Central Coast Campus - Geotechnical Investigation Report

305 Mann Street, Gosford NSW

20232408.001A

9 December 2022

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305 Mann Street, Gosford NSW 2250

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1 INTRODUCTION

1.1 BACKGROUND

Kleinfelder Australia Pty Ltd (Kleinfelder) was commissioned by The University of Newcastle (UoN) to undertake an Environmental and Geotechnical Soil Assessment at the subject site identified as 305 Mann Street, Gosford (herein referred to as the 'Site'). The Site location and layout is presented in in text **Figure 2.1** and **Figure 1, Appendix A**.

It is understood that UoN is seeking to redevelop the Site into a University teaching building with student accommodation. It is anticipated that up to six storeys will be constructed initially; however, this may be extended up to twenty stories at a later date. This report presents the results of the geotechnical field investigation and provides geotechnical advice to inform the design and construction stage of the building and ancillary infrastructure.

1.2 PURPOSE

The purpose of the investigation was to investigate the underlying ground conditions and provide geotechnical recommendations, as appropriate, for the following:

- Identification of suitable footing types & founding levels including
  - Recommendations on allowable bearing pressures for foundations, including end bearing and skin friction for piles
  - Advice on footing settlements
  - Advice on pile design (including tension piles) and recommended geotechnical parameters and testing requirements in accordance with AS2159
- Ground anchor design parameters
- Parameters for retaining & shoring wall design (including both at-rest and active parameters), including suitable input soil and rock parameters for use in WALLAP
- Advice in relation to exposed rock basement walls adjacent areas of high level surface loading
- Advice on the construction of temporary and permanent batters
- Reporting on site conditions, potential constraints to development and excavation conditions including the identification of encountered wet or poor subgrade conditions encountered during fieldwork
- Advice on techniques for establishing building platforms including treatment of wet and unsuitable areas
- Advice on the ability to excavate subsoil and rock materials likely to be encountered during construction
- Identification of "site sub-soil classification" for earthquake design as per AS1170.4-2007
- Identification of characteristic site movement 'ys' and site classification in accordance with AS2870: 2011.

1.3 SCOPE OF WORK

The following scope of work was developed based on Kleinfelder's understanding of the project and the information provided by UoN during preparation of our accepted proposal and specific information that became available during the works:

- Desktop study
- Walkover inspection
- Provision of Health Safety, Environmental and Quality Plan (HSEQP)
- Acquiring DBYD service plans for the investigation area and non-destructive service detection at borehole locations by a Telstra accredited utility clearance sub-contractor
- Drilling of eight boreholes. Four boreholes were advanced to suspected rockhead using flight augers and terminated, with the remaining four continued with diamond coring to prove 12m of medium to high strength sandstone. Standard Penetration Tests were undertaken at 1m intervals in soils and U75 Samples recovered for Triaxial testing. Representative core samples were collected for UCS and Point Load testing

- Three standpipes were installed to monitor general groundwater levels encountered below the Site
- Laboratory Testing comprising
  - Soil Aggressivity
  - Atterberg Limits
  - Shrink Swell Index
  - Particle Size Distribution
  - Unconfined Compression Strength
  - Point Load
- Geotechnical Evaluation and Reporting.

2 SITE DESCRIPTION AND GEOLOGICAL SETTING

2.1 SITE SETTING

The Site is located at 305 Mann Street, Gosford 2308 (NSW), approximately 90km southwest of Newcastle, as shown on **Figure 2.1** below.

Figure 2.1: Site Location

A summary of the Site details is outlined in **Table 2.1**.

Table 2.1: Site Details

Site Name	Central Coast Campus
Site Address	305 Mann Street, Gosford, NSW 2308
Current Title Identification	• Lots 1, 2, 4, 29, 30, 31 & 32 • Section 1 – DP 1591 • Lot 1 – DP 911163, DP 911164
Local Council	Central Coast Council
Site Zoning	B4 – Mixed Use
Site Owner	University of Newcastle
Current Site Use	Vacant commercial premises (most recent past operation as a Mitre 10 Hardware store)
Proposed Site Use	It is understood the Site will be developed into a University of Newcastle campus in line with current zoning (B4 Mixed Use)

2.2 SITE FEATURES

The Site covers an area of approximately 4,675 m^2. The walkover confirmed that the Site comprises a large warehouse building occupying the western portion, a central vegetated garden area and a concreted open car park occupying the remainder.

- The large warehouse has historically had several retail businesses operating within including a fruit and vegetable store and a DIY store
- A wide variety of disused materials and equipment remain around the Site including but not limited to steel piping, scrap metal, timber, poly piping, and furniture.

The concreted open car park and central vegetated garden area slope from south-east to north-west. The car park and garden area are in poor condition with several surface cracks and protruding vegetation growing throughout.

2.3 SURROUNDING LAND USE

Adjacent, land use to the Site comprises:

- **North** – Numerous commercial businesses are located north along Mann Street, zoned as Mixed Use (B4). Approximately 150m north-east and 180m north-west are residential properties zoned as General Residential (R1). Gosford Golf Club is located approximately 400m north-west under Public Recreation (RE1) zoning
- **East** – Variable zoning including Mixed Use (B4), General Residential (R1) and Public Recreation (RE1) is present directly east. Further east of this is Rumbalara Reserve located approximately 170m
- **South** – Mixed Use (B4) zoning continues south for approximately 250m, with Commercial Core (B3) zoning beyond this. Hotel Gosford, Woolworths and Chemist Warehouse are all located along Mann Street within 500m
- **West** – A rail infrastructure facility zoned as Infrastructure (SP2) runs north-south approximately 50m west, adjacent to Showground Road. Central Coast Local Health District and Gosford Hospital are located 100m west, zoned as Infrastructure (SP2). South of the hospital is residential housing zoned as General Residential (R1), with Gosford High Waterview Park located approximately 500m south-west under Public Recreation (RE1) zoning.

2.4 TOPOGRAPHY, DRAINAGE, HYDROLOGY AND CLIMATE

Typical landforms within the regional landscape are made up of undulating to rolling rises and low hills, with a local relief of <60m and slope gradients below 25%. The topography on-site ranges from 15m to 22m Australian Height Datum (AHD).

It is considered that surface water collected on the Site during periods of rainfall would runoff the concrete surfaces (including roof drainage) and enter stormwater drains adjacent to Mann St. Where concrete is not present, rainfall would infiltrate the soil profile.

The nearest sensitive surface water bodies to the Site include:

- Brisbane Water - located approx. 1.1km to the southwest
- Narara Creek - located approx. 1km northwest of the Site, flowing in a south-westerly direction into Brisbane Water.

Monthly climate statistic from the Gosford (Narara Research Station) AWS (061087) located approximately 5km from the Site, indicates that the Site experiences warm summers to cold winters with an average maximum temperature of 23.0°C and average minimum temperature of 11.1°C. The average annual rainfall is approximately 1,328.7mm with the highest average rainfall period observed to be January – March and the lowest average rainfall period from July to October.

2.5 GEOLOGY AND HYDROGEOLOGY

The Soil Landscape Map of Gosford – Lake Macquarie (Soil Landscape Series Sheet 9131-9231, Scale 1:100,000, 1993), indicates that the Site is located within the Erina Landscape, which comprises undulating to rolling rises and low hills on the Terrigal Formation. Soils within this landscape are generally moderately deep to deep, commonly prone to waterlogging, mass movement and high erosion. These soils are also commonly highly acidic.

Geological mapping from https://minview.geoscience.nsw.gov.au (See **Figure 2.2** below) indicates that the Site soils comprise the Burralow Formation of the Gosford Sub-group which form part of the Narrabeen Group of Triassic age.

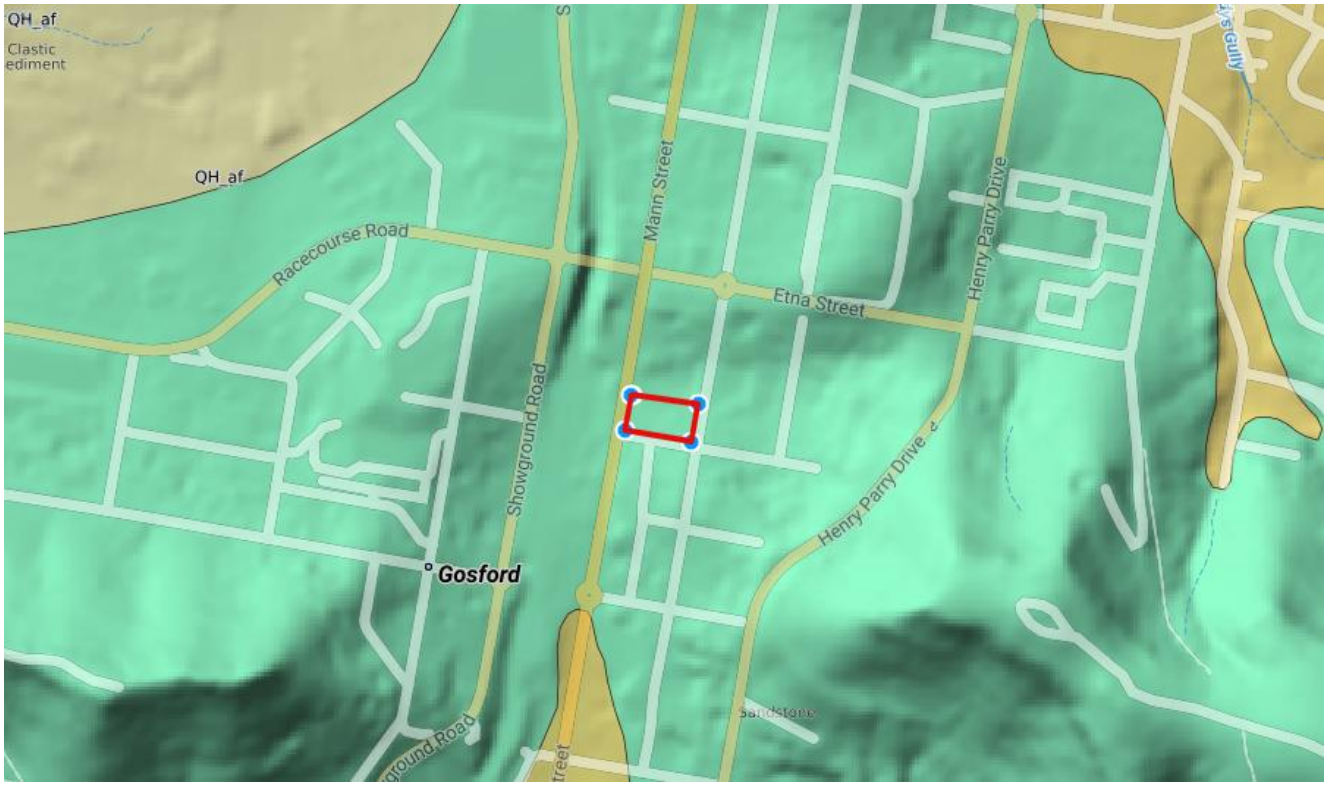


Figure 2.2: Geological Map

The Burralow Formation comprises fine-grained, micaceous, quartz to quartz-lithic sandstone; interbedded with siltstone, grey shale and red-brown claystone.

Given that the Site has been previously developed it was considered likely that there would be some fill present.

2.6 PREVIOUS INVESTIGATIONS

Driller's logs from previous environmental investigations identified subsurface conditions at the Site to primarily consist of four lithological units:

- **Surface Cover** – Concrete (underlain by gravel), pavers or imported gravel, ranging in thickness from near surface to approx. 0.35m below ground level (bgl)
- **Fill** – Generally reworked silty clayey Sand, fine to medium grained with some gravels, ranging in depth from approx. 0.3m to 1.25m bgl
- **Topsoil** (where fill is absent) –silty clayey Sand, fine to medium grained, dark brown, typically 0.2m to 0.4m thick below ground surface
- **Natural Soil** –Generally firm to stiff and stiff silty Clay, medium to high plasticity with occasional; layers of Medium dense clayey Sand, fine to medium grained, or encountered beneath the fill and/or topsoil layers at depths ranging from approx. 0.4m and 1.25m bgl and extending to the maximum depth of investigation of 3.0m m bgl.

Bedrock was not encountered.

Groundwater was not encountered in the previous investigations.

2.7 Acid Sulphate Soils

A review of the Acid Sulfate Soils (ASS) Map performed as part of the Enviro Screen report (LIR, 2022) obtained by Kleinfelder, identified the Site and land within its 500m buffer to be Class 5, meaning that "development consent is required for the carrying out of works within 500m of adjacent Class 1, 2, 3 or 4 land that is below 5m AHD and by which the water table is likely to be lowered below 1m AHD on adjacent Class 1, 2, 3 or 4 land".

Class 4 land is present within 500m of the site to the south east; however, this land is at an elevation of above 16m AHD. Therefore, ASS is not considered to be an issue for consent.

3 FIELDWORK

3.1 BOREHOLES

The Geotechnical Investigation comprised a field investigation undertaken between 14th and 21st of October, and on 10th November. The Site layout including borehole locations and existing groundwater monitoring wells are shown on **Figure 1** in **Appendix A**.

All boreholes (BH1 – BH8) were advanced to suspected rockhead using solid auger drilling to auger refusal. BH1, BH2, BH3, BH8 were advanced beyond using rotary coring to a maximum depth of approx. 24.8m. Hole depths are summarised in **Table 3.1** below.

Table 3.1: Borehole Depths

Borehole	Final Depth (m)	Borehole	Final Depth (m)
BH1	21.30	BH5	8.30
BH2	21.06	BH6	4.45
BH3	20.82	BH7	7.30
BH4	9.50	BH8	24.8

3.2 LABORATORY TESTING

The following laboratory testing as presented in **Table 3.2** was undertaken on representative soil and rock samples.

Table 3.2: Laboratory Testing

Test	Number undertaken
Atterberg Limits	10
Shrink Swell	5
Particle Size Distribution (PSD)	1
Unconfined Compression Strength with Young's Modulus and Poison's Ratio (UCS)	12
Point Load	24

Not all testing has been completed in time for inclusion in this draft report, which should be viewed as preliminary. Completed test results are discussed in **Section 5** and Laboratory Test Reports are included in **Appendix C**. The outstanding test results will be included in a future revision of this report.

4 ENCOUNTERED GROUND CONDITIONS

4.1 SUBSURFACE SOIL PROFILE

The subsurface profile encountered was generally consistent across the investigation locations. The following geological sequence was encountered depths are shown in **Table 4.1.**

- Surface cover comprised a shallow layer of concrete/asphalt where present, underlain by sandy clay / gravelly sand Fill material
- Very Soft to Soft and Firm Silty / Sandy Clay and bands of Loose Clayey Sand
- Stiff and Very Stiff Silty Clay / Clay with Trace Sand medium to high plasticity
- Completely weathered clayey Sandstone / Siltstone (white to red, firm to stiff) with occasional small bands of ironstone bedrock
- Weathered Very low or low strength siltstone and claystone with some bands of high strength sandstone
- Medium to high strength Sandstone, reddish brown with grey and yellow mottling, with occasional thin (0.1-0.5m) bands of low medium and high strength Siltstone and Claystone.

Table 4.1: Summary of Encountered Ground Conditions

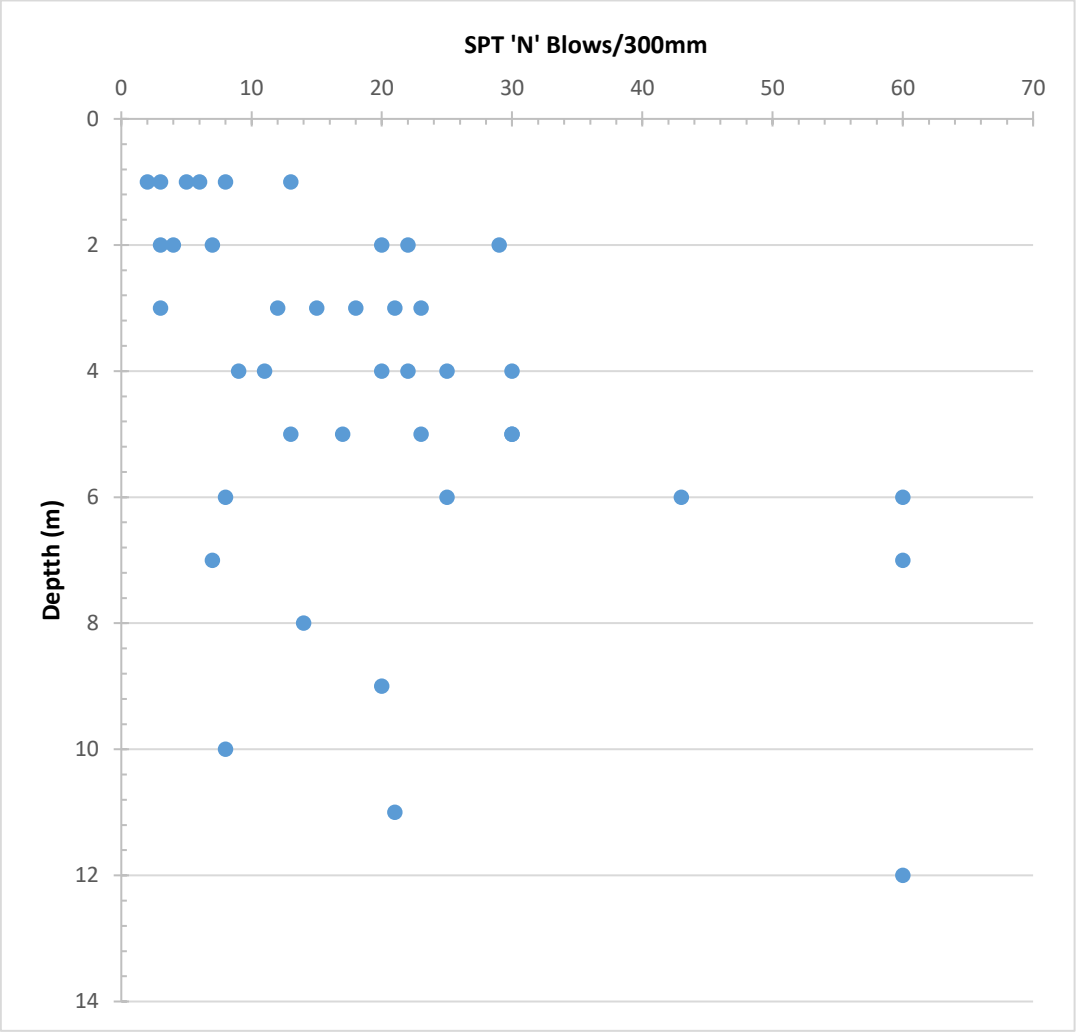
	Depth to Base							
Borehole	**BH1**	**BH2**	**BH3**	**BH4**	**BH5**	**BH6**	**BH7**	**BH8**
Cover/Fill	0.60	0.30	0.8	0.7	0.6	0.6	0.5	1.1
Very Soft to Soft and Firm Silty / Sandy Clay / Loose Clayey Sand	NE	2.6	2.0	1.9	2.3	1.3	3.0	4.0
Stiff and Very Stiff Silty Clay / Clay with Trace Sand	4.50	6.10	6.5	9.6	8.3	4.5	4.5	11
Completely Weathered Sandstone/ Siltstone	5.70	NE	NE	NE	NE	NE	7.3	12
Weathered Very low or low strength sandstone or siltstone with some bands of high strength sandstone	9.3	8.9	6.8	>9.60*	>8.30*	>4.45*	>7.30*	14.3
Medium to High Strength Sandstone/ Siltstone	>21.3	>21.06	>20.82	NE	NE	NE	NE	>24.8

NE – Not Proven
* - Assumed, Auger Refusal

Soil bore logs detailing the geological profile encountered are presented in **Appendix B**.

4.2 IN-SITU TESTING

Standard Penetration Tests (SPT) were undertaken in boreholes at 1m intervals. **Figure 4.1** illustrates the recorded SPT N values with respect to depth in m bgl.



Note: Blow count stopped at 30 blows/150mm and prorated to get N value

Figure 4.1: SPT 'N' Values verses Depth

4.3 GROUNDWATER

Groundwater water encountered in all boreholes during drilling at the depth indicated in **Table 4.2** below.

Table 4.2: Groundwater Strikes During Drilling

Borehole	Depth Encountered (m bgl)	Standing Level after 5mins	Stratum of Groundwater Strike
BH1	4.0	No Rise	Silty Clay
BH2	3.9	2.9	Clay
BH3	2.3	No Rise	Clay
BH4	3.5	No Rise	Clay
BH5	3.5	No Rise	Clay
BH6	Not Encountered	-	-
BH7	5.9	No Rise	Weathered Siltstone
BH8	3.2	No Rise	Clay

A total of three groundwater monitoring wells were installed in BH1, BH7 and BH8 within the soft to firm and stiff to very stiff clay layers. At-rest groundwater levels were monitored on 23 November 2022 and are shown in Table 4.3 below:

Table 4.3: Groundwater Level Monitoring

Borehole	Depth of Well (m bgl)	Depth to Water (m bgl)
BH1	6.55	4.44
BH7	6.81	3.23
BH8	6.98	2.24

Groundwater is known to fluctuate due to local and regional factors including, but not limited to, irrigation, precipitation events, site topography, seasonal changes, well pumping and periods of wet or dry weather. Therefore, subsurface water conditions at other times may be different from those described in this report.

