

Former Shoalhaven Anglican School Site - Geotechnical Investigation

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Prepared by:
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Acronyms / Abbreviations

Acronym / Abbreviation	Full Name
BH	Borehole
CBR	California Bearing Ratio
DCP	Dynamic Cone Penetrometer
ID	Identification Number
LL	Liquid Limit
LS	Linear Shrinkage
PI	Plasticity Index
PL	Plastic Limit
PSD	Particle Size Distribution
mBGL	Meters Below Ground Level
MC	Moisture Content
MGA	Map Grid of Australia
RL	Reduced level
UTM	Universal Transverse Mercator

Executive Summary

This report provides a summary of the geotechnical field review of the former Shoalhaven Anglican School site at 17 Croobyar Rd, Milton NSW 2538. This report highlights the geotechnical constraints for factors such as groundwater, slope stability, foundations, pavements & excavatability. At a high level, the following conclusions are drawn:

- A variable subsurface profile was observed with significant thicknesses of uncontrolled fill across the site. The alluvial & residual soils comprised mostly clays. Auger refusal on extremely weathered material or bedrock occurred between 1.4 and 4.6 mbgl.
- Groundwater was encountered in Douglas Partners boreholes 101, 104 and 107 between 2.7 and 3.5 mbgl. Shallow groundwater may be problematic and require further consideration for all trenching, basement designs and piled foundations.
- It is expected that earth retaining structures will be required across the site based on the topography. Further investigation and design should be undertaken to address global slope stability and internal stability of proposed retaining structures once concept design plans are finalised.
- The site is currently classified 'P', as there is greater than 0.40m of uncontrolled fill across the site. Reworking of fill would be required for any buildings proposed on shallow footings. It should be noted that the site may be re-classified depending on the construction methodology and bulk earthworks.
- The design subgrade CBR test results ranged between 2.0% and 9.0% but typically in the range of 2.0-3.5%. It is noted that CBR swells of between 2.5% and 4.5% were recorded in the CBR testing. It is recommended that pavement designs are treated as having high swell potential in the subgrade.
- Excavation of alluvial & residual soils is expected to be readily achieved using conventional earthmoving equipment with ripping possibly required within the weathered rock profile. An excavatability assessment is recommended if cut and filling plans extend beyond the bedrock.
- It is recommended that a qualified geotechnical engineer or engineering geologist be present during construction work to confirm ground conditions, design assumptions and provide advice.



1 Introduction

1.1 Project Description

NSW Department of Education has engaged Stantec Australia Pty Ltd (Stantec) to undertake a geotechnical investigation to assess the in-situ subsurface conditions to support the proposed upgrades of; four (4) buildings, landscaping, upgrade of a sporting field, construction of two (2) new sports courts, demolition of seven (7) buildings to be replaced with car parks and bus set-down area and improvement of access roads.

The proposed scope of works in which the investigation was targeted towards is presented in Figure 1-1 below.



Figure 1-1: Site Plan presenting investigation scope work localities

1.2 Objectives

This geotechnical investigation was conducted to provide subsoil units encountered and associated footing parameters and produce a report comprised of the following:

- Introduction, overview and background of the investigation.
- Subsurface soil conditions encountered in the boreholes.
- Groundwater table if encountered.
- In-situ test results.
- Geotechnical parameters for retaining wall design, proposed building foundation in accordance with AS2870-2011 including bearing capacity and earthworks recommendations.
- Preliminary pavement advice



1.3 Available Information

The following relevant geotechnical report was made available for review prior to undertaking the geotechnical investigation:

- 'Report on Geotechnical Investigation proposed Budawang SSP Relocation' dated 6 November 20220 by Douglas Parters [ref: 89390.02.R.001.Rev0].
- 'Report on Limited Intrusive Investigation for Contaminated Land Proposed Budawang SSP Relocation' dated 8 December 2020 by Douglas Partners [ref: 89390.02.R002.Rev0]
- 'Report on Desktop Surface Water and Groundwater Assessment Proposed Budawang School Relocation' dated 23 April 2021 by Douglas Partners [ref: 89390.04.R.001.Rev3].

The above reports were reviewed and associated relevant data was considered with respect to the recommendations presented in this report. The relevant data from these reports has been included in Appendix D for reference.

2 Site description

2.1 Site Location and Topography

The former Shoalhaven Anglican School site has a natural sloping gradient, typically 3° in a westerly direction towards a shallow creek which borders the western perimeter of the site boundary. The site encompasses a playing field is present toward the south of the site, it is understood the field has been constructed using inferred site-won cut and fill, with cutting visible on the eastern side.

The investigation area is presented in Figure 2-1 below with the indicative topography of the site area showing the sports field cut/fill presented in Figure 2-2.



Figure 2-1: Former Shoalhaven Anglican School, Imagery courtesy of Nearmap, dated 23 Feb 2025





Figure 2-2: 3D Image of the Former Shoalhaven Anglican School Site, courtesy of (Nearmap, 2025)

2.2 Regional Geology

An assessment of the regional geology has been undertaken through review of MinView spatial geology website (NSW Department of Primary Industries and Regional Development, 2025) which indicated the site is underlain by the following geological units as presented in *Figure 2-3* below.

- Milton Monzonite (**Puim**): comprised of porphyritic monzonite with phenocrysts of glassy plagioclase in a black fine grained (and sporadically sub-aphanitic) matrix, variable to a monzonite-porphry, weathers to a light colour, small zones of olivine basalt and dyke material.
- Alluvial Valley Deposits (**Q_av**): comprising of silt, clay, (fluvially deposited) lithic to quartz-lithic sand, gravel.

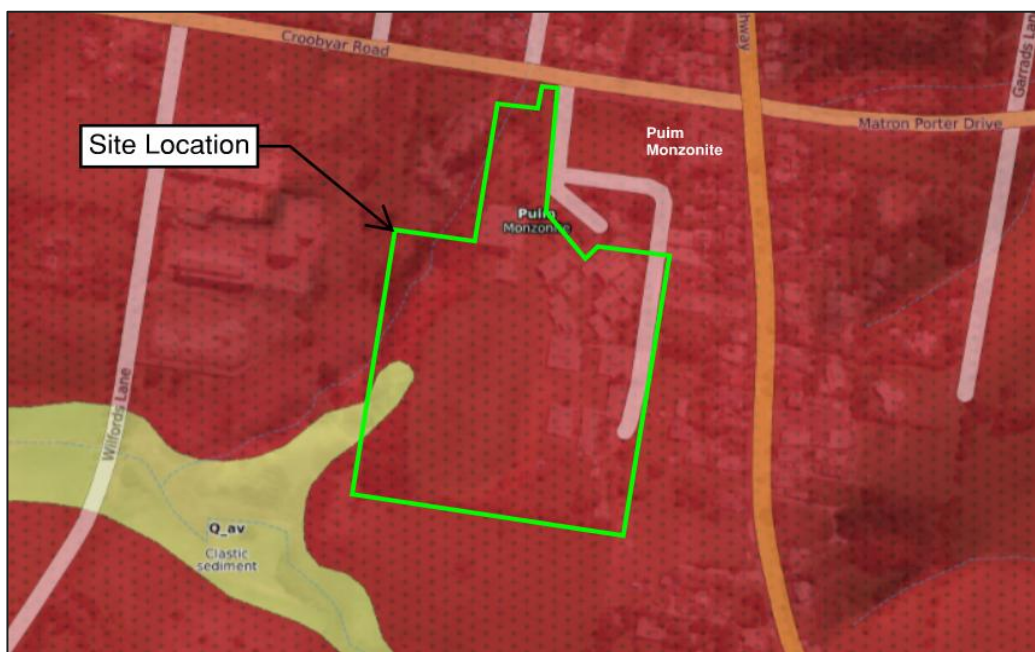


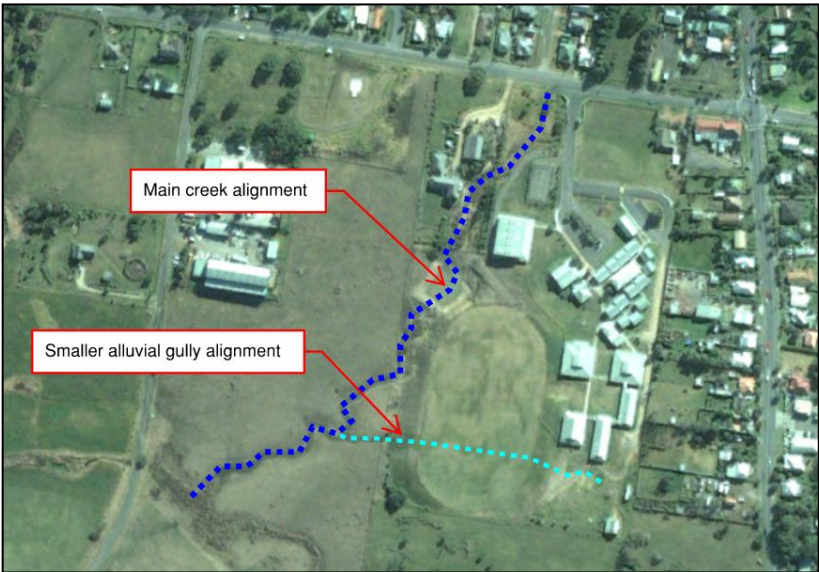
Figure 2-3: Former Shoalhaven Anglican School Site Geology



2.3 Historical Aerial Imagery

Review of historical aerial imagery from (NSW Department of Primary Industries and Regional Development, 2025) and (Nearmap, 2025) has been undertaken to gain an understanding of past site conditions, details of this review are provided in Table 2-1 below.

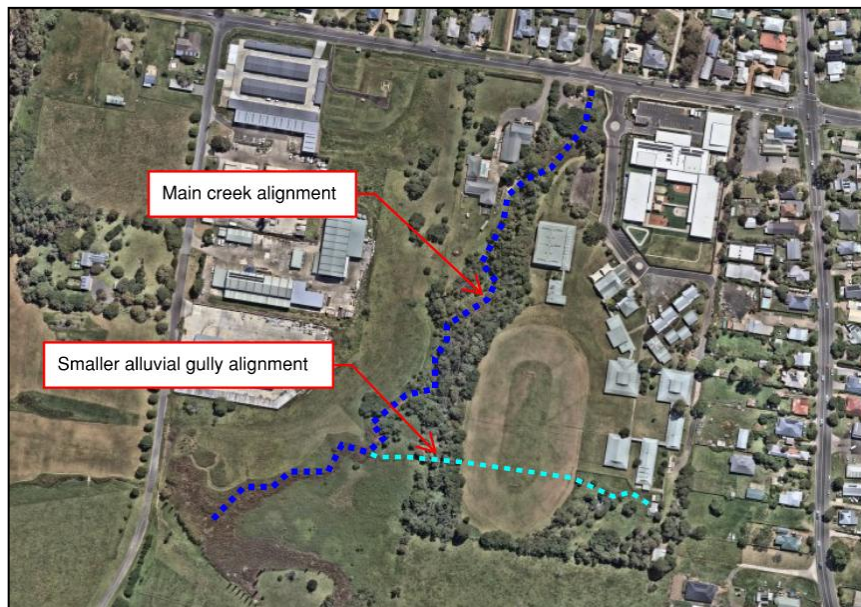
Table 2-1: Site Aerial Imagery Review

Date/Year	Description
25 Nov 1991	 The site can be seen within the original landform, prior to school establishment, at the eastern side of the main creek alignment and a smaller alluvial gully system to the south.
15 Sep 2003	 The aerial image shows the initial filling and buildings within the site.



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Large amounts of filling and changes to the original landform. Smaller alluvial gully alignment has been filled in and flattened for sporting field.



3 Geotechnical Investigation

3.1 Site Investigation

3.1.1 Intrusive Investigation

Intrusive site investigatory works were completed between the 12th and 13th May 2025, comprising of the following:

- A site walkover to inspect the site conditions and confirm borehole and contamination test pit locations and site access.
- Underground utility location was undertaken by an accredited contractor and comprised of clearing of borehole locations using Cable Avoidance Tool (CAT) and ground penetrating radar (GPR) prior to drilling commencing. A service location clearance report was presented on-site to Stantec's site representative prior to breaking ground.
- Drilling of sixteen (16) boreholes to a maximum depth of 4.6m below ground level (mBGL) with a trailer mounted drill rig, typically refusing on inferred bedrock or extremely weathered material.
- Dynamic Cone Penetrometer (DCP) testing conducted from surface at test locations to a maximum 3.5mbgl, to assist with the assessment of the in-situ soil strength conditions at each borehole location.
- Engineering assessment of the subsurface profiles encountered in accordance with AS1726 – 2017 (Standards Australia Limited, 2017) by a geotechnical engineer from Stantec.
- Sampling of material considered representative of soil units encountered for subsequent geotechnical laboratory assessment.
- Once completed, each borehole was backfilled with excavated material, compacted with the auger and crowbar once returned to existing surface level. Boreholes in pavement area were surface with bitumen and left slightly proud of the road surface.
- Borehole locations were recorded using a hand-held GPS device with an accuracy of +/- 5m.
- An experienced Stantec geotechnical engineer was present on site to make visual and tactile assessments of the encountered materials, prepare engineering logs and take select samples for laboratory testing.
- A site plan with borehole locations is provided in Appendix A. Engineering logs of the boreholes are presented together with explanatory notes in Appendix B.

3.1.2 Test Locations

Investigation locations are summarized in Table 3-1 below and presented in the Investigation Plan in Appendix A. Engineering logs of the boreholes and DCP reports are presented with explanatory notes in Appendix B with interpretive cross sections in Appendix C.



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Table 3-1: Summary of Investigation Locations

Test ID	Test Type	Termination Depth (m)	Termination Reason	MGA2020 UTM Zone 55H		RL (mAHD)
				Easting	Northing	
BH-01	Borehole	3.1	Refusal	267303.2856	6088046.603	45.9
BH-02	Borehole	1.5	Refusal	267366.3299	6088024.636	47.0
BH-03	Borehole	1.4	Refusal	267383.1066	6088084.144	47.2
BH-04	Borehole	2.8	Refusal	267308.928	6088100.996	56.0
BH-05	Borehole	4.6	Refusal	267326.457	6088166.899	46.1
BH-06	Borehole	1.6	Refusal	267386.0787	6088147.008	47.0
BH-07	Borehole	1.6	Refusal	267387.8838	6088259.472	46.3
BH-08	Borehole	2.0	Refusal	267401.7794	6088316.738	47.1
BH-09	Borehole	2.4	Refusal	267352.3838	6088272.167	46.0
BH-10	Borehole	3.0	Refusal	267370.7266	6088309.005	46.4
BH-11	Borehole	4.0	Refusal	267484.0394	6088086.556	55.3
BH-12	Borehole	1.2	Refusal	267493.2119	6088159.124	54.0
BH-13	Borehole	1.2	Refusal	267497.7417	6088194.038	53.4
BH-14	Borehole	1.3	Refusal	267498.6883	6088217.816	53.0
BH-15	Borehole	0.43	Refusal	267462.9218	6088227.056	50.6
BH-16	Borehole	2.2	Refusal	267457.5014	6088204.253	51.0

Notes: RL's extracted from 'Detail & Contour Survey Plan' [ref: 217272-TS01] by dated 18 July 2024 by LandTeam Australia Pty Ltd against recorded borehole locations.

3.1.3 Laboratory Testing

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

- Six (6) no. Atterberg Limit tests.
- Six (6) no. Particle Size Distribution (PSD) tests.
- Six (6) no. Field Moisture Content tests.
- Five (5) California Bearing Ratio tests
- Five (5) soil aggressivity tests

Testing was conducted by Nata accredited laboratories ASCT Illawarra and Eurofins. Laboratory test certificates are included in Appendix C.



4 Results of Investigation

4.1 Subsurface Conditions

Subsurface units and conditions encountered in the sixteen (16) boreholes completed by Stantec and previously completed eight (8) boreholes by Douglas Partners in 2020 are provided in Table 4-1 and Table 4-2 below. It is noted that origin classifications have not been provided below the topsoil and fill units in the Douglas Partners 2020 report and logs, based on review of the logs, it has been assumed that the layer nominated as 'CLAY' is residual in origin.

