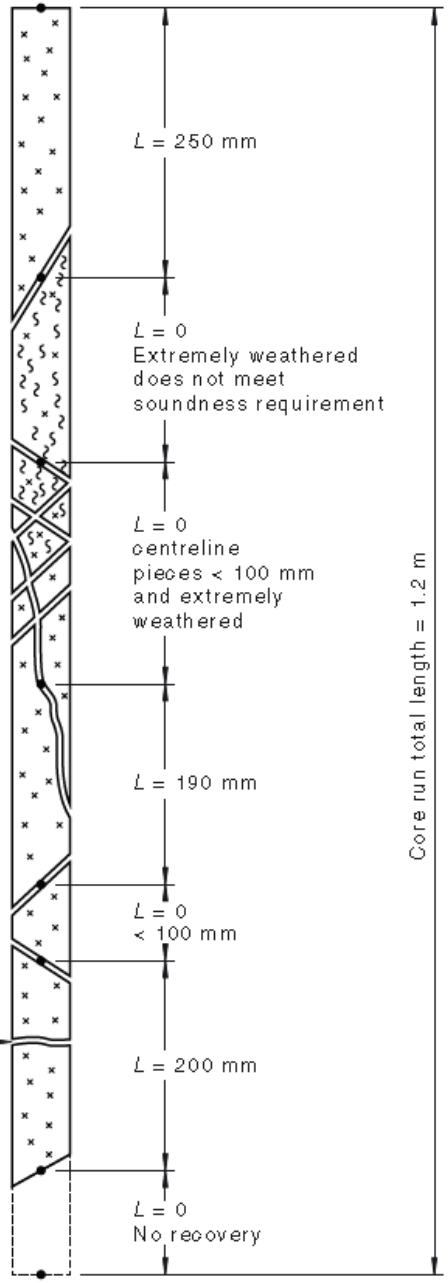
C5: Coatings

ABBREVIATION	TERM	Description
CN	Clean	No visible coating
SN	Stained	No coating but surface discoloured
VN	Veneer	visible coating too thin to measure
CT	Coating	visible coating up to 1mm thick
IF	Infilled	Over 1mm thick of soil present

E1: ROCK CORE RECOVERY		
Symbol	**Term**	**Definition**
TCR	Total Core Recovery (%)	The ratio of total length of core recovered to length of core run drilled, expressed as a percentage.
SCR	Solid Core Recovery (%)	The ratio of the total length of solid cylindrical pieces of core recovered to length of core run drilled, expressed as a percentage.
RQD	Rock Quality Designation (%)	The ratio of the total length of solid cylindrical pieces of core over 100mm in length recovered to length of core run drilled, expressed as a percentage.

E2: FRACTURE INDEX (FI): number of defects per meter of core	
Min / Max (mm)	0-20
	20-40
	40-100
	100-300
	300-1000
	>1000

$$RQD = \frac{250 + 190 + 200}{1200} \times 100\% = 53\%$$



CORE PRESENTATION	
Project name	High Definition
Project number	Drilling notes and depths
Date	Scale
Borehole name	Colour chart
Box number	Good lighting
Core depth	Wet core

FIGURE 13 RQD MEASUREMENT PROCEDURE

BOREHOLE LOG - BH 01

Client: Diversified Group Pty Ltd
Project: 67, Pacific Parade, Dee Why, NSW
Location: 67, Pacific Parade, Dee Why, NSW
Project ID: SYD2020-0066
Date: 10/06/2020

CMW Geosciences

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Logged by: CS
Checked by: RS

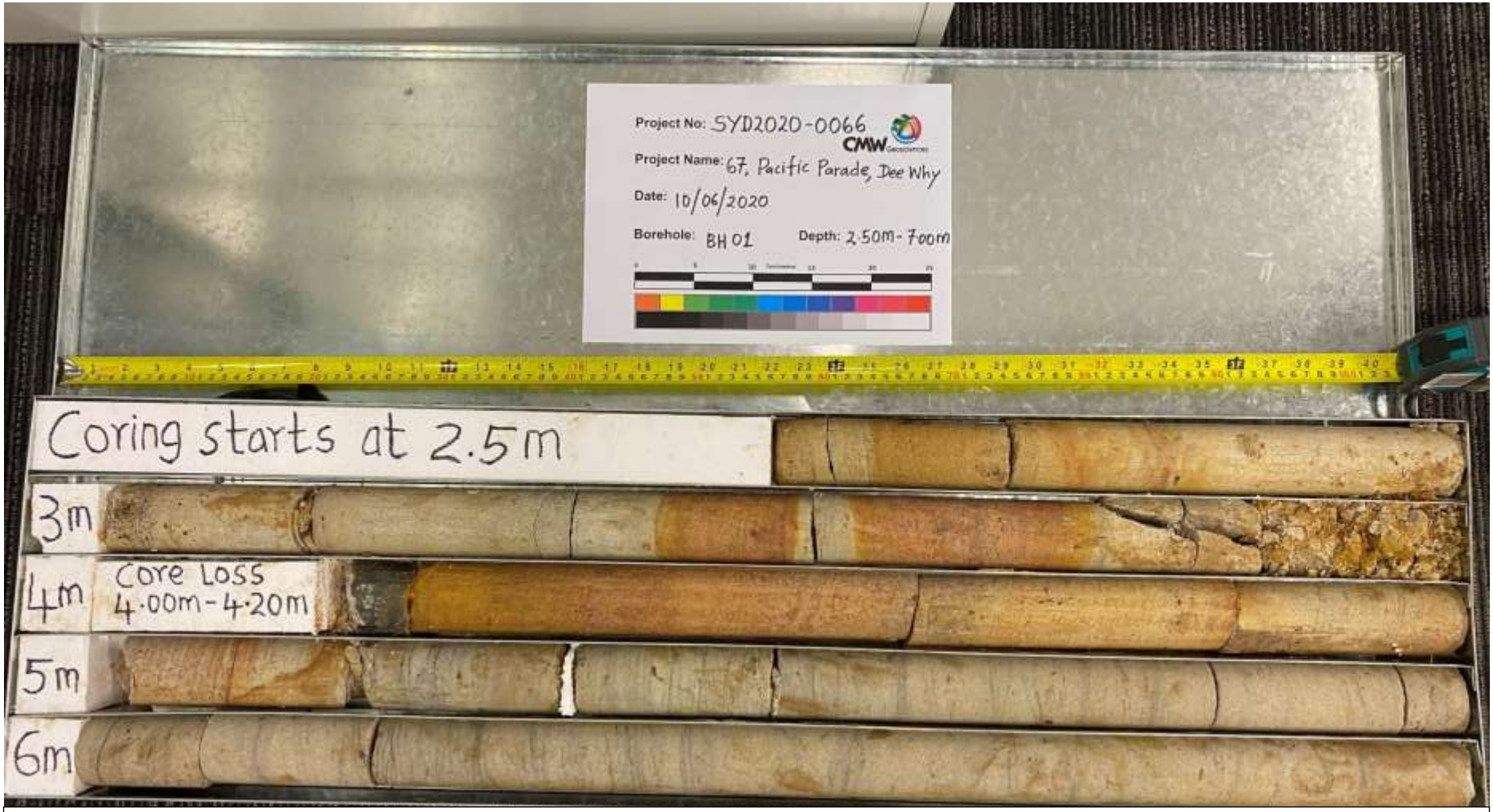
Position: ~ E.341571m N.6263669m (MGA 51)
Elevation: ~ 31 m (AHD)