5 LABORATORY TEST RESULTS

Laboratory tests were performed on selected samples obtained from the boreholes to assess the characteristic soil classification and associated properties. The following tests were undertaken:

- Atterberg Limits
- PSD
- Shrink Swell
- Aggressivity Suite (pH, Sulphate and Chloride)
- Unconfined Compression Strength with Young's Modulus and Poison's Ratio
- Point Load

The results of the laboratory tests are included in Error! Reference source not found. and summarised on the b elow figure and tables.

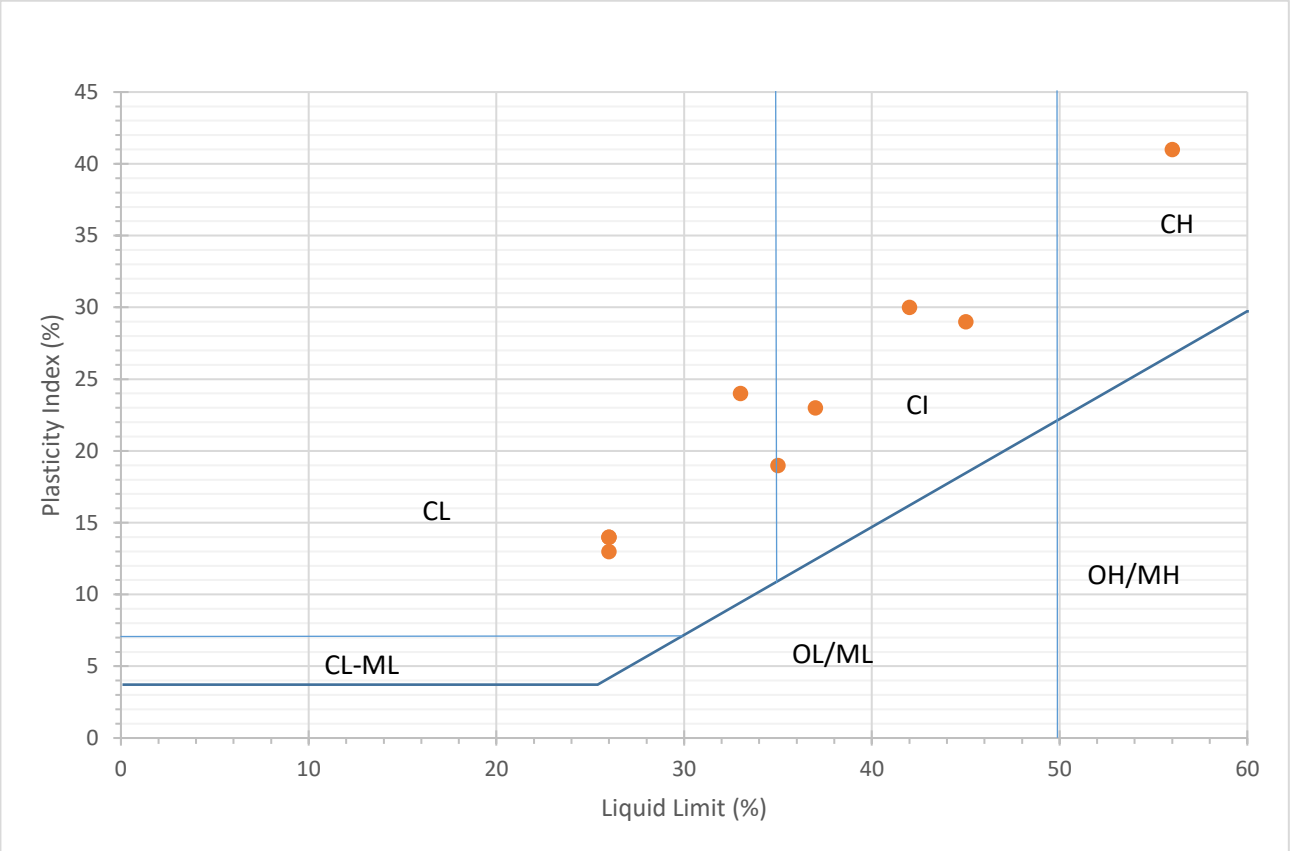


Figure 5.1: Summary of Laboratory Classification Test Data (Atterberg Limits)

Table 5.1 :Summary of PSD Results

Borehole	Depth m bgl	Gravel %	Sand %	Fines %
BH02	2.0	0	49	51

Table 5.2: Summary of Shrink Swell Test Data

Borehole	Depth m bgl	Shrinkage Strain %	Swell Strain %	Shrink / Swell Index %
BH1	3.0	3.6	0.0	2.0
BH3	2.0	1.7	0.5	1.1
BH4	2.5	1.3	0.0	0.7
BH5	2.0	2.7	0.0	1.5
BH8	2.0	2.4	0.0	1.3

Table 5.3: Soil Aggressivity Test Results

Borehole	Depth m bgl	pH	Sulphate mg/kg	Chloride mg/kg	Electrical Conductivity µS/cm
BH1	1.0	5.3	40	< 10	30
BH1	3.0	5.4	10	< 10	17
BH2	1.0	7.6	< 10	< 10	19
BH2	3.0	5.1	40	< 10	32
BH3	1.0	4.8	90	< 10	58
BH3	2.5	5.0	30	< 10	30
BH4	1.0	8.3	< 10	< 10	93
BH4	3.0	5.7	20	< 10	21
BH5	1.0	6.9	-	-	67
BH5	1.9	4.9	40	< 10	35
BH5	2.0	5.4	20	< 10	23
BH6	1.0	4.9	50	< 10	42
BH6	4.0	4.9	20	< 10	41
BH7	1.0	5.6	50	10	45
BH7	3.0	4.9	30	< 10	28
BH7	4.0	5.1	40	< 10	39
BH7	6.0	5.2	40	50	62
BH8	1.0	7.9	90	20	105
BH8	5.0	5.2	30	< 10	22

Table 5.4: Summary of UCS Testing Data

Borehole	Depth m bgl	UCS MPa	Tangent Young's Modulus (GPa)	Secant Young's Modulus (GPa)	Tangent Poisson's Ratio	Secant Poisson's Ratio
BH1	10.58-10.79	15.9	4.75	5.35	0.165	0.040
BH1	14.28-14.52	13.2	1.07	0.856	0.338	0.259
BH1	19.135-19.385	21.9	4.39	3.19	0.255	0.074
BH2	7.81-8.01	19.5	2.04	1.45	0.248	0.085
BH2	13.44-13.73	33.2	7.35	5.35	0.255	0.098
BH2	20.12-20.43	24.4	1.21	1.17	0.294	0.185
BH3	10.13-10.40	24.5	6.03	4.38	0.255	0.055
BH3	14.40-14.70	26.4	5.58	3.64	0.214	0.037
BH8	15.68-15.96	26.6	3.71	3.01	0.346	0.141
BH8	19.31-19.56	31.9	6.95	5.33	0.218	0.108
BH8	22.645	27.5	8.44	6.54	0.342	0.147

Table 5.5: Summary of Point Load Testing Data

Borehole	Depth m bgl	Direction	Uncorrected Point Load Strength MPa	Point Load Strength Index Is(50) MPa	Correlated Equivalent UCS[1] MPa
BH1	13.04 to 13.25	Axial	1.1	1.4	28
BH1	13.04 to 13.25	Diametral	2.7	2.6	52
BH1	18.875 to 18.995	Axial	0.5	0.66	13.2
BH1	18.875 to 18.995	Diametral	2.0	1.9	28
BH1	20.845 to 21.05	Axial	0.5	2.1	42
BH1	20.845 to 21.05	Diametral	0.66	2.0	40
BH2	8.05 to 8.25	Axial	0.4	0.52	10.4
BH2	8.05 to 8.25	Diametral	1.0	0.99	19.8
BH2	13.85 to 14.07	Axial	0.4	0.46	9.6
BH2	13.85 to 4.07	Diametral	0.7	0.68	13.6
BH2	18.82 to 19.07	Axial	1.0	1.2	24
BH2	18.82 to 19.07	Diametral	2.9	2.8	56
BH3	12.239 to 12.439	Axial	1.4	1.6	32
BH3	12.239 to 12.439	Diametral	1.3	1.3	26

Borehole	Depth m bgl	Direction	Uncorrected Point Load Strength MPa	Point Load Strength Index Is(50) MPa	Correlated Equivalent UCS[1] MPa
BH3	16.578 to 15.777	Axial	1.0	1.2	24
BH3	16.578 to 15.777	Diametral	2.4	2.4	48
BH3	20.662 to 20.842	Axial	0.5	0.61	12.2
BH3	20.662 to 20.842	Diametral	1.2	1.2	24
BH8	14.52 to 14.71	Axial	0.4	0.53	10.6
BH8	14.52 to 14.71	Diametral	0.6	0.63	12.6
BH8	17.28 to 17.48	Axial	0.7	0.9	18.0
BH8	17.28 to 17.48	Diametral	1.5	1.5	30.0
BH8	21.59 to 21.82	Axial	0.6	0.81	16.1
BH8	21.59 to 21.82	Diametral	1.5	1.5	30.0

1. Based on UCS =20 Is(50)

6 GEOTECHNCIAL ASSESSMENT AND RECOMMENDATIONS

6.1 RETAINING WALL AND GEOTECHNICAL DESIGN PARAMETERS

Based on the findings of the current site investigation, field and laboratory test results, and the guidance given in Appendix D3 of AS4678:2002 Earth Retaining Structures, the preliminary geotechnical design parameters, shown in **Table 6.1** below, may be adopted for detailed design of the Site retaining walls and footings.

Table 6.1: Allowable Bearing Capacity and Geotechnical Design Parameters

Soil Strata	Bulk Density γb kN/m³	Undrained Shear Strength Cu kPa	Effective Cohesion c' kPa	Effective Friction Angle ϕ' °	Allowable Bearing Capacity at 0.6m depth kPa
Fill	19	25	1	20	NR
Very Soft to Soft and Firm Silty / Sandy Clay / Loose Clayey Sand	19	25	2	22	NR
Stiff and Very Stiff Silty Clay / Clay with Trace Sand	18	75	5	28	150
Completely Weathered Sandstone / Siltstone	18	250	10	32	500
Rock Strata	**Bulk Density γb kN/m3**	**UCS Mpa**	**Effective Cohesion c' kPa**	**Effective Friction Angle ϕ' °**	**Allowable Bearing Capacity kPa**
Very low to low Strength Siltstone and Claystone	22	1	25	30	750
Medium to High Strength Sandstone / Siltstone	22	18	100	35	20,000

NR – Founding not recommended in this soil type at any depth

Table 6.2: Retaining Wall Design Parameters

Strata	Coefficient of Earth Pressure at rest Ko[1]	Active Earth Pressure Coefficient Ka[1]	Passive Earth Pressure Coefficient Kp[1]	Poisson's Ratio	Undrained Elastic Modulus Eu MPa
Fill	0.66	0.49	2.03	0.3	10
Very Soft to Soft and Firm Silty / Sandy Clay / Loose Clayey Sand	0.62	0.45	2.19	0.5	10
Stiff and Very Stiff Silty Clay / Clay with Trace Sand	0.53	0.36	2.77	0.25	30

Strata	Coefficient of Earth Pressure at rest Ko[1]	Active Earth Pressure Coefficient Ka[1]	Passive Earth Pressure Coefficient Kp[1]	Poisson's Ratio	Undrained Elastic Modulus Eu MPa
Completely Weathered Sandstone / Siltstone	0.41	0.31	3.25	0.25	35
Very low to low Strength Siltstone and Claystone	0.2	0.21	4.5	0.2	80
Medium to High Strength Sandstone / Siltstone	0.2	0.17	5.8	0.2	3000

NR – Founding not recommended in this soil type at any depth

1. Assuming Level ground behind/in front of wall and vertical back face to wall.

Retaining walls, especially on the Hill Street boundary, will need to consider that the groundwater table detected within the Stiff Silty Clay deposit was recorded as shallow as 2.3m below existing ground level.

6.2 Earthquake Design Soil Classification

Bedrock was encountered during the investigation at approximately 4-12 m bgl. Hence, for earthquake design, a site classification of **Class Ce** (**Shallow Soil Site**) is recommended in accordance with AS1170.4-2007 "Structural design action Part 4: Earthquake action in Australia".

6.3 Reactive Soil Considerations

The subgrade includes reactive soil that will exhibit shrink and swell behaviour. The amount of shrink/swell behaviour that can occur will depend upon moisture fluctuations that occur over the design life of the structure. The total magnitude of the shrink/swell behaviour will also be dependent upon the thickness of the expansive soil layer and the corresponding depth of the moisture variation. Moisture fluctuations occur due to seasonal cycles but can also be influenced to varying degrees by drainage conditions; site grades/sloping ground, landscaping, irrigation practices, soil treatments, the presence of vegetation, groundwater and the presence of flatwork or other impervious barriers. This large number of variables complicates the determination of the magnitude of shrink/swell movements that could occur.

The Australia Standard (AS2870) was developed to guide design engineers to evaluate the reactive soil risk and design foundations. AS2870 was developed for the design of residential footings and slab foundations (BCA Class 1 and 10a structures) but has been widely applied to the development of new buildings.

6.3.1 Site Classification

Considering the depth and extent of intermediate to high plasticity clays, the appropriate geotechnical Site classification is Class H1, in accordance with AS 2870. A shrink/swell movement of up to 45mm should be expected; however, this classification is based upon there being a minimum of 3m of clay beneath a ground bearing footing supporting residential loadings. The structural engineer should consider carefully if this is a valid assumption for this type of structure and design accordingly using their professional judgement.

6.4 Shallow Footings

Based on the current geotechnical investigation and our understanding of the proposed development, a discussion of shallow footing types are provided below.

The use of standard footings as presented in AS2870-2011 is only applicable to buildings with a loading and construction style similar to that of a residential dwelling as described in section 3.1 of AS2870-2011.

The following recommendations assume that aspects of Site drainage, paving, and landscaping are taken into consideration and implemented in accordance with Footing and Foundation Practice Notes (2013) ‘’Guide to Foundation Maintenance for Reactive Soils”.

6.4.1 Shallow Footings

Shallow footings may be suitable for elements to the structure provided the guidance given in AS2870 is followed. The Fill and upper very soft to soft and firm silty / sandy Clay and loose sand that extends to between 1.3 and 4m bgl is not suitable for shallow footings. It is anticipated that, for the majority of the Site, this upper soil layer will be excavated. However, if left in place, any strip or pad footings shall be founded below this material in stiff Clay or piled. Allowable bearing capacities are given in **Table 6.1**.

Alternatively, the soft material may be excavated and replaced or treated and recompacted in accordance with **Section 6.10**Error! Reference source not found. beneath footings to provide a suitable bearing stratum. Strip and p ad footings should also achieve a minimum founding depth in accordance with AS2870-2011 Figure 3.6.

6.4.2 Piled Footings

Piled footings are expected to transfer the loads to deeper soil and/or competent bedrock layers which have higher bearing capacities and, as such, will negate the potential requirement for ground improvement and excavation of soft material.

Given the proposed need to accommodate 20 stories, it is recommended that bored piles founded on the medium and high strength sandstone bedrock beneath the site at depth of 6.8 and 14.3m bgl are adopted for the support of structural loads at the site.

Based on the findings of the current site investigation, field and laboratory test results, and the guidance given in Appendix D3 of AS4678:2002 Earth Retaining Structures, piles socketed at least one diameter into bedrock or 3 diameter in to stiff clay shall be designed based on the the geotechnical design parameters shown in below in **Table 6.3**.

Table 6.3: Pile Design Parameters

Strata	Ultimate Skin Friction Compression kPa	Ultimate Skin Friction Tension kPa	Ultimate End Bearing Capacity kPa
Fill	NR	NR	NR
Very Soft to Soft and Firm Silty / Sandy Clay / Clayey Sand	NR	NR	NR
Stiff and Very Stiff Silty Clay/ Clay with Trace Sand	75	52	675
Completely Weathered Sandstone / Siltstone	87	60	2,250
Medium to High Strength Sandstone / Siltstone	900	600	20,000

NR – Not Recommended. Stratum will not make a significant contribution to pile capacity

In order to assess allowable pile capacity, a geotechnical strength reduction factor (Φ_g) of 0.52 is recommended to be applied to the above ultimate values in accordance with AS2159-2009 “Piling-Design and Installation”; however, the pile designer shall make their own assessment based upon the construction techniques used and sound professional judgement.

It is recommended that bored pile excavations be assessed by a geotechnical engineer during construction to ensure that founding conditions are consistent with those on which the design recommendations are based. Care

should be taken to ensure that the base and side of any pile excavations are clean of loose material and water, prior to pouring concrete.

The potential for differential settlement across the Site exists for piled footings and the effects on the building shall be considered by the structural engineer and accommodated in their design.

6.5 Ground Anchors

Temporary ground anchors are likely to be required for support of the basement wall during construction. These may be drilled into the stiff Clay, completely weathered sandstone or the underlying competent sandstone. Design parameters for these strata are given in **Table 6.4.**

Table 6.4: Ground Anchor Design Parameters

Strata	Ultimate Bond Stress Tension[1] kPa
Stiff and Very Stiff Silty Clay/ Clay with Trace Sand	$120 \times L^{-0.57}$
Completely Weathered Sandstone / Siltstone	$400 \times L^{-0.57}$
Medium to High Strength Sandstone/ Siltstone	2,000

Where L is the bonded (fixed) anchor length.
1. – Indicative value only, more accurate values will be provided in the final version of this report once laboratory testing has been completed.

Anchors shall be designed in accordance with AS4678 – 2002 and BS8081:2015. Anchors shall be a minimum of 3m and a maximum of 12m bonded length. Anchors with bonded lengths in sandstone shall not include any contribution from the clay or completely weathered bedrock materials.

6.6 Soil Aggressivity

Soil Aggressivity has been assessed in accordance with AS2159 – 2009 Chapter 6. Soils on-site have been assessed as mildly aggressive to concrete because due to a low pH, and non-aggressive to steel.

6.7 Temporary Slopes and Excavations

Excavations must comply with applicable safety regulations. Construction site safety is solely the responsibility of the contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing the preliminary advice below as a service to our client; under no circumstances should the information provided be interpreted to mean that Kleinfelder is assuming responsibility for construction site safety or the contractor's activities.

Excavations deeper than 1.0 m must be battered, benched, or have a lateral soil retaining device inserted, such as a trench box for stability, and assessed, prior to anyone entering them.

Near-surface soils that we encountered during our field investigation consisted of soft and very soft silty or sandy clay or clayey sand and fill. For preliminary planning purposes, excavated slopes in on-site materials may be cut initially to 1:2.0 (V:H) and that the stability of the slopes be reviewed on an on-going basis by a geotechnical engineer. If sand bands or groundwater are present in excavations, flatter slopes may be required to maintain stability.

Sandstone excavations are likely to stand vertically without support but should be periodically assessed by a geotechnical engineer to ensure stability, especially after heavy rain.

6.8 EXCAVATABILITY

Excavation of soils above the sandstone should be practically achievable with conventional medium duty excavators. The sandstone is likely to require extremely hard digging and ripping, hydraulic breaking or even pre-spilt blasting.

6.9 SITE DRAINAGE DURING CONSTRUCTION

Adequate Site drainage is considered essential to prevent softening of the clay soils that will become rutted when wet and could lead to significant construction delays. Placement of a geotextile and crushed concrete, or stone working platform, at formation level is highly recommended to prevent delays during construction.

In order to effectively mitigate against wet weather, the following procedures are recommended:

- Planning works involving soil exposure for anticipated dry weather periods and planning works such that exposure periods are minimised i.e. clear and cover immediately
- Grade the Site so that surface water can drain readily away from excavation areas
- Promptly pump out or otherwise remove water that accumulates in excavations or on subgrades, and allow these areas to dry out before resuming construction
- Use berms, ditches, and similar means to prevent stormwater from entering the work area and to convey it off-site efficiently and in accordance with any permitting pr planning requirements.

If exposed to excess moisture and repeated construction traffic, the native surficial soils may become unstable, especially during the wetter seasons of the year. The contractor should plan to repair subgrade conditions that become unstable/disturbed and should develop a plan to manage subgrade exposed to construction traffic across the Site throughout the construction period.

6.10 EARTHWORKS

This section applies to all earthworks required for any construction preparation for the project. Design and construction of earthworks should be carried out in accordance with Australian Standard AS 3798-2007. Inspections by the project geotechnical engineer will be required during earthworks, subgrade preparation and proof rolling.

6.10.1 Site Preparation

The Site should be stripped of vegetation and any loose or disturbed soils, deleterious or organic material and roots. Stripping operations should include removing materials that, in the judgment of the project geotechnical engineer, are not suitable for the anticipated loading conditions.

Over-excavations should be backfilled with engineered fill as recommended in **Sections 6.10.2 and 6.10.3** of this report.

6.10.2 Fill Materials

Design and construction of earthworks should be carried out in accordance with AS3798. Observation by the project geotechnical engineer will be required during earthworks, subgrade preparation and proof rolling.

Engineered fill consists of on-site or similar imported soils that are moisture-treated and placed for site grading, or as foundation or roadway subgrade materials. The materials should satisfy the requirements of AS3798. Engineered fill should be non-organic soil that is free of particles larger than 120 mm in diameter, has an organic content less than 5 percent by weight, and is substantially clean (i.e., free of contaminants, deleterious or organic material). High plasticity material and soft material that is removed in cut areas of the Site may be suitably moisture conditioned and recompacted to meet the design assumptions for use as fill material.

The soils at the Site, if considered for use as engineered fill, should be further tested to confirm that they meet the recommendations stated above.