Table 4-1: Summary of Subsurface Units

Unit	Material Type / Origin	Description of Layer
1A	PAVEMENT	Spray Seal: dark grey, igneous aggregate
1B		Asphalt: AC14, dense graded asphalt
1C		Sandy GRAVEL/ Clayey Sandy GRAVEL: fine to medium gravel up to 20mm, grey, fine to coarse sand, moist
2A	FILL	Gravely SAND: fine to coarse grained, grey, fine to coarse gravel up to 40mm, with clay
2B		Sandy SILT: low plasticity, dark brown, fine to coarse sand, trace organics, moisture typically wetter than plastic limit
2C		CLAY / Sandy CLAY: low to high plasticity, pale brown, dark grey, blue-grey, fine to coarse sand, moisture typically at or dryer than plastic limit
3	ALLUVIAL (AL)	CLAY / Sandy CLAY; high plasticity, pale blue grey, with fine to medium sand, firm to very stiff, moisture typically wetter than the plastic limit.
4	RESIDUAL (RS)	CLAY / Sandy CLAY: high plasticity, grey, brown, pale brown, orange, fine to coarse sand, firm to hard, moisture ranging from dryer to wetter than plastic limit.
5	EXTREMELY WEATHERED MATERIAL (XW)	Sandy CLAY; medium plasticity, orange-brown, fine to coarse sand, very stiff to hard, typical moisture content dryer than plastic limit
6	BEDROCK (RK)	MONZONITE; medium grained, orange, brown, with extremely weathered rock bands, very low strength, highly weathered



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Table 4-2: Depth to top of Subsurface Units

BH ID	Depth to top of Unit (mbgl)										Termination Depth (mbgl)	Termination Reason
	Pavement			Fill			AL	RS	XW	RK		
	1A	1B	1C	2A	2B	2C	3	4	5	6		
BH01	-	-	-	-	0.0	0.15	1.5	-	3.0	-	3.1	Refusal
BH02	-	-	-	-	0.0	0.10	-	-	0.5	-	1.5	Refusal
BH03	-	-	-	-	0.0	0.1	-	0.6	1.1	-	1.4	Refusal
BH04	-	-	-	-	0.0	0.1	2.5	-	-	-	2.8	Refusal
BH05	-	-	-	-	0.0	0.1	2.0	3.1	-	-	4.6	Refusal
BH06	-	-	-	-	0.0	-	-	0.1	1.0	-	1.6	Refusal
BH07	-	-	-	-	0.0	-	-	0.1	1.4	-	1.6	Refusal
BH08	-	-	-	-	-	0.0	-	0.3	1.5	-	2.0	Refusal
BH09	-	-	0.0	-	-	-	-	0.2	2.2	-	2.4	Refusal
BH10	-	-	0.0	-	-	-	-	0.1	2.0	-	3.0	Refusal
BH11	-	0.0	0.03	-	-	-	-	0.2	-	-	4.0	Refusal
BH12	-	0.0	-	0.02	-	-	-	0.12	-	-	1.2	Refusal
BH13	0.0	-	0.014	-	-	-	-	0.22	-	-	1.2	Refusal
BH14	0.0	-	0.014	-	-	-	-	-	0.22	-	1.3	Refusal
BH15	-	0.0	-	0.05	-	-	-	-	-	-	0.43	Refusal on Concrete
BH16	-	-	-	-	-	0.0	0.5	1.0	1.8	-	2.2	Refusal
101 ¹	-	-	-	0.1	0.0	-	-	1.0	-	-	5.5	Limit of investigation
102 ¹	-	-	-	-	0.0	-	-	0.15	-	3.5	4.0	Refusal on monzonite
103 ¹	-	-	-	-	0.0	-	-	0.15	-	2.9	3.0	Refusal on monzonite
104 ¹	-	-	-	-	0.0	0.1	-	0.5	-	-	4.0	Refusal on hard sandy clay
105 ¹	-	-	-	-	0.0	-	-	0.1	-	2.5	2.9	Refusal on monzonite
106 ¹	-	-	-	-	0.0	-	-	0.15	-	2.3	2.5	Refusal on monzonite
107 ¹	-	-	-	-	0.0	-	-	0.2	-	-	3.7	Refusal on monzonite
108 ¹	-	-	-	-	0.0	-	-	0.2	-	1.9	2.0	Refusal on monzonite

Notes:

- mBGL = Meters below ground level
- 1 = Douglas Partners 2020 Boreholes



4.2 Groundwater Observations

Groundwater was encountered at BH10 was likely due to close proximity of the adjacent waterway, and BH11 from inferred seepage from the adjacent concrete block retaining wall that was approximately 1.8m tall. Groundwater was also encountered in Douglas Partners boreholes 101, 104 and 107 between 2.7 and 3.5 mbgl. It should be noted that groundwater levels are likely to fluctuate with variations in climatic and site conditions. Reference should be made to the engineering logs presented in Appendix B, together with explanatory notes.

4.3 Laboratory Testing

4.3.1 Soil Classification Testing

Selected samples from the boreholes were tested at NATA accredited laboratories for testing. A summary of mechanical geotechnical laboratory tests undertaken including previous Douglas Partners 2020 tests is presented in Table 4-3 below with laboratory test certificates presented Appendix C and previous Douglas Partners certificates presented in Appendix D.

Table 4-3: Summary of Particle Size Distribution and Atterberg Limit Testing

Borehole	Depth Range (m)	Unit	Soil Type	% Gravel	% Sand	% Fines	LL (%)	PL (%)	PI (%)	MC (%)	LS (%)
BH01	1.0-1.1	2C	Sandy CLAY	7	52	41	48	24	24	26.5	-
BH01	1.5-1.6	3	CLAY with Sand	0	25	75	74	28	46	36.6	-
BH03	0.9-1.0	5	Sandy CLAY	3	56	41	42	22	20	26.2	-
BH05	2.5-2.6	3	CLAY with Sand	0	25	75	82	33	49	42.9	-
BH07	0.5-0.6	4	Sandy CLAY	5	30	65	68	27	41	37.5	-
BH08	1.5-1.7	5	Sandy CLAY	4	53	33	42	22	20	28.3	-
102 ¹	0.5	4	CLAY	-	-	-	73	20	53	36.3	13.0
103 ¹	1.0	4	CLAY	-	-	-	85	23	62	40.2	15.5
105 ¹	0.5	4	CLAY	-	-	-	83	27	56	36.1	16.0
108 ¹	1.0	4	Sandy CLAY	-	-	-	60	23	37	23.4	1.25

Notes:

- LL: Liquid Limit
- PL: Plastic Limit
- PI: Plasticity Index
- MC: Moisture Content
- LS: Linear Shrinkage
- 1: Douglas Partners 2020 Report



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A summary of California Bearing Ratio tests, including previous Douglas Partners 2020 tests is presented in to Table 4-4 below with laboratory test certificates presented Appendix C and previous Douglas Partners certificates presented in Appendix D.

Table 4-4: California Bearing Ratio Tests

BH	Depth Range (m)	Unit	Soil Type	CBR (%)	Swell (%)	FMC (%)	OMC (%)	SMDD (t/m ³)
BH02	0.5-1.0	5	Sand CLAY	3.5	1.5	20.8	22.5	1.63
BH11	0.2-0.5	4	CLAY	2.5	2.5	27.8	25.5	1.53
BH12	0.2-0.5	4	Sandy CLAY	9.0	0.0	13.3	16.5	1.77
BH14	0.2-0.5	5	Sandy CLAY	3.0	2.0	23.7	21.0	1.65
BH16	0.5-0.8	3	CLAY	2.0	4.5	38.5	29.9	1.31
103 ¹	0.5-1.0	4	CLAY	2.5	2.5	39.5	37.0	1.31
107 ¹	0.5-1.0	4	CLAY	3.0	1.5	34.2	34.0	1.35

Notes:

- CBR: California Bearing Ratio
- FMC: Field Moisture Content
- OMC: Standard compaction optimal moisture content
- SMDD: Standard maximum dry density
- 1: Douglas Partners 2020 Report

4.3.2 Chemical Testing

Soil aggressivity testing was undertaken including previous Douglas Partners 2020 data is summarised in Table 4-5 below. Laboratory test certificates are presented Appendix C and previous Douglas Partners certificates presented in Appendix D

Table 4-5: Soil Aggressivity Tests

Borehole	Depth (m)	Unit	Soil Type	Chloride (mg/kg)	EC (μS/cm)	pH	Resistivity (ohm.m)	Sulfate (mg/kg)	MC (%)
BH01	2.0	3	CLAY	16	30	5.5	330	40	26
BH03	1.0	5B	Sandy CLAY	52	55	5.9	180	30	20
BH05	1.0	2C	Sandy CLAY	31	43	6.0	230	73	21
BH07	0.5	4	Sandy CLAY	120	110	5.1	89	37	32
BH09	0.5	3	CLAY	280	410	4.5	24	240	30
BH11	0.5	4	CLAY	<10	10	6.2	980	15	22
BH14	0.5	5B	Sandy CLAY	15	150	4.9	65	190	16
102 ¹	0.5	4	CLAY	37	68	5.2	68	32	-
104 ¹	0.5	4	CLAY	20	65	5.6	65	72	-
105 ¹	1.0	4	CLAY	21	70	5.3	70	58	-
108 ¹	1.0	4	Sandy CLAY	78	130	4.9	130	100	-

Notes:

- 1: Douglas Partners 2020 Report



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In accordance with AS2159-2009 'Piling-Design and Installation' (Standards Australia Limited, 2009), 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 (all soils above ground water or low permeability soils).
- Moderate (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).
- 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 Discussion and Recommendations

The site is suitable for the proposed development subject to the following recommendations being conditioned/implemented.

5.1 Summary of Site Conditions

The following was noted at the time of the geotechnical investigation:

- The playing field which incorporated boreholes BH01 through to BH06 appears to be constructed using cut to the west and fill to the east, with depth of fill to 2.5m below ground surface observed. No record of filling is available resulting in the fill being deemed as 'uncontrolled', noting that the filling appears to have occurred between 1997 and 2003 based on past aerial imagery review.
- A previous creek alignment and possible drainage alignment is present below the playing field which is shown in the historical aerial imagery review in Section 2.3 which will likely have deepened sections of filling and higher potential for groundwater.
- Auger refusal on extremely weathered material or bedrock occurred between 1.4 and 4.6 mbgl, with the exclusion of BH15, where concrete was encountered at 0.43 mbgl.
- Alluvial soils were observed at locations adjacent to the creek.
- Fill was encountered throughout the majority of the site
- A concrete retaining wall of up to about 1.8m height was observed on the eastern edge of the school. Wall construction comprised of concrete blocks approx. 600mm in height per block, with evidence of drainage installed behind the wall. No structures were identified within a 1:1 H:V above the retaining wall. Some bulging and overturning were observed, however it is unclear of the condition of the retaining wall at the time of construction.





Figure 5-1: Concrete Block Retaining Wall

5.2 Geotechnical Parameters

Design parameters for subsurface soil encountered are presented in



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Table 5-1 below.



Table 5-1: Geotechnical Parameters for Soil

Unit	Material	Description	γ (kN/m ³)	C_u (kPa)	c' (kPa)	ϕ (deg)	E' (MPa)	ν	K_a	K_p
2A	Fill	Gravelly SAND	18	-	-	-	-	-	-	-
2B		Sandy SILT	17	-	-	-	-	-	-	-
2C		CLAY	18	-	-	-	-	-	-	-
3	Alluvial	CLAY, firm	18	25	2	22	2	0.35	0.45	2.20
		CLAY, stiff	19	50	3	24	4	0.3	0.42	2.37
		CLAY, very stiff	20	100	5	26	8	0.3	0.39	2.56
4	Residual	CLAY, soft	17	-	-	-	-	-	-	-
		Clay, firm	18	25	2	23	3	0.35	0.44	2.28
		CLAY, stiff	19	50	4	24	5	0.3	0.42	2.37
		CLAY, very stiff to hard	20	100	6	26	10	0.3	0.39	2.56
5	Extremely Weathered Material	CLAY, very stiff to hard	21	100	8	27	10	0.3	0.38	2.66

Notes:

γ : Unit Weight

ϕ : Internal Friction Angle

K_a : Active Pressure Coefficient

c_u :Undrained shear strength

E : Elasticity Modulus

K_p : Passive Pressure Coefficient

c' :Drained shear strength

ν : Poisson's Ratio

5.3 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 deeply weathered soil profile encountered, the site is deemed to have the following site subsoil classification, however noting that depth to rock was not confirmed during the investigation.

- Class Ce – Shallow soil site. The Hazard Design Factor (Z) of 0.09 is recommended.

5.4 Pavement Subgrade Assessment

The design subgrade CBR test results ranged between 2.0% and 9.0% but typically in the range of 2.0-3.5%. DCP testing undertaken at the site indicated in-situ CBR values of about 3.6% (Figure 5.3 from (Austroads Ltd, 2024)) in general at likely top of subgrade depths (around 0.4 to 1m below surface level) but the values changed from location to location. A design CBR value of 2.0% is recommended for design of any pavements/carparks associated with the site upgrades.

It is noted that CBR swells of between 2.5% and 4.5% were recorded in the CBR testing. A review of locations of swell should be undertaken during any pavement design per pavement location. However, noting that three of the tests resulted in 2.5% or higher swell. It is recommended that any pavement designs are treated as having high swell potential in the subgrade and be designed in accordance with recommendations of (Section 5 (VicRoads, 2018)). This standard, although not 'local' is more calibrated to lower traffic loading roads which is expected for this site. If higher loads are present,



recommendations within (Section 3.14.1 and Section 5.3.5 (Transport for NSW, 2018)) should be followed.

It should be noted localised 'soft' spots and uncontrolled fill may be encountered during construction. These areas will require some form of subgrade removal and replacement with engineered fill or enhancement through stabilisation.

5.5 Foundations

At this stage, the proposed building/loads are not known. The subsurface conditions important in selection of a foundation system comprise the following:

- Groundwater level, acknowledging that this was inferred to have been encountered in two (2) boreholes (BH10 and BH11) and may not be representative of the actual groundwater level.
- Variable subsurface profiles with significant thickness of uncontrolled fill in certain locations.
- Variable depth soil strength parameters over depth.
- Various units with different subsurface reactivity due to moisture change are present and designs may need to be assessed on a location per location basis.

5.5.1 Site Classification

Preliminary site classification has been assessed in accordance with Australian Standard 2870-2011 - Residential Slabs and Footings (Standards Australia Limited, 2011). It is noted that due to the presence of up to 2.5m thickness of uncontrolled fill material at the site associated with the sports field. construction and 1.0m thickness of uncontrolled fill found in BH16, the classification is considered to be Class 'P'.

In lieu of the site being characterised as Class 'P', considering the site is likely to undergo future earthworks and require reclassification, an assessment of likely subsurface reactivity has been undertaken to support design development.

Soils across the site did comprise high plasticity clays at shallow depths all soils except some fill and extremely weathered material exceeding a Liquid Limits (LL) of 50%, and three (3) results >80% with linear shrinkage values associated with the >80 LL results being 15.5% to 16%. The assessment has been made on change in suction at the soil surface of 1.2pF. AS 2870-2011 (Standards Australia Limited, 2011). (Chan & Mostyn, 2009) indicates that the site is located in Zone 2 (wet temperate climate) with a Thornthwaite Moisture Index (TMI) of +10 to +40, reference to AS 2870-2011 (Standards Australia Limited, 2011) indicates a height of suction of 1.5m for this TMI rating. Based on the above, it is anticipated that movement up to 75mm (in line with Class 'H2') due to moisture changes in the subsurface profile are possible.

5.5.2 Shallow Footings

In lieu of the Site Classification, if shallow footings are to be utilised, they should be designed and constructed in accordance with AS2870-2011, with appropriate measures to mitigate shrink swell risks.

Due to the unknown anticipated loading conditions of the structures at this stage, no specified allowable bearing capacities can be determined at this time. Once specific loadings have been ascertained, Stantec can assist to optimise the footing size and depth to suit the loading on the founding material.



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The following parameters are provided for preliminary sizing of shallow footings of ancillary structures. Bearing capacity of footings needs to be subjected to geotechnical checking considering site classification, footing size, depth, slope (ground surface and/or footing base) and loadings (i.e. bearing capacity is not a soil property but is dependant of footing size, depth, slope and loadings). A footing subjected to pull out forces should be further geotechnical assessment in addition to bearing capacity, overturning and sliding. Preliminary allowable bearing capacities are provided in Table 5-2 below.

Table 5-2: Indicative Allowable Bearing Capacity

Material	Nominal Embedment Depth (m)	Nominal Footing (m)	Allowable Bearing Capacity ³ (kPa)
Alluvial CLAY – Stiff to Very stiff	0.50	1m x 1m	100
Residual CLAY – Very stiff to hard	0.50	1m x 1m	150
Extremely Weathered CLAY – very stiff to hard	0.50	1m x 1m	150

Notes:

1. Ultimate bearing capacity tabulated above assuming eccentricity of 1/6 x footing width.
2. Horizontal ground is assumed.
3. Geotechnical reduction factor (Φ_g) of 0.33 applied to these values.
4. Consideration of section 5.5.1 should be considered, prior to selection of founding level.

Footing construction methods should be “flexible” so that footing excavations can be readily deepened or widened to target more competent materials should lower bearing capacity materials be present. Values have not been provided for the Clayey/Silty Sand material due to its surficial and thin nature.

Shallow footings will need to be constructed so 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.

All footing excavations should be inspected by a suitably qualified 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 Piled Foundations

Based on the soil units encountered, Table 5-3 below presents preliminary parameters for the design of piles in the expected founding materials present. These parameters are preliminary and indicative in nature and will need to be confirmed with the geotechnical design engineer as they are dependent on material depth and loading conditions at individual locations. Given it was the shallowed point of groundwater observed was 1.8m, this has been the assumed depth in assessing the parameters. These parameters are compatible with AS2159-2009 (Standards Australia Limited, 2009) which follows a limit state method.