Hole Diameter: 100mm
Angle from horizontal: 90°

Plant: Rig 17
Contractor: BG Drilling

Drilling Method	Well	Groundwater	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength (VL L M H VH EH; UCS (MPa); UCS (from Is50))	Cementation/ Weathering	Defect Spacing (mm)	Samples, test results and additional Data
HA						31.0			SP: TOPSOIL: SAND: fine to medium grained, dark brown with rootlets						
						30.9			SP: SAND: fine to medium grained, grey brown						
AD/V						30.6	1		SANDSTONE: fine to medium grained, brown				XW		
						29.0	2		SANDSTONE: medium to coarse grained, brown				XW-HW		
RC			92	87	82	28.5	3		SANDSTONE: pale orange brown to grey				MW		2.50-2.54m:JT, 10°, CU, rough 2.54-2.68m:JT, 0°, CU, rough 2.68-3.16m:JT, 0°, CU, rough 3.16-3.36m:IF, 0°, CU, rough 3.36-3.53m:JT, 3°, CU, rough 3.53-3.80m:JT, 2°, CU, rough
						27.2	4		SANDSTONE: fine to medium grained, pale orange brown to grey				XW		3.86-4.00m:SM, 10°, CU, rough
						27.0			CORE LOSS						
						26.8			grey *... from 4.20m to 5.20m, pale orange grey*				MW		4.20-4.23m:JT, 10°, CU, rough 4.23-4.60m:IF, 0°, CU, rough 4.60-4.80m:IF, 0°, CU, rough 4.80-5.20m:JT, 0°, CU, rough
			98	100	100		5						MW-SW		5.35-5.50m:JT, 0°, CU, rough 5.50-5.82m:IF, 0°, CU, rough 5.50-5.60m:C Is50=1.53MPa 5.82-5.95m:IF, 0°, CU, rough 5.95-6.09m:JT, 0°, CU, rough 6.09-6.21m:JT, 5°, CU, rough 6.20-6.29m:C Is50=1.67MPa
							6								
							7		Borehole terminated at 7.0 m						
							8								

Termination reason: Target Depth Reached
Remarks:



Borehole terminated at 7.0m

BOREHOLE CORE PHOTOGRAPH:

Logged by:	CS	Hole Diameter: 100mm	
Checked by:	RS	Angle from Horizontal: 90°	
Position:	E.341571m N.6263669m	Plant: Rig 17	
Elevation:	31 m (AHD)	Contractor: BG Drilling	

Client: BL2093 Pty Ltd
Project: Site investigation in Dee Why NSW
Location: 67 Pacific Parade, Dee Why, NSW
Project No: SYD2020-0066
Date: 10/06/2020

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BOREHOLE LOG - BH 02

Client: Diversified Group Pty Ltd
Project: 67, Pacific Parade, Dee Why, NSW
Location: 67, Pacific Parade, Dee Why, NSW
Project ID: SYD2020-0066
Date: 10/06/2020

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1:10 Sheet 1 of 1

Logged by: CS Position: ~ E.341565m N.6263633m (MGA 51) Plant used: Hand Auger
Checked by: RS Elevation: ~ 37.8 m (AHD) Contractor: N/A

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Structure & other observations
				37.6			SP: TOPSOIL: SAND: fine to medium grained, dark brown with rootlets	M	D	
							Borehole terminated at 0.2 m			
					1					
					2					

Termination Reason: Refusal on Rock
Remarks:

BOREHOLE LOG - BH 03

Client: Diversified Group Pty Ltd
Project: 67, Pacific Parade, Dee Why, NSW
Location: 67, Pacific Parade, Dee Why, NSW
Project ID: SYD2020-0066
Date: 10/06/2020

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1:10 Sheet 1 of 1

Logged by: CS Position: ~ E.341575m N.6263658m (MGA 51) Plant used: Hand Auger
Checked by: RS Elevation: ~ 35.9 m (AHD) Contractor: N/A

Well	Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description Soil Type, Plasticity or Particle Characteristics, Colour, Secondary and Minor Components	Moisture Condition	Consistency/ Relative Density	Structure & other observations
				35.8			SP: TOPSOIL: SAND: fine to medium grained, dark brown with grass and rootlets	M	D	
							Borehole terminated at 0.1 m			
					1					
					2					

Termination Reason: Refusal on Rock
Remarks:

BOREHOLE LOG - BH04

Client: Benson McCormack Architecture
Project: Additional GI - 67 Pacific Parade, Dee Why
Location: 67 Pacific Parade, Dee Why
Project ID: SYD2022-0051
Date: 23/09/2022

CMW Geosciences

1:25 Sheet 1 of 3

Logged by: Ebrahim Alaei
Checked by: AB

Position: ~ E.341568m N.6263646m
Elevation: ~ 36m (AHD)