6.10.3 Fill Placement and Compaction

Fill to support structures or pavements shall be placed in lifts having a maximum loose lift thickness of 300mm and compacted to a minimum of 98 percent of the material's Standard Maximum Dry Density (SMDD) in accordance with Standard Proctor compaction. The moisture content of clay fill at the time of compaction shall be within a range of -2 to +2% of the optimum moisture content. Moisture contents shall be maintained within the recommended range until completion of all fill placement, slabs, and footings. Compaction of fill materials intended not to support structures or roadways, such as fills for landscape areas, may be reduced to 90 percent standard compaction.

Aggregate base course and crushed rock should be moistened to within 2 percent of optimum moisture content and compacted to at least 98 percent of Modified Maximum Dry Density (MMDD).

6.11 Constraints to Development

Although major constraints to development have not been encountered during the preparation of this draft report, the following issues should be considered during foundation design and construction:

- The upper 0.6 to 1.1m of Fill is not suitable for shallow footings
- The upper 2-3m of clay is soft or very soft and is not suitable for shallow footings
- Shallow groundwater was encountered in most boreholes at up to 2.3m bgl it is anticipated that sum and pump method of groundwater control during construction will be adequate and the retaining walls should be designed to resist appropriate hydraulic loadings
- The Sandstone depth is variable across the site encountered at between 5.7m bgl at the Hill Street end of the site and 12m bgl at the Mann Street Site of the site
- The competent sandstone (underlying the weathered profile) is high strength and will likely require hydraulic breakers or pre-split blasting to excavate.

7 LIMITATIONS

This report has been prepared by Kleinfelder and may be used only by the Client and its designated representatives or relevant statutory authorities and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two years from the date of the report.

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. It is possible that conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

This report cannot be reproduced without the written authorisation of Kleinfelder and then can only be reproduced in its entirety.

The findings and conclusions contained within this report are relevant to the conditions of the Site and the state of legislation currently enacted in the relevant jurisdiction in which the Site is located as at the date of this report.

Additionally, the findings and conclusions contained within this report are made following a review of certain information, reports, correspondence and data noted by methods described in this report including information supplied by the client or its assigns. Kleinfelder has designed and managed the program for this report in good faith and in a manner that seeks to confirm the information provided and test its accuracy and completeness.

However, Kleinfelder does not provide guarantees or assurances regarding the accuracy, completeness and validity of information and data obtained from these sources and accepts no responsibility for errors or omissions arising from relying on data or conclusions obtained from these sources.

Any representation, statement, opinion or advice expressed or implied in this report is made on the basis that Kleinfelder, its agents and employees are not liable to any other person taking or not taking (as the case may be) action in respect of any representation, statement, opinion or advice referred to above.

8 REFERENCES

- AS2159 - 2009 – Piling-Design and Installation
- AS4678 - 2002 – Earth-Retaining Structures
- AS3798 - 2007 – Guidelines on Earthworks for Commercial and Residential Developments
- BS8081 - 2015 – Code of Practice for Ground Anchors
- AS 2870-2011 – Residential Slabs and Footings

APPENDIX A FIGURES

Legend

- Site Boundary
- Primary Road
- Local Road

Sample Locations

- Borehole to rock
- Core Borehole 12m Medium Strength Sandstone

Metres
0 2.5 5 10 15 20

N

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PROJECT REFERENCE: 20232408
DATE DRAWN: 9/12/2022 12:31 Version 1
DRAWN BY: CMiskell
DATA SOURCE:
LPI - 2009
Nearmap - 2022

Site Figure & Sampling Locations

University of Newcastle
Geotechnical Investigation
UoN Gosford campus
305 Mann Street, Gosford, 2308

FIGURE:
1

J:\00 CLIENT FILES\124163_University_Of_Newcastle\20232408_UON_GosfordCampus\Mapping\20232408_Geotechnical_Fig01_Locality.mxd

APPENDIX B BOREHOLE LOGS

Date Begin - End:	19/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Inclination:	-90 degrees	**Drilling Method:**	Continuous Flight Auger
Weather:	Overcast	**Bore Diameter:**	100 mm. O.D.

ROCK CORING LOG BH1

FIELD EXPLORATION

Surface Condition: Asphalt

Depth (metres)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/152 mm. RQD=%	Drill Notes / Remarks
		FILL: **CONCRETE**: grey, no odour, no staining			
		FILL: **Sandy CLAY with Gravel**: coarse sand, subrounded gravel, subrounded sand, low to medium plasticity, dark gray, no odour, moist, soft, no staining			**PID=** 0
		CLAY with Silt: high plasticity, orangish red, no odour, moist to wet, stiff to very stiff, no staining			
1					**PID=** 0
		Sandy CLAY: coarse sand, subrounded sand, low to medium plasticity, yellow to white, no odour, dry to moist, stiff, no staining		BC=2 4 9	
2					**PID=** 0
				BC=6 9 11	
		Silty CLAY: low plasticity, red to white, no odour, dry, very stiff, no staining			
3				BC=11 14 19	
▽ 4				BC=7 11 14	
		Completely Weathered SILTSTONE: brown to reddish white, no odour, very stiff, no staining			
5		**Completely Weathered SILTSTONE**: red to yellowish white, no odour, very stiff, no staining		BC=8 14 16	
6					
7					

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CHECKED BY: DK

DATE: 15/11/22

ROCK CORING LOG BH1

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	19/10/22	**Drilling Company:**	Tucker Environmental	**ROCK CORING LOG BH1**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Coring Method:**	Coring	
Weather:	Overcast	**Core Bit Type:**		

ROCK CORING INFORMATION

Coordinates Not Available
Ground Surface RL Not Available

Depth (metres)	Graphical Log	Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing	Sample Number [Box Number]	Fracture Index	Total Core Recovery (NR=No Recovery)	RQD (%)	Relative Strength	Discontinuity Description Fracture#: (Depth), Type, Relative Dip, Density or Spacing. Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC
6		SANDSTONE, coarse to medium grained, reddish white , Bedding, bands of dark grey siltstone, Medium to High Strength, Slightly Weathered		NI		<25		1: (5.7'), fracture zone, 0°, highly to intensely fractured, none, Several fractures throughout this zone. Highly weathered to decomposed material.
		SILTSTONE, fine grained, white withred, Bedding, bands of dark grey siltstone, Very Low Strength, Residual Soil						(6')
		CORE LOSS						
		CLAYSTONE, fine grained, reddish white togrey, Bedding, bands of dark grey siltstone, Very Low Strength, Residual Soil						
7		CORE LOSS		NI				(7')
		CLAYSTONE, fine grained, reddish white , Lamination, Very Low Strength, Residual Soil, Ironstone band at 8.88m-9.1m						
8				NI				(8')
						55		
9				NI				(9')
		SANDSTONE, coarse grained, yellowish brown , Bedding, bands of dark grey siltstone, High Strength, Fresh						(9.42'), mechanical break (9.59'), mechanical break
10				3				2: (9.78'), fracture zone, 20°, slightly fractured, none (10')
			BH1_UCS_10.58					3: (10.43'), fracture zone, 10°, slightly fractured, none
11				2				(10.85'), mechanical break (11') 4: (11.08'), fracture zone, 5°, slightly fractured, partially filled, Fe
		SILTSTONE, fine grained, grey todark grey, Lamination, High Strength, Fresh						(11.35'), mechanical break 5: (11.46'), fracture zone, 5°, slightly fractured, partially filled, Fe
		SANDSTONE, coarse grained, yellowish brown , Bedding, bands of dark grey siltstone, High Strength, Fresh				82		6: (11.46'), fracture zone, 90°, moderately fractured, partially filled, Fe, tight
12				3				(12') (12.05'), mechanical break 7: (12.18'), fracture zone, 0°, slightly fractured, partially filled, Fe
13				1				(12.92'), mechanical break (13')
			BH1_PL_13.04					(13.22'), mechanical break

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DATE:	15/11/22

ROCK CORING LOG BH1

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	19/10/22	**Drilling Company:**	Tucker Environmental	**ROCK CORING LOG BH1**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Coring Method:**	Coring	
Weather:	Overcast	**Core Bit Type:**		

ROCK CORING INFORMATION

Coordinates Not Available
Ground Surface RL Not Available

Depth (metres)	Graphical Log	Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing	Sample Number [Box Number]	Fracture Index	Total Core Recovery (NR=No Recovery)	RQD (%)	Relative Strength	Discontinuity Description Fracture#: (Depth), Type, Relative Dip, Density or Spacing. Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC
14		SANDSTONE, coarse grained, yellowish brown , Bedding, bands of dark grey siltstone, High Strength, Fresh		0				(14')
								(14.16'), mechanical break
			BH1_UCS_14.28					(14.4'), mechanical break
								(14.65'), mechanical break
						92		
15		SILTSTONE, fine grained, grey toyellowish brown, Bedding, bands of dark grey siltstone, High Strength, Fresh		0				(15')
		SANDSTONE, coarse grained, yellowish brown , Bedding, bands of dark grey siltstone, High Strength, Fresh						8: (15.2'), fracture zone, 0°, slightly fractured, none 9: (15.35'), fracture zone, 2°, slightly fractured, none
16				2				(16') (16.02'), mechanical break
17				0				(17') (17.01'), mechanical break
						92		
18				0				(18') (18.01'), mechanical break 10: (18.16'), fracture zone, 2°, slightly fractured, none 11: (18.44'), fracture zone, 10°, slightly fractured, partially filled, Cl
			BH1_PL_18.875					
19				1				(18.99'), mechanical break (19')
			BH1_UCS_19.135					
20				0				(20') (20.12'), mechanical break (20.4'), mechanical break
						98		
			BH1_PL_20.845					
21				0				(21')

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ROCK CORING LOG BH1

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	18/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Inclination:	-90 degrees	**Drilling Method:**	Continuous Flight Auger
Weather:	Overcast	**Bore Diameter:**	100 mm. O.D.

ROCK CORING LOG BH2

FIELD EXPLORATION

Surface Condition: Asphalt

Depth (metres)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/152 mm. RQD=%	Drill Notes / Remarks
		FILL: **ASPHALT**: grey			
		FILL: **Sandy GRAVEL**: coarse gravel, subangular gravel, subangular sand, low plasticity, dark grey, dry to moist			**PID=** 0
1		**Clayey SAND**: coarse sand, subangular to subrounded sand, non-plastic to low plasticity, light grey, moist, loose		BC=1 1 2	**PID=** 0
2		**CLAY with Sand**: coarse sand, subangular to subrounded sand, low to medium plasticity, yellow, moist, soft		BC=1 1 2	
		CLAY: low plasticity, grey, moist, very soft			
		CLAY: medium to high plasticity, orangish red, dry to moist, stiff			
3				BC=4 6 9	**PID=** 0
4		**CLAY with Sand**: coarse sand, subrounded sand, low to medium plasticity, orangish red, wet, stiff		BC=7 4 7	
		CLAY with Sand: coarse sand, subrounded sand, low to medium plasticity, grey, moist, stiff			
		CLAY: medium to high plasticity, orangish red, dry to moist, stiff			
5				BC=5 8 9	
6				BC=30	
7					

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ROCK CORING LOG BH2

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305 Mann Street
Gosford, NSW

Date Begin - End:	18/10/22	**Drilling Company:**	Tucker Environmental	**ROCK CORING LOG BH2**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Coring Method:**	Coring	
Weather:	Overcast	**Core Bit Type:**		

ROCK CORING INFORMATION

Coordinates Not Available
Ground Surface RL Not Available

Depth (metres)	Graphical Log	Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing	Sample Number [Box Number]	Fracture Index	Total Core Recovery (NR=No Recovery)	RQD (%)	Relative Strength	Discontinuity Description Fracture#: (Depth), Type, Relative Dip, Density or Spacing. Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC
		SANDSTONE, coarse grained, reddish yellow , Bedding, bands of dark grey siltstone, High Strength, Slightly Weathered				62		1: (6.2'), fracture zone, 2°, slightly fractured, none, unweathered to slightly weathered
7		CORE LOSS		4				2: (6.48'), fracture zone, 10°, slightly fractured, none, unweathered to slightly weathered 3: (6.73'), fracture zone, 25°, slightly to moderately fractured, none, unweathered to slightly weathered (6.83'), mechanical break 5: (6.92'), fracture zone, 0°, highly fractured, none, decomposed, Decomposed material. Multiple pathways throughout. (7')
		CLAYSTONE, fine grained, white , Very Low Strength, Residual Soil	BH2_UCS_7.81					
8				1				(8') (8.2'), mechanical break (8.28'), mechanical break (8.42'), mechanical break (8.53'), mechanical break (8.77'), mechanical break
9		SANDSTONE, coarse grained, reddish brown toyellow, Bedding, bands of dark grey siltstone, High Strength, Slightly Weathered		3		76		6: (8.8'), fracture zone, 2°, slightly to moderately fractured, none, unweathered to slightly weathered (9') 7: (9.1'), fracture zone, 0°, slightly fractured, partially filled, Fe, unweathered to slightly weathered
10				2				8: (9.14'), fracture zone, 20°, slightly fractured, partially filled, Fe, unweathered to slightly weathered (9.22'), mechanical break (9.35'), mechanical break (9.48'), mechanical break (9.64'), mechanical break 9: (9.76'), fracture zone, 0°, moderately fractured, none, slightly weathered
11		CLAYSTONE, fine grained, white , Low Stength, Residual Soil		5				(10') (10.01'), mechanical break 10: (10.26'), fracture zone, 0°, slightly fractured, decomposed
		SANDSTONE, coarse grained, yellowish brown togrey, Bedding, bands of dark grey siltstone, Medium to High Strength, Moderately Weathered						11: (10.41'), fracture zone, 5°, slightly to moderately fractured, none, slightly weathered (11')
12				2		52		12: (11.11'), fracture zone, 0°, slightly to moderately fractured, partially filled, Fe, slightly weathered 13: (11.26'), fracture zone, 10°, slightly fractured, partially filled, Fe, slightly weathered 14: (11.42'), fracture zone, 5°, slightly fractured, partially filled, Cl, slightly weathered 15: (11.69'), fracture zone, 80°, moderately to highly fractured, partially filled, Fe, moderately weathered
13			BH2_PL_13.04	2				16: (11.93'), fracture zone, 2°, slightly fractured, none, slightly weathered (12')
		CLAYSTONE, fine grained, dark grey , Low Stength, Residual Soil	BH2_UCS_13.44					17: (12.11'), fracture zone, 0°, slightly fractured, none, slightly weathered (12.53'), mechanical break (12.65'), mechanical break
14		SILTSTONE interbedded with SANDSTONE, fine grained, whitish grey , Bedding, bands of dark grey siltstone, Medium to High Strength, Fresh	BH2_PL_13.85	0				

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ROCK CORING LOG BH2

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Date Begin - End:	18/10/22	**Drilling Company:**	Tucker Environmental	**ROCK CORING LOG BH2**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Coring Method:**	Coring	
Weather:	Overcast	**Core Bit Type:**		

ROCK CORING INFORMATION

Coordinates Not Available
Ground Surface RL Not Available

Depth (metres)	Graphical Log	Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing	Sample Number [Box Number]	Fracture Index	Total Core Recovery (NR=No Recovery)	RQD (%)	Relative Strength	Discontinuity Description Fracture#: (Depth), Type, Relative Dip, Density or Spacing. Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC
15		SANDSTONE, coarse grained, yellowish grey , Bedding, bands of dark grey siltstone, High Strength, Fresh		0		84		(12.76'), mechanical break 18: (12.93'), fracture zone, 30°, slightly fractured, none, slightly weathered (13') 19: (13.23'), fracture zone, moderately to highly fractured, decomposed 20: (13.99'), fracture zone, 80°, slightly fractured, none, tight, slightly weathered (14') (14.32'), mechanical break (14.9'), mechanical break (15')
		SILTSTONE, fine grained, dark grey , Lamination, High Strength, Slightly Weathered						
16		SILTSTONE, fine grained, dark grey tolight grey, Bedding, bands of dark grey siltstone, High Strength, Slightly Weathered		3				(15.13'), mechanical break (15.31'), mechanical break (15.74'), mechanical break (15.78'), mechanical break (16') 21: (16.12'), fracture zone, 30°, slightly fractured, none, slightly weathered 22: (16.21'), fracture zone, moderately to highly fractured, decomposed (16.49'), mechanical break
		NOTE: Layer of gravelly cobbles @16.23m. Siltstone decomposed 16.23-16.34m.						
17				3				23: (16.94'), fracture zone, 20°, slightly fractured, none, slightly weathered (17') (17.12'), mechanical break 24: (17.37'), fracture zone, 15°, slightly to moderately fractured, none, slightly weathered (17.51'), mechanical break (17.61'), mechanical break
18				2		72		25: (17.7'), fracture zone, 15°, slightly fractured, none, slightly weathered 26: (17.9'), fracture zone, 25°, slightly fractured, none, slightly weathered (18') (18.18'), mechanical break 27: (18.2'), fracture zone, 0°, moderately to highly fractured, none, slightly to highly weathered, Multiple fracture zones 28: (18.89'), fracture zone, 0°, slightly fractured, none, slightly weathered (19')
		CLAYSTONE, fine grained, grey toyellow, Low Stength, Residual Soil						
		SILTSTONE, fine grained, grey , Lamination, Thinly, Low Stength, Slightly Weathered	BH2_PL_18.82					
19		CLAYSTONE, fine grained, grey toyellow, Low Stength, Residual Soil		0				
		SANDSTONE, coarse grained, yellow , Bedding, bands of dark grey siltstone, High Strength, Fresh						
20			BH2_UCS_20.12	0				(20')
21				0				(21')
22								

Date Begin - End:	19/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Inclination:	-90 degrees	**Drilling Method:**	Continuous Flight Auger
Weather:	Overcast	**Bore Diameter:**	100 mm. O.D.

ROCK CORING LOG BH3

FIELD EXPLORATION

Surface Condition: Asphalt

Depth (metres)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/152 mm. RQD=%	Drill Notes / Remarks
		FILL: **ASPHALT**: grey, dry			
		FILL: **Sandy CLAY**: coarse sand, subangular sand, low plasticity, yellowish brown, moist, soft			**PID=** 0
1		**CLAY**: medium to high plasticity, reddish brown, dry to moist, firm to stiff		BC=2 2 4	**PID=** 0
2		NOTE: Density change @2.0m, very stiff with low plasticity. Iron oxide staining		BC=10 13 16	**PID=** 0
3				BC=5 10 11	
4				BC=5 10 12	
5		**Silty CLAY**: low plasticity, white, dry, very stiff		BC=5 9 14	
6				BC=6 13 12	
7					

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PROJECT NO.: 20232408.001A

DRAWN BY: AK

CHECKED BY: DK

DATE: 15/11/22

ROCK CORING LOG BH3

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	19/10/22	**Drilling Company:**	Tucker Environmental	**ROCK CORING LOG BH3**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Coring Method:**	Coring	
Weather:	Overcast	**Core Bit Type:**		

ROCK CORING INFORMATION

Coordinates Not Available
Ground Surface RL Not Available

Depth (metres)	Graphical Log	Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing	Sample Number [Box Number]	Fracture Index	Total Core Recovery (NR=No Recovery)	RQD (%)	Relative Strength	Discontinuity Description Fracture#: (Depth), Type, Relative Dip, Density or Spacing. Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC
		CORE LOSS				93		
7		SANDSTONE, coarse-grained sand, reddish brown , Bedding, bands of dark grey siltstone, High Strength, Fresh		3				1: (6.97'), fracture zone, 40°, slightly fractured, none, tight (7') (7.02'), mechanical break, 0°, none, tight
		SANDSTONE, coarse-grained sand, white , Bedding, bands of dark grey siltstone, Medium to High Strength, Fresh						
		SANDSTONE, coarse-grained sand, reddish brown , Bedding, bands of dark grey siltstone, High Strength, Fresh						2: (7.72'), fracture zone, 2°, slightly fractured, none, tight
8		SANDSTONE, coarse-grained sand, white , Bedding, bands of dark grey siltstone, Medium to High Strength, Fresh		4				3: (7.88'), fracture zone, 85°, slightly fractured, partially filled, Cl, open 4: (8'), fracture zone, 10°, none, tight (8')
		SANDSTONE interlayered with SILTSTONE, coarse-grained sand, reddish brown withgrey, Bedding, bands of dark grey siltstone, High Strength, Fresh, Becoming thinly bedded with siltstone at 8.255m.						5: (8.42'), fracture zone, 2°, slightly to moderately fractured, partially filled, Fe, multiple fractures. 6: (8.85'), fracture zone, 0°, slightly fractured, partially filled, Fe, tight
9		SILTSTONE, fine grained, grey , Bedding, bands of dark grey siltstone, Medium to High Strength, Slightly Weathered		2				7: (8.9'), fracture zone, 0°, slightly fractured, partially filled, Fe, tight (9')
		SILTSTONE, fine grained, reddish brown togrey, Bedding, bands of dark grey siltstone, Medium to High Strength, Slightly Weathered, More reddish brown at top following through as grey with black laminations of silt.				88		8: (9.06'), fracture zone, 0°, moderately fractured, partially filled, Fe, multiple fractures 9: (9.64'), fracture zone, 0°, slightly fractured, partially filled, Fe, decomposed (10')
10			BH3_UCS_10.129	4				10: (10.04'), fracture zone, 5°, slightly to moderately fractured, partially filled, Fe, tight, multiple fractures 11: (10.13'), fracture zone, 0°, slightly fractured, partially filled, Fe
		SANDSTONE, coarse-grained sand, whitish gray andreddish brown, Bedding, bands of dark grey siltstone, High Strength, Slightly Weathered						12: (10.66'), fracture zone, 10°, slightly fractured, partially filled, Fe, tight, slightly weathered, Ironstone band.
		CLAYSTONE, fine grained, yellowish grey , Medium to High Strength, Residual Soil						
11		SANDSTONE, coarse-grained sand, grey andreddish brown, Bedding, bands of ironstone, High Strength, Slightly Weathered, yellow at top 7.5cm.		2				13: (10.86'), fracture zone, 1°, slightly fractured, partially filled, Fe, tight, slightly weathered, Ironstone band (11') (11.28'), mechanical break
12		SILTSTONE, fine grained, grey andreddish purple, Bedding, bands of dark grey siltstone, Medium to High Strength		2				14: (11.43'), fracture zone, 0°, slightly fractured, partially filled, Fe, tight, slightly weathered, Ironstone band (11.5'), mechanical break
			BH3_PL_12.239					
		SANDSTONE, coarse grained, yellowish grey , Medium to High Strength				94		15: (11.76'), fracture zone, 2°, slightly fractured, none, tight, slightly weathered (12') (12.39'), mechanical break
13				0				16: (12.58'), fracture zone, 19°, slightly fractured, partially filled, Fe, tight, slightly weathered 17: (12.96'), fracture zone, 5° (13') (13.39'), mechanical break (13.5'), mechanical break
14				0				(14')
			BH3_UCS_14.339					(14.35'), mechanical break

