Geotechnical Interpretive Report

Shoalhaven Hospital Redevelopment

8202118202

Prepared for
NSW Health Infrastructure

29 June 2022

Cardno

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3	29/06/2022	Minor update to site area	RD	DD

Table of Contents

Tables

Figures

Appendices

1 Introduction

1.1 Project Description

NSW Health Infrastructure and Johnstaff ("the clients") have engaged Cardno NSW/ACT Pty Ltd ("Cardno") to undertake a geotechnical investigation as part of the proposed redevelopment for the Shoalhaven Hospital on Scenic Drive, Nowra. The project is currently in conceptual stages with developed master planning options presented below.

Figure 1-1 Master Plan Options for Shoalhaven Hospital Redevelopment

1.2 Objectives

The geotechnical investigation for the site was undertaken to inform the following:

- Assess subsurface and groundwater conditions at the site;
- Preliminary lot classification in accordance with AS2870-2011, Residential Slabs and Footings;
- Comments on excavation conditions, excavatability and rock rippability;
- Comments of likely subgrade CBR value to inform pavement design;
- Comments on suitability of site won material for re-use as engineered fill;
- Provide recommendations relating to likely suitable foundation systems;
- Provide foundation design parameters;
- Provide comments of any other geotechnical related factors relevant to the proposed development;
- Provide geotechnical subsurface cross sections referencing soil type, depth and general properties to assist with foundation design; and
- Provide permeability assessment to correlate infiltration rates to assist with stormwater and infiltration trench design.

1.3 Scope of Works

The scope of works for the geotechnical assessment comprised the following:

- Assessment of geological maps and other published resources before attending site;
- Geotechnical assessment of subsurface conditions including excavation of test pits, excavation of hand auger boreholes and drilling of boreholes across the site;
- Visual assessment of the composition of existing fill at stockpiles;
- Laboratory testing to assist with the geotechnical assessment; and

> Permeability assessment of hand auger borehole locations.

It is noted that this geotechnical assessment is preliminary only and was intended to inform and finalise the master plan. Further detailed assessment would be required for the purpose of detailed design.

2 Site Description

The site is identified as Shoalhaven Hospital and Nowra Park, located within section of Lot 104 DP1165533, Lot 7034 DP1031852 and Part-lot Lot 373 DP755952. The current site is a vacant plot within the hospital ground. A site plan is presented in **Appendix A**, detailing the proposed development site boundary.

2.1 Topography and Drainage

The eastern and southern boundaries are adjacent to Shoalhaven Street and North Street respectively, whilst the northern and western boundary are adjacent to existing hospital buildings. Two filling areas have been identified on site with the origin of the fill material unknown. A portion of the fill potentially originated from the construction of the adjacent multilevel carpark and surrounding hospital buildings.

The site topography falls generally towards the north-east with the highest elevations at the south-western corner of the site. Surface slopes are generally gentle to moderate with steeper slopes associated with filling and embankments for surrounding structures.

The site and neighbouring land surfaces are a mixture of predominantly permeable covers (grass and bare earth) with impermeable hardstands (concrete and asphalt) to a lesser extent. Surface run-off is anticipated to either drain into stormwater management systems or penetrate ground surfaces at a rate reflective of the underlying material.

Figure 2-1 View of the site looking north-west across Nowra Park towards multi-storey parking

2.2 Regional Geology

Reference to the 1:250,000 Ulladulla Geological Series Sheet indicates that the site is underlain by:

> Psh – Permian aged Nowra Sandstone of the Shoalhaven Group comprising siltstone or sandstone.

Formations identified in close proximity to the site include:

> Q_av – Quaternary aged alluvium gravel, swamp deposits or sand dunes; and

Figure 2-2 Site Geology Map (MinView Seamless Geology)

3 Geotechnical Investigation

3.1 Site Investigation

3.1.1 Service Location

Underground utility locating was undertaken by A1 Locate Pty Ltd on the 17th June 2021 and additionally by Coastal Cable Locators Pty Ltd on 26th October 2021. Underground utility locating comprised the clearing of test pit, hand auger borehole and borehole locations using Cable Avoidance Tool (CAT) and generator. Test Pits

3.1.2 Test Pits

Geotechnical investigation comprising the excavation of test pits, was undertaken between 17th and 18th June 2021 and included:

- Excavation of nine (9) test pits utilising a 10t backhoe fitted with a 300 mm mud bucket. Test pits conducted for geotechnical assessment were advanced to the target depth of 3.00m below ground level or prior refusal.
- Dynamic Cone Penetrometer (DCP) testing conducted adjacent to geotechnical test pit locations to provide an assessment of the in-situ soil strength conditions.
- Engineering assessment of the subsurface profiles encountered in general accordance with AS 1726 – 2017 *Geotechnical Site Investigations* by an engineering geologist from Cardno;
- Sampling of material considered representative of subsurface profile encountered across the site for the purpose of laboratory assessment. Samples collected included bulk samples.
- Upon completion, test pits were backfilled with excavation spoil materials, and nominally compacted with the excavator bucket and tracked over.

The locations of geotechnical test pits are shown on the Investigation Plan presented in Appendix A. Test locations were located by a hand-held GPS device and site RL's measured from the site contour plan. As such, the locations shown on the drawings shall be considered as approximate only. Engineering logs are contained in Appendix B together with explanatory notes.

3.1.3 Boreholes

Geotechnical investigation comprising boreholes was undertaken between 21st and 22nd June 2021 and included:

- Drilling of six (6) boreholes to a target depth of six (6) metres, utilising solid flight auger techniques, equipped with tungsten carbide (TC) drill bit. Where refusal on rock was encountered, four (4) of the boreholes were progressed further using NMLC diamond drilling and allowed a minimum three (3) metres of core.
- Standard Penetration Tests (SPTs) were conducted at nominal 1.50m intervals at each borehole location to assess the in-situ strength characteristics of the encountered materials and to allow sample retrieval for laboratory testing;
- Engineering assessment of the subsurface profiles encountered in general accordance with AS 1726 – 2017 *Geotechnical Site Investigations* by an engineering geologist from Cardno;
- Sampling of material considered representative of soil units encountered for subsequent laboratory assessment, including geotechnical and acid sulfate soil sampling;
- Upon completion, boreholes were backfilled with drill cuttings returning the location to existing surface level.

The locations of geotechnical boreholes are shown on the Investigation Plan presented in Appendix A. Test locations were located by a hand-held GPS device and site RL's measured from the site contour plan. As such, the locations shown on the drawings shall be considered as approximate only. Engineering logs are contained in Appendix B together with explanatory notes.

3.1.4 Hand Auger Boreholes and Permeability Testing

Geotechnical investigation comprising hand augers with permeability testing was undertaken between 28th and 29th October 2021 and included:

- Hand excavation of five (5) hand auger boreholes utilising hand auger equipment. Hand auger boreholes were advanced to a target depth of 1.00m below ground level or prior refusal.
- Dynamic Cone Penetrometer (DCP) testing conducted adjacent to hand auger borehole locations to provide an assessment of the in-situ soil strength conditions.
- Engineering- assessment of the subsurface profiles encountered in general accordance with AS 1726 – 2017 *Geotechnical Site Investigations* by an experienced engineering geologist from Cardno;
- Sampling of material considered representative of subsurface profile encountered across the site for the purpose of laboratory assessment. Samples collected included disturbed samples.
- Permeability testing was undertaken within all five (5) hand auger borehole locations with use of a trailer mounted water cart with routine water measurements taken to calculate permeability rates.
- Upon completion, hand auger borehole locations were backfilled with excavation spoil materials, and nominally compacted with the excavator bucket and tracked over.

The locations of hand auger boreholes are shown on the Investigation Plan presented in Appendix A. Test locations were located by a hand-held GPS device and site RL's measured from the site contour plan. As such, the locations shown on the drawings shall be considered as approximate only. Engineering logs are contained in Appendix B together with explanatory notes.

3.1.5 Laboratory Testing

Laboratory testing conducted on strategically selected samples recovered during the fieldwork comprised the following:

- Seven (7) Particle Size Distribution (PSD) tests for material classification;
- Seven (7) Atterberg Limits (PI) tests for material classification;
- Seven (7) Moisture Content (MC) tests;
- Two (2) Standard Compaction and California Bearing Ratio (CBR) tests for subgrade assessment;
- Four (4) Emerson crumb tests to classify soil dispersion;
- Four (4) Unconfined Compressive Strength (UCS) tests for rock strength assessment; and
- Four (4) Soil Aggressivity testing suites.

Testing was conducted at 'Australian Soil and Concrete Testing (ASCT)' in Albion Park and 'Eurofins Scientific' in Unanderra, all of which are NATA accredited testing laboratories. Laboratory test report sheets and certificates are included in Appendix C.

4 Investigation Results

4.1 Subsurface Conditions

The soil profile encountered in test locations across the site comprised either fill material associated with fill embankments and built up areas for car parks and hospital buildings or a natural profile.

For a detailed description of the subsurface ground conditions encountered, engineering logs in Appendix B should be referred to. In summary, subsurface conditions encountered are displayed in Table 4-1 and Table 4-2 below.

Table 4-1 Geotechnical Units and Descriptions

Unit	Soil Type	Description of Layer
1a	FILL (PAVEMENT)	**ASPHALT** black
1b	FILL / TOPSOIL	**Silty SAND / Clayey SAND / Clayey Sandy GRAVEL / Gravelly SAND / Gravelly Sandy CLAY** low to medium plasticity, fine to coarse sand, grey, grey-brown, dark orange-brown, fine to coarse sub-angular gravels, moist, trace roots and rootlets, trace organic matter.
2	RESIDUAL SOIL	**Sandy CLAY / Clayey SAND / CLAY** medium to high plasticity, fine to coarse grained sand, brown, pale grey, pale blue-grey, pale red-brown, grey-brown mottled yellow and orange, trace gravels, weakly cemented, moist.
3	EXTREMELEY WEATHERED MATERIAL	**Clayey Gravelly SAND** medium plasticity, orange-brown, pale-grey, pale blue-grey, with fine to medium grained sand, weakly cemented, inferred as extremely weathered rock.
4	ROCK	**SANDSTONE,** medium to coarse grained, bedded, pale grey, stained red-brown and orange-brown

The subsurface profiles encountered across the site, are summarised below in Table 4-2.

Table 4-2 Summary of Subsurface Conditions – Depth to Top of Layer (m)

Test Location	Unit 1A	Unit 1B	Unit 2	Unit 3	Unit 4	Termination Depth (mbgl)
TP02	-	0.00	0.20	1.10	-	1.40
TP03	-	0.00	0.30	1.70	-	1.90
TP04	-	0.00	0.30	1.50	-	1.80
TP05	-	0.00	0.50	-	-	1.50
TP06	-	0.00	0.20	2.00	-	2.40
TP07	-	0.00	0.30	0.90	-	1.40
TP08	-	0.00	0.90	-	-	1.40
TP09	-	0.00	0.80	1.30	-	1.70
BH01	0.00	0.10	0.40	1.10	1.40	4.80
BH02	-	0.00	0.20	2.00	2.80	6.48
BH03	-	0.00	0.20	3.10	3.66	7.00
BH04	-	0.00	0.20	2.70	3.50	6.90
BH05	0.00	0.05	1.70	2.50	-	2.75
BH06	0.00	0.10	0.30	1.50	-	1.80
HA01	-	0.00	0.03	-	-	0.92
HA02	-	0.00	0.04	-	-	1.02
HA03	-	0.00	0.04	-	-	0.86
HA04	-	0.00	0.04	-	-	0.91
HA05	-	0.00	0.04	-	-	0.83

For more detail of the subsurface conditions encountered, reference shall be made to the ‘Engineering Logs’ attached in **Appendix B**, with explanatory notes.

4.1.2 Geotechnical Cross Sections

Geotechnical cross sections have been drawn for the configurations shows in Figure 4-1 below. Geotechnical cross sections are attached in **Appendix D.**

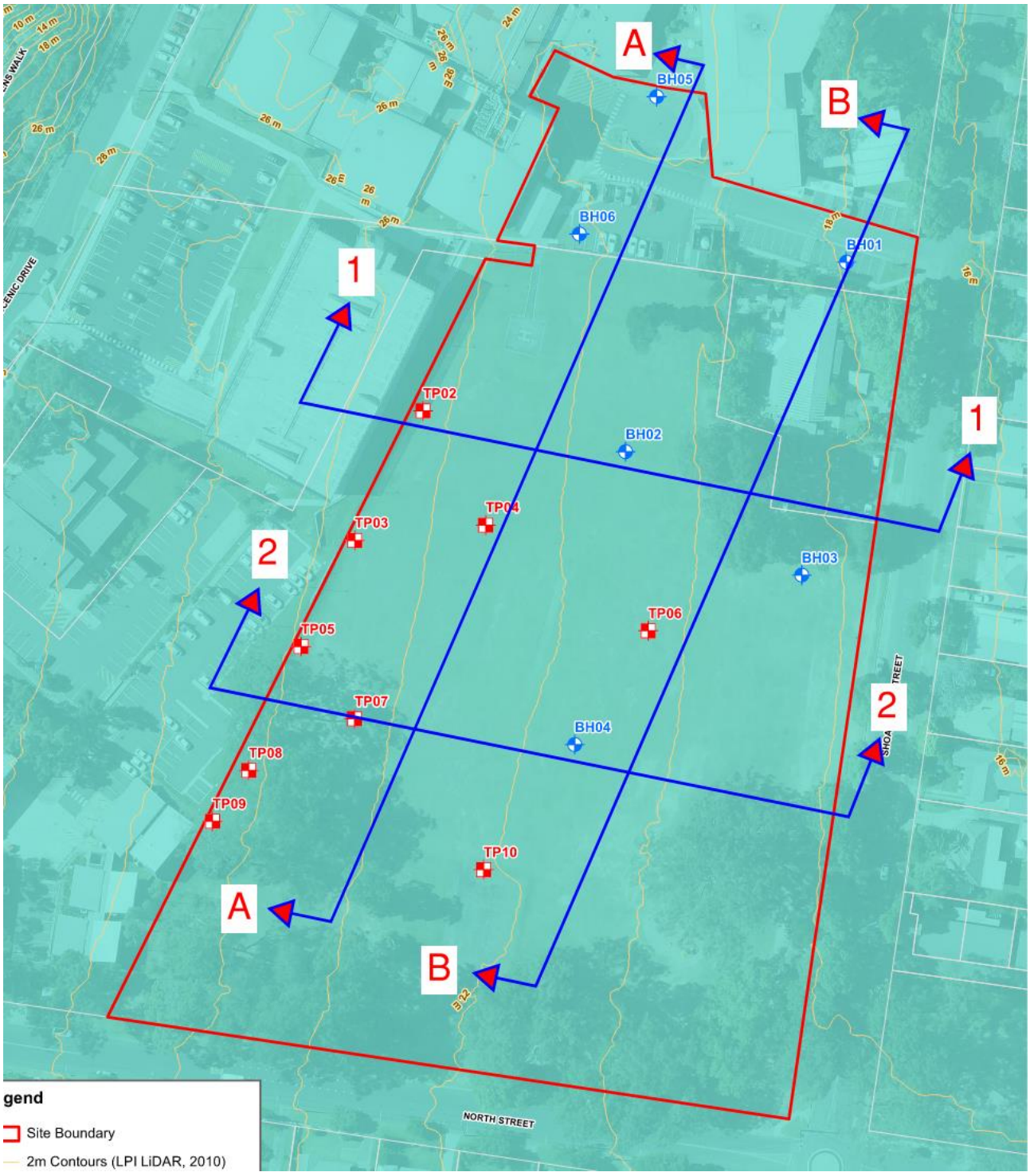


Figure 4-1 Geotechnical cross section alignments

4.2 Groundwater Observations

Groundwater was not encountered during investigation. It should be noted that groundwater levels are likely to fluctuate with variations in climatic and site conditions. Seepage may also occur along the soil/rock interface during and after periods of wet weather.

4.3 In-Situ Permeability

In-situ falling head permeability tests were performed by filling each hand auger borehole with water and recording the drop in water level over time. The depth of tested in-situ soil is summarised in Table 4-3 below.

Table 4-3 Permeability Test Depth

Hand Auger	Groundwater (m bgl)	Permeability Test Depth
HA01	Not encountered	0.00m to 0.92m bgl
HA02	Not encountered	0.00m to 1.02m bgl
HA03	Not encountered	0.00m to 0.86m bgl
HA04	Not encountered	0.00m to 0.91m bgl
HA05	Not encountered	0.00m to 0.83m bgl

Falling head tests were calculated over a time period considered practical with one test in each hand auger borehole been left over night. Following the first test, the hand auger borehole walls were scraped to eliminate any smear effects. Falling head permeability test results are attached to **Appendix E**. A summary of soil permeability is presented below in Table 4-4.

Table 4-4 Falling Head Permeability Results

Borehole	Test Number	Permeability K (m/s)	Time Interval (seconds)	Final Water Level (m bgl)	Permeability Classification *
HA01	1	2.02 E-08	70200	0.46m	Well Watertight
	2	2.02 E-08	37380	0.61m	Well Watertight
HA02	1	9.38 E-09	22500	0.29m	Well Watertight
	2	1.65 E-08	52200	0.39m	Well Watertight
	3	1.78 E-08	37800	0.34m	Well Watertight
HA03	1	2.34 E-08	66600	0.50m	Well Watertight
	2	2.14 E-08	37080	0.42m	Well Watertight
HA04	1	5.04 E-08	57600	0.64m	Well Watertight
	2	5.85 E-08	36600	0.58m	Well Watertight
HA05	1	2.83 E-08	63000	0.48m	Well Watertight
	2	3.25 E-08	36840	0.43m	Well Watertight
Average		2.71 E-08			

Notes:

* NagyL. Tabacks A., Huszak T., Mahler A., Varga G, *Comparison of Permeability Testing Methods,* Proceedings of the 18th International Conference on Soil Mechanics and Geotechnical Engineering, Paris 2013.

Coefficient of permeability is broadly consistent with Table 2.1 of BS 8004: 1986 as seen in Figure 4-2 below.

Table 2.1 Coefficient of permeability (m/s) (BS 8004: 1986)

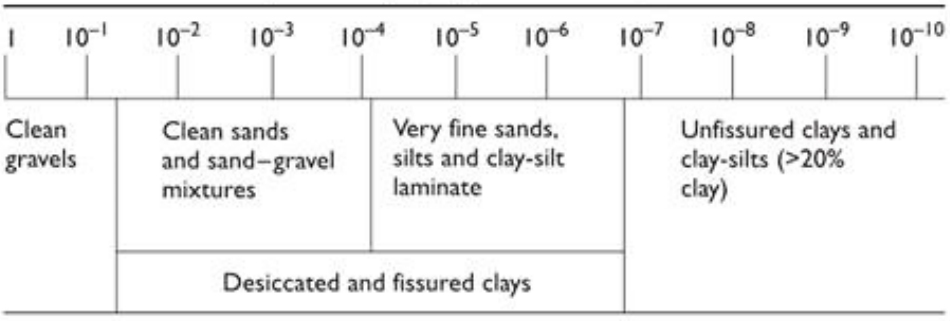


Figure 4-2 Coefficient of permeability from BS 8004: 1986

4.4 In-Situ Testing

4.4.1 Dynamic Cone Penetrometer (DCP)

A DCP test involves raising and dropping a 9kg hammer to drive a steel cone on the end of a rod shaft through the underlying layers. The number of blows it requires to penetrate the rod across 100mm increments is measured until target depth is reached or the cone is bouncing, causing refusal (Blow counts > 25).

DCP tests were undertaken at seven (7) test pit locations and five (5) hand auger borehole locations to determine subsurface strength properties. CPT tests were undertaken from surface to 3.00mbgl for test pits and 1.00mbgl for hand auger boreholes, or prior refusal. The DCP results are presented in the engineering logs provided in Appendix B.

4.4.2 Standard Penetration Testing (SPT)

A SPT test is undertaken on the drill rig and involves the raising and dropping of a 63.5kg weight a standard distance of 760mm. Blow counts are counted for every 150mm increments over three increments. The first increment is classed as the seating drive, with the next two increments classed as the test. The total blow counts over the test become the 'N' value. If the hammer is bouncing, or the count reaches 30 in an increment this becomes a refusal.

SPT tests were undertaken at all six (6) borehole locations at 1.50m intervals to determine the 'N' value and assess subsurface strength properties.

4.5 Laboratory Test Results

4.5.1 Soil Testing

The results of laboratory testing are summarised in the tables below. Table 4-5 presents material property and soil classification testing and Table 4-6 presents results of standard compaction and California Bearing Ratio (CBR) testing. Chemical testing results are presented in Table 4-8.

Table 4-5 Material property test results

Test Pit / Borehole	Depth (m)	Unit	Gravel (%)	Sand (%)	Fines (%)	MC (%)	LL (%)	PL (%)	PI (%)	LS (%)	Emerson Class
TP02	0.10-0.20	1B	-	-	-	14.2	24	20	4	1.5	-
TP04	1.00-1.20	2	-	-	-	23.1	55	25	50	15.0	-
TP05	0.60-0.80	2	-	-	-	11.0	-	-	-	-	4
TP06	1.00-1.20	2	11	42	47	-	-	-	-	-	-
TP07	0.40-0.60	2	-	-	-	23.2	49	24	25	12.0	-

TP09	0.40-0.50	1B	-	-	-	10.9	-	-	-	-	4
TP09	1.00-1.20	2	-	-	-	17.4	38	17	21	10.0	-
TP09	1.50-1.70	3	23	44	29	-	-	-	-	-	-
BH01	0.20-0.40	1B	55	26	14	-	-	-	-	-	-
BH01	0.50-0.95	2	-	-	-	12.9	-	-	-	-	4
BH02	1.20-1.50	2	-	-	-	25.1	64	26	38	18.0	-
BH03	2.70-3.00	2	12	48	40	-	-	-	-	-	-
BH04	0.50-1.00	2	-	-	-	28.4	-	-	-	-	4
BH04	1.20-1.50	2	-	-	-	25.8	51	25	26	13.0	-
BH04	1.50-1.95	2	8	34	55	-	-	-	-	-	-
BH06	1.20-1.50	2	8	62	31	-	-	-	-	-	-
HA04	0.50-0.91	2	20	55	25	21.3	42	22	20	10	-

Notes to table:
- MC: Moisture Content
- LL: Liquid Limit
- PL: Plastic Limit
- PI: Plasticity Index
- LS: Linear Shrinkage

Table 4-6 Laboratory CBR test results

Test Pit / Borehole	Depth (m)	Unit	Soil Description	MC (%)	SOMC (%)	SMDD (t/m^3)	Swell (%)	CBR (%)
TP02	1.20-1.40	3	Clayey Gravelly SAND	15.4	13.4	1.863	0.0	30
BH04	0.50-1.00	2	Sandy CLAY	28.4	24.7	1.562	1.0	6

Notes to table:
- MC: Field moisture content
- SOMC: Standard Optimum Moisture Content
- SMDD: Standard Maximum Dry Density

CBR testing was undertaken on remoulded specimens compacted to a target 100% standard maximum dry density and soaked with a surcharge for four (4) days. Subgrade strength is moisture and density dependent and where the existing subgrade is compacted to less than 100% standard compaction and moistures above SOMC exist, the in-situ CBR values may be less than the above tested values.

For details of the laboratory testing conducted, reference shall be made to the laboratory report sheets contained within Appendix C.

4.5.2 Rock Testing

Unconfined Compressive Strength (UCS) testing was carried out on recovered rock core to assess intact rock strength. The laboratory test certificates are presented in Appendix C and a summary of the test results are presented in Table 4-7 below.

Table 4-7 Summary of UCS Testing

Borehole	Depth (m)	UCS (MPa)
BH01	3.36-3.59	47.5
BH02	3.29-3.38	34.5
BH03	4.60-4.81	41.3
BH04	6.59-6.79	42.8

4.5.3 Chemical Testing

Four (4) soil samples were recovered and tested for aggressivity including chloride content, electrical conductivity (EC), pH, resistivity, sulphate content, and moisture content (MC). The test certificate is presented in Appendix C and a summary of the test result is presented in Table 4-8 below.

Table 4-8 Soil Aggressivity Testing

Borehole	Depth (m)	Soil Description	Chloride (mg/kg)	EC (µS/cm)	pH	Resistivity (ohm.m)	Sulfate (mg/kg)	MC (%)
BH02	0.50-0.95	Sandy CLAY	15	15	5.3	660	<10	18
BH02	1.50-1.95	Sandy CLAY	10	13	5.2	770	<10	12
BH03	1.50-1.95	Sandy CLAY	10	13	5.3	750	<10	18
BH04	0.50-0.95	Sandy CLAY	<10	13	5.9	780	14	20

In accordance with AS2159-2009 Piling-Design and Installation [3], the exposure classification has been assessed for in-ground concrete structures (Table 6.4.2 (C)) and in-ground steel structures (Table 6.5.2 (C)) as follows:

For in-ground concrete structures:

- Mild to moderate (all soils above ground water or low permeability soils).
- Moderate to severe (all soils below ground water with high permeability soils).

For in-ground steel structures:

- Non-aggressive (all soils above ground water or low permeability soils).
- Non-aggressive to mild (all soils below ground water with high permeability soils).

For design purposes it is recommended the worst-case classification be taken i.e. all soils below ground water with high permeability soils.

5 Comment & Recommendations

5.1 Preliminary Site Classification

A preliminary site classification has been provided for the site with a separate classification for areas of filling greater than 0.40m deep and less than 0.40m deep.

A summary of preliminary site classifications can be seen below in Table 5-1.

Table 5-1 Preliminary site classification summary table

Test Location	Site Classification
Areas with FILL greater than 0.40 mbgl: BH05, TP08, TP09, TP10	CLASS P
Areas with FILL less than 0.40 mbgl: BH01, BH02, BH03, BH04, BH06, TP02, TP03, TP04, TP05, TP06, TP07	CLASS M

Based on these results and using the calculation method presented in Appendix F of AS2870-2011, a characteristic surface movement (ys) between 20mm to 40mm is estimated for the natural portion of the site in its existing condition. Based on our experience of soils in this area, we recommend that residential slabs and footings in these areas are designed in accordance with recommendations in AS2870-2011 for a Class M site provided that footings founded in the natural ground.

It is noted that the final site classification would be dependent on conducting a site-specific geotechnical investigation and testing following completion of the bulk earthworks at the site.

Details regarding causes of soil related building movements and prevention methods are presented in CSIRO Building Technology File, BTF18. The following precautions could be considered to assist in reducing the reactive soil movements:

- Provide paving to the edge of a building (where applicable) to limit soil moisture variations due to seasonal wetting and drying. The paved surface should be graded away from the building such that run-off drains away and water cannot pond against the building.
- Restrict tree planting in the vicinity of the building. AS2870 recommends that trees be planted no closer to a building / footing than a distance equal to 1.0 times their mature height on Class H1 sites. This distance should be increased where rows or groups of trees are involved.
- Service trenches, particularly plumbing and drainage, should be avoided beneath amenities buildings. Where service trenches are to pass beneath or near to a building they should be backfilled with a low permeability material, such as non-reactive compacted clay, to prevent the ingress of water.
- During construction the exposed subgrade, trenches and footing excavations should not be left exposed to the weather for extended periods. Water should not be allowed to pond in these areas nor should they be left unprotected to dry and crack in the sun.

5.2 Earthworks

5.2.1 Site Preparation

Prior to bulk earthworks, any fill, pavement or structure footings areas shall be cleared of any foreign matter or unsuitable material which includes but is not limited to the following:

- Vegetation or organic matter including root balls of any larger trees onsite;
- Topsoil or soil significantly affected by roots or root fibres;
- Any scattered waste or dumped materials;
- Uncontrolled filling which would be subject to further assessment; or
- Loose or low strength (soft) soils or otherwise ‘unsuitable’ soils.

Deleterious materials that cannot be reused on site shall be disposed of at a licenced waste facility and classified in accordance with the NSW EPA Waste Classification Guidelines. Stripped topsoils shall be stockpiled for re-use where suitable.

The majority of the site clays may also require treatment, dry-back or over excavation prior to filling over due to the high moisture content and consistency.

Soils with high moisture contents may be considered unsuitable at the time of construction but appropriate dry back would deem the soils suitable for general fill. The requirement for moisture conditioning will depend on the weather conditions prior to and during construction.

5.2.2 Excavation and Trench Stability

Temporary excavations in the existing fill and alluvial soils or where water seepage occurs, may be unstable. Unsupported short-term excavations or trenches may undergo slumping into the excavation as observed during the excavation of test pits across the site. Trench support should be used or excavations shall be battered and benched in accordance with recommendations below.

Temporary excavations or trenches in the stiff or better clay within the residual soil profile would be expected to stand close to vertical in the short-term (<1 day) however should be limited to no greater than 2 m in height. Where deeper excavations are required, benching or shallower batters should be provided. No personnel shall be permitted to enter trenches or stand adjacent an unsupported vertical excavation over 1.2 m in height due to the risk of sudden collapse. Unsupported short-term excavations or trenches may undergo some local slumping into the excavation in residual stratum or where seepage occurs.

Excavations in the vicinity of existing road, footpath or carparks or other structures shall be fully supported in accordance with a temporary works design from a suitably qualified geotechnical engineer where appropriate to ensure no inadvertent instability affecting adjacent infrastructure.

Where personnel are to enter excavations, options for short-term excavations include benching or battering back of the excavations to recommendations as per Table 5-2 or flatter batters would be required or the support of excavations.

Temporary excavations should be inspected for signs of failure i.e. tension cracks, on a daily basis and following inclement weather. No plant / equipment or stockpiling of material shall be placed within a horizontal distance equal to the height of the excavation. Where this is not possible to be adhered to, a specific geotechnical assessment shall be carried out by a suitably experienced geotechnical engineer.

Groundwater inflow was not encountered at the time of investigation. As seepage or inflow may be encountered during construction, an allowance should be made for control such water utilising a sump and pump.

5.2.2.1 Open Cuts / Temporary and Permanent

Recommendations for temporary unsupported cuts batters (if required) are presented in the following table:

Table 5-2 Cut Batter Recommendations

Geotechnical profile	Temporary Batter (Horizontal to Vertical Ratio)
Fill	2H: 1V
Residual Soil	1.5H : 1V
Sandstone Class IV - V	1.3H:1V
Sandstone Class III or better [g)]	1H:1V

Notes:

a) Table 5-2 applies to temporary unsupported cut batters only, for a period of no greater than 1 months once constructed and inspected
b) Temporary support applies to batters no greater than 1.50m in vertical height. Where deeper cuts are proposed for each stratum, further geotechnical designed support or retention systems may be required.
c) Excavations in soil have assumed no groundwater table has been encountered;
d) The ground surface at the crest of the excavation is horizontal;
e) There is no surcharge at the crest of the excavation for a distance equal to the depth of the excavation;
f) All cuts are protected from erosion.
g) Subject to inspection by qualified geotechnical engineer

5.2.2.2 Permanent cuts

Permanent cuts have not been fully identified at this stage, due to the unknown locality and depth of proposed cuts. However, where deep cuts are envisaged as part of permanent works, the following measures would potentially be required

Table 5-3 Batter stabilisation options for permanent works

Geotechnical profile	Permanent Options	Additional Comments
Residual Soils	▪ Regrade batter slope ▪ Soil nail and shotcrete	▪ Longer soil nails would be required in thicker soil profile areas encountered across subject site
Sandstone Class IV – V / or better	▪ Regrade batter ▪ Scaling, block removal and re-profiling ▪ Rock / spot bolting ▪ Rock fall netting ▪ Catch fence and ditches	▪ Requires geotechnical input / site observations during top down excavation works to determine extend of stabilization options required

5.2.3 Filling

Fill shall be placed and compacted in accordance with AS 3798-2007 *Guidelines on Earthworks for Commercial and Residential Development* with consideration to the following recommendations.