Plant: CE180
Angle from horizontal: 90° Contractor: BG Drilling

Drilling Method	Well	Groundwater	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength VL L M H VH EH (6, 60; UCS (MPa), UCS (from Is50))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Samples, test results and additional Data
AD/V							1		SAND: fine to medium grained, sub-angular to sub-rounded; yellow mottled pale brown; with gravel, fine grained, sub-angular to sub-rounded; FILL, Trace of brick fragments.						FILL
									SAND: fine to medium grained, sub-angular to sub-rounded; white mottled pale brown-orange; with gravel, fine grained, sub-angular to sub-rounded; Sandstone fragments.	D to VD	D to M				RESIDUAL
															1.50-1.53m:S 1.5m:SPT: (20/30mm) N=R
							2		SANDSTONE, medium to coarse grained, pale grey orange streaked dark grey, Indistinctly bedded with frequent very thin carbonaceous layers.				SW		BEDROCK 1.55-1.70m:D(1KG) 1.60-1.66m:C 2 1.60-2.00m:C 1 1.60-2.00m:C 1.0 Is50=0.51MPa Is50=0.26MPa
			100	96	91				*... from 2.10m to 2.25m, Colour change to grey streaked orange*				MW		2.12m:JT, 30°, UN, RO, CO, (sand)
									INTERBEDDED SANDSTONE AND SILTSTONE (80:20); medium to coarse grained, grey streaked dark grey orange, indistinctly bedded.				HW		2.26m:JT, 20°, IR, RO, CO, (sand) 2.38m:SM, 10°, infilled, (clay)
									SANDSTONE, medium to coarse grained, pale grey orange streaked dark grey, Indistinctly bedded.				SW		2.47m:PT, 10°, CU, RO, CO, (sand) 2.48-2.53m:C 4 2.48-2.65m:C 3 Is50=0.30MPa Is50=0.24MPa
							3		*... from 3.05m to 3.30m, Colour change to orange grey streaked dark grey*						3.00-3.40m:C 2.0
			100	100	100				*... from 3.81m to 3.88m, Thick orange bedding (10-20°)*				SW		3.66-3.70m:C 6 3.66-3.81m:C 5 Is50=0.57MPa 3.80m:PT, 5°, UN, RO, CO, (sand) Is50=0.57MPa
							4								4.17m:PT, 0°, CU, RO, CO, (sand) 4.18-4.23m:C 8 4.18-4.31m:C 7 Is50=0.63MPa Is50=0.63MPa
							5								

Termination reason: Target depth reached

Remarks:

BOREHOLE LOG - BH04

Client: Benson McCormack Architecture
Project: Additional GI - 67 Pacific Parade, Dee Why
Location: 67 Pacific Parade, Dee Why
Project ID: SYD2022-0051
Date: 23/09/2022

CMW Geosciences

1:25 Sheet 2 of 3

Logged by: Ebrahim Alaei
Checked by: AB

Position: ~ E.341568m N.6263646m
Elevation: ~ 36m (AHD)

Plant: CE180
Angle from horizontal: 90°
Contractor: BG Drilling

Drilling Method	Well	Groundwater	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength (VL L M H VH EH; 6 60; UCS (MPa) UCS (from Is50))	Cementation/ Weathering	Defect Spacing (mm) (<20 20-40 40-100 100-300 300-1000 >1000)	Samples, test results and additional Data
RC							6		SANDSTONE, medium to coarse grained, pale grey orange streaked dark grey, Indistinctly bedded.				SW		5.55-5.60m:C 10 5.55-5.66m:C 9 Is50=0.70MPa Is50=0.71MPa
									SANDSTONE, medium to coarse grained, pale grey streaked dark grey, Frequent thin carbonaceous layers, distinctly bedded (10-20°).						
									... from 5.78m to 5.82m, Coarse carbonaceous layers (40mm) *... from 5.83m to 5.85m, Siltstone layer (20mm), dark grey* *... from 5.85m to 5.97m, Highly fractured* *... from 6.00m to 6.20m, Colour change to brown streaked pale grey*				SW to MW		5.83-5.85m:SM, 30°, infilled, (silt) 5.85-5.94m:CS, Recovered as coarse angular gravel 5.97m:PT, 0°, CU, RO, CO, (sand) 6.00m:PT, 0°, CU, RO, CO, (sand) 6.15m:PT, 10°, CU, RO, CO, (sand)
							7		*... from 6.35m to 6.37m, Seam, sandy clay, grey, low to medium plasticity*						6.34-6.37m:CS, Recovered as gravel, dark grey, angular 6.38-6.56m:C 11 6.39m:JT, 0°, ST, RO, CO, (sand) 6.51-6.56m:C 12 Is50=0.96MPa Is50=1.08MPa
			100	94	89				SANDSTONE, medium to coarse grained, pale brown streaked grey, Frequent thin carbonaceous layers, distinctly bedded (10-20°).				SW		7.18m:PT, 15°, UN, RO, CO, (sand) 7.59-7.64m:C 14 7.59-7.71m:C 13 Is50=0.98MPa Is50=0.85MPa
							8								8.00m:PT, 20°, UN, RO, CO, (sand)
							9		*... from 8.88m to 8.95m, Colour change to brown, streaked pale grey*				SW		8.71-8.75m:C 16 8.71-8.87m:C 15 Is50=0.55MPa Is50=0.99MPa 8.88m:PT, 10°, CU, RO, CO, (sand) 9.50m:PT, 10°, ST, RO, CO, (sand) 9.50-9.55m:C 18 9.50-9.63m:C 17 Is50=0.48MPa Is50=0.92MPa 9.65m:PT, 5°, CU, RO, infilled, (sand)
							10								

Termination reason: Target depth reached

Remarks:

BOREHOLE LOG - BH04

Client: Benson McCormack Architecture
Project: Additional GI - 67 Pacific Parade, Dee Why
Location: 67 Pacific Parade, Dee Why
Project ID: SYD2022-0051
Date: 23/09/2022

CMW Geosciences

1:25 Sheet 3 of 3

Logged by: Ebrahim Alaei
Checked by: AB

Position: ~ E.341568m N.6263646m
Elevation: ~ 36m (AHD)