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PROJECT NO.:	20232408.001A
DRAWN BY:	AK
CHECKED BY:	DK
DATE:	15/11/22

ROCK CORING LOG BH3

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	19/10/22	**Drilling Company:**	Tucker Environmental	**ROCK CORING LOG BH3**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Coring Method:**	Coring	
Weather:	Overcast	**Core Bit Type:**		

ROCK CORING INFORMATION

Coordinates Not Available
Ground Surface RL Not Available

Depth (metres)	Graphical Log	Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing	Sample Number [Box Number]	Fracture Index	Total Core Recovery (NR=No Recovery)	RQD (%)	Relative Strength	Discontinuity Description Fracture#: (Depth), Type, Relative Dip, Density or Spacing. Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC
15		SILTSTONE, medium to fine grained, grey withblack, Bedding, bands of carbonate, Medium to High Strength, Fresh	BH3_UCS_14.339 (cont.)					(14.63'), mechanical break, Multiple mechanical breaks
		SANDSTONE, coarse grained, grey withyellow, Bedding, bands of dark grey siltstone, High Strength, Fresh		3				(15')
		SILTSTONE, fine grained, dark grey , Bedding, bands of dark grey siltstone, Low to Medium Strength, Fresh				88		18: (15.27'), fracture zone, 5°, slightly fractured, none, unweathered to slightly weathered 19: (15.31'), fracture zone, 5°, slightly fractured, none, unweathered to slightly weathered
16		SANDSTONE, coarse grained, gray withyellow, Bedding, bands of dark grey siltstone, High Strength, Fresh		0				20: (15.36'), fracture zone, 0°, slightly fractured, highly weathered to decomposed (16')
		CLAYSTONE, fine grained, dark grey , Bedding, bands of dark grey siltstone, Low Stength, Residual Soil						(16.39'), mechanical break (16.45'), mechanical break
		SANDSTONE, coarse grained, gray withyellow, Bedding, bands of dark grey siltstone, High Strength, Fresh	BH3_PL_16.587					
17				3				(16.91'), mechanical break (17')
								21: (17.42'), fracture zone, 5°, slightly fractured, none, unweathered
								22: (17.71'), fracture zone, 0°, slightly fractured, none, unweathered to slightly weathered
18				0				23: (17.83'), fracture zone, 1°, slightly fractured, partially filled, Cl, unweathered to slightly weathered (18')
		SILTSTONE, fine grained, dark grey togrey, Lamination, High Strength, Fresh, decomposed material at 20.47-20.52m.				92		(18.52'), mechanical break (18.67'), mechanical break (18.84'), mechanical break
19				0				(19')
								(19.73'), mechanical break (19.82'), mechanical break
20				1				(20') (20.37'), mechanical break
			BH3_PL_20.662					24: (20.43'), fracture zone, 0°, moderately to highly fractured, none, decomposed
21				0				(21')
22								

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PROJECT NO.:	20232408.001A
DRAWN BY:	AK
CHECKED BY:	DK
DATE:	15/11/22

ROCK CORING LOG BH3

UON Gosford Campus
305 Mann Street
Gosford, NSW

SAMPLE LOG BH4

Date Begin - End:	17/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Inclination:	-90 degrees	**Drilling Method:**	Continuous Flight Auger
Weather:	Cloud/Rain	**Auger Diameter:**	100 mm. O.D.

FIELD EXPLORATION

Surface Condition: Asphalt

Depth (metres)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/152 mm. RQD=%	Drill Notes / Remarks
		FILL: **CONCRETE**: grey			
		FILL: **Gravelly SAND**: coarse sand, subangular to subrounded gravel, subangular to subrounded sand, yellow, dry to moist			**PID=** 0
		FILL: **Silty SAND**: coarse sand, angular to subangular sand, low plasticity, black, dry to moist, loose			**PID=** 0
1		**Silty CLAY**: medium to coarse sand, low to medium plasticity, black, moist, soft			**PID=** 0
		Clayey SAND: coarse sand, subrounded sand, low plasticity, dark grey, moist, soft			
2		**CLAY with Sand**: coarse sand, subrounded sand, medium to high plasticity, yellowish brown, moist, stiff			**PID=** 0
3					
▽		Note: No sand and moisture change to wet @3.5m			
4					
5					
6		Note: Becoming stiff and colour change to light grey at 5.9m to 6.1m Note: Colour change to reddish orange @6.1m			
7					
8					
9					
10		The sample was terminated because of practical auger refusal (▲) at approximately 9.5 m. below ground level on Bedrock. The sample was backfilled with auger cuttings on 17 October, 2022.			

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 3.5 m. below ground surface during drilling.
GENERAL NOTES:

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PROJECT NO.:	20232408.001A
DRAWN BY:	AK
CHECKED BY:	DK
DATE:	15/11/22

SAMPLE LOG BH4

UON Gosford Campus
305 Mann Street
Gosford, NSW

SAMPLE LOG BH5

Date Begin - End:	17/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Inclination:	-90 degrees	**Drilling Method:**	Continuous Flight Auger
Weather:	Cloud/Rain	**Auger Diameter:**	100 mm. O.D.

FIELD EXPLORATION

Surface Condition: Concrete

Depth (metres)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/152 mm. RQD=%	Drill Notes / Remarks
		FILL: **CONCRETE**: grey, dry, Note: Orange plastic layer at 0.15			
		FILL: **GRAVEL**: fine to coarse gravel, subangular to subrounded gravel, low plasticity, grey, dry			**PID=** 0
		Silty CLAY: low to medium plasticity, dark grey, moist, soft to firm			**PID=** 0
1		**Sandy CLAY**: fine to medium sand, subangular to subrounded sand, medium plasticity, grey, moist to wet, soft to firm			**PID=** 0
2		**CLAY**: medium plasticity, yellowish grey, moist to wet, soft to firm			**PID=** 0
		CLAY: high plasticity, orangish red, dry to moist, stiff			
3					
▽		Note: Moisture change to wet @3.5m			
4					
5					
6					
7					
		CLAY: high plasticity, greyish white, wet, stiff			
8					
		The sample was terminated because of practical auger refusal (▲) at approximately 8.5 m. below ground level on Bedrock. The sample was backfilled with auger cuttings on 17 October, 2022.			
9					

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 3.5 m. below ground surface during drilling.
GENERAL NOTES:

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PROJECT NO.:	20232408.001A
DRAWN BY:	AK
CHECKED BY:	DK
DATE:	15/11/22

SAMPLE LOG BH5

UON Gosford Campus
305 Mann Street
Gosford, NSW

SAMPLE LOG BH6

Date Begin - End:	21/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Inclination:	-90 degrees	**Drilling Method:**	Continuous Flight Auger
Weather:	Cloud/Rain	**Auger Diameter:**	100 mm. O.D.

FIELD EXPLORATION

Surface Condition: Concrete

Depth (metres)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/152 mm. RQD=%	Drill Notes / Remarks
		FILL: **CONCRETE**: grey, dry			
		FILL: **Sandy CLAY**: subrounded sand, low plasticity, yellow			
		FILL: **Silty SAND**: low plasticity, dark grey, loose			**PID=** 0
1		**CLAY with Sand**: subrounded sand, low to medium plasticity, yellowish orange, firm			**PID=** 0
		CLAY: medium plasticity, orangish red, stiff		BC=2 4 4	
2		Note: becoming very stiff from 2.0m		BC=5 10 12	
3		**CLAY with Silt**: medium to high plasticity, pinkish white, very stiff, iron oxide staining		BC=5 7 11	
4		Note: Band of Ironstone @ 4.2-4.25m.		BC=13 10 20	**PID=** 0
5					
6					
7					
8					
9					

The sample was terminated because of practical auger refusal ( ) at approximately 4.5 m. below ground level on Bedrock. The sample was backfilled with auger cuttings on 21 October, 2022.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:

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PROJECT NO.: 20232408.001A
DRAWN BY: AK
CHECKED BY: DK
DATE: 15/11/22

SAMPLE LOG BH6

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	21/10/22	**Drilling Company:**	Tucker Environmental	**MONITORING WELL LOG BH7**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Inclination:	-90 degrees	**Drilling Method:**	Continuous Flight Auger	
Weather:	Cloud/Rain	**Auger Diameter:**	100 mm. O.D.	

FIELD EXPLORATION

Surface Condition: Concrete

Depth (metres)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/152 mm. ROD=%	Drill Notes / Remarks
		FILL: grey			
		FILL: **Gravelly SAND**: coarse sand, subangular to subrounded gravel, subangular to subrounded sand, grey, dry			
		Silty CLAY with Sand: coarse sand, subrounded sand, low plasticity, dark brown, dry to moist, very soft to soft			**PID=** 0
1		**Sandy CLAY**: coarse sand, subrounded sand, low plasticity, yellowish brown, moist, very soft to soft		BC=1 1 1	**PID=** 0
		CLAY: medium to high plasticity, reddish brown, moist, firm			
2				BC=2 3 4	
3		Note: Stiff @3.0m		BC=3 5 7	
4		**CLAY**: high plasticity, white with reddish brown, moist, stiff		BC=4 9 11	**PID=** 1.0
		Weathered SILTSTONE: low to medium plasticity, white, dry, very stiff			
5		Note: Fractured Ironstone layer @5.0-5.1m. Moist to wet		BC=6 12 18	
▽ 6		Note: Wet @5.9m, becoming hard @ 6.0m moderate hydrocarbon odour		BC=8 14 29	**PID=** 102.1
7				BC=30	
8					
9					

The monitoring well was terminated because of practical auger refusal ( ) at approximately 7.5 m. below ground level on Bedrock. Monitoring Well installed to a depth of 7.3m.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 6 m. below ground surface during drilling.
GENERAL NOTES:
A PID (ppmv) was used for environmental field screening.
A 50 mm. diameter PVC casing was drilled to a depth of 7.3 m.

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PROJECT NO.:	20232408.001A
DRAWN BY:	AK
CHECKED BY:	DK
DATE:	15/11/22

MONITORING WELL LOG BH7

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	11/10/22	**Drilling Company:**	Tucker Environmental
Logged By:	J.Roby	**Drill Crew:**	J. Tucker
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe
Inclination:	-90 degrees	**Drilling Method:**	Continuous Flight Auger
Weather:	Overcast	**Bore Diameter:**	100 mm. O.D.

ROCK CORING LOG BH8

FIELD EXPLORATION

Surface Condition: Concrete

Depth (metres)	Graphical Log	Lithologic Description	Sample Type	Blow Counts(BC)= Uncorr. Blows/152 mm. RQD=%	Drill Notes / Remarks
		FILL: **CONCRETE**			
		FILL: **SAND with Gravel**: coarse sand, sub-angular, yellow, dry, loose			**PID=** 0
1		**Sandy CLAY**: medium sand, rounded, low plasticity, dark grey, moist, soft		BC=1 3 2	**PID=** 0
2				BC=2 2 2	**PID=** 0
3		Note: consistency change, firm to stiff @ 3.1-3.2m Note: Wet @ 3.2m		BC=2 2 1	**PID=** 0
4		**CLAY with Sand**: high plasticity, reddish brown, dry to moist, stiff		BC=2 4 5	**PID=** 0
5		**SAND with Clay**: coarse sand, non-plastic to low plasticity, grey, dry to moist, stiff **CLAY**: medium to high plasticity, red and brown, dry to moist, stiff		BC=5 6 7	**PID=** 0
6		Note: colour change to grey at 6.5m		BC=3 3 5	**PID=** 0
7				BC=3 3 4	
8				BC=4 6 8	
9				BC=6 9 11	
10				BC=3 3 5	
11		**Weathered SILTSTONE**: high plasticity, red and white, dry, very stiff		BC=7 11 10	
12		Note:White and Hard at 12.0m		BC=7 30 RQD=52	
13					

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PROJECT NO.:	20232408.001A
DRAWN BY:	JR
CHECKED BY:	DK
DATE:	15/11/22

ROCK CORING LOG BH8

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	11/10/22	**Drilling Company:**	Tucker Environmental	**ROCK CORING LOG BH8**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Coring Method:**	Coring	
Weather:	Overcast	**Core Bit Type:**		

ROCK CORING INFORMATION

Depth (metres)	Graphical Log	Coordinates Not Available Ground Surface RL Not Available Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing	Sample Number [Box Number]	Fracture Index	Total Core Recovery (NR=No Recovery)	RQD (%)	Relative Strength	Discontinuity Description Fracture#: (Depth), Type, Relative Dip, Density or Spacing. Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC
13		SANDSTONE, medium grained, white , Medium Strength, Slightly Weathered				52		
		SANDSTONE with CLAYSTONE, medium to fine grained, white , Low Stength, Highly Weathered		3				1: (12.76'), fracture zone, 2°, slightly fractured, none, slightly weathered
		CORE LOSS						2: (12.82'), fracture zone, 2°, slightly fractured, none, slightly weathered
		SANDSTONE, medium grained, reddish brown , Medium to High Strength, Slightly Weathered						(13')
14		CORE LOSS		1				(13.15'), mechanical break, 0°, none
		CLAYSTONE, fine grained, white , Very Low Strength, Residual Soil	PL_14.52					3: (13.25'), fracture zone, 75°, slightly to moderately fractured, none, slightly to moderately weathered
		SANDSTONE, medium grained, reddish brown , Medium to High Strength, Slightly Weathered						(13.63'), mechanical break, 0°
15				3				(13.71'), mechanical break, 0°
						60		4: (13.82'), fracture zone, 5°, moderately to highly fractured, none, decomposed
			UCS_15.68					(13.85'), mechanical break, 0°
16				1				5: (13.92'), fracture zone, 45°, slightly fractured, none, slightly weathered
								(14')
		SANDSTONE, medium grained, grey , High Strength, Fresh						6: (14.23'), fracture zone, 40°, slightly fractured, none, unweathered
17				0				(14.48'), mechanical break, 0°, none
			PL_17.28					(15')
								7: (15.29'), fracture zone, 20°, slightly fractured, none, unweathered
18				0				8: (15.58'), fracture zone, 25°, slightly fractured, surface stain, Fe, unweathered
						95		9: (15.82'), fracture zone, 5°, slightly fractured, surface stain, Fe, slightly weathered
								(16')
19				1				(16.79'), mechanical break, 0°, none
			UCS_19.32					10: (16.92'), fracture zone, 0°, slightly fractured, partially filled, Cl, slightly weathered
						89		(17')
								(18')
20				0				(19')
								11: (19.56'), fracture zone, 50°, slightly fractured, partially filled, Cl, slightly weathered
								(20')
21		SANDSTONE, coarse grained, whitish grey , High Strength, Fresh		1				(21')
		SANDSTONE with SILTSTONE, medium grained, grey , High Strength, Fresh	PL_21.595					
22				2				12: (21.83'), fracture zone, 90°, slightly to moderately fractured, none, slightly weathered
								(22')
			UCS_22.645					13: (22.03'), fracture zone, 5°, slightly fractured, none, slightly weathered
23		SANDSTONE, medium grained, light grey , High Strength, Fresh		1				(22.37'), mechanical break, 15°, slightly fractured, none, unweathered
		SILTSTONE, fine grained, grey todark grey, Bedding, bands of dark grey siltstone, High Strength, Moderately Weathered						14: (22.48'), fracture zone, 2°, slightly fractured, partially filled, Cl, slightly to moderately weathered
24				0				(23')
								(23.32'), mechanical break, 0°, slightly fractured, none, unweathered
								15: (23.39'), fracture zone, 0°, none
25								(23.55'), mechanical break, 0°, slightly fractured, none, slightly weathered
								(24'), mechanical break, 0°, slightly fractured, none, unweathered
								(24')

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PROJECT NO.: 20232408.001A
DRAWN BY: JR
CHECKED BY: DK
DATE: 15/11/22

ROCK CORING LOG BH8

UON Gosford Campus
305 Mann Street
Gosford, NSW

Date Begin - End:	11/10/22	**Drilling Company:**	Tucker Environmental	**ROCK CORING LOG BH8**
Logged By:	J.Roby	**Drill Crew:**	J. Tucker	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe	
Plunge:	-90 degrees	**Coring Method:**	Coring	
Weather:	Overcast	**Core Bit Type:**		

Depth (metres)	Graphical Log	ROCK CORING INFORMATION Coordinates Not Available Ground Surface RL Not Available Formation and Rock Type, Color, Grain/Particle Size, Weathering, Bedding, Density or Spacing	Sample Number [Box Number]	Fracture Index	Total Core Recovery (NR=No Recovery)	RQD (%)	Relative Strength	Discontinuity Description Fracture#: (Depth), Type, Relative Dip, Density or Spacing. Degree of Infilling, Infilling Type, Aperture, Surface Weathering, JRC
26								(24.04'), mechanical break, 1°, slightly fractured, none, unweathered (24.56'), mechanical break, 0°, slightly fractured, none, unweathered (24.7'), mechanical break, 0°, slightly fractured, none, unweathered (24.75'), mechanical break, 0°, slightly fractured, none, unweathered (24.8')
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								
38								
39								

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PROJECT NO.: 20232408.001A

DRAWN BY: JR

CHECKED BY: DK

DATE: 15/11/22

ROCK CORING LOG BH8

UON Gosford Campus
305 Mann Street
Gosford, NSW

APPENDIX C LABORATORY TEST RESULTS

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
Unit 1, 12 Callistemon Close
Warabrook NSW 2304

Laboratory: **Warabrook Laboratory**
Phone: 02 4062 0200
Fax: 02 6654 0261
Email: Newcastle@constructionsciences.net

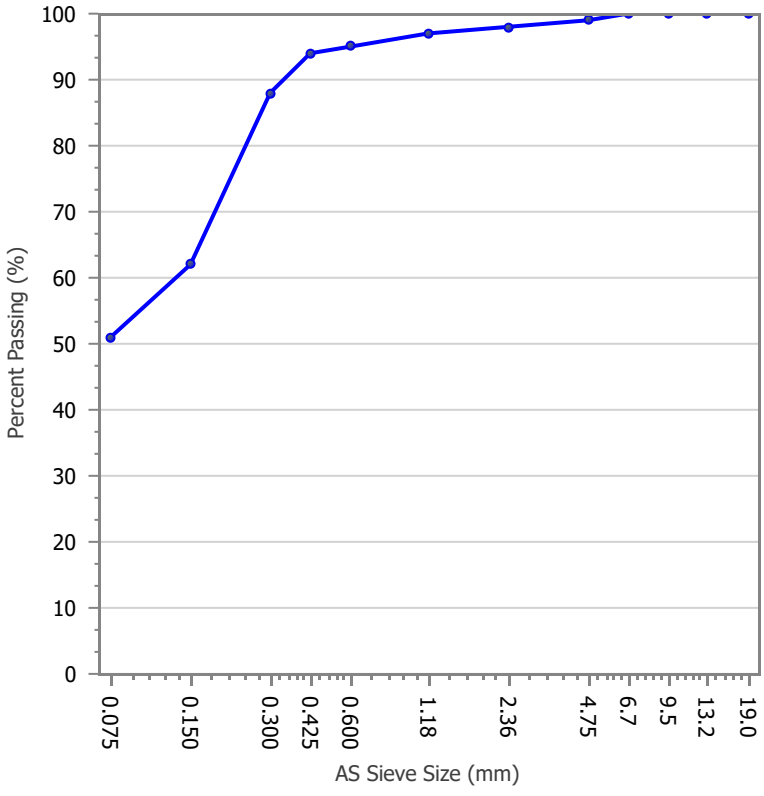
PARTICLE SIZE DISTRIBUTION REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36853-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	7/11/2022 Page 1 of 1

Test Procedures:	AS1289.3.6.1			
Sample Number	16822/S/118328	Bore No.		BH-02
Sampling Method	Tested As Received	Sample Type		D
Date Sampled	26/10/2022	Sample Depth	m	2.0
Sampled By	Client Sampled			
Date Tested	31/10/2022	Material Source		In situ
Prep / Drying Method	n/a	Material Type		Existing
Prep > 53mm (%)	-	Specification		-

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**100**	
9.5		**100**	
6.7		**100**	
4.75		**99**	
2.36		**98**	
1.18		**97**	
0.600		**95**	
0.425		**94**	
0.300		**88**	
0.150		**62**	
0.075		**51**	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks	Results apply to the sample/s as received.,