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Table 5-3: Design Parameters for Cast In-Situ Piles

Unit	Ultimate End Bearing Capacity - f_b (kPa)	Ultimate Shaft Adhesion - f_s (kPa)	Typical Elastic Modulus - E' (MPa)
3 – Alluvial – Firm CLAY	225	10.0	2
3 – Alluvial – Stiff CLAY	450	20.0	4
3 – Alluvium – Very Stiff CLAY	900	35.0	8
4 – Residual – Firm Clay / Sandy Clay	450	10.0	2
3 – Residual – Stiff Clay / Sandy Clay	900	20.0	4
4/5 – Residual / Extremely Weathered – Very Stiff to Hard Clay / Sandy Clay	900	35.0	10

Notes:

1. Skin friction (f_s) and base resistance (f_b) as defined in AS2159-2009 (Standards Australia Limited, 2009).
2. Ignore pile shaft within 1.5m of ground surface to account for potential site disturbance and moisture change effects.
3. Shaft adhesion changes with respect to the overburden pressure, as such, should be assessed by a geotechnical engineer at design stage to refine values.
4. To utilise the above values, a minimum embedment of 3 times the pile diameter in clays is required.

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 elastic modulus values provided is to be used to calculate settlements to assess serviceability.

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 preliminary geotechnical strength reduction factor (Φ_{gb}) of 0.4 can be applied to the ultimate capacity presented in Table 5-3 but should be assessed at design phase based on assessed risk rating in accordance with AS2159-2009 (Standards Australia Limited, 2009). It is noted that the site has reasonably complex variability and is not located within a well understood geological unit. Pile testing requirements will be dependent on AS2159-2009 (Standards Australia Limited, 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.

It is recommended that an experienced geotechnical engineer or engineering geologist be engaged to confirm the above parameters, acknowledging the deep soil profile. An experienced geotechnical engineer or engineering geologist should also observe the pile drilling, as well as shaft and mechanical base cleaning process, 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. Potential for pile excavation collapse due to 'weaker' fill and alluvial soils may be present and should also be considered by the contractor and designer



5.6 Earthworks

5.6.1 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.
- 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.
- Loose or low strength (soft) soils or otherwise 'unsuitable' soils.

5.6.2 Drainage

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

Care should be exercised in constructing up-slope overland surface flows particularly in times of inclement weather. Depending on the conditions encountered, subsurface drainage may be required at the base of drainage lines prior to filling.

5.6.3 Excavation and Trench Stability

Excavations in the vicinity of existing structures should be fully supported in accordance with the design 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 will be required, given the variability of subsurface units on site, it is recommended that any locations and proposed works be specifically reviewed by a geotechnical engineer to assess requirements to trench/excavation battering, benching or bracing.

It is recommended that long-term excavations in the soil profile or weathered rock shall be either battered at 1V:4H or flatter and protected against erosion or be supported by engineered and suitably constructed retaining walls.

Seepage or inflow may be encountered during construction and allowance should be made for control such as sump and pump.

5.6.4 Filling

Following site preparation works, fill should be placed and compacted in accordance with the following guidelines and specifications:

- AS 3798-2007 - Earthworks for Commercial and Residential Development.
- C213 Shoalhaven City Council – Earthworks Specification.



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It is expected that construction of temporary or permanent fill platforms during the bulk earthwork will occur. To support structural loads associated with the development the following should be undertaken, with more exact nomination provided by a geotechnical engineer for specific tasks:

- Removal of any existing uncontrolled fill and topsoil or otherwise unsuitable soils from areas where controlled fill is to be placed.
- Locations where controlled fill is not required, e.g. under piled structures or not under any development areas such as the park sites or open areas may have uncontrolled fill left in place.
- Terracing of the exposed subgrade slope in the area where fill is to be placed if slopes are steeper than 1V:4H at the start of filling level.
- 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 compacted thickness and each layer compacted to achieve a Dry Density Ratio of at least 100% Standard and within $\pm 2\%$ 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 unless geotechnical assessment is undertaken. Should extensive soft or weak areas be encountered, further geotechnical advice should be sought.

Fill placement should be undertaken in accordance with Table 5-4 below. Fill should be placed in uniform horizontal layers. If specific tasks require specialised advice on material and compaction, e.g. the compaction of granular material for a crane pad, advice from a geotechnical engineer should be sought.

Table 5-4: Compaction Specification

Purpose	Minimum density ratio (at standard compactive effort)	Maximum Compacted Layer Thickness (mm)	Moisture Variation	Test method
General Filling	98%	200	$\pm 2\%$ of Standard Optimum Moisture Content (SOMC)	AS1289.5.1.1, 5.4.1 or 5.7.1
Pavement Subgrade	100%	200	$\pm 2\%$ of Standard Optimum Moisture Content (SOMC)	AS1289.5.1.1, 5.4.1 or 5.7.1

Exposed subgrade and all fill layers should be test-rolled immediately following completion of compaction. If further test polling 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.

5.7 Vibration

5.7.1 Vibration Assessment

Vibratory compaction techniques may have adverse impact on nearby developments and associated infrastructure. As such, it is recommended that the use of vibratory rollers be avoided within 40m of existing dwellings or sensitive structures. This requirement would be reviewed once more information regarding construction methodology and proposed equipment is available.

Vibration assessment based on the Australian Road Research Boards Special Report: Ground Vibrations, Damaging Effect to Buildings (Tynan, A. E., 1973) 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 2670.1-2001 Evaluation of human exposure to whole-body (Standards Australia Limited, 2001).

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.

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 in Table 5-5 below 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 5-5: 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, insignificant 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.
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

5.7.2 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 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.

5.7.3 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 20m of any structure. If the works are within a 20m zone of the school buildings, then the contractor must utilise equipment that produces acceptable vibrations (based on the guidelines in Table 5-5) and provide vibration monitoring, dilapidation reports as required depending on the structure and the tolerated level of vibration. It is noted that the above recommendations are general in nature and any specific construction works nominated may require specific assessment of potential vibration, specifically if any sensitive receptors are nearby, such as the existing school buildings or adjacent Budawang School.



6 Closure

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*” found in Appendix E. 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 Stantec, but rather to identify where Stantec 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 Stantec on the information supplied.

7 References

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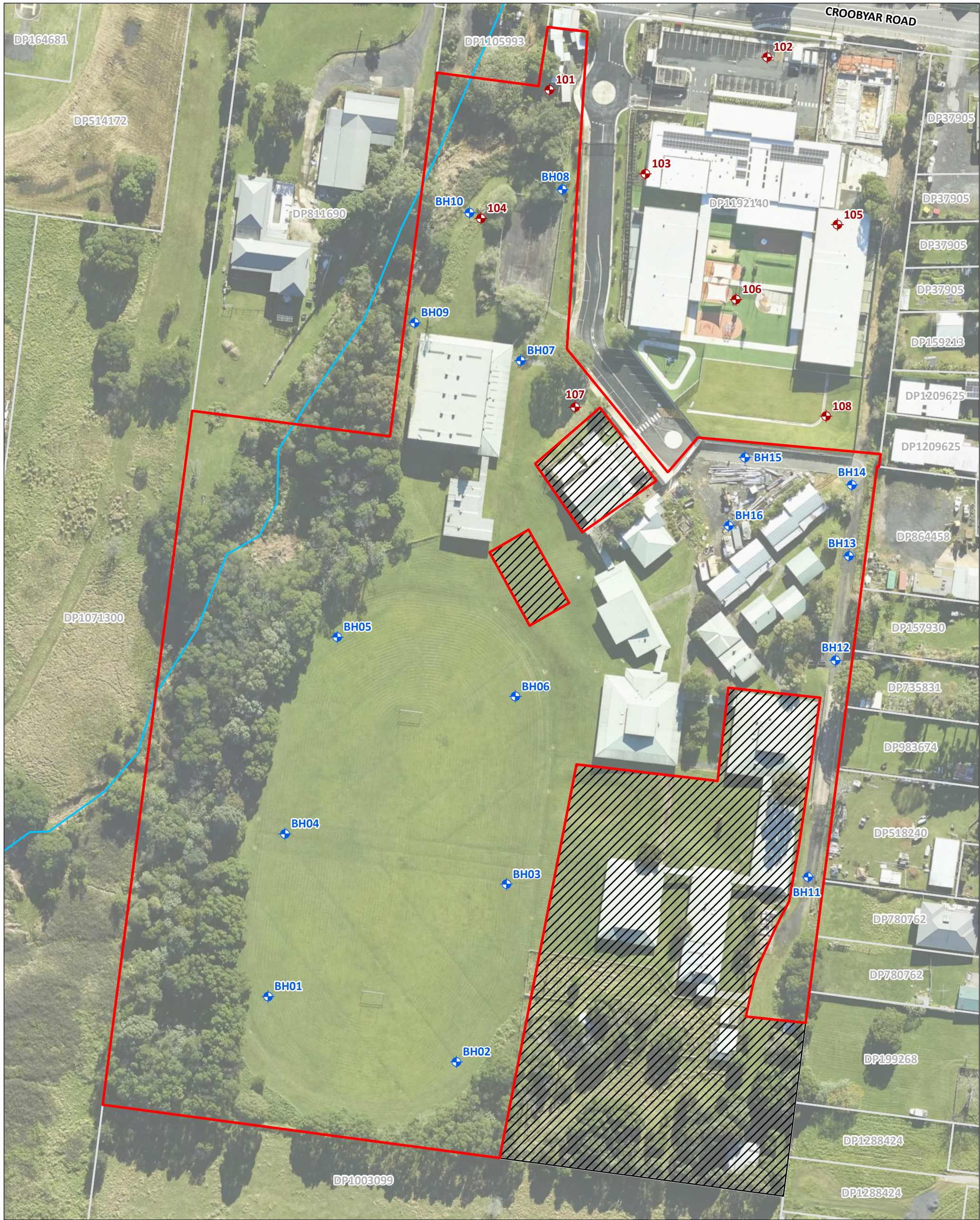


APPENDICES



Appendix A Investigation Plan





Site Plan

Milton Public School
Milton, NSW

Figure 01

Project Code: 305001663_GS-004
Drawn By: CC, Checked By: SM
Date: 2025-06-25
Revision: 02

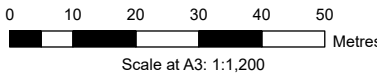


Legend

- Site boundary
- Area not part of site
- Stantec borehole location
- Douglas Partners 2020 borehole location
- Watercourse
- Cadastre

Notes:
1. Map displayed in GDA2020 MGA Zone 56

References:
1. Aerial imagery supplied by Metromap (June, 2024).
2. Watercourse and Cadastre (NSW SS, 2024)



Appendix B Subsurface Logs



Explanatory Notes

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. Material descriptions are deduced from field observation or engineering examination, and may be appended or confirmed by in situ or laboratory testing. The information is dependent on the scope of investigation, the extent of sampling and testing, and the inherent variability of the conditions encountered.

Subsurface investigation may be conducted by one or a combination of the following methods.

Method	
Test Pitting: excavation/trench	
BH	Backhoe bucket
EX	Excavator bucket
R	Ripper
H	Hydraulic Hammer
X	Existing excavation
N	Natural exposure
Manual drilling: hand operated tools	
HA	Hand Auger
Continuous sample drilling	
PT	Push tube
PS	Percussion sampling
SON	Sonic drilling
Hammer drilling	
AH	Air hammer
AT	Air track
Spiral flight auger drilling	
AS	Auger screwing
AD/V	Continuous flight auger: V-bit
AD/T	Continuous spiral flight auger: TC-Bit
HFA	Continuous hollow flight auger
Rotary non-core drilling	
WB	Washbore drilling
RR	Rock roller
Rotary core drilling	
PQ	85mm core (wire line core barrel)
HQ	63.5mm core (wire line core barrel)
NMLC	51.94mm core (conventional core barrel)
NQ	47.6mm core (wire line core barrel)
DT	Diatube (concrete coring)

Sampling is conducted to facilitate further assessment of selected materials encountered.

Sampling method	
Soil sampling	
B	Bulk disturbed sample
D	Disturbed sample
C	Core sample
ES	Environmental soil sample
SPT	Standard Penetration Test sample
U	Thin wall tube 'undisturbed' sample
Water sampling	
WS	Environmental water sample

Field testing may be conducted as a means of assessment of the in situ conditions of materials.

Field testing	
SPT	Standard Penetration Test
HP/PP	Hand/Pocket Penetrometer
Dynamic Penetrometers (blows per noted increment)	
DCP	Dynamic Cone Penetrometer
PSP	Perth Sand Penetrometer
MC	Moisture Content
VS	Vane Shear
PBT	Plate Bearing Test
IMP	Borehole Impression Test
PID	Photo Ionization Detector

If encountered, refusal (R), virtual refusal (VR) or hammer bouncing (HB) of penetrometers may be noted.

The quality of the rock can be assessed by the degree of natural defects/fractures and the following.

Rock quality description	
TCR	Total Core Recovery (%) (length of core recovered divided by the length of core run)
RQD	Rock Quality Designation (%) (sum of axial lengths of core greater than 100mm long divided by the length of core run)

Notes on groundwater conditions encountered may include.

Groundwater	
Not Encountered	Excavation is dry in the short term
Not Observed	Water level observation not possible
Seepage	Water seeping into hole
Inflow	Water flowing/flooding into hole

Perched groundwater may result in a misleading indication of the depth to the true water table. Groundwater levels are also likely to fluctuate with variations in climatic and site conditions.

Notes on the stability of excavations may include.

Excavation conditions	
Stable	No obvious/gross short term instability noted
Spalling	Material falling into excavation (minor/major)
Unstable	Collapse of the majority, or one or more face of the excavation

Explanatory Notes: General Soil Description

The methods of description and classification of soils used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, a material is described as a soil if it can be remoulded by hand in its field condition or in water. The dominant component is shown in upper case, with secondary components in lower case. In general descriptions cover: soil type, plasticity or particle size/shape, colour, strength or density, moisture and inclusions.

In general, soil types are classified according to the dominant particle on the basis of the following particle sizes.

Soil Classification		Particle Size (mm)
CLAY		< 0.002
SILT		0.002 to 0.075
SAND	fine	0.075 to 0.21
	medium	0.21 to 0.6
	coarse	0.6 to 2.36
GRAVEL	fine	2.36 to 6.7
	medium	6.7 to 19
	coarse	19 to 63
COBBLES		63 to 200
BOULDERS		> 200

Soil types may be qualified by the presence of minor components on the basis of field examination methods and/or the soil grading.

Terminology	In coarse grained soils		In fine soils
	% fines	% coarse	% coarse
Trace	≤5	≤15	≤15
With	>5, ≤12	>15, ≤30	>15, ≤30

The strength of cohesive soils is classified by engineering assessment or field/lab testing as follows.

Strength	Symbol	Undrained shear strength
Very Soft	VS	≤12kPa
Soft	S	12kPa to ≤25kPa
Firm	F	25kPa to ≤50kPa
Stiff	St	50kPa to ≤100kPa
Very Stiff	VSt	100kPa to ≤200kPa
Hard	H	>200kPa

Cohesionless soils are classified on the basis of relative density as follows.

Relative Density	Symbol	Density Index
Very Loose	VL	<15%
Loose	L	15% to ≤35%
Medium Dense	MD	35% to ≤65%
Dense	D	65% to ≤85%
Very Dense	VD	>85%

The plasticity of cohesive soils is defined by the Liquid Limit (LL) as follows.

Plasticity	Silt LL	Clay LL
Low plasticity	≤ 50%	≤ 35%
Medium plasticity	N/A	> 35% ≤ 50%
High plasticity	> 50%	> 50%

The moisture condition of soil (w) is described by appearance and feel and may be described in relation to the Plastic Limit (PL), Liquid Limit (LL) or Optimum Moisture Content (OMC).

Moisture condition and description

Dry	Cohesive soils: hard, friable, dry of plastic limit. Granular soils: cohesionless and free-running
Moist	Cool feel and darkened colour: Cohesive soils can be moulded. Granular soils tend to cohere
Wet	Cool feel and darkened colour: Cohesive soils usually weakened and free water forms when handling. Granular soils tend to cohere

The structure of the soil may be described as follows.

Zoning	Description
Layer	Continuous across exposure or sample
Lens	Discontinuous layer (lenticular shape)
Pocket	Irregular inclusion of different material

The structure of soil layers may include: defects such as softened zones, fissures, cracks, joints and root-holes; and coarse grained soils may be described as strongly or weakly cemented.

The soil origin may also be noted if possible to deduce.

Soil origin and description

Fill	Anthropogenic deposits or disturbed material
Topsoil	Zone of soil affected by roots and root fibres
Peat	Significantly organic soils
Colluvial	Transported down slopes by gravity/water
Aeolian	Transported and deposited by wind
Alluvial	Deposited by rivers
Estuarine	Deposited in coastal estuaries
Lacustrine	Deposited in freshwater lakes
Marine	Deposits in marine environments
Residual soil	Soil formed by in situ weathering of rock, with no structure/fabric of parent rock evident
Extremely weathered material	Formed by in situ weathering of geological formations, with the structure/fabric of parent rock intact but with soil strength properties

The origin of the soil generally cannot be deduced solely on the appearance of the material and the inference may be supplemented by further geological evidence or other field observation. Where there is doubt, the terms 'possibly' or 'probably' may be used

Explanatory Notes: General Rock Description

The methods of description and classification of rocks used in this report are based on Australian Standard AS1726-2017 Geotechnical Site Investigations. In practice, if a material cannot be remoulded by hand in its field condition or in water, it is described as a rock. In general, descriptions cover: rock type, grain size, structure, colour, degree of weathering, strength, minor components or inclusions, and where applicable, the defect types, shape, roughness and coating/infill.

Rock types are generally described according to the predominant grain or crystal size, and in groups for each rock type as follows.