Plant: CE180
Angle from horizontal: 90° Contractor: BG Drilling

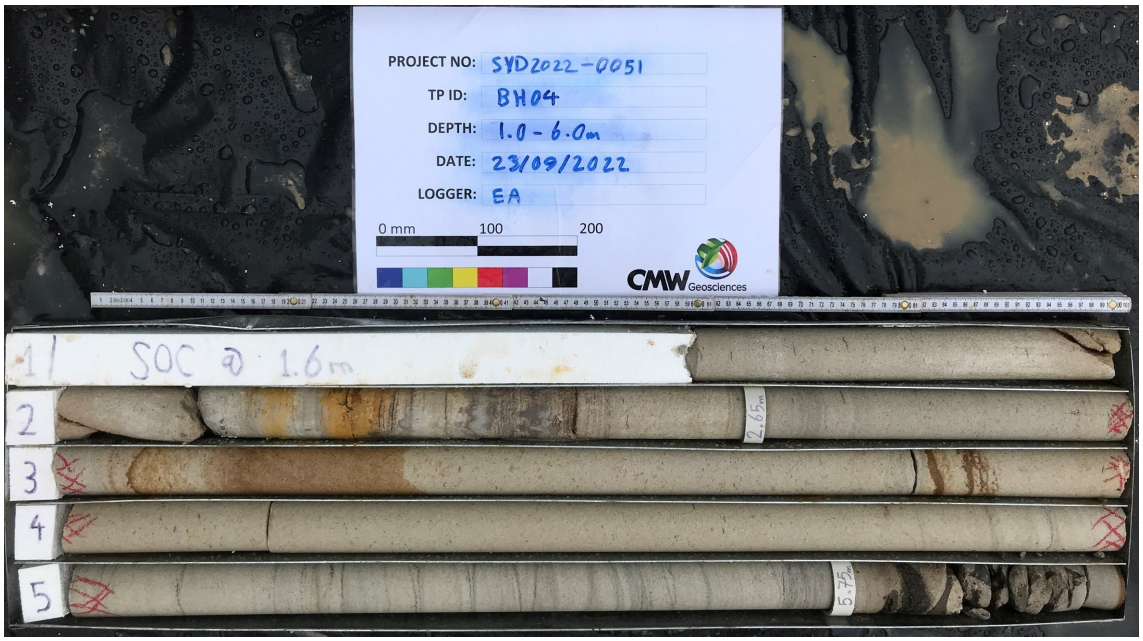
Drilling Method	Well	Groundwater	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength (VL L M H VH EH; 6 60; UCS (MPa); UCS (from Is50))	Cementation/ Weathering	Defect Spacing (mm) (<20; 20-40; 40-100; 100-300; 300-1000; >1000)	Samples, test results and additional Data
			100	99	97		11		SANDSTONE, medium to coarse grained, pale brown streaked grey, Frequent thin carbonaceous layers, distinctly bedded (10-20°).				SW		9.90m:JT, 80°, UN, RO, CO, (sand) 10.10m:PT, 15°, CU, RO, CO, (sand) 10.10-10.15m:C 20 10.10-10.25m:C 19 Is50=1.37MPa Is50=1.18MPa 11.23m:PT, 5°, CU, RO, CO, (sand) 11.60-11.66m:C 22 11.60-11.70m:C 21 Is50=1.79MPa Is50=1.11MPa
							12		Borehole terminated at 12.0 m				SW		
							13								
							14								
							15								

Termination reason: Target depth reached

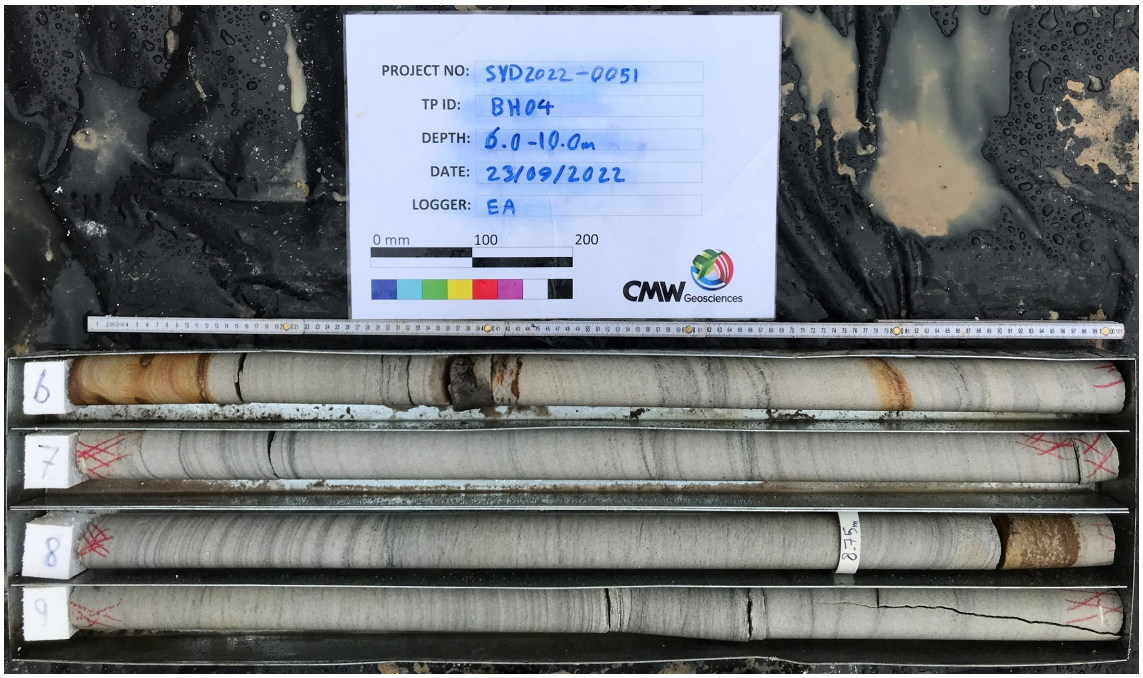
Remarks:

PHOTOGRAPH SHEET - BH04

Client: Benson McCormack Architecture
Project: Additional GI - 67 Pacific Parade, Dee Why
Location: 67 Pacific Parade, Dee Why
Project ID: SYD2022-0051
Date: 23/09/2022