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NATA

Accreditation Number: 1986
Corporate Site Number: 16822

Approved Signatory: Blayke Desvaux
Form ID: W9Rep Rev 3

Construction Sciences

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Phone: 02 4062 0200
Fax: 02 6654 0261
Email: Newcastle@constructionsciences.net

ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36854-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	7/11/2022 Page 1 of 7

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	16822/S/118323	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-01
Date Sampled	26/10/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	2.0
Date Tested	4/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	Sandy CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**37**	
Plastic Limit (%)		**14**	
Plasticity Index (%)		**23**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.,

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NATA

Accreditation Number: 1986
Corporate Site Number: 16822

Approved Signatory: Blayke Desvaux
Form ID: W11bRep Rev 2

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ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36854-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	7/11/2022 Page 2 of 7

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	16822/S/118326	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-02
Date Sampled	26/10/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	1.0
Date Tested	4/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	SAND		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**Can't be determined**	
Plastic Limit (%)		**Can't be determined**	
Plasticity Index (%)		**Non Plastic**	
Linear Shrinkage (%)		**0.5**	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.4mm / Nil		

Remarks	Results apply to the sample/s as received.,

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Form ID: W11bRep Rev 2

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ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36854-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	7/11/2022 Page 3 of 7

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	16822/S/118329	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-03
Date Sampled	26/10/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	3.0
Date Tested	4/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	Sandy CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**45**	
Plastic Limit (%)		**16**	
Plasticity Index (%)		**29**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.,

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Form ID: W11bRep Rev 2

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ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36854-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	7/11/2022 Page 4 of 7

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	16822/S/118333	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-04
Date Sampled	26/10/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	4.0
Date Tested	4/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	Sandy CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**33**	
Plastic Limit (%)		**9**	
Plasticity Index (%)		**24**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.,

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Form ID: W11bRep Rev 2

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ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36854-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	7/11/2022 Page 5 of 7

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	16822/S/118337	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-05
Date Sampled	26/10/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	5.0
Date Tested	4/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	Sandy CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**42**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**30**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.,

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Form ID: W11bRep Rev 2

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ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36854-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	7/11/2022 Page 6 of 7

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	16822/S/118341	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-06
Date Sampled	26/10/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	2.0
Date Tested	4/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	Sandy CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**56**	
Plastic Limit (%)		**15**	
Plasticity Index (%)		**41**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.,

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Form ID: W11bRep Rev 2

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ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36854-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	7/11/2022 Page 7 of 7

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.2.1.1		
Sample Number	16822/S/118343	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-07
Date Sampled	26/10/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	5.0
Date Tested	4/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	Sandy CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**35**	
Plastic Limit (%)		**16**	
Plasticity Index (%)		**19**	
Linear Shrinkage (%)			
Linear Shrinkage Defects:			

Remarks	Results apply to the sample/s as received.,

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Form ID: W11bRep Rev 2

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ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/37415-4
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/23061
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford (Second Batch)	Report Date / Page:	8/12/2022 Page 1 of 3

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	16822/S/119357	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-08
Date Sampled	14/11/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	6.0m
Date Tested	30/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	Silty CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**26**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**14**	
Linear Shrinkage (%)		**7.0**	
Linear Shrinkage Mould Length / Defects:	Mould Length: 250.5mm / Cracking		

Remarks	Re-Issued Report Replaces Report No 16822/R/37415-3 (reason: Liquid Limit Added to S/119357)., Results apply to the sample/s as received.,

NATA

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Accreditation Number: 1986
Corporate Site Number: 16822

Approved Signatory: Blayke Desvaux
Form ID: W11bRep Rev 2

Construction Sciences

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ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/37415-4
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/23061
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford (Second Batch)	Report Date / Page:	8/12/2022 Page 2 of 3

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	16822/S/119364	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-08
Date Sampled	14/11/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	1.0
Date Tested	30/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	Silty CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**26**	
Plastic Limit (%)		**13**	
Plasticity Index (%)		**13**	
Linear Shrinkage (%)		**4.0**	
Linear Shrinkage Mould Length / Defects:	Mould Length: 253.9mm / Cracking		

Remarks	Re-Issued Report Replaces Report No 16822/R/37415-3 (reason: Liquid Limit Added to S/119357)., Results apply to the sample/s as received.,

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

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Corporate Site Number: 16822

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Form ID: W11bRep Rev 2

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ATTERBERG LIMITS REPORT

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/37415-4
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/23061
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford (Second Batch)	Report Date / Page:	8/12/2022 Page 3 of 3

Test Procedures:	AS1289.3.1.1, AS 1289.3.3.1, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	16822/S/119365	Sample Location	
Sampling Method	Tested As Received	Bore No.	BH-08
Date Sampled	14/11/2022	Sample Type	D
Sampled By	Client Sampled	Sample Depth m	3.0
Date Tested	30/11/2022		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	In situ
LL Water Type	Potable	Material Type	Existing
LL Device Type	Cassagrande	Prep Mat > 53mm (%)	-
Material Description	Silty CLAY		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Liquid Limit (%)		**26**	
Plastic Limit (%)		**12**	
Plasticity Index (%)		**14**	
Linear Shrinkage (%)		**4.5**	
Linear Shrinkage Mould Length / Defects:	Mould Length: 253.9mm / Cracking		

Remarks	Re-Issued Report Replaces Report No 16822/R/37415-3 (reason: Liquid Limit Added to S/119357)., Results apply to the sample/s as received.,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 16822

Approved Signatory: Blayke Desvaux
Form ID: W11bRep Rev 2

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SHRINK SWELL INDEX

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36945-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	10/11/2022 Page 1 of 4

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Bore No.		BH-01
Sample Number	16822/S/118325	Sample Type		D
Sampling Method	Tested As Received	Sample Depth	m	3.0
Date Sampled	26/10/2022			
Sampled By	Client Sampled	Material Source	In situ	
Date Tested	2/11/2022	Material Type	Existing	

Soil Description:	Silty CLAY		
Cracking / Crumbling:	Min		
Estimated Inert Inclusions (%):	0.00	Swell Pre-Soak Moisture Content (%)	12.1
Shrinkage Moisture Content (%):	16.0	Swell Post-Soak Moisture Content (%)	21.8

Shrinkage Strain (%)	3.6	Shrink / Swell Index	2.0
Swell Strain (%)	0.0		

Remarks	Results apply to the sample/s as received.,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 16822

Approved Signatory: Blayke Desvaux
Form ID: W21Rep Rev 1

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SHRINK SWELL INDEX

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36945-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	10/11/2022 Page 2 of 4

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Bore No.		BH-03
Sample Number	16822/S/118331	Sample Type		D
Sampling Method	Tested As Received	Sample Depth	m	2.0
Date Sampled	26/10/2022			
Sampled By	Client Sampled	Material Source	In situ	
Date Tested	2/11/2022	Material Type	Existing	

Soil Description:	Silty CLAY		
Cracking / Crumbling:	Min		
Estimated Inert Inclusions (%):	2.90	Swell Pre-Soak Moisture Content (%)	12.5
Shrinkage Moisture Content (%):	16.7	Swell Post-Soak Moisture Content (%)	16.9

Shrinkage Strain (%)	1.7	Shrink / Swell Index	1.1
Swell Strain (%)	0.5		

Remarks	Results apply to the sample/s as received.,

NATA

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Email: Newcastle@constructionsciences.net

SHRINK SWELL INDEX

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36945-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	10/11/2022 Page 3 of 4

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Bore No.		BH-04
Sample Number	16822/S/118335	Sample Type		D
Sampling Method	Tested As Received	Sample Depth	m	2.5
Date Sampled	26/10/2022			
Sampled By	Client Sampled	Material Source	In situ	
Date Tested	3/11/2022	Material Type	Existing	

Soil Description:	Sandy CLAY		
Cracking / Crumbling:	Min		
Estimated Inert Inclusions (%):	0.00	Swell Pre-Soak Moisture Content (%)	18.4
Shrinkage Moisture Content (%):	18.6	Swell Post-Soak Moisture Content (%)	19.5

Shrinkage Strain (%)	1.3	Shrink / Swell Index	0.7
Swell Strain (%)	0.0		

Remarks	Results apply to the sample/s as received.,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

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Form ID: W21Rep Rev 1

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Email: Newcastle@constructionsciences.net

SHRINK SWELL INDEX

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/36945-1
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/22904
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford	Report Date / Page:	10/11/2022 Page 4 of 4

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Bore No.		BH-05
Sample Number	16822/S/118339	Sample Type		D
Sampling Method	Tested As Received	Sample Depth	m	2.0
Date Sampled	26/10/2022			
Sampled By	Client Sampled	Material Source	In situ	
Date Tested	3/11/2022	Material Type	Existing	

Soil Description:	Silty CLAY		
Cracking / Crumbling:	Moderate		
Estimated Inert Inclusions (%):	0.00	Swell Pre-Soak Moisture Content (%)	21.2
Shrinkage Moisture Content (%):	21.3	Swell Post-Soak Moisture Content (%)	21.9

Shrinkage Strain (%)	2.7	Shrink / Swell Index	1.5
Swell Strain (%)	0.0		

Remarks	Results apply to the sample/s as received.,

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Accreditation Number: 1986
Corporate Site Number: 16822

Approved Signatory: Blayke Desvaux
Form ID: W21Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
Unit 1, 12 Callistemon Close
Warabrook NSW 2304

Laboratory: **Warabrook Laboratory**
Phone: 02 4062 0200
Fax: 02 6654 0261
Email: Newcastle@constructionsciences.net

SHRINK SWELL INDEX

Client:	Kleinfelder Pty Ltd	Report Number:	16822/R/37414-2
Client Address:	95 Mitchell Road, Cardiff	Project Number:	16822/P/214
Project:	UoN Gosford	Lot Number:	
Location:	Cardiff - Varous Locations	Internal Test Request:	16822/T/23061
Component:	Site Investigation	Client Reference/s:	20232408
Area Description:	UoN - Gosford (Second Batch)	Report Date / Page:	8/12/2022 Page 1 of 1

Test Procedures:	AS1289.7.1.1, AS1289.2.1.1	Bore No.		BH-08
Sample Number	16822/S/119355	Sample Type		U50
Sampling Method	Tested As Received	Sample Depth	m	2.0
Date Sampled	14/11/2022			
Sampled By	Client Sampled	Material Source	In situ	
Date Tested	16/11/2022	Material Type	Existing	

Soil Description:	Sandy CLAY		
Cracking / Crumbling:	Min		
Estimated Inert Inclusions (%):	0.50	Swell Pre-Soak Moisture Content (%)	16.4
Shrinkage Moisture Content (%):	16.9	Swell Post-Soak Moisture Content (%)	15.8

Shrinkage Strain (%)	2.4	Shrink / Swell Index	1.3
Swell Strain (%)	0.0		

Remarks	Re-Issued Report Replaces Report No 16822/R/37414-1 (reason: BH Number Corrected)., Results apply to the sample/s as received.,

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Accreditation Number: 1986
Corporate Site Number: 16822

Approved Signatory: Blayke Desvaux
Form ID: W21Rep Rev 1

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

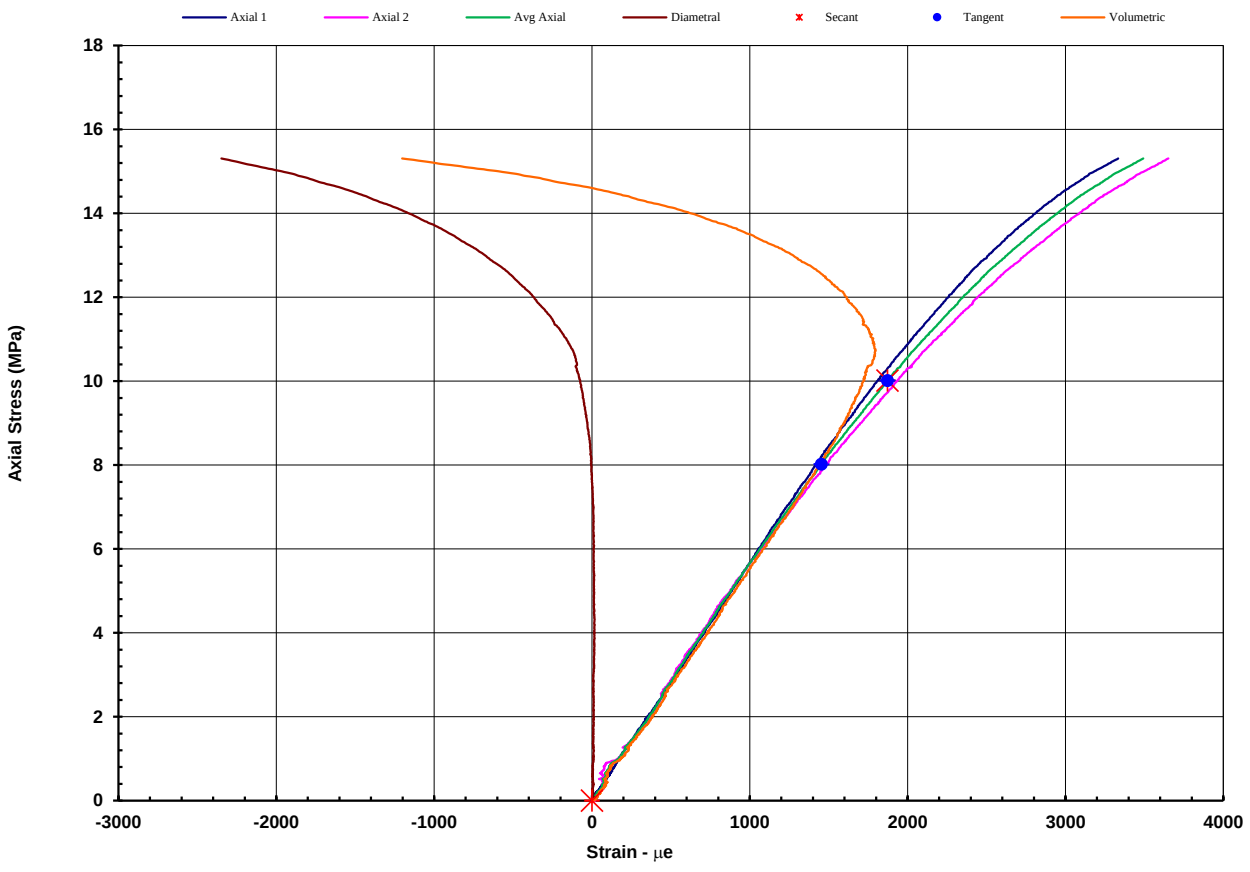
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110838-MOD
		Workorder No	0010454
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	23/11/2022
		Report Date	28/11/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	BH1 / U50 / 16822/S/118817	**Depth (m)**	10.58-10.79
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 15.9 MPa

	Young's Modulus	Poisson Ratio	
Tangent	4.75 GPa	0.165	from 50 % to 63 % of Max UCS
Secant	5.35 GPa	0.040	from 0 % to 63 % of Max UCS

Axial Stress vs Strain Plots



Notes/Remarks:

Sample/s supplied by client Graph not to scale Tested as received. **Page 1 of 2** REP13402

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110838-MOD

Average Sample Diameter (mm)	52.0	Moisture Content (%)	5.6
Sample Height (mm)	140.1	Wet Density (t/m^3)	2.42
Duration of Test (min)	18.95	Dry Density (t/m^3)	2.29
Rate of Displacement (mm/min)	0.10	Bedding (°)	Nil
Mode of Failure	Shear	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	70		

Notes/Remarks:

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

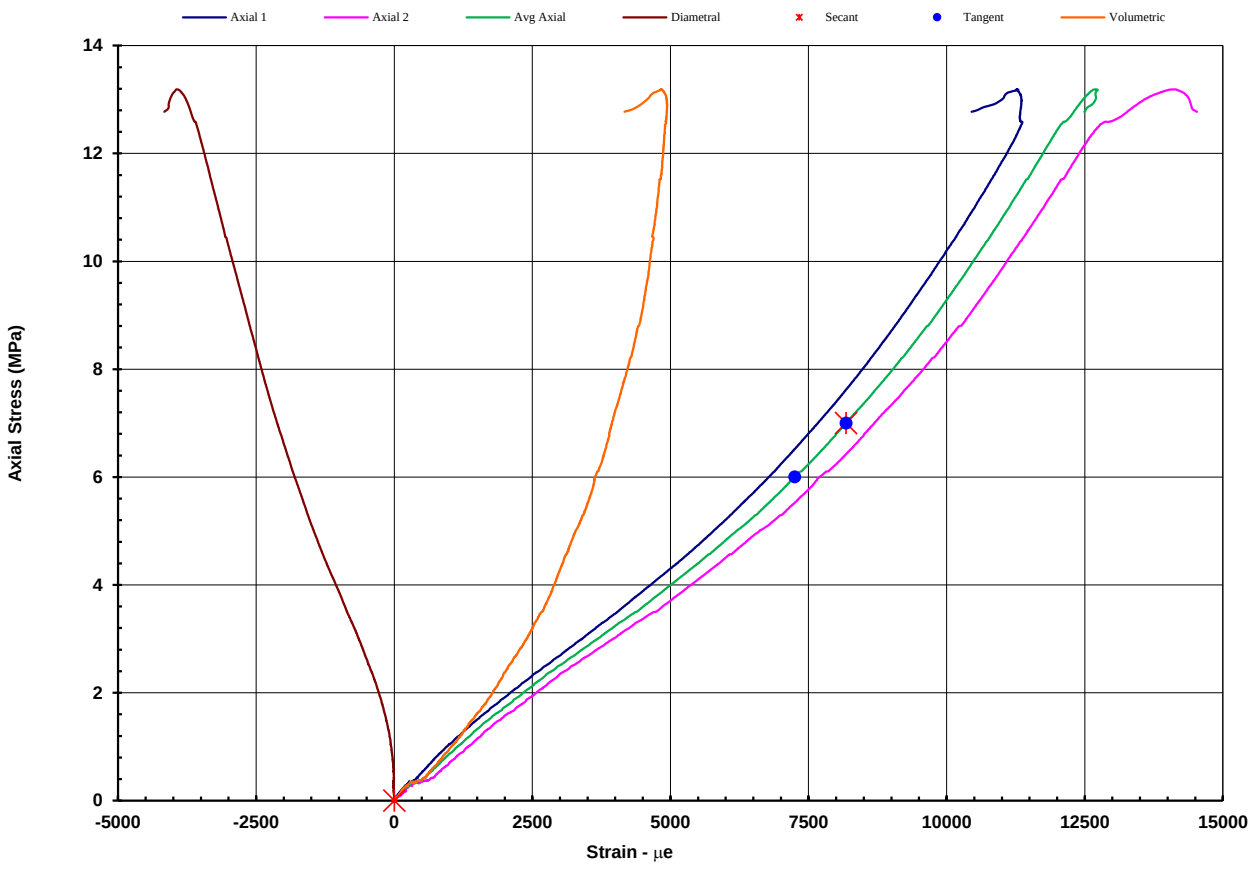
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110839-MOD
		Workorder No	0010454
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	23/11/2022
		Report Date	28/11/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	BH1 / U50 / 16822/S/118818	**Depth (m)**	14.28-14.52
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 13.2 MPa

	Young's Modulus	Poisson Ratio	
Tangent	1.07 GPa	0.338	from 45 % to 53 % of Max UCS
Secant	0.856 GPa	0.259	from 0 % to 53 % of Max UCS

Axial Stress vs Strain Plots



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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110839-MOD

Average Sample Diameter (mm)	51.9	Moisture Content (%)	5.0
Sample Height (mm)	143.4	Wet Density (t/m^3)	2.48
Duration of Test (min)	29.73	Dry Density (t/m^3)	2.36
Rate of Displacement (mm/min)	0.10	Bedding (°)	10
Mode of Failure	Conical	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	80		

Notes/Remarks:

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

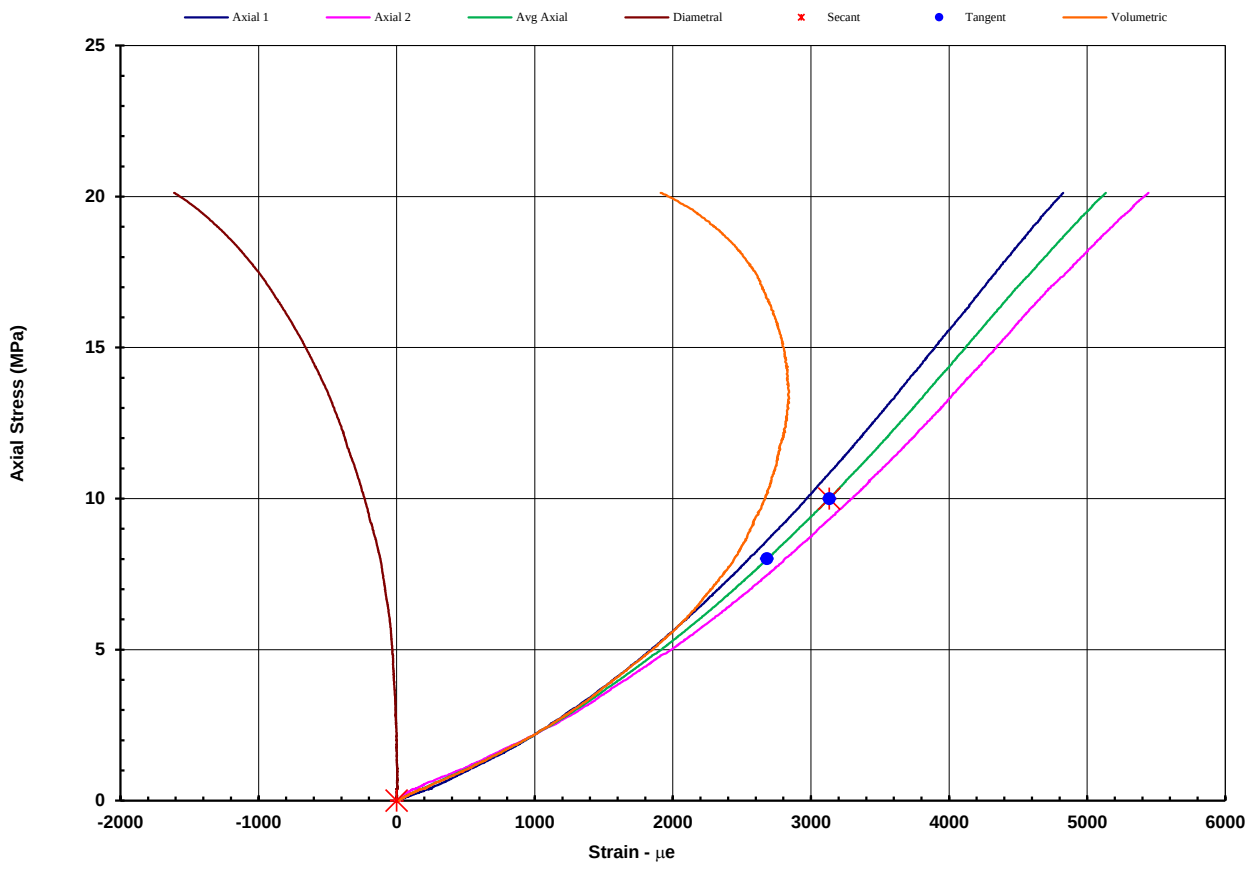
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110840-MOD
		Workorder No	0010454
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	23/11/2022
		Report Date	28/11/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	BH1 / U50 / 16822/S/118819	**Depth (m)**	19.135-19.385
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 21.9 MPa

	Young's Modulus	Poisson Ratio	
Tangent	4.39 GPa	0.255	from 37 % to 46 % of Max UCS
Secant	3.19 GPa	0.074	from 0 % to 46 % of Max UCS

Axial Stress vs Strain Plots



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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110840-MOD

Average Sample Diameter (mm)	51.9	Moisture Content (%)	6.9
Sample Height (mm)	142.8	Wet Density (t/m^3)	2.39
Duration of Test (min)	22.83	Dry Density (t/m^3)	2.23
Rate of Displacement (mm/min)	0.10	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	75		

Notes/Remarks:

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

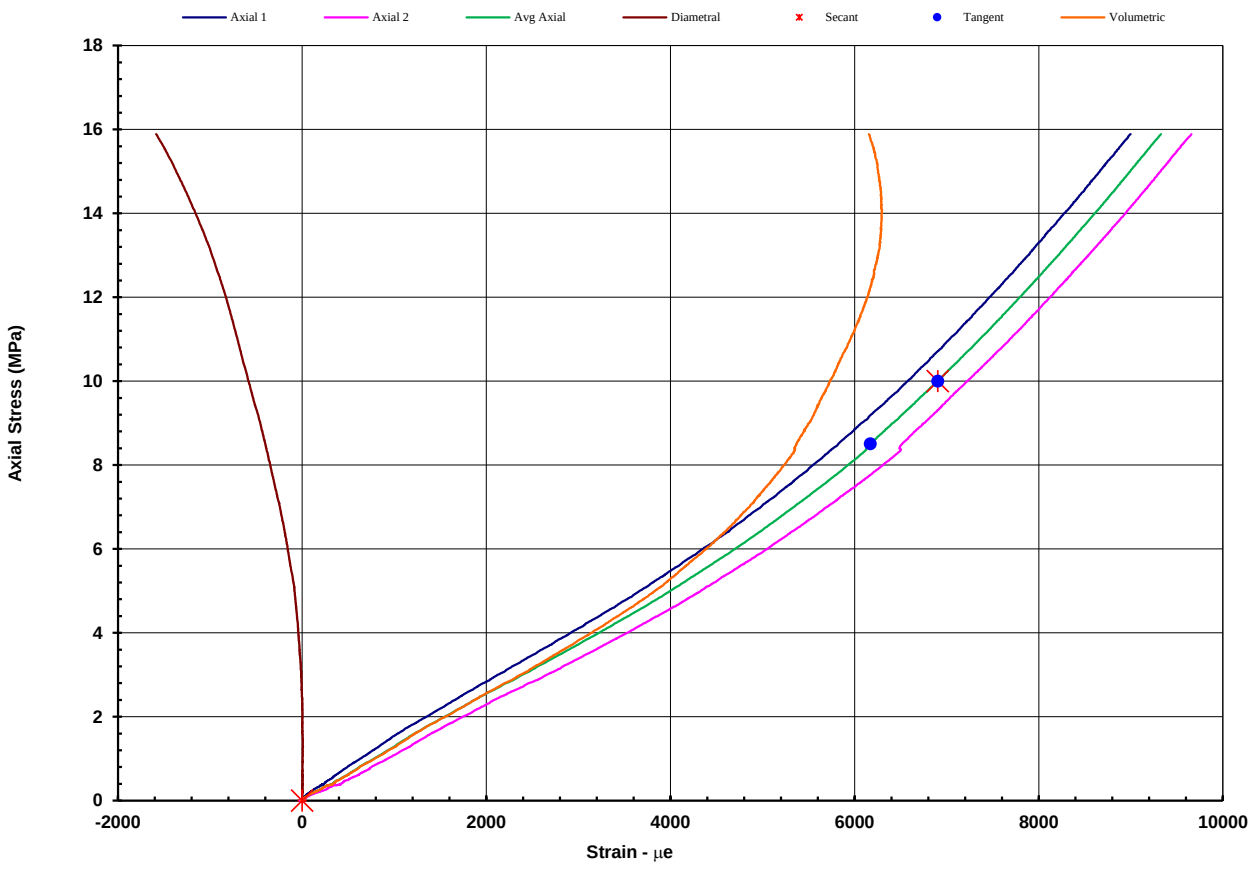
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110835-MOD
		Workorder No	0010454
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	23/11/2022
		Report Date	28/11/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	BH2 / U50 / 16822/S/118814	**Depth (m)**	7.81-8.01
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 19.5 MPa

	Young's Modulus	Poisson Ratio	
Tangent	2.04 GPa	0.248	from 44 % to 51 % of Max UCS
Secant	1.45 GPa	0.085	from 0 % to 51 % of Max UCS

Axial Stress vs Strain Plots



Notes/Remarks:

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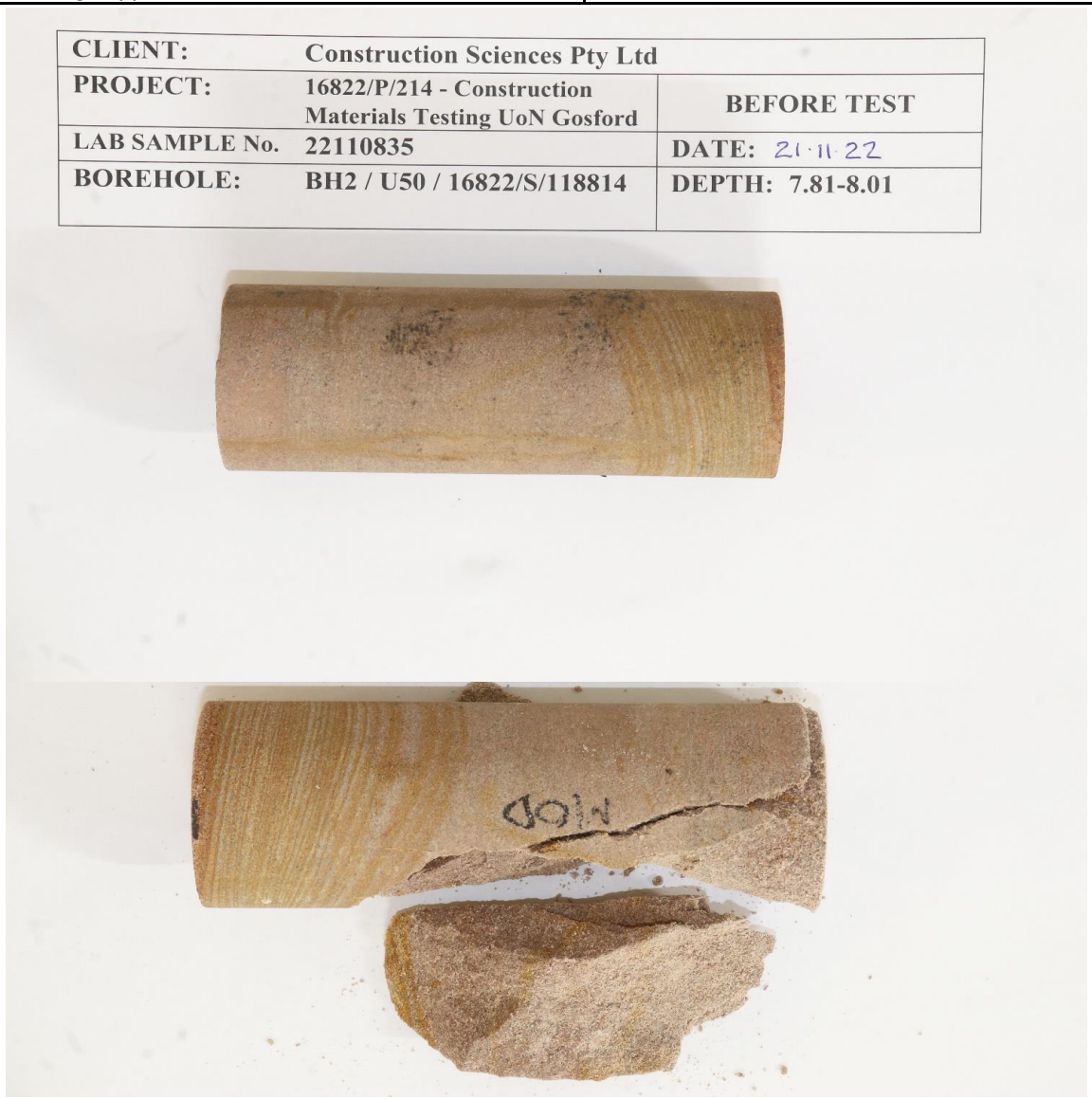
UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110835-MOD

Average Sample Diameter (mm)	51.8	Moisture Content (%)	6.1
Sample Height (mm)	141.4	Wet Density (t/m^3)	2.40
Duration of Test (min)	30.53	Dry Density (t/m^3)	2.26
Rate of Displacement (mm/min)	0.10	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	75		



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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

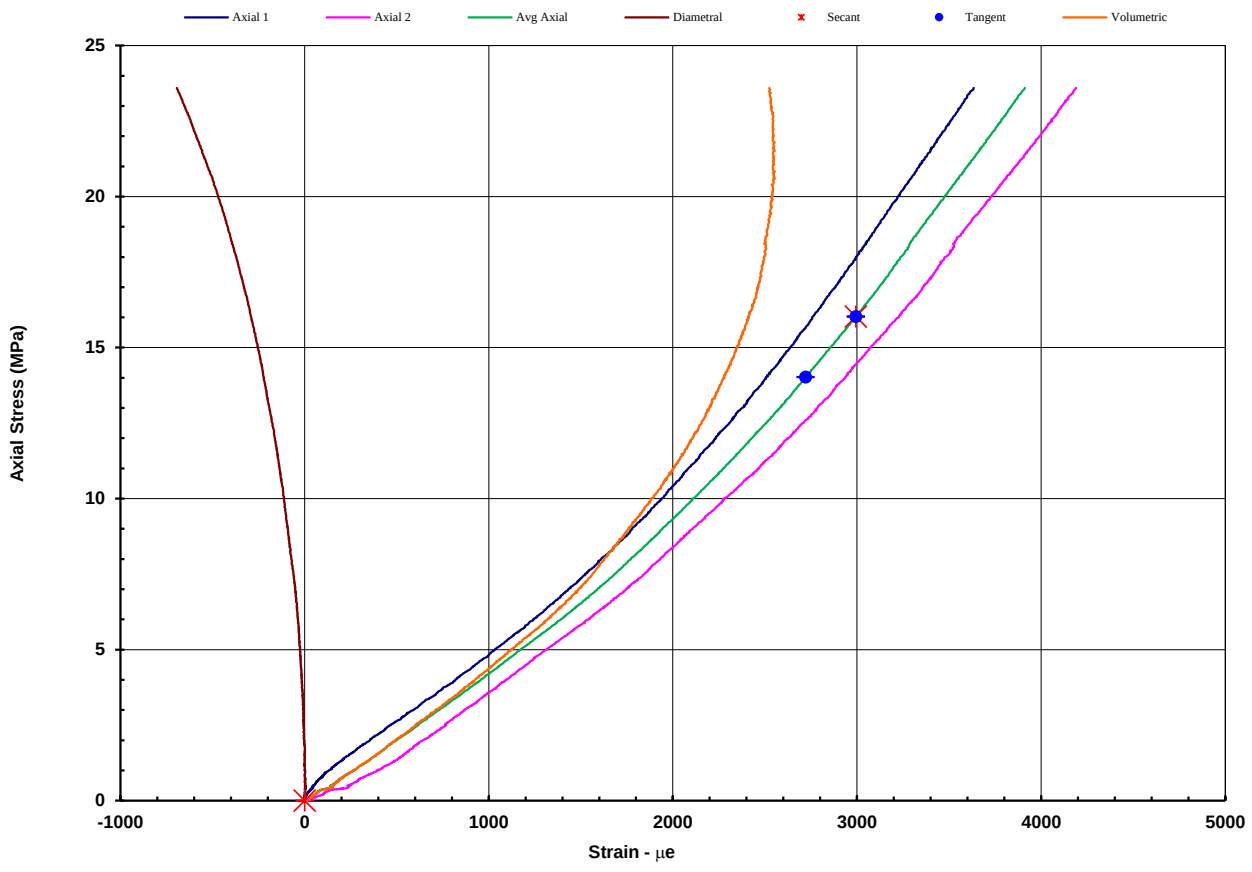
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110836-MOD
		Workorder No	0010454
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	23/11/2022
		Report Date	28/11/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	BH2 / U50 / 16822/S/118815	**Depth (m)**	13.44-13.73
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 33.2 MPa

	Young's Modulus	Poisson Ratio	
Tangent	7.35 GPa	0.255	from 42 % to 48 % of Max UCS
Secant	5.35 GPa	0.098	from 0 % to 48 % of Max UCS

Axial Stress vs Strain Plots



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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110836-MOD

Average Sample Diameter (mm)	51.8	Moisture Content (%)	2.7
Sample Height (mm)	145.1	Wet Density (t/m^3)	2.51
Duration of Test (min)	25.77	Dry Density (t/m^3)	2.44
Rate of Displacement (mm/min)	0.10	Bedding (°)	10
Mode of Failure	Conical	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	80		

Notes/Remarks:

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

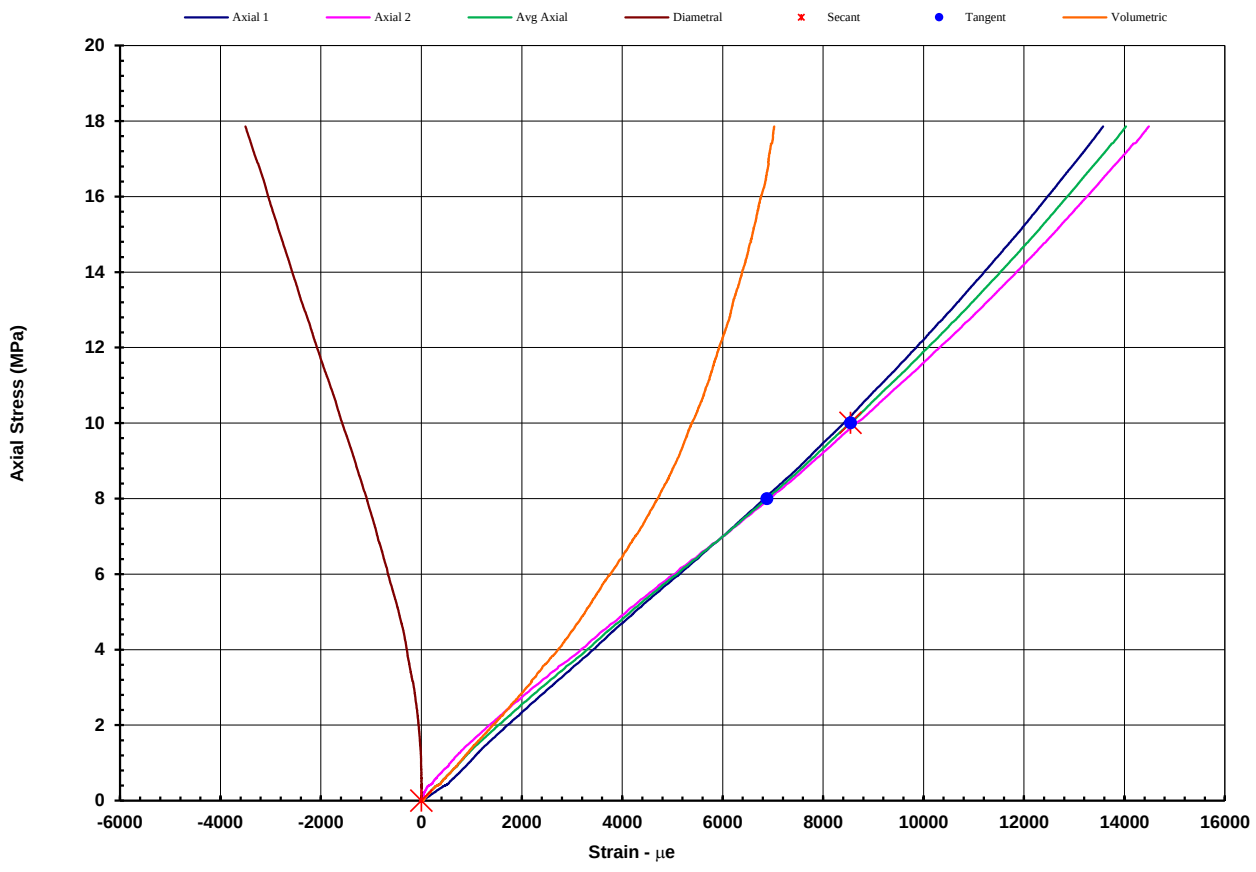
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110837-MOD
		Workorder No	0010454
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	23/11/2022
		Report Date	28/11/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	BH2 / U50 / 16822/S/118816	**Depth (m)**	20.12-20.43
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 24.4 MPa

	Young's Modulus	Poisson Ratio	
Tangent	1.21 GPa	0.294	from 33 % to 41 % of Max UCS
Secant	1.17 GPa	0.185	from 0 % to 41 % of Max UCS

Axial Stress vs Strain Plots



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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110837-MOD

Average Sample Diameter (mm)	52.0	Moisture Content (%)	4.1
Sample Height (mm)	145.7	Wet Density (t/m^3)	2.48
Duration of Test (min)	43.63	Dry Density (t/m^3)	2.38
Rate of Displacement (mm/min)	0.10	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	70		

Notes/Remarks:

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

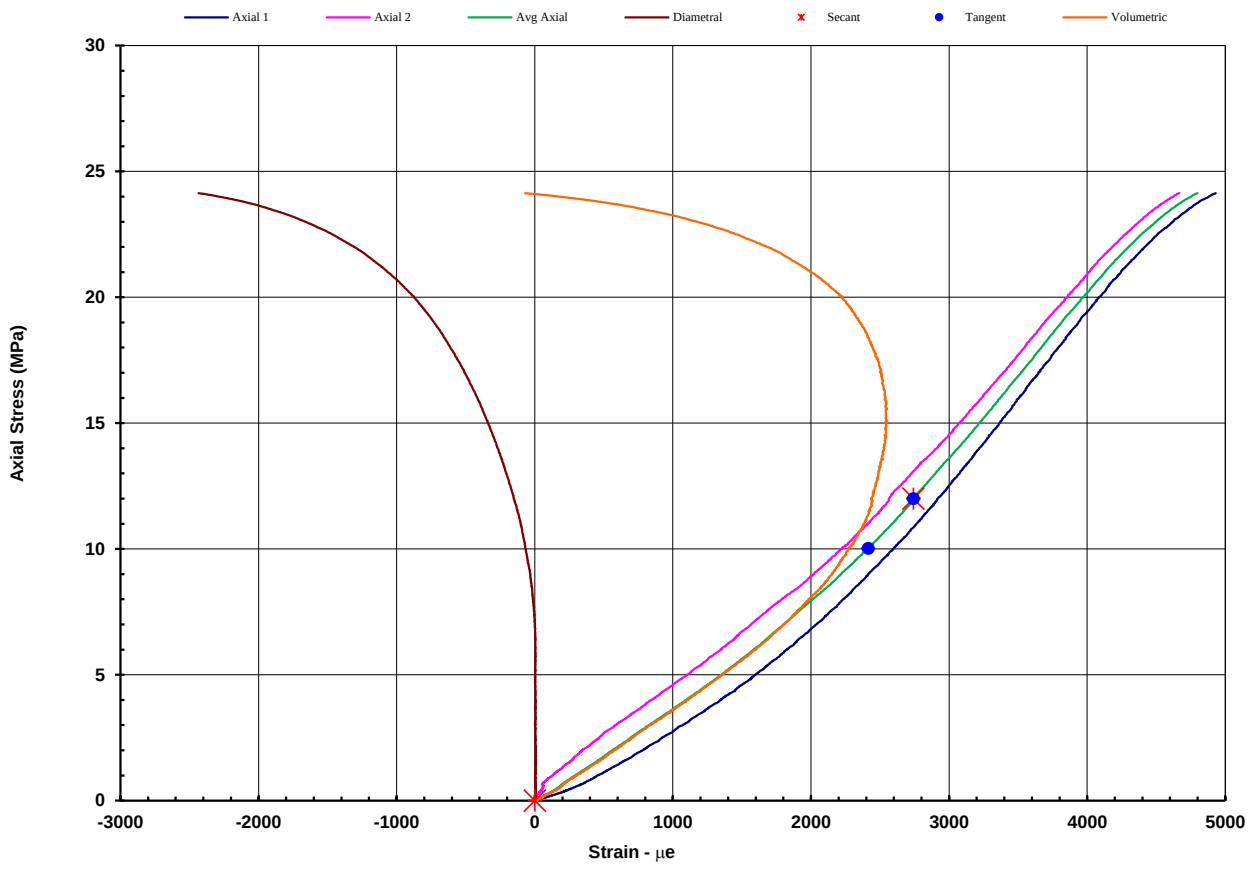
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110841-MOD
		Workorder No	0010454
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	23/11/2022
		Report Date	28/11/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	BH3 / U50 / 16822/S/118820	**Depth (m)**	10.13-10.40
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 24.5 MPa