It is expected that construction of fill platforms during the bulk earthworks, which would be suitable to support structural loads associated with residential development, would include the following:

> Removal of any existing fill, topsoil or deleterious soils and unsuitable material from areas where fill is to be placed. In general, unsuitable material such as presence of vegetation, organic matter, topsoil, silts and existing filling shall be removed.

> Benching shall be provided in slopes steeper than 1V:8H (approximately 7°) where filling is to occur.

> The exposed subgrade should be scarified and compacted using a heavy vibrating pad foot roller to achieve a dry density ratio of at least 100% Standard compaction and within ± 2% of Standard Optimum Moisture Content (SOMC) in accordance with AS1289.5.1.1, 5.4.1 or 5.7.1.

> Any soft or weak areas identified during the subgrade compaction process or proof rolling, that do not respond to further compaction, should be removed and replaced with select fill in layers not exceeding 200mm loose thickness and each layer compacted to achieve a Dry Density Ratio of at least 100% Standard and within ± 2% of SOMC in accordance with AS1289 5.1.1, 5.4.1 or 5.7.1. Excavations to remove any soft or weak areas should have side slopes battered not steeper than 2H:1V. Should extensive soft or weak areas be encountered, further geotechnical advice should be sought.

> Engineered fill should be placed in uniform horizontal layers with maximum thickness of 150mm after compaction. Each layer should be compacted to a minimum dry density ratio of 95% Standard Compaction at moisture contents in the order of ±2% optimum moisture content. Over compaction and/or placement of clays significantly dry of OMC should be avoided.

> Exposed subgrade and all fill layers should be test-rolled immediately following completion of compaction. If further test rolling is required at later date, the surface should be moisture conditions as required, and given not less than four coverages of the testing roller prior to test rolling.

> Fill materials shall comprise suitable materials as detailed below in Section 5.2.5.

All fill shall be battered at a slope of 1V:2H or flatter (preferably 1V:3H) and temporary erosion control shall be provided. To prevent erosion in the long term, provision of protection by vegetation along with adequate drainage is also required. Batter slopes of 1V:3H are recommended for long term maintenance as it would reduce the risk of erosion. Where a suitable batter slope is not possible, the fill shall be supported by a designed and suitably constructed retaining wall.

All fill placed for lot filling shall be tested in accordance with Level 1 Inspection and Testing by the Geotechnical Inspection and Testing Authority (GITA) including:

> Completion of removal of topsoil and inspection/proof rolling;

- Placing imported or cut material;
- Compaction and adding/removing of moisture;
- Test rolling;
- Trenching and backfilling as required;
- Testing to comply with the required compaction control;

The Level 1 testing schedule, including the number of field density tests should be conducted in accordance with Table 8.1 in AS3798-2007.

5.2.4 Reuse of Fill Material

Filling is expected to comprise both site-won soils and import material. This shall not include any unsuitable material as described in Section 5.2.2. The site materials may require treatment and would be expected to require some degree of moisture re-conditioning, subject to further assessment and weather conditions prior to and during construction. Fill materials are expected to comprise of the following.

- Site won residual soils: Generally, soils excavated on site with the exception of topsoil and unsuitable materials are considered suitable for re-use as engineered general fill with the limit that it cannot be used as structural fill.
- Imported materials: Classified as Virgin Excavated Natural Material (VENM) in accordance with the NSW Waste Classification Guidelines Part 1 - Classification of Waste, or Excavated Natural Material (ENM) as per the Protection of the Environment Operations (Waste) Regulation 2005 The Excavated Natural Material Exemption 2012.

The reuse of reactive soils is generally not advised however it is acceptable under circumstances where the movements due to moisture changes are controlled. This may include capping the material with non-reactive soils and ensuring the material is placed in the lower portion of any fill volume as to minimise potential movements. If reactive soils are to be used as fill, further detailed assessment will be required.

5.2.5 Pavement Subgrade Conditions

Laboratory testing undertaken on residual sandy CLAY and clayey gravelly SAND (extremely weathered material), resulted in CBR values of 6% & 30% respectively, with a swell of 1% & 0% respectively.

Based on the lab results and our experience with similar materials, it is recommended for pavements within the existing fill, a design CBR of 2.5% may be adopted due to the variable nature of fill soils. For pavements within the alluvial and residual soils a design CBR of 5% may be adopted.

Subgrade comprising residual clays would have considerable potential for volume change due to moisture variations and strategies to minimise volume change as outline in clause 5.3.5 of Austroads should be employed.

The specific considerations in relation to expansive soils should be considered:

- Regimented moisture control of subgrade and protection to prevent drying prior to placement of overlying layers;
- Lower permeability and low swell select fill layers in the upper layers of filling or comprising a minimum 150 mm of subgrade replacement in clay subgrades;
- Placing subsoil drains to subbase or select level, not extending to the expansive subgrade;
- Restrict planting of vegetation planting near the pavement;
- Recommendation for sealed shoulders and impermeable verge material;
- Recommend appropriate construction techniques; and
- Reduction of the volume expansion potential of the expansive soils by lime stabilisation.

5.2.6 Trench Backfill

Trench backfill including bed and haunch zones, and side and overlay zones shall meet the requirements of the SCC requirements. Care is required to ensure that compaction is achieved over the entire fill area, particularly adjacent any vertical excavated faces. This may require ‘keying in’ or benching to allow

compaction equipment to achieve full compaction to the edge. Alternately, the use of hand compaction equipment would be required.

Level 2 Inspection and Testing is to be undertaken by a geotechnical testing authority (GTA) and should follow the testing schedule in Shoalhaven City Council Construction Specifications.

5.3 Erosion Control

The results of the limited laboratory dispersion tests indicate that the Emerson Class Number of the site soils is 4, with materials classified as highly dispersive to slightly dispersive with calcite or gypsum present. This variability of Emerson Class on site may result from the fill containing mixed soils.

Prior to earthworks, appropriate site surface drainage and other measures shall be implemented to prevent ponding and scouring during the construction, and to minimise the risk of trafficability issues on site clays and sands during and after inclement weather. These measures shall include temporary drains, surface grading along with erosion and sediment control, and shall be appropriately reinstated following the construction.

In general, the dispersion potential can be ameliorated by regimented compaction and moisture control. A suitable thickness of topsoil (preferably >150 mm) shall also be provided to promote vegetation growth for longer term erosion control.

Provision of suitable vegetation protection and adequate drainage would be required as a minimum erosion protection measure. Appropriate surface drainage should be installed to intercept and reduce the velocity of up-slope overland surface flows and to restrict overland surface flows from flowing onto adjacent areas where practical.

All collected stormwater shall be appropriately detained in on-site storage or detention basins and discharged in a controlled manner where required. This shall be conducted in accordance with the relevant SCC requirements.

Consideration should also be made to installing subsurface drainage at the base of drainage lines prior to filling.

5.4 Excavatability

Fill and residual soils were observed throughout the site which generally comprised soft to hard clays or loose to medium dense sand. Boreholes encountered moderately weathered sandstone between 1.40-3.66 mbgl, becoming increasingly harder with depth, and refusal of TC auger bit between 1.80-2.75 mbgl.

The results of the investigation indicate that excavations and stripping could be readily undertaken in the surficial soil and extremely weathered rock at shallow depths of down to approximately 2.00m bgl, permitting easy ripping with traditional excavation methods to be implemented (such as a 20t excavator or equivalent).

5.5 Foundations

All footing systems for residential structures should be designed and constructed in accordance with AS2870-2011 [4] for the appropriate classification. Suitable footing systems may comprise pad or strip footings.

5.5.1 Earthquake Site Classification

Based on the classification system presented in AS 1170.4-2007 “Structural Design Actions Part 4: Earthquake Actions in Australia” and the encountered conditions, the site is deemed to have a site subsoil classification of ‘Class Ce’, shallow soil site with a Hazard Design Factor (Z) of 0.09.

5.5.2 Shallow Foundations

Allowable bearing pressures for mass concrete pad footings are provided in Table 5-2.

Table 5-4 Allowable bearing pressures for high level footings

Expected founding material	Nominal Embedment Depth (m)	Nominal Footing Dimensions (m)	Allowable Bearing Capacity (kPa)

Uncontrolled FILL	Not recommended	Not recommended	Not recommended
Residual - stiff to very stiff CLAY	0.50	1m x 1m	200

Notes to table:

a) Allowable bearing capacity tabulated above assuming eccentricity of 1/6 x footing width

b) Horizontal ground is assumed.

Footing construction methods should be “flexible” in that footing excavations can be readily deepened or widened to target more competent materials should lower bearing capacity materials be present.

Bearing pressures nominated above are based on footing bases founding a minimum of 0.50m into the founding material.

The nominated bearing pressures assume that all loose, disturbed or softened materials will be removed from footing excavations prior to casting concrete. If the material at the base of the excavation is allowed to wet and soften, it must be over-excavated until competent material is encountered and replaced with lean mix concrete or compacted granular fill. Footing excavation should be inspected by a suitably experienced geotechnical engineer or engineering geologist prior to installing reinforcing and casting concrete to confirm that founding conditions are consistent with the design values.

5.5.3 Settlement

Settlement of spread footings will depend on the size, shape and founding depth of the footings. At the time of preparing this report, details of the footing loads have not been provided. However, based on the allowable bearing pressures presented in Section 5.5.1, settlements less than 20mm may be anticipated for spread footings up to 1.00m wide for preliminary purposes with a proportion of this settlement likely to occur during construction.

A detailed review of settlement should be undertaken once footing layouts and loadings are finalised.

5.5.4 Piled Foundations

At the time of writing this report the expected column loads have not been provided. Table 5-3 presents parameters for the design of piles founded in rock. These parameters are compatible with AS2159-2009 which follows a limit state method.

Table 5-5 Design Parameters for Bored Cast In-situ Piles

Geotechnical Material	Ultimate end bearing capacity (kPa)	Ultimate shaft adhesion (kPa)	Elastic modulus E’ (MPa)
Residual – stiff to very stiff CLAY	450	50	15
Extremely weathered sandstone	3,000	100	100

Notes:

1. Skin friction (fs) and base resistance (fb) as defined in AS2159-2009.
2. Ignore bored pile shaft within 1 m of ground surface to account for potential site disturbance and moisture change effects.
3. Ultimate shaft adhesion based on a clean rock socket with roughness category R2 or better (Pells 1998).

Piles should be designed for both ultimate and serviceability conditions. Ultimate end bearing and shaft adhesion values are to be used with appropriate load factors and geotechnical strength reduction factors to assess ultimate capacity.

The geotechnical strength reduction factor will depend on various influences such as the level of information available for the rock and the level of construction control. Based on the above influence factors applicable for the site and uncertainty with construction method and quality control etc., an average risk rating, ARR and geotechnical strength reduction factor, Φ_{gb} should be calculated. For limit state strength design, a geotechnical strength reduction factor (Φ_{gb}) of 0.45 can be applied to the ultimate capacity presented in Table 5-3.

Pile testing requirements will be dependent on AS2159-2009. For piles subject to uplift loads, the geotechnical strength should be multiplied by a factor of 0.7 in addition to the geotechnical strength reduction factor.

Whilst bored piles are considered feasible, constructability within a high groundwater level may be problematic and will likely require temporary lining. An alternative would be to use CFA pile techniques. This would alleviate the need for temporary lining and reduce the amount of spoil generated through the installation. Piles should extend a minimum of two (2) pile diameters into the founding bedrock.

The design values require good construction practices which includes socket cleaning and concreting in a continuous process without delay. It is recommended that an experienced geotechnical engineer or engineering geologist observes pile drilling as well as shaft and mechanical base cleaning to confirm the adequacy of founding strata. Such observations would be undertaken from the piling platform level and would include observation of returned cuttings and drill rig performance, as well as the effectiveness of shaft roughening (if required) and down-hole cleaning.

5.6 Vibration

5.6.1 Vibration Assessment

Vibration effects may impact on the adjacent shopping centre structures or residential properties. Vibration assessment based on the Australian Road Research Boards Special Report: Ground Vibrations, Damaging Effect to Buildings is used to assess the likelihood of impacts to any neighbouring structures or features. The proposed limit of effects on humans are based on AS 2670.2-1990 *Evaluation of human exposure to whole-body vibration - Continuous and shock-induced vibration in buildings.*

The effects of vibrations may vary greatly depending on the magnitude and frequency of works, the ground conditions and the interaction between footings and foundations. The intensity, duration, frequency and number of occurrences of a vibration all play a vital role in both the annoyance levels caused and the strains induced in structures. Sources of ground vibration for construction is likely to comprise bulldozers, hydraulic rock breakers, and vibratory rollers during road construction.

Where there is concern due to construction related vibration effects, a continuous vibration assessment during construction could be adopted to ensure that vibrations to adjacent structures are within an acceptable limit; however in lieu of this, the following levels should be adopted. The guidelines are based on previous experience and published data with generalised distance limits considered suitable for the management of ground vibrations generated through earthworks and construction.

Table 5-6 Approximate generated vibration levels for various construction activities

Activity	Typical Levels of Ground Vibration
Vibratory rollers	Up to 1.5 mm/s at distances of 25 m Higher levels could occur at closer distances; however, no damage would be expected for any new buildings at distances greater than approximately 12m (for a medium to heavy roller)
Bulldozer	1 to 2 mm/s at distances of approximately 5 m at distances greater than 20 m, vibration is usually below 0.2 mm/s. At closer distances to the piling operations, some compaction of loose fill would occur due to vibratory effects and may cause displacement
Hydraulic rock breakers	4.5 mm/s at 5 m 1.3 mm/s at 10 m 0.4 mm/s at 20 m 0.1 mm/s at 50 m
Compactor	20 mm/s at distances of approximately 5 m, 2 mm/s at distances of 15 m. At distances greater than 30m, vibration is typically below 0.3 mm/s
Pile driving/removal	1 to 5 mm/s at distances of 25 to 50 m depending on soil conditions and the energy of the pile driving hammer.

5.6.2 Effects of Vibration

It is well documented that humans often perceive vibrations to be much higher in amplitude than what is occurring in reality and complaints can often be made in cases where no structural damage is likely. A proactive measure or contingency plan would be to install vibration monitoring equipment to provide evidence to potential residents that may feel their homes are not being structurally damaged. Regular community engagement with updates advising when and where construction activities may generate perceptible levels of vibration may also help mitigate community complaints.

5.6.3 Vibration Management

As heavy machinery including vibrating rollers are likely to be used during development, it is advised that an assessment by the contractor must be conducted prior to the use of heavy machinery. This assessment is to determine the suitability of the equipment and proposed methodology if the machine will be operating within 20.0 m of any structure. If the works are within a 20.0 m zone of a dwelling or structure, then the contractor must utilise equipment that produces acceptable vibrations (based on the guidelines in Table 5-1) and provide vibration monitoring, dilapidation reports as required depending on the structure and the tolerated level of vibration.

6 Important Information

We appreciate the opportunity to work collaboratively with you on this project. Our team looks forward to bringing our high level of expertise to deliver successful outcomes in your future projects.

Your attention is drawn to the appended document titled "*Important Information about this Geotechnical Report".* This document is intended to clarify to the reader what the realistic expectations of this report should be, and what is the correct use of the document. Misinterpretation of geotechnical information presents significant risk to projects: The document includes a discussion on general limitations of geotechnical services, which by nature, are based extensively on opinion and judgement.

The statements included in this document are not intended to be exculpatory clauses or to reduce the general responsibility accepted by Cardno, but rather to identify where Cardno and our Client's responsibilities lie. The statements ensure that all parties that may rely on the report are aware of their respective responsibilities.

For further enquiries, please do not hesitate to contact Cardno on the information supplied.

Shoalhaven Hospital Redevelopment

APPENDIX A

INVESTIGATION PLAN

NSW GOVERNMENT Health Infrastructure

1:1,000 Scale at A3

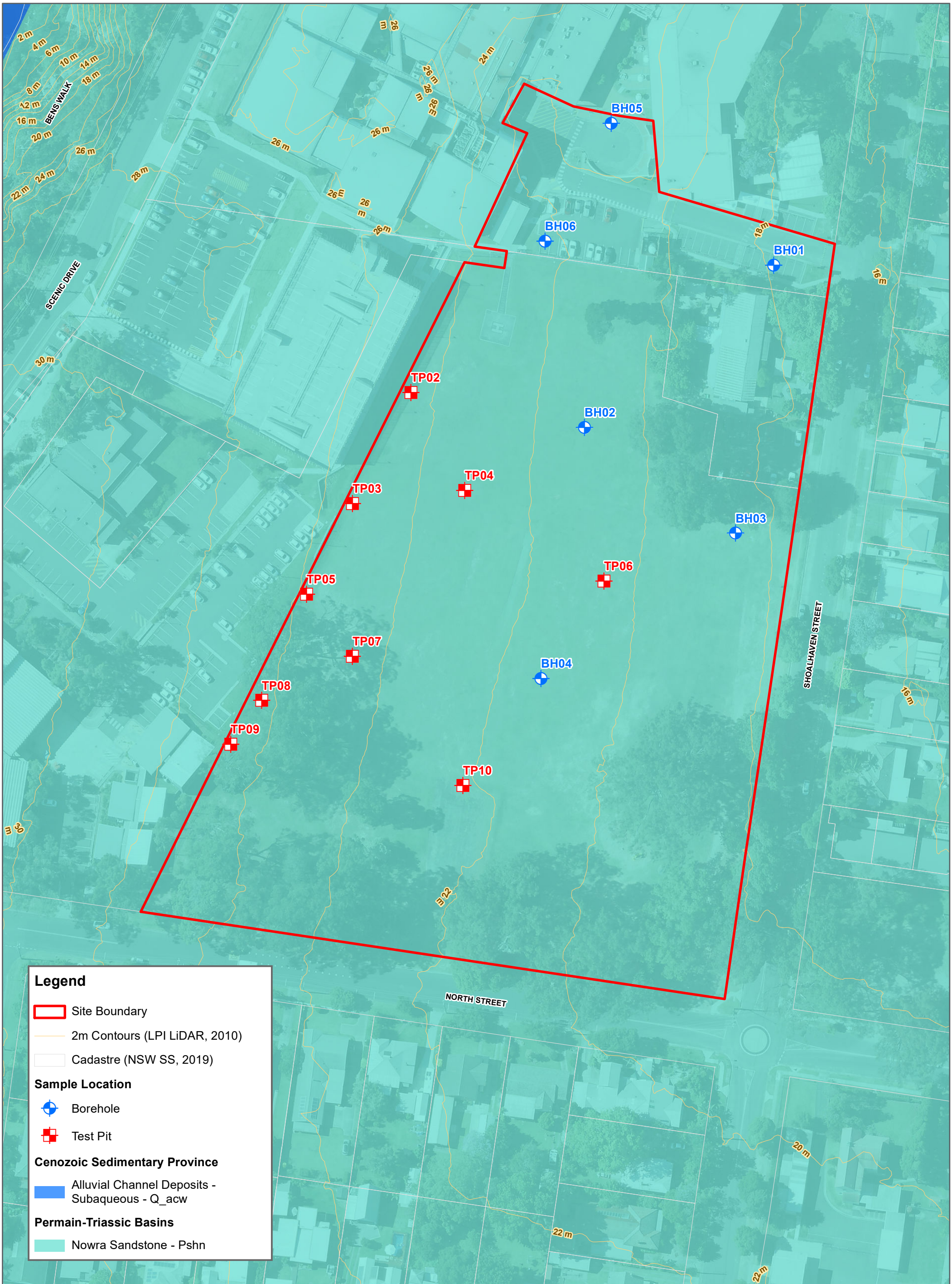
m
0 10 20 30 40

Geotechnical Sampling Plan

SHOALHAVEN HOSPITAL REDEVELOPMENT

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (NW&E)
Date: 2022-06-29 | Project: 8202118201
Coordinate System: GDA 1994 MGA Zone 56
Map: 8202118201-GS-008-GeotechPlan.mxd 02
Aerial imagery supplied by Metromap (November, 2020)


BH05
BH06
BH01
BH02
BH03
BH04
TP02
TP03
TP04
TP05
TP06
TP07
TP08
TP09
TP10
BENS WALK
SCENIC DRIVE
SHOALHAVEN STREET
NORTH STREET
Legend
Site Boundary
2m Contours (LPI LiDAR, 2010)
Cadastre (NSW SS, 2019)
Sample Location
Borehole
Test Pit
Cenozoic Sedimentary Province
Alluvial Channel Deposits - Subaqueous - Q_acw
Permain-Triassic Basins
Nowra Sandstone - Pshn
NSW GOVERNMENT Health Infrastructure
FIGURE 3
1:1,000 Scale at A3
m
0 10 20 30 40
Geotechnical Sampling Plan
SHOALHAVEN HOSPITAL REDEVELOPMENT
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (NW&E)
Date: 2022-06-29 | Project: 8202118201
Coordinate System: GDA 1994 MGA Zone 56
Map: 8202118201-GS-007-GEOSamplingPlan.mxd 02
Aerial imagery supplied by Metromap (November, 2020)

Shoalhaven Hospital Redevelopment

APPENDIX B

ENGINEERING LOGS

Cardno

CORE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH01

Job No: 8202118201 **Sheet:** 3 of 3

Position: E280296.396 N6138778.147 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 17.910 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Bit Type:** NMLC **Bit Condition:** Good **Contractor:** Total Drilling

Date Started: 22/6/21 **Date Completed:** 22/6/21 **Logged By:** BA **Checked By:** DR

Coring						Material Description			Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
NMLC	0% LOSS	100	100	13.5	4.5		SANDSTONE, medium to coarse grained, bedded, grey, trace fossils present *(continued)*	SW				4.00 m: HB 4.12 m: HB 4.29 m: JT, 10°, PR, RF, SN, Fe 4.58 m: BP, 0°, UN, RF, SN 4.70 m: HF, 5°
						4.80m	TERMINATED AT 4.80 m Target depth					
				13.0	5.0							
				12.5	5.5							
				12.0	6.0							
				11.5	6.5							
				11.0	7.0							
				10.5	7.5							
				10.0								

DRILLING
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller
PQ Rotary core (85mm)
HQ Rotary core (63.5mm)
NMLC Rotary core (51.94mm)
DT Diatube concrete coring
PT Push tube
PS Percussion sampling
SON Sonic drilling
AH Air hammer

WATER
Water Level on date shown
water inflow
water outflow

ROCK QUALITY DESCRIPTIONS
RQD Rock Quality Designation (%)
TCR Total Core Recovery (%)

ROCK STRENGTH
EH Extremly High
VH Very High
H High
M Medium
L Low
VL Very Low

ROCK WEATHERING
FR Fresh
SW Slightly Weathered
DW Distinctly Weathered
MW Moderately Weathered
HW Highly Weathered
XW Extremly Weathered

DEFECT TYPE
JT Joint
SZ Sheared zone
BP Bedding Parting
SM Seam
FL Foliation
VN Vein
CL Cleavage
CS Crushed Seam
FZ Fracture Zone
DL Drift Lift
HB Handing Break
DB Drilling Break

PLANARITY
CU Curved
DIS Discontinuous
IR Irregular
PR Planar
ST Stepped
UN Undulose

ROUGHNESS
VR Very Rough
RF Rough
S Smooth
SL Slockensided
POL Polished

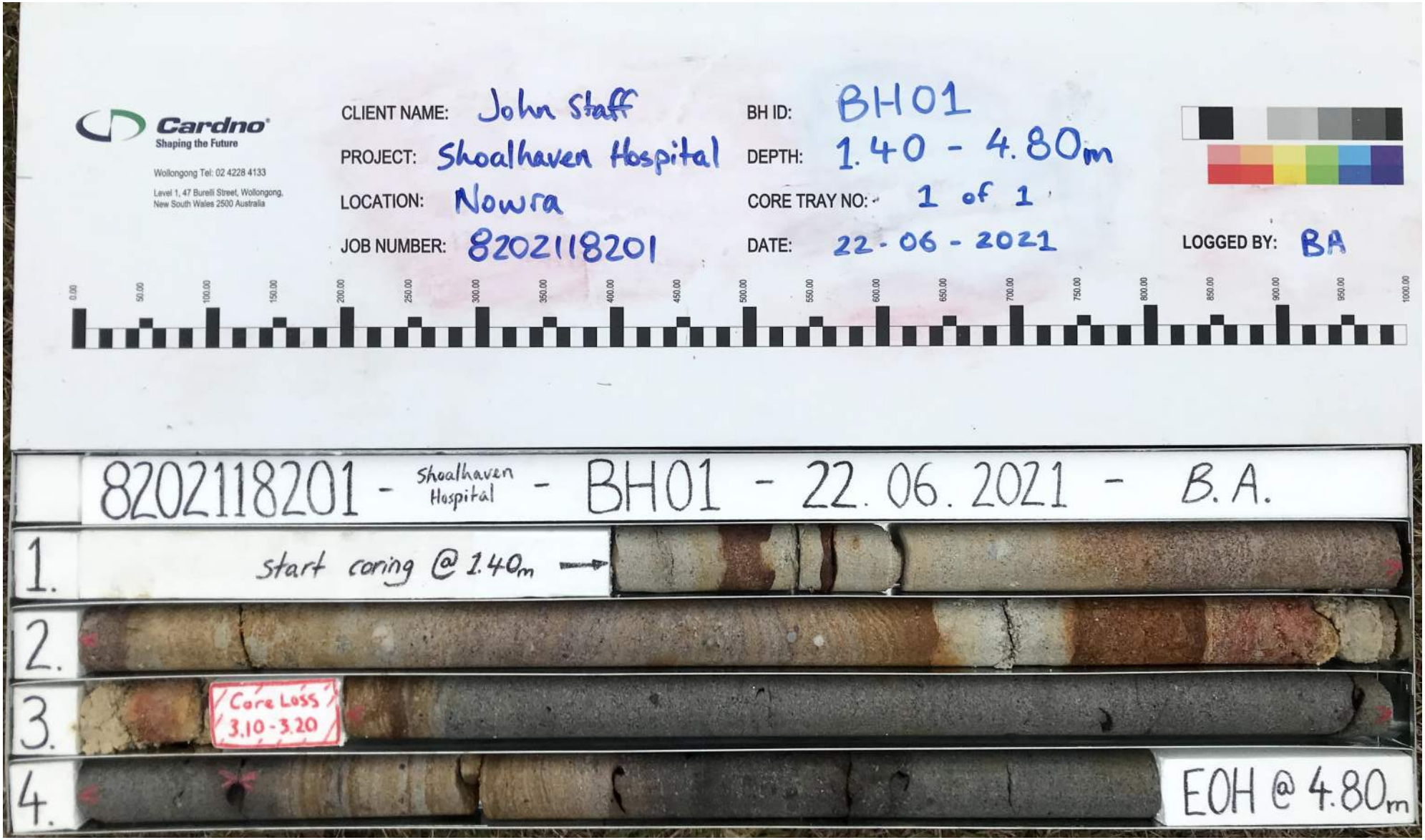
COATING
CN Clean
SN Stained
VNR Veneer (thin or patchy)
CT Coating (up to 1mm)

INFILL MATERIALS
X Carbonaceus
MU Unidentified minteral
MS Secondary mineral
KT Chlorite
CA Calcite
Fe Iron Oxide
Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno Shaping the Future	TITLE: **Borehole Core Photographs - BH01** Geotechnical Investigation - Shoalhaven Hospital GI			
	PROJECT NO: **8202118201**	TEST DATE: **22/06/2021**	INCLINATION: **-90 degree**	CORED LENGTH: **BOX 1 OF 1 - 1.40m to 4.80m - 3.40m Length**
	DRILL RIG: **Hanjin DB8**	CONTRACTOR: **Cardno & Total Drilling**	LOGGED BY: **BA**	CHECKED BY: **DR**



Cardno

BOREHOLE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH02

Job No: 8202118201 **Sheet:** 1 of 3

Position: E280241.151 N6138730.733 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 21.130 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Contractor:** Total Drilling

Date Started: 21/6/21 **Date Completed:** 21/6/21 **Logged By:** BA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	Material Description: STRUCTURE & Other Observations
AD/T	E	HW	2.20m Minor Seepage - Wet Soil	ES 0.10 m	21.0	0.0		SM	Silty SAND: fine to coarse grained, dark grey and dark brown, trace fine to coarse grained sand	M		TOPSOIL
						0.20m						
	F			ES 0.50 m SPT 0.50 - 0.95 m 3, 4, 5 N=9	20.5	0.5		CI	Sandy CLAY: orange-brown, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (>PL)	St	RESIDUAL SOIL
				D 1.20 - 1.00 m	20.0	1.0						
				SPT 1.50 - 1.95 m 5, 7, 9 N=16	19.5	1.5				M (<PL)	VSt	
						2.00m						
	H			D 2.20 - 2.50 m	19.0	2.0		SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, mottled red-brown and grey, fine to coarse, sub-angular to sub-rounded gravel	M		EXTREMELY WEATHERED
	VH				18.5	2.5				W	D - VD	
						2.80m						
					18.0	3.0			Continued as Cored Drill Hole			
					17.5	3.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

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Cardno

CORE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH02

Job No: 8202118201 **Sheet:** 2 of 3

Position: E280241.151 N6138730.733 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 21.130 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Bit Type:** NMLC **Bit Condition:** Good **Contractor:** Total Drilling

Date Started: 21/6/21 **Date Completed:** 21/6/21 **Logged By:** BA **Checked By:** DR

Coring						Material Description				Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
				21.0	0.5							
				20.5								
				20.0	1.0							
				19.5	1.5							
				19.0	2.0							
				18.5	2.5		2.80m START CORING AT 2.80m					
NMLC	0% LOSS	100	87	18.0	3.0		SANDSTONE, medium to coarse grained, bedded, pale grey stained orange-brown to red-brown	MW				3.00 m: HB 3.07 m: DB
				17.5	3.5							3.69 m: JT, 10°, PR, RF, SN, Fe 3.75 m: JT, 10°, PR, RF, SN, Fe 3.83 m: DB 3.88 m: BP, 0°, UN, RF, SN, Fe 3.95 m: HF, 5°

DRILLING
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller
PQ Rotary core (85mm)
HQ Rotary core (63.5mm)
NMLC Rotary core (51.94mm)
DT Diatube concrete coring
PT Push tube
PS Percussion sampling
SON Sonic drilling
AH Air hammer