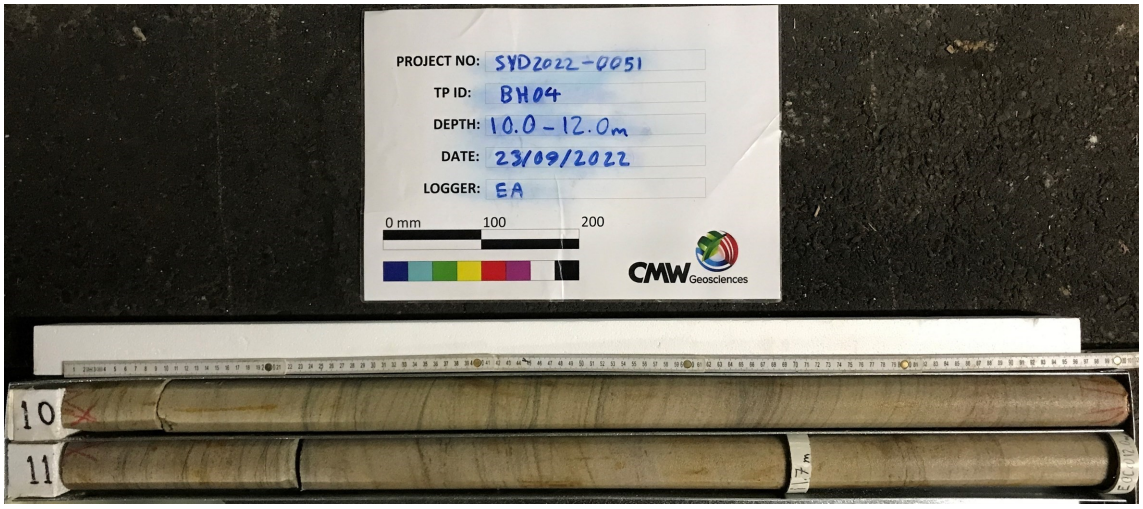
BH04_1-6m



BH04_6-10m

PHOTOGRAPH SHEET - BH04

Client: Benson McCormack Architecture
Project: Additional GI - 67 Pacific Parade, Dee Why
Location: 67 Pacific Parade, Dee Why
Project ID: SYD2022-0051
Date: 23/09/2022



BH04_10-12m

BOREHOLE LOG - BH05

Client: Benson McCormack Architecture
Project: Additional GI - 67 Pacific Parade, Dee Why
Location: 67 Pacific Parade, Dee Why
Project ID: SYD2022-0051
Date: 23/09/2022

CMW Geosciences

1:25 Sheet 1 of 2

Logged by: Ebrahim Alaei
Checked by: AB

Position: ~ E.341566m N.6263643m
Elevation: ~ 37m (AHD)

Plant: CE180
Angle from horizontal: 90° Contractor: BG Drilling

Drilling Method	Well	Groundwater	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength (VL L M H VH EH; 6 60; ● UCS (MPa) × UCS (from Is50))	Cementation/ Weathering	Defect Spacing (mm) <20 20-40 40-100 100-300 300-1000 >1000	Samples, test results and additional Data
AD/V							0		SAND: fine to medium grained, sub-angular to sub-rounded; yellow mottled pale brown; with gravel, fine grained, sub-angular to sub-rounded; FILL,Trace of brick fragments.		M				FILL
							1		SAND: fine to medium grained, sub-angular to sub-rounded; white; trace gravel, fine grained, sub-angular to sub-rounded.	VD	D to M				ALLUVIUM 0.50-0.79m:S 0.5m:SPT: (5,20/140mm) N=R 1.50-1.54m:S 1.5m:SPT: (20/40mm) N=R
							2		SAND: fine to medium grained, sub-angular to sub-rounded; white mottled pale brown-orange; trace gravel, fine grained, sub-angular to sub-rounded.						
									SAND: fine to medium grained, sub-angular to sub-rounded; white mottled pale brown-orange; with gravel, fine grained, sub-angular to sub-rounded; Sandstone fragments.						RESIDUAL 2.50-2.70m:D(1KG)
			100	100	100		3		SANDSTONE, medium to coarse grained, brown orange mottled pale grey, Indistinctly bedded. SANDSTONE, medium to coarse grained, pale grey orange mottled pale blue, Indistinctly bedded.			×	SW to MW SW		BEDROCK 2.70-2.82m:C 23 2.77-2.82m:C 24 Is50=0.62MPa Is50=0.81MPa 3.57-3.63m:C 26 3.57-4.00m:C 25 Is50=0.56MPa
							4					×			Is50=0.54MPa
									SANDSTONE, medium to coarse grained, yellow mottled pale brown, Indistinctly bedded. SANDSTONE, medium to coarse grained, pale brown streaked grey, Frequent thin carbonaceous layers, distinctly bedded (15-30°).			×	SW XW SW to MW		4.50-4.56m:SM, Recovered as sandy gravel, angular, yellow mottled grey 4.58m:PT, 15°, UN, RO, CO, (sand) 4.61m:PT, 15°, CU, RO, CO, (sand) 4.61-4.66m:C 28 4.61-4.73m:C 27
							5								

Termination reason: Target depth reached

Remarks:

BOREHOLE LOG - BH05

Client: Benson McCormack Architecture
Project: Additional GI - 67 Pacific Parade, Dee Why
Location: 67 Pacific Parade, Dee Why
Project ID: SYD2022-0051
Date: 23/09/2022

CMW Geosciences

1:25 Sheet 2 of 2

Logged by: Ebrahim Alaei
Checked by: AB

Position: ~ E.341566m N.6263643m
Elevation: ~ 37m (AHD)