	Young's Modulus	Poisson Ratio	
Tangent	6.02 GPa	0.255	from 41 % to 49 % of Max UCS
Secant	4.38 GPa	0.055	from 0 % to 49 % of Max UCS

Axial Stress vs Strain Plots



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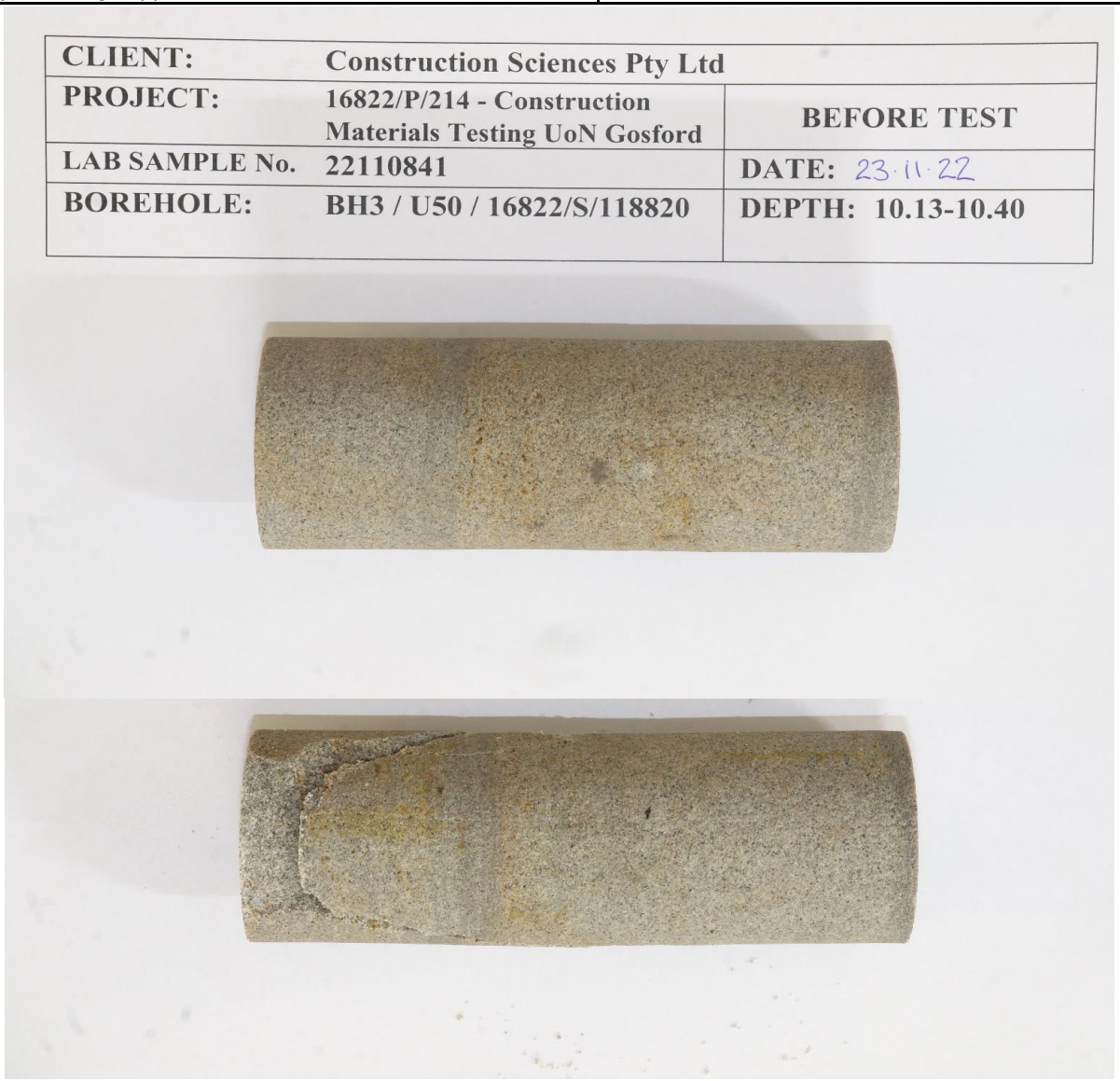
UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110841-MOD

Average Sample Diameter (mm)	51.9	Moisture Content (%)	8.4
Sample Height (mm)	141.7	Wet Density (t/m^3)	2.29
Duration of Test (min)	23.05	Dry Density (t/m^3)	2.11
Rate of Displacement (mm/min)	0.10	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	75		



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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

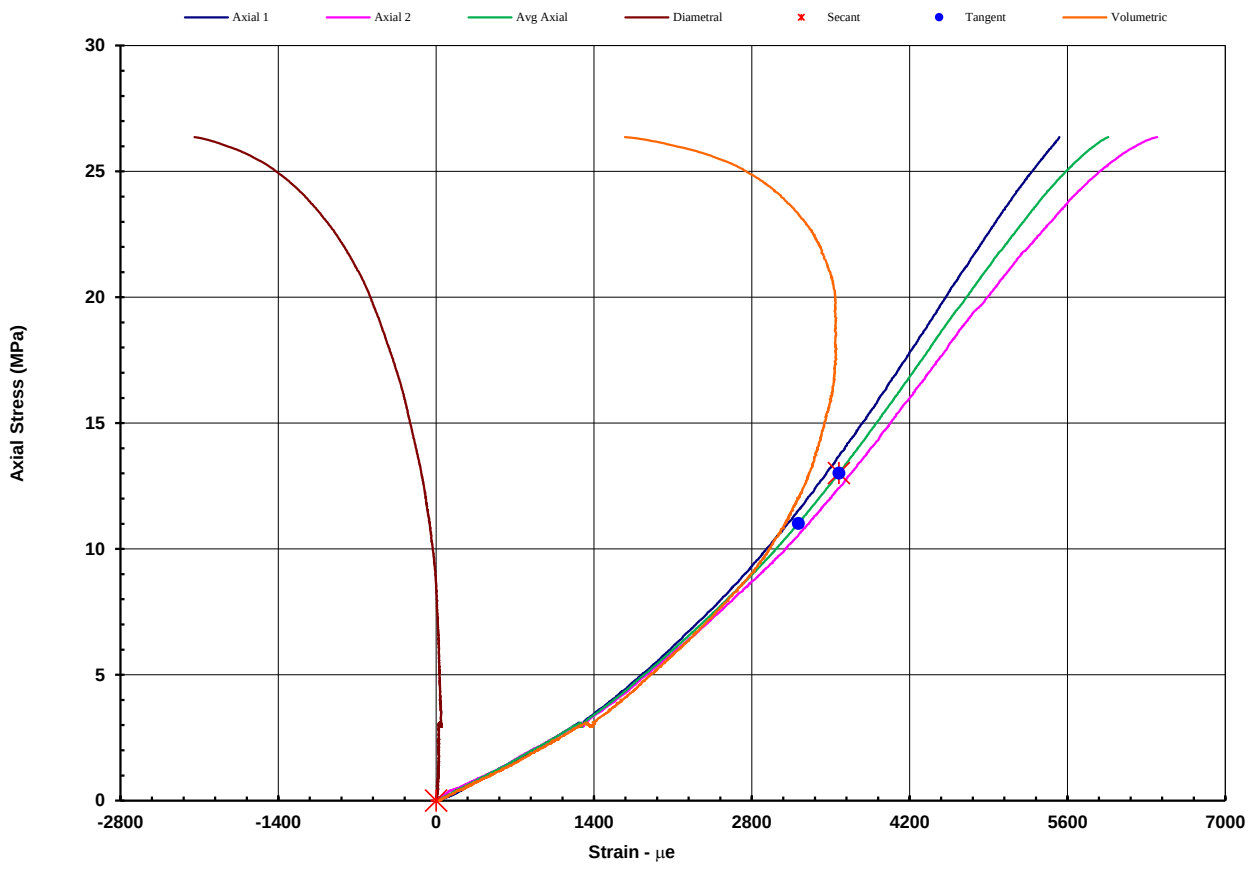
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110842-MOD
		Workorder No	0010454
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	23/11/2022
		Report Date	28/11/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	BH3 / U50 / 16822/S/118821	**Depth (m)**	14.40-14.70
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 26.4 MPa

	Young's Modulus	Poisson Ratio	
Tangent	5.58 GPa	0.214	from 42 % to 49 % of Max UCS
Secant	3.64 GPa	0.037	from 0 % to 49 % of Max UCS

Axial Stress vs Strain Plots



Notes/Remarks:

Sample/s supplied by client Graph not to scale Tested as received. **Page 1 of 2** REP13402

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Tested at Trilab Brisbane Laboratory

Authorised Signatory

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22110842-MOD

Average Sample Diameter (mm)	51.9	Moisture Content (%)	6.5
Sample Height (mm)	146.9	Wet Density (t/m^3)	2.40
Duration of Test (min)	30.92	Dry Density (t/m^3)	2.25
Rate of Displacement (mm/min)	0.10	Bedding (°)	Nil
Mode of Failure	Conical	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	80		

Notes/Remarks:

Sample/s supplied by client Photo not to scale Tested as received.

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

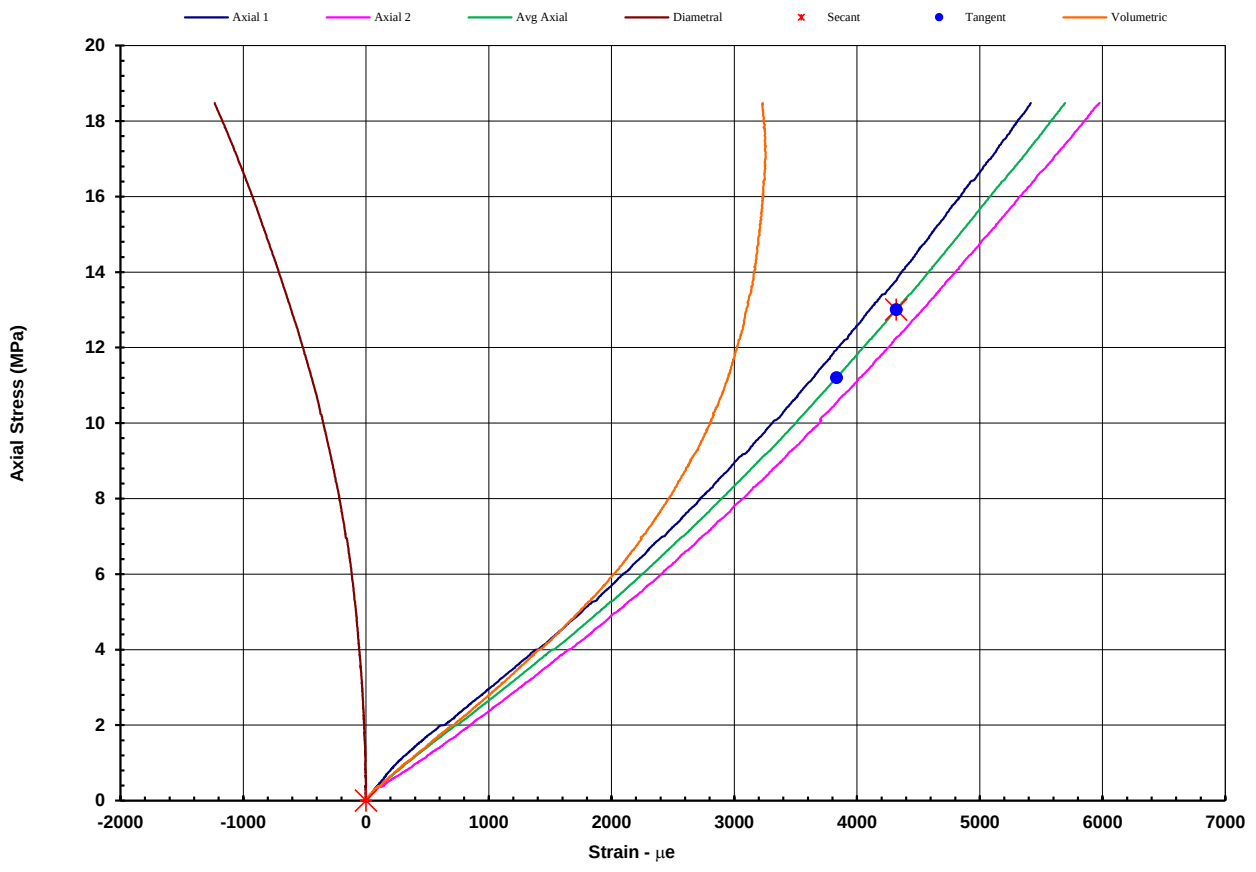
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22111403-MOD
		Workorder No	0010488
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	6/12/2022
		Report Date	8/12/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	16822/S/119361 - BH-08	**Depth (m)**	15.68-15.96
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 26.6 MPa

	Young's Modulus	Poisson Ratio	
Tangent	3.71 GPa	0.346	from 42 % to 49 % of Max UCS
Secant	3.01 GPa	0.141	from 0 % to 49 % of Max UCS

Axial Stress vs Strain Plots



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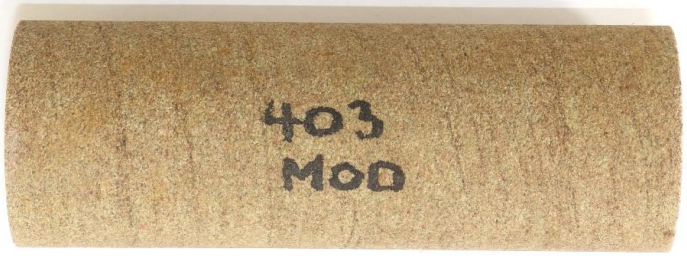
UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22111403-MOD

Average Sample Diameter (mm)	51.6	Moisture Content (%)	4.7
Sample Height (mm)	137.5	Wet Density (t/m^3)	2.48
Duration of Test (min)	26:26	Dry Density (t/m^3)	2.37
Rate of Displacement (mm/min)	0.10	Bedding (°)	10
Mode of Failure	Shear	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	60		

CLIENT:	Construction Sciences Pty Ltd	
PROJECT:	16822/P/214 - Construction Materials Testing UoN Gosford	BEFORE TEST
LAB SAMPLE No.	22111403	DATE: 5-12-22
BOREHOLE:	16822/S/119361 - BH-08	DEPTH: 15.68-15.96



Notes/Remarks:

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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

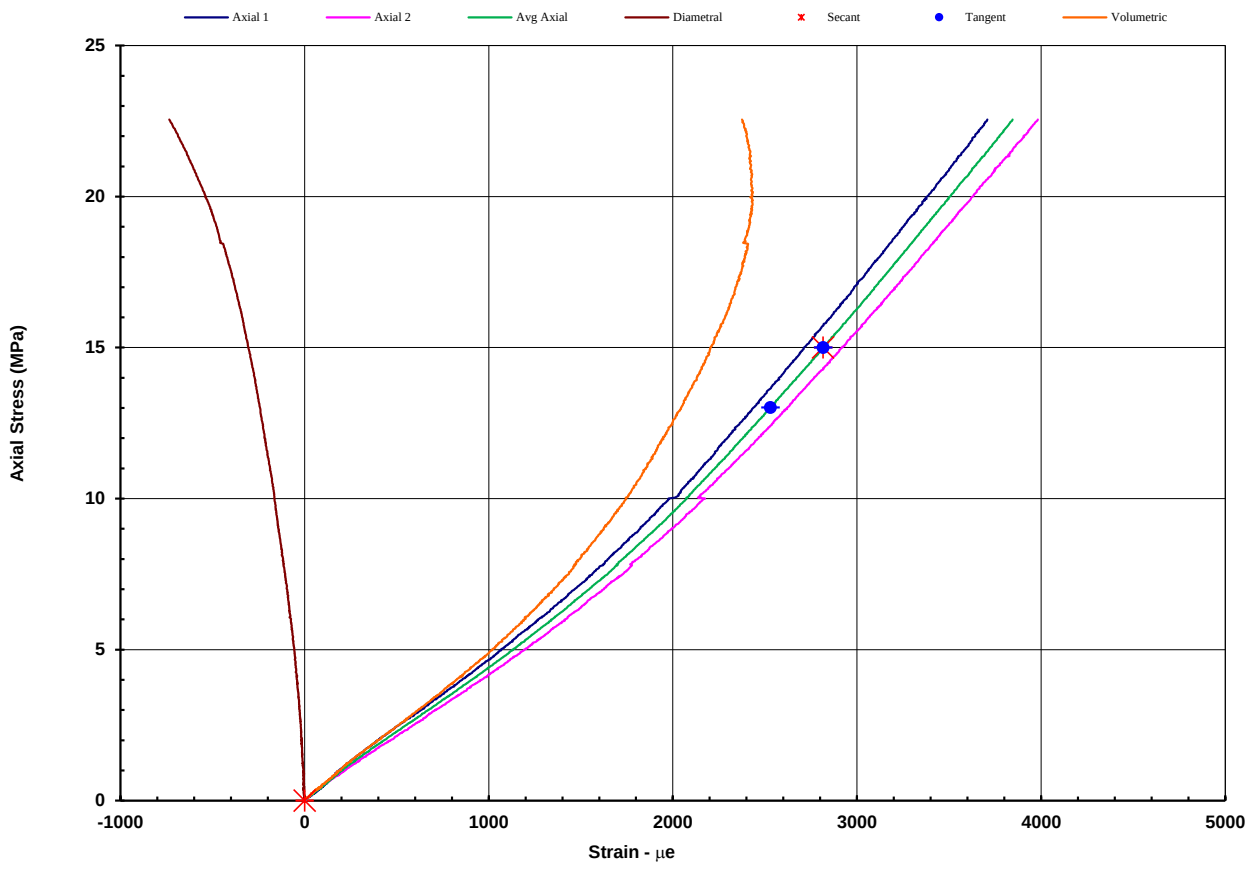
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22111404-MOD
		Workorder No	0010488
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	6/12/2022
		Report Date	8/12/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	16822/S/119362 - BH-08	**Depth (m)**	19.32-19.56
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 31.9 MPa

	Young's Modulus	Poisson Ratio	
Tangent	6.95 GPa	0.218	from 41 % to 47 % of Max UCS
Secant	5.33 GPa	0.108	from 0 % to 47 % of Max UCS

Axial Stress vs Strain Plots



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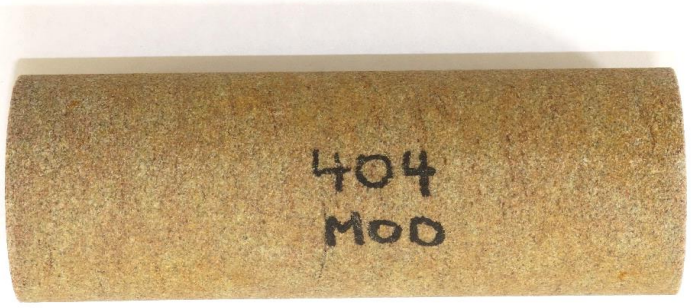
UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

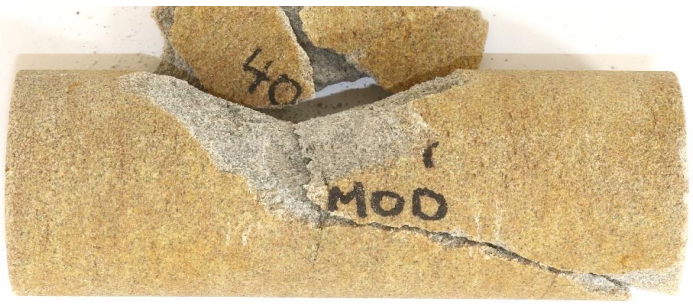
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22111404-MOD

Average Sample Diameter (mm)	51.6	Moisture Content (%)	5.7
Sample Height (mm)	138.3	Wet Density (t/m^3)	2.43
Duration of Test (min)	24:53	Dry Density (t/m^3)	2.30
Rate of Displacement (mm/min)	0.10	Bedding (°)	10
Mode of Failure	Shear	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	60		