Rock type	Groups
Sedimentary	Deposited, carbonate (porous or non), volcanic ejection
Igneous	Felsic (much quartz, pale), Intermediate, or mafic (little quartz, dark)
Metamorphic	Foliated or non-foliated
Duricrust	Cementing mineralogy (iron oxides or hydroxides, silica, calcium carbonate, gypsum)

Reference should be made to AS1726 for details of the rock types and methods of classification.

The classification of rock weathering is described based on definitions in AS1726 and summarised as follows.

Term and symbol	Definition
Residual Soil RS	Soil developed on rock with the mass structure and substance of the parent rock no longer evident
Extremely weathered XW	Weathered to such an extent that the rock has 'soil-like' properties. Mass structure and substance still evident
Distinctly weathered DW	The strength is usually changed and may be highly discoloured. Porosity may be increased by leaching, or decreased due to deposition in pores. May be distinguished into MW (Moderately Weathered) and HW (Highly Weathered).
Slightly weathered SW	Slightly discoloured; little or no change of strength from fresh rock
Fresh Rock FR	The rock shows no sign of decomposition or staining

The rock material strength can be defined based on the point load index as follows.

Term and symbol	Point Load Index I_{s50} (MPa)
Very Low VL	0.03 to 0.1
Low L	0.1 to 0.3
Medium M	0.3 to 1.0
High H	1.0 to 3
Very High VH	3 to 10
Extremely High EH	> 10

It is important to note that the rock material strength as above is distinct from the rock mass strength which can be significantly weaker due to the effect of defects.

A preliminary assessment of rock strength may be made using the field guide detailed in AS1726, and this is conducted in the absence of point load testing.

The defect spacing measured normal to defects of the same set or bedding, is described as follows.

Definition	Defect Spacing (mm)
Thinly laminated	< 6
Laminated	6 to 20
Very thinly bedded	20 to 60
Thinly bedded	60 to 200
Medium bedded	200 to 600
Thickly bedded	600 to 2000
Very thickly bedded	> 2000

Terms for describing rock and defects are as follows.

Defect Terms			
Joint	JT	Sheared zone	SZ
Bedding Parting	BP	Seam	WSm
Foliation	FL	Vein	VN
Cleavage	CL	Drill Lift	DL
Crushed Seam	CSm	Handling Break	HB
Fracture Zone	CZ	Drilling Break	MB

The shape and roughness of defects in the rock mass are described using the following terms.

Planarity	Roughness
Planar PR	Very Rough VR
Curved CU	Rough RF
Undulose UN	Smooth S
Irregular IR	Slickensided SL
Stepped ST	Polished POL
Discontinuous DIS	

The coating or infill associated with defects in the rock mass are described as follows.

Infill and Coating		
Clean	CN	
Stained	SN	
Carbonaceous	X	
Minerals	MU	Unidentified mineral
	MS	Secondary mineral
	KT	Chlorite
	CA	Calcite
	Fe	Iron Oxide
	Qz	Quartz
Veneer	VNR	Thin or patchy coating
Coating	CT	Infill up to 1mm



Client: NSW Department of Education
Project: Former Shoalhaven Anglican School Site
Location: Milton, NSW
Job No: 305001663_8

Non-Cored Drill Hole Log

Hole No : BH01

Sheet 1 of 1

Position: E 267303.29 N 6088046.60 (GDA 2020 56H)			Surface Elevation: 45.900 m AHD		
Rig Type: Christie Engineering		Mounting: Trailer	Contractor: ASCT		Driller: AP
Date Started: 12/05/2025		Date Completed: 12/05/2025	Logged By: AC		Checked By: BA

Drilling				Sampling & Testing		Material Description							DCP Blows/100mm							
Method	Penetration	Casing (mm)	Water Observations	Sample or Field Test	RL (m AHD)	Depth Below Surface (m)	Graphic Log	Classification	SOIL TYPE: colour, plasticity or particle characteristic, secondary and minor components	Moisture Condition	Consistency / Relative Density	SOIL ORIGIN Structure & Other Observations								
HA	F		Not Encountered	ES: 0.00-0.10 m	45	1		ML	Sandy SILT (ML): low plasticity, dark brown; Sand, fine to coarse; trace organic's; TOPSOIL. Sandy CLAY (CI): medium plasticity, pale brown; Sand, fine to coarse; trace plastics; FILL.	w > PL		TOPSOIL								
								FILL												
				ES: 0.40-0.50 m																
				ES: 0.90-1.00 m																
				D: 1.00-1.10 m																
				ES: 1.40-1.50 m																
				D: 1.50-1.60 m																
AD/T	H		Not Encountered		44	2		CI	CLAY (CH): high plasticity, pale blue-grey; with sand, fine to coarse; ALLUVIAL SOIL.	w > PL	St	ALLUVIAL SOIL								
				ES: 1.90-2.00 m																
				ES: 2.90-3.00 m																
				D: 3.00-3.10 m																
			Not Encountered		43	3		CH	Sandy CLAY (CL): low plasticity, orange-brown; Sand, fine to coarse; EXTREMELY WEATHERED MATERIAL. Terminated at 3.10m. Refusal.	w < PL	VSt	EXTREMELY WEATHERED MATERIAL								
			Not Encountered		42	4		CL			VSt - H									
			Not Encountered		41															

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



Client: NSW Department of Education
Project: Former Shoalhaven Anglican School Site
Location: Milton, NSW
Job No: 305001663_8

Non-Cored Drill Hole Log

Hole No : BH02

Sheet 1 of 1

Position: E 267366.33 N 6088024.64 (GDA 2020 56H)				Surface Elevation: 47.000 m AHD	
Rig Type: Christie Engineering		Mounting: Trailer		Contractor: ASCT	
Date Started: 12/05/2025		Date Completed: 12/05/2025		Logged By: AC	
				Checked By: BA	

Drilling				Sampling & Testing		Material Description							DCP Blows/100mm 5 10 15				
Method	Penetration	Casing (mm)	Water Observations	Sample or Field Test	RL (m AHD)	Depth Below Surface (m)	Graphic Log	Classification	SOIL TYPE: colour, plasticity or particle characteristic, secondary and minor components	Moisture Condition	Consistency / Relative Density	SOIL ORIGIN Structure & Other Observations					
HA AD/T	F	Not Encountered	ES: 0.01-0.10 m	46	1		ML	0.10 m	Sandy SILT (ML): low plasticity, dark brown; Sand, fine to coarse; TOPSOIL. Sandy CLAY (CI): medium plasticity, pale brown; Sand, fine to coarse; FILL.	w > PL		TOPSOIL	2 2 4 6 11 7 10 16				
						CI	w > PL			FILL							
			ES: 0.40-0.50 m				CI	0.50 m	Sandy CLAY (CI): medium plasticity, orange-brown; Sand, fine to coarse; EXTREMELY WEATHERED MATERIAL.	VSt	EXTREMELY WEATHERED MATERIAL						
	B: 0.50-1.00 m																
	ES: 0.90-1.00 m		w < PL									H					
								Terminated at 1.50m. Refusal.									
					45	2											
					44	3											
					43	4											

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



Client: NSW Department of Education
Project: Former Shoalhaven Anglican School Site
Location: Milton, NSW
Job No: 305001663_8

Non-Cored Drill Hole Log

Hole No : BH04

Sheet 1 of 1

Position: E 267308.93 N 6088101.00 (GDA 2020 56H)

Surface Elevation: 56.000 m AHD

Rig Type: Christie Engineering

Mounting: Trailer

Contractor: ASCT

Driller: AP

Date Started: 12/05/2025

Date Completed: 12/05/2025

Logged By: AC

Checked By: BA

Drilling				Sampling & Testing		Material Description							DCP Blows/100mm			
Method	Penetration	Casing (mm)	Water Observations	Sample or Field Test	RL (m AHD)	Depth Below Surface (m)	Graphic Log	Classification	SOIL TYPE: colour, plasticity or particle characteristic, secondary and minor components	Moisture Condition	Consistency / Relative Density	SOIL ORIGIN Structure & Other Observations				
HA AD/T	F	Not Encountered		ES: 0.00-0.10 m	55	1		ML	0.10 m Sandy SILT (ML): low plasticity, dark brown; Sand, fine to coarse; TOPSOIL. Sandy CLAY (CI): medium plasticity, pale brown; Sand, fine to coarse; FILL.	w < PL		TOPSOIL	1			
								w > PL		FILL		3				
												4				
				ES: 0.40-0.50 m								7				
												6				
												5				
												5				
												4				
												4				
				ES: 0.90-1.00 m								4				
	H											4				
												4				
												3				
												4				
												3				
				D: 1.40-1.50 m								4				
				ES: 1.50-1.60 m								4				
												5				
			3													
			3													
ES: 1.90-2.00 m	54	2							4							
									3							
									4							
									6							
									5							
ES: 2.40-2.50 m								2.50 m	CLAY (CH): high plasticity, blue-grey; with sand, fine to coarse; RESIDUAL SOIL possibly ALLUVIAL SOIL.	VSt - H			7			
		9														
		8														
D: 2.70-2.80 m			18													
					53	3										
				</												



Client: NSW Department of Education
Project: Former Shoalhaven Anglican School Site
Location: Milton, NSW
Job No: 305001663_8

Non-Cored Drill Hole Log

Hole No : BH08

Sheet 1 of 1

Position: E 267401.78 N 6088316.74 (GDA 2020 56H)				Surface Elevation: 47.100 m AHD			
Rig Type: Chrisitie Engineering		Mounting: Track		Contractor: ASCT		Driller: AP	
Date Started: 13/05/2025		Date Completed: 13/05/2025		Logged By: AC		Checked By: BA	

Drilling				Sampling & Testing			Material Description									
Method	Penetration	Casing (mm)	Water Observations	Sample or Field Test	RL (m AHD)	Depth Below Surface (m)	Graphic Log	Classification	SOIL TYPE: colour, plasticity or particle characteristic, secondary and minor components	Moisture Condition	Consistency / Relative Density	SOIL ORIGIN Structure & Other Observations	DCP Blows/100mm			
													5	10	15	
HA AD/T	F		Not Encountered	ES: 0.00-0.10 m	47			CL	Sandy CLAY (CL): low plasticity, brown; Sand, fine to coarse, trace organics; TOPSOIL.	w < PL		TOPSOIL	2			
											3					
											2					
											3					
	ES: 0.40-0.50 m			46		CH	CLAY (CH): high plasticity, grey / brown; RESIDUAL SOIL.	w > PL	St	RESIDUAL SOIL	4					
	D: 0.50-0.60 m										4					
											4					
											4					
	D: 1.50-1.70 m			43		CI	Sandy CLAY (CI): medium plasticity, orange / pale grey; Sand, fine to coarse; EXTREMELY WEATHERED MATERIAL.	w < PL	H	EXTREMELY WEATHERED MATERIAL	3					
											3					
											2					



Client: NSW Department of Education
Project: Former Shoalhaven Anglican School Site
Location: Milton, NSW
Job No: 305001663_8

Non-Cored Drill Hole Log

Hole No : BH09

Sheet 1 of 1

Position: E 267352.38 N 6088272.17 (GDA 2020 56H)

Surface Elevation: 46.000 m AHD

Rig Type: Chrisitie Engineering

Mounting: Track

Contractor: ASCT

Driller: AP

Date Started: 13/05/2025

Date Completed: 13/05/2025

Logged By: AC

Checked By: BA

Drilling				Sampling & Testing		Material Description							DCP Blows/100mm			
Method	Penetration	Casing (mm)	Water Observations	Sample or Field Test	RL (m AHD)	Depth Below Surface (m)	Graphic Log	Classification	SOIL TYPE: colour, plasticity or particle characteristic, secondary and minor components	Moisture Condition	Consistency / Relative Density	SOIL ORIGIN Structure & Other Observations				
HA AD/T	I		Not Encountered	ES: 0.00-0.10 m	45	1		GP-GC	Clayey Sandy GRAVEL (GP-GC): fine to medium grained, 20.0 mm maximum particle size, sub-angular to sub-rounded, grey; Clay, low plasticity; Sand, fine to medium grained; FILL. CLAY (CH): high plasticity, grey / brown; RESIDUAL SOIL.	w < PL		FILL	18			
													18			
				ES: 0.40-0.50 m								RESIDUAL SOIL	20			
				D: 0.50-0.60 m												
					44	2		CI	Sandy CLAY (CI): medium plasticity, red brown; Sand, fine to coarse; EXTREMELY WEATHERED MATERIAL.	w < PL	H	EXTREMELY WEATHERED MATERIAL				
									Terminated at 2.40m. Refusal.							
					43	3										
					42	4										

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



Client: NSW Department of Education
Project: Former Shoalhaven Anglican School Site
Location: Milton, NSW
Job No: 305001663_8

Non-Cored Drill Hole Log

Hole No : BH10

Sheet 1 of 1

Position: E 267370.73 N 6088309.00 (GDA 2020 56H)			Surface Elevation: 46.400 m AHD		
Rig Type: Chrisitie Engineering		Mounting: Track	Contractor: ASCT		Driller: AP
Date Started: 13/05/2025		Date Completed: 13/05/2025	Logged By: AC		Checked By: BA

Drilling				Sampling & Testing		Material Description							DCP Blows/100mm 51015				
Method	Penetration	Casing (mm)	Water Observations	Sample or Field Test	RL (m AHD)	Depth Below Surface (m)	Graphic Log	Classification	SOIL TYPE: colour, plasticity or particle characteristic, secondary and minor components	Moisture Condition	Consistency / Relative Density	SOIL ORIGIN Structure & Other Observations					
HA				ES: 0.00-0.10 m	46			GP-GC	0.10 m Clayey Sandy GRAVEL (GP-GC): fine to medium grained, 20.0 mm maximum particle size, sub-angular to sub-rounded, grey; Clay, low plasticity ; Sand, fine to medium grained; FILL. CLAY (CH): high plasticity, grey / brown; RESIDUAL SOIL.	M		FILL					
														16			
														17			
				ES: 0.40-0.50 m										22			
AD/T	H		▼		45	1		CH	w < PL	H							
					44	2		CI	2.00 m Sandy CLAY (CI): medium plasticity, red brown; Sand, fine to coarse ; EXTREMELY WEATHERED MATERIAL.	w < PL	H	EXTREMELY WEATHERED MATERIAL organic odour from water?					
					43	3			Terminated at 3.00m. Refusal.								
					42	4											

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



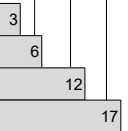
Client: NSW Department of Education
Project: Former Shoalhaven Anglican School Site
Location: Milton, NSW
Job No: 305001663_8

Non-Cored Drill Hole Log

Hole No : BH13

Sheet 1 of 1

Position: E 267497.74 N 6088194.04 (GDA 2020 56H)			Surface Elevation: 53.400 m AHD		
Rig Type: Chrisitie Engineering		Mounting: Track	Contractor: ASCT		Driller: AP
Date Started: 13/05/2025		Date Completed: 13/05/2025	Logged By: AC		Checked By: BA

Drilling				Sampling & Testing			Material Description										
Method	Penetration	Casing (mm)	Water Observations	Sample or Field Test	RL (m AHD)	Depth Below Surface (m)	Graphic Log	Classification	SOIL TYPE: colour, plasticity or particle characteristic, secondary and minor components	Moisture Condition	Consistency / Relative Density	SOIL ORIGIN Structure & Other Observations	DCP Blows/100mm				
AD/T	±		Not Encountered	ES: 0.02-0.10 m	53	0.01 m		SW	SPRAYED SEAL: 14mm thick; ROAD SURFACE. Gravelley SAND (SW): fine to coarse grained, grey; Gravel, fine to coarse grained, up to 40mm, sub-rounded to sub-angular ; with clay; FILL. Sandy CLAY (CH): high plasticity, orange; Sand, fine to coarse; RESIDUAL SOIL.	M		ROAD SURFACE FILL					
				ES: 0.20-0.50 m													
								CH		w < PL	VSt - H						
									Terminated at 1.20m. Refusal.								