Plant: CE180
Angle from horizontal: 90° Contractor: BG Drilling

Drilling Method	Well	Groundwater	Coring TCR	Coring SCR	Coring RQD	RL (m)	Depth (m)	Graphic Log	Rock/Soil Description	Consistency	Moisture Condition	Rock Strength (VL L M H VH EH; 6; 60; UCS (MPa); UCS (from Is50))	Cementation/ Weathering	Defect Spacing (mm) (<20; 20-40; 40-100; 100-300; 300-1000; >1000)	Samples, test results and additional Data
RC			100	95	91		6		SANDSTONE, medium to coarse grained, pale brown streaked grey, Frequent thin carbonaceous layers, distinctly bedded (15-30°). *... from 5.61m to 5.70m, Colour change to brown streaked grey* *... from 5.70m to 6.30m, Colour change to pale grey streaked pale black* *... from 6.30m to 6.45m, Colour change to pale grey streaked orange* *... from 6.35m to 6.38m, Carbonaceous layers (10mm), yellow brown*				SW to MW MW to HW SW		Is50=0.40MPa 4.73m:PT, 10°, CU, RO, CO, (sand) Is50=0.21MPa 5.54m:PT, 10°, CU, RO, CO, (sand) 5.54-5.59m:C 30 5.54-5.65m:C 29 Is50=0.61MPa 5.64m:JT, 45°, CU, RO, CO, (sand) Is50=0.49MPa 5.70m:PT, 10°, CU, RO, CO, (sand) 5.95m:PT, 15°, CU, RO, CO, (sand) 6.28m:PT, 10°, CU, RO, SN, (Fe) 6.33m:PT, 20°, CU, RO, SN, (Fe) 6.36m:PT, 15°, CU, RO, SN, (Fe) 6.36-6.40m:C 32 6.36-6.58m:C 31 Is50=0.19MPa 6.57m:PT, 10°, IR, RO, infilled, (sand) Is50=0.35MPa 6.65m:PT, 10°, IR, RO, infilled, (sand)
			100	100	100		8		SANDSTONE, medium to coarse grained, pale grey streaked grey brown, Frequent thin carbonaceous layers, distinctly bedded (15-30°). *... from 7.43m to 7.53m, Colour change to pale brown orange streaked grey* Borehole terminated at 9.75 m				SW		7.25-7.30m:C 34 7.25-7.58m:C 33 Is50=1.21MPa Is50=1.23MPa 7.90m:PT, 5°, CU, RO, CO, (sand) 8.60-8.74m:C 35 8.69-8.74m:C 36 8.71m:PT, 10°, CU, RO, CO, (sand) Is50=0.90MPa Is50=1.01MPa 9.65m:PT, 10°, CU, RO, CO, (sand) 9.65-9.70m:C 38 9.65-9.75m:C 37 Is50=1.14MPa Is50=0.94MPa

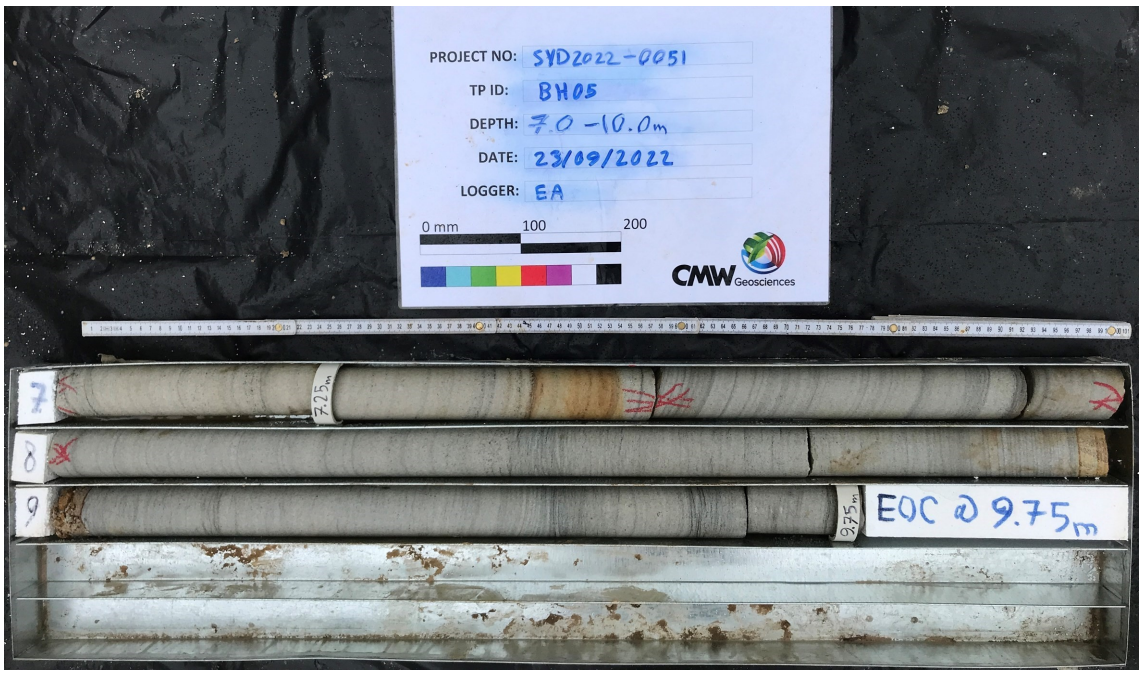
Termination reason: Target depth reached

Remarks:

PHOTOGRAPH SHEET - BH05

Client: Benson McCormack Architecture
Project: Additional GI - 67 Pacific Parade, Dee Why
Location: 67 Pacific Parade, Dee Why
Project ID: SYD2022-0051
Date: 23/09/2022

BH05_2-7m



BH05_7-10m

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APPENDIX C
Laboratory test results

CMW Geosciences	CLIENT:	BL2093 Pty Ltd	TESTED: EA
	PROJECT:	Additional GI - 67 Pacific Parade, Dee Why NSW 2099	CHECKED: AB
			REVISION: A
	TITLE:	**Point Load Strength Index (AS 4133.4.1: 2007)**	DATE: 28/09/2022
			PROJECT: SYD2022-0051

Borehole	Depth From (m)	Depth To (m)	Rock Description	Moisture Condition	Test Type	W (mm)	D (mm)	P (kN)	Failure Mode	$(D_e)^2$ (mm^2)	Is(50) (Mpa)	Strength Class	L	Diametral L>0.5D	Axial 0.6W<D	Axial D<W	Validity
BH04	1.6	2	SANDSTONE	Dry	D		60	0.85	3	3,600	**0.26**	L	**400**	True			Valid
BH04	1.6	1.66	SANDSTONE	Dry	A	60	55	1.92	1	4,202	**0.51**	M			True	True	Valid
BH04	2.48	2.65	SANDSTONE	Dry	D		60	0.81	3	3,600	**0.24**	L	**170**	True			Valid
BH04	2.48	2.53	SANDSTONE	Dry	A	60	50	1.05	1	3,820	**0.30**	M			True	True	Valid
BH04	3.66	3.81	SANDSTONE	Dry	D		60	1.88	3	3,600	**0.57**	M	**150**	True			Valid
BH04	3.66	3.7	SANDSTONE	Dry	A	60	45	1.81	1	3,438	**0.57**	M			True	True	Valid
BH04	4.18	4.31	SANDSTONE	Dry	D		60	2.10	3	3,600	**0.63**	M	**130**	True			Valid
BH04	4.18	4.23	SANDSTONE	Dry	A	60	45	2.00	1	3,438	**0.63**	M			True	True	Valid
BH04	5.55	5.66	SANDSTONE	Dry	D		60	2.35	3	3,600	**0.71**	M	**110**	True			Valid
BH04	5.55	5.6	SANDSTONE	Dry	A	60	45	2.23	1	3,438	**0.70**	M			True	True	Valid
BH04	6.38	6.56	SANDSTONE	Dry	D		60	3.20	3	3,600	**0.96**	M	**180**	True			Valid
BH04	6.51	6.56	SANDSTONE	Dry	A	60	45	3.47	1	3,438	**1.08**	H			True	True	Valid
BH04	7.59	7.71	SANDSTONE	Dry	D		60	2.81	3	3,600	**0.85**	M	**120**	True			Valid
BH04	7.59	7.64	SANDSTONE	Dry	A	60	45	3.15	1	3,438	**0.98**	M			True	True	Valid
BH04	8.71	8.87	SANDSTONE	Dry	D		60	3.27	3	3,600	**0.99**	M	**160**	True			Valid
BH04	8.71	8.75	SANDSTONE	Dry	A	60	40	1.60	1	3,056	**0.55**	M			True	True	Valid