CLIENT:	Construction Sciences Pty Ltd	
PROJECT:	16822/P/214 - Construction Materials Testing UoN Gosford	BEFORE TEST
LAB SAMPLE No.	22111404	DATE: 5-12-22
BOREHOLE:	16822/S/119362 - BH-08	DEPTH: 19.32-19.56





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UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

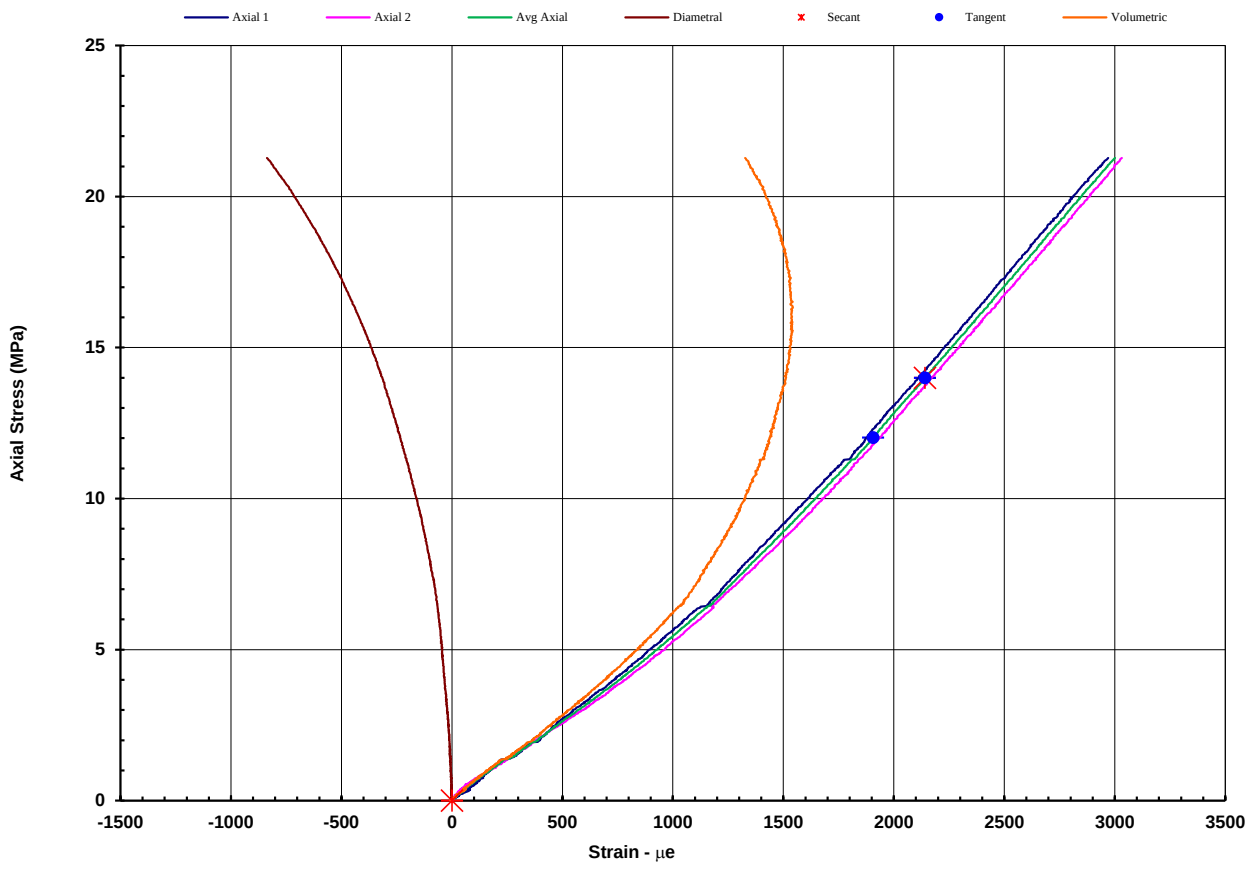
Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22111405-MOD
		Workorder No	0010488
Address	1/12 Callistemon Close, Warabrook NSW 2304	**Test Date**	6/12/2022
		Report Date	8/12/2022
Project	16822/P/214 - Construction Materials Testing UoN Gosford		
Client ID	16822/S/119363 - BH-08	**Depth (m)**	22.645-22.885
Description	-		
Sample Type	Single Individual Rock Core Specimen		

Uniaxial Compressive Strength 27.5 MPa

	Young's Modulus	Poisson Ratio	
Tangent	8.44 GPa	0.342	from 44 % to 51 % of Max UCS
Secant	6.54 GPa	0.147	from 0 % to 51 % of Max UCS

Axial Stress vs Strain Plots



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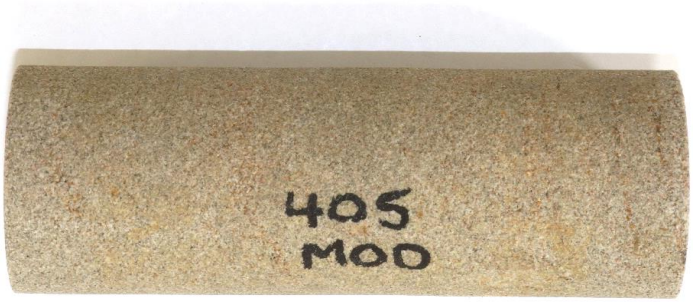
UNIAXIAL COMPRESSIVE STRENGTH & DEFORMATION TEST REPORT

Test Method: AS 4133.4.3.2 & AS 4133.1.1.1

Client	Construction Sciences Pty Ltd	**Report No.**	22111405-MOD

Average Sample Diameter (mm)	51.6	Moisture Content (%)	6.9
Sample Height (mm)	138.7	Wet Density (t/m^3)	2.36
Duration of Test (min)	21:17	Dry Density (t/m^3)	2.21
Rate of Displacement (mm/min)	0.10	Bedding (°)	Nil
Mode of Failure	Shear	Test Apparatus	100kN Compression Machine
Rupture Angle (°)	65		

CLIENT:	Construction Sciences Pty Ltd	
PROJECT:	16822/P/214 - Construction Materials Testing UoN Gosford	BEFORE TEST
LAB SAMPLE No.	22111405	DATE: 5-12-22
BOREHOLE:	16822/S/119363 - BH-08	DEPTH: 22.645-22.885



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Tested at Trilab Brisbane Laboratory

Authorised Signatory

Jacob Caruana

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Laboratory: **Coffs Coast Laboratory**
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POINT LOAD STRENGTH INDEX REPORT

Client:	Construction Sciences Newcastle	Report Number:	10823/R/46183-1
Client Address:	1/12 Callistemon Close, Warabrook	Project Number:	10823/P/751
Project:	CS Newcastle	Lot Number:	
Location:	Newcastle area	Internal Test Request:	10823/T/21691
Supplied To:	n/a	Client Reference/s:	
Area Description:		Report Date / Page:	16/11/2022 Page 1 of 4

Test Procedures:	T223

Sample Number	10823/S/180939	10823/S/180939	10823/S/180940	10823/S/180940
ID / Client ID	16822/S/118806	16822/S/118806	16822/S/118807	16822/S/118807
Lot Number	-	-	-	-
Date / Time Tested	26/10/2022	26/10/2022	26/10/2022	26/10/2022
Material Source	-	-	-	-
Material Type	-	-	-	-
Sampling Method	Tested As Received	Tested As Received	Tested As Received	Tested As Received
Borehole Number	BH2 13.85m - 14.07m	BH2 13.85m - 14.07m	BH2 18.82m - 19.07m	BH2 18.82m - 19.07m
Section Tested (m)	Axial	Diametral	Axial	Diametral
Client sample number				
Date sample received				
Manner of Testing	Axial	Diametral	Axial	Diametral
Failure Mode	Multi-Fracturing	Axial Splitting	Single Shear	Single Shear
Storage History	Air Tight Bags	Air Tight Bags	Air Tight Bags	Air Tight Bags
Moisture Condition	Moist	Moist	Moist	Moist
Lithology	n/a	n/a	n/a	n/a
Weakness Plane (Orientation)	Multiple Plane	Vertical	Shear	Shear
Weakness Plane (Nature)	n/a	n/a	n/a	n/a
Uncorrected Point Load Strength (MPa) - Is	**0.4**	**0.7**	**1.0**	**2.9**
Point Load Strength Index (MPa) - Is(50)	**0.46**	**0.68**	**1.2**	**2.8**
Specimen Remarks	n/a	n/a	n/a	n/a

Remarks	Results apply to the sample/s as received.,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 10823

Approved Signatory: Alexander Hannah
Form ID: W50Rep Rev 1

Construction Sciences

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POINT LOAD STRENGTH INDEX REPORT

Client:	Construction Sciences Newcastle	Report Number:	10823/R/46183-1
Client Address:	1/12 Callistemon Close, Warabrook	Project Number:	10823/P/751
Project:	CS Newcastle	Lot Number:	
Location:	Newcastle area	Internal Test Request:	10823/T/21691
Supplied To:	n/a	Client Reference/s:	
Area Description:		Report Date / Page:	16/11/2022 Page 2 of 4

Test Procedures:	T223

Sample Number	10823/S/180941	10823/S/180941	10823/S/180942	10823/S/180942
ID / Client ID	16822/S/118808	16822/S/118808	16822/S/118809	16822/S/118809
Lot Number	-	-	-	-
Date / Time Tested	26/10/2022	26/10/2022	26/10/2022	26/10/2022
Material Source	-	-	-	-
Material Type	-	-	-	-
Sampling Method	Tested As Received	Tested As Received	Tested As Received	Tested As Received
Borehole Number	BH1 13.04m - 13.25m	BH1 13.04m - 13.25m	BH1 18.875m - 18.995	BH1 18.875m - 18.995
Section Tested (m)	Axial	Diametral	Axial	Diametral
Client sample number				
Date sample received				
Manner of Testing	Axial	Diametral	Axial	Diametral
Failure Mode	Single Shear	Axial Splitting	Single Shear	Axial Splitting
Storage History	Air Tight Bags	Air Tight Bags	Air Tight Bags	Air Tight Bags
Moisture Condition	Moist	Moist	Moist	Moist
Lithology	n/a	n/a	n/a	n/a
Weakness Plane (Orientation)	Shear	Vertical	Shear	Vertical
Weakness Plane (Nature)	n/a	n/a	n/a	n/a
Uncorrected Point Load Strength (MPa) - Is	**1.1**	**2.7**	**0.5**	**2.0**
Point Load Strength Index (MPa) - Is(50)	**1.4**	**2.6**	**0.66**	**1.9**
Specimen Remarks	n/a	n/a	n/a	n/a

Remarks	Results apply to the sample/s as received.,

NATA

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POINT LOAD STRENGTH INDEX REPORT

Client:	Construction Sciences Newcastle	Report Number:	10823/R/46183-1
Client Address:	1/12 Callistemon Close, Warabrook	Project Number:	10823/P/751
Project:	CS Newcastle	Lot Number:	
Location:	Newcastle area	Internal Test Request:	10823/T/21691
Supplied To:	n/a	Client Reference/s:	
Area Description:		Report Date / Page:	16/11/2022 Page 3 of 4

Test Procedures:	T223

Sample Number	10823/S/180943	10823/S/180943	10823/S/180944	10823/S/180944
ID / Client ID	16822/S/118810	16822/S/118810	16822/S/118811	16822/S/118811
Lot Number	-	-	-	-
Date / Time Tested	26/10/2022	26/10/2022	26/10/2022	26/10/2022
Material Source	-	-	-	-
Material Type	-	-	-	-
Sampling Method	Tested As Received	Tested As Received	Tested As Received	Tested As Received
Borehole Number	BH1 20.845m - 21.05m	BH1 20.845m - 21.05m	BH3 12.239m - 12.439	BH3 12.239m - 12.439
Section Tested (m)	Axial	Diametral	Axial	Diametral
Client sample number				
Date sample received				
Manner of Testing	Axial	Diametral	Axial	Diametral
Failure Mode	Y-Shaped	Axial Splitting	Single Shear	Axial Splitting
Storage History	Air Tight Bags	Air Tight Bags	Air Tight Bags	Air Tight Bags
Moisture Condition	Moist	Moist	Moist	Moist
Lithology	n/a	n/a	n/a	n/a
Weakness Plane (Orientation)	Multiple Plane	Vertical	Shear	Vertical
Weakness Plane (Nature)	n/a	n/a	n/a	n/a
Uncorrected Point Load Strength (MPa) - Is	**0.5**	**2.1**	**1.4**	**1.3**
Point Load Strength Index (MPa) - Is(50)	**0.66**	**2.0**	**1.6**	**1.3**
Specimen Remarks	n/a	n/a	n/a	n/a

Remarks	Results apply to the sample/s as received.,

NATA

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POINT LOAD STRENGTH INDEX REPORT

Client:	Construction Sciences Newcastle	Report Number:	10823/R/46183-1
Client Address:	1/12 Callistemon Close, Warabrook	Project Number:	10823/P/751
Project:	CS Newcastle	Lot Number:	
Location:	Newcastle area	Internal Test Request:	10823/T/21691
Supplied To:	n/a	Client Reference/s:	
Area Description:		Report Date / Page:	16/11/2022 Page 4 of 4

Test Procedures:	T223

Sample Number	10823/S/180945	10823/S/180945	10823/S/180946	10823/S/180946
ID / Client ID	16822/S/118812	16822/S/118812	16822/S/118813	16822/S/118813
Lot Number	-	-	-	-
Date / Time Tested	26/10/2022	26/10/2022	26/10/2022	26/10/2022
Material Source	-	-	-	-
Material Type	-	-	-	-
Sampling Method	Tested As Received	Tested As Received	Tested As Received	Tested As Received
Borehole Number	BH3 16.587m - 15.777	BH3 16.587m - 15.777	BH3 20.662m - 20.842	BH3 20.662m - 20.842
Section Tested (m)	Axial	Diametral	Axial	Diametral
Client sample number				
Date sample received				
Manner of Testing	Axial	Diametral	Axial	Diametral
Failure Mode	Axial Splitting	Axial Splitting	Single Shear	Axial Splitting
Storage History	Air Tight Bags	Air Tight Bags	Air Tight Bags	Air Tight Bags
Moisture Condition	Moist	Moist	Moist	Moist
Lithology	n/a	n/a	n/a	n/a
Weakness Plane (Orientation)	Vertical	Vertical	Shear	Vertical
Weakness Plane (Nature)	n/a	n/a	n/a	n/a
Uncorrected Point Load Strength (MPa) - Is	**1.0**	**2.4**	**0.5**	**1.2**
Point Load Strength Index (MPa) - Is(50)	**1.2**	**2.4**	**0.61**	**1.2**
Specimen Remarks	n/a	n/a	n/a	n/a

Remarks	Results apply to the sample/s as received.,

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Form ID: W50Rep Rev 1

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POINT LOAD STRENGTH INDEX REPORT

Client:	Construction Sciences Newcastle	Report Number:	10823/R/46390-2
Client Address:	1/12 Callistemon Close, Warabrook	Project Number:	10823/P/751
Project:	Kleinfelder	Lot Number:	
Location:	Newcastle area	Internal Test Request:	10823/T/21726
Component:	Site Investigation	Client Reference/s:	UoN Gosford (Phil Band)
Area Description:	UoN Gosford	Report Date / Page:	1/12/2022 Page 1 of 2

Test Procedures:	T223

Sample Number		10823/S/181276	10823/S/181276	10823/S/181277	10823/S/181277
ID / Client ID		-	-	-	-
Lot Number		-	-	-	-
Date / Time Tested		18/11/2022	18/11/2022	18/11/2022	18/11/2022
Material Source		-	-	-	-
Material Type		-	-	-	-
Sampling Method					
Borehole Number		BH2 8.05 to 8.25	BH2 8.05 to 8.25	BH8 14.52 to 14.71	BH8 14.52 to 14.71
Section Tested (m)		Axial	Diametral	Axial	Diametral
Borehole	No.	BH2	BH2	BH8	BH8
Chainage	m				
Offset C/L	m				
Depth/Level	m	8.05 to 8.25	8.05 to 8.25	14.52 to 14.71	14.52 to 14.71
Manner of Testing		Axial	Diametral	Axial	Diametral
Failure Mode		Single Shear	Axial Splitting	Single Shear	Axial Splitting
Storage History		Air Tight Bags	Air Tight Bags	Air Tight Bags	Air Tight Bags
Moisture Condition		Moist	Moist	Moist	Moist
Lithology		n/a	n/a	n/a	n/a
Weakness Plane (Orientation)		shear	Vertical	shear	Vertical
Weakness Plane (Nature)		n/a	n/a	n/a	n/a
Uncorrected Point Load Strength (MPa) - Is		**0.4**	**1.0**	**0.4**	**0.6**
Point Load Strength Index (MPa) - Is(50)		**0.52**	**0.99**	**0.53**	**0.63**
Specimen Remarks		n/a	n/a	n/a	n/a

Remarks	Re-Issued Report Replaces Report No 10823/R/46390-1 (reason: sub project added).,

NATA

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 10823

Approved Signatory: Alexander Hannah
Form ID: W50Rep Rev 1

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
Unit 1, 36 Hawke Drive,
Woolgoolga NSW 2456

Laboratory: **Coffs Coast Laboratory**
Phone: 02 5621 8200
Fax: 02 6654 0261
Email: CoffsHarbour@constructionsciences.net

POINT LOAD STRENGTH INDEX REPORT

Client:	Construction Sciences Newcastle	Report Number:	10823/R/46390-2
Client Address:	1/12 Callistemon Close, Warabrook	Project Number:	10823/P/751
Project:	Kleinfelder	Lot Number:	
Location:	Newcastle area	Internal Test Request:	10823/T/21726
Component:	Site Investigation	Client Reference/s:	UoN Gosford (Phil Band)
Area Description:	UoN Gosford	Report Date / Page:	1/12/2022 Page 2 of 2

Test Procedures:	T223

Sample Number		10823/S/181278	10823/S/181278	10823/S/181279	10823/S/181279
ID / Client ID		-	-	-	-
Lot Number		-	-	-	-
Date / Time Tested		18/11/2022	18/11/2022	18/11/2022	18/11/2022
Material Source		-	-	-	-
Material Type		-	-	-	-
Sampling Method					
Borehole Number		BH8 17.28 to 17.48	BH8 17.28 to 17.48	BH8 21.59 to 21.82	BH8 21.59 to 21.82
Section Tested (m)		Axial	Diametral	Axial	Diametral
Borehole	No.	BH8	BH8	BH8	BH8
Chainage	m				
Offset C/L	m				
Depth/Level	m	17.28 to 17.48	17.28 to 17.48	21.59 to 21.83	21.59 to 21.83
Manner of Testing		Axial	Diametral	Axial	Diametral
Failure Mode		Single Shear	Axial Splitting	Single Shear	Axial Splitting
Storage History		Air Tight Bags	Air Tight Bags	Air Tight Bags	Air Tight Bags
Moisture Condition		Moist	Moist	Moist	Moist
Lithology		n/a	n/a	n/a	n/a
Weakness Plane (Orientation)		shear	Vertical	shear	Vertical
Weakness Plane (Nature)		n/a	n/a	n/a	n/a
Uncorrected Point Load Strength (MPa) - Is		**0.7**	**1.5**	**0.6**	**1.5**
Point Load Strength Index (MPa) - Is(50)		**0.9**	**1.5**	**0.81**	**1.5**
Specimen Remarks		n/a	n/a	n/a	n/a

Remarks	Re-Issued Report Replaces Report No 10823/R/46390-1 (reason: sub project added).,

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Analyte			Inorganics			
			Sulphate	Chloride	Electrical Conductivity @ 25°C	pH
LOR			10	10	1.0	0.1
Units			mg/kg	mg/kg	µS/cm	pH units
Sample Name	Sample Date	Start Depth (m)				
BH1_1.0	19-Oct-22	1.0	**40**	< 10	**30**	**5.3**
BH1_3.0	19-Oct-22	3.0	**10**	< 10	**17**	**5.4**
BH2_1.0	18-Oct-22	1.0	< 10	< 10	**19**	**7.6**
BH2_3.0	18-Oct-22	3.0	**40**	< 10	**32**	**5.1**
BH3_1.0	19-Oct-22	1.0	**90**	< 10	**58**	**4.8**
BH3_2.5	19-Oct-22	2.5	**30**	< 10	**30**	**5.0**
BH4_1.0	17-Oct-22	1.0	< 10	< 10	**93**	**8.3**
BH4_3.0	17-Oct-22	3.0	**20**	< 10	**21**	**5.7**
BH5_1.0	17-Oct-22	1.0	-	-	**67**	**6.9**
BH5_1.9	17-Oct-22	1.9	**40**	< 10	**35**	**4.9**
BH5_2.0	17-Oct-22	2.0	**20**	< 10	**23**	**5.4**
BH6_1.0	21-Oct-22	1.0	**50**	< 10	**42**	**4.9**
BH6_4.0	21-Oct-22	4.0	**20**	< 10	**41**	**4.9**
BH7_1.0	21-Oct-22	1.0	**50**	**10**	**45**	**5.6**
BH7_3.0	21-Oct-22	3.0	**30**	< 10	**28**	**4.9**
BH7_4.0	21-Oct-22	4.0	**40**	< 10	**39**	**5.1**
BH7_6.0	21-Oct-22	6.0	**40**	**50**	**62**	**5.2**

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
mg/kg - Milligrams per kilogram
µS/cm - Microsiemens per centimeter
Bold indicates a detection above the laboratory limit of reporting