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



Client: NSW Department of Education
Project: Former Shoalhaven Anglican School Site
Location: Milton, NSW
Job No: 305001663_8

Non-Cored Drill Hole Log

Hole No : BH15

Sheet 1 of 1

Position: E 267462.92 N 6088227.06 (GDA 2020 56H)			Surface Elevation: 50.600 m AHD		
Rig Type: Chrisitie Engineering		Mounting: Track	Contractor: ASCT		Driller: AP
Date Started: 13/05/2025		Date Completed: 13/05/2025	Logged By: AC		Checked By: BA

Drilling				Sampling & Testing		Material Description								DCP Blows/100mm				
Method	Penetration	Casing (mm)	Water Observations	Sample or Field Test		RL (m AHD)	Depth Below Surface (m)	Graphic Log	Classification	SOIL TYPE: colour, plasticity or particle characteristic, secondary and minor components	Moisture Condition	Consistency / Relative Density	SOIL ORIGIN Structure & Other Observations		5	10	15	
AD/T	VH		Not Encountered	ES: 0.05-0.10 m		50	1		SW	0.05 m ASPHALTIC CONCRETE: AC10 50mm thick dense graded; ROAD SURFACE. Gravelley SAND (SW): fine to coarse grained, grey; Gravel, fine to coarse grained, up to 20mm, sub-angular ; FILL.	M		ROAD SURFACE FILL					
				D: 0.10-0.20 m														
				ES: 0.20-0.30 m														
						49	2			Terminated at 0.43m. Refusal.								
						48	3											
						47	4											
						46												

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



Client: NSW Department of Education
Project: Former Shoalhaven Anglican School Site
Location: Milton, NSW
Job No: 305001663_8

Non-Cored Drill Hole Log

Hole No : BH16

Sheet 1 of 1

Position: E 267457.50 N 6088204.25 (GDA 2020 56H)			Surface Elevation: 51.000 m AHD		
Rig Type: Chrisitie Engineering		Mounting: Track	Contractor: ASCT		Driller: AP
Date Started: 13/05/2025		Date Completed: 13/05/2025	Logged By: AC		Checked By: BA

Drilling				Sampling & Testing		Material Description							DCP Blows/100mm							
Method	Penetration	Casing (mm)	Water Observations	Sample or Field Test	RL (m AHD)	Depth Below Surface (m)	Graphic Log	Classification	SOIL TYPE: colour, plasticity or particle characteristic, secondary and minor components	Moisture Condition	Consistency / Relative Density	SOIL ORIGIN Structure & Other Observations	5	10	15					
AD/T	F	Not Encountered		ES: 0.00-0.10 m	50	1		CL	Sandy CLAY (CL): low plasticity, brown; Sand, fine to coarse; with gravel, fine to medium ; with silt, low plasticity, trace organics, earthy odour; FILL. CLAY (CH): high plasticity, blue grey; FILL.	w > PL		FILL								
				ES: 0.40-0.50 m																
				B: 0.50-0.80 m				CH										FILL		
	H			ES: 1.00-1.10 m	49	2		CH	CLAY (CH): high plasticity, brown yellow; with sand, fine to coarse ; RESIDUAL SOIL. Sandy CLAY (CI): medium plasticity, orange; Sand, fine to coarse ; EXTREMELY WEATHERED MATERIAL.	w < PL	VSt	RESIDUAL SOIL								
								CI										EXTREMELY WEATHERED MATERIAL		
	Terminated at 2.20m. Refusal.																			

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

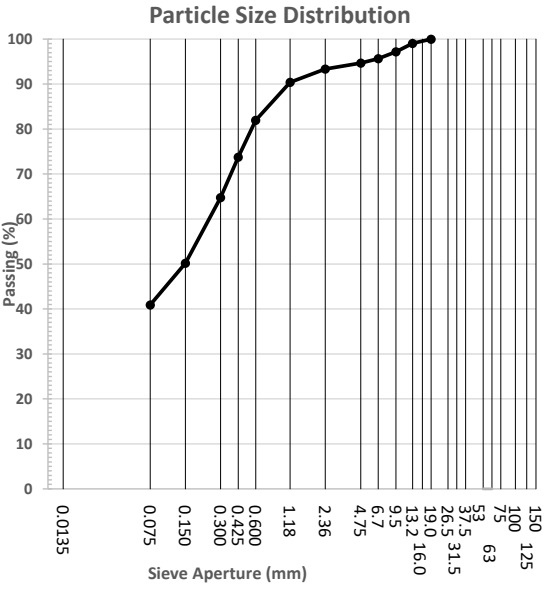
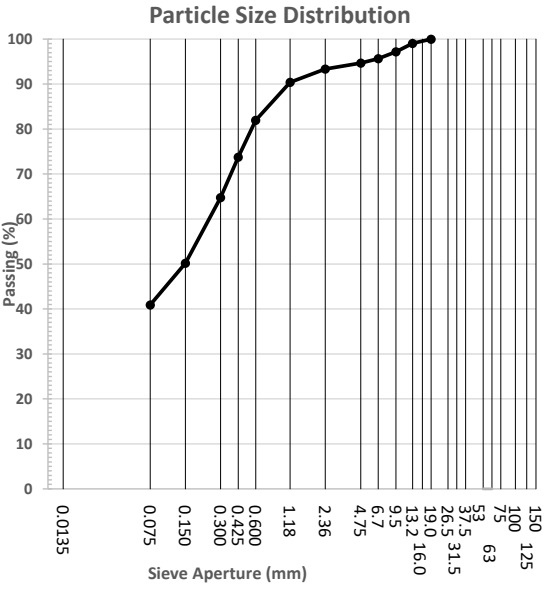
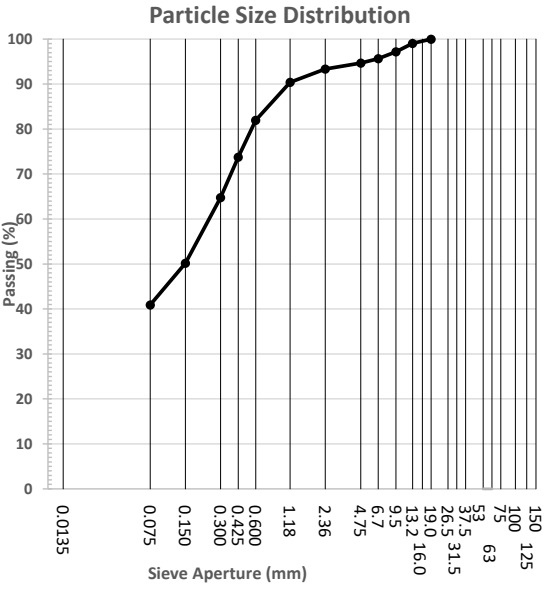
Appendix C Laboratory Certificates





ASCT Illawarra

Postal: 2/15 Miall Way, Albion Park Rail NSW 2527
 Lab: 2/15 Miall Way, 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

WB080 - Rev 38, 20/02/2025		Report on Material Quality																																																																																																																			
Client:	Stantec Australia Pty Ltd	Report No:	26-1706-MQ																																																																																																																		
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/05/2025																																																																																																																		
Project:	Geotechnical Testing	Report Page:	Page 1 of 2																																																																																																																		
Works Component:	Milton Public School -Milton, NSW	Project No:	26																																																																																																																		
Material Used:	-	Request/Order:	305001663																																																																																																																		
Material Description:	-	Lot Number:	-																																																																																																																		
Lot Comments:	-	ITP/PCP Number:	-																																																																																																																		
Lab Test Date/s:	Laboratory testing 23/05/2025 to 28/05/2025	Control Line:	BH01_DS1																																																																																																																		
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth																																																																																																																
35935	12/05/2025	-	-	BH01_DS1	1.0-1.1m																																																																																																																
Sampling & Test Methods (Results relate only to the items sampled/tested)		(** NATA accreditation does not cover the performance of this service)																																																																																																																			
Sampled by Customer: Results apply to the sample/s as received. **		AS 1289.1.1: (2001)Preparation of disturbed soil samples																																																																																																																			
AS 1289.3.6.1 Coarse: (2009)Particle size distribution of a soil		AS 1289.3.6.1 Fine: (2009)Particle size distribution of a soil																																																																																																																			
AS 1289.3.1.2: (2009)Determination of Liquid Limit (1 point Casagrande)		AS 1289.3.2.1: (2009) Determination of the Plastic Limit																																																																																																																			
AS 1289.3.3.1: (2009)Calculation of the Plastic Index of a soil		PSD: Ratios, Co-efficients & Weighted Indices **																																																																																																																			
Report Remarks & Endorsement																																																																																																																					
																																																																																																																					
			Issued By:  L.Romano Approved Signatory																																																																																																																		
Accredited for compliance with ISO/IEC 17025 - Testing. NATA Accreditation number: 20656																																																																																																																					
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WB080 - Rev 38, 20/02/2025

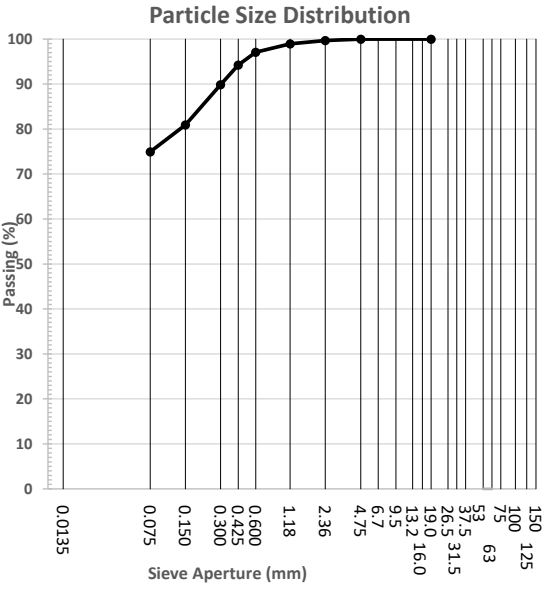
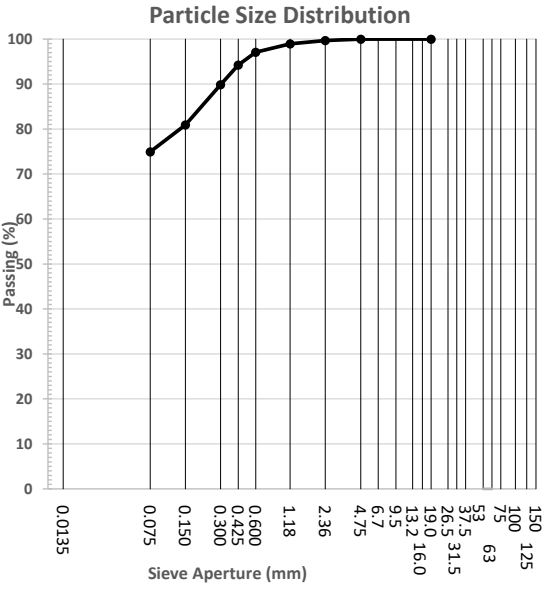
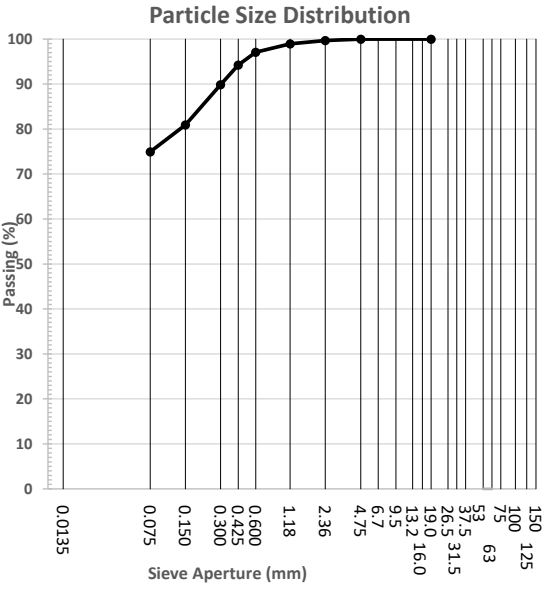
Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	26-1706-MQ		
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/05/2025		
Project:	Geotechnical Testing	Report Page:	Page 2 of 2		
Works Component:	Milton Public School -Milton, NSW	Project No:	26		
Material Used:	-	Request/Order:	305001663		
Material Description:	-	Lot Number:	-		
Lot Comments:	-	ITP/PCP Number:	-		
Lab Test Date/s:	Laboratory testing 23/05/2025 to 28/05/2025	Control Line:	BH01_DS1		
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35935	12/05/2025	-	-	BH01_DS1	1.0-1.1m
Plasticity	Units	Result	Specification Limits	Remarks	
Liquid Limit	%	48		Oven Dried & Dry Sieved	
Plastic Limit	%	24		Oven Dried & Dry Sieved	
Plastic Index	%	24		Oven Dried & Dry Sieved	



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WB080 - Rev 38, 20/02/2025

Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	26-1707-MQ
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/05/2025
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used:	-	Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 27/07/2025	Control Line:	BH01_DS2

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35936	12/05/2025	-	-	BH01_DS2	1.5-1.6m

Plasticity	Units	Result	Specification Limits	Remarks
Liquid Limit	%	74		Oven Dried & Dry Sieved
Plastic Limit	%	28		Oven Dried & Dry Sieved
Plastic Index	%	46		Oven Dried & Dry Sieved



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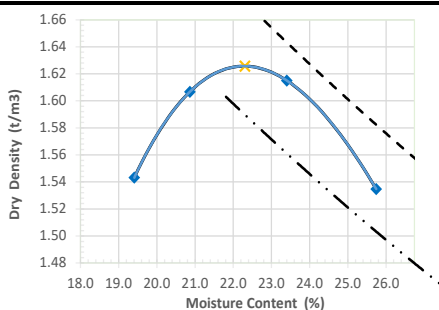
Report on AS CBR and MDD

Client:	Stantec Australia Pty Ltd	Report No:	26-1708-CBR
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	3/06/2025
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used(Source):	-	Test Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Boundaries:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 03/06/2025	Control Line:	BH02_BS1

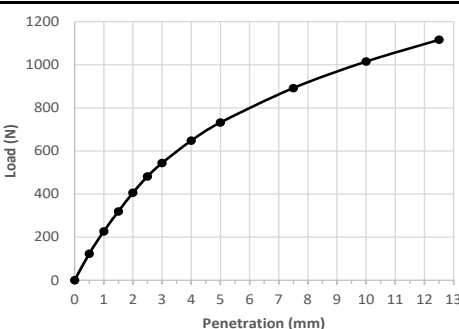
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35937	12/05/2025	-	-	BH02_BS1	0.5-1.0m

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)	--	Low (Less than 35%)	By Technician's Assessment
Sample Curing Time	hrs	MDD = 1099333 hrs	CBR = 141 hrs
Soil Particle Density	t/m3	2.67	Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.63	Standard compactive effort
Optimum Moisture Content (OMC)	%	22.5	
Field Moisture Content	%	Field 20.8 %	Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 22 %	LMR = 98.5%
Compaction Dry Density	t/m3	Achieved 1.62 t/m3	LDR = 99.5%
Surcharge Load	kg	4.5	
Period of Soaking	Days	Soaked - 4 Days	Dry Density (after soaking) = 1.60 t/m3.
Specimen Swell	%	1.5	
Moisture Content - Top 30mm	%	24.8	After Penetration
Moisture Content - Remaining	%	22.7	After Penetration

Dry Density Vs Moisture Content



Load-Penetration Curve



Material CBR Value (%)

3.5

California Bearing Ratios

CBR_{2.5} = 3.5

CBR_{5.0} = 3.5

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



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

Issued By:

L. Romano
 L. Romano
 Approved Signatory

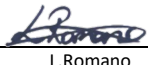
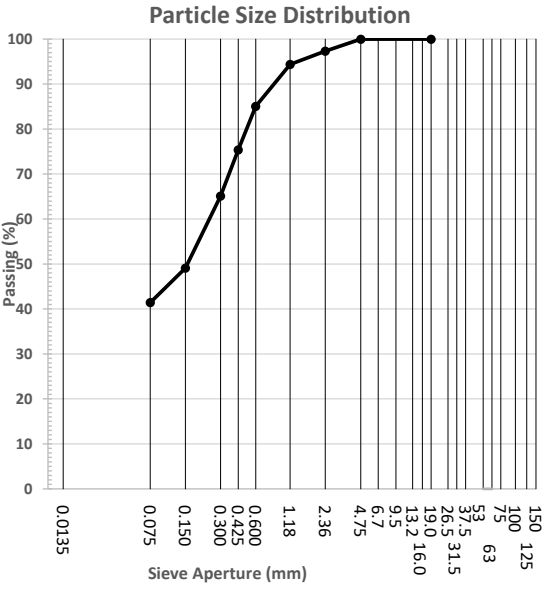
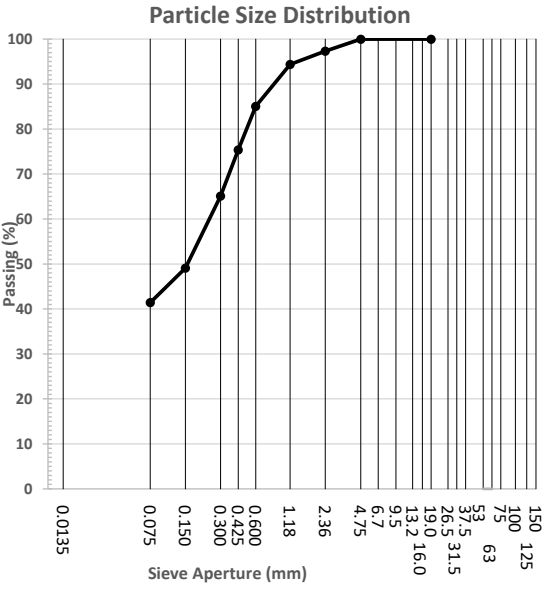
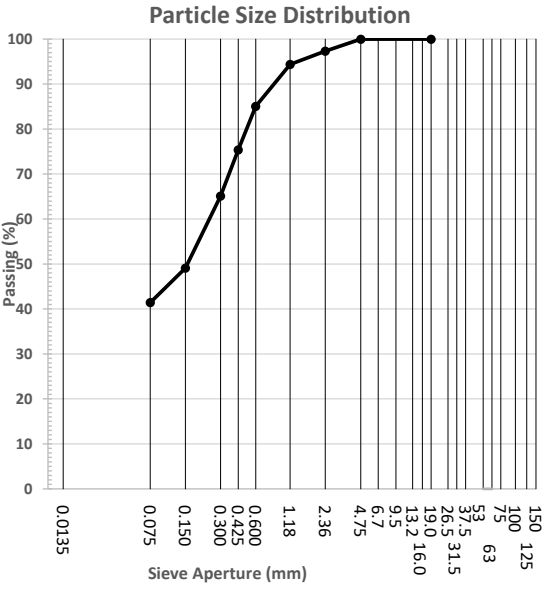
** NATA accreditation does not cover the performance of this service

WB011 - Rev 33, 05/02/2024



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WB080 - Rev 38, 20/02/2025

Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	26-1709-MQ
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/05/2025
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used:	-	Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 27/05/2025	Control Line:	BH03_DS1

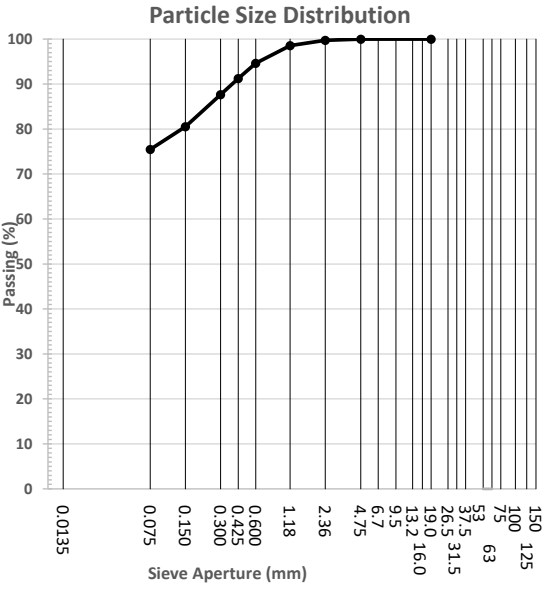
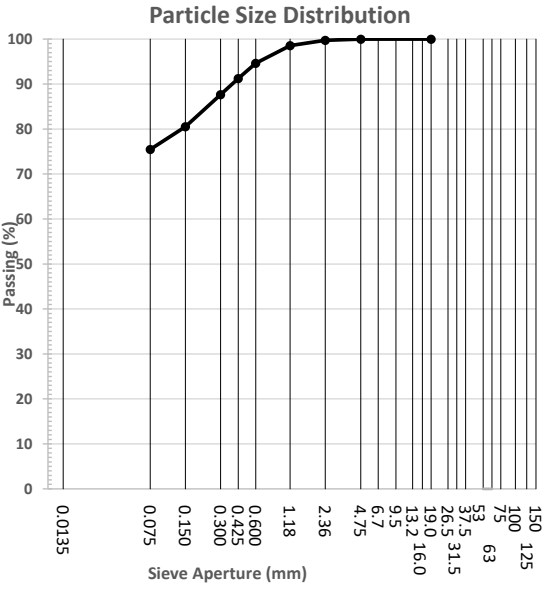
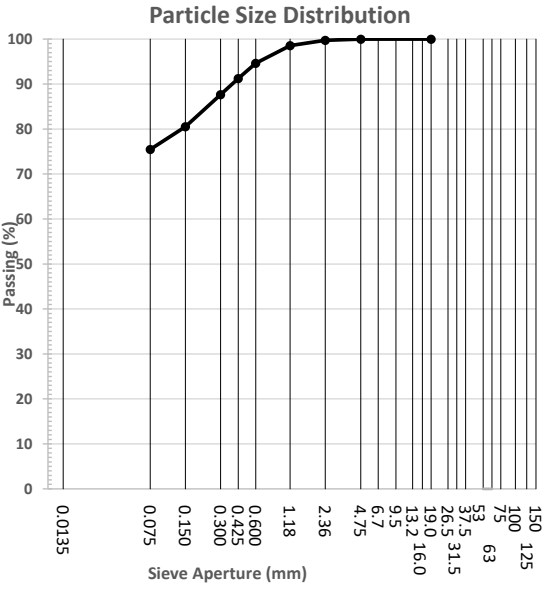
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35938	12/05/2025	-	-	BH03_DS1	0.9-1.0m

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



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WB080 - Rev 38, 20/02/2025

Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	26-1710-MQ
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/05/2025
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used:	-	Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 28/05/2025	Control Line:	BH05_DS2

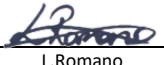
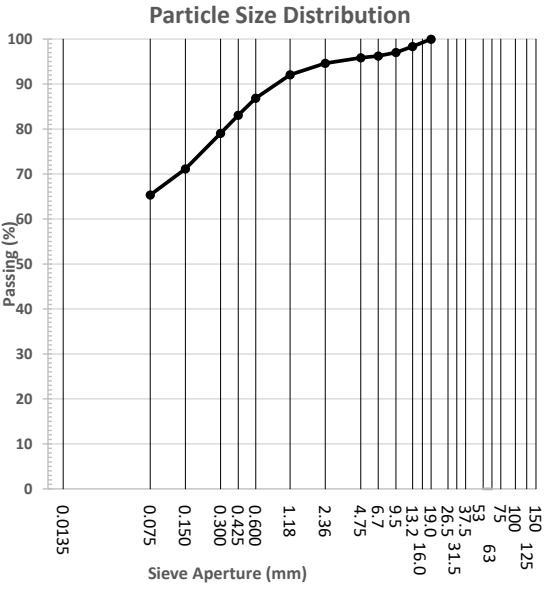
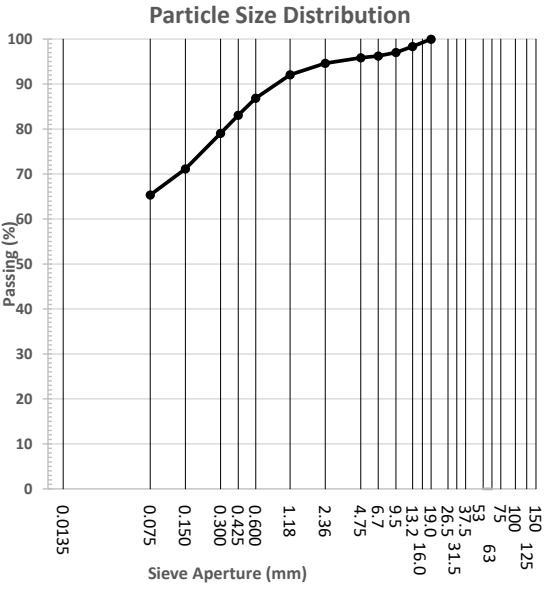
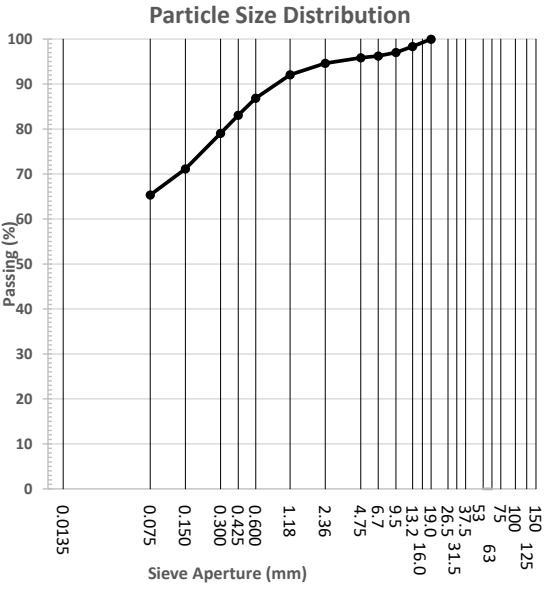
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35939	12/05/2025	-	-	BH05_DS2	2.5-2.6m

Plasticity	Units	Result	Specification Limits	Remarks
Liquid Limit	%	82		Oven Dried & Dry Sieved
Plastic Limit	%	33		Oven Dried & Dry Sieved
Plastic Index	%	49		Oven Dried & Dry Sieved



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35940	12/05/2025	-	-	BH07_DS1	0.5-0.6m																																																																																																																	
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WB080 - Rev 38, 20/02/2025

Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	26-1711-MQ
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/05/2025
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used:	-	Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 28/05/2025	Control Line:	BH07_DS1

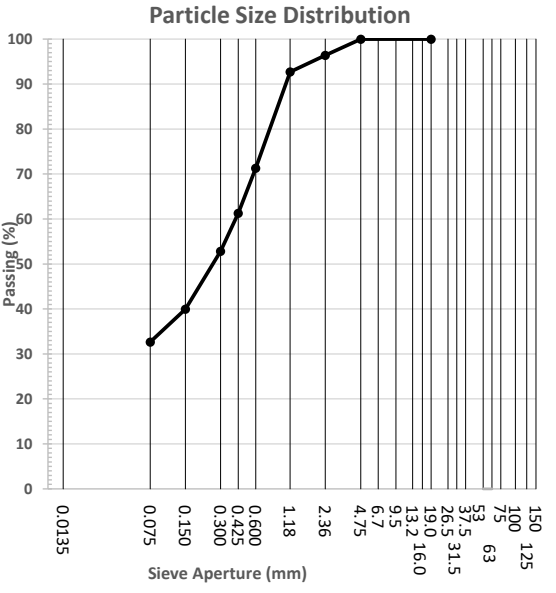
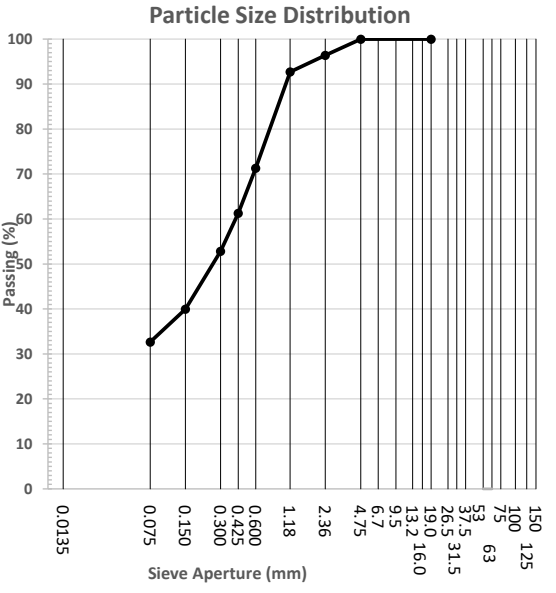
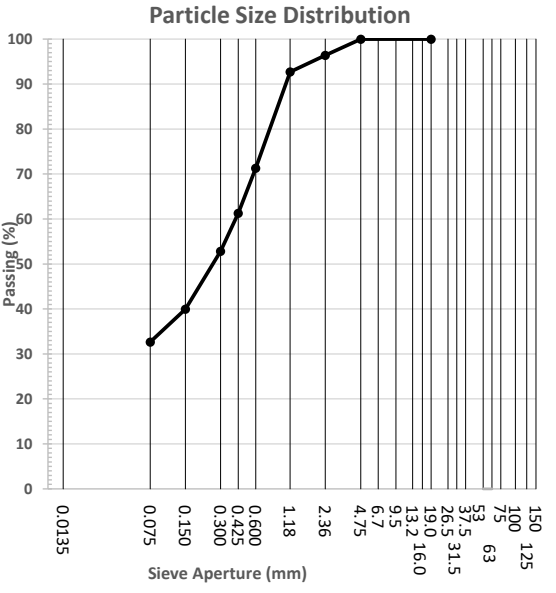
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35940	12/05/2025	-	-	BH07_DS1	0.5-0.6m

Plasticity	Units	Result	Specification Limits	Remarks
Liquid Limit	%	68		Oven Dried & Dry Sieved
Plastic Limit	%	27		Oven Dried & Dry Sieved
Plastic Index	%	41		Oven Dried & Dry Sieved



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Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/05/2025																																																																																																																		
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AS 1289.3.1.2: (2009)Determination of Liquid Limit (1 point Casagrande)		AS 1289.3.2.1: (2009) Determination of the Plastic Limit																																																																																																																			
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WB080 - Rev 38, 20/02/2025

Report on Material Quality

Client:	Stantec Australia Pty Ltd	Report No:	26-1712-MQ
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	28/05/2025
Project:	Geotechnical Testing	Report Page:	Page 2 of 2
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used:	-	Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 26/05/2025	Control Line:	BH08_DS1

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35941	12/05/2025	-	-	BH08_DS1	1.5-1.7m

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

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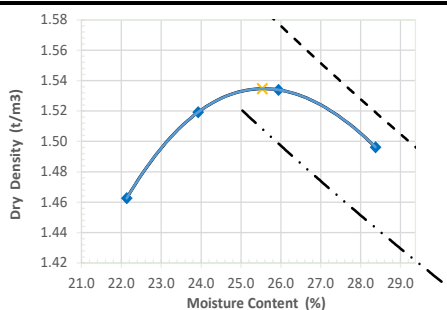
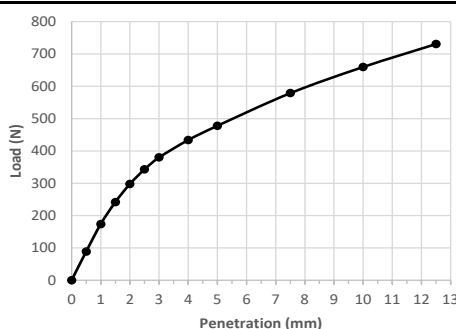
A.B.N. 34 635 062 609

Report on AS CBR and MDD

Client:	Stantec Australia Pty Ltd	Report No:	26-1713-CBR
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	3/06/2025
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used(Source):	-	Test Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Boundaries:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 03/06/2025	Control Line:	BH11_BS1

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35942	12/05/2025	-	-	BH11_BS1	0.2-0.5m

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	MDD = 96 hrs	CBR = 140 hrs
Soil Particle Density	t/m3	2.67	Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.53	Standard compactive effort
Optimum Moisture Content (OMC)	%	25.5	
Field Moisture Content	%	Field 27.8 %	Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 25.7 %	LMR = 100.5%
Compaction Dry Density	t/m3	Achieved 1.54 t/m3	LDR = 100.0%
Surcharge Load	kg	4.5	
Period of Soaking	Days	Soaked - 4 Days	Dry Density (after soaking) = 1.50 t/m3.
Specimen Swell	%	2.5	
Moisture Content - Top 30mm	%	29.6	After Penetration
Moisture Content - Remaining	%	26.9	After Penetration

Dry Density Vs Moisture Content**Load-Penetration Curve****Material CBR Value (%)****2.5****California Bearing Ratios****CBR_{2.5} = 2.5****CBR_{5.0} = 2.5**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

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

Issued By:

L.Romano
Approved Signatory

20656

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

WB011 - Rev 33, 05/02/2024



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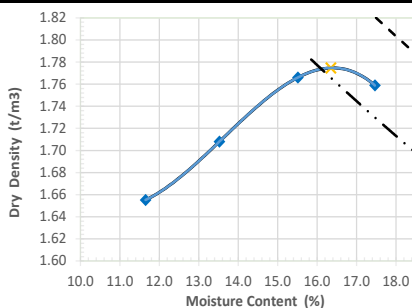
Report on AS CBR and MDD

Client:	Stantec Australia Pty Ltd	Report No:	26-1714-CBR
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	4/06/2025
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used(Source):	-	Test Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Boundaries:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 04/06/2025	Control Line:	BH12_BS1

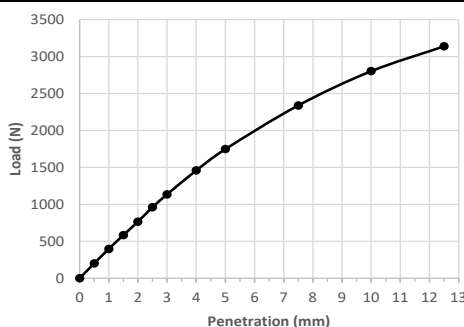
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35943	12/05/2025	-	-	BH12_BS1	0.2-0.5m

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)	--	Low (Less than 35%)	By Technician's Assessment
Sample Curing Time	hrs	MDD = 68 hrs	CBR = 141 hrs
Soil Particle Density	t/m3	2.67	Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.77	Standard compactive effort
Optimum Moisture Content (OMC)	%	16.5	
Field/Prep Moisture Content	%	Field 13.3 %	Prep 13.3 %
Compaction Moisture Content	%	Achieved 16.7 %	LMR = 102.5%
Compaction Dry Density	t/m3	Achieved 1.76 t/m3	LDR = 99.5%
Surcharge Load	kg	4.5	
Period of Soaking	Days	Soaked - 4 Days	Dry Density (after soaking) = 1.76 t/m3.
Specimen Swell	%	0.0	
Moisture Content - Top 30mm	%	18.8	After Penetration
Moisture Content - Remaining	%	17.3	After Penetration

Dry Density Vs Moisture Content



Load-Penetration Curve



Material CBR Value (%)

9

California Bearing Ratios

CBR_{2.5} = 7

CBR_{5.0} = 9

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



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

WB011 - Rev 33, 05/02/2024

**ASCT Illawarra**

Postal: 2/15 Miall Way, Albion Park Rail NSW 2527

Lab: 2/15 Miall Way, Albion Park Rail NSW 2527

Telephone: (02) 4256 1684

E-Mail: illawarra@asct.com.au

Mobile: 0497 979 929

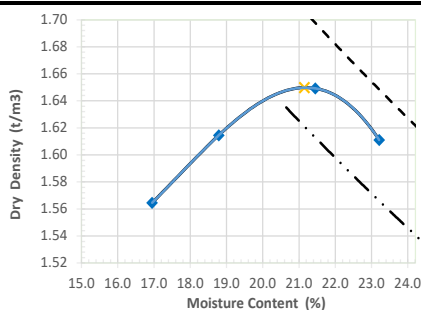
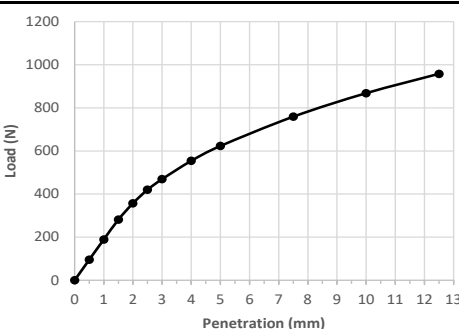
A.B.N. 34 635 062 609

Report on AS CBR and MDD

Client:	Stantec Australia Pty Ltd	Report No:	26-1715-CBR
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	4/06/2025
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used(Source):	-	Test Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Boundaries:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 04/06/2025	Control Line:	BH14_BS1

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35944	12/05/2025	-	-	BH14_BS1	0.2-0.5m

Parameters	Units	Test Results		Information
Pretreatment Regime	--	No Pretreatment		
Portion Retained on AS Sieve	%	0% on 19mm	#VALUE!	Retained material excluded from CBR
Material Plasticity (Liquid Limit)	--	Low (Less than 35%)		By Technician's Assessment
Sample Curing Time	hrs	MDD = 70 hrs	CBR = 141 hrs	
Soil Particle Density	t/m3	2.67		Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.65		Standard compactive effort
Optimum Moisture Content (OMC)	%	21.0		
Field Moisture Content	%	Field 23.7 %		Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 21.5 %	LMR = 101.5%	Specified LMR = 100%
Compaction Dry Density	t/m3	Achieved 1.64 t/m3	LDR = 99.0%	Specified LDR = 100%
Surcharge Load	kg	4.5		
Period of Soaking	Days	Soaked - 4 Days		Dry Density (after soaking) = 1.61 t/m3.
Specimen Swell	%	2.0		
Moisture Content - Top 30mm	%	24.9		After Penetration
Moisture Content - Remaining	%	22.2		After Penetration

Dry Density Vs Moisture Content**Load-Penetration Curve****Material CBR Value (%)****3.0****California Bearing Ratios****CBR_{2.5} = 3.0****CBR_{5.0} = 3.0**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

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

Issued By:

L.Romano
Approved Signatory

20656

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WB011 - Rev 33, 05/02/2024

**ASCT Illawarra**

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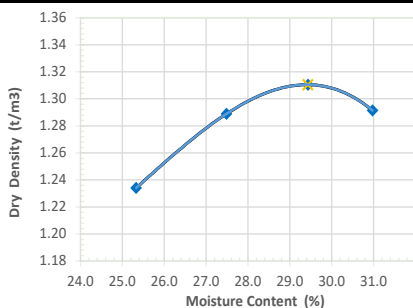
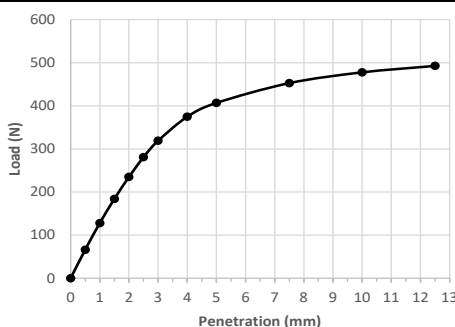
A.B.N. 34 635 062 609

Report on AS CBR and MDD

Client:	Stantec Australia Pty Ltd	Report No:	26-1716-CBR
Client Address:	16 Burelli St, Wollongong NSW 2500	Report Date:	4/06/2025
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	Milton Public School -Milton, NSW	Project No:	26
Material Used(Source):	-	Test Request/Order:	305001663
Material Description:	-	Lot Number:	-
Lot Boundaries:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 23/05/2025 to 04/06/2025	Control Line:	BH16_BS1

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
35945	12/05/2025	-	-	BH16_BS1	0.5-0.8m

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)	--	Low (Less than 35%)		By Technician's Assessment
Sample Curing Time	hrs	MDD = 24 hrs	CBR = 72 hrs	
Soil Particle Density	t/m3	2.67		Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.31		Standard compactive effort
Optimum Moisture Content (OMC)	%	29.5		
Field/Prep Moisture Content	%	Field 38.5 %	Prep 27.9 %	Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 29.9 %	LMR = 101.5%	Specified LMR = 100%
Compaction Dry Density	t/m3	Achieved 1.3 t/m3	LDR = 99.5%	Specified LDR = 100%
Surcharge Load	kg	4.5		
Period of Soaking	Days	Soaked - 4 Days		Dry Density (after soaking) = 1.24 t/m3.
Specimen Swell	%	4.5		
Moisture Content - Top 30mm	%	36.7		After Penetration
Moisture Content - Remaining	%	30.9		After Penetration

Dry Density Vs Moisture Content**Load-Penetration Curve****Material CBR Value (%)****2.0****California Bearing Ratios****CBR_{2.5} = 2.0****CBR_{5.0} = 2.0**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

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

Issued By:

L.Romano

Approved Signatory

20656

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

WB011 - Rev 33, 05/02/2024

Stantec Australia Pty Ltd
Ground Floor, 16 Burelli Street
Wollongong
NSW 2500



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: **Aaron Coghlan**

Report **1230217-S**
Project name **Additional: Milton Public School**
Project ID **305001663**
Received Date **Jun 05, 2025**

Client Sample ID			BH01_2	BH03_1	BH05_1	BH07_0.5
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S25-Jn0023386	S25-Jn0023387	S25-Jn0023388	S25-Jn0023389
Date Sampled			May 12, 2025	May 12, 2025	May 12, 2025	May 12, 2025
Test/Reference	LOR	Unit				
Chloride	10	mg/kg	16	52	31	120
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	30	55	43	110
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	5.5	5.9	6.0	5.1
Resistivity*	0.5	ohm.m	330	180	230	89
Sulphate (as SO4)	10	mg/kg	40	30	73	37
Sample Properties						
% Moisture	1	%	26	20	21	32

Client Sample ID			BH09_0.5	BH11_0.5	BH14_0.5
Sample Matrix			Soil	Soil	Soil
Eurofins Sample No.			S25-Jn0023390	S25-Jn0023391	S25-Jn0023392
Date Sampled			May 12, 2025	May 12, 2025	May 12, 2025
Test/Reference	LOR	Unit			
Chloride	10	mg/kg	280	< 10	15
Conductivity (1:5 aqueous extract at 25 °C as rec.)	10	uS/cm	410	10	150
pH (1:5 Aqueous extract at 25 °C as rec.)	0.1	pH Units	4.5	6.2	4.9
Resistivity*	0.5	ohm.m	24	980	65
Sulphate (as SO4)	10	mg/kg	240	15	190
Sample Properties					
% Moisture	1	%	30	22	16

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 - Method: In-house method LTM-INO-4090 Chloride by Discrete Analyser	Sydney	Jun 11, 2025	28 Days
Conductivity (1:5 aqueous extract at 25 °C as rec.) - Method: LTM-INO-4030 Conductivity	Sydney	Jun 11, 2025	7 Days
pH (1:5 Aqueous extract at 25 °C as rec.) - Method: LTM-GEN-7090 pH by ISE	Sydney	Jun 11, 2025	7 Days
Sulphate (as SO ₄) - Method: In-house method LTM-INO-4110 Sulphate by Discrete Analyser	Sydney	Jun 11, 2025	28 Days
% Moisture - Method: LTM-GEN-7080 Moisture	Sydney	Jun 10, 2025	14 Days



web: www.eurofins.com.au
email: EnviroSales@eurofinsanz.com

Melbourne 6 Monterey Road Dandenong South VIC 3175 +61 3 8564 5000 NATA# 1261 Site# 1254	Geelong 19/8 Lewalan Street Grovedale VIC 3216 +61 3 8564 5000 NATA# 1261 Site# 25403	Sydney 179 Magowar Road Girraween NSW 2145 +61 2 9900 8400 NATA# 1261 Site# 18217	Canberra Unit 1,2 Dacre Street Mitchell ACT 2911 +61 2 6113 8091 NATA# 1261 Site# 25466	Brisbane 1/21 Smallwood Place Murarrie QLD 4172 +61 7 3902 4600 NATA# 1261 Site# 20794 & 2780	Newcastle 1/2 Frost Drive Mayfield West NSW 2304 +61 2 4968 8448 NATA# 1261 Site# 25079	Perth 46-48 Banksia Road Welshpool WA 6106 +61 8 6253 4444 NATA# 2377 Site# 2370 & 2554	Auckland 35 O'Rorke Road Penrose Auckland 1061 +64 9 526 4551 IANZ# 1327	Auckland (Focus) Unit C1/4 Pacific Rise Mount Wellington Auckland 1061 +64 9 525 0568 IANZ# 1308	Christchurch 43 Detroit Drive Rolleston Christchurch 7675 +64 3 343 5201 IANZ# 1290	Tauranga 1277 Cameron Road Gate Pa Tauranga 3112 +64 9 525 0568 IANZ# 1402
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Company Name: Stantec Australia Pty Ltd (Wollongong)

Address: Ground Floor, 16 Burelli Street
Wollongong
NSW 2500

Project Name: Additional: Milton Public School

Project ID: 305001663

Order No.:

Report #: 1230217

Phone: (02) 9493 9700

Fax:

Received: Jun 5, 2025 1:41 PM

Due: Jun 13, 2025

Priority: 5 Day

Contact Name: Aaron Coghlan

Eurofins Analytical Services Manager : Roopesh Rangarajan

Sample Detail						Aggressivity Soil Set	Moisture Set
Sydney Laboratory - NATA # 1261 Site # 18217						X	X
External Laboratory							
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID		
1	BH01_2	May 12, 2025		Soil	S25-Jn0023386	X	X
2	BH03_1	May 12, 2025		Soil	S25-Jn0023387	X	X
3	BH05_1	May 12, 2025		Soil	S25-Jn0023388	X	X
4	BH07_0.5	May 12, 2025		Soil	S25-Jn0023389	X	X
5	BH09_0.5	May 12, 2025		Soil	S25-Jn0023390	X	X
6	BH11_0.5	May 12, 2025		Soil	S25-Jn0023391	X	X
7	BH14_0.5	May 12, 2025		Soil	S25-Jn0023392	X	X
Test Counts						7	7

Internal Quality Control Review and Glossary

General

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

Holding Times

Please refer to the '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 before sample receipt deadlines as stated on the SRA.

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

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

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

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - 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.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

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%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as 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 are not data from your samples.
3. 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.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. 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										
Conductivity (1:5 aqueous extract at 25 °C as rec.)				uS/cm	< 10			10	Pass	
LCS - % Recovery										
Conductivity (1:5 aqueous extract at 25 °C as rec.)				%	92			70-130	Pass	
Resistivity*				%	92			70-130	Pass	
Test	Lab Sample ID	QA Source		Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery										
					Result 1					
Chloride	S25-Jn0023882	NCP		%	108			70-130	Pass	
Sulphate (as SO4)	S25-Jn0023882	NCP		%	98			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	S25-Jn0023896	NCP		mg/kg	12	12	4.0	30%	Pass	
Conductivity (1:5 aqueous extract at 25 °C as rec.)	S25-Jn0023897	NCP		uS/cm	68	67	1.0	30%	Pass	
pH (1:5 Aqueous extract at 25 °C as rec.)	S25-Jn0023897	NCP		pH Units	5.9	5.8	pass	30%	Pass	
Resistivity*	S25-Jn0023897	NCP		ohm.m	150	150	1.0	30%	Pass	
Sulphate (as SO4)	S25-Jn0023896	NCP		mg/kg	18	17	1.0	30%	Pass	
Duplicate										
Sample Properties					Result 1	Result 2	RPD			
% Moisture	S25-Jn0023386	CP		%	26	27	4.0	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:

Nileshni Goundar	Analytical Services Manager
Ryan Phillips	Senior Analyst-Inorganic
Ryan Phillips	Senior Analyst-Sample Properties



Glenn Jackson
Managing Director

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](#).

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Appendix D Douglas Partners 2020 Investigation Data



BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed Budawang SSP Relocation
LOCATION: 17 Croobyar Road, Milton

SURFACE LEVEL: 48.0 AHD
EASTING: 267398
NORTHING: 6088349
DIP/AZIMUTH: 90°/-

BORE No: 101
PROJECT No: 89390.02
DATE: 13/10/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
48.0	0.1	TOPSOIL/SILT (ML): low plasticity, dark brown, w<PL		E	0.1		PID = 0.9					
		FILL/Silty GRAVEL (GP): medium gravel, brown and dark brown, dry		D E	0.5		PID = 1.0					
47.0	1.0	CLAY (CH): high plasticity, dark brown, with silt, w>PL, firm		D E	1.0		PID = 0.8		1			
				D E	1.5		pp = 50 PID = 0.6					
46.0	2.0			D	2.0		pp = 50		2			
		-becoming grey mottled green and brown, trace sand below 2.2m		D	2.5		pp = 75					
45.0	3.0			D	3.0		pp = 100		3			
		-becoming stiff below 3.0m										
44.0	3.3	Sandy CLAY (CI): medium plasticity, brown red, fine to medium sand, w>PL, very stiff										
				D	4.5							
43.0	5.0											
				D	5.5							
	5.5	Bore discontinued at 5.5m -limit of investigation		D	5.5							

RIG: Kubota KX018-4 mini-excavator **DRILLER:** Clinton Taylor

LOGGED: FH

CASING: Uncased

TYPE OF BORING: Solid flight auger - TC bit

WATER OBSERVATIONS: Groundwater seepage at 3.5m

REMARKS: w =moisture content, PL = plastic limit

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U _s	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	W	Water seep	pp	Standard penetration test
E	Environmental sample	W	Water level	V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed Budawang SSP Relocation
LOCATION: 17 Croobyar Road, Milton

SURFACE LEVEL: 50.7 AHD
EASTING: 267471
NORTHING: 6088360
DIP/AZIMUTH: 90°/--

BORE No: 102
PROJECT No: 89390.02
DATE: 13/10/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
	0.15	TOPSOIL/SILT (ML): low plasticity, dark brown, w<PL		E	0.1		PID = 1.5		
		CLAY (CH): high plasticity, brown, w<PL, stiff		E	0.5		pp = 100-150 PID = 0.1		
		-with fine to medium sand below 0.8m		E	1.0		pp = 150 PID = 0.3		
				E	1.5		PID = 0.2		
	1.8	Sandy CLAY (CI): medium plasticity, red brown, fine to medium sand, w~PL, stiff		D	2.0				
				D	2.5				
				D	3.0				
		-very stiff to hard, below 3.0m		D	3.5				
	3.5	MONZONITE: medium grained, orange brown, with extremely weathered rock bands, very low strength, highly weathered		D	4.0				
	4.0	Bore discontinued at 4.0m -refusal on very low strength monzonite		D					

RIG: Kubota KX018-4 mini-excavator **DRILLER:** Clinton Taylor

LOGGED: FH

CASING: Uncased

TYPE OF BORING: Solid flight auger - TC bit

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w =moisture content, PL = plastic limit

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed Budawang SSP Relocation
LOCATION: 17 Croobyar Road, Milton

SURFACE LEVEL: 48.3 AHD
EASTING: 267430
NORTHING: 6088321
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 89390.02
DATE: 13/10/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 1000mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
48	0.15	TOPSOIL/SILT (ML): low plasticity, dark brown, w<PL		E	0.1		PID = 0.1					
		CLAY (CH): high plasticity, brown, with silt, w<PL, stiff to very stiff		D	0.5		pp = 200 PID = 0.8					
				B								
	1			D	1.0		PID = 0.4	1				
	1.3			E								
47	1.3	CLAY (CH): high plasticity, pale brown orange, with fine to medium sand, w>PL, stiff		D	1.5		pp = 150 PID = 0.6					
	2			D	2.0		pp = 150-200	2				
	2.2											
46	2.2	Sandy CLAY (CI): medium plasticity, brown orange, fine to medium sand, w>PL, stiff to very stiff		D	2.5		pp = 150-200					
3	2.9											
	3.0	MONZONITE: medium grained, brown orange red, with extremely weathered rock bands, very low strength, highly weathered		D	3.0			3				
45		Bore discontinued at 3.0m -refusal on very low strength monzonite										
44												
43												

RIG: Kubota KX018-4 mini-excavator **DRILLER:** Clinton Taylor

LOGGED: FH

CASING: Uncased

TYPE OF BORING: Solid flight auger - TC bit

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w =moisture content, PL = plastic limit

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW) **SURFACE LEVEL:** 46.7 AHD
PROJECT: Proposed Budawang SSP Relocation **EASTING:** 267375
LOCATION: 17 Croobyar Road, Milton **NORTHING:** 6088306

BORE No: 104
PROJECT No: 89390.02
DATE: 13/10/2020
SHEET 1 OF 1

[illegible]

RIG: Kubota KX018-4 mini-excavator **DRILLER:** Clinton Taylor

LOGGED: FH

CASING: Uncased

TYPE OF BORING: Solid flight auger - TC bit

WATER OBSERVATIONS: Groundwater seepage at 3.4m

REMARKS: w =moisture content, PL = plastic limit

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)



BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed Budawang SSP Relocation
LOCATION: 17 Croobyar Road, Milton

SURFACE LEVEL: 51.4 AHD
EASTING: 267494
NORTHING: 6088304
DIP/AZIMUTH: 90°/-

BORE No: 105
PROJECT No: 89390.02
DATE: 13/10/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)
				Type	Depth	Sample	Results & Comments		
	0.1	TOPSOIL/SILT (ML): low plasticity, dark brown, w<pl		D	0.1		PID = 1.1		
	0.2	CLAY (CH): high plasticity, brown, trace fine to medium sand, w~PL, stiff		B	0.2				
	0.5			E	0.5		pp = 150 PID = 0.2		
	1.0			E	1.0		pp = 150-200 PID = 0.5		
	1.5			D	1.5		pp = 100-150		
	1.9	-becoming stiff to very stiff below 1.8m							
	2.0	Sandy CLAY (CI): medium plasticity, fine to medium sand, w~PL, stiff		D	2.0				
	2.5			D	2.5				
	2.9	MONZONITE: medium grained, brown with pale grey, with extremely weathered rock bands, very low strength, highly weathered							
	2.9	Bore discontinued at 2.9m -refusal on very low strength monzonite							
	3.0								
	4.0								
	5.0								

RIG: Kubota KX018-4 mini-excavator **DRILLER:** Clinton Taylor

LOGGED: FH

CASING: Uncased

TYPE OF BORING: Solid flight auger - TC bit

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w =moisture content, PL = plastic limit

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	>	Water seep	SP	Standard penetration test
E	Environmental sample	≡	Water level	S	Shear vane (kPa)

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed Budawang SSP Relocation
LOCATION: 17 Croobyar Road, Milton

SURFACE LEVEL: 50.2 AHD
EASTING: 267460
NORTHING: 6088279
DIP/AZIMUTH: 90°/-

BORE No: 106
PROJECT No: 89390.02
DATE: 13/10/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 1000mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
49.0	0.15	TOPSOIL /SILT (ML): low plasticity, dark brown, trace clay, w<PL		E	0.1		PID = 3.9					
		CLAY (CH): high plasticity, brown, trace silt, w<PL, stiff										
	0.5	CLAY (CH): high plasticity, pale brown, trace fine to medium sand, w<PL, stiff to very stiff		D E	0.5		pp = 150-200 PID = 0.2					
1				D E	1.0		pp = 200 PID = 0.2	1				
49	1.2	CLAY (CI): medium plasticity, pale orange brown, trace fine to medium sand, w<PL, very stiff		D E	1.5		pp = 200-250 PID = 0.4					
	2	-with extremely weathered rock bands below 2m		D	2.0			2				
48	2.3	MONZONITE: medium grained, brown orange, with extremely weathered bands, very low strength, highly weathered										
	2.5	Bore discontinued at 2.5m -refusal on very low strength monzonite		D	2.5							
3								3				
47												
4								4				
46												
5								5				
45												

RIG: Kubota KX018-4 mini-excavator **DRILLER:** Clinton Taylor

LOGGED: FH

CASING: Uncased

TYPE OF BORING: Solid flight auger - TC bit

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w =moisture content, PL = plastic limit

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed Budawang SSP Relocation
LOCATION: 17 Croobyar Road, Milton

SURFACE LEVEL: 48.0 AHD
EASTING: 267406
NORTHING: 6088243
DIP/AZIMUTH: 90°/--

BORE No: 107
PROJECT No: 89390.02
DATE: 13/10/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
48.0	0.2	TOPSOIL/SILT (ML): low plasticity, dark brown, trace clay, w<PL		E	0.1		PID = 1.8					
	0.5	CLAY (CH): high plasticity, dark brown, with silt, w<PL, stiff		D	0.5		pp = 200 PID = 18.2					
	1.0	CLAY (CH): high plasticity, pale orange brown, trace fine to medium sand, w~PL, stiff		B	1.0		pp = 150 PID = 0.2					
	1.5	-w<PL, below 0.8m		D	1.5		pp = 100-150					
	1.8	Sandy CLAY (CI): medium plasticity, pale orange brown, fine to medium sand, w<PL, stiff		D	1.8		pp = 100					
	2.0	-becoming w>PL, below 2.2m		D	2.0							
	2.5			D	2.5							
	3.0			D	3.0							
	3.5			D	3.5							
	3.7	Bore discontinued at 3.7m										
	4.0	-refusal on very low strength monzonite										
	5.0											

RIG: Kubota KX018-4 mini-excavator **DRILLER:** Clinton Taylor

LOGGED: FH

CASING: Uncased

TYPE OF BORING: Solid flight auger - TC bit

WATER OBSERVATIONS: Groundwater seepage at 2.7m

REMARKS: w =moisture content, PL = plastic limit

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	>	Water seep
E	Environmental sample	≡	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

BOREHOLE LOG

CLIENT: School Infrastructure New South Wales (SINSW)
PROJECT: Proposed Budawang SSP Relocation
LOCATION: 17 Croobyar Road, Milton

SURFACE LEVEL: 52.5 AHD
EASTING: 267490
NORTHING: 6088240
DIP/AZIMUTH: 90°/-

BORE No: 108
PROJECT No: 89390.02
DATE: 13/10/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 1000mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
	0.2	TOPSOIL/SILT (ML): low plasticity, dark brown, trace fine sand, w<PL		D E	0.1		PID = 6.4					
	0.6	CLAY (CH): high plasticity, brown mottled dark brown, with silt, w<PL, stiff		D E	0.5		pp = 150 PID = 6					
	1.0	Sandy CLAY (CI): medium to high plasticity, brown, fine to medium sand, w<PL, stiff		D E	1.0		pp = 150	1				
	1.9	-becoming very stiff, with extremely weathered rock bands below 1.3m		D E	1.5							
	2.2	MONZONITE: medium grained, brown with grey, with extremely weathered bands, very low strength, highly weathered		D	2.0			2				
	2.2	Bore discontinued at 2.2m -refusal on very low strength monzonite										
	3.0							3				
	4.0							4				
	5.0							5				

RIG: Kubota KX018-4 mini-excavator **DRILLER:** Clinton Taylor

LOGGED: FH

CASING: Uncased

TYPE OF BORING: Solid flight auger - TC bit

WATER OBSERVATIONS: No free groundwater observed

REMARKS: w =moisture content, PL = plastic limit

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND			
A	Auger sample	G	Gas sample
B	Bulk sample	P	Piston sample
BLK	Block sample	U	Tube sample (x mm dia.)
C	Core drilling	W	Water sample
D	Disturbed sample	W	Water seep
E	Environmental sample	W	Water level
		PID	Photo ionisation detector (ppm)
		PL(A)	Point load axial test Is(50) (MPa)
		PL(D)	Point load diametral test Is(50) (MPa)
		pp	Pocket penetrometer (kPa)
		S	Standard penetration test
		V	Shear vane (kPa)

CERTIFICATE OF ANALYSIS 253917

Client Details

Client	Douglas Partners Unanderra
Attention	Kenton Horsley
Address	Unit 1, 1 Luso Drive, Unanderra, NSW, 2526

Sample Details

Your Reference	<u>89390.02, Milton</u>
Number of Samples	4 Soil
Date samples received	21/10/2020
Date completed instructions received	21/10/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
 Samples were analysed as received from the client. Results relate specifically to the samples as received.
 Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	28/10/2020
Date of Issue	27/10/2020
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Nick Sarlamis, Inorganics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

Soil Aggressivity					
Our Reference		253917-1	253917-2	253917-3	253917-4
Your Reference	UNITS	102/0.5	104/0.5	105/1.0	108/1.0
Date Sampled		13/10/2020	13/10/2020	13/10/2020	13/10/2020
Type of sample		Soil	Soil	Soil	Soil
pH 1:5 soil:water	pH Units	5.2	5.6	5.3	4.9
Electrical Conductivity 1:5 soil:water	µS/cm	68	65	70	130
Resistivity in soil*	ohm m	150	150	140	78
Chloride, Cl 1:5 soil:water	mg/kg	37	20	21	78
Sulphate, SO4 1:5 soil:water	mg/kg	32	72	58	100

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25oC in accordance with APHA 22nd ED 2510 and Rayment & Lyons. Resistivity is calculated from Conductivity (non NATA). Resistivity (calculated) may not correlate with results otherwise obtained using Resistivity-Current method, depending on the nature of the soil being analysed.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Soil Aggressivity						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	100	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Resistivity in soil*	ohm m	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	91	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	108	[NT]

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

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.
Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.	
The recommended maximums for analytes in urine are taken from "2018 TLVs and BEIs", as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.	
Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2	

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

pH/EC

Samples were out of the recommended holding time for this analysis.

Material Test Report

Report Number: 89390.02-1
Issue Number: 1
Date Issued: 04/11/2020
Client: School Infrastructure New South Wales (SINSW)
Level 8, 259 George Street, Sydney NSW 2000
Contact: Michael Stern
Project Number: 89390.02
Project Name: Proposed Bundawang SSP Relocation
Project Location: 17 Croobyar Road, MILTON
Work Request: 6565
Sample Number: WO-6565A
Date Sampled: 13/10/2020
Dates Tested: 21/10/2020 - 03/11/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: 103, Depth: 0.5-1.0
Material: Clay

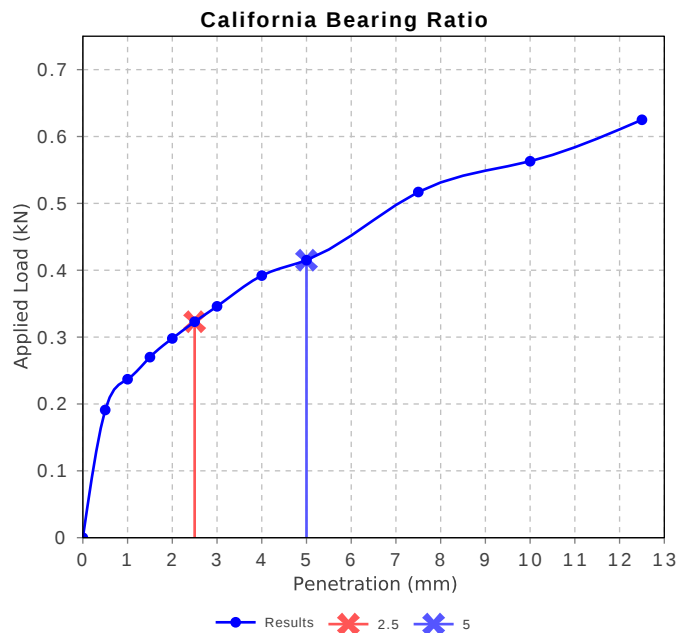


Accredited for compliance with ISO/IEC 17025 - Testing

(Signature)

Approved Signatory: Anes Ibracic
Laboratory Manager
NATA Accredited Laboratory Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	2.5		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.31		
Optimum Moisture Content (%)	37.0		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m ³)	1.28		
Field Moisture Content (%)	39.5		
Moisture Content at Placement (%)	37.1		
Moisture Content Top 30mm (%)	43.7		
Moisture Content Rest of Sample (%)	38.2		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	96.1		
Swell (%)	2.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

Report Number: 89390.02-1
Issue Number: 1
Date Issued: 04/11/2020
Client: School Infrastructure New South Wales (SINSW)
Level 8, 259 George Street, Sydney NSW 2000
Contact: Michael Stern
Project Number: 89390.02
Project Name: Proposed Bundawang SSP Relocation
Project Location: 17 Croobyar Road, MILTON
Work Request: 6565
Sample Number: WO-6565B
Date Sampled: 13/10/2020
Dates Tested: 21/10/2020 - 02/11/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: 107, Depth: 0.5-1.0
Material: Clay

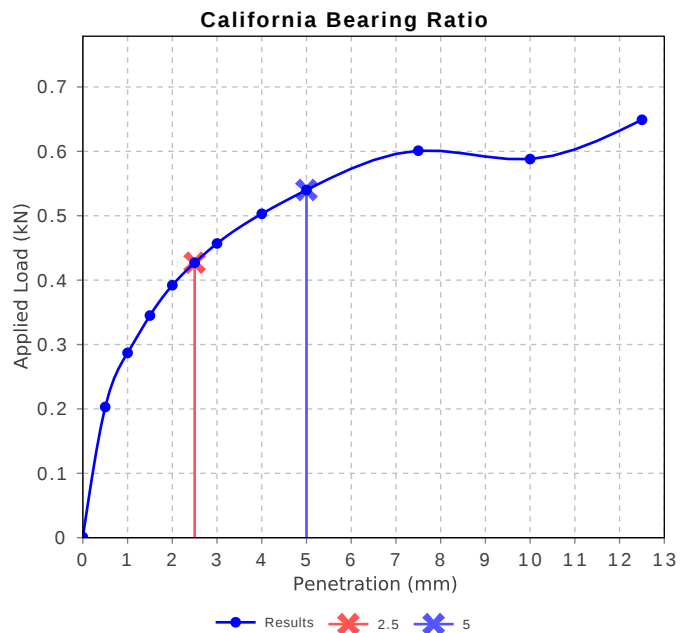


Accredited for compliance with ISO/IEC 17025 - Testing

(Signature)

Approved Signatory: Anes Ibracic
Laboratory Manager
NATA Accredited Laboratory Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	3.0		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.35		
Optimum Moisture Content (%)	34.0		
Laboratory Density Ratio (%)	100.5		
Laboratory Moisture Ratio (%)	99.5		
Dry Density after Soaking (t/m ³)	1.34		
Field Moisture Content (%)	34.2		
Moisture Content at Placement (%)	33.7		
Moisture Content Top 30mm (%)	40.9		
Moisture Content Rest of Sample (%)	35.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	48.4		
Swell (%)	1.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

Report Number: 89390.02-1
Issue Number: 1
Date Issued: 04/11/2020
Client: School Infrastructure New South Wales (SINSW)
Level 8, 259 George Street, Sydney NSW 2000
Contact: Michael Stern
Project Number: 89390.02
Project Name: Proposed Bundawang SSP Relocation
Project Location: 17 Croobyar Road, MILTON
Work Request: 6565
Sample Number: WO-6565C
Date Sampled: 13/10/2020
Dates Tested: 21/10/2020 - 02/11/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: 102, Depth: 0.5m
Material: Clay



Approved Signatory: Anes Ibracic
Laboratory Manager

NATA Accredited Laboratory Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	73		
Plastic Limit (%)	20		
Plasticity Index (%)	53		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	13.0		
Cracking Crumbling Curling	Curling		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	36.3

Material Test Report

Report Number: 89390.02-1
Issue Number: 1
Date Issued: 04/11/2020
Client: School Infrastructure New South Wales (SINSW)
Level 8, 259 George Street, Sydney NSW 2000
Contact: Michael Stern
Project Number: 89390.02
Project Name: Proposed Bundawang SSP Relocation
Project Location: 17 Croobyar Road, MILTON
Work Request: 6565
Sample Number: WO-6565D
Date Sampled: 13/10/2020
Dates Tested: 21/10/2020 - 02/11/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: 103, Depth: 1.0m
Material: Clay



Approved Signatory: Anes Ibracic
Laboratory Manager

NATA Accredited Laboratory Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	85		
Plastic Limit (%)	23		
Plasticity Index (%)	62		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	15.5		
Cracking Crumbling Curling	Cracking & Curling		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	40.2

Material Test Report

Report Number: 89390.02-1
Issue Number: 1
Date Issued: 04/11/2020
Client: School Infrastructure New South Wales (SINSW)
Level 8, 259 George Street, Sydney NSW 2000
Contact: Michael Stern
Project Number: 89390.02
Project Name: Proposed Bundawang SSP Relocation
Project Location: 17 Croobyar Road, MILTON
Work Request: 6565
Sample Number: WO-6565E
Date Sampled: 13/10/2020
Dates Tested: 21/10/2020 - 03/11/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: 105, Depth: 0.5m
Material: Clay



Approved Signatory: Anes Ibracic
Laboratory Manager

NATA Accredited Laboratory Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	83		
Plastic Limit (%)	27		
Plasticity Index (%)	56		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	16.0		
Cracking Crumbling Curling	Curling		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	36.1

Material Test Report

Report Number: 89390.02-1
Issue Number: 1
Date Issued: 04/11/2020
Client: School Infrastructure New South Wales (SINSW)
Level 8, 259 George Street, Sydney NSW 2000
Contact: Michael Stern
Project Number: 89390.02
Project Name: Proposed Bundawang SSP Relocation
Project Location: 17 Croobyar Road, MILTON
Work Request: 6565
Sample Number: WO-6565F
Date Sampled: 13/10/2020
Dates Tested: 21/10/2020 - 03/11/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: 108, Depth: 1.0m
Material: Sandy Clay



Douglas Partners

Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd

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Approved Signatory: Anes Ibracic
Laboratory Manager

NATA Accredited Laboratory Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	60		
Plastic Limit (%)	23		
Plasticity Index (%)	37		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	12.5		
Cracking Crumbling Curling	None		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	23.4

Appendix E 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 Stantec'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 Stantec 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

Stantec 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.

Stantec'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, Stantec 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 Stantec assumes no responsibility for the adequacy, incompleteness, inaccuracies, or reliability of this information.

Stantec does not assume any responsibility for assessments made partly, or entirely based on information provided by third parties.

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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 Stantec 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. Stantec 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 judgement of both data and interpretive assessments or observation. This report and its associated documentation are provided explicitly based on Stantec'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, Stantec must be notified and be provided with an opportunity to review the recommendations.

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