Geotechnical and Contamination Services

Intrusive Geotechnical Investigation (IGI) for New Primary School at Wilton Junction

Prepared for

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Acronyms and Abbreviations

The following acronyms are used in this report.

Acronym	Description
AMC	Abnormal Moisture Conditions
AHD	Australian Height Datum
ARR	Average Risk Rating
CBR	California Bearing Ratio
GITA	Geotechnical Inspection and Testing Authority
GPS	Global Positioning System
Ha	Hectare
Km	Kilometre
kPa	Kilopascals
MPa	Megapascals
NSW	New South Wales
RL	Reduced Level
RQD	Rock Quality Designation
SINSW	Schools Infrastructure New South Wales
SPT	Standard Penetration Test
TCR	Total Core Recovery

1. EXECUTIVE SUMMARY

This report presents the results of an Intrusive Geotechnical Investigation (IGI) undertaken by Green Geotechnics Pty Limited for the construction of proposed new Primary School at 200 Fairway Drive, Wilton, NSW 2571 (the Site). Based on the subsurface conditions encountered, the subject site is considered suitable for the proposed construction provided that the recommendations presented in this report are complied with. A summary of the critical recommendations is included below:

- The site is underlain by a shallow layer of topsoil extending to depths of 0.2 to 0.3 metres overlying residual clayey soils and weathered to fresh shale, siltstone and sandstone bedrock.

- Depending on the structural loads, foundations for the new structures may be constructed in either the upper stiff residual soils, or transferred to the underlying bedrock.

- The overlying residual soils are reactive. Reactive clays are sensitive to changes in moisture, and therefore consideration must be given to appropriate site drainage both during construction and longer term.

- Groundwater was not encountered during auger drilling of the boreholes and therefore we do not foresee the requirements for construction stage or long term dewatering.

- The site is not within an Acid Sulfate Soils Area.

- The site is located within the Wilton Mine Subsidence District. Guideline 8 applies to any surface development on the site. No restrictions apply to suites under Guideline 8.

- Recommendations have been provided herein for general site preparation and re-grading, the design of foundations and retaining walls, bulk earthworks and batter slopes, slabs-on-grade, earthquake loads, soil aggressivity and pavement construction.

NOTE: The scope of services provided within this report is limited to the assessment of the subsurface conditions at the subject site. The executive summary is provided solely for purposes of overview and is not intended to replace the report of which it is part and should not be used separately from the report.

2. INTRODUCTION

This Intrusive Geotechnical Investigation (IGI) report has been prepared to support a Review of Environmental Factors (REF) for the NSW Department of Education (DoE) for the construction and operation of the new primary school at Wilton Junction (the activity).

The purpose of the REF is to assess the potential environmental impacts of the activity prescribed by State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) as “development permitted without consent” on land carried out by or on behalf of a public authority under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Section 3.37A of the T&I SEPP.

This document has been prepared in accordance with the Guidelines for Division 5.1 assessments (the Guidelines) by the Department of Planning, Housing and Infrastructure (DPHI) as well as the Addendum Division 5.1 guidelines for schools.

The proposed activity comprises the construction and operation of a new primary school at Wilton Junction which will accommodate up to 552 students and 35 staff. Additionally, the proposal includes an integrated pre-school which will capacity for up to 60 students and 7 staff. In total, the new school will support up to 612 students and 42 staff.

The new school includes general and support learning spaces, a library, administrative areas and a staff hub. Core facilities include a standalone school hall and canteen, two carparks and a sports court.

Specifically, this proposal includes the following:

- Construction of a 3-storey learning hub which includes:
  - 24x General Learning Spaces
  - 3 x Support Learning Spaces
  - Staff hub including administrative areas and library
  - Integrated public pre-school.
- Standalone hall and COLA with outside of school hours care (OSHC).
- Associated landscaping including sports court and separate outdoor play space for the preschool.
- Associated site utilities and services including installation of new 1500 kVA padmount substation and a new main switchboard.
- Main Car park to the south of the site with 33 car spaces (including one accessible space).
- Separate car park for preschool located to the north of the school with 18 spaces (including one accessible space).
- Main school pedestrian entrance proposed off Road 14.
- Earthworks.

The proposed activity will require bulk earthworks for site preparation and re-grading, however, does not include any basement levels or below ground structures. Column loads from the three storey buildings are in the order of 2,000kN.

The purpose of the investigation was to:

- assess the subsurface conditions over the site,
- provide a Site Classification to AS2870,
- provide a subsoil classification in accordance with AS1170.4,
- comment on the presence of Acid Sulfate Soils,
- determine if the site is located within a Mine Subsidence District,
- provide recommendations regarding the appropriate foundation system for the site including design parameters,
- comment on excavation conditions and vibration control during bulk earthworks,
- provide a design subgrade CBR value for the design of pavements and car parking,
- provide parameters for the construction of retaining walls,
- provide recommendations for site preparation and re-grading including an earthworks specification, and
- provide an exposure classification in accordance with AS2159 and AS2870.

3. INVESTIGATION PROCEDURE

3.1 Fieldwork Details

The fieldwork was carried out over the period Monday 27 May to Thursday 30 May 2024 and comprised a detailed site walkover together with the drilling of fifteen (15) boreholes numbered BH1 to BH15.

BH1 to BH7 were drilled to practical refusal using rotary solid flight augers attached to a utility mounted Christie Engineering drilling rig, owned and operated by Green Geotecnics. BH8 to BH15 were drilled using a Hanjin DB8 track mounted drilling rig supplied and operated by BG Drilling. BH8 to BH15 were commenced using rotary solid flight augers until at least low strength bedrock was encountered.

The boreholes were then advanced into the underlying bedrock to the target depths using NMLC sized diamond coring equipment with a water/polymer flush.

The recovered rock core from BH8 to BH15 was logged, boxed and photographed. To assist in assessing rock strengths the recovered rock core was Point Load Index tested, with tests undertaken at a nominal depth interval of 1 metre.

Groundwater observations were made in all boreholes during auger drilling. No longer term groundwater monitoring was carried out.

The borehole locations were nominated by the project structural engineer. The surface reduced levels of the boreholes were determined using an RTK GNSS Global Positioning System (GPS) with a 3 dimensional accuracy of +/-100mm. The datum of the levels is Australian Height Datum (AHD).

The approximate site location is shown in the attached Figure GG11529.001A. The borehole locations, as shown on Figure GG11529.001B, were determined using GPS. Photographs of the site indicating the borehole locations are provided in Figure GG11529.001C.

The fieldwork was completed in the full-time presence of our Senior and Principal Engineering Geologists who set out the boreholes, nominated the sampling and testing, and prepared the borehole logs. The logs which include the approximate surface reduced levels and groundwater observations together with photos of the rock core and Point Load Index test results, are attached to this report, together with a glossary of the terms and symbols used in the logs.

For further details of the investigation techniques adopted, reference should be made to the attached explanation notes.

Environmental and contamination testing of the soils was beyond the agreed scope of the works.

3.2 Laboratory Testing

In order to assist with determining the Site Classification, un-disturbed soil samples were obtained for shrink swell testing. Bulk disturbed samples were also collected to determine the subgrade California Bearing Ratio (CBR) value.

In order to assess the soils for their aggressiveness in accordance with AS2159 and AS2870, selected representative soil samples were tested to determine the following:

- pH,
- Sulphate Content (SO4),
- Chloride Content (CL), and
- Electrical Conductivity (EC).

The detailed test reports are provided in Appendix B and are further discussed in Section 5 of this report.

4. RESULTS OF INVESTIGATION

4.1 Site Description

The current street address is 200 Fairway Drive, Wilton, 2571, NSW. The site forms part of the northern portion of Lot 1063 in Deposited Plan 1289197 that was previously subdivided by Landcom. The site is approximately 3.4ha hectares in size and is located within Wilton Junction which is part of the North Wilton Precinct.

As a result of precinct wide rezonings, the surrounding locality is transitioning from a semi-rural residential area to a highly urbanised area with new low to medium density residential development with supporting services. North Wilton Precinct is approximately 85km south-west of the Sydney CBD, 30km north-west of Wollongong and 30km southwest of Campbelltown-Macarthur Strategic Centre. The precinct is located on the interchange with the Hume Highway, which connects the Southern Highlands with the Sydney metropolitan region to the northeast and Canberra to the south-west.

The proposed school site does not currently have road access, however Landcom is expected to deliver the road network and surrounding public domain network in accordance with DA/2022/1279/1. Proposed Road 14 located on the eastern boundary of the site will ultimately provide future access to the site. The site contains several patches of remnant native vegetation particularly within the northern portion of the site. The central part of the site has been predominantly cleared and consists of grassland. An aerial photograph of the site is provided in Figure 1

The ground surface slopes to the north east with a fall of approximately 8 metres, from Reduced Level (RL) 171 metres AHD in the vicinity of BH1 to RL 163 metres AHD in the vicinity of BH7.

To the north, east and west are further open grassed paddocks and to the south is the under-construction Wilton North residential subdivision. The proposed subdivision works will include the construction of local and sub-arterial roads which will eventually border the site to the north, east and west.

There are no open water courses or dams on the site, however there are farm dams to the north east and a tree lined overland flow channel to the east which is fed by a temporary water quality basin associated with the subdivision works.

4.2 Regional Geology & Subsurface Conditions

The 1:100,000 series geological map of the Wollongong – Port Hacking region (Geological Survey of NSW, Geological Series Sheet 9029-9129) indicates that the site is underlain by Triassic Age bedrock belonging to the Ashfield Shale formation of the Wianamatta Group. Bedrock within this formation comprises shale and laminite. To the east of the site is a geological boundary with Triassic Age bedrock belonging to the Hawkesbury Sandstone formation. Bedrock within the Hawkesbury Sandstone formation comprises fine to medium grained quartz sandstone.

For the development of a site-specific geotechnical model, the observed subsurface conditions from the boreholes have been grouped into five (5) geotechnical units which are summarised below in Table 3.1.

TABLE 4.1 – Summary of Subsurface Conditions

Unit	Material Type	Depth to top of Layer (m)*	Depth to base of Layer (m)*	Material Description
1	Topsoil	Surface	0.2 – 0.3m	Silty Clay, dark brown, low and medium plasticity with organics and a trace of fine gravel. Some sandstone boulders on site. Moist
2	Firm to Stiff Residual Clays	0.2 – 0.3m	0.6 – 0.8m	Silty clays, orange to red brown and grey brown, firm to stiff and medium and high plasticity with ironstone gravel. Moist
3	Stiff and Very Stiff Residual Clays	0.6 – 0.8m	1.05 – 1.5m	Silty clays and gravelly silty clays, orange to grey and red brown, stiff becoming very stiff and medium with ironstone and shale gravel. Moist becoming dry with depth.
4	Class 5 Shale and Sandstone Bedrock	1.05 – 1.5m	1.8 – 3.9m	Extremely weathered extremely low to very low strength shale and sandstone bedrock. Fine grained with higher strength bands of iron indurated rock. Generally not core drilled.
4	Class 5 Shale and Sandstone Bedrock	1.8 – 3.9m	2.7 – 4.8m	Highly and moderately weathered shale, siltstone and sandstone bedrock, generally fine grained and orange to grey and dark grey in colour, frequent clay seams and bedding partings.
5	Class 3 Sandstone Bedrock*	2.7 – 4.8m	Unknown	Slightly weathered to fresh medium and mostly high strength fine to medium grained sandstone bedrock with occasional shale interbeds, widely spaced seams and lenses of coarser materials.

*BH8 to BH15 only.

TABLE 4.2 – Summary of Bedrock Classification

Borehole ID	Depth of Rock Classification (m)		
	Class 5	Class 4	Class 3
1	1.1 – 2.6m	>2.6m	-
2	1.2 – 3.0m	>3.0m	-
3	1.2 – 2.5m	>2.5m	-
4	1.4 – 2.5m	>2.5m	-
5	1.3 – 3.2m	>3.2m	-
6	1.3 – 1.8m	>1.8m	-
7	1.5 – 2.5m	>2.5m	-
8	1.05 – 1.8m	1.8 – 4.1m	4.1 – 8.7m
9	1.4 – 2.4m	2.4 – 4.8m	4.8 – 9.0m
10	1.2 – 2.3m	2.3 – 2.7m	2.7 – 8.9m
11	0.8 – 1.7m	1.7 – 2.9m	2.9 – 8.0m
12	1.2 – 2.0m	2.0 – 3.3m	3.3 – 8.8m
13	1.2 – 1.8m	1.8 – 3.3m	3.3 – 8.0m
14	1.2 – 3.9m	3.9 – 4.4m	4.4 – 8.5m
15	1.2 – 1.7m	1.7 – 1.9m	1.9 – 8.55m

Groundwater seepage was not observed during auger drilling of the boreholes.

5. GEOTECHNICAL RECOMMENDATIONS

Based on the results of the assessment, we consider the following to be the primary geotechnical considerations for the development:

- Construction of buildings on sites underlain by reactive clay soils,
- Site preparation for the construction of structures and pavements, and
- Foundation design for structural loads.

5.1 Site Classification to AS2870

To assist with determining the Site Classification, undisturbed soil samples were obtained for shrink swell testing. The results of the testing are summarised below in Table 5.1.

TABLE 5.1 – Atterberg Limit Test and Shrink Swell Test Results

Borehole ID	Sample Depth	Shrink Swell Index
BH2	0.6 – 0.9m	1.7
BH6	0.6 – 0.9m	2.0
BH7	0.6 – 0.8m	2.2

The classification has been prepared in accordance with the guidelines set out in the "Residential Slabs and Footings" Code, AS2870 – 2011.

Because there are large mature trees present on the site, abnormal moisture conditions (AMC) prevail at the subject site (Refer to Section 1.3.3 of AS2870).

Because of the AMC present, the site is classified a ***Problem Site (P).*** However, provided the recommendations given below in Section 5.2 are adopted and footings are founded in at least firm to stiff clays the site may be re-classified as ***Moderately Reactive (M).***

5.2 Foundation Design

Structural loads from the buildings and structures should be founded on either the stiff residual clayey soils, or the underlying bedrock. The existing topsoil materials should not be relied upon for foundation support. Footings may also be founded in controlled engineered fill where the fill is placed in accordance with the recommendations given in Section 5.10 of this report.

The minimum depth of founding for shallow foundations must comply with AS2870-2011. The design of shallow foundations must also be undertaken in accordance with Appendix C and CH of AS2870 to account for the presence of trees. You may also wish to consider installing root barriers around the structures to protect buried service lines.

Foundation design parameters for the various units are provided in Table 5.2 below:

TABLE 5.2 – Foundation Design Parameters

Material	Maximum Allowable (Serviceability) Values (kPa)			Ultimate Strength Limit State Values (kPa)		
	End Bearing Pressure	Shaft Friction in compression#	Shaft Friction in tension*	End Bearing Pressure	Shaft Friction in compression#	Shaft Friction in tension*
Firm to Stiff Natural Clay / Engineered Fill	100	20	10	450	50	25
Very Stiff Natural Clay	300	20	10	750	50	25
Class 5 Bedrock	700	70	35	3,000	100	50
Class 4 Bedrock	1,000	100	50	4,000	210	105
Class 3 Bedrock	3,500	350	175	20,000	1,200	600

* Uplift capacity of piles in tension loading should also be checked for inverted cone pull out mechanism.

clean socket of roughness category R2 or better is assumed

In accordance with AS2159-2009 “Piling–Design and Installation”, for limit state design, the ultimate geotechnical pile capacity shall be multiplied by a geotechnical reduction factor (Φg). This factor is derived from an Average Risk Rating (ARR) which considers geotechnical uncertainties, redundancy of the foundation system, construction supervision, and the quantity and type of pile testing (if any). Where testing is undertaken, or more comprehensive ground investigation is carried out, it may be possible to adopt a larger Φ_g value that results in a more economical pile design. Further geotechnical advice will be required in consultation with the pile designer and piling contractor, to develop an appropriate Φ_g value.

Settlements for piles socketed into rock are anticipated to be about 1% of the minimum footing dimension, based on serviceability parameters as per Table 5.2. Settlements of pad footings in soils are anticipated to be up to about 15mm where loading does not exceed the maximum allowable values.

All shallow footings should be poured with minimal delay (i.e. preferably on the same day of excavation) or the base of the footing should be protected by a concrete blinding layer after cleaning of loose spoil and inspection.

Conventional open hole bored cast in-situ piles are considered suitable for the site conditions. Drilling of rock sockets into the shale and sandstone bedrock will require the use of large excavators or piling rigs equipped with rock augers. Some limited groundwater inflow should be anticipated into the bored pile excavations. We expect any minor seepage to be controllable by conventional pumping methods. However, some contingency for pouring concrete by tremie methods should be allowed.

Piles embedded below a depth of 1.8 metres will be below the depth of seasonal moisture variation (H_s), which is 1.8 metres for metropolitan Sydney. Founding below the depth of seasonal moisture variation will reduce any shrink swell effects on the base of the piles. To overcome soil shrinkage around the piles, we would recommend ignoring any adhesion within the upper “cracked zone” of the soil, which is generally taken as 0.5 (H_s), or 0.9 metres.

Bored pile footings should be drilled, cleaned, inspected and poured with minimal delay, on the same day. Water should be prevented from ponding in the base of footings as this will tend to soften the foundation material, resulting in further excavation and cleaning being required.

The initial stages of footing excavation/drilling, particularly if bored piles are adopted, should be inspected by a geotechnical engineer/engineering geologist to ascertain that the recommended foundation material has been reached and to check initial assumptions about foundation conditions and possible variations that may occur between borehole locations. The need for further inspections can be assessed following the initial visit.

5.3 Site Classification to AS1170.4 (Earthquake)

The site sub-soil classification has been determined using AS1170.4-2007. The classification is based on the results of the borehole drilling. The depth of soil recorded in the subsurface is less than 3 metres in all locations, therefore the site is classified as a Rock Site (B_e). An earthquake hazard factor (Z) of 0.08 applies to sites within the Sydney region.

5.4 Mine Subsidence

The site is located within the Wilton Mine Subsidence District under Guideline 8. No restrictions apply to suites under Guideline 8.

5.5 Acid Sulfate Soils

The site is located within an area where there are no known occurrences of Acid Sulfate Soils.

5.6 Design CBR Value

Based on the laboratory test results, a CBR value of 5% is recommended for the design of flexible and rigid pavements.

5.7 Bulk Excavation and Vibration Control

Based on the provided design documentation we understand that Building A will have a finished floor level of RL 165.8 metres AHD and Building B will have a finished floor level of RL 166.8 metres AHD. Based on existing topographical levels we anticipate excavations required for the school be limited in depth to no greater than 1.5 to 2.0 metres. Based on the results of the testing, bulk excavations to these depths of up to 2.0 metres are expected to encounter topsoil and residual clayey soils overlaying Class 5 and 4 bedrock. Excavators without assistance should be capable of excavating the soils, and large excavators fitted with ripping tynes or small to medium sized bulldozes would be capable of ripping any sandstone and shale bedrock to depths of up to 2.0 metres. We do not anticipate the need to use hydraulic rock hammers during the works.

Should excavations need to extend below a depth of 2.0 metres then a ripability assessment should be carried out. The assessment should be carried out following finalisation of the bulk earthworks design.

5.8 Safe Batter Slopes

In the short term, dry cut slopes should remain stable at an angle of 1(H) to 1(V). In the long term dry cut slopes formed at an angle of 2(H) to 1(V) should remain stable. Slopes cut at this angle would be subject to erosion unless protected by topsoil and diversion drains at the crest of the slopes. In order to use mowers to maintain cut slopes, an angle of 4(H) to 1(V) or flatter should be used.

5.9 Retaining Wall Design

When considering the design of any retaining walls, it will be necessary to allow for the loading from adjoining structures, any ground surface slope and the water table present.

A triangular stress distribution should be adopted for the design of cantilevered retaining walls. The lateral earth pressure for a cantilevered wall should be determined as a proportion of the vertical stress, as given in the following formula:

$\sigma z = K z \gamma$, where σz = Horizontal pressure at depth z (kPa)

K = Earth pressure coefficient

z = Depth (m)

γ = Unit weight of soil or rock (kN/m^3)

Retaining walls may be designed using the parameters provided below in Table 5.3.

TABLE 5.3 – Retaining Wall Design Parameters

Material Unit	Unit Weight (kN/m^3	Earth Pressure Coefficient			Poisson's Ratio	Effective Angle of Friction, ϕ (Deg)	Effective Cohesion C' (kPa)	Elastic Modulus E' (MPa)
		Active (K_a)	At Rest (K_O)	Passive (K_p)				
Topsoil	18	0.4	0.65	-	0.3	27	0	8
Controlled Fill / Residual Clays	19	0.37	0.58	2.5	0.3	28	5	15
Class 5 Bedrock	22	0.33	0.5	3.0	0.3	30	30	80
Class 4 Bedrock	22	-	-	3.5	0.25	32	50	150
Class 3 Bedrock	23	-	-	4.5	0.2	40	200	500

The embedment of retaining walls can be used to achieve passive support. A triangular passive earth pressure distribution (increasing linearly with depth) may be assumed, starting from 0.5 m below excavation toe/base level.

Adequate drainage must be installed behind any retaining or below ground structures to prevent the build-up of hydrostatic forces.

5.10 Site Preparation and re-grading

The performance of the slabs and pavements cannot be guaranteed unless the following procedures are adopted during the site earthworks:

- Remove any vegetation, topsoil and uncontrolled fill present. The exposed subgrade should be inspected by a geotechnical engineer who may wish to proof roll the exposed subgrade with a heavy, non-vibrating roller to detect soft or wet areas. These areas should be excavated to competent material and then filled as detailed below.

- Fill the site to the underside of slab or pavement level, in layers not exceeding 200 mm loose thickness, compacted to achieve a density ratio in the range of 98% to 102% of the Standard maximum dry density, at a moisture content within the range of -2% to +2% of the optimum for the material adopted.

The onsite silty clays can become un-trafficable during periods of wet weather.

Residual clayey soils and any bedrock won from the site during bulk excavation are considered suitable for re-use as engineered fill. However, any topsoil materials should be excluded from use as engineered fill. These materials may however be suitable for re-use for landscaping purposes, subject to the outcomes of environmental assessments being undertaken by others.

5.11 Exposure Classification to AS2870 & AS2159

The aggressiveness or erosion potential of an environment in building materials, particularly concrete and steel is dependent on the levels of soil pH and the types of salts present, generally sulphates and chlorides. In order to determine the degree of aggressiveness, the test values obtained are compared to Tables 6.4.2 (C) and 6.5.2 (C) in AS2159 – 2009 Piling – Design and Installation and Tables 5.1 and 5.2 of AS2870-2011. In regard to the electrical conductivity, the laboratory test results have been multiplied by the appropriate factor to convert the results to EC_e.

The soils on the site consist of high permeability sands above the groundwater table. Therefore, the soil conditions B are considered appropriate. The test results are summarised in Table 4.4 below.

Table 4.4 – Exposure Classification Summary Table

Sample ID	Location	Depth (m)	pH	EC_e (dS/m)	Sulfate (ppm)	Chloride (ppm)	Exposure Classification AS2159		Exposure Classification AS2870
							Steel Piles	Concrete Piles	
S1	BH1	0.6m	6.2	0.2	30	30	Non Aggressive	Non Aggressive	A1
S2	BH2	1.5m	5.5	1.0	60	100	Non Aggressive	Mild	A2
S3	BH3	1.0m	5.8	0.3	<10	20	Non Aggressive	Non Aggressive	A1
S4	BH4	0.2m	5.6	0.5	40	60	Non Aggressive	Non Aggressive	A1
S5	BH5	1.0m	5.9	0.4	90	<10	Non Aggressive	Non Aggressive	A1
S6	BH6	0.3m	5.8	0.2	60	40	Non Aggressive	Non Aggressive	A1
S7	BH7	0.4m	6.5	0.3	50	10	Non Aggressive	Non Aggressive	A1
S8	BH8	0.5m	6.2	0.4	20	70	Non Aggressive	Non Aggressive	A1
S9	BH9	1.2m	5.6	0.5	40	150	Non Aggressive	Non Aggressive	A1
S10	BH15	0.6m	5.8	0.3	50	<10	Non Aggressive	Non Aggressive	A1
S11	BH11	0.6m	6.0	0.3	60	<10	Non Aggressive	Non Aggressive	A1
S12	BH12	0.7m	6.1	0.2	30	10	Non Aggressive	Non Aggressive	A1

6. FURTHER GEOTECHNICAL INPUT

The following summarises the scope of further geotechnical work recommended within this report. For specific details reference should be made to the relevant sections of this report.

- Geotechnical supervision and testing by a Geotechnical Inspection and Testing Authority (GITA) during any bulk earthworks or detailed earthworks including the construction of pavements and subgrade areas and the backfilling of service trenches.

- Inspection of footing excavations to ascertain that the recommended foundation has been reached and to check initial assumptions regarding foundation conditions and possible variations that may occur.

- We also recommend that Green Geotechnics view the proposed earthworks and structural drawings in order to confirm they are within the guidelines of this report.

Nevertheless, it will be essential during excavation and construction works that progressive geotechnical inspections be commissioned to check initial assumptions about excavation and foundation conditions and possible variations that may occur between inspected and tested locations and to provide further relevant geotechnical advice.

7. MITIGATION MEASURES

Table 7.1 – Mitigation Measures

Project Stage	Mitigation Measures	Reason for Mitigation Measures	Section of Report
D	Foundations must be designed by a qualified structural engineer as per the recommendations given in Section 5.2 of this report and take into consideration the general recommendations given in Section 5	To avoid uneconomical design and ensure serviceability for built structures. To ensure compliance with AS2870 and AS2159.	5.1, 5.2 and 5.3
D	Buried concrete and steel foundations and structures must be designed to withstand soil and groundwater aggression (durability)	To prevent corrosion or degradation of buried structures over its design life. To ensure compliance with AS2870 and AS2159	5.11
D	Pavements or trafficable areas area to be designed in accordance with the recommendations given in Section 5.6 and the earthworks specification is to conform with the recommendations given in Section 5.10.	To ensure that pavements or trafficable surfaces have adequate strength to perform over their intended design life. To ensure earthworks are carried out in accordance with AS3798	5.6 & 5.10
C	Inspection of foundation excavations during construction	To ascertain that the recommended foundation has been reached and to check initial assumptions regarding foundation conditions and possible variations that may occur	6
C	Geotechnical supervision and testing by a Geotechnical Inspection and Testing Authority (GITA) during any bulk earthworks or detailed earthworks including the construction of pavements and subgrade areas and the backfilling of service trenches	To ensure compliance with the project earthworks specification and AS3798	6
O	Compliance with CSIRO Foundation Maintenance and Footing Performance Guideline	To prevent future building cracking in reactive clay soils	Appendix C

8. GENERAL RECOMMENDATIONS

The recommendations presented in this report are preliminary in nature. Prior to finalising any structural designs it is essential that intrusive investigations are carried out to confirm the actual ground conditions on the site.

The recommendations presented in this report include specific issues to be addressed during the construction phase of the project. In the event that any of the construction phase recommendations presented in this report are not implemented, the general recommendations may become inapplicable and Green Geotechnics accept no responsibility whatsoever for the performance of the structure where recommendations are not implemented in full and properly tested, inspected and documented.

Occasionally, the subsurface conditions may be found to be different (or may be interpreted to be different) from those expected. Variation can also occur with groundwater conditions, especially after climatic changes. If such differences appear to exist, we recommend that you immediately contact this office.

This report provides advice on geotechnical aspects for the proposed civil and structural design. As part of the documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of contract documents to confirm the intent of our recommendations has been correctly implemented.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. If there is any change in the proposed development described in this report then all recommendations should be reviewed. Copyright in this report is the property of Green Geotechnics. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

REPORT INFORMATION

Introduction

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

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

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation.

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

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. The borehole must be flushed, and any water must be extracted from the hole if further water measurements are to be made.

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

Reports

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

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

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

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

Site Anomalies

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

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FIGURES

Subject Site

GREEN GEOTECHNICS	Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **SITE LOCATION PLAN**	Figure No: GG11529.001A
	Client: SINSW C/- SMEC		Drawn By: MG
	Date: 21 February 2025		Scale: Unknown

Legend:

⊕ = Borehole

◎ = DCP

⊞ = Test Pit

GREEN
GEOTECHNICS

Project No: GG11529.001

Client: SINSW C/- SMEC

Date: 21 February 2025

Geotechnical Investigation
New Primary School at Wilton Junction
TEST LOCATION PLAN

Figure No: GG11529.001B

Drawn By: MG

Scale: Unknown

Position of BH1

Position of BH2

GREEN GEOTECHNICS

Project No: GG11529.001

Client: SINSW C/- SMEC

Date: 21 February 2025

Geotechnical Investigation
New Primary School at Wilton Junction

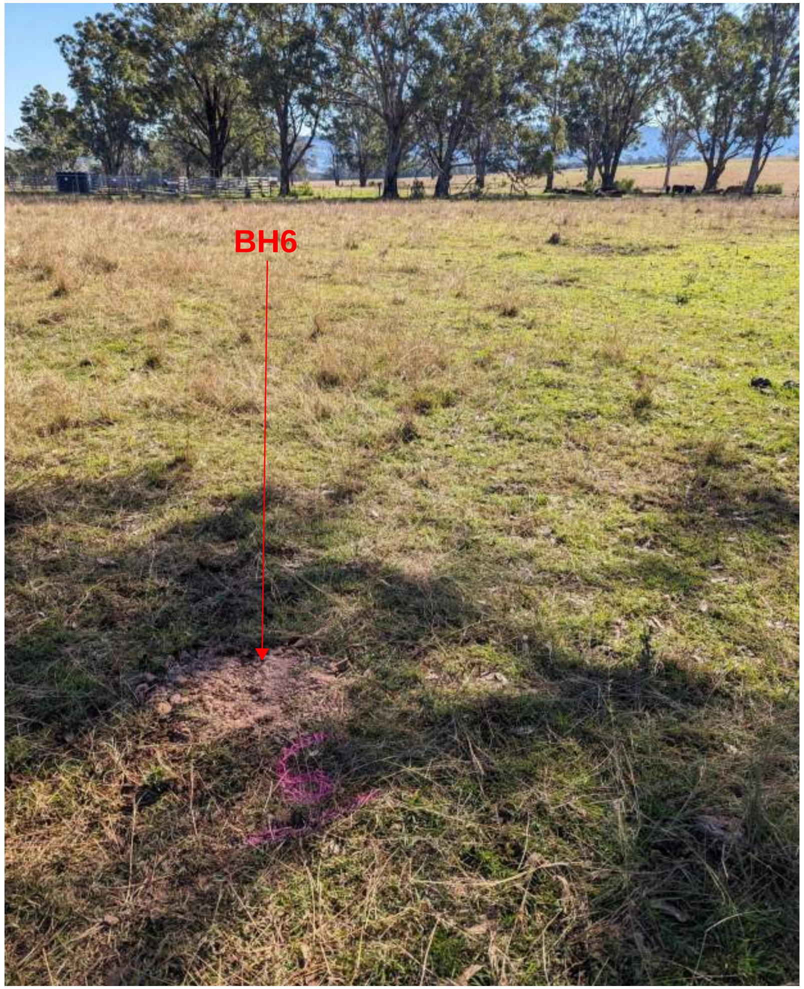
SITE PHOTOGRAPHS

Position of BH3

Position of BH4

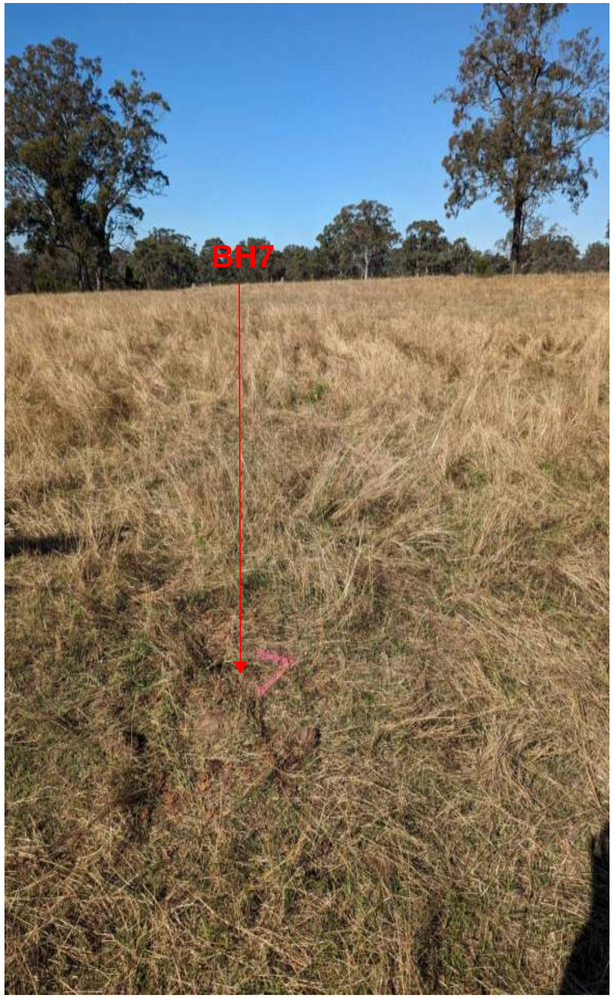
GREEN GEOTECHNICS	Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **SITE PHOTOGRAPHS**	Page: 2 of 6
	Client: SINSW C/- SMEC		
	Date: 21 February 2025		

Position of BH5

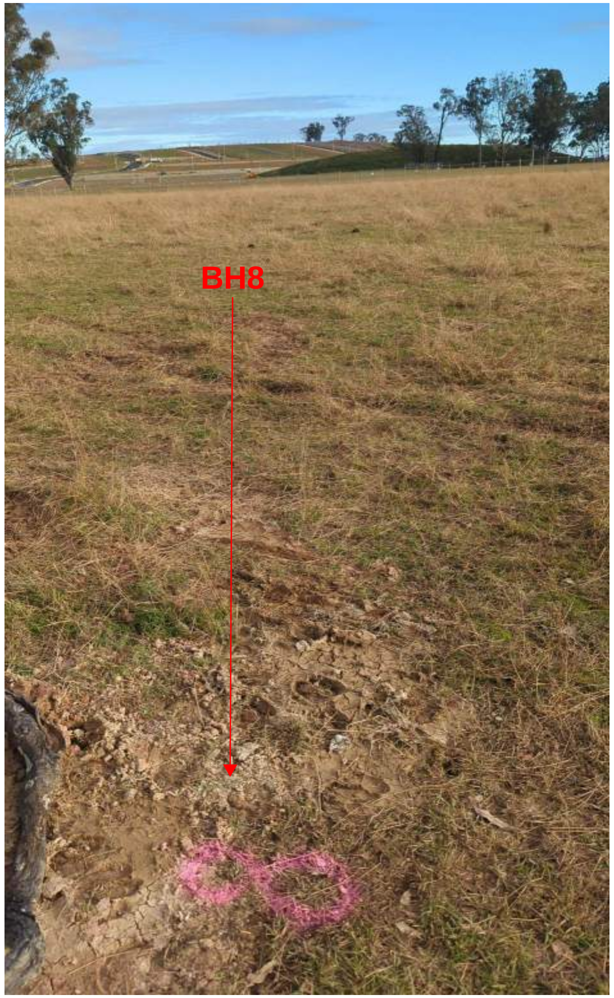


Position of BH6

GREEN GEOTECHNICS	Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **SITE PHOTOGRAPHS**	Page: 3 of 6
	Client: SINSW C/- SMEC		
	Date: 21 February 2025		



Position of BH7



Position of BH8

Position of BH9

GREEN GEOTECHNICS	Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **SITE PHOTOGRAPHS**	Page: 4 of 6
	Client: SINSW C/- SMEC		
	Date: 21 February 2025		

Position of BH10

Position of BH11

Position of BH12

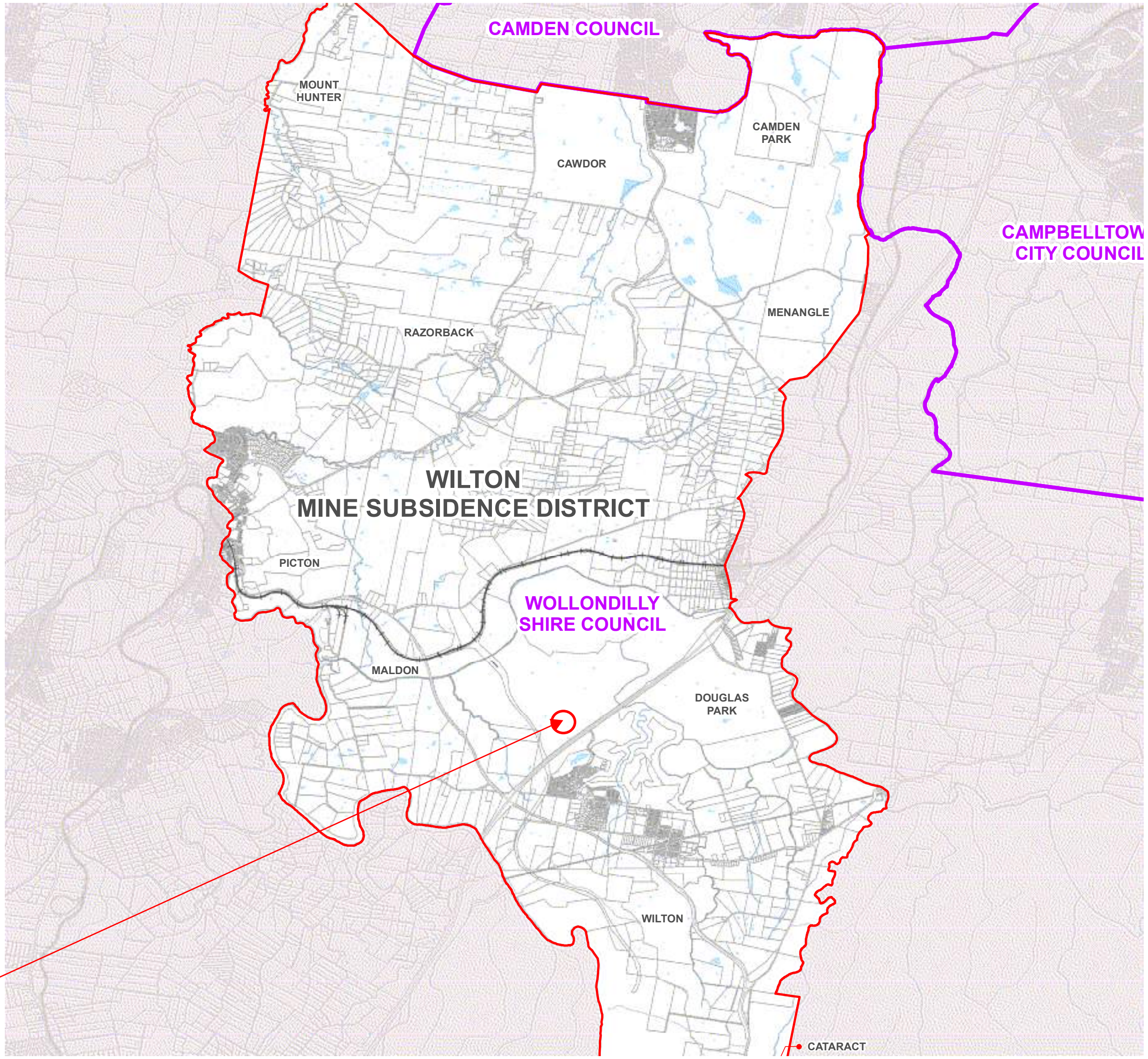
GREEN GEOTECHNICS	Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **SITE PHOTOGRAPHS**	Page: 5 of 6
	Client: SINSW C/- SMEC		
	Date: 21 February 2025		

Position of BH13

Position of BH14

Position of BH15

GREEN GEOTECHNICS	Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **SITE PHOTOGRAPHS**	Page: 6 of 6
	Client: SINSW C/- SMEC		
	Date: 21 February 2025		



Subject Site

GREEN GEOTECHNICS

Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **MINE SUBSIDENCE MAP**	Figure No: GG11529.001A
Client: SINSW C/- SMEC		Drawn By: MG
Date: 21 February 2025		Scale: Unknown

APPENDIX A – BOREHOLE LOGS , CORE PHOTOS AND POINT LOAD TEST RESULTS

GREEN GEOTECHNICS

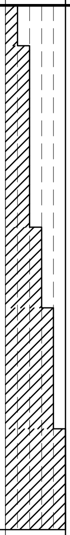
Borehole No.
BH1
Page 1 of 1

Engineering Log - Borehole

Project No.: GG11529.001

Client: SINSW C/- SMEC
Project Name: Geotechnical Investigation: Wilton Junction School
Hole Location: Wilton Junction School, Wilton
Hole Position: See Plan 286208.6 m E 6212173.8 m N MGA2020-56
Commenced: 27/5/2024
Completed: 27/5/2024
Logged By: JK
Checked By: MG

Drill Model and Mounting: Christie Utility
Hole Diameter: 105 mm
Inclination: -90°
Bearing:
RL Surface: 170.80 m
Datum: AHD
Operator: JK



Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.20m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
				0.60m D-S1 0.70m			0.80m		CI /CH	Silty CLAY: medium to high plasticity, orange brown with pale grey.	M	F to St St	RESIDUAL SOIL
						169.8	1 1.10m		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown, trace of shale gravel; (completely weathered shale).	M M / D	VSt	
						168.8	2 2.60m			SHALE: dark grey with pale grey, with clay seams. Estimate very low strength (Class 5).	D		ROCK
						167.8 166.8 165.8	3 4 5			Hole Terminated at 2.60 m Refusal in weathered shale (Class 4)			

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
▨ No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN
GEOTECHNICS

Borehole No.
BH2
Page 1 of 1

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286268.1 m E 6212194.4 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Christie Utility	Inclination:	-90°	RL Surface:	169.20 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	JK

Drilling Information | **Soil Description** | **Observations**

Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.20m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
				0.60m D-U50 0.90m			0.90m		CI /CH	Silty CLAY: medium to high plasticity, orange brown with pale grey.	M	F to St St	RESIDUAL SOIL
						168.2	1 1.20m		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown.	M	VSt	
				1.50m D-S2 1.60m		167.2	2			SHALE: pale grey with orange brown and dark grey, with clay seams. Estimate very low strength (Class 5).	D M / D		ROCK
							3.00m				D		
						166.2	3			Hole Terminated at 3.00 m Refusal in weathered shale (Class 4)			
						165.2	4						
						164.2	5						

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Borehole No.
BH3
Page 1 of 1

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286279.9 m E 6212143.0 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Christie Utility	Inclination:	-90°	RL Surface:	169.00 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	JK

Drilling Information								Soil Description					Observations
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.20m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
							0.90m		CI /CH	Silty CLAY: medium to high plasticity, orange brown with pale grey.	M	F to St St	RESIDUAL SOIL
				1.00m D-S3 1.10m		168.0	1 1.30m		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown.	M M / D	VSt	
						167.0	2 3.00m			SHALE: dark grey with pale grey and orange brown, with clay seams. Estimate very low strength (Class 5). Estimate low strength (Class 4).	D		ROCK
						166.0	3			Hole Terminated at 3.00 m Refusal in weathered shale (Class 4)			
						165.0	4						
						164.0	5						

Method
- AS - Auger Screwing
- ADV - Auger V Bit
- ADT - Auger Tungsten Carbide Bit
- RR - Rock Roller
- WB - Washbore

Support
- C - Casing

Penetration
No resistance ranging to refusal

Water
- Level (Date)
- Inflow
- Partial Loss
- Complete Loss

Graphic Log/Core Loss
- Core recovered (hatching indicates material)
- Core loss

Samples and Tests
- U - Undisturbed Sample
- D - Disturbed Sample
- SPT - Standard Penetration Test
- PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
- D - Dry
- M - Moist
- W - Wet
- w - Moisture Content
- PL - Plastic Limit
- LL - Liquid Limit

Consistency/Relative Density
- VS - Very Soft
- S - Soft
- F - Firm
- VSt - Very Stiff
- H - Hard
- Fr - Friable
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

GREEN
GEOTECHNICS

Borehole No.
BH4
Page 1 of 1

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286351.8 m E 6212099.5 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Christie Utility	Inclination:	-90°	RL Surface:	166.70 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	JK

Drilling Information								Soil Description					Observations
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T				0.20m			0.20m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M / D		TOPSOIL
				D-S4 0.30m 0.40m B-B1 1.10m		165.7	1 1.10m		CI /CH	Silty CLAY: medium to high plasticity, orange brown with pale grey.	M / D	St	RESIDUAL SOIL
							1.40m		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown, trace of shale gravel.	M / D	VSt	
						164.7	2 2.50m			SHALE: orange brown and dark brown with pale grey, with clay seams. Estimate very low strength (Class 5).	D		ROCK
						163.7 162.7 161.7	3 4 5			Hole Terminated at 2.50 m Refusal in weathered shale (Class 4)			

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
▨ No resistance ranging to refusal

Water
⊻ Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Graphic Log/Core Loss
▦ Core recovered (hatching indicates material)
☐ Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN
GEOTECHNICS

Borehole No.
BH5
Page 1 of 1

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286381.4 m E 6212139.6 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Christie Utility	Inclination:	-90°	RL Surface:	166.20 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	JK

Drilling Information								***Soil Description***					***Observations***
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T									CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
							0.20m		CI /CH	Silty CLAY: medium to high plasticity, red brown and orange brown with pale grey.	M	F to St St	RESIDUAL SOIL
				1.00m D-S5 1.10m		165.2	1.00m 1		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown.	M M / D	VSt	
						164.2 163.2	1.30m 2 3			SHALE: pale grey with orange brown, with clay seams. Estimate very low strength (Class 5).	D		ROCK
						162.2 161.2	3.20m 4 5			Hole Terminated at 3.20 m Refusal in weathered shale (Class 4)			

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN
GEOTECHNICS

Borehole No.
BH6
Page 1 of 1

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286315.4 m E 6212228.0 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Christie Utility	Inclination:	-90°	RL Surface:	167.80 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	JK

Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.20m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
				0.30m D-S6 0.40m			0.60m		CI /CH	Silty CLAY: medium to high plasticity, orange brown and red brown with pale grey.	M	F to St	RESIDUAL SOIL
				0.60m D-U50 0.80m		166.8	1 1.30m		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown.	M M / D	St VSt	
							1.80m			SHALE: pale grey with red brown, with clay seams. Estimate very low strength (Class 5).	D		ROCK
						165.8	2			Hole Terminated at 1.80 m Refusal in weathered shale (Class 4)			
						164.8	3						
						163.8	4						
						162.8	5						

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN
GEOTECHNICS

Borehole No.
BH7
Page 1 of 1

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286357.5 m E 6212317.7 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Christie Utility	Inclination:	-90°	RL Surface:	163.80 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	JK

Drilling Information								*Soil Description*					*Observations*
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.30m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
				0.40m B-B2 0.60m D-S7 D-U50 0.70m 0.80m 1.00m		162.8	1 1.10m		CI /CH	Silty CLAY: medium to high plasticity, red brown with orange brown and pale grey, with occasional shale gravel.	M	F to St St	RESIDUAL SOIL
							1.50m		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown.	M / D	VSt	
						161.8	2 2.50m			SHALE: pale grey with orange brown, with clay seams. Estimate very low strength (Class 5).	D		ROCK
						160.8 159.8 158.8	3 4 5			Hole Terminated at 2.50 m Refusal in weathered shale (Class 4)			

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
⊻ Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN
GEOTECHNICS

Borehole No.
BH8
Page 1 of 3

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	MG
Hole Position:	See Plan 286311.4 m E 6212209.7 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	168.20 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information								***Soil Description***					***Observations***
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.25m		CI	TOPSOIL Silty CLAY: medium plasticity, brown to pale brown, with fine grained sand; with rootlet.	M		TOPSOIL
				0.50m SPT 3,6,11 N=17 0.95m			0.55m		CI /CH	Gravelly Silty CLAY: medium to high plasticity, red mottled brown, with ironstone gravel.	M	F / St	RESIDUAL SOIL
						167.2	1 1.05m		CI /CH	Silty CLAY: medium to high plasticity, pale grey, mottled red and brown, with a trace of ironstone gravel.	M D / M	St VSt	
				1.50m SPT 10,21,Bounce N=R 1.85m			1.80m			SHALE: red brown, becoming pale grey, estimated extremely weathered, very low strength (class 5).	D / M		ROCK
						166.2	2 2.20m			SHALE: dark grey to grey, estimated highly weathered, very low strength (class 4).	D		
						165.2	3			Continued on cored borehole sheet			
						164.2	4						
						163.2	5						

Method
AS - Auger Screwing
ADV- Auger V Bit
ADT- Auger Tungsten Carbide Bit
RR - Rock Roller
WB- Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN
GEOTECHNICS

Cored Borehole No.
BH8
Page 2 of 3

Engineering Log - Cored Borehole

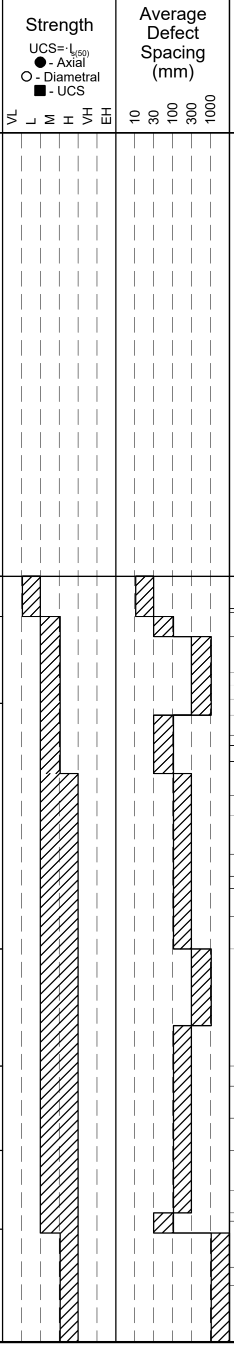
Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	MG
Hole Position:	See Plan 286311.4 m E 6212209.7 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	168.20 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information | **Rock Substance** | **Rock Mass Defects**

Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering
					167.2	1		
					166.2	2		
NMLC		100% Polymer Return	100	36		2.20m	Continued from non-cored borehole sheet SHALE: orange brown to grey brown, laminated at 0-5°.	HW
						2.40m	SHALE: dark grey with red orange, laminated at 0-5°.	MW
			100	89	165.2	2.83m	SHALE: dark grey to grey, with occasional orange grey lenses, laminated at 0-5°.	MW / SW
					164.2	4.05m	SANDSTONE: fine to medium grained, orange brown to pale grey, bedded at 10-15°.	SW
						4.63m	SILTSTONE: fine grained, pale grey, with stained orange, laminated at 0-10°.	SW
					163.2	5.05m	SHALE: fine grained, grey to orange and dark grey, laminated at 0-10°.	SW
			100	100		5.44m	SANDSTONE: fine grained, pale grey, with grey bedding at 0-10°.	FR



Defect Description
thickness, type, inclination, planarity, roughness, coating/infilling

- EW, <5 mm, closed spaced
- IS, clay, =20 mm
- P, 0°, clay
- HB
- DB
- DB
- IS
- HB
- P, 0°
- EW, <5 mm
- P, 0°
- P, 0°
- EW, =10 mm
- HB
- P, 0°
- P, 3°
- EW, =40 mm
- P, 5°
- P, 2°
- P, 5°
- HB
- J, 45°, CN, PR, SM
- P, 0°
- EW, 10°
- HB
- DB

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

GREEN
GEOTECHNICS

Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	MG
Hole Position:	See Plan 286311.4 m E 6212209.7 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	168.20 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information							***Rock Substance***				***Rock Mass Defects***	
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength $UCS = I_{s(50)}$ ● - Axial ○ - Diametral ■ - UCS VL L M H VH EH	Average Defect Spacing (mm) 10 30 100 300 1000	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
NMLC		100% Polymer Return	100	100	161.2 160.2	7 8		SANDSTONE: fine grained, pale grey, with grey bedding at 0-10°.*(continued)* 8.60m: becoming orange stained and bedded at 10-20°	FR	H	1000	DB HB
					159.2 158.2 157.2	8.72m 9 10 11		Hole Terminated at 8.72 m Target depth				

Method
- AS - Auger Screwing
- WB - Washbore
- HQ3 - HQ3 Core Barrel
- NQ3 - NQ3 Core Barrel
- NMLC - NMLC Core Barrel

Water
- Level (Date)
- ▷ Inflow
- ◁ Partial Loss
- ◀ Complete Loss

Support
- T - Timbering

Graphic Log/Core Loss
- Core recovered (hatching indicates material)
- ☒ Core loss

Weathering
- FR - Fresh
- SW - Slightly Weathered
- MW - Moderately Weathered
- DW - Distinctly Weathered
- HW - Highly Weathered
- XW - Extremely Weathered
- RS - Residual Soil

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

GREEN GEOTECHNICS

Project No: GG11529.001

Client: SINSW C/- SMEC

Date Cored: 27/05/2024

Geotechnical Investigation
New Primary School at Wilton Junction
CORE PHOTO - BH8

Box : 1 of 1

GREEN GEOTECHNICS

Borehole No.
BH9
Page 1 of 3

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286256.5 m E 6212239.6 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	168.20 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information								*Soil Description*					*Observations*
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T									CI	TOPSOIL Silty CLAY: medium plasticity, dark brown. 0.30m	M		TOPSOIL
				0.50m SPT 4,7,10 N=17 S8 at 0.60m 0.95m					CI /CH	Silty CLAY: medium to high plasticity, orange brown with pale grey. 1.00m	M	F to St St	RESIDUAL SOIL 0.60: PP= 450kPa
				1.00m SPT 3,6,16 N=22 S9 at 1.20m 1.45m		167.2	1		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown. 1.40m	M / D M / D	VSt	1.20: PP= 450kPa
						166.2	2			SHALE: dark grey with pale grey and orange brown. Estimate very low strength (Class 5). 2.37m	D		ROCK
						165.2	3			Continued on cored borehole sheet			
						164.2	4						
						163.2	5						

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Engineering Log - Cored Borehole

Project No.: GG11529.001

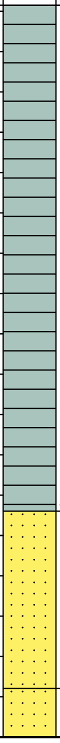
Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286256.5 m E 6212239.6 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	168.20 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

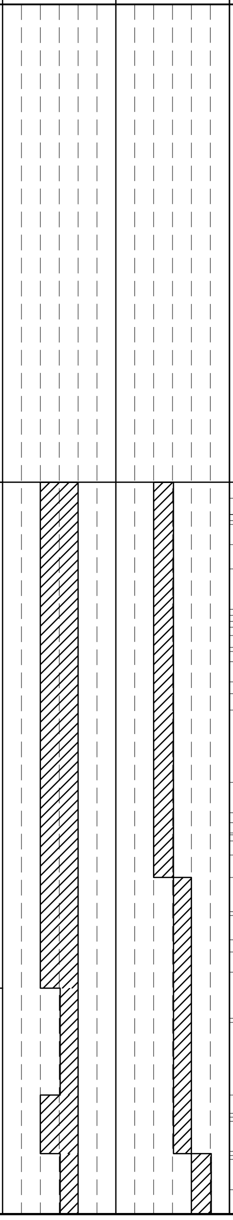
Drilling Information | Rock Substance | Rock Mass Defects

Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
					167.2 166.2	1 2	Continued from non-cored borehole sheet		
NMLC		100% Water Return	100	25		2.37m	SHALE: dark grey with red brown and pale grey, laminated at 0-15°, with clay seams.	SW	J, 85°, IR, RF clay, SM P, 0°, PR, RF P, 0°, clay VN, PR, RF clay, SM
			100	58	165.2 164.2	3 4			J, 90°, IR, RF P, 0°, PR, RF P, 0°, PR, RF clay, SM P, 0°, PR, RF clay, SM J, 85°, IR, SM J, 90°, IR, RF P, 0°, PR, RF J, 85°, clay, IR, RF P, 2°, clay VN, PR, RF P, 3°, clay VN, PR, RF P, 2°, PR, SM P, 0°, clay VN, PR, SM J, 40°, clay VN, IR, RF P, 10°, clay VN, PR, SM
					163.2	4.88m 5	SANDSTONE: fine to medium grained, orange brown with pale grey, bedded at 0-10° with shale interbeds.	SW	J, 90°, clay, IR, RF, infill P, 0°, PR, SM P, 0°, PR, SM clay, SM clay, SM
			100	100		5.76m	Fine to medium grained, pale grey with dark grey, bedded at 0-10°.		P, 0°, PR, SM DB

Graphic Log



Strength: UCS=$I_{s(50)}$ ● - Axial ○ - Diametral ■ - UCS; VL L M H VH EH. Average Defect Spacing (mm): 10 30 100 300 1000



Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

Cored Borehole No.

BH9

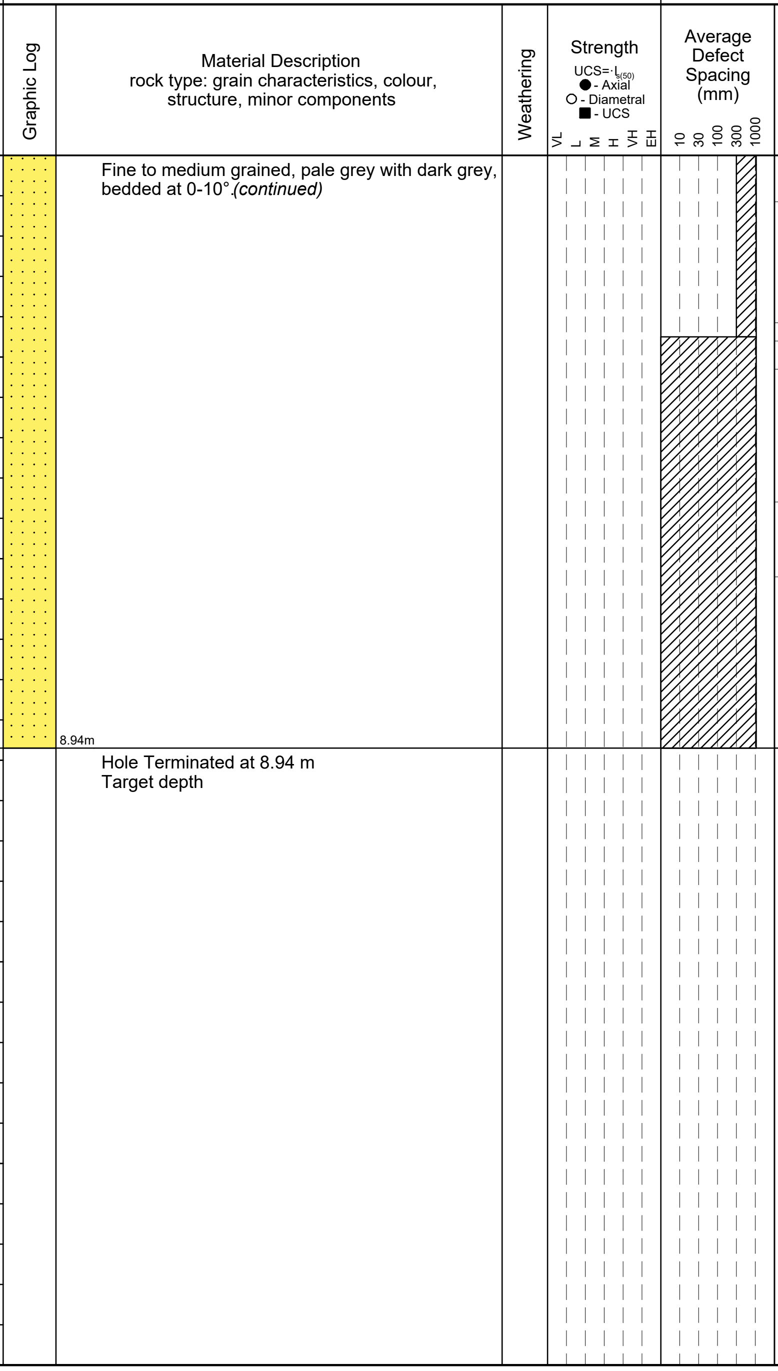
Page 3 of 3

Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	27/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	27/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286256.5 m E 6212239.6 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	168.20 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC



Drilling Information							Rock Substance				Rock Mass Defects	
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=·I$_{s(50)}$ ● - Axial ○ - Diametral ■ - UCS VL L M H VH EH	Average Defect Spacing (mm) 10 30 100 300 1000	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
NMLC		100% Water Return	100	100	161.2 160.2	7 8		Fine to medium grained, pale grey with dark grey, bedded at 0-10°.*(continued)*				P, 5° P, 2° P, 2° HB DB HB
					159.2 158.2 157.2	9 10 11	8.94m	Hole Terminated at 8.94 m Target depth				

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
⊻ Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
▨ Core recovered (hatching indicates material)
☒ Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

GREEN GEOTECHNICS

Project No: GG11529.001

Client: SINSW C/- SMEC

Date Cored: 27/05/2024

Geotechnical Investigation
New Primary School at Wilton Junction

CORE PHOTO - BH9

Box : 1 of 1

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	28/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	28/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286273.0 m E 6212265.9 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting: Hanjin DB8
Hole Diameter: 105 mm
Inclination: -90°
Bearing:
RL Surface: 167.20 m
Datum: AHD
Operator: AC

Drilling Information								Soil Description					Observations
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.20m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
				0.50m SPT 3,4,7 N=11 0.95m			0.90m		CI /CH	Silty CLAY: medium to high plasticity, orange brown with pale grey.	M	F to St St	RESIDUAL SOIL
				1.00m SPT 8,14,22 N=36 1.45m		166.2	1 1.20m		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown.	M M / D	VSt	
						165.2	2 2.25m			SHALE: dark brown and orange brown with pale grey, with clay seams. Estimate very low strength (Class 5).	D		ROCK
						164.2 163.2 162.2	3 4 5			Continued on cored borehole sheet			

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
St - Stiff
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN
GEOTECHNICS

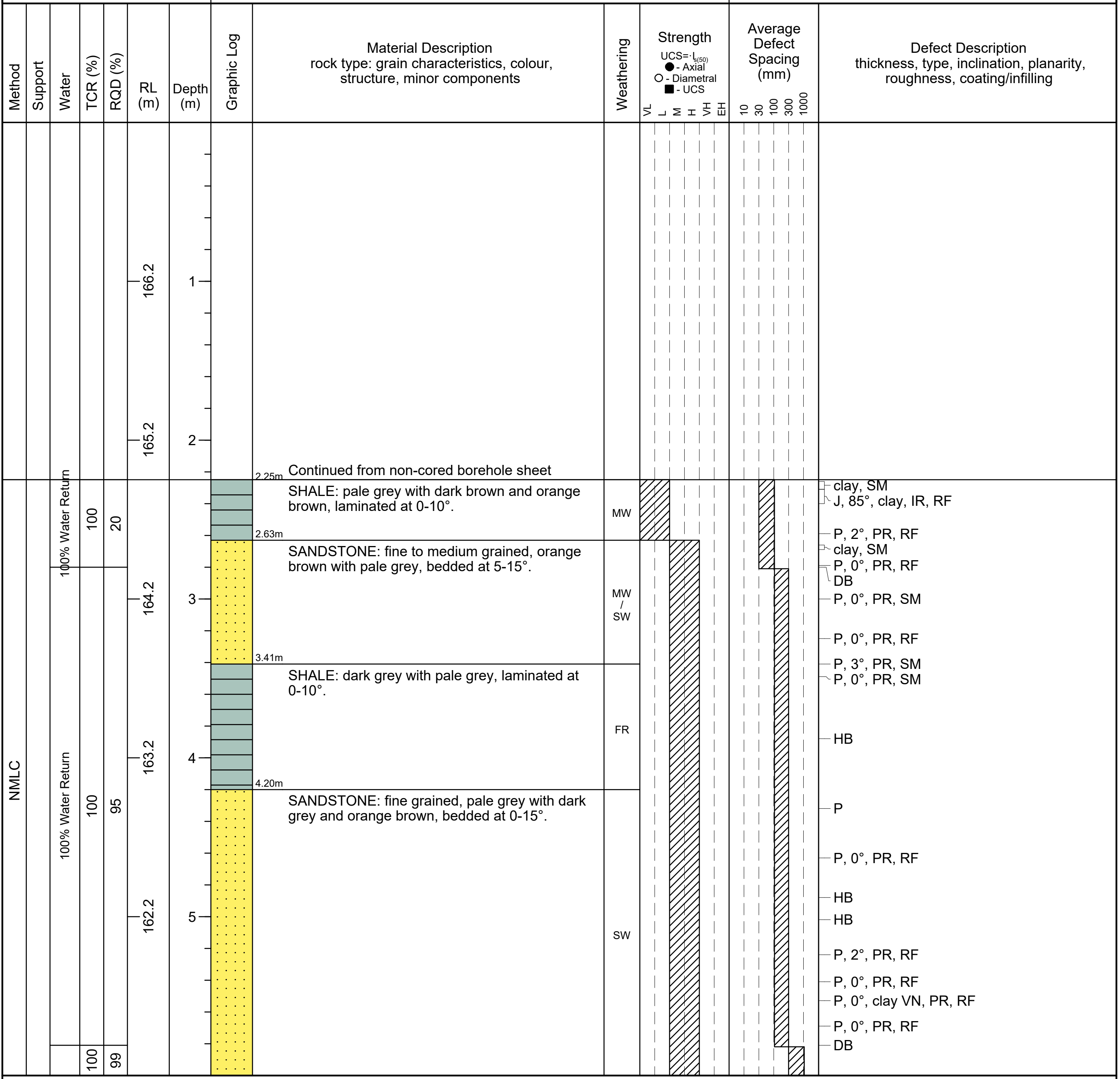
Cored Borehole No.
BH10
Page 2 of 3

Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	28/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	28/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286273.0 m E 6212265.9 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting: Hanjin DB8 | Inclination: -90° | RL Surface: 167.20 m
Barrel Type and Length: Stepped Face 3 m | Bearing: | Datum: AHD | Operator: AC



Method	Water	TCR (%)	RQD (%)
NMLC	100% Water Return	100	20
	100% Water Return	100	95
		100	99

Depth (m)	Material Description	Weathering
2.25m	Continued from non-cored borehole sheet	
2.25m	SHALE: pale grey with dark brown and orange brown, laminated at 0-10°.	MW
2.63m	SANDSTONE: fine to medium grained, orange brown with pale grey, bedded at 5-15°.	MW / SW
3.41m	SHALE: dark grey with pale grey, laminated at 0-10°.	FR
4.20m	SANDSTONE: fine grained, pale grey with dark grey and orange brown, bedded at 0-15°.	SW

Defect Description:
- clay, SM
- J, 85°, clay, IR, RF
- P, 2°, PR, RF
- clay, SM
- P, 0°, PR, RF
- DB
- P, 0°, PR, SM
- P, 0°, PR, RF
- P, 3°, PR, SM
- P, 0°, PR, SM
- HB
- P
- P, 0°, PR, RF
- HB
- HB
- P, 2°, PR, RF
- P, 0°, PR, RF
- P, 0°, clay VN, PR, RF
- P, 0°, PR, RF
- DB

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
⊻ Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
▨ Core recovered (hatching indicates material)
☒ Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

Engineering Log - Cored Borehole

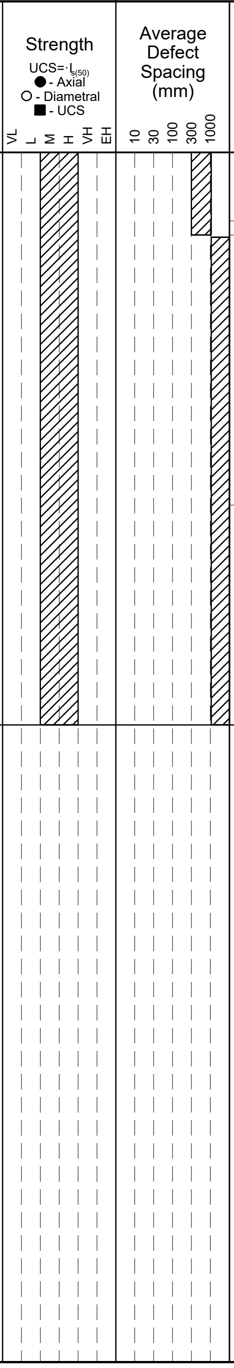
Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	28/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	28/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286273.0 m E 6212265.9 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	167.20 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information | ***Rock Substance*** | ***Rock Mass Defects***

Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
NMLC		100% Water Return	100	99			▨	SANDSTONE: fine grained, pale grey with dark grey and orange brown, bedded at 0-15°.*(continued)*	SW			HB P, 0°, PR, RF
					160.2	7						
												HB
					159.2	8	8.84m					
					158.2	9		Hole Terminated at 8.84 m Target depth				
					157.2	10						
					156.2	11						



Method	***Water***	***Graphic Log/Core Loss***	***Weathering***	***Strength***
AS - Auger Screwing WB - Washbore HQ3 - HQ3 Core Barrel NQ3 - NQ3 Core Barrel NMLC - NMLC Core Barrel	Level (Date) ▷ Inflow ◁ Partial Loss ◀ Complete Loss ***Support*** T - Timbering	Core recovered (hatching indicates material) ☒ Core loss	FR - Fresh SW - Slightly Weathered MW - Moderately Weathered DW - Distinctly Weathered HW - Highly Weathered XW - Extremely Weathered RS - Residual Soil	VL - Very Low L - Low M - Medium H - High VH - Very High EH - Extremely High

GREEN GEOTECHNICS

Project No: GG11529.001

Client: SINSW C/- SMEC

Date Cored: 28/05/2024

Geotechnical Investigation
New Primary School at Wilton Junction
CORE PHOTO - BH10

Box : 1 of 1

GREEN
GEOTECHNICS

Borehole No.
BH11
Page 1 of 3

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	29/5/2025
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	29/5/2025
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286307.5 m E 6212300.9 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	165.60 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information								*Soil Description*					*Observations*
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol		Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T									CI	0.20m	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
									CI /CH	0.40m	Silty CLAY: medium to high plasticity, orange brown with pale grey.	M	F to St	RESIDUAL SOIL
				0.50m SPT 3,4,17 N=21 S11 at 0.60m 0.95m					CI	0.80m	Silty CLAY: medium plasticity, pale grey with orange brown, trace of fine grained sand; (completely weathered sandstone).	M / D	St	
						164.6	1			1.70m	SANDSTONE: fine grained, orange brown with pale grey, with clay seams. Estimate very low strength (Class 5).	D		ROCK
											Continued on cored borehole sheet			
						163.6	2							
						162.6	3							
						161.6	4							
						160.6	5							

Method
AS - Auger Screwing
ADV Auger V Bit
ADT Auger Tungsten Carbide Bit
RR - Rock Roller
WB- Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Engineering Log - Cored Borehole

Project No.: GG11529.001

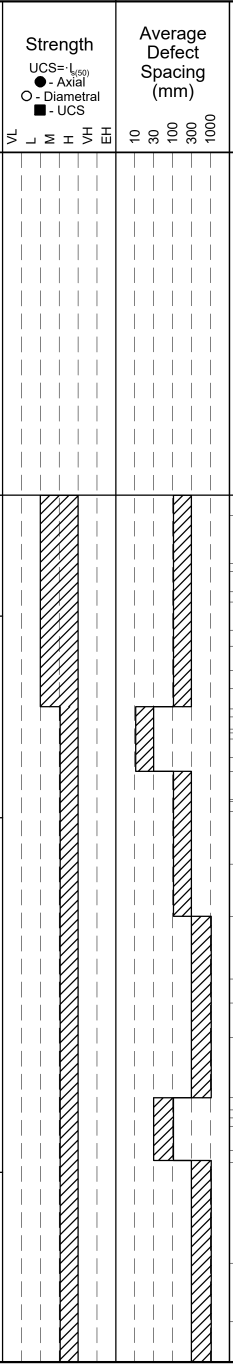
Client:	SINSW C/- SMEC	Commenced:	29/5/2025
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	29/5/2025
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286307.5 m E 6212300.9 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	165.60 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information / Rock Substance / Rock Mass Defects

Method	Water	TCR (%)	RQD (%)	Depth (m)	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering
				0.00–1.70	Continued from non-cored borehole sheet	
NMLC	100% Water Return	100	74	1.70–2.30	SANDSTONE: fine grained, orange brown with pale grey and dark grey bands, bedded at 0-10°.	SW
				2.30–3.30	SANDSTONE: fine grained, dark brown with dark grey, orange brown and pale grey, with shale interbeds, laminated at 0-10°.	MW
	100% Water Return	100	85	3.30–5.06	SANDSTONE: fine grained, pale grey with orange brown, dark grey bands, bedded at 0-10°.	SW
		100	99	5.06–	SANDSTONE: fine grained, pale grey with dark grey bands, bedded at 0-10°.	FR

RL (m)	Depth (m)
164.6	1
163.6	2
162.6	3
161.6	4
160.6	5



Defect Description
thickness, type, inclination, planarity, roughness, coating/infilling

- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, clay VN, PR, RF
- J, 90°, clay, IR, RF, infill
- J, 85°, clay, IR, RF, infill
- P, 10°, PR, RF
- DB
- HB
- clay, SM
- P, 5°, RF
- P
- clay, SM
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, SM
- HB
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- J, 20°, IR, RF
- P, 0°, PR, SM
- DB

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
⊻ Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
▦ Core recovered (hatching indicates material)
☒ Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

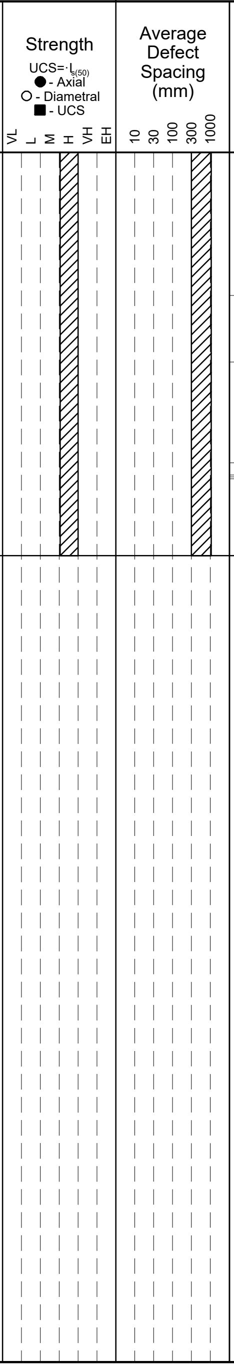
Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Engineering Log - Cored Borehole

Client:	SINSW C/- SMEC	Project No.:	GG11529.001
Project Name:	Geotechnical Investigation: Wilton Junction School	Commenced:	29/5/2025
Hole Location:	Wilton Junction School, Wilton	Completed:	29/5/2025
Hole Position:	See Plan 286307.5 m E 6212300.9 m N MGA2020-56	Logged By:	JK
		Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	165.60 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
NMLC		100% Water Return	100	99	158.6	7	▨	SANDSTONE: fine grained, pale grey with dark grey bands, bedded at 0-10° *(continued)*	FR	P, 0°, PR, RF HB P, 0°, PR, SM
						7.61m	▨	SANDSTONE: fine to medium grained, pale orange to pale grey, bedded at 5-15°.		P, 0°, PR, SM clay, SM
					157.6	8.00m / 8		Hole Terminated at 8.00 m Target depth		
					156.6	9				
					155.6	10				
					154.6	11				



Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

GREEN GEOTECHNICS	Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **CORE PHOTO - BH11**	Box : 1 of 1
	Client: SINSW C/- SMEC		
	Date Cored: 29/05/2024		

Engineering Log - Borehole

Project No.: GG11529.001

Client: SINSW C/- SMEC
Project Name: Geotechnical Investigation: Wilton Junction School
Hole Location: Wilton Junction School, Wilton
Hole Position: See Plan 286328.1 m E 6212295.9 m N MGA2020-56
Commenced: 29/5/2025
Completed: 29/5/2025
Logged By: JK
Checked By: MG

Drill Model and Mounting: Hanjin DB8
Hole Diameter: 105 mm
Inclination: -90°
Bearing:
RL Surface: 164.80 m
Datum: AHD
Operator: AC

Drilling Information								Soil Description					Observations
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.30m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
				0.50m SPT 4,6,7 N=13 S12 at 0.70m 0.95m			0.90m		CI /CH	Silty CLAY: medium to high plasticity, orange brown with pale grey.	M	F to St St	RESIDUAL SOIL
						163.8	1 1.20m		CI	Silty CLAY: medium plasticity, pale grey with orange brown, trace of fine grained sand; (completely weathered sandstone).	M / D	VSt	
							1.70m			SHALE: fine to medium grained, pale grey with dark grey and orange brown, with clay seams and sandstone interbeds. Estimate very low strength (Class 5).	D		ROCK
										Continued on cored borehole sheet			
						162.8	2						
						161.8	3						
						160.8	4						
						159.8	5						

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
▨ No resistance ranging to refusal

Water
⊻ Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Graphic Log/Core Loss
▦ Core recovered (hatching indicates material)
☐ Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN GEOTECHNICS

Cored Borehole No.
BH12
Page 2 of 3

Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	29/5/2025
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	29/5/2025
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286328.1 m E 6212295.9 m N MGA2020-56	Checked By:	MG

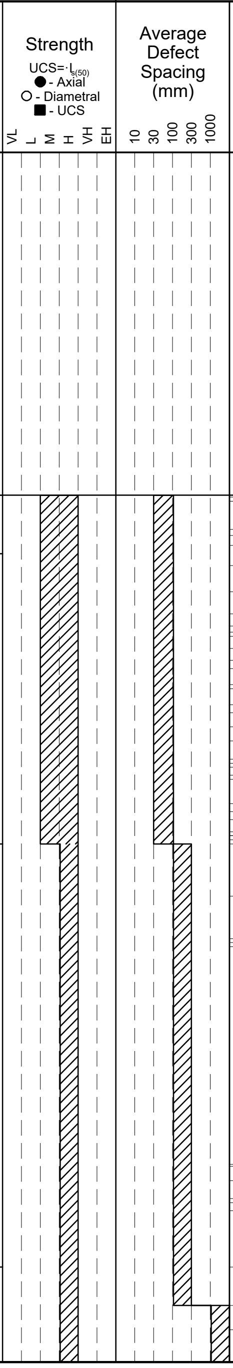
Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	164.80 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information

Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)
					163.8	1
NMLC		100% Water Return	100	20	162.8	2
		100% Water Return	100	77	161.8 / 160.8 / 159.8	3 / 4 / 5
			100	84		

Rock Substance

Depth	Material Description (rock type: grain characteristics, colour, structure, minor components)	Weathering
1.70m	Continued from non-cored borehole sheet	
1.70m–1.99m	SHALE: dark grey with pale grey and orange brown, with clay seams.	EW
1.99m–3.43m	SANDSTONE: fine grained, pale grey with dark grey and orange brown bands, with shale interbeds, laminated at 0-10°.	SW
3.43m–5.53m	SANDSTONE: fine grained, pale grey with dark grey and orange brown bands, bedded at 0-10°.	SW
5.53m–	SANDSTONE: fine grained, pale grey with dark grey bands, bedded at 0-10°.	FR



Rock Mass Defects

Defect Description (thickness, type, inclination, planarity, roughness, coating/infilling)

- CS, clay
- clay, SM
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, SM
- P, 0°, IR, RF
- clay, SM
- P, 0°, clay VN, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- clay, SM
- P, 0°, PR, SM
- P, 0°, PR, RF
- DB
- P, 0°, PR, SM
- clay, SM
- P, 0°, clay VN, PR, SM
- P, 0°, clay VN, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- clay, SM
- P, 0°, PR, SM
- P, 0°, PR, RF
- P, 0°, PR, SM
- P, 0°, PR, SM
- HB
- P, 0°, PR, RF
- P, 0°, PR, RF
- CS, clay
- P, 0°, PR, SM
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, RF
- DB

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
▨ Core recovered (hatching indicates material)
☒ Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

Cored Borehole No.
BH12
Page 3 of 3

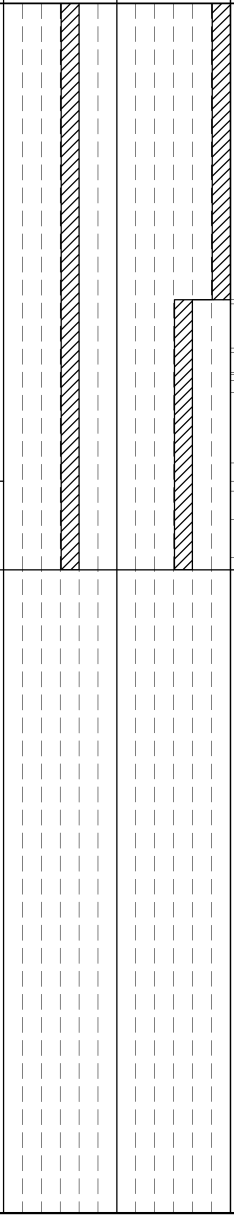
Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	29/5/2025
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	29/5/2025
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286328.1 m E 6212295.9 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	164.80 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=-I$_{s(50)}$ ● - Axial ○ - Diametral ■ - UCS VL L M H VH EH	Average Defect Spacing (mm) 10 30 100 300 1000	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
NMLC		100% Water Return	100	84	157.8 156.8	7 8		SANDSTONE: fine grained, pale grey with dark grey bands, bedded at 0-10°*(continued)*	FR			P, 0°, PR, SM P, 0°, PR, SM J, 90°, IR, RF clay, SM P, 0°, clay VN, PR, RF P, 0°, PR, SM
						