Legend

Test Type		Failure Mode		Strength Classification		Is(50) (MPa)
D	Diametral	1	Through Substance	EL	Extremely Low	<0.03
A	Axial	2	Along Defect	VL	Very Low	0.03 - 0.1
I	Irregular	3	Parallel to Bedding	L	Low	0.1 - 0.3
		4	Not Applicable	M	Medium	0.3 - 1.0
				H	High	1.0 - 3.0
				VH	Very High	3.0 - 10.0
				EH	Extremely High	10.0 - 30.0

Notes

- For diametral tests $D_e^2 = D^2$
- For axial or irregular tests $D_e^2 = 4.W.D/\pi$
- Strength classification based on AS1726-2017
- Moisture content required by AS4133.3.1-2007

CMW Geosciences	CLIENT:	BL2093 Pty Ltd	TESTED: EA
	PROJECT:	Additional GI - 67 Pacific Parade, Dee Why NSW 2099	CHECKED: AB
			REVISION: A
	TITLE:	**Point Load Strength Index (AS 4133.4.1: 2007)**	DATE: 28/09/2022
			PROJECT: SYD2022-0051

Borehole	Depth From (m)	Depth To (m)	Rock Description	Moisture Condition	Test Type	W (mm)	D (mm)	P (kN)	Failure Mode	$(D_e)^2$ (mm^2)	Is(50) (Mpa)	Strength Class	L	Diametral L>0.5D	Axial 0.6W<D	Axial D<W	Validity
BH04	9.5	9.63	SANDSTONE	Dry	D		60	3.06	3	3,600	**0.92**	M	**130**	True			Valid
BH04	9.5	9.55	SANDSTONE	Dry	A	60	50	1.68	1	3,820	**0.48**	M			True	True	Valid
BH04	10.1	10.25	SANDSTONE	Dry	D		60	3.90	3	3,600	**1.18**	H	**150**	True			Valid
BH04	10.1	10.15	SANDSTONE	Dry	A	60	50	4.75	1	3,820	**1.37**	H			True	True	Valid
BH04	11.6	11.7	SANDSTONE	Dry	D		60	3.67	3	3,600	**1.11**	H	**100**	True			Valid
BH04	11.6	11.66	SANDSTONE	Dry	A	60	55	6.68	1	4,202	**1.79**	H			True	True	Valid
										-							
										-							
										-							
										-							
										-							
										-							
										-							
										-							
										-							

Legend

Test Type		Failure Mode		Strength Classification		Is(50) (MPa)
D	Diametral	1	Through Substance	EL	Extremely Low	<0.03
A	Axial	2	Along Defect	VL	Very Low	0.03 - 0.1
I	Irregular	3	Parallel to Bedding	L	Low	0.1 - 0.3
		4	Not Applicable	M	Medium	0.3 - 1.0
				H	High	1.0 - 3.0
				VH	Very High	3.0 - 10.0
				EH	Extremely High	10.0 - 30.0

Notes

- For diametral tests $D_e^2 = D^2$
- For axial or irregular tests $D_e^2 = 4.W.D/\pi$
- Strength classification based on AS1726-2017
- Moisture content required by AS4133.3.1-2007

CMW Geosciences	CLIENT: BL2093 Pty Ltd	TESTED:	EA
	PROJECT: Additional GI - 67 Pacific Parade, Dee Why NSW 2099	CHECKED:	AB
		REVISION:	A
	TITLE: **Point Load Strength Index (AS 4133.4.1: 2007)**	DATE:	28/09/2022
		PROJECT:	SYD2022-0051

Borehole	Depth From (m)	Depth To (m)	Rock Description	Moisture Condition	Test Type	W (mm)	D (mm)	P (kN)	Failure Mode	$(D_e)^2$ (mm^2)	Is(50) (Mpa)	Strength Class	L	Diametral L>0.5D	Axial 0.6W<D	Axial D<W	Validity
BH05	2.7	2.82	SANDSTONE	Dry	D		60	2.05	3	3,600	**0.62**	M	**120**	True			Valid
BH05	2.77	2.82	SANDSTONE	Dry	A	60	45	2.58	1	3,438	**0.81**	M			True	True	Valid
BH05	3.57	4	SANDSTONE	Dry	D		60	1.78	3	3,600	**0.54**	M	**430**	True			Valid
BH05	3.57	3.63	SANDSTONE	Dry	A	60	55	2.10	1	4,202	**0.56**	M			True	True	Valid
BH05	4.61	4.73	SANDSTONE	Dry	D		60	0.69	3	3,600	**0.21**	L	**120**	True			Valid
BH05	4.61	4.66	SANDSTONE	Dry	A	60	45	1.27	1	3,438	**0.40**	M			True	True	Valid
BH05	5.54	5.65	SANDSTONE	Dry	D		60	1.62	3	3,600	**0.49**	M	**110**	True			Valid
BH05	5.54	5.59	SANDSTONE	Dry	A	60	45	1.96	1	3,438	**0.61**	M			True	True	Valid
BH05	6.36	6.58	SANDSTONE	Dry	D		60	1.15	3	3,600	**0.35**	M	**220**	True			Valid
BH05	6.36	6.4	SANDSTONE	Dry	A	60	40	0.56	1	3,056	**0.19**	L			True	True	Valid
BH05	7.25	7.58	SANDSTONE	Dry	D		60	4.07	3	3,600	**1.23**	H	**330**	True			Valid
BH05	7.25	7.3	SANDSTONE	Dry	A	60	55	4.53	1	4,202	**1.21**	H			True	True	Valid
BH05	8.6	8.74	SANDSTONE	Dry	D		60	2.99	3	3,600	**0.90**	M	**140**	True			Valid
BH05	8.69	8.74	SANDSTONE	Dry	A	60	50	3.52	1	3,820	**1.01**	H			True	True	Valid
BH05	9.65	9.75	SANDSTONE	Dry	D		60	3.12	3	3,600	**0.94**	M	**100**	True			Valid
BH05	9.65	9.7	SANDSTONE	Dry	A	60	45	3.64	1	3,438	**1.14**	H			True	True	Valid

Legend

Test Type		Failure Mode		Strength Classification		Is(50) (MPa)
D	Diametral	1	Through Substance	EL	Extremely Low	<0.03
A	Axial	2	Along Defect	VL	Very Low	0.03 - 0.1
I	Irregular	3	Parallel to Bedding	L	Low	0.1 - 0.3
		4	Not Applicable	M	Medium	0.3 - 1.0
				H	High	1.0 - 3.0
				VH	Very High	3.0 - 10.0
				EH	Extremely High	10.0 - 30.0

Notes

- For diametral tests $D_e^2 = D^2$
- For axial or irregular tests $D_e^2 = 4.W.D/\pi$
- Strength classification based on AS1726-2017
- Moisture content required by AS4133.3.1-2007

SYDNEY LABORATORY
Coffey Testing Pty Ltd
ABN 92 114 364 046
31 Hope Street, Melrose Park NSW 2114 Australia
ph: +61 2 8876 0500

Test report - uniaxial compressive strength >50 Mpa

client:	*CMW GEOSCIENCES*	job no:	***SYDN00366AA***
Principal:			
project:	*SYD2022-0051 PACIFIC PARADE DEE WHY - ADDITIONAL GI*	report date:	*7 October 2022*
location:		borehole:	***BH04***
test procedure:	*AS 4133.1.1.1 and 4133.4.2.1*	date received:	*28 September 2022*
test apparatus:	*Avery with 200 kN CAS load cell 4222*		*page 1 of 1*

All samples were tested in an "As Received" condition.
Top platen 228 mm, Bottom platen 120 mm

depth	date tested / test duration	height / average diameter / height/dia ratio	uniaxial compressive strength MPa	wet density / moisture content	sample description / bedding/foliation	Client's Sample ID / failure mechanism
QESTLab work order ID:				***SYDN22W01772***		
11.70 to 12.00 m *SYDN22W01772*	*6 Oct 22* *10.89 min*	*144 mm* *51.6 mm* *2.80:1*	***42***	***2.4 t/m³*** ***7.5 %***	*Sandstone* *Bedding planes are at an angle of 80° to the axis of loading*	*Shear*

11.70 to 12.00 m

SYDS_001R

Authorised Signature:
Alan Cocks
Rock Testing Manager

Date: *7 Oct 2022*

SYDNEY LABORATORY
Coffey Testing Pty Ltd
ABN 92 114 364 046
31 Hope Street, Melrose Park NSW 2114 Australia
ph: +61 2 8876 0500

Test report - uniaxial compressive strength >50 Mpa

client: *CMW GEOSCIENCES* | job no: ***SYDN00366AA***
Principal:
project: *SYD2022-0051 PACIFIC PARADE DEE WHY - ADDITIONAL GI* | report date: *7 October 2022*
location: | borehole: ***BH05***
test procedure: *AS 4133.1.1.1 and 4133.4.2.1* | date received: *28 September 2022*
test apparatus: *Avery with 200 kN CAS load cell 4222* | *page 1 of 1*

All samples were tested in an "As Received" condition.
Top platen 228 mm, Bottom platen 120 mm

depth / QESTLab sample ID	date tested / test duration	height / average diameter / height/dia ratio	uniaxial compressive strength MPa	wet density / moisture content	sample description / bedding/foliation	Client's Sample ID / failure mechanism
QESTLab work order ID:				***SYDN22W01772***		
9.45 to 9.65 m / *SYDN22W01772*	*6 Oct 22* / *8.38 min*	*149 mm* / *51.6 mm* / *2.88:1*	***26***	***2.4 t/m³*** / ***6.5 %***	*Sandstone* / *Bedding planes are at an angle of 75° to the axis of loading*	/ *Shear*

9.45 to 9.65 m

SYDS_001R

F:\Data\50. ROCK TESTING_SYDS-Rocks-2022\SYDN00366AA - Pacific Parade Dee Why - Additional GI\[BH05 UCS.xlsm]Report

Accredited for compliance with ISO/IEC 17025 - Testing. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection and proficiency testing scheme providers reports.

NATA Accredited Laboratory No. 431

Date: *7 Oct 2022*

Authorised Signature:
Alan Cocks
Rock Testing Manager

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2234721**	Page	: 1 of 2
Client	: **CMW GEOSCIENCES**	Laboratory	: Environmental Division Sydney
Contact	: AMIRM	Contact	: Customer Services ES
Address	: Level 1, 12b Julius Avenue, North Ryde 2113	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Pacific Parade Dee Why - Additional GI (SYD2022-0051)	Date Samples Received	: 28-Sep-2022 15:55
Order number	: ----	Date Analysis Commenced	: 29-Sep-2022
C-O-C number	: ----	Issue Date	: 06-Oct-2022 17:48
Sampler	: EBRAHIM ALAEI		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

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

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

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

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Sample ID	**BH04_1.5-1.7m**	**BH05_2.5-2.7m**	**----**	**----**	**----**
			Sampling date / time	23-Sep-2022 10:00	23-Sep-2022 13:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2234721-001**	**ES2234721-002**	**--------**	**--------**	**--------**
				Result	Result	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**5.8**	**5.9**	**----**	**----**	**----**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**5.0**	**4.9**	**----**	**----**	**----**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	<10	**----**	**----**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	**----**	**----**	**----**

CMW Sydney

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