WATER
Water Level on date shown
water inflow
water outflow

ROCK QUALITY DESCRIPTIONS
RQD Rock Quality Designation (%)
TCR Total Core Recovery (%)

ROCK STRENGTH
EH Extremly High
VH Very High
H High
M Medium
L Low
VL Very Low

ROCK WEATHERING
FR Fresh
SW Slightly Weathered
DW Distinctly Weathered
MW Moderately Weathered
HW Highly Weathered
XW Extremly Weathered

DEFECT TYPE
JT Joint
SZ Sheared zone
BP Bedding Parting
SM Seam
FL Foliation
VN Vein
CL Cleavage
CS Crushed Seam
FZ Fracture Zone
DL Drift Lift
HB Handing Break
DB Drilling Break

PLANARITY
CU Curved
DIS Discontinuous
IR Irregular
PR Planar
ST Stepped
UN Undulose

ROUGHNESS
VR Very Rough
RF Rough
S Smooth
SL Slockensided
POL Polished

COATING
CN Clean
SN Stained
VNR Veneer (thin or patchy)
CT Coating (up to 1mm)

INFILL MATERIALS
X Carbonaceus
MU Unidentified minteral
MS Secondary mineral
KT Chlorite
CA Calcite
Fe Iron Oxide
Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

CORE LOG SHEET

Hole No: BH02

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Job No: 8202118201 **Sheet:** 3 of 3

Position: E280241.151 N6138730.733 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 21.130 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Bit Type:** NMLC **Bit Condition:** Good **Contractor:** Total Drilling

Date Started: 21/6/21 **Date Completed:** 21/6/21 **Logged By:** BA **Checked By:** DR

Coring						Material Description			Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
NMLC	0% LOSS	100	87	17.0 16.5	4.5		SANDSTONE, medium to coarse grained, bedded, pale grey stained orange-brown to red-brown *(continued)*	MW SW				3.97 m: BP, 0°, UN, RF, SN, Fe 4.00 m: BP, 0°, UN, RF, SN, Fe 4.02 m: HF, 5° 4.04 m: HF, 0° 4.09 m: BP, 5°, UN, RF, SN, Fe 4.18 m: BP, 10°, UN, RF, SN, Fe 4.20 m: BP, 5°, UN, RF, SN, Fe 4.53 m: HB 4.88 m: BP, 5°, UN, RF, CN 5.00 m: HB 5.03 m: BP, 10°, UN, RF, CN 5.16 m: BP, 5°, UN, RF, CN 5.37 m: BP, 10°, UN, RF, CN 5.51 m: BP, 10°, UN, RF, CN 5.59 m: BP, 10°, UN, RF, CN 5.73 m: BP, 10°, UN, RF, CN 5.75 m: DB 5.77 m: DB 6.00 m: HB 6.19 m: BP, 0°, IR, RF, CN, on Fossil
	0% LOSS	100	91	16.0 15.5 15.0	5.0 5.5 6.0							
				14.5 14.0 13.5	6.5 7.0 7.5		6.48m TERMINATED AT 6.48 m Target depth					

DRILLING
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller
PQ Rotary core (85mm)
HQ Rotary core (63.5mm)
NMLC Rotary core (51.94mm)
DT Diatube concrete coring
PT Push tube
PS Percussion sampling
SON Sonic drilling
AH Air hammer

WATER
Water Level on date shown
water inflow
water outflow

ROCK QUALITY DESCRIPTIONS
RQD Rock Quality Designation (%)
TCR Total Core Recovery (%)

ROCK STRENGTH
EH Extremely High
VH Very High
H High
M Medium
L Low
VL Very Low

ROCK WEATHERING
FR Fresh
SW Slightly Weathered
DW Distinctly Weathered
MW Moderately Weathered
HW Highly Weathered
XW Extremely Weathered

DEFECT TYPE
JT Joint
SZ Sheared zone
BP Bedding Parting
SM Seam
FL Foliation
VN Vein
CL Cleavage
CS Crushed Seam
FZ Fracture Zone
DL Drift Lift
HB Handing Break
DB Drilling Break

PLANARITY
CU Curved
DIS Discontinuous
IR Irregular
PR Planar
ST Stepped
UN Undulose

ROUGHNESS
VR Very Rough
RF Rough
S Smooth
SL Slockensided
POL Polished

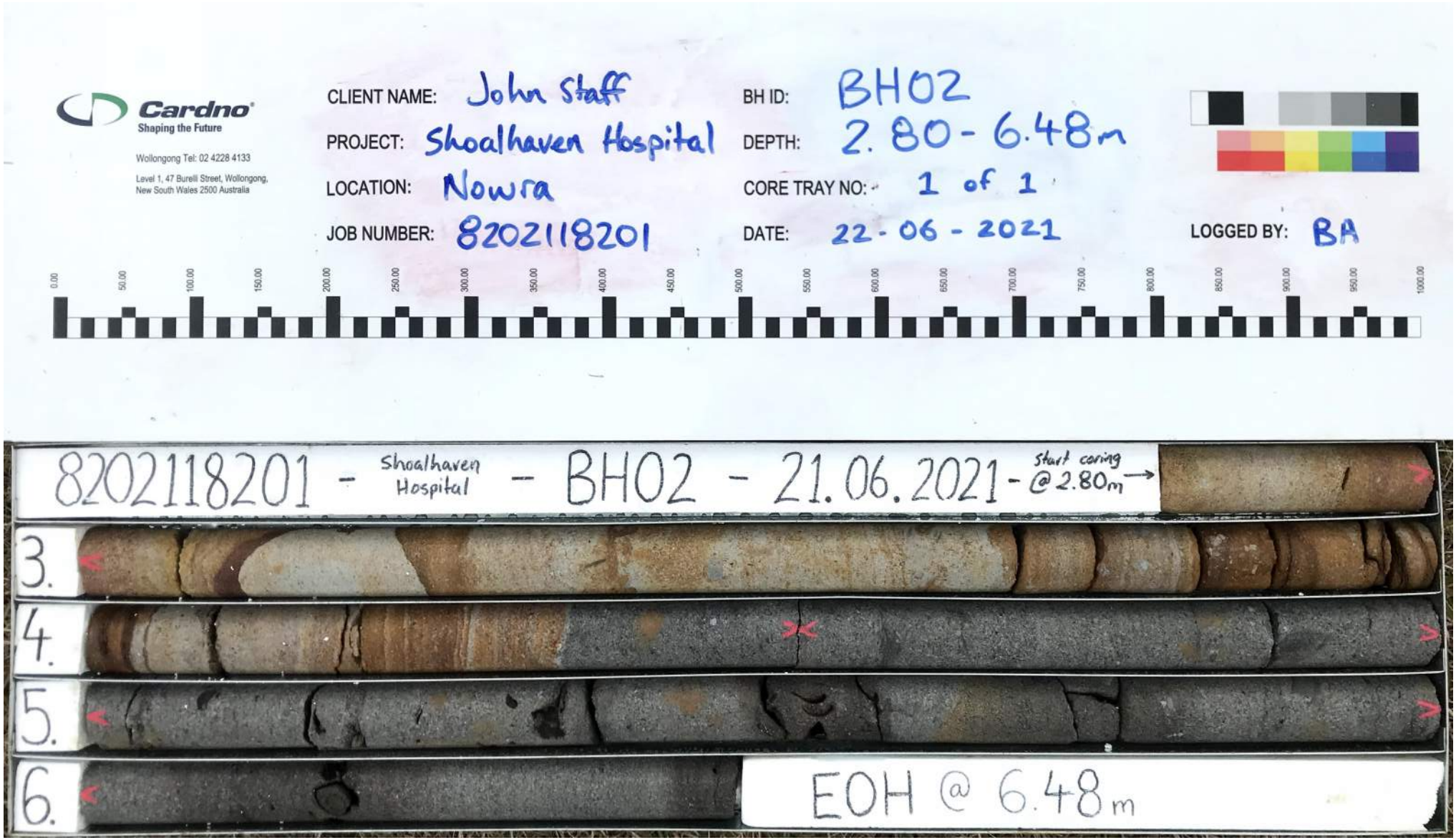
COATING
CN Clean
SN Stained
VNR Veneer (thin or patchy)
CT Coating (up to 1mm)

INFILL MATERIALS
X Carbonaceus
MU Unidentified minteral
MS Secondary mineral
KT Chlorite
CA Calcite
Fe Iron Oxide
Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno Shaping the Future	TITLE: **Borehole Core Photographs - BH02** Geotechnical Investigation - Shoalhaven Hospital GI			
	PROJECT NO: **8202118201**	TEST DATE: **21/06/2021**	INCLINATION: **-90 degree**	CORED LENGTH: **BOX 1 OF 1 - 2.80m to 6.48m - 3.68m Length**
	DRILL RIG: **Hanjin DB8**	CONTRACTOR: **Cardno & Total Drilling**	LOGGED BY: **BA**	CHECKED BY: **DR**



Cardno

BOREHOLE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH03

Job No: 8202118201 **Sheet:** 1 of 3

Position: E280285.178 N6138699.830 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 18.620 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Contractor:** Total Drilling

Date Started: 21/6/21 **Date Completed:** 21/6/21 **Logged By:** BA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	RL (m AHD)	Depth (m)	Graphic Log	Classification	Material Description: SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	Material Description: STRUCTURE & Other Observations
AD/T	E	HW	Not Encountered	ES 0.10 m	18.5	0.0		SM	Silty SAND: fine to coarse grained, dark grey and dark brown, trace fine to coarse grained sand	M		TOPSOIL
						0.20m						
				ES 0.50 m SPT 0.50 - 0.95 m 3, 3, 5 N=8	18.0	0.5			Sandy CLAY: low to medium plasticity, orange-brown, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel			RESIDUAL SOIL
					17.5	1.0		CL-Cl		M (>PL)	St	
				D 1.20 - 1.50 m								
	F			SPT 1.50 - 1.95 m 4, 4, 5 N=9	17.0	1.5						
						1.90m			Sandy CLAY: low to medium plasticity, red-brown, fine to coarse grained, sub-rounded to sub-angular sand, with fine to coarse, sub-rounded to sub-angular gravel			
					16.5	2.0						
						2.5		CL-Cl		M (<PL)	VSt	
				D 2.70 - 3.00 m	16.0							
				SPT 3.00 - 3.35 m 8, 10, 8/50mm N=R	15.5	3.0						
	H							SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, grey, fine to coarse, sub-angular to sub-rounded gravel	M	D - VD	EXTREMELY WEATHERED
WB	VH					3.50m						
					15.0	3.5			Continued as Cored Drill Hole			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

CORE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH03

Job No: 8202118201 **Sheet:** 2 of 3

Position: E280285.178 N6138699.830 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 18.620 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Bit Type:** NMLC **Bit Condition:** Good **Contractor:** Total Drilling

Date Started: 21/6/21 **Date Completed:** 21/6/21 **Logged By:** BA **Checked By:** DR

Coring						Material Description				Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
				18.5	0.5							
				18.0	1.0							
				17.5	1.5							
				17.0	2.0							
				16.5	2.5							
				16.0	3.0							
				15.5	3.5		3.50m START CORING AT 3.50m					
NMLC	0% LOSS	92	79	15.0			CORE LOSS 0.16m (3.50-3.66) 3.66m SANDSTONE, medium to coarse grained, bedded, pale grey stained orange-brown to red-brown	MW				3.73 - 3.75 m: SM, 20 mm, Clay 3.78 m: DB 3.81 m: HB

DRILLING
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller
- PQ Rotary core (85mm)
- HQ Rotary core (63.5mm)
- NMLC Rotary core (51.94mm)
- DT Diatube concrete coring
- PT Push tube
- PS Percussion sampling
- SON Sonic drilling
- AH Air hammer

WATER
- Water Level on date shown
- water inflow
- water outflow

ROCK QUALITY DESCRIPTIONS
- RQD Rock Quality Designation (%)
- TCR Total Core Recovery (%)

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

ROCK WEATHERING
- FR Fresh
- SW Slightly Weathered
- DW Distinctly Weathered
- MW Moderately Weathered
- HW Highly Weathered
- XW Extremely Weathered

DEFECT TYPE
- JT Joint
- SZ Sheared zone
- BP Bedding Parting
- SM Seam
- FL Foliation
- VN Vein
- CL Cleavage
- CS Crushed Seam
- FZ Fracture Zone
- DL Drift Lift
- HB Handing Break
- DB Drilling Break

PLANARITY
- CU Curved
- DIS Discontinuous
- IR Irregular
- PR Planar
- ST Stepped
- UN Undulose

ROUGHNESS
- VR Very Rough
- RF Rough
- S Smooth
- SL Slockensided
- POL Polished

COATING
- CN Clean
- SN Stained
- VNR Veneer (thin or patchy)
- CT Coating (up to 1mm)

INFILL MATERIALS
- X Carbonaceus
- MU Unidentified minteral
- MS Secondary mineral
- KT Chlorite
- CA Calcite
- Fe Iron Oxide
- Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

CORE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH03

Job No: 8202118201 **Sheet:** 3 of 3

Position: E280285.178 N6138699.830 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 18.620 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Bit Type:** NMLC **Bit Condition:** Good **Contractor:** Total Drilling

Date Started: 21/6/21 **Date Completed:** 21/6/21 **Logged By:** BA **Checked By:** DR

Coring						Material Description			Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
NMLC	0% LOSS	92	79	14.5	4.5		SANDSTONE, medium to coarse grained, bedded, pale grey stained orange-brown to red-brown *(continued)*	MW				4.00 m: HB 4.41 m: BP, 10°, UN, RF, SN, Fe 4.85 m: BP, 5°, UN, RF, SN, Fe 4.91 m: BP, 10°, UN, RF, VNR, Clay 4.93 m: BP, 0°, UN, RF, VNR, Clay 4.94 - 5.00 m: SM, 5°, 60 mm, Clay
				14.0	5.0							5.10 m: BP, 5°, UN, RF, VNR, Clay 5.14 m: BP, 10°, UN, RF, VNR, Clay
				13.5	5.5							5.51 m: BP, 5°, UN, RF, CN
	0% LOSS	100	89	13.0	6.0							5.77 m: BP, 5°, UN, RF, SN, Fe 5.93 m: BP, 10°, UN, RF, SN, Fe 6.00 m: HB
				12.5	6.5			HW				6.41 m: JT, 60°, PR, RF, SN, Fe 6.50 m: JT, 20°, PR, RF, SN, Fe 6.58 m: JT, 20°, PR, RF, SN, Fe
				12.0	7.0	7.00m		SW				6.71 m: BP, 5°, UN, RF, CN 6.86 m: BP, 10°, UN, RF, CN, on Fossil 7.00 m: DB
				11.5	7.5		TERMINATED AT 7.00 m Target depth					
				11.0								

DRILLING
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller
PQ Rotary core (85mm)
HQ Rotary core (63.5mm)
NMLC Rotary core (51.94mm)
DT Diatube concrete coring
PT Push tube
PS Percussion sampling
SON Sonic drilling
AH Air hammer

WATER
Water Level on date shown
water inflow
water outflow

ROCK QUALITY DESCRIPTIONS
RQD Rock Quality Designation (%)
TCR Total Core Recovery (%)

ROCK STRENGTH
EH Extremly High
VH Very High
H High
M Medium
L Low
VL Very Low

ROCK WEATHERING
FR Fresh
SW Slightly Weathered
DW Distinctly Weathered
MW Moderately Weathered
HW Highly Weathered
XW Extremly Weathered

DEFECT TYPE
JT Joint
SZ Sheared zone
BP Bedding Parting
SM Seam
FL Foliation
VN Vein
CL Cleavage
CS Crushed Seam
FZ Fracture Zone
DL Drift Lift
HB Handing Break
DB Drilling Break

PLANARITY
CU Curved
DIS Discontinuous
IR Irregular
PR Planar
ST Stepped
UN Undulose

ROUGHNESS
VR Very Rough
RF Rough
S Smooth
SL Slockensided
POL Polished

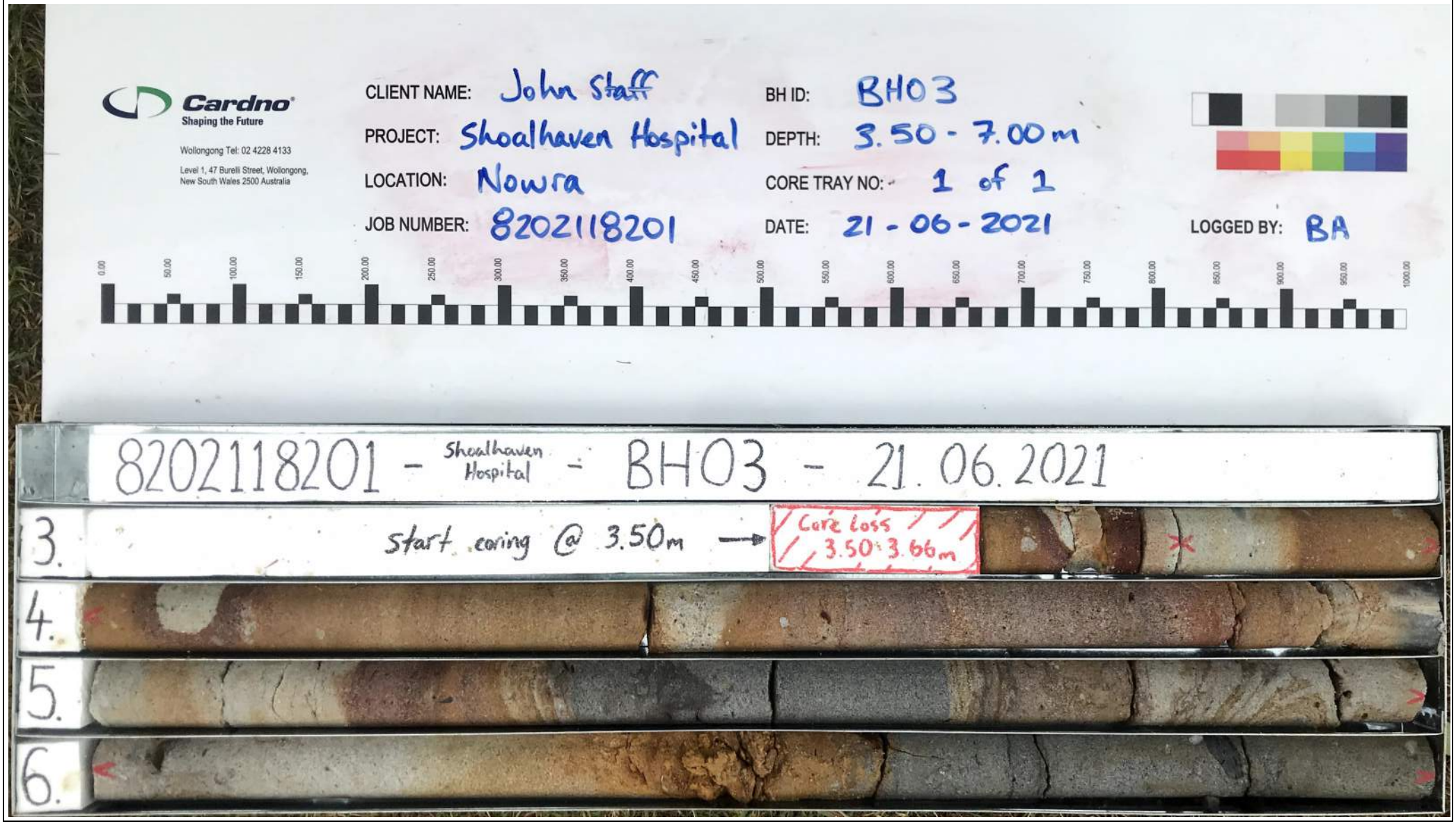
COATING
CN Clean
SN Stained
VNR Veneer (thin or patchy)
CT Coating (up to 1mm)

INFILL MATERIALS
X Carbonaceus
MU Unidentified minteral
MS Secondary mineral
KT Chlorite
CA Calcite
Fe Iron Oxide
Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno Shaping the Future	TITLE: **Borehole Core Photographs - BH03** Geotechnical Investigation - Shoalhaven Hospital GI			
	PROJECT NO: **8202118201**	TEST DATE: **21/06/2021**	INCLINATION: **-90 degree**	CORED LENGTH: **BOX 1 OF 1 - 3.50m to 7.00m - 3.50m Length**
	DRILL RIG: **Hanjin DB8**	CONTRACTOR: **Cardno & Total Drilling**	LOGGED BY: **BA**	CHECKED BY: **DR**



Cardno

BOREHOLE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH04

Job No: 8202118201 **Sheet:** 1 of 3

Position: E280228.451 N6138657.496 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 21.320 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Contractor:** Total Drilling

Date Started: 22/6/21 **Date Completed:** 22/6/21 **Logged By:** BA **Checked By:** DR

Drilling				Sampling & Testing	RL (m AHD)	Depth (m)	Material Description					
Method	Resistance	Casing	Water	Sample or Field Test			Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	E	HW	Not Encountered	ES 0.10 m	21.0	0.5		SM	Silty SAND: fine to coarse grained, dark grey and dark brown, trace fine to coarse grained sand 0.20m	M		TOPSOIL
				B 0.50 - 1.00 m ES 0.50 m SPT 0.50 - 0.95 m 3, 5, 5 N=10	20.5	1.0		CL-CI	Sandy CLAY: low to medium plasticity, orange-brown, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel 1.20m	M (>PL)	St	RESIDUAL SOIL
				1.00 m C 1.00 m								
	F			D 1.20 - 1.50 m	20.0	1.5		CL-CI	Sandy CLAY: low to medium plasticity, red-brown and grey, fine to coarse grained, sub-rounded to sub-angular sand, with fine to coarse, sub-rounded to sub-angular gravel	M (<PL)		
				SPT 1.50 - 1.95 m 8, 13, 21 N=34	19.5	2.0					VSt	
				D 2.70 - 3.00 m	19.0	2.5			2.70m			
WB	H			SPT 3.00 - 3.10 m 12/100mm N=R	18.5	3.0		SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, mottled red-brown and grey, fine to coarse, sub-angular to sub-rounded gravel	M	D - VD	EXTREMELY WEATHERED
	VH				18.0	3.5			3.50m			
									Continued as Cored Drill Hole			
					17.5							

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

CORE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH04

Job No: 8202118201 **Sheet:** 2 of 3

Position: E280228.451 N6138657.496 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 21.320 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Bit Type:** NMLC **Bit Condition:** Good **Contractor:** Total Drilling

Date Started: 22/6/21 **Date Completed:** 22/6/21 **Logged By:** BA **Checked By:** DR

Coring						Material Description				Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
				21.0	0.5							
				20.5	1.0							
				20.0	1.5							
				19.5	2.0							
				19.0	2.5							
				18.5	3.0							
				18.0	3.5		3.50m START CORING AT 3.50m					
NMLC	0% LOSS	100	87	17.5			SANDSTONE, medium to coarse grained, bedded, pale grey stained orange-brown to red-brown	MW				3.80 m: BP, 10°, CU, RF, VNR, 10 mm, Clay 3.83 - 3.84 m: SM, 10 mm, Clay 3.98 m: DB

DRILLING
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller
- PQ Rotary core (85mm)
- HQ Rotary core (63.5mm)
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- SON Sonic drilling
- AH Air hammer

WATER
- Water Level on date shown
- water inflow
- water outflow

ROCK QUALITY DESCRIPTIONS
- RQD Rock Quality Designation (%)
- TCR Total Core Recovery (%)

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

ROCK WEATHERING
- FR Fresh
- SW Slightly Weathered
- DW Distinctly Weathered
- MW Moderately Weathered
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- XW Extremely Weathered

DEFECT TYPE
- JT Joint
- SZ Sheared zone
- BP Bedding Parting
- SM Seam
- FL Foliation
- VN Vein
- CL Cleavage
- CS Crushed Seam
- FZ Fracture Zone
- DL Drift Lift
- HB Handing Break
- DB Drilling Break

PLANARITY
- CU Curved
- DIS Discontinuous
- IR Irregular
- PR Planar
- ST Stepped
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ROUGHNESS
- VR Very Rough
- RF Rough
- S Smooth
- SL Slockensided
- POL Polished

COATING
- CN Clean
- SN Stained
- VNR Veneer (thin or patchy)
- CT Coating (up to 1mm)

INFILL MATERIALS
- X Carbonaceus
- MU Unidentified minteral
- MS Secondary mineral
- KT Chlorite
- CA Calcite
- Fe Iron Oxide
- Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

CORE LOG SHEET

Hole No: BH04

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Job No: 8202118201 **Sheet:** 3 of 3

Position: E280228.451 N6138657.496 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 21.320 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: HW **Bit Type:** NMLC **Bit Condition:** Good **Contractor:** Total Drilling

Date Started: 22/6/21 **Date Completed:** 22/6/21 **Logged By:** BA **Checked By:** DR

Coring						Material Description			Defect Description		
Method	Fluid	TCR (%)	RQD (%)	RL (m AHD)	Depth (m)	Graphic Log	SOIL TYPE, plasticity or particle characteristic, colour, secondary & minor components ROCK NAME, grain size and type, colour, fabric and texture, inclusions & minor components	Weathering	Estimated Strength $Is_{(50)}$ MPa ●- Axial O- Diametral VL 0.1 L 0.3 M 1 H 3 VH 10 EH	Average Natural Defect Spacing (mm) 20 60 200 600 2000	Visual	Additional Data DEFECT TYPE, orientation, shape, roughness, infilling or coating, thickness, other
NMLC	0% LOSS	100	87	17.0	4.5		SANDSTONE, medium to coarse grained, bedded, pale grey stained orange-brown to red-brown *(continued)*	MW				4.00 m: HB 4.08 m: HB 4.18 m: BP, 10°, UN, RF, SN, Fe 4.23 m: JT, 20°, PR, RF, SN, Fe 4.25 m: JT, 30°, PR, RF, SN, Fe 4.30 m: BP, 10°, UN, RF, SN, Fe 4.48 - 4.50 m: SM, 5°, Clay 4.51 m: HF, 10° 4.54 m: HF, 10° 4.57 m: HF, 10°
				16.5	5.0			SW				4.73 m: JT, 10°, PR, RF, CN, on Fossil 4.86 m: HB 5.00 m: HB 5.10 m: BP, 10°, UN, RF, CN, on Fossil
				16.0	5.5			HW SW				5.37 m: BP, 10°, PR, RF, SN, Fe 5.40 m: BP, 10°, PR, RF, SN, Fe 5.45 m: BP, 20°, UN, RF, SN, Fe
	0% LOSS	100	100	15.5	6.0							5.66 m: DB 6.00 m: HB 6.09 m: BP, 20°, UN, RF, CN, on Fossil
				15.0	6.5							6.30 m: BP, 20°, UN, RF, CN, on Fossil
				14.5			6.90m					
					7.0		TERMINATED AT 6.90 m Target depth					
				14.0	7.5							
				13.5								

DRILLING
- AD/V Solid flight auger: V-Bit
- AD/T Solid flight auger: TC-Bit
- HFA Hollow flight auger
- WB Washbore drilling
- RR Rock roller
- PQ Rotary core (85mm)
- HQ Rotary core (63.5mm)
- NMLC Rotary core (51.94mm)
- DT Diatube concrete coring
- PT Push tube
- PS Percussion sampling
- SON Sonic drilling
- AH Air hammer

WATER
- Water Level on date shown
- water inflow
- water outflow

ROCK QUALITY DESCRIPTIONS
- RQD Rock Quality Designation (%)
- TCR Total Core Recovery (%)

ROCK STRENGTH
- EH Extremly High
- VH Very High
- H High
- M Medium
- L Low
- VL Very Low

ROCK WEATHERING
- FR Fresh
- SW Slightly Weathered
- DW Distinctly Weathered
- MW Moderately Weathered
- HW Highly Weathered
- XW Extremly Weathered

DEFECT TYPE
- JT Joint
- SZ Sheared zone
- BP Bedding Parting
- SM Seam
- FL Foliation
- VN Vein
- CL Cleavage
- CS Crushed Seam
- FZ Fracture Zone
- DL Drift Lift
- HB Handing Break
- DB Drilling Break

PLANARITY
- CU Curved
- DIS Discontinuous
- IR Irregular
- PR Planar
- ST Stepped
- UN Undulose

ROUGHNESS
- VR Very Rough
- RF Rough
- S Smooth
- SL Slockensided
- POL Polished

COATING
- CN Clean
- SN Stained
- VNR Veneer (thin or patchy)
- CT Coating (up to 1mm)

INFILL MATERIALS
- X Carbonaceus
- MU Unidentified minteral
- MS Secondary mineral
- KT Chlorite
- CA Calcite
- Fe Iron Oxide
- Qz Quartz

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno Shaping the Future	TITLE: **Borehole Core Photographs - BH04** Geotechnical Investigation - Shoalhaven Hospital GI			
	PROJECT NO: **8202118201**	TEST DATE: **22/06/2021**	INCLINATION: **-90 degree**	CORED LENGTH: **BOX 1 OF 1 - 3.50m to 6.90m - 3.40m Length**
	DRILL RIG: **Hanjin DB8**	CONTRACTOR: **Cardno & Total Drilling**	LOGGED BY: **BA**	CHECKED BY: **DR**

Cardno

BOREHOLE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH05

Job No: 8202118201 **Sheet:** 1 of 1

Position: E280248.930 N6138819.475 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 23.650 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: **Contractor:** Total Drilling

Date Started: 21/6/21 **Date Completed:** 21/6/21 **Logged By:** BA **Checked By:** DR

Drilling			Water	Sampling & Testing		RL (m AHD)	Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	(blows per 150 mm)			Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	H		Not Encountered			23.5	0			0.05m ASPHALT: 0.05m thick			PAVEMENT
	F								GC	Clayey Sandy GRAVEL: fine to medium, angular, grey to dark grey, fine to coarse grained sand	D		
										0.40m			
	E			SPT 0.50 - 0.95 m 6, 5, 5 N=10		23.0	0.5			FILL: Gravelly Sandy CLAY: low plasticity, brown, fine to coarse grained sand, fine to coarse gravel, trace fine to coarse, sub-rounded to sub-angular gravel			FILL
							1.0		CL		M (<PL)		
				D 1.20 - 1.50 m		22.5							
				SPT 1.50 - 1.95 m 4, 4, 5 N=9			1.5						
	F					22.0				1.70m			
							2.0		CI	Sandy CLAY: orange-brown, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (<PL)	St	RESIDUAL SOIL
						21.5				2.50m			
	H			D 2.50 - 2.70 m			2.5		SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, mottled red-brown and grey, fine to coarse, sub-angular to sub-rounded gravel	M	D - VD	EXTREMELY WEATHERED
	VH					21.0				2.75m			
										TERMINATED AT 2.75 m Refusal TC-Bit Auger Refusal			
						20.5	3.0						
							3.5						
						20.0							

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

BOREHOLE LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: BH06

Job No: 8202118201 **Sheet:** 1 of 1

Position: E280229.575 N6138785.184 56 MGA2020 **Angle from Horizontal:** 90° **Surface Elevation:** 22.430 m AHD

Rig Type: Hanjin D&B 8D **Mounting:** Track **Driller:** CM

Casing Diameter: **Contractor:** Total Drilling

Date Started: 22/6/21 **Date Completed:** 22/6/21 **Logged By:** BA **Checked By:** DR

Drilling: Method	Drilling: Resistance	Drilling: Casing	Water	Sampling & Testing: Sample or Field Test	RL (m AHD)	Depth (m)	Material Description: Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
AD/T	H		Not Encountered						ASPHALT: 0.05m thick			PAVEMENT
	F							GC	0.10m Clayey Sandy GRAVEL: fine to medium, angular, grey to dark grey, fine to coarse grained sand	M		
	E			SPT 0.50 - 0.95 m 3, 4, 4 N=8	22.0	0.5		CI	0.30m Sandy CLAY: mottled orange-brown, red-brown and grey, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (<PL)	St	RESIDUAL SOIL
	F			D 1.20 - 1.50 m	21.5	1.0						
	H			SPT 1.50 - 1.64 m 25/140mm N=R	21.0	1.5		SC	1.50m Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, orange-brown, fine to coarse, sub-angular to sub-rounded gravel	M	D - VD	EXTREMELY WEATHERED
	VH								1.80m TERMINATED AT 1.80 m Refusal TC-Bit Auger Refusal			
					20.5	2.0						
					20.0	2.5						
					19.5	3.0						
					19.0	3.5						
					18.5							

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: TP02

Job No: 8202118201 **Sheet:** 1 of 1

Position: **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: Backhoe **Excavation Method:** Excavator Bucket

Excavation Dimensions: 1.50m LONG AND 0.50m WIDE **Contractor:** Lynch Civil

Date Excavated: 17/6/21 **Logged By:** BA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	(blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E	Stable	Not Encountered	D 0.10 - 0.20 m ES 0.10 m PID 0.10 m 0.4 ppm		0.5		ML	FILL: Sandy SILT: low plasticity, dark brown, fine to coarse grained sand, trace fine gravel, trace rootlets, trace plastic	M (<PL)		FILL
									0.20m			
								SC	FILL: Clayey SAND: fine to coarse grained, orange-brown	M		
									0.50m			
	F			ES 0.50 m PID 0.50 m 1.1 ppm PP 0.70 m =200 - 250 kPa ES 1.00 m PID 1.00 m 1.7 ppm		1.0		Cl	Sandy CLAY: mottled orange-brown, red-brown and grey, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (>PL)	St	RESIDUAL SOIL
									1.10m			
	H			D 1.20 - 0.40 m				SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, mottled red-brown and grey, fine to coarse, sub-angular to sub-rounded gravel	M	D - VD	EXTREMELY WEATHERED
	VH								1.40m			
					25/90mm R	1.5			TERMINATED AT 1.40 m Refusal Backhoe Bucket Refusal			
						2.0						
						2.5						
						3.0						
						3.5						

METHOD

EX	Excavator bucket
R	Ripper
HA	Hand auger
PT	Push tube
SON	Sonic drilling
AH	Air hammer
PS	Percussion sampler
AS	Short spiral auger
AD/V	Solid flight auger: V-Bit
AD/T	Solid flight auger: TC-Bit
HFA	Hollow flight auger
WB	Washbore drilling
RR	Rock roller

PENETRATION

VE	Very Easy (No Resistance)
E	Easy
F	Firm
H	Hard
VH	Very Hard (Refusal)

WATER

Water Level on Date shown
water inflow
water outflow

FIELD TESTS

SPT	-	Standard Penetration Test
HP	-	Hand/Pocket Penetrometer
DCP	-	Dynamic Cone Penetrometer
PSP	-	Perth Sand Penetrometer
MC	-	Moisture Content
PBT	-	Plate Bearing Test
IMP	-	Borehole Impression Test
PID	-	Photoionisation Detector
VS	-	Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES

B	-	Bulk disturbed sample
D	-	Disturbed sample
ES	-	Environmental sample
U	-	Thin wall tube 'undisturbed'

MOISTURE

D	-	Dry
M	-	Moist
W	-	Wet
PL	-	Plastic limit
LL	-	Liquid limit
w	-	Moisture content

SOIL CONSISTENCY

VS	-	Very Soft
S	-	Soft
F	-	Firm
St	-	Stiff
VSt	-	Very Stiff
H	-	Hard

RELATIVE DENSITY

VL	-	Very Loose
L	-	Loose
MD	-	Medium Dense
D	-	Dense
VD	-	Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: TP03

Job No: 8202118201 **Sheet:** 1 of 1

Position: **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: Backhoe **Excavation Method:** Excavator Bucket

Excavation Dimensions: 1.50m LONG AND 0.50m WIDE **Contractor:** Lynch Civil

Date Excavated: 17/6/21 **Logged By:** BA **Checked By:** DR

Excavation				Sampling & Testing			Material Description					
Method	Resistance	Stability	Water	Sample or Field Test	(blows per 150 mm) 1 3 6 12	Depth (m)	Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E	Stable	Not Encountered	ES 0.10 m PID 0.10 m 0.5 ppm		0		SM	FILL: Silty SAND: fine to coarse grained, dark grey, trace rootlets, trace ceramics			FILL
									0.30m			
				ES 0.50 m PID 0.50 m 0.8 ppm		0.5		SC	FILL: Clayey SAND: fine to coarse grained, orange-brown, trace fine to coarse, sub-rounded to sub-angular gravel	M		
									0.90m			
	F			ES 1.00 m PP 1.00 m =200 - 250 kPa PID 1.00 m 0.3 ppm	11/30mm R	1.0		Cl	Sandy CLAY: mottled orange-brown, red-brown and grey, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (<PL)	VSt	RESIDUAL SOIL
				D 1.40 - 1.60 m		1.5						
	H								1.70m			
	VH			D 1.80 - 1.90 m				SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, mottled red-brown and grey, fine to coarse, sub-angular to sub-rounded gravel	D - M	D - VD	EXTREMELY WEATHERED
									1.90m			
						2.0			TERMINATED AT 1.90 m Refusal Backhoe Bucket Refusal			
						2.5						
						3.0						
						3.5						

METHOD

EX	Excavator bucket
R	Ripper
HA	Hand auger
PT	Push tube
SON	Sonic drilling
AH	Air hammer
PS	Percussion sampler
AS	Short spiral auger
AD/V	Solid flight auger: V-Bit
AD/T	Solid flight auger: TC-Bit
HFA	Hollow flight auger
WB	Washbore drilling
RR	Rock roller

PENETRATION

VE	Very Easy (No Resistance)
E	Easy
F	Firm
H	Hard
VH	Very Hard (Refusal)

WATER

Water Level on Date shown
water inflow
water outflow

FIELD TESTS

SPT	-	Standard Penetration Test
HP	-	Hand/Pocket Penetrometer
DCP	-	Dynamic Cone Penetrometer
PSP	-	Perth Sand Penetrometer
MC	-	Moisture Content
PBT	-	Plate Bearing Test
IMP	-	Borehole Impression Test
PID	-	Photoionisation Detector
VS	-	Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES

B	-	Bulk disturbed sample
D	-	Disturbed sample
ES	-	Environmental sample
U	-	Thin wall tube 'undisturbed'

MOISTURE

D	-	Dry
M	-	Moist
W	-	Wet
PL	-	Plastic limit
LL	-	Liquid limit
w	-	Moisture content

SOIL CONSISTENCY

VS	-	Very Soft
S	-	Soft
F	-	Firm
St	-	Stiff
VSt	-	Very Stiff
H	-	Hard

RELATIVE DENSITY

VL	-	Very Loose
L	-	Loose
MD	-	Medium Dense
D	-	Dense
VD	-	Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

TEST PIT LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: TP04

Job No: 8202118201 **Sheet:** 1 of 1

Position: **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: Backhoe **Excavation Method:** Excavator Bucket

Excavation Dimensions: 1.50m LONG AND 0.50m WIDE **Contractor:** Lynch Civil

Date Excavated: 17/6/21 **Logged By:** BA **Checked By:** DR

Excavation				Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability	Water	Sample or Field Test	(blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E	Stable	Not Encountered	D 0.10 - 0.20 m ES 0.10 m PID 0.10 m 1.1 ppm		0		SM	FILL: Silty SAND: fine to coarse grained, dark grey, trace rootlets	M		FILL
									0.30m			
				ES 0.50 m PID 0.50 m 1.5 ppm		0.5		SC	FILL: Clayey SAND: fine to coarse grained, orange-brown, trace fine to coarse, sub-angular to sub-rounded gravel			
									0.70m			
	F			D 1.00 - 1.20 m ES 1.00 m PID 1.00 m 1.1 ppm		1.0		CI	Sandy CLAY: mottled orange-brown, red-brown and grey, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (>PL)	F St	RESIDUAL SOIL
									1.50m			
	H			D 1.50 - 1.60 m		1.5		SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, mottled red-brown and grey, fine to coarse, sub-angular to sub-rounded gravel	M	D - VD	EXTREMELY WEATHERED
	VH								1.80m			
					10/14mm R	2.0 2.5 3.0 3.5			TERMINATED AT 1.80 m Refusal Backhoe Bucket Refusal			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: TP05

Job No: 8202118201 **Sheet:** 1 of 1

Position: **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: Backhoe **Excavation Method:** Excavator Bucket

Excavation Dimensions: 1.50m LONG AND 0.50m WIDE **Contractor:** Lynch Civil

Date Excavated: 17/6/21 **Logged By:** BA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	(blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E	Stable	Not Encountered	ES 0.10 m PID 0.10 m 1 ppm D 0.20 - 0.40 m		0		SM	FILL: Silty SAND: fine to coarse grained, dark grey and dark brown, trace rootlets, trace ceramics, trace charcoal			FILL
				ES 0.50 m PID 0.50 m 1.2 ppm D 0.60 - 0.80 m		0.5			0.50m FILL: Clayey SAND: fine to coarse grained, orange-brown, trace fine to coarse, sub-angular to sub-rounded gravel, trace rootlets			
	F			ES 1.00 m PID 1.00 m 0.5 ppm PP 1.20 m =300 - 350 kPa		1.0		SC	1.00m Sandy CLAY: mottled orange-brown, red-brown and grey, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (>PL)	St	RESIDUAL SOIL
	VH				10/10mm,R	1.5		CI	1.50m TERMINATED AT 1.50 m Refusal Backhoe Bucket Refusal	M (<PL)	VSt	
						2.0						
						2.5						
						3.0						
						3.5						

METHOD

EX	Excavator bucket
R	Ripper
HA	Hand auger
PT	Push tube
SON	Sonic drilling
AH	Air hammer
PS	Percussion sampler
AS	Short spiral auger
AD/V	Solid flight auger: V-Bit
AD/T	Solid flight auger: TC-Bit
HFA	Hollow flight auger
WB	Washbore drilling
RR	Rock roller

PENETRATION

VE	Very Easy (No Resistance)
E	Easy
F	Firm
H	Hard
VH	Very Hard (Refusal)

WATER

Water Level on Date shown
water inflow
water outflow

FIELD TESTS

SPT	-	Standard Penetration Test
HP	-	Hand/Pocket Penetrometer
DCP	-	Dynamic Cone Penetrometer
PSP	-	Perth Sand Penetrometer
MC	-	Moisture Content
PBT	-	Plate Bearing Test
IMP	-	Borehole Impression Test
PID	-	Photoionisation Detector
VS	-	Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES

B	-	Bulk disturbed sample
D	-	Disturbed sample
ES	-	Environmental sample
U	-	Thin wall tube 'undisturbed'

MOISTURE

D	-	Dry
M	-	Moist
W	-	Wet
PL	-	Plastic limit
LL	-	Liquid limit
w	-	Moisture content

SOIL CONSISTENCY

VS	-	Very Soft
S	-	Soft
F	-	Firm
St	-	Stiff
VSt	-	Very Stiff
H	-	Hard

RELATIVE DENSITY

VL	-	Very Loose
L	-	Loose
MD	-	Medium Dense
D	-	Dense
VD	-	Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: TP06

Job No: 8202118201 **Sheet:** 1 of 1

Position: **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: Backhoe **Excavation Method:** Excavator Bucket

Excavation Dimensions: 1.50m LONG AND 0.50m WIDE **Contractor:** Lynch Civil

Date Excavated: 17/6/21 **Logged By:** BA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	(blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E	Stable	Not Encountered	ES 0.10 m PID 0.10 m 0.5 ppm		0.5		SM	FILL: Silty SAND: fine to coarse grained, dark grey, trace rootlets 0.20m	M		FILL
								SC	FILL: Clayey SAND: fine to coarse grained, orange-brown, trace fine to coarse, sub-angular to sub-rounded gravel 0.50m			
	F			ES 0.50 m PID 0.50 m 0.8 ppm		1.0		CI	Sandy CLAY: mottled orange-brown, red-brown and grey, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (>PL)	St	RESIDUAL SOIL
				D 1.00 - 1.20 m ES 1.00 m PP 1.00 m =200 - 250 kPa PID 1.00 m 0.7 ppm		1.5				M (<PL)	VSt	
	H			PP 2.00 m =250 - 300 kPa		2.0		SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, mottled red-brown and grey, fine to coarse, sub-angular to sub-rounded gravel 2.40m	M	VD	EXTREMELY WEATHERED
	VH				25/90mm R							
						2.5			TERMINATED AT 2.40 m Refusal Backhoe Bucket Refusal			
						3.0						
						3.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

TEST PIT LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: TP07

Job No: 8202118201 **Sheet:** 1 of 1

Position: **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: Backhoe **Excavation Method:** Excavator Bucket

Excavation Dimensions: 1.50m LONG AND 0.50m WIDE **Contractor:** Lynch Civil

Date Excavated: 17/6/21 **Logged By:** BA **Checked By:** DR

Excavation				Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability	Water	Sample or Field Test	(blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E	Stable	Not Encountered	ES 0.10 m PID 0.10 m 0.6 ppm		0		SM	FILL: Silty SAND: fine to coarse grained, dark brown, trace rootlets	M		FILL
									0.30m			
	F			D 0.40 - 0.60 m ES 0.50 m PID 0.50 m 0.9 ppm		0.5		CI	Sandy CLAY: mottled orange-brown, red-brown and grey, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (<PL)	F St	RESIDUAL SOIL
										M (<PL)	VSt	
									0.90m			
	H			D 1.00 - 1.20 m	9/40mm R	1.0		SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, mottled red-brown and grey, fine to coarse, sub-angular to sub-rounded gravel	M (<PL)	H	EXTREMELY WEATHERED
	VH								1.40m			
						1.5			TERMINATED AT 1.40 m Refusal Backhoe Bucket Refusal			
						2.0						
						2.5						
						3.0						
						3.5						

METHOD

EX	Excavator bucket
R	Ripper
HA	Hand auger
PT	Push tube
SON	Sonic drilling
AH	Air hammer
PS	Percussion sampler
AS	Short spiral auger
AD/V	Solid flight auger: V-Bit
AD/T	Solid flight auger: TC-Bit
HFA	Hollow flight auger
WB	Washbore drilling
RR	Rock roller

PENETRATION

VE	Very Easy (No Resistance)
E	Easy
F	Firm
H	Hard
VH	Very Hard (Refusal)

WATER

Water Level on Date shown
water inflow
water outflow

FIELD TESTS

SPT	-	Standard Penetration Test
HP	-	Hand/Pocket Penetrometer
DCP	-	Dynamic Cone Penetrometer
PSP	-	Perth Sand Penetrometer
MC	-	Moisture Content
PBT	-	Plate Bearing Test
IMP	-	Borehole Impression Test
PID	-	Photoionisation Detector
VS	-	Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES

B	-	Bulk disturbed sample
D	-	Disturbed sample
ES	-	Environmental sample
U	-	Thin wall tube 'undisturbed'

MOISTURE

D	-	Dry
M	-	Moist
W	-	Wet
PL	-	Plastic limit
LL	-	Liquid limit
w	-	Moisture content

SOIL CONSISTENCY

VS	-	Very Soft
S	-	Soft
F	-	Firm
St	-	Stiff
VSt	-	Very Stiff
H	-	Hard

RELATIVE DENSITY

VL	-	Very Loose
L	-	Loose
MD	-	Medium Dense
D	-	Dense
VD	-	Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: TP08

Job No: 8202118201 **Sheet:** 1 of 1

Position: **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: Backhoe **Excavation Method:** Excavator Bucket

Excavation Dimensions: 1.50m LONG AND 0.50m WIDE **Contractor:** Lynch Civil

Date Excavated: 17/6/21 **Logged By:** CL **Checked By:** CC

Excavation			Water	Sampling & Testing	Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX		Stable	Not Encountered	ES 0.10 m PID 0.10 m 0.4 ppm	0.5		SM	FILL: Silty SAND: fine to coarse grained, dark brown, trace fine to coarse sub-rounded gravel, trace fine to coarse sub-rounded cobbles, no odour observed	D to M		FILL 0.00 m: Organic matter (grass and rootlets) Trace glass, brick and fine to coarse grained sandstone boulders observed Frequent wood observed
				ES 0.50 m PID 0.50 m 0.1 ppm				0.90m			
				ES 1.00 m PID 1.00 m 0.4 ppm	1.0		CI	Sandy CLAY: medium plasticity, pale brown to orange-brown, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel, no odour observed	M		RESIDUAL SOIL 0.90 m: Organic matter (grass and rootlets) Trace wood observed
								1.40m			
					1.5			TERMINATED AT 1.40 m Target depth Target Depth Reached			
					2.0						
					2.5						
					3.0						
					3.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

TEST PIT LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: TP09

Job No: 8202118201 **Sheet:** 1 of 1

Position: **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: Backhoe **Excavation Method:** Excavator Bucket

Excavation Dimensions: 1.50m LONG AND 0.50m WIDE **Contractor:** Lynch Civil

Date Excavated: 17/6/21 **Logged By:** BA **Checked By:** DR

Excavation			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test	(blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX	E	Stable	Not Encountered	ES 0.10 m PID 0.10 m 0.1 ppm		0.5		SM	FILL: Silty SAND: fine to coarse grained, dark brown, trace fine to coarse sub-rounded gravel, trace cobbles, trace rootlets, trace hessian, plastic and aluminium	M		FILL
				D 0.40 - 0.50 m ES 0.50 m PID 0.50 m 0.4 ppm					0.80m			
	F			D 1.00 - 1.20 m ES 1.00 m PID 1.00 m 0.3 ppm		1.0		Cl	Sandy CLAY: pale brown to orange-brown, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse, sub-rounded to sub-angular gravel	M (>PL)	St	RESIDUAL SOIL
	H								1.30m			
	VH			D 1.50 - 1.70 m ES 1.50 m PID 1.50 m 0.3 ppm		1.5		SC	Clayey Gravelly SAND: fine to coarse grained, sub-rounded to sub-angular, mottled red-brown and grey, fine to coarse, sub-angular to sub-rounded gravel	M	D - VD	EXTREMELY WEATHERED
									1.70m			
					Refusal	2.0 2.5 3.0 3.5			TERMINATED AT 1.70 m Refusal Backhoe Bucket Refusal			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

TEST PIT LOG SHEET

Client: NSW Health Infrastructure
Project: Shoalhaven Hospital
Location: Scenic Drive, Nowra NSW 2541

Hole No: TP10

Job No: 8202118201 **Sheet:** 1 of 1

Position: **Angle from Horizontal:** 90° **Surface Elevation:**

Machine Type: Backhoe **Excavation Method:** Excavator Bucket

Excavation Dimensions: 1.50m LONG AND 0.50m WIDE **Contractor:** Lynch Civil

Date Excavated: 17/6/21 **Logged By:** CL **Checked By:** CC

Excavation			Water	Sampling & Testing	Depth (m)	Material Description					
Method	Resistance	Stability		Sample or Field Test		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
EX		Stable	Not Encountered	ES 0.10 m QA/QC100 PID 0.10 m 0.2 ppm ES 0.30 m PID 0.30 m 0.7 ppm ES 1.00 m PID 1.00 m 0.3 ppm	0.5 1.0		SP-SC	0.05m ASPHALT: 0.05m thick, no odour observed FILL: Gravelly SAND: fine to coarse grained, gap graded, sub-rounded to sub-angular, orange / brown, fine to coarse grained, sub-rounded to sub-angular gravel, with fine to coarse grained, sub-rounded to sub-angular cobbles, no odour observed	D D to M		PAVEMENT FILL 0.05 m: Organic matter (grass and rootlets)
							SC	0.25m FILL: Clayey SAND: fine to coarse grained, well graded, sub-rounded to sub-angular, light brown, low to medium plasticity clay, trace fine to coarse grained, sub-rounded to sub-angular gravel, no odour observed	M		0.25 m: Organic matter (grass and rootlets)
							CL-CI	0.60m Sandy CLAY: low to medium plasticity, orange / brown, fine to coarse grained, sub-rounded to sub-angular sand, trace fine to coarse grained, sub-rounded to sub-angular gravel, no odour observed	M		RESIDUAL SOIL 0.60 m: Organic matter (rootlets) observed
					1.5 2.0 2.5 3.0 3.5			1.20m TERMINATED AT 1.20 m Target depth Target Depth Reached			

METHOD

EX	Excavator bucket
R	Ripper
HA	Hand auger
PT	Push tube
SON	Sonic drilling
AH	Air hammer
PS	Percussion sampler
AS	Short spiral auger
AD/V	Solid flight auger: V-Bit
AD/T	Solid flight auger: TC-Bit
HFA	Hollow flight auger
WB	Washbore drilling
RR	Rock roller

PENETRATION

VE	Very Easy (No Resistance)
E	Easy
F	Firm
H	Hard
VH	Very Hard (Refusal)

WATER

Water Level on Date shown
water inflow
water outflow

FIELD TESTS

SPT	-	Standard Penetration Test
HP	-	Hand/Pocket Penetrometer
DCP	-	Dynamic Cone Penetrometer
PSP	-	Perth Sand Penetrometer
MC	-	Moisture Content
PBT	-	Plate Bearing Test
IMP	-	Borehole Impression Test
PID	-	Photoionisation Detector
VS	-	Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES

B	-	Bulk disturbed sample
D	-	Disturbed sample
ES	-	Environmental sample
U	-	Thin wall tube 'undisturbed'

MOISTURE

D	-	Dry
M	-	Moist
W	-	Wet
PL	-	Plastic limit
LL	-	Liquid limit
w	-	Moisture content

SOIL CONSISTENCY

VS	-	Very Soft
S	-	Soft
F	-	Firm
St	-	Stiff
VSt	-	Very Stiff
H	-	Hard

RELATIVE DENSITY

VL	-	Very Loose
L	-	Loose
MD	-	Medium Dense
D	-	Dense
VD	-	Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

HAND AUGER SHEET

Client: JohnStaff
Project: Shoalhaven Hospital Redevelopment Additional GI
Location: Nowra, NSW

Hole No: HA01

Job No: 82021182-02 **Sheet:** 1 of 1

Position: E280194.000 N6138605.000 56 MGA94 **Angle from Horizontal:** 90° **Surface Elevation:**

Equipment: Hand Auger

Casing Diameter: **Contractor:** Cardno

Data Started: 28/10/21 **Logged By:** DP **Checked By:** DO

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
HA			Dry	D 0.03 - 0.15 m				SP	0.03m SAND: fine to coarse grained, grey, with low plasticity clay, trace roots and rootlets (<2mm)	D		TOPSOIL
								SC	Clayey SAND: fine to coarse grained, brown, low plasticity clay	D to M	MD	0.00 m: grass over RESIDUAL SOIL
	E			D 0.15 - 0.40 m					0.15m			
								Cl	Sandy CLAY: medium plasticity, brown, fine to coarse sand, trace clayey sand beds (<2mm)	M (<PL)	St	
									0.40m		F	
	F			D 0.40 - 0.85 m		0.5		Cl	Sandy CLAY: medium plasticity, brown and orange-brown, fine to coarse sand, trace fine, sub-angular gravel	M (≈PL)	F to St	
				D 0.85 - 0.92 m					0.85-0.92m: trace fine to coarse, sub-angular gravel 0.92m		St	
						1.0			TERMINATED AT 0.92 m Hand Auger Refusal			
						1.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

HAND AUGER SHEET

Client: JohnStaff
Project: Shoalhaven Hospital Redevelopment Additional GI
Location: Nowra, NSW

Hole No: HA02

Job No: 82021182-02 **Sheet:** 1 of 1

Position: E280207.000 N6138628.000 56 MGA94 **Angle from Horizontal:** 90° **Surface Elevation:**

Equipment: Hand Auger

Casing Diameter: Nil **Contractor:** Cardno

Data Started: 28/10/21 **Logged By:** DP **Checked By:** DO

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
HA	E		Dry	D 0.00 - 0.04 m				SC	0.04m Clayey SAND: fine to coarse grained, dark grey-brown, low plasticity clay, trace fine to medium, sub-rounded to sub-angular gravel, trace roots and rootlets (<2mm)			TOPSOIL 0.00 m: grass over RESIDUAL SOIL
				D 0.04 - 0.30 m				SC	Clayey SAND: fine to coarse grained, brown and orange-brown, low plasticity clay, trace fine to medium, sub-angular gravel 0.20-0.30m: becoming sandy clay	D to M	MD	
				D 0.30 - 0.35 m					0.30m			
	F			D 0.35 - 1.00 m		0.5		Cl	0.35m Sandy CLAY: medium plasticity, brown and pale orange-brown, fine to coarse sand Sandy CLAY: medium plasticity, pale brown, fine to coarse sand, trace fine, sub-angular gravel	M (≈PL)	S to F	
										M (<PL)	F to St	
						1.0			1.02m		St	
						1.5			TERMINATED AT 1.02 m Hand Auger Refusal			

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Cardno

HAND AUGER SHEET

Client: JohnStaff
Project: Shoalhaven Hospital Redevelopment Additional GI
Location: Nowra, NSW

Hole No: HA03

Job No: 82021182-02 **Sheet:** 1 of 1

Position: E280183.000 N6138652.000 56 MGA94 **Angle from Horizontal:** 90° **Surface Elevation:**

Equipment: Hand Auger

Casing Diameter: Nil **Contractor:** Cardno

Data Started: 28/10/21 **Logged By:** DP **Checked By:** DO

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
HA			Dry					SC	0.04m Clayey SAND: fine to coarse grained, dark grey, low plasticity clay, trace roots and rootlets (<2mm)			TOPSOIL 0.00 m: grass over RESIDUAL SOIL
								SC	Clayey SAND: fine to coarse grained, dark grey, low plasticity clay, trace fine, sub-angular gravel			
	E			D 0.04 - 0.20 m					0.20m	D to M	MD	
				D 0.20 - 0.40 m				SC	Clayey SAND: fine to coarse grained, brown, low plasticity clay, trace fine to medium, sub-rounded to sub-angular gravel, trace pockets of clay (<10mm)			
									0.40m			
				D 0.40 - 0.55 m		0.5		CI	Sandy CLAY: medium plasticity, brown and orange-brown, fine to coarse sand			
									0.55m			
	F			D 0.55 - 0.86 m				CI	Sandy CLAY: medium plasticity, orange-brown, fine to coarse sand, trace fine to coarse, sub-rounded to angular gravel	M (<PL)	St	
									0.86m			
									TERMINATED AT 0.86 m Hand Auger Refusal			
						1.0						
						1.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

HAND AUGER SHEET

Client: JohnStaff
Project: Shoalhaven Hospital Redevelopment Additional GI
Location: Nowra, NSW

Hole No: HA04

Job No: 82021182-02 **Sheet:** 1 of 1

Position: E280214.000 N6138664.000 56 MGA94 **Angle from Horizontal:** 90° **Surface Elevation:**

Equipment: Hand Auger

Casing Diameter: Nil **Contractor:** Cardno

Data Started: 28/10/21 **Logged By:** DP **Checked By:** DO

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
HA			Dry	D 0.04 - 0.20 m				SC	0.04m Clayey SAND: fine to coarse grained, dark grey, trace roots and rootlets (<2mm)			TOPSOIL 0.00 m: grass over RESIDUAL SOIL
								SC	Clayey SAND: fine to coarse grained, dark grey, trace fine, sub-rounded gravel	D to M	MD	
	E			D 0.20 - 0.50 m					0.20m			
								CL-CI	Sandy CLAY: low to medium plasticity, brown and dark grey-brown, fine to coarse sand, trace fine, sub-rounded gravel		F to St	
									0.50m			
	F			D 0.50 - 0.91 m		0.5		SC	Clayey SAND: fine to coarse grained, brown and orange-brown trace red-brown, fine to coarse clay, with fine, sub-angular gravel	M (<PL)	St	
									0.91m			
									TERMINATED AT 0.91 m Hand Auger Refusal			
						1.0						
						1.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
W - Wet
PL - Plastic limit
LL - Liquid limit
w - Moisture content

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VS - Very Soft
S - Soft
F - Firm
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VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
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VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

HAND AUGER SHEET

Client: JohnStaff
Project: Shoalhaven Hospital Redevelopment Additional GI
Location: Nowra, NSW

Hole No: HA05

Job No: 82021182-02 **Sheet:** 1 of 1

Position: E280187.000 N6138682.000 56 MGA94 **Angle from Horizontal:** 90° **Surface Elevation:**

Equipment: Hand Auger

Casing Diameter: Nil **Contractor:** Cardno

Data Started: 28/10/21 **Logged By:** DP **Checked By:** DO

Drilling			Water	Sampling & Testing		Depth (m)	Material Description					
Method	Resistance	Casing		Sample or Field Test	DCP (blows per 150 mm) 1 3 6 12		Graphic Log	Classification	SOIL TYPE, plasticity or particle characteristic, colour, secondary and minor components ROCK TYPE, grain size and type, colour, fabric & texture, strength, weathering, defects and structure	Moisture Condition	Consistency Relative Density	STRUCTURE & Other Observations
HA								SC	0.04m Clayey SAND: fine to coarse grained, dark grey, low plasticity clay, trace roots and rootlets (<2mm)	D		TOPSOIL 0.00 m: grass over RESIDUAL SOIL
								SC	Clayey SAND: fine to coarse grained, dark grey, low plasticity clay			
	E			D 0.15 - 0.35 m					0.15m			
								SC	Clayey SAND: fine to coarse grained, dark grey and brown, low plasticity clay, trace fine to medium, angular gravel	D to M	MD	
			Dry	D 0.35 - 0.65 m		0.5			0.35m			
								Cl	Sandy CLAY: medium plasticity, brown and orange-brown, fine to coarse sand, trace fine to coarse, sub-rounded to sub-angular gravel		F to St	
	F								0.60m	M (<PL)		
				D 0.65 - 0.83 m				Cl	Sandy CLAY: medium plasticity, orange-brown and red-brown, fine to coarse sand, trace fine to medium, sub-angular gravel		VSt	
									0.83m		H	
						1.0			TERMINATED AT 0.83 m Hand Auger Refusal			
						1.5						

METHOD
EX Excavator bucket
R Ripper
HA Hand auger
PT Push tube
SON Sonic drilling
AH Air hammer
PS Percussion sampler
AS Short spiral auger
AD/V Solid flight auger: V-Bit
AD/T Solid flight auger: TC-Bit
HFA Hollow flight auger
WB Washbore drilling
RR Rock roller

PENETRATION
VE Very Easy (No Resistance)
E Easy
F Firm
H Hard
VH Very Hard (Refusal)

WATER
Water Level on Date shown
water inflow
water outflow

FIELD TESTS
SPT - Standard Penetration Test
HP - Hand/Pocket Penetrometer
DCP - Dynamic Cone Penetrometer
PSP - Perth Sand Penetrometer
MC - Moisture Content
PBT - Plate Bearing Test
IMP - Borehole Impression Test
PID - Photoionisation Detector
VS - Vane Shear; P=Peak, R=Resdual (uncorrected kPa)

SAMPLES
B - Bulk disturbed sample
D - Disturbed sample
ES - Environmental sample
U - Thin wall tube 'undisturbed'

MOISTURE
D - Dry
M - Moist
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PL - Plastic limit
LL - Liquid limit
w - Moisture content

SOIL CONSISTENCY
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard

RELATIVE DENSITY
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Refer to explanatory notes for details of abbreviations and basis of descriptions

CARDNO (NSW/ACT) PTY LTD

Shoalhaven Hospital Redevelopment

APPENDIX C

LABORATORY CERTIFICATES

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

Telephone: 02 4256 1684
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

Report on Moisture Content, Emerson Class, Soil pH, EC and PASS/AASS

Client:	Cardno	Report No:	**454**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	26/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request/Order:	8202118201
Material Description:	-	Lot Number:	-
Lot Boundaries:	Chainage - to -. Offsets - to -.	ITP/PCP Number:	-
Lot Comments:	-	Control Line:	BH01-SPT01

Sample Number:		**39662**	**39663**	**39665**	**39667**	**39669**
Field Sample/Test Date:		22/06/2021	21/06/2021	22/06/2021	22/06/2021	17/06/2021
Lab Test Date (Moisture):		7/07/2021	7/07/2021	7/07/2021	7/07/2021	7/07/2021
Chainage / Location:	(m)	-	-	-	-	-
Offset from control line:	(m)	-	-	-	-	-
Level of Test:	(m)	BH01-SPT01	BH02-D01	BH04-B01	BH04-D01	TP02-D01
Test Depth:	(mm)	0.50-0.95	1.20-1.50	0.50-1.00	1.20-1.50	0.10-0.20
Moisture Content:	**(%)**	**12.9**	**25.1**	**28.4**	**25.8**	**14.2**
Test Water Used:		Distilled	-	Distilled	-	-
Temperature of Water:	(°C)	15	-	15	-	-
Soil Description:		CI,Silty CLAY	-	CI,Silty CLAY	-	-
Emerson Class Number:		**CLASS 4**	**-**	**CLASS 4**	**-**	**-**
Soil-suspension made of 30g soil & :		-	-	-	-	-
pH Value of Soil-suspension:	**(pH)**	**-**	**-**	**-**	**-**	**-**
Field pH:	**(pH_F)**	**-**	**-**	**-**	**-**	**-**
Field pH Oxidised:	**(pH_{FOX})**	**-**	**-**	**-**	**-**	**-**
Acid Sulfate Soil Indication:		**-**	**-**	**-**	**-**	**-**
Electrical Conductivity:	**(mS)**	**-**	**-**	**-**	**-**	**-**

Sample Number:		**39671**	**39672**	**39674**	**39675**	**39676**
Field Sample/Test Date:		17/06/2021	17/06/2021	17/06/2021	17/06/2021	17/06/2021
Lab Test Date (Moisture):		7/07/2021	7/07/2021	7/07/2021	7/07/2021	7/07/2021
Chainage / Location:	(m)	-	-	-	-	-
Offset from control line:	(m)	-	-	-	-	-
Level of Test:	(m)	TP04-D02	TP05-D02	TP07-D01	TP09-D01	TP09-D02
Test Depth:	(mm)	1.00-1.20	0.60-0.80	0.40-0.60	0.40-0.50	1.00-1.20
Moisture Content:	**(%)**	**23.1**	**11**	**23.2**	**10.9**	**17.4**
Test Water Used:		-	Distilled	-	Distilled	-
Temperature of Water:	(°C)	-	15	-	15	-
Soil Description:		-	CL,Sandy CLAY	-	SM,Silty SAND	-
Emerson Class Number:		**-**	**CLASS 4**	**-**	**CLASS 4**	**-**
Soil-suspension made of 30g soil & :		-	-	-	-	-
pH Value of Soil-suspension:	**(pH)**	**-**	**-**	**-**	**-**	**-**
Field pH:	**(pH_F)**	**-**	**-**	**-**	**-**	**-**
Field pH Oxidised:	**(pH_{FOX})**	**-**	**-**	**-**	**-**	**-**
Acid Sulfate Soil Indication:		**-**	**-**	**-**	**-**	**-**
Electrical Conductivity:	**(mS)**	**-**	**-**	**-**	**-**	**-**

Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Customer: Results apply to the sample/s as received. **
AS 1289.1.1: (2001)Preparation of disturbed soil samples
AS 1289.3.8.1: (2017)Emerson Class number of a soil
AS 1289.4.3.1: (1997)pH value of a soil (Electrometric method)

(NATA accreditation does not cover the performance of this service)**

Report Remarks & Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
P.Baltoski
Approved Signatory

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

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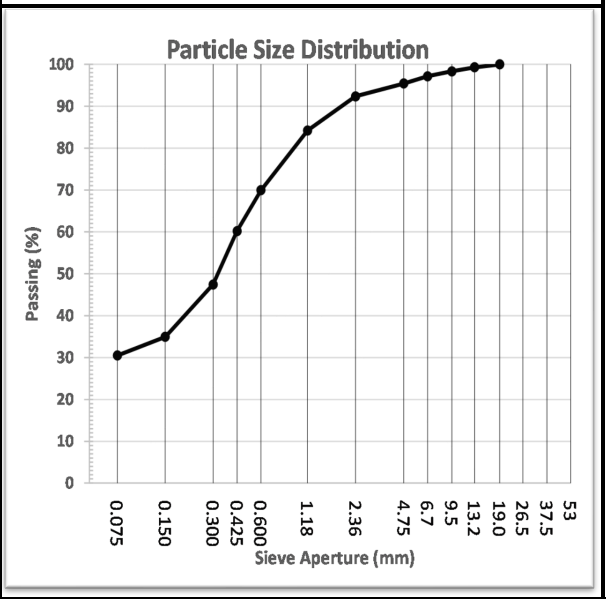
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

Report on PSD (AS1289.3.6.1) and AS Atterbergs

Client:	Cardno	Report No:	**460B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	BH06-D01

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39668	**22/06/2021**	**-**	**-**	**BH06-D01**	**1.20-1.50**

Pre-Treatment	Units	**Result**	**Specification Limits**	**Specification Name**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	%			
Pretreatment by Compaction	%			
Particle Size Distribution	Units	**Result**	**Specification Limits**	
Passing Sieve - 150mm	%			
Passing Sieve - 125mm	%			
Passing Sieve - 100mm	%			
Passing Sieve - 75mm	%			
Passing Sieve - 53mm	%			
Passing Sieve - 37.5mm	%			
Passing Sieve - 26.5mm	%			
Passing Sieve - 19.0mm	%	**100**		
Passing Sieve - 13.2mm	%	**99**		
Passing Sieve - 9.5mm	%	**98**		
Passing Sieve - 6.7mm	%	**97**		
Passing Sieve - 4.75mm	%	**95**		
Passing Sieve - 2.36mm	%	**92**		
Passing Sieve - 1.18mm	%	**84**		
Passing Sieve - 0.600mm	%	**70**		
Passing Sieve - 0.425mm	%	**60**		
Passing Sieve - 0.300mm	%	**47**		
Passing Sieve - 0.150mm	%	**35**		
Passing Sieve - 0.075mm	%	**31**		



Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Customer: Results apply to the sample/s as received. **
AS 1289.1.1: (2001) Preparation of disturbed soil samples for testing
AS 1289.3.6.1: (2009) Particle Size Distribution of a soil (Standard, by Sieving)

(NATA accreditation does not cover the performance of this service)**

Report Remarks & Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: L.Romano
L.Romano
Approved Signatory

AUSTRALIAN SOIL AND CONCRETE TESTING

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

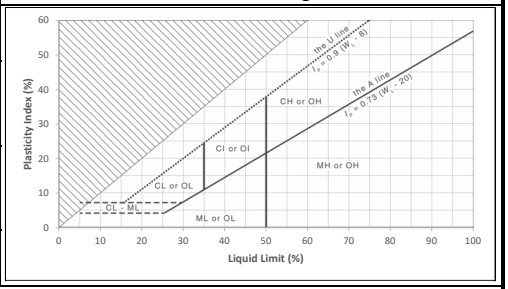
Telephone: 02 4256 1684
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

Report on PSD (AS1289.3.6.1) and AS Atterbergs

Client:	Cardno	Report No:	**460B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	Page 2 of 2
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	BH06-D01

PSD Curve Characteristics	Units	**Result**	**Specification Limits**	**Remarks**
* Ratio A - 0.425mm/2.36mm	--	**65**		
* Ratio B - 0.075mm/0.425mm	--	**51**		
* Ratio C - 0.0135mm/0.075mm	--			
# Coefficient of Uniformity (Cu)	--			
# Coefficient of Curvature (Cc)	--			
# D85	mm	**1.26**		
# D60	mm	**0.42**		
# D50	mm	**0.32**		
# D30	mm			
# D20	mm			
# D15	mm			
# D10	mm			
Plasticity	Units	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%			
Plastic Limit	%	-		
Plastic Index	%			
Linear Shrinkage	%			
Weighted Plasticity Index (WPI)	%			
Weighted Linear Shrinkage (WLS):	%			

^ AS 1726:2017 - Components & Description

Fraction	Component	Size (mm)	Sample (%)		AS 1726:2017 - Figure 5
Oversize	BOULDERS	150+		**0**	
	COBBLES	53-150			
Coarse Grained Soil	GRAVEL Coarse	19-53		**8**	
	GRAVEL Medium	6.7-19	3		
	GRAVEL Fine	2.36-6.7	5		
	SAND Coarse	0.6-2.36	22	**62**	
	SAND Medium	0.3-0.6	22		
	SAND Fine	0.075-0.3	17		
Fine Grained Soil	SILT	0.002-0.075	31	**31**	
	CLAY	<0.002			
Description					

* These values (*), are derived from RMS method T107.
The values are not included in the Nata endorsement.

\# These values (#), are derived from the calculations provided in AS1726:2017 Clause 6.1.4.11.
The values are not included in the Nata endorsement.

^ The values given in this table are approximated from AS1726:2017, given the available test data.
The table & it's contents are not included in the Nata endorsement.

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

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Mobile: 0497 979 929
A.B.N. 34 635 062 609

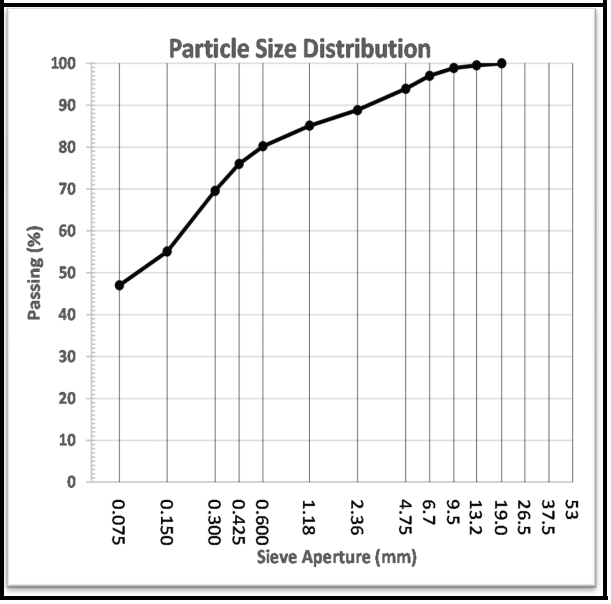
Report on PSD (AS1289.3.6.1) and AS Atterbergs

Client:	Cardno	Report No:	**465B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	TP06-D01

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39673	**17/06/2021**	**-**	**-**	**TP06-D01**	**1.00-1.20**

Pre-Treatment	Units	**Result**	**Specification Limits**
Retained 53.0mm Sieve	%		
Pretreatment by Weathering	%		
Pretreatment by Compaction	%		
Particle Size Distribution	Units	**Result**	**Specification Limits**
Passing Sieve - 150mm	%		
Passing Sieve - 125mm	%		
Passing Sieve - 100mm	%		
Passing Sieve - 75mm	%		
Passing Sieve - 53mm	%		
Passing Sieve - 37.5mm	%		
Passing Sieve - 26.5mm	%		
Passing Sieve - 19.0mm	%	**100**	
Passing Sieve - 13.2mm	%	**100**	
Passing Sieve - 9.5mm	%	**99**	
Passing Sieve - 6.7mm	%	**97**	
Passing Sieve - 4.75mm	%	**94**	
Passing Sieve - 2.36mm	%	**89**	
Passing Sieve - 1.18mm	%	**85**	
Passing Sieve - 0.600mm	%	**80**	
Passing Sieve - 0.425mm	%	**76**	
Passing Sieve - 0.300mm	%	**70**	
Passing Sieve - 0.150mm	%	**55**	
Passing Sieve - 0.075mm	%	**47**	

Specification Name



Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Customer: Results apply to the sample/s as received. **
AS 1289.1.1: (2001) Preparation of disturbed soil samples for testing
AS 1289.3.6.1: (2009) Particle Size Distribution of a soil (Standard, by Sieving)

(NATA accreditation does not cover the performance of this service)**

Report Remarks & Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: L.Romano
L.Romano
Approved Signatory

AUSTRALIAN SOIL AND CONCRETE TESTING

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

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E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

Report on PSD (AS1289.3.6.1) and AS Atterbergs

Client:	Cardno	Report No:	**465B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	Page 2 of 2
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	TP06-D01

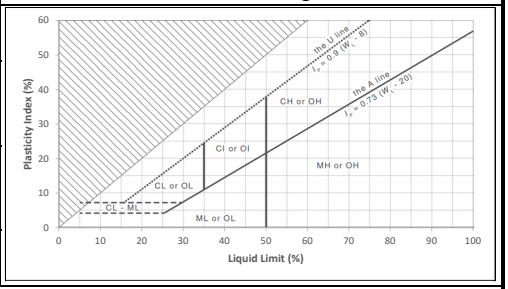
PSD Curve Characteristics	Units	**Result**	**Specification Limits**	**Remarks**
* Ratio A - 0.425mm/2.36mm	--	**86**		
* Ratio B - 0.075mm/0.425mm	--	**62**		
* Ratio C - 0.0135mm/0.075mm	--			
# Coefficient of Uniformity (Cu)	--			
# Coefficient of Curvature (Cc)	--			
# D85	mm	**1.16**		
# D60	mm	**0.19**		
# D50	mm	**0.10**		
# D30	mm			
# D20	mm			
# D15	mm			
# D10	mm			

Plasticity	Units	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%			
Plastic Limit	%	-		
Plastic Index	%			
Linear Shrinkage	%			
Weighted Plasticity Index (WPI)	%			
Weighted Linear Shrinkage (WLS):	%			

^ AS 1726:2017 - Components & Description

Fraction	Component	Size (mm)	**Sample (%)**	
Oversize	BOULDERS	150+		**0**
	COBBLES	53-150		
Coarse Grained Soil	GRAVEL Coarse	19-53		**11**
	GRAVEL Medium	6.7-19	3	
	GRAVEL Fine	2.36-6.7	8	
	SAND Coarse	0.6-2.36	9	**42**
	SAND Medium	0.3-0.6	11	
	SAND Fine	0.075-0.3	23	
Fine Grained Soil	SILT	0.002-0.075	47	**47**
	CLAY	<0.002		
Description				

AS 1726:2017 - Figure 5



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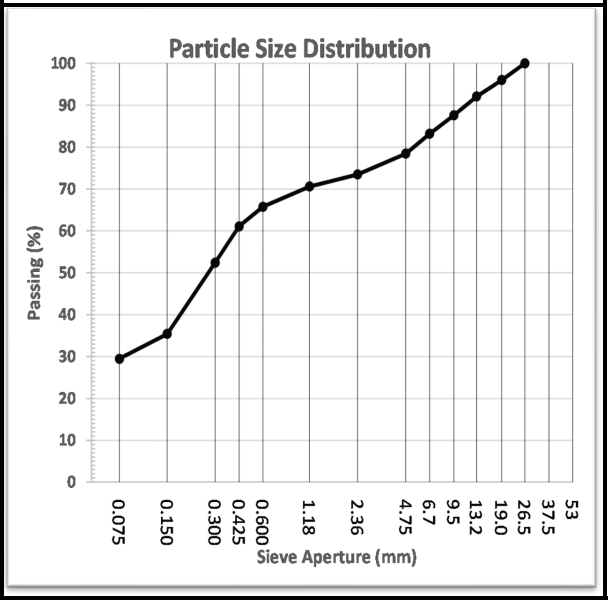
Report on PSD (AS1289.3.6.1) and AS Atterbergs

Client:	Cardno	Report No:	**469B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	TP09-D03

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39677	**17/06/2021**	**-**	**-**	**TP09-D03**	**1.50-1.70**

Pre-Treatment	Units	**Result**	**Specification Limits**
Retained 53.0mm Sieve	%		
Pretreatment by Weathering	%		
Pretreatment by Compaction	%		
Particle Size Distribution	Units	**Result**	**Specification Limits**
Passing Sieve - 150mm	%		
Passing Sieve - 125mm	%		
Passing Sieve - 100mm	%		
Passing Sieve - 75mm	%		
Passing Sieve - 53mm	%		
Passing Sieve - 37.5mm	%		
Passing Sieve - 26.5mm	%	**100**	
Passing Sieve - 19.0mm	%	**96**	
Passing Sieve - 13.2mm	%	**92**	
Passing Sieve - 9.5mm	%	**88**	
Passing Sieve - 6.7mm	%	**83**	
Passing Sieve - 4.75mm	%	**78**	
Passing Sieve - 2.36mm	%	**73**	
Passing Sieve - 1.18mm	%	**71**	
Passing Sieve - 0.600mm	%	**66**	
Passing Sieve - 0.425mm	%	**61**	
Passing Sieve - 0.300mm	%	**52**	
Passing Sieve - 0.150mm	%	**35**	
Passing Sieve - 0.075mm	%	**29**	

Specification Name



Sampling & Test Methods (Results relate only to the items sampled/tested)

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AS 1289.1.1: (2001) Preparation of disturbed soil samples for testing
AS 1289.3.6.1: (2009) Particle Size Distribution of a soil (Standard, by Sieving)

(NATA accreditation does not cover the performance of this service)**

Report Remarks & Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: L.Romano
L.Romano
Approved Signatory

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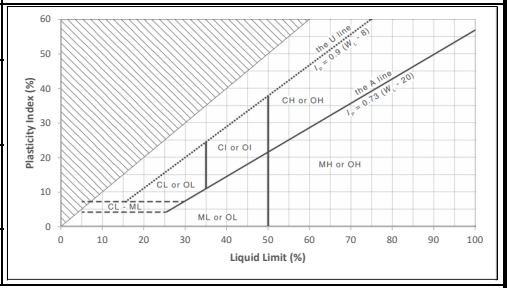
Client:	Cardno	Report No:	**469B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	Page 2 of 2
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	TP09-D03

PSD Curve Characteristics	Units	**Result**	**Specification Limits**	**Remarks**
* Ratio A - 0.425mm/2.36mm	--	**83**		
* Ratio B - 0.075mm/0.425mm	--	**48**		
* Ratio C - 0.0135mm/0.075mm	--			
# Coefficient of Uniformity (Cu)	--			
# Coefficient of Curvature (Cc)	--			
# D85	mm	**7.74**		
# D60	mm	**0.41**		
# D50	mm	**0.27**		
# D30	mm	**0.08**		
# D20	mm			
# D15	mm			
# D10	mm			

Plasticity	Units	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%			
Plastic Limit	%	-		
Plastic Index	%			
Linear Shrinkage	%			
Weighted Plasticity Index (WPI)	%			
Weighted Linear Shrinkage (WLS):	%			

^ AS 1726:2017 - Components & Description

Fraction	Component	Size (mm)	Sample (%)		AS 1726:2017 - Figure 5
Oversize	BOULDERS	150+		**0**	
	COBBLES	53-150			
Coarse Grained Soil	GRAVEL Coarse	19-53		**23**	
	GRAVEL Medium	6.7-19	13		
	GRAVEL Fine	2.36-6.7	10		
	SAND Coarse	0.6-2.36	8	**44**	
	SAND Medium	0.3-0.6	13		
	SAND Fine	0.075-0.3	23		
Fine Grained Soil	SILT	0.002-0.075	29	**29**	
	CLAY	<0.002			
Description					

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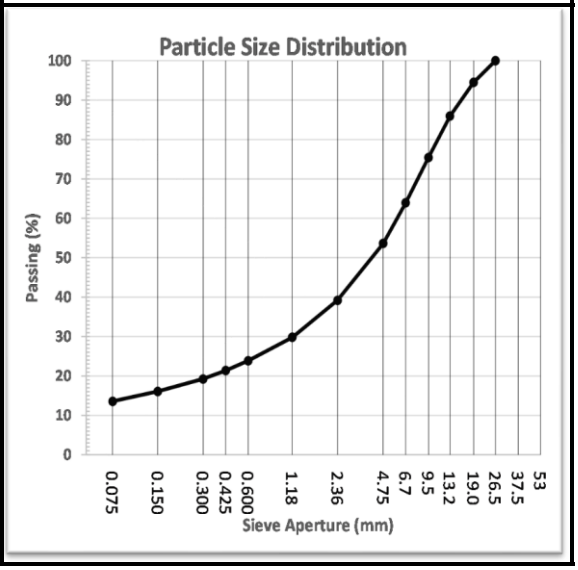
Report on PSD (AS1289.3.6.1) and AS Atterbergs

Client:	Cardno	Report No:	**453B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	27/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	BH01-D01

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39661	**22/06/2021**	**-**	**-**	**BH01-D01**	**0.20-0.40**

Pre-Treatment	Units	**Result**	**Specification Limits**	**Specification Name**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	%			
Pretreatment by Compaction	%			
Particle Size Distribution	Units	**Result**	**Specification Limits**	
Passing Sieve - 150mm	%			
Passing Sieve - 125mm	%			
Passing Sieve - 100mm	%			
Passing Sieve - 75mm	%			
Passing Sieve - 53mm	%			
Passing Sieve - 37.5mm	%			
Passing Sieve - 26.5mm	%	**100**		
Passing Sieve - 19.0mm	%	**95**		
Passing Sieve - 13.2mm	%	**86**		
Passing Sieve - 9.5mm	%	**75**		
Passing Sieve - 6.7mm	%	**64**		
Passing Sieve - 4.75mm	%	**54**		
Passing Sieve - 2.36mm	%	**39**		
Passing Sieve - 1.18mm	%	**30**		
Passing Sieve - 0.600mm	%	**24**		
Passing Sieve - 0.425mm	%	**21**		
Passing Sieve - 0.300mm	%	**19**		
Passing Sieve - 0.150mm	%	**16**		
Passing Sieve - 0.075mm	%	**14**		



Sampling & Test Methods (Results relate only to the items sampled/tested)

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(NATA accreditation does not cover the performance of this service)**

Report Remarks & Endorsement

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NATA Accreditation number: 20656

Issued By:
T.Morgan
Approved Signatory

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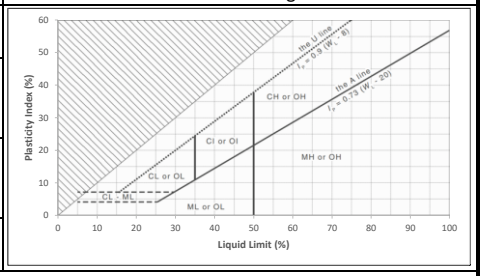
Client:	Cardno	Report No:	**453B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	27/07/2021
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	Page 2 of 2
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	BH01-D01

PSD Curve Characteristics	Units	**Result**	**Specification Limits**	**Remarks**
* Ratio A - 0.425mm/2.36mm	--	**55**		
* Ratio B - 0.075mm/0.425mm	--	**63**		
* Ratio C - 0.0135mm/0.075mm	--			
# Coefficient of Uniformity (Cu)	--			
# Coefficient of Curvature (Cc)	--			
# D85	mm	**12.82**		
# D60	mm	**5.88**		
# D50	mm	**3.98**		
# D30	mm	**1.20**		
# D20	mm	**0.34**		
# D15	mm	**0.11**		
# D10	mm			
Plasticity	Units	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%			
Plastic Limit	%	-		
Plastic Index	%			
Linear Shrinkage	%			
Weighted Plasticity Index (WPI)	%			
Weighted Linear Shrinkage (WLS):	%			

^ AS 1726:2017 - Components & Description

Fraction	Component	Size (mm)	Sample (%)	
Oversize	BOULDERS	150+		**0**
	COBBLES	53-150		
Coarse Grained Soil	GRAVEL Coarse	19-53		**55**
	GRAVEL Medium	6.7-19	31	
	GRAVEL Fine	2.36-6.7	25	
	SAND Coarse	0.6-2.36	15	**26**
	SAND Medium	0.3-0.6	5	
	SAND Fine	0.075-0.3	6	
Fine Grained Soil	SILT	0.002-0.075	14	**14**
	CLAY	<0.002		
Description				

AS 1726:2017 - Figure 5



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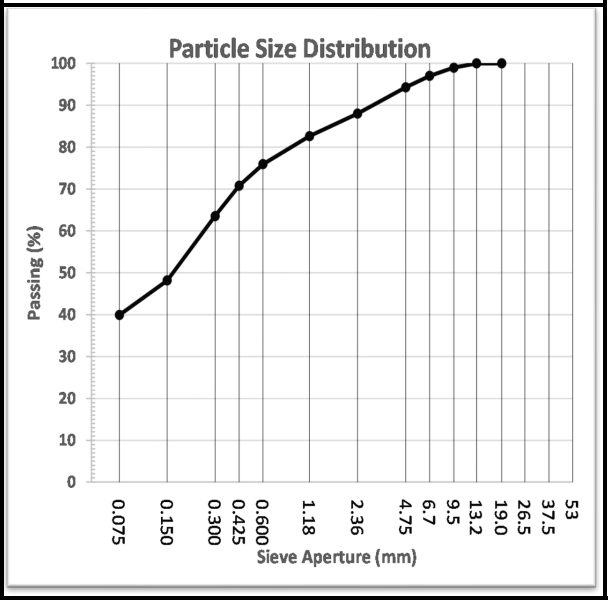
Client:	Cardno	Report No:	**456B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	27/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	BH03-D02

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39664	**21/06/2021**	**-**	**-**	**BH03-D02**	**2.70-3.00**

Pre-Treatment	Units	Result	Specification Limits
Retained 53.0mm Sieve	%		
Pretreatment by Weathering	%		
Pretreatment by Compaction	%		
Particle Size Distribution	Units	**Result**	**Specification Limits**
Passing Sieve - 150mm	%		
Passing Sieve - 125mm	%		
Passing Sieve - 100mm	%		
Passing Sieve - 75mm	%		
Passing Sieve - 53mm	%		
Passing Sieve - 37.5mm	%		
Passing Sieve - 26.5mm	%		
Passing Sieve - 19.0mm	%	**100**	
Passing Sieve - 13.2mm	%	**100**	
Passing Sieve - 9.5mm	%	**99**	
Passing Sieve - 6.7mm	%	**97**	
Passing Sieve - 4.75mm	%	**94**	
Passing Sieve - 2.36mm	%	**88**	
Passing Sieve - 1.18mm	%	**83**	
Passing Sieve - 0.600mm	%	**76**	
Passing Sieve - 0.425mm	%	**71**	
Passing Sieve - 0.300mm	%	**64**	
Passing Sieve - 0.150mm	%	**48**	
Passing Sieve - 0.075mm	%	**40**	

Specification Name



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Report Remarks & Endorsement

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NATA Accreditation number: 20656

Issued By: L.Romano
L.Romano
Approved Signatory

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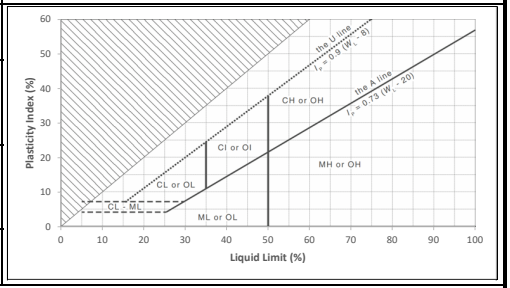
Client:	Cardno	Report No:	**456B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	27/07/2021
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	Page 2 of 2
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	BH03-D02

PSD Curve Characteristics	Units	**Result**	**Specification Limits**	**Remarks**
* Ratio A - 0.425mm/2.36mm	--	**80**		
* Ratio B - 0.075mm/0.425mm	--	**56**		
* Ratio C - 0.0135mm/0.075mm	--			
# Coefficient of Uniformity (Cu)	--			
# Coefficient of Curvature (Cc)	--			
# D85	mm	**1.60**		
# D60	mm	**0.26**		
# D50	mm	**0.16**		
# D30	mm			
# D20	mm			
# D15	mm			
# D10	mm			

Plasticity	Units	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%			
Plastic Limit	%	-		
Plastic Index	%			
Linear Shrinkage	%			
Weighted Plasticity Index (WPI)	%			
Weighted Linear Shrinkage (WLS):	%			

^ AS 1726:2017 - Components & Description

Fraction	Component	Size (mm)	**Sample (%)**		AS 1726:2017 - Figure 5
Oversize	BOULDERS	150+		**0**	
	COBBLES	53-150			
Coarse Grained Soil	GRAVEL Coarse	19-53		**12**	
	GRAVEL Medium	6.7-19	3		
	GRAVEL Fine	2.36-6.7	9		
	SAND Coarse	0.6-2.36	12	**48**	
	SAND Medium	0.3-0.6	12		
	SAND Fine	0.075-0.3	24		
Fine Grained Soil	SILT	0.002-0.075	40	**40**	
	CLAY	<0.002			
Description					

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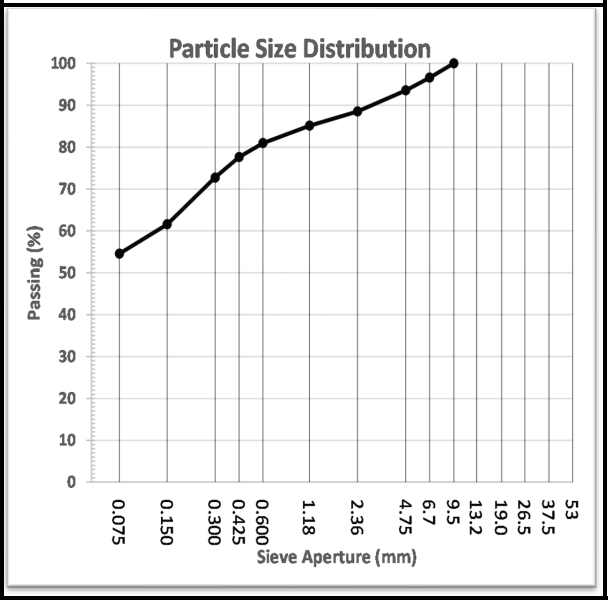
Client:	Cardno	Report No:	**458B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	27/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	BH04-SPT02

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39666	**22/06/2021**	**-**	**-**	**BH04-SPT02**	**1.50-1.95**

Pre-Treatment	Units	Result	Specification Limits
Retained 53.0mm Sieve	%		
Pretreatment by Weathering	%		
Pretreatment by Compaction	%		
Particle Size Distribution	Units	**Result**	**Specification Limits**
Passing Sieve - 150mm	%		
Passing Sieve - 125mm	%		
Passing Sieve - 100mm	%		
Passing Sieve - 75mm	%		
Passing Sieve - 53mm	%		
Passing Sieve - 37.5mm	%		
Passing Sieve - 26.5mm	%		
Passing Sieve - 19.0mm	%		
Passing Sieve - 13.2mm	%		
Passing Sieve - 9.5mm	%	**100**	
Passing Sieve - 6.7mm	%	**97**	
Passing Sieve - 4.75mm	%	**94**	
Passing Sieve - 2.36mm	%	**89**	
Passing Sieve - 1.18mm	%	**85**	
Passing Sieve - 0.600mm	%	**81**	
Passing Sieve - 0.425mm	%	**78**	
Passing Sieve - 0.300mm	%	**73**	
Passing Sieve - 0.150mm	%	**62**	
Passing Sieve - 0.075mm	%	**55**	

Specification Name



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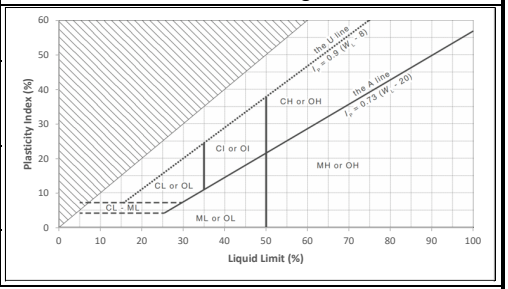
Client:	Cardno	Report No:	**458B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	27/07/2021
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	Page 2 of 2
Lab Test Date/s:	Laboratory testing 07/07/2021	Control Line:	BH04-SPT02

PSD Curve Characteristics	Units	**Result**	**Specification Limits**	**Remarks**
* Ratio A - 0.425mm/2.36mm	--	**88**		
* Ratio B - 0.075mm/0.425mm	--	**70**		
* Ratio C - 0.0135mm/0.075mm	--			
# Coefficient of Uniformity (Cu)	--			
# Coefficient of Curvature (Cc)	--			
# D85	mm	**1.16**		
# D60	mm	**0.13**		
# D50	mm			
# D30	mm			
# D20	mm			
# D15	mm			
# D10	mm			

Plasticity	Units	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%			
Plastic Limit	%	-		
Plastic Index	%			
Linear Shrinkage	%			
Weighted Plasticity Index (WPI)	%			
Weighted Linear Shrinkage (WLS):	%			

^ AS 1726:2017 - Components & Description

Fraction	Component	Size (mm)	Sample (%)		AS 1726:2017 - Figure 5
Oversize	BOULDERS	150+		**0**	
	COBBLES	53-150			
Coarse Grained Soil	GRAVEL Coarse	19-53		**8**	
	GRAVEL Medium	6.7-19			
	GRAVEL Fine	2.36-6.7	8		
	SAND Coarse	0.6-2.36	8	**34**	
	SAND Medium	0.3-0.6	8		
	SAND Fine	0.075-0.3	18		
Fine Grained Soil	SILT	0.002-0.075	55	**55**	
	CLAY	<0.002			
Description					

* These values (*), are derived from RMS method T107.
The values are not included in the Nata endorsement.

\# These values (#), are derived from the calculations provided in AS1726:2017 Clause 6.1.4.11.
The values are not included in the Nata endorsement.

^ The values given in this table are approximated from AS1726:2017, given the available test data.
The table & it's contents are not included in the Nata endorsement.

AUSTRALIAN SOIL AND CONCRETE TESTING

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A.B.N. 34 635 062 609

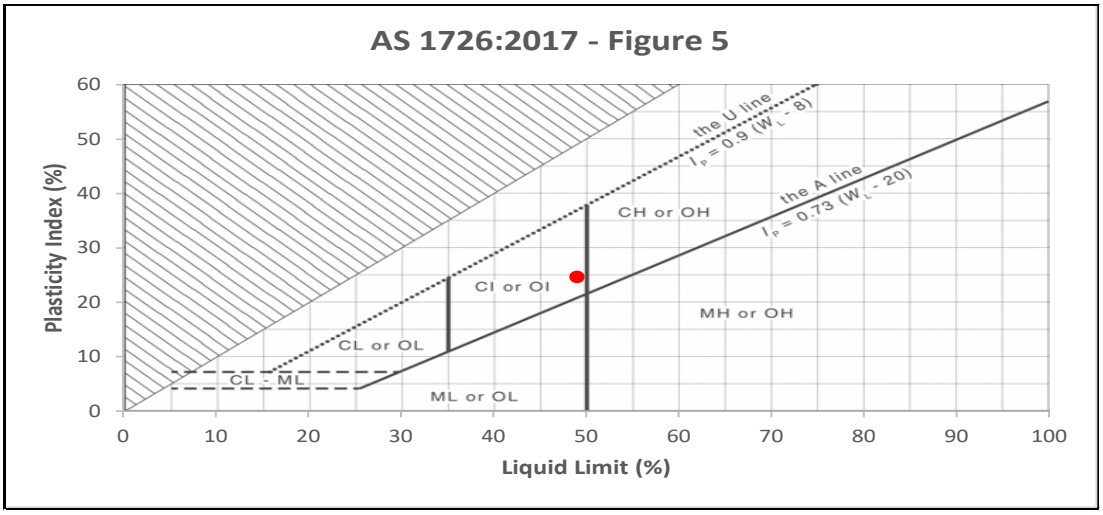
Report on Plastic Properties

Client:	Cardno	Report No:	**466A**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/07/2021	Control Line:	TP07-D01

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39674	**17/06/2021**	**-**	**-**	**TP07-D01**	**0.40-0.60**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**49**		Oven Dried & Dry Sieved
Plastic Limit	%	**24**		Oven Dried & Dry Sieved
Plastic Index	%	**25**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**12.0**		Oven Dried & Dry Sieved. Curled Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	**Report Remarks & Endorsement**
Sampled by Customer: Results apply to the sample/s as received. ** AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil AS 1289.3.4.1: (2008)Linear Shrinkage of a soil	

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L.Romano
Approved Signatory

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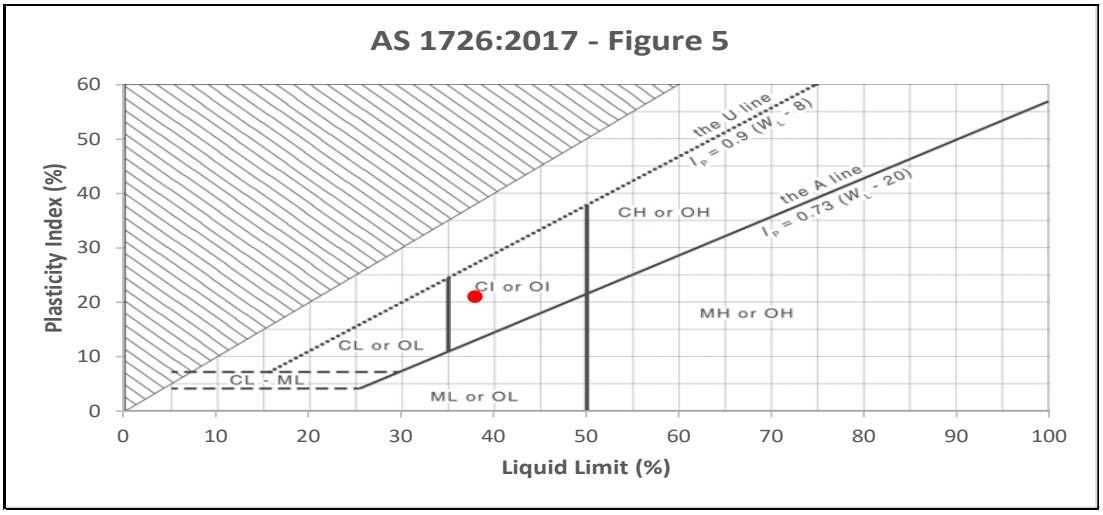
Report on Plastic Properties

Client:	Cardno	Report No:	**468A**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/07/2021	Control Line:	TP09-D02

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39676	**17/06/2021**	**-**	**-**	**TP09-D02**	**1.00-1.20**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**38**		Oven Dried & Dry Sieved
Plastic Limit	%	**17**		Oven Dried & Dry Sieved
Plastic Index	%	**21**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**10.0**		Oven Dried & Dry Sieved. Cracked/Broken Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	**Report Remarks & Endorsement**
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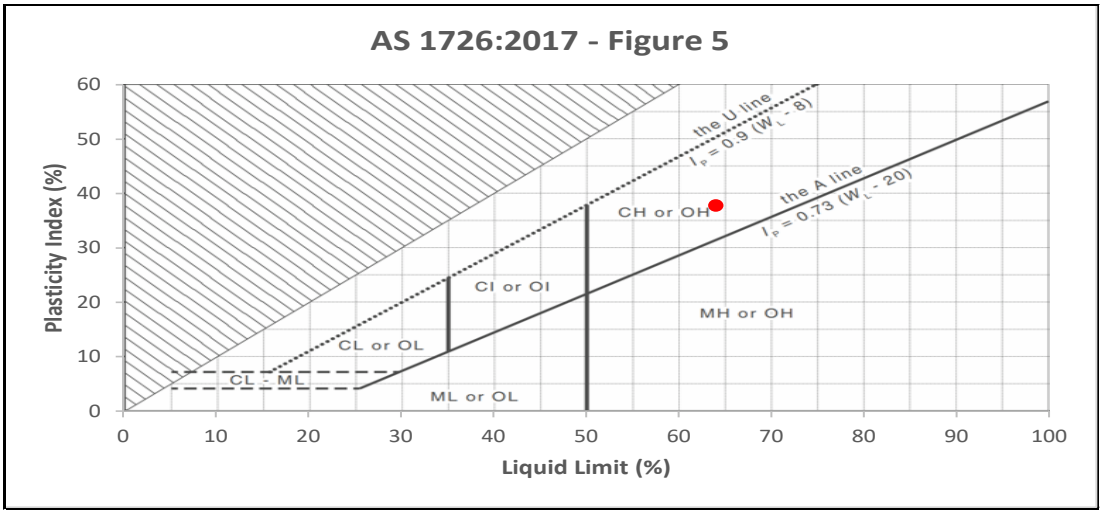
Report on Plastic Properties

Client:	Cardno	Report No:	**455A**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 26/07/2021	Control Line:	BH02-D01

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39663	**21/06/2021**	**-**	**-**	**BH02-D01**	**1.20-1.50**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**64**		Oven Dried & Dry Sieved
Plastic Limit	%	**26**		Oven Dried & Dry Sieved
Plastic Index	%	**38**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**18.0**		Oven Dried & Dry Sieved. Curled Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	**Report Remarks & Endorsement**
Sampled by Customer: Results apply to the sample/s as received. ** AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil AS 1289.3.4.1: (2008)Linear Shrinkage of a soil	.

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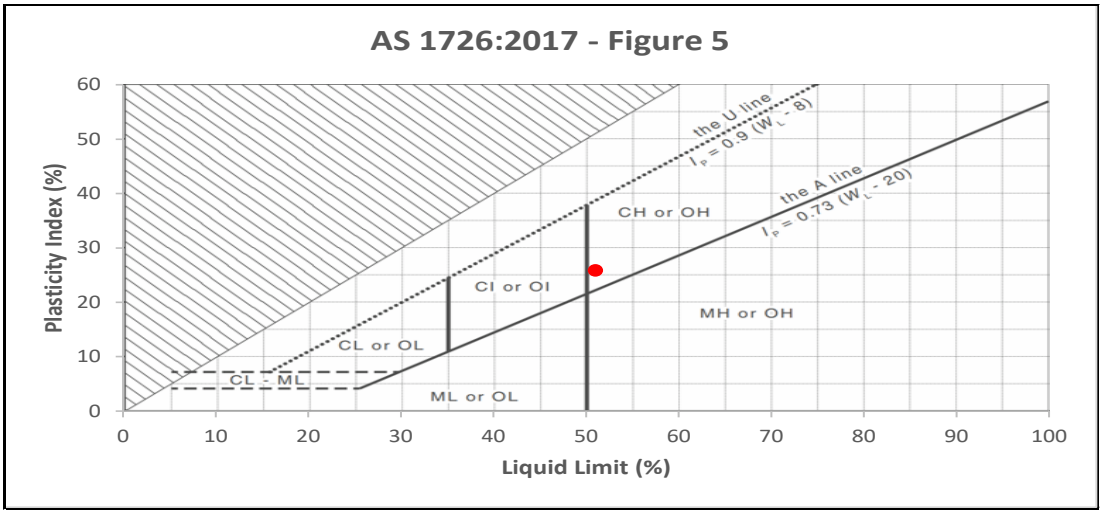
Report on Plastic Properties

Client:	Cardno	Report No:	**459A**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 26/07/2021	Control Line:	BH04-D01

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39667	**22/06/2021**	**-**	**-**	**BH04-D01**	**1.20-1.50**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**51**		Oven Dried & Dry Sieved
Plastic Limit	%	**25**		Oven Dried & Dry Sieved
Plastic Index	%	**26**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**13.0**		Oven Dried & Dry Sieved. Curled Bar



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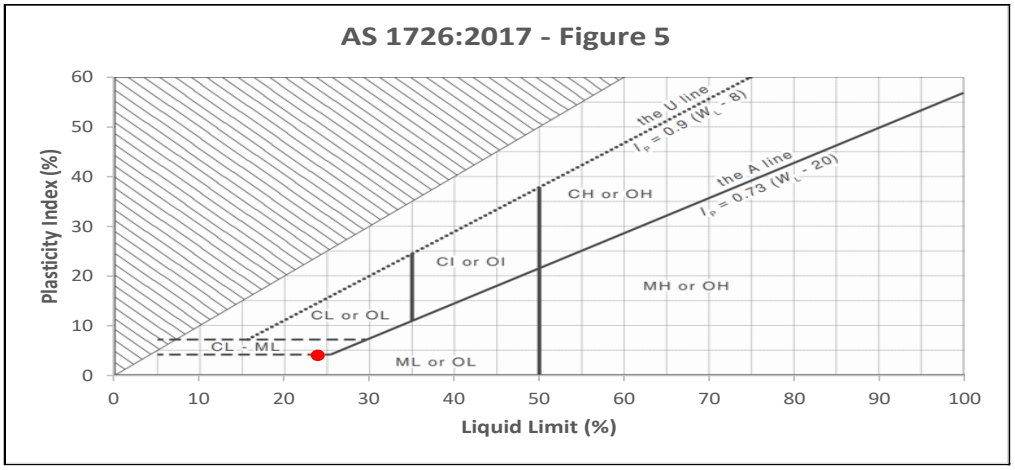
Report on Plastic Properties

Client:	Cardno	Report No:	**461A**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	27/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 26/07/2021	Control Line:	TP02-D01

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39669	**17/06/2021**	**-**	**-**	**TP02-D01**	**0.10-0.20**

Specification Name	

Pretreatment	Units	Result	Specification Limits	Remarks
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**24**		Oven Dried & Dry Sieved
Plastic Limit	%	**20**		Oven Dried & Dry Sieved
Plastic Index	%	**4**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**1.5**		Oven Dried & Dry Sieved. Cracked/Broken Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
Sampled by Customer: Results apply to the sample/s as received. ** AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil AS 1289.3.4.1: (2008)Linear Shrinkage of a soil	

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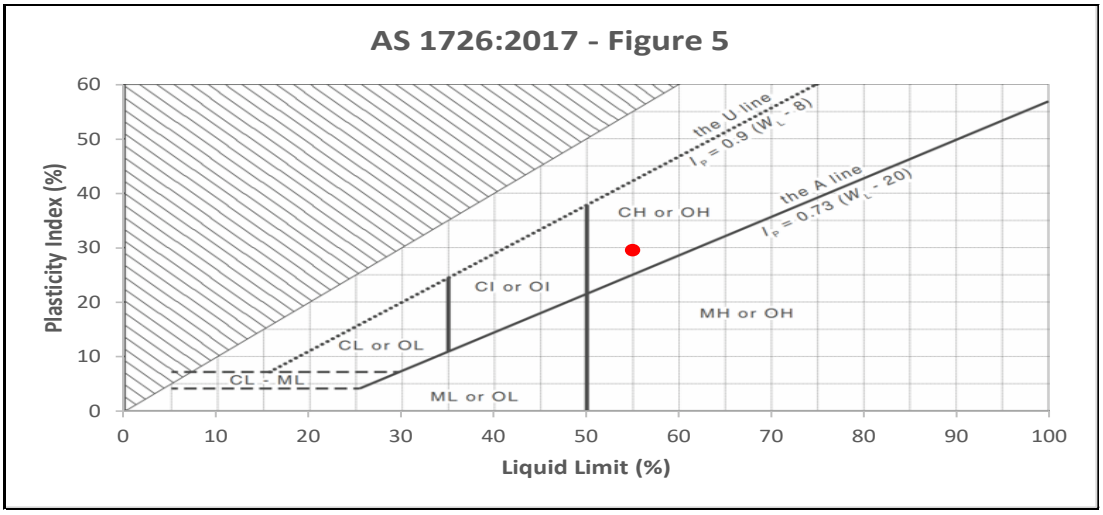
Report on Plastic Properties

Client:	Cardno	Report No:	**463A**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	Insitu	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 26/07/2021	Control Line:	TP04-D02

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39671	**17/06/2021**	**-**	**-**	**TP04-D02**	**1.00-1.20**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**55**		Oven Dried & Dry Sieved
Plastic Limit	%	**25**		Oven Dried & Dry Sieved
Plastic Index	%	**30**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**15.0**		Oven Dried & Dry Sieved. Curled Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	**Report Remarks & Endorsement**
Sampled by Customer: Results apply to the sample/s as received. ** AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil AS 1289.3.4.1: (2008)Linear Shrinkage of a soil	

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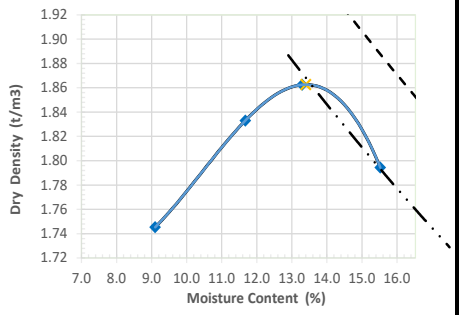
Report on AS CBR and MDD

Client:	Cardno	Report No:	**26-462-CBR**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used(Source):	Insitu	Test Request/Order:	**8202118201**
Material Description:	-	Lot Number:	-
Lot Boundaries:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 07/07/2021 to 28/07/2021	Control Line:	TP02-B01

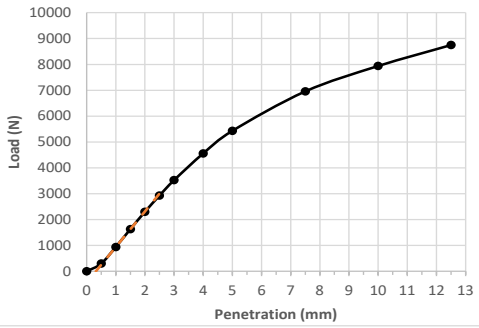
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39670	**17/06/2021**	-	-	**TP02-B01**	**1.20-1.40**

Parameters	Units	Test Results		Information
Pretreatment Regime	--	No Pretreatment		
Portion Retained on AS Sieve	%	16% on 19mm		Retained material excluded from CBR
Material Plasticity (Liquid Limit)	--	Low (Less than 35%)		By Technician's Assessment
Sample Curing Time	hrs	289		
Soil Particle Density	t/m3	2.67		Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.863		Standard compactive effort
Optimum Moisture Content (OMC)	%	13.4		
Field/Prep Moisture Content	%	Field %	Prep 13.3 %	Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 13.3 %	LMR = 99.5%	Specified LMR = 100%
Compaction Dry Density	t/m3	Achieved 1.87 t/m3	LDR = 100.5%	Specified LDR = 100%
Surcharge Load	kg	4.5		
Period of Soaking	Days	Soaked - 4 Days		Dry Density (after soaking) = 1.87 t/m3.
Specimen Swell	%	0.0		
Moisture Content - Top 30mm	%	15.4		After Penetration
Moisture Content - Remaining	%	13.8		After Penetration

Dry Density Vs Moisture Content



Load-Penetration Curve



Material CBR Value (%)

30

California Bearing Ratios

CBR $_{2.5}$ = 25

CBR $_{5.0}$ = 30

Including an Applied Correction of 0.3 mm

Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Customer: Results apply to the sample/s as received. **
AS 1289.1.1: (2001)Preparation of disturbed soil samples
AS1289.2.1.1: (2005) Moisture Content of a Soil (Oven Drying)
AS1289.5.1.1: (2017)Dry Density/Moisture content relation of a soil (Standard)
AS1289.6.1.1: (2014)California Bearing Ratio of a soil (remoulded specimen)

Report Remarks & Endorsement

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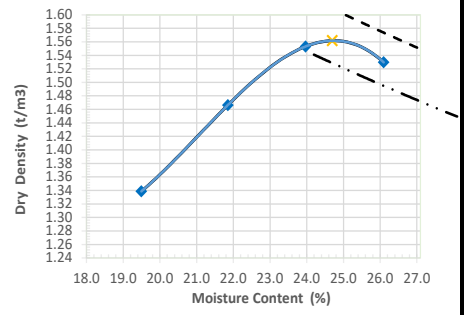
Report on AS CBR and MDD

Client:	Cardno	Report No:	**26-457-CBR**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/07/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used(Source):	Insitu	Test Request/Order:	**8202118201**
Material Description:	-	Lot Number:	-
Lot Boundaries:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 07/07/2021 to 28/07/2021	Control Line:	BH04-B01

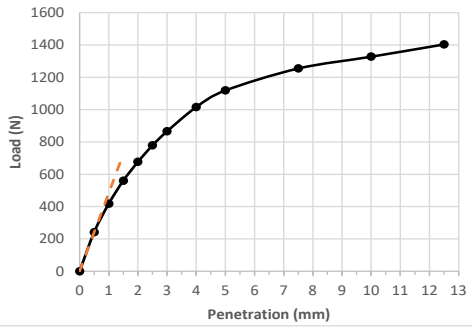
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
39665	**22/06/2021**	-	-	**BH04-B01**	**0.50-1.00**

Parameters	Units	Test Results		Information
Pretreatment Regime	--	No Pretreatment		
Portion Retained on AS Sieve	%	0% on 19mm		Retained material excluded from CBR
Material Plasticity (Liquid Limit)	--	Medium (35% to 50%)		By Technician's Assessment
Sample Curing Time	hrs	140		
Soil Particle Density	t/m3	2.67		Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.562		Standard compactive effort
Optimum Moisture Content (OMC)	%	24.7		
Field/Prep Moisture Content	%	Field 28.4 %	Prep 27.0 %	Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 24.6 %	LMR = 100.0%	Specified LMR = 100%
Compaction Dry Density	t/m3	Achieved 1.55 t/m3	LDR = 99.5%	Specified LDR = 100%
Surcharge Load	kg	4.5		
Period of Soaking	Days	Soaked - 4 Days		Dry Density (after soaking) = 1.54 t/m3.
Specimen Swell	%	1.0		
Moisture Content - Top 30mm	%	27.7		After Penetration
Moisture Content - Remaining	%	26.7		After Penetration

Dry Density Vs Moisture Content



Load-Penetration Curve



Material CBR Value (%)

6

California Bearing Ratios

CBR $_{2.5}$ = 6

CBR $_{5.0}$ = 6

Including an Applied Correction of 0.0 mm

Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Customer: Results apply to the sample/s as received. **
AS 1289.1.1: (2001)Preparation of disturbed soil samples
AS1289.2.1.1: (2005) Moisture Content of a Soil (Oven Drying)
AS1289.5.1.1: (2017)Dry Density/Moisture content relation of a soil (Standard)
AS1289.6.1.1: (2014)California Bearing Ratio of a soil (remoulded specimen)

Report Remarks & Endorsement

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Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: L.Romano
L.Romano
Approved Signatory

**** NATA accreditation does not cover the performance of this service**

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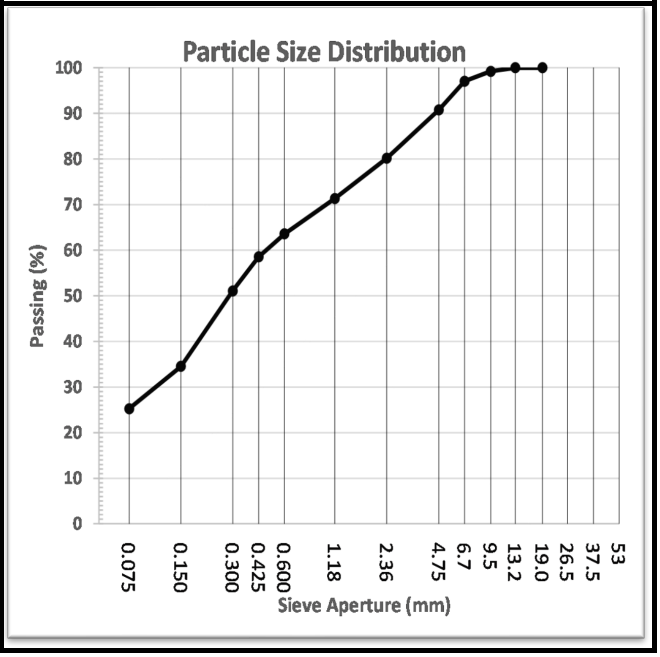
Report on PSD (AS1289.3.6.1) and AS Atterbergs

Client:	Cardno	Report No:	**724B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	19/11/2021
Project:	Geotechnical Testing	Report Page:	Page 1 of 2
Works Component:	Shoalhaven Hospital Redevelopment Additional Geotechnical Investigation	Project No:	26
Material Used:	-	Test Request:	82021182-02
Material Description:	-	Lot Number:	-
Lot Comments:	DS	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 12/11/2021 to 18/11/2021	Control Line:	HA04

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
43786	**28/10/2021**	**-**	**-**	**0.50-0.91**	**HA04**

Pre-Treatment	Units	**Result**	**Specification Limits**
Retained 53.0mm Sieve	%		
Pretreatment by Weathering	%		
Pretreatment by Compaction	%		
Particle Size Distribution	Units	**Result**	**Specification Limits**
Passing Sieve - 150mm	%		
Passing Sieve - 125mm	%		
Passing Sieve - 100mm	%		
Passing Sieve - 75mm	%		
Passing Sieve - 53mm	%		
Passing Sieve - 37.5mm	%		
Passing Sieve - 26.5mm	%		
Passing Sieve - 19.0mm	%	**100**	
Passing Sieve - 13.2mm	%	**100**	
Passing Sieve - 9.5mm	%	**99**	
Passing Sieve - 6.7mm	%	**97**	
Passing Sieve - 4.75mm	%	**91**	
Passing Sieve - 2.36mm	%	**80**	
Passing Sieve - 1.18mm	%	**71**	
Passing Sieve - 0.600mm	%	**64**	
Passing Sieve - 0.425mm	%	**59**	
Passing Sieve - 0.300mm	%	**51**	
Passing Sieve - 0.150mm	%	**35**	
Passing Sieve - 0.075mm	%	**25**	

Specification Name



Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Customer: Results apply to the sample/s as received. **
AS 1289.1.1: (2001) Preparation of disturbed soil samples for testing
AS 1289.3.6.1: (2009) Particle Size Distribution of a soil (Standard, by Sieving)
AS 1289.3.1.2: (2009) Liquid Limit, One point Casagrande
AS 1289.3.2.1: (2009) Plastic Limit of a soil
AS 1289.3.3.1: (2009) Plasticity Index of a soil
AS 1289.3.4.1: (2008) Linear Shrinkage of a soil

(NATA accreditation does not cover the performance of this service)**

Report Remarks & Endorsement

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
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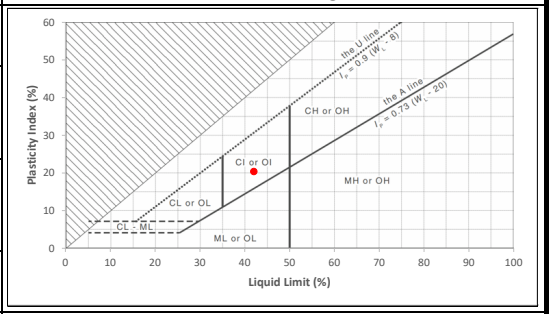
Report on PSD (AS1289.3.6.1) and AS Atterbergs

Client:	Cardno	Report No:	**724B**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	19/11/2021
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Shoalhaven Hospital Redevelopment Additional Geotechnical Investigation	Project No:	26
Material Used:	-	Test Request:	82021182-02
Material Description:	-	Lot Number:	-
Lot Comments:	DS	ITP/PCP Number:	Page 2 of 2
Lab Test Date/s:	Laboratory testing 12/11/2021 to 18/11/2021	Control Line:	HA04

PSD Curve Characteristics	Units	**Result**	**Specification Limits**	**Remarks**
* Ratio A - 0.425mm/2.36mm	--	**73**		
* Ratio B - 0.075mm/0.425mm	--	**43**		
* Ratio C - 0.0135mm/0.075mm	--			
# Coefficient of Uniformity (Cu)	--			
# Coefficient of Curvature (Cc)	--			
# D85	mm	**3.25**		
# D60	mm	**0.47**		
# D50	mm	**0.29**		
# D30	mm	**0.11**		
# D20	mm			
# D15	mm			
# D10	mm			
Plasticity	Units	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**42**		Oven Dried & Dry Sieved
Plastic Limit	%	**22**		Oven Dried & Dry Sieved
Plastic Index	%	**20**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**10.0**		Oven Dried & Dry Sieved. Cracked/Broken Bar
Weighted Plasticity Index (WPI)	%	**1193**		
Weighted Linear Shrinkage (WLS):	%	**581**		

^ AS 1726:2017 - Components & Description

Fraction	Component	Size (mm)	Sample (%)		AS 1726:2017 - Figure 5
Oversize	BOULDERS	150+		**0**	
	COBBLES	53-150			
Coarse Grained Soil	GRAVEL Coarse	19-53		**20**	
	GRAVEL Medium	6.7-19	3		
	GRAVEL Fine	2.36-6.7	17		
	SAND Coarse	0.6-2.36	17	**55**	
	SAND Medium	0.3-0.6	12		
	SAND Fine	0.075-0.3	26		
Fine Grained Soil	SILT	0.002-0.075	25	**25**	
	CLAY	<0.002			
Description					

* These values (*), are derived from RMS method T107.
The values are not included in the Nata endorsement.

\# These values (#), are derived from the calculations provided in AS1726:2017 Clause 6.1.4.11.
The values are not included in the Nata endorsement.

^ The values given in this table are approximated from AS1726:2017, given the available test data.
The table & it's contents are not included in the Nata endorsement.

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Report on Moisture Content

Client:	Cardno	Report No:	**26-724-MC**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	19/11/2021
Project:	**Geotechnical Testing**	Report Page:	Page 1 of 1
Works Component:	Shoalhaven Hospital Redevelopment Additional Geotechnical Investigation	Project No:	26
Material Used:	-	Test Request/Order:	82021182-02
Material Description:	-	Lot Number:	-
Lot Boundaries:	Chainage - to -. Offsets - to -.	ITP/PCP Number:	-
Lot Comments:	DS	Control Line:	HA04

Sample Number:		**43786**	**-**	**-**	**-**	**-**
Field Sample/Test Date:		28/10/2021	-	-	-	-
Lab Test Date:		12/11/2021	-	-	-	-
Chainage / Location:	(m)	-	-	-	-	-
Offset from control line:	(m)	-	-	-	-	-
Level of Test:	(m)	0.50-0.91	-	-	-	-
Test Depth:	(mm)	HA04	-	-	-	-
Moisture Content (Calculated):	(%)	21.3	-	-	-	-
Moisture Content (Corrected):	**(%)**	**-**	**-**	**-**	**-**	**-**
Sample Number:		**-**	**-**	**-**	**-**	**-**
Field Sample/Test Date:		-	-	-	-	-
Lab Test Date:		-	-	-	-	-
Chainage / Location:	(m)	-	-	-	-	-
Offset from control line:	(m)	-	-	-	-	-
Level of Test:	(m)	-	-	-	-	-
Test Depth:	(mm)	-	-	-	-	-
Moisture Content (Calculated):	(%)	-	-	-	-	-
Moisture Content (Corrected):	**(%)**	**-**	**-**	**-**	**-**	**-**
Sample Number:		**-**	**-**	**-**	**-**	**-**
Field Sample/Test Date:		-	-	-	-	-
Lab Test Date:		-	-	-	-	-
Chainage / Location:	(m)	-	-	-	-	-
Offset from control line:	(m)	-	-	-	-	-
Level of Test:	(m)	-	-	-	-	-
Test Depth:	(mm)	-	-	-	-	-
Moisture Content (Calculated):	(%)	-	-	-	-	-
Moisture Content (Corrected):	**(%)**	**-**	**-**	**-**	**-**	**-**

Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Customer: Results apply to the sample/s as received. **
AS 1289.1.1: (2001)Preparation of disturbed soil samples
AS 1289.2.1.1: (2005) Moisture Content (Oven Drying)

(NATA accreditation does not cover the performance of this service)**

Report Remarks & Endorsement

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
P.Baltoski
Approved Signatory

AUSTRALIAN SOIL AND CONCRETE TESTING
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Report on Rock Core Testing

Client:	**Cardno**	Report No:	**470**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	2/07/2021
Project:	**Geotechnical Testing**	Report Page:	Page 1 of 3
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	-	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 30/06/2021	Control Line:	BH01 - UCS
Sample Date:	22/06/2021	**Sample Number:**	**39742**

Point Load Strength Index	Specimen 1	Specimen 2	Specimen 3	Specimen 4	Specimen 5	Specimen 6	Specimen 7	Specimen 8	Specimen 9	Specimen 10
Client ID Number										
Borehole	**BH01**	**BH02**	**BH03**	**BH04**						
Depth	**3.36-3.59**	**3.29-3.38**	**4.60-4.81**	**6.59-6.79**						
Lithological Description										
Moisture Condition	Moist	Moist	Moist	Moist						
Test Type	Axial	Axial	Axial	Axial						
Anisotropic Direction										
Failure Mode	1	1	1	1						
Failure Sketch										
Uncorrected Strength (Mpa)	1.30	0.92	0.83	1.47						
Point Load Strength Index (Mpa)	**1.33**	**0.93**	**0.90**	**1.55**						
Descriptive Strength (AS1726, Table 19)	High	Medium	Medium	High						
UCS [AS1726, Table 19] (MPa)	20 to 60	6 to 20	6 to 20	20 to 60						
Comments										

MEAN VALUE - Point Load Strength Index (Mpa)	**Normal Direction**	-	**Parallel Direction**	-	**Strength Anisotropy Index [Ia(50)] (Mpa)**	--

Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by Client: Results apply to the sample/s as received. **
As Received: Samples stored & Tested in as received condition.
AS4133.4.1: (2007) Determination of Point Load Index
AS4133.4.2.2: (2013) Determination of Uniaxial Compressive Strength (<50MPa) **
AS4133.1.1.1: (2005) Determination of moisture content of rock, oven drying. **

(NATA accreditation does not cover the performance of this service)**

Point Load - Failure Mode Descriptions

1	Fracture through fabric, oblique to banding.
2	Fracture along banding.
3	Fracture through rock mass.
4J	Fracture influenced by Joint Plane.
4M	Fracture influenced by Micro-fracture.
4F	Fracture influenced by Foliation.
4V	Fracture influenced by Vein.
5	Invalid Result (Partial fracture, or chip).

Report Endorsement

NATA

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NATA Accreditation number: 20656

Issued By: P.Baltoski
Approved Signatory

WB62 - Rev 5, 06/05/2021

AUSTRALIAN SOIL AND CONCRETE TESTING
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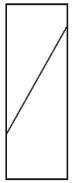
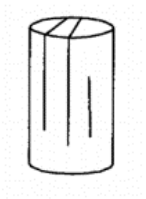
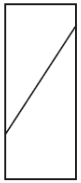
Report on Rock Core Testing

Client:	Cardno	Report No:	**470**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	2/07/2021
Project:	**Geotechnical Testing**	Report Page:	Page 2 of 3
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	-	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 30/06/2021	Control Line:	BH01 - UCS
Sample Date:	22/06/2021	**Sample Number:**	**39742**

Uniaxial Compressive Strength	Specimen 1	Specimen 2	Specimen 3	Specimen 4	Specimen 5	Specimen 6	Specimen 7	Specimen 8	Specimen 9	Specimen 10
Client ID Number										
Borehole	**BH01**	**BH02**	**BH03**	**BH04**						
Depth	**3.36-3.59**	**3.29-3.38**	**4.60-4.81**	**6.59-6.79**						
Lithological Description										
Type of Testing Machine	ILLACONC1	ILLACONC1	ILLACONC1	ILLACONC1						
Date of Test	30/06/2021	30/06/2021	30/06/2021	30/06/2021						
Height (mm)	143	142	137	140						
Diameter (mm)	52.1	52.0	52.0	52.0						
Test Duration (mins)	212.00	274.00	331.00	336.00						
Failure Mode	(a) Single Shear	(AM) Axial Multiple	(e) Tensile Dominated	(a) Single Shear						
Failure Sketch										
UCS (Mpa)	**47.521**	**34.506**	**41.329**	**42.754**						
Average UCS (Mpa)	**41.528**									
Moisture Content	Specimen 1	Specimen 2	Specimen 3	Specimen 4	Specimen 5	Specimen 6	Specimen 7	Specimen 8	Specimen 9	Specimen 10
Moisture Content (%)	4.8	4.8	3.9	6.3						

General Report Remarks:

AUSTRALIAN SOIL AND CONCRETE TESTING
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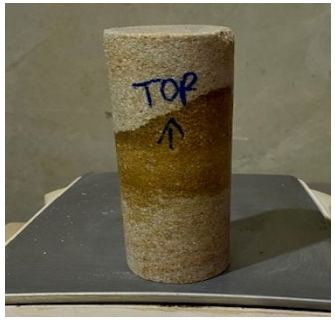
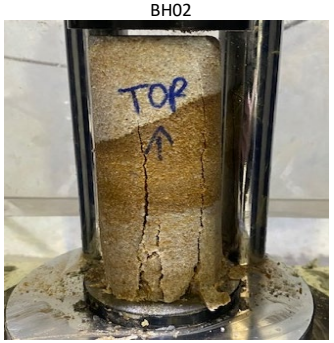
Report on Rock Core Testing

Client:	Cardno	Report No:	**470**
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	2/07/2021
Project:	**Geotechnical Testing**	Report Page:	Page 3 of 3
Works Component:	Shoalhaven Hospital Redevelopmet	Project No:	26
Material Used:	-	Test Request:	8202118201
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 30/06/2021	Control Line:	BH01 - UCS
Sample Date:	22/06/2021	**Sample Number:**	**39742**

Uniaxial Compressive Strength (UCS Less Than 50 Mpa) - Specimen 1
Rate of Displacement (mm/min):

Specimen - Before Testing	Specimen - After Failure
BH01	BH01
	
BH02	BH02
	

Uniaxial Compressive Strength (UCS Less Than 50 Mpa)
Rate of Displacement (mm/min):

Specimen - Before Testing	Specimen - After Failure
BH03	BH03
	
BH04	BH04
	

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NATA Accredited
Accreditation Number 1261
Site Number 18217

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

Attention: **Benjamin Armstrong**

Report **806809-S**
Project name SHOALHAVEN HOSPITAL REDEVELOPMENT
Project ID 8202118201
Received Date Jun 25, 2021

Client Sample ID			**BH04-SPT01 0.50-0.95**	**BH02-SPT01 0.50-0.95**	**BH03-SPT02 1.50-1.95**	**BH02-SPT02 1.50-1.95**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S21-Jn60332**	**S21-Jn60333**	**S21-Jn60334**	**S21-Jn60335**
Date Sampled			**Jun 22, 2021**	**Jun 21, 2021**	**Jun 21, 2021**	**Jun 21, 2021**
Test/Reference	LOR	Unit				
Chloride	10	mg/kg	< 10	15	10	10
Conductivity (1:5 aqueous extract at 25°C as rec.)	10	uS/cm	13	15	13	13
pH (1:5 Aqueous extract at 25°C as rec.)	0.1	pH Units	5.9	5.3	5.3	5.2
Resistivity*	0.5	ohm.m	780	660	750	770
Sulphate (as SO4)	10	mg/kg	14	< 10	< 10	< 10
% Moisture	1	%	20	18	18	12

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chloride	Sydney	Jun 30, 2021	28 Days
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Conductivity (1:5 aqueous extract at 25°C as rec.)	Sydney	Jun 30, 2021	7 Days
- Method: LTM-INO-4030 Conductivity			
pH (1:5 Aqueous extract at 25°C as rec.)	Sydney	Jun 30, 2021	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			
Sulphate (as SO4)	Sydney	Jun 30, 2021	28 Days
- Method: E045 Anions by Ion Chromatography			
% Moisture	Sydney	Jun 30, 2021	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins | Environment Testing

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NSW 2500

Project Name: SHOALHAVEN HOSPITAL REDEVELOPMENT
Project ID: 8202118201

Order No.:
Report #: 806809
Phone: 02 4231 9672
Fax:

Received: Jun 25, 2021 3:15 PM
Due: Jul 2, 2021
Priority: 5 Day
Contact Name: Benjamin Armstrong

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						HOLD	Aggressivity Soil Set	Moisture Set
Melbourne Laboratory - NATA Site # 1254								
Sydney Laboratory - NATA Site # 18217						X	X	X
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory - NATA Site # 25079								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	BH04-SPT01 0.50-0.95	Jun 22, 2021		Soil	S21-Jn60332		X	X
2	BH02-SPT01 0.50-0.95	Jun 21, 2021		Soil	S21-Jn60333		X	X
3	BH03-SPT02 1.50-1.95	Jun 21, 2021		Soil	S21-Jn60334		X	X
4	BH02-SPT02 1.50-1.95	Jun 21, 2021		Soil	S21-Jn60335		X	X
5	BH03-SPT01 0.50-0.95	Jun 21, 2021		Soil	S21-Jn60336	X		
6	BH05-SPT01	Jun 21, 2021		Soil	S21-Jn60337	X		

eurofins | Environment Testing

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NATA # 1261 Site # 20794

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NATA # 1261
Site # 23736

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NATA # 1261 Site # 25079

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IANZ # 1327

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Order No.:
Report #: 806809
Phone: 02 4231 9672
Fax:

Received: Jun 25, 2021 3:15 PM
Due: Jul 2, 2021
Priority: 5 Day
Contact Name: Benjamin Armstrong

Project Name: SHOALHAVEN HOSPITAL REDEVELOPMENT
Project ID: 8202118201

Eurofins Analytical Services Manager : Ursula Long

Sample Detail						HOLD	Aggressivity Soil Set	Moisture Set
Melbourne Laboratory - NATA Site # 1254								
Sydney Laboratory - NATA Site # 18217						X	X	X
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory - NATA Site # 25079								
External Laboratory								
	0.50-0.95							
7	BH06-SPT01 0.50-0.95	Jun 21, 2021		Soil	S21-Jn60338	X		
Test Counts						3	4	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Chloride	mg/kg	< 10			10	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)	uS/cm	< 10			10	Pass	
Sulphate (as SO4)	mg/kg	< 10			10	Pass	
LCS - % Recovery							
Conductivity (1:5 aqueous extract at 25°C as rec.)	%	88			70-130	Pass	
Resistivity*	%	88			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Chloride	S21-Jn52802	NCP	%	103			70-130	Pass	
Sulphate (as SO4)	S21-Jn52802	NCP	%	103			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Chloride	S21-Jn52802	NCP	mg/kg	< 10	< 10	<1	30%	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)	S21-Jn54607	NCP	uS/cm	220	200	8.0	30%	Pass	
pH (1:5 Aqueous extract at 25°C as rec.)	S21-Jn54607	NCP	pH Units	5.1	5.1	<1	30%	Pass	
Resistivity*	S21-Jn54607	NCP	ohm.m	47	51	8.0	30%	Pass	
Sulphate (as SO4)	S21-Jn52802	NCP	mg/kg	46	44	4.0	30%	Pass	
% Moisture	S21-Jn60239	NCP	%	14	14	1.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised by:

Ursula Long	Analytical Services Manager
Charl Du Preez	Senior Analyst-Inorganic (NSW)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

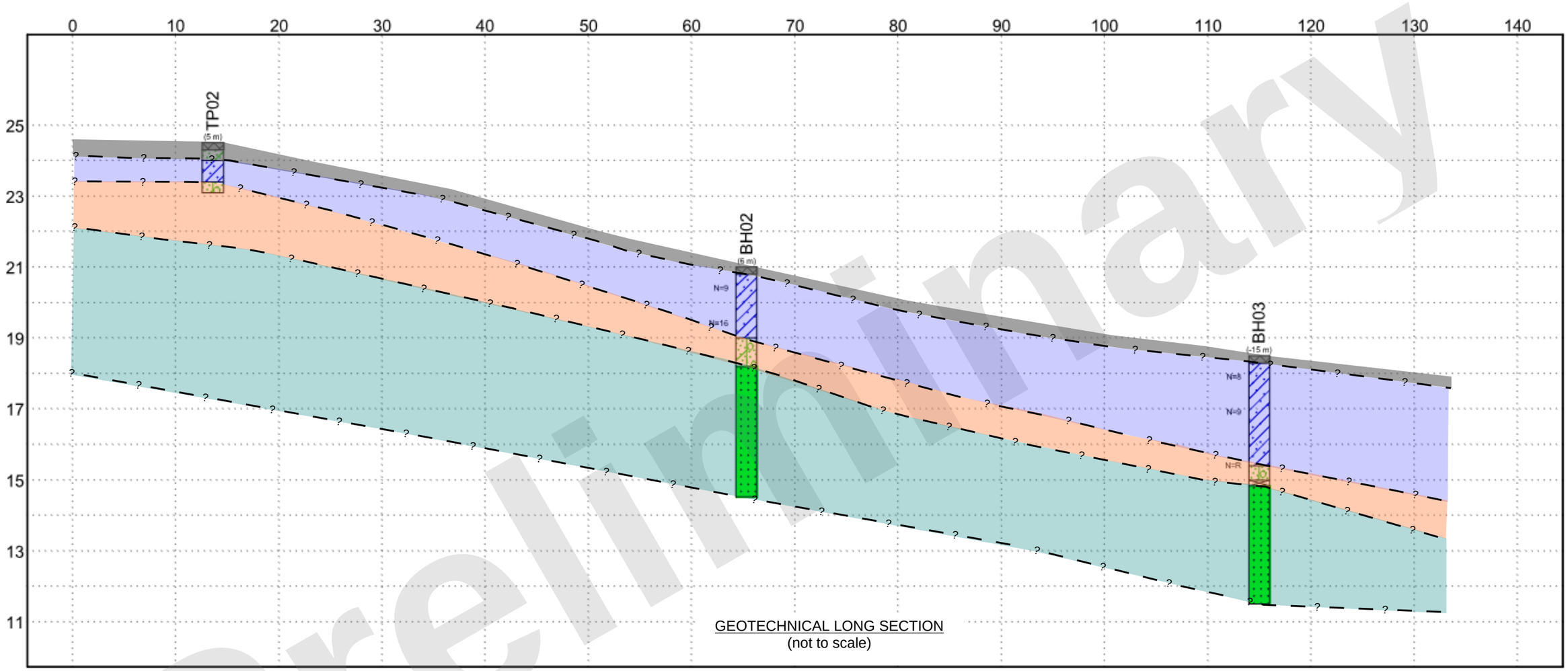
Measurement uncertainty of test data is available on request or please click here.

Shoalhaven Hospital Redevelopment

APPENDIX D

GEOTECHNICAL CROSS SECTIONS

CROSS SECTION 1



GEOTECHNICAL LONG SECTION
(not to scale)

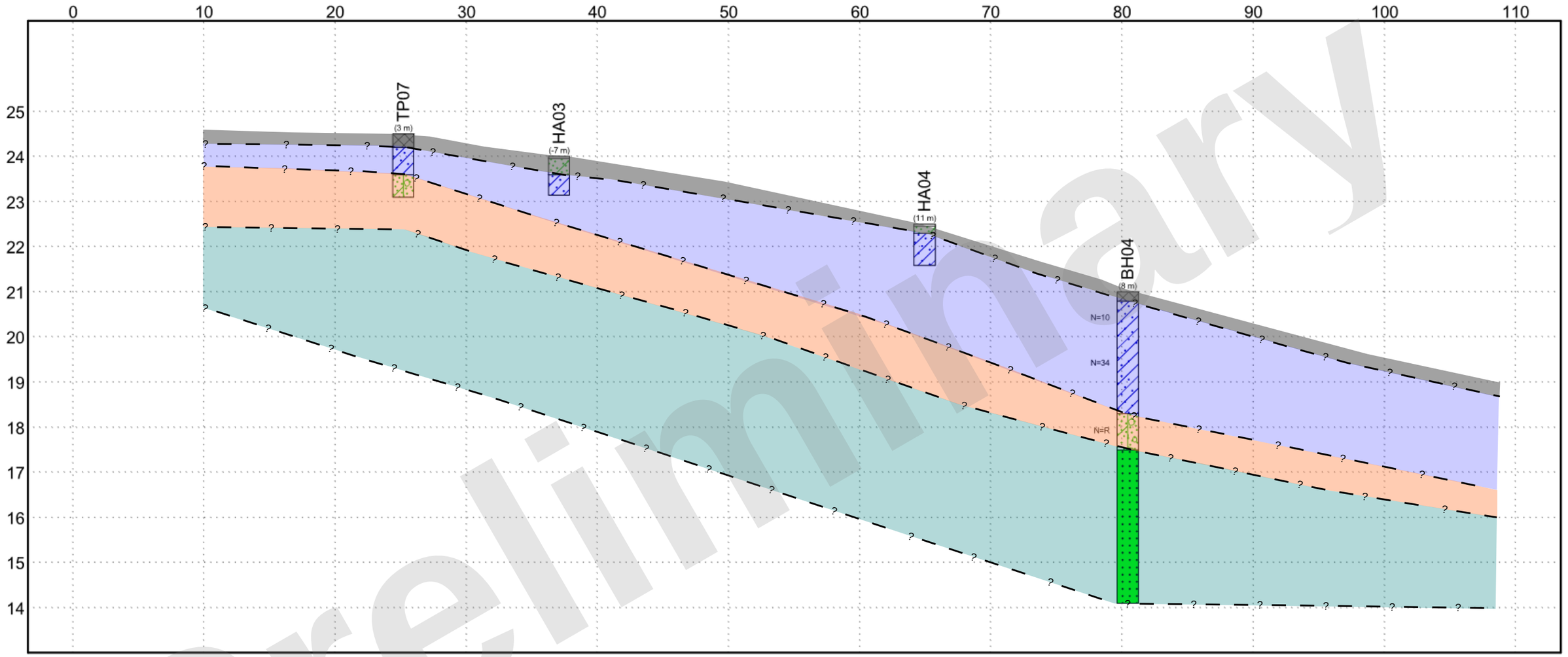
KEY

Unit	Soil Type	Description of Layer
1a	FILL (PAVEMENT)	**ASPHALT** black
1b	FILL / TOPSOIL	**Silty SAND / Clayey SAND / Clayey Sandy GRAVEL / Gravelly SAND / Gravelly Sandy CLAY** low to medium plasticity, fine to coarse sand, grey, grey-brown, dark orange-brown, fine to coarse sub-angular gravels, moist, trace roots and rootlets, trace organic matter.
2	RESIDUAL SOIL	**Sandy CLAY / Clayey SAND / CLAY** medium to high plasticity, fine to coarse grained sand, brown, pale grey, pale blue-grey, pale red-brown, grey-brown mottled yellow and orange, trace gravels, weakly cemented, moist.
3	EXTREMELEY WEATHERED MATERIAL	**Clayey Gravelly SAND** medium plasticity, orange-brown, pale-grey, pale blue-grey, with fine to medium grained sand, weakly cemented, inferred as extremely weathered rock.
4	ROCK	**SANDSTONE,** medium to coarse grained, bedded, pale grey, stained red-brown and orange-brown

Cardno
Shaping the Future

PROJECT NAME:	Shoalhaven Hospital Redevelopment	PROJECT NUMBER:	8202118201
DESCRIPTION:	Geotechnical Cross Section (not to scale)	DESIGNED:	DP
		DATE: 5/11/2021	SHEET 1 of 1

CROSS SECTION 2



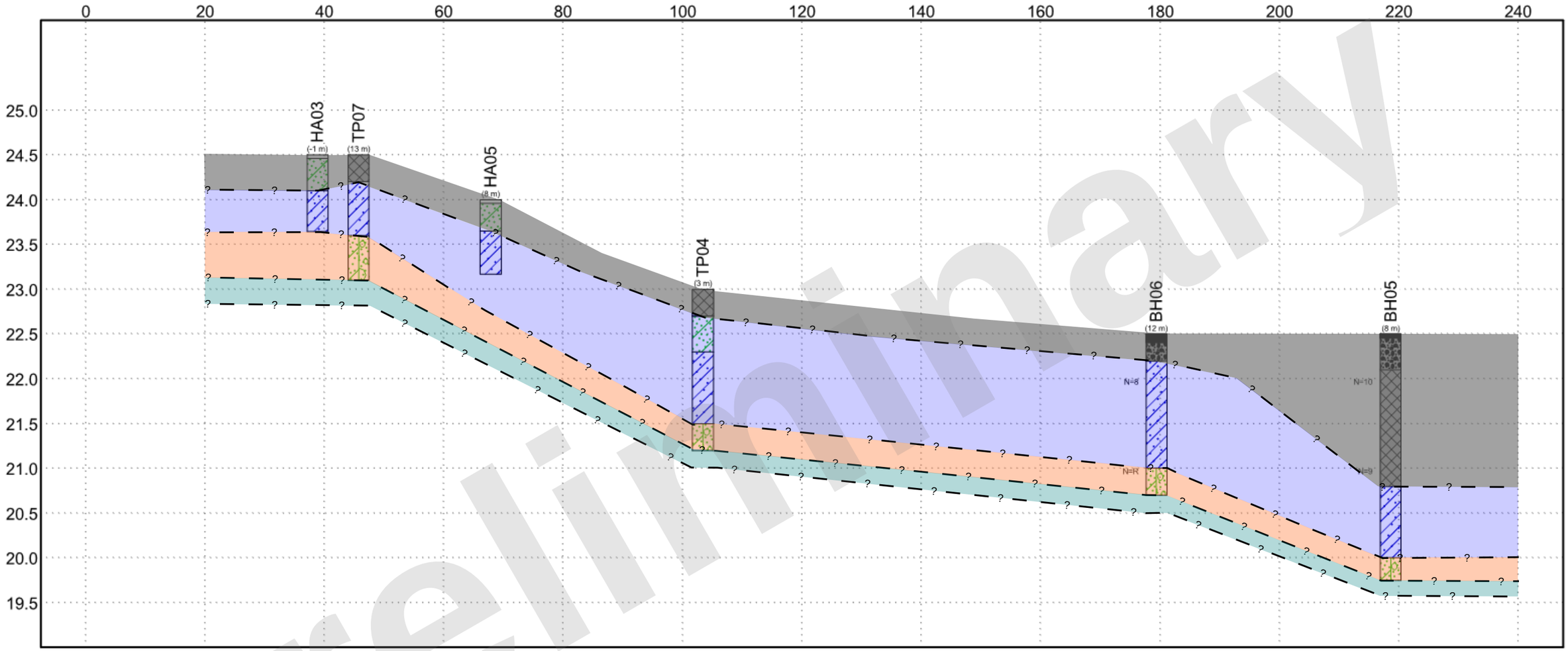
KEY

Unit	Soil Type	Description of Layer
1a	FILL (PAVEMENT)	**ASPHALT** black
1b	FILL / TOPSOIL	**Silty SAND / Clayey SAND / Clayey Sandy GRAVEL / Gravelly SAND / Gravelly Sandy CLAY** low to medium plasticity, fine to coarse sand, grey, grey-brown, dark orange-brown, fine to coarse sub-angular gravels, moist, trace roots and rootlets, trace organic matter.
2	RESIDUAL SOIL	**Sandy CLAY / Clayey SAND / CLAY** medium to high plasticity, fine to coarse grained sand, brown, pale grey, pale blue-grey, pale red-brown, grey-brown mottled yellow and orange, trace gravels, weakly cemented, moist.
3	EXTREMELEY WEATHERED MATERIAL	**Clayey Gravelly SAND** medium plasticity, orange-brown, pale-grey, pale blue-grey, with fine to medium grained sand, weakly cemented, inferred as extremely weathered rock.
4	ROCK	**SANDSTONE,** medium to coarse grained, bedded, pale grey, stained red-brown and orange-brown

Cardno
Shaping the Future

PROJECT NAME: Shoalhaven Hospital Redevelopment		PROJECT NUMBER: 8202118201
DESCRIPTION: Geotechnical Cross Section (not to scale)		DESIGNED: DP
		DATE: 5/11/2021 SHEET 1 of 1

CROSS SECTION A



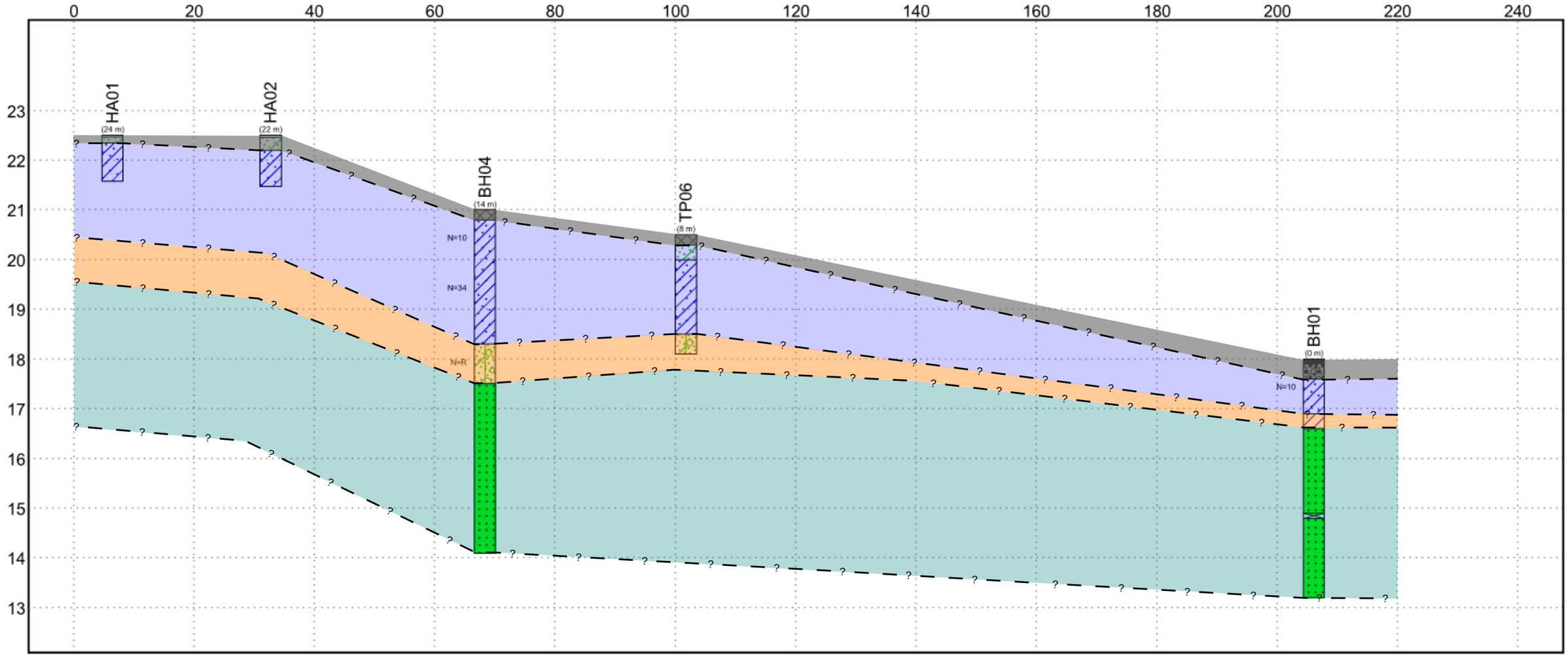
KEY

Unit	Soil Type	Description of Layer
1a	FILL (PAVEMENT)	**ASPHALT** black
1b	FILL / TOPSOIL	**Silty SAND / Clayey SAND / Clayey Sandy GRAVEL / Gravelly SAND / Gravelly Sandy CLAY** low to medium plasticity, fine to coarse sand, grey, grey-brown, dark orange-brown, fine to coarse sub-angular gravels, moist, trace roots and rootlets, trace organic matter.
2	RESIDUAL SOIL	**Sandy CLAY / Clayey SAND / CLAY** medium to high plasticity, fine to coarse grained sand, brown, pale grey, pale blue-grey, pale red-brown, grey-brown mottled yellow and orange, trace gravels, weakly cemented, moist.
3	EXTREMELEY WEATHERED MATERIAL	**Clayey Gravelly SAND** medium plasticity, orange-brown, pale-grey, pale blue-grey, with fine to medium grained sand, weakly cemented, inferred as extremely weathered rock.
4	ROCK	**SANDSTONE,** medium to coarse grained, bedded, pale grey, stained red-brown and orange-brown

Cardno
Shaping the Future

PROJECT NAME:	Shoalhaven Hospital Redevelopment	PROJECT NUMBER:	8202118201
DESCRIPTION:	Geotechnical Cross Section (not to scale)	DESIGNED:	DP
		DATE: 5/11/2021	SHEET 1 of 1

CROSS SECTION B



KEY

Unit	Soil Type	Description of Layer
1a	FILL (PAVEMENT)	**ASPHALT** black
1b	FILL / TOPSOIL	**Silty SAND / Clayey SAND / Clayey Sandy GRAVEL / Gravelly SAND / Gravelly Sandy CLAY** low to medium plasticity, fine to coarse sand, grey, grey-brown, dark orange-brown, fine to coarse sub-angular gravels, moist, trace roots and rootlets, trace organic matter.
2	RESIDUAL SOIL	**Sandy CLAY / Clayey SAND / CLAY** medium to high plasticity, fine to coarse grained sand, brown, pale grey, pale blue-grey, pale red-brown, grey-brown mottled yellow and orange, trace gravels, weakly cemented, moist.
3	EXTREMELEY WEATHERED MATERIAL	**Clayey Gravelly SAND** medium plasticity, orange-brown, pale-grey, pale blue-grey, with fine to medium grained sand, weakly cemented, inferred as extremely weathered rock.
4	ROCK	**SANDSTONE,** medium to coarse grained, bedded, pale grey, stained red-brown and orange-brown

Cardno
Shaping the Future

PROJECT NAME: Shoalhaven Hospital Redevelopment		PROJECT NUMBER: 8202118201
DESCRIPTION: Geotechnical Cross Section (not to scale)		DESIGNED: DP
		DATE: 5/11/2021 SHEET 1 of 1

Shoalhaven Hospital Redevelopment

APPENDIX

E

PERMEABILITY TEST TABLES

VARIABLE HEAD PERMEABILITY TEST

SITE	HA01-TEST 1	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	0.92 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	0.92	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	0.92	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.77 (i)

Borehole Case
Hvorslev

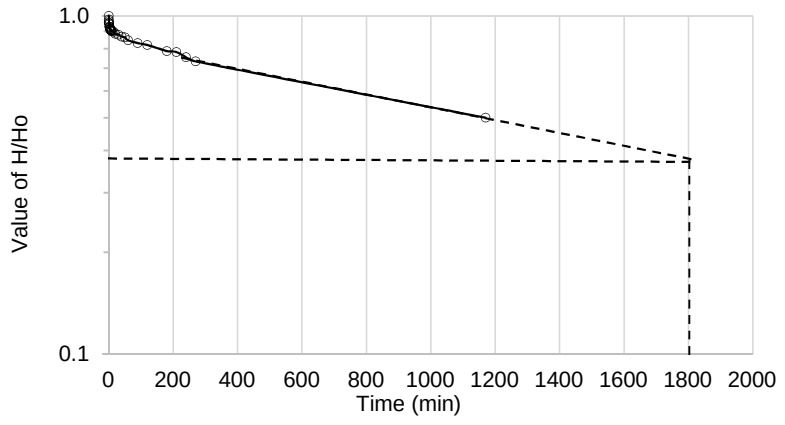
Permeability, K

$$K=\frac{A}{F.T} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor
corresponding to an H/Ho value of 0.37
Hvorslev

L=	0.92	m	
D=	0.070	m	
L/D=	13		
A=	0.00385	m^2	
F=	1.77		From (i)
T=	1800	min	corresponding to an H/Ho value of 0.37
T=	108000	s	corresponding to an H/Ho value of 0.37
K=	**2.02E-08**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	0.92	1.00
0	9.6	0.90	0.98
1	30	0.89	0.97
1	45	0.88	0.96
1	60	0.88	0.95
2	90	0.87	0.95
2	120	0.86	0.93
3	150	0.86	0.93
3	180	0.85	0.92
4	210	0.85	0.92
4	240	0.84	0.91
5	270	0.84	0.91
5	300	0.84	0.91
6	360	0.84	0.91
7	420	0.84	0.91
8	480	0.84	0.91
9	540	0.83	0.90
10	600	0.83	0.90
15	900	0.83	0.90
20	1200	0.82	0.89
30	1800	0.81	0.88
40	2400	0.80	0.87
50	3000	0.80	0.86
60	3600	0.78	0.85
90	5400	0.77	0.83
120	7200	0.76	0.82
180	10800	0.73	0.79
210	12600	0.72	0.78
240	14400	0.70	0.76
270	16200	0.68	0.73
1170	70200	0.46	0.50

VARIABLE HEAD PERMEABILITY TEST

SITE	HA01-TEST 2	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	0.92 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	0.92	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	0.92	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.77 (i)

Borehole Case
Hvorslev

Permeability, K

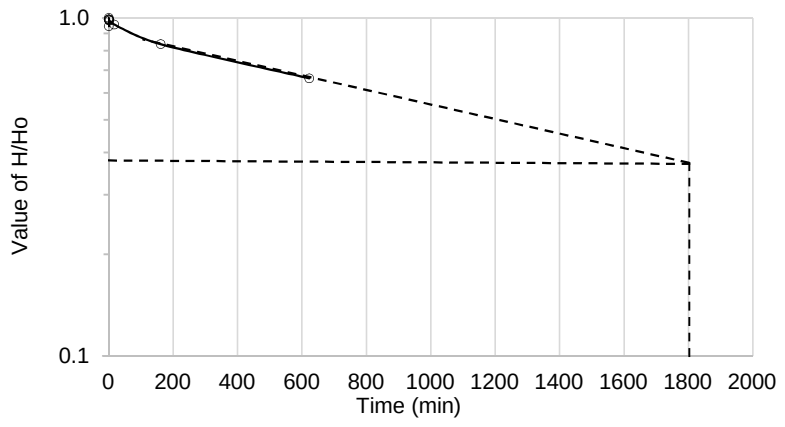
$$K=\frac{A}{F.T} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37
Hvorslev

L=	0.92	m	
D=	0.070	m	
L/D=	13		
A=	0.00385	m^2	
F=	1.77		From (i)
T=	1800	s	corresponding to an H/Ho value of 0.37
T=	108000	min	corresponding to an H/Ho value of 0.37
K=	**2.02E-08**	m/s	From (iii)

Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	0.92	1.00
0	9.6	0.87	0.95
0	19.8	0.91	0.99
1	30	0.91	0.99
1	45	0.91	0.99
1	60	0.91	0.98
2	120	0.91	0.98
17	1020	0.88	0.96
161	9660	0.77	0.84
623	37380	0.61	0.66

Remarks



VARIABLE HEAD PERMEABILITY TEST

SITE	HA02-TEST 1	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	1.02 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	1.02	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	1.02	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.90 (i)

Borehole Case
Hvorslev

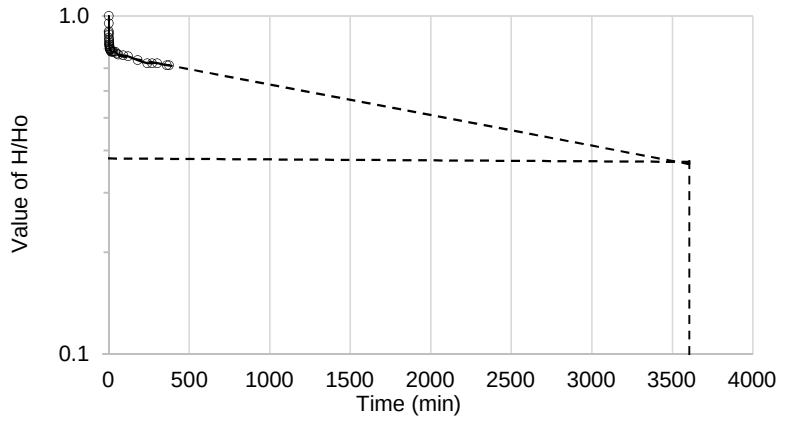
Permeability, K

$$K=\frac{A}{F.T} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor
corresponding to an H/Ho value of 0.37
Hvorslev

L=	1.02	m	
D=	0.070	m	
L/D=	15		
A=	0.00385	m^2	
F=	1.90		From (i)
T=	3600	min	corresponding to an H/Ho value of 0.37
T=	216000	s	corresponding to an H/Ho value of 0.37
K=	**9.38E-09**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	1.02	1.00
0	9.6	0.97	0.95
1	30	0.92	0.90
1	45	0.91	0.89
1	60	0.90	0.88
2	90	0.88	0.86
2	120	0.87	0.85
3	150	0.86	0.84
3	180	0.85	0.83
4	210	0.84	0.82
4	240	0.84	0.82
5	270	0.83	0.81
5	300	0.83	0.81
6	360	0.82	0.80
7	420	0.82	0.80
8	480	0.81	0.79
9	540	0.81	0.79
10	600	0.81	0.79
15	900	0.80	0.78
20	1200	0.80	0.78
25	1500	0.80	0.78
30	1800	0.80	0.78
40	2400	0.80	0.78
50	3000	0.79	0.77
60	3600	0.79	0.77
90	5400	0.78	0.76
120	7200	0.78	0.76
180	10800	0.76	0.74
240	14400	0.74	0.73
270	16200	0.74	0.73
300	18000	0.74	0.73
360	21600	0.73	0.72
375	22500	0.73	0.72

VARIABLE HEAD PERMEABILITY TEST

SITE	HA02-TEST 2	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	1.02 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	1.02	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	1.02	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.90 (i)

Borehole Case
Hvorslev

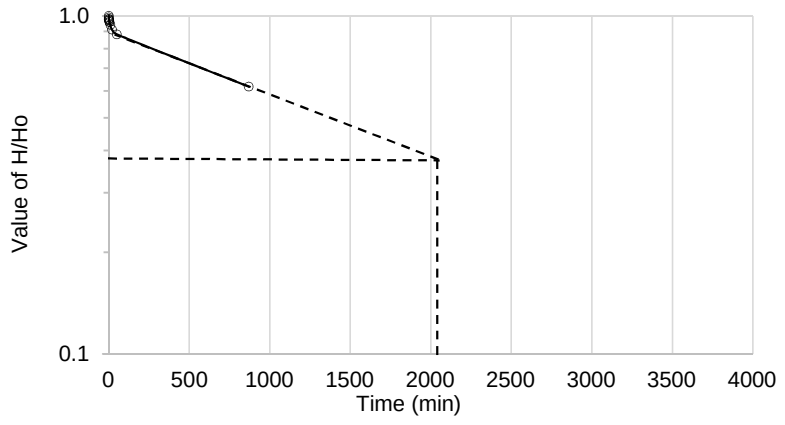
Permeability, K

$$K=\frac{A}{F.T} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor
corresponding to an H/Ho value of 0.37
Hvorslev

L=	1.02	m	
D=	0.070	m	
L/D=	15		
A=	0.00385	m^2	
F=	1.90		From (i)
T=	2050	min	corresponding to an H/Ho value of 0.37
T=	123000	s	corresponding to an H/Ho value of 0.37
K=	**1.65E-08**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	1.02	1.00
0	9.6	1.01	0.99
1	30	1.00	0.98
1	60	1.00	0.98
2	120	0.99	0.97
3	180	0.99	0.97
4	240	0.98	0.96
5	300	0.98	0.96
10	600	0.96	0.94
20	1200	0.93	0.91
50	3000	0.90	0.88
870	52200	0.63	0.62

VARIABLE HEAD PERMEABILITY TEST

SITE	HA02-TEST 3	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	1.02 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	1.02	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	1.02	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.90 (i)

Borehole Case
Hvorslev

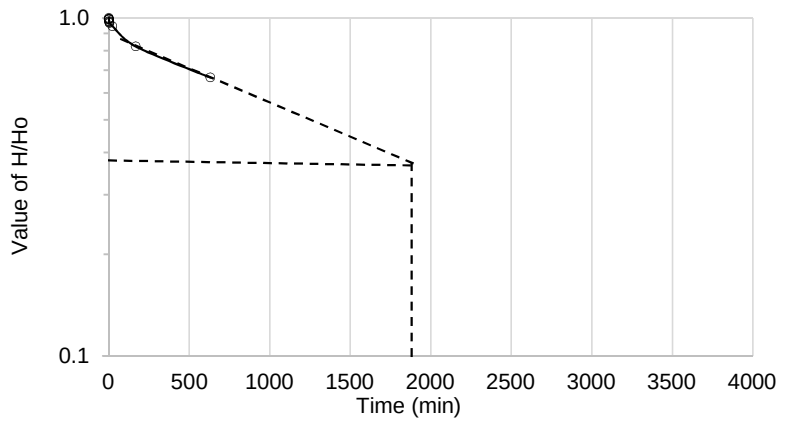
Permeability, K

$$K=\frac{A}{F.T} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37
Hvorslev

L=	1.02	m	
D=	0.070	m	
L/D=	15		
A=	0.00385	m^2	
F=	1.90		From (i)
T=	1900	min	corresponding to an H/Ho value of 0.37
T=	114000	s	corresponding to an H/Ho value of 0.37
K=	**1.78E-08**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	1.02	1.00
0	9.6	1.02	1.00
0	19.8	1.02	1.00
1	30	1.02	1.00
1	45	1.01	0.99
1	60	1.01	0.99
2	120	1.00	0.98
3	180	1.00	0.98
4	240	0.99	0.97
5	300	0.99	0.97
23	1380	0.97	0.95
168	10080	0.84	0.82
630	37800	0.68	0.67

VARIABLE HEAD PERMEABILITY TEST

SITE	HA03-TEST 1	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	0.86 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	0.86	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	0.86	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.69 (i)

Borehole Case
Hvorslev

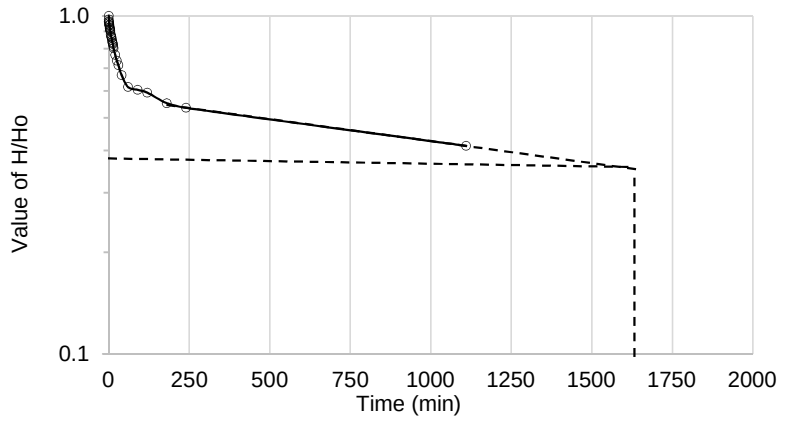
Permeability, K

$K=\frac{A}{F.T}$ (iii)

Where T is the Basic Time Lag Factor
corresponding to an H/Ho value of 0.37
Hvorslev

L=	0.86	m	
D=	0.070	m	
L/D=	12		
A=	0.00385	m^2	
F=	1.69		From (i)
T=	1625	min	corresponding to an H/Ho value of 0.37
T=	97500	s	corresponding to an H/Ho value of 0.37
K=	**2.34E-08**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	0.86	1.00
0	9.6	0.84	0.98
1	30	0.83	0.97
1	45	0.83	0.96
1	60	0.82	0.95
2	90	0.81	0.94
2	120	0.81	0.94
3	150	0.81	0.94
3	180	0.80	0.92
4	210	0.79	0.92
4	240	0.79	0.91
5	270	0.78	0.91
5	300	0.78	0.90
6	360	0.76	0.88
7	420	0.75	0.87
8	480	0.75	0.87
9	540	0.74	0.86
10	600	0.73	0.85
11	660	0.72	0.84
12	720	0.72	0.83
13	780	0.71	0.83
14	840	0.70	0.81
15	900	0.69	0.80
20	1200	0.66	0.77
25	1500	0.64	0.74
30	1800	0.62	0.72
40	2400	0.58	0.67
60	3600	0.53	0.62
90	5400	0.52	0.60
120	7200	0.51	0.59
180	10800	0.48	0.55
240	14400	0.46	0.53
1110	66600	0.36	0.41

VARIABLE HEAD PERMEABILITY TEST

SITE	HA03-TEST 2	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	0.86 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	0.86	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	0.86	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.69 (i)

Borehole Case
Hvorslev

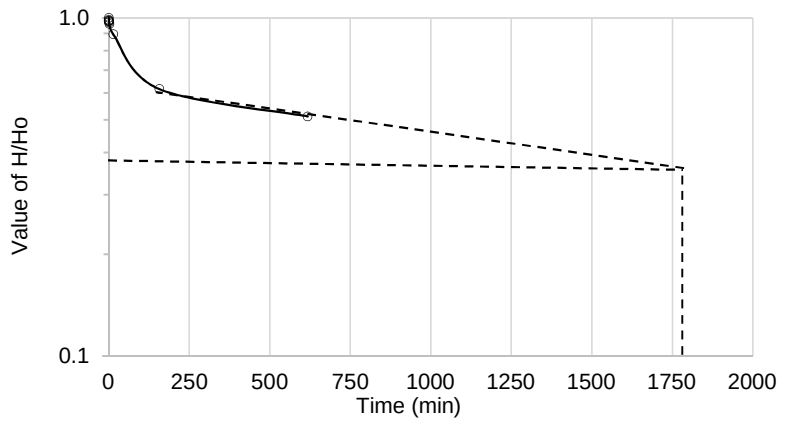
Permeability, K

$$K=\frac{A}{F.T} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37
Hvorslev

L=	0.86	m	
D=	0.070	m	
L/D=	12		
A=	0.00385	m^2	
F=	1.69		From (i)
T=	1775	min	corresponding to an H/Ho value of 0.37
T=	106500	s	corresponding to an H/Ho value of 0.37
K=	**2.14E-08**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	0.86	1.00
0	9.6	0.85	0.99
0	19.8	0.85	0.98
1	30	0.85	0.98
1	45	0.84	0.98
1	60	0.84	0.97
2	120	0.83	0.96
14	840	0.77	0.90
157	9420	0.53	0.62
618	37080	0.44	0.51

VARIABLE HEAD PERMEABILITY TEST

SITE	HA04-TEST 1	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	0.91 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	0.91	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	0.91	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.75 (i)

Borehole Case
Hvorslev

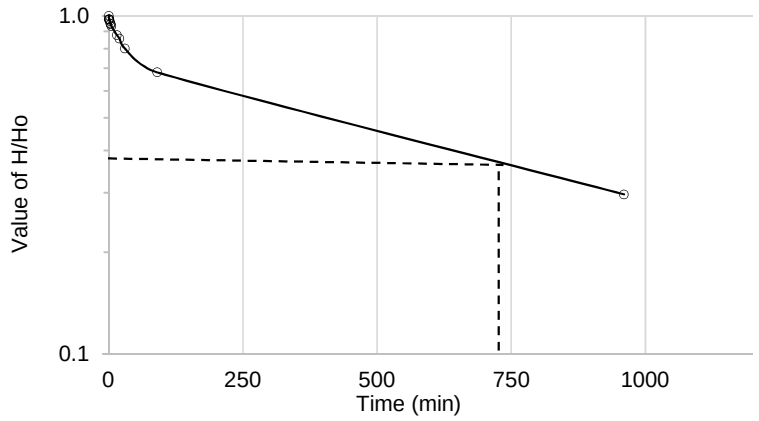
Permeability, K

$$K=\frac{A}{F.T} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37
Hvorslev

L=	0.91	m	
D=	0.070	m	
L/D=	13		
A=	0.00385	m^2	
F=	1.75		From (i)
T=	725	min	corresponding to an H/Ho value of 0.37
T=	43500	s	corresponding to an H/Ho value of 0.37
K=	**5.04E-08**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	0.91	1.00
0	9.6	0.89	0.98
1	30	0.89	0.98
1	45	0.89	0.98
1	60	0.89	0.98
2	120	0.88	0.97
3	180	0.87	0.95
4	240	0.86	0.95
5	300	0.85	0.93
15	900	0.80	0.88
20	1200	0.78	0.86
30	1800	0.73	0.80
90	5400	0.62	0.68
960	57600	0.27	0.30

VARIABLE HEAD PERMEABILITY TEST

SITE	HA04-TEST 2	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	0.91 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	0.91	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	0.91	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.75 (i)

Borehole Case
Hvorslev

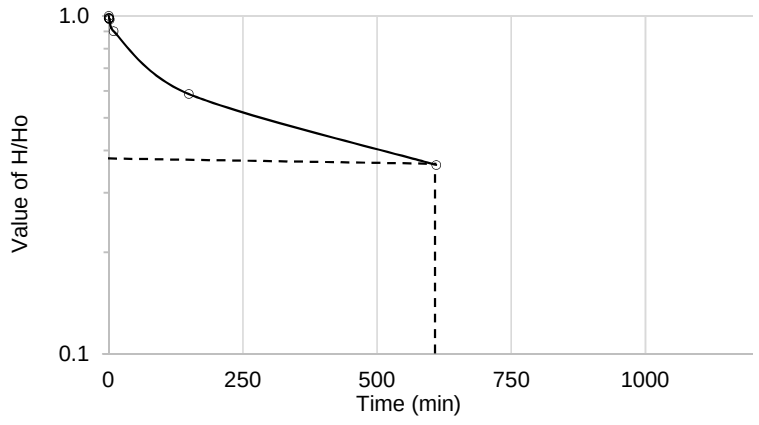
Permeability, K

$$K=\frac{A}{F.T} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37
Hvorslev

L=	0.91	m	
D=	0.070	m	
L/D=	13		
A=	0.00385	m^2	
F=	1.75		From (i)
T=	625	min	corresponding to an H/Ho value of 0.37
T=	37500	s	corresponding to an H/Ho value of 0.37
K=	**5.85E-08**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	0.91	1.00
0.16	9.6	0.90	0.99
0.33	19.8	0.90	0.98
0.5	30	0.90	0.98
0.75	45	0.90	0.98
1	60	0.90	0.98
2	120	0.89	0.98
9	540	0.82	0.90
149	8940	0.54	0.59
610	36600	0.33	0.36

VARIABLE HEAD PERMEABILITY TEST

SITE	HA05-TEST 1	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	0.83 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	0.83	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	0.83	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.65 (i)

Borehole Case
Hvorslev

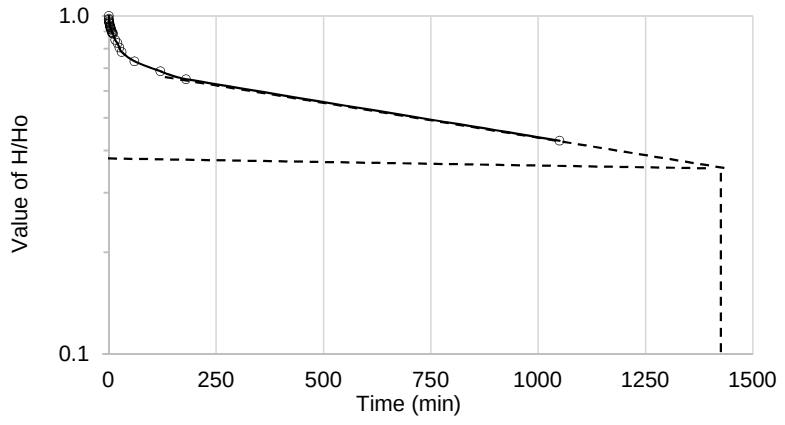
Permeability, K

$K = \frac{A}{F.T}$ (iii)

Where T is the Basic Time Lag Factor
corresponding to an H/Ho value of 0.37
Hvorslev

L=	0.83	m	
D=	0.070	m	
L/D=	12		
A=	0.00385	m^2	
F=	1.65		From (i)
T=	1375	min	corresponding to an H/Ho value of 0.37
T=	82500	min	corresponding to an H/Ho value of 0.37
K=	**2.83E-08**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	0.83	1.00
0.16	9.6	0.82	0.98
0.5	30	0.81	0.98
0.75	45	0.80	0.96
1	60	0.80	0.96
1.5	90	0.79	0.95
2	120	0.79	0.95
2.5	150	0.78	0.94
3	180	0.78	0.93
3.5	210	0.77	0.93
4	240	0.77	0.93
5	270	0.77	0.92
5	300	0.76	0.92
6	360	0.76	0.91
7	420	0.75	0.90
8	480	0.74	0.89
9	540	0.74	0.89
10	600	0.74	0.89
15	900	0.71	0.85
20	1200	0.69	0.83
25	1500	0.67	0.81
30	1800	0.65	0.78
60	3600	0.61	0.73
120	7200	0.57	0.69
180	10800	0.54	0.65
1050	63000	0.36	0.43

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VARIABLE HEAD PERMEABILITY TEST

SITE	HA05-TEST 1	Report Revision:	1
PROJECT	SHOALHAVEN HOSPITAL	Piezometer Depth:	0.83 mBGL

INITIAL CONDITIONS

Test Carried out on	Standpipe	
Base of Standpipe	0.83	mBGL
Top of Standpipe	0.00	mBGL
Top of Screen (Top Response Zone)	0.00	mBGL
Bottom of Screen (Bottom Response Zone)	0.00	mBGL
Diameter of Borehole	70.00	mm
Diameter of Casing	70.00	mm
Elevation of Surface	-	m RL
Groundwater Level (Below Top of Pipe)	-	m

Operator	DP	
Date	28/10/2021	
Checked by	DR	
Time		
Weather		
Response Length	0.83	m
Response Zone Materials	SANDY CLAY	

TEST CALCULATION

Intake Factor, F

F= 1.65 (i)

Borehole Case
Hvorslev

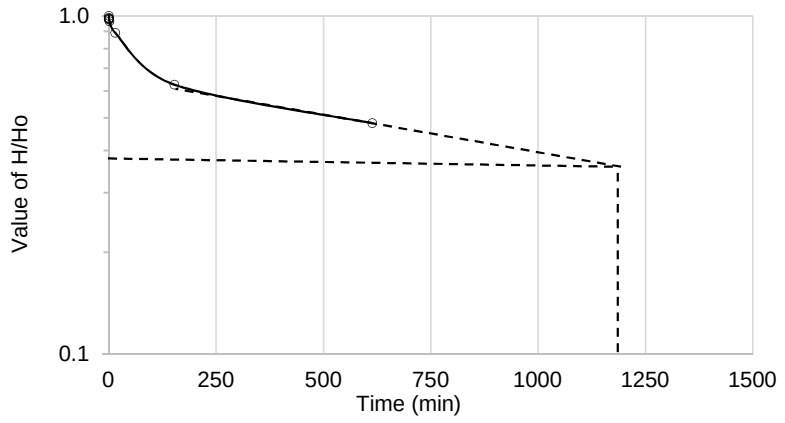
Permeability, K

$$K=\frac{A}{F.T} \quad \text{(iii)}$$

Where T is the Basic Time Lag Factor corresponding to an H/Ho value of 0.37
Hvorslev

L=	0.83	m	
D=	0.070	m	
L/D=	12		
A=	0.00385	m^2	
F=	1.65		From (i)
T=	1200	min	corresponding to an H/Ho value of 0.37
T=	72000	s	corresponding to an H/Ho value of 0.37
K=	**3.25E-08**	m/s	From (iii)

Remarks



Elapsed (minutes)	Total seconds	Head (metres)	H/Ho
0	0	0.83	1.00
0.16	9.6	0.82	0.99
0.33	19.8	0.82	0.98
0.5	30	0.82	0.98
0.75	45	0.82	0.98
1	60	0.81	0.98
2	120	0.80	0.96
15	900	0.74	0.89
153	9180	0.52	0.63
614	36840	0.40	0.48

Shoalhaven Hospital Redevelopment

APPENDIX F

IMPORTANT INFORMATION

Important Information about this Geotechnical Report

Scope of Work

The purpose of this report and any associated documentation is expressly stated in the document. This document does not form a complete assessment of the site, and no implicit determinations about Cardno's scope can be taken if not specifically referenced. Whilst this report is intended to reduce geotechnical risk, no level of detail or scope of work can entirely eliminate risk.

The nature of geotechnical data typically precludes auxiliary environmental assessment without undertaking specific methods in the investigation. Therefore, unless it is explicitly stated in the scope of work, this report does not provide any contamination or environmental assessment of the site or adjacent sites, nor can it be inferred or implied from any component of the document.

The scope of work, geotechnical information, and assessments made by Cardno may be summarised in the report; however, all aspects of the document, including associated data and limitations should be reviewed in its entirety.

Standard of care

Cardno have undertaken investigations, performed consulting services, and prepared this report based on the Client's specific requirements, data that was available or was collected, and previous experience.

Cardno's findings and assessment represent its reasonable judgment, diligence, skill, with sound professional standards, within the time and budget constraints of its commission. No warranty, expressed or implied, is made as to the professional advice included in this report.

Data sources

In preparing this document, or providing any consulting services during the commission, Cardno may have relied on information from third parties including, but not limited to; sub-consultants, published data, and the Client including its employees or representatives. This data may not be verified and Cardno assumes no responsibility for the adequacy, incompleteness, inaccuracies, or reliability of this information.

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Variability in conditions and limitations of data

Subsurface conditions are complex and can be highly variable; they cannot be accurately defined by discrete investigations. Geotechnical data is based on investigation locations which are explicitly representative of the specific sample or test points. Interpretation of conditions between such points cannot be assumed to represent actual subsurface information and there are unknowns or variations in ground conditions between test locations that cannot be inferred or predicted.

The precision and reliability of interpretive assessment between discrete points is dependent on the uniformity of the subsurface strata, as well as the frequency, detail, and method of sampling or testing.

Subsurface conditions are formed by various natural and anthropogenic processes and therefore are subject to change over time. This is particularly relevant with changes to the site ownership or usage, site boundary or layout, and design or planning modifications. Aspects of the site may also not be able to be determined due to physical or project related constraints and any information provided by Cardno cannot apply following modification to the site, regulations, standards, or the development itself.

It is important to appreciate that no level of detail in investigation, or diligence in assessment, can eliminate uncertainty related to subsurface conditions and thus, geotechnical risk. Cardno cannot and does not provide unqualified warranties nor does it assume any liability for site conditions not observed or accessible during the investigations.

Verification of opinions and recommendations

Geotechnical information, by nature, represents an opinion and is based extensively on judgment of both data and interpretive assessments or observation. This report and its associated documentation are provided explicitly based on Cardno's opinion of the site at the time of inspection, and cannot be extended beyond this.

Any recommendations or design are provided as preliminary until verified on site during project implementation or construction. Inspection and verification on site shall be conducted by a suitably qualified geotechnical consultant or engineer, and where subsurface conditions or interpretations differ from those provided in this document or otherwise anticipated, Cardno must be notified and be provided with an opportunity to review the recommendations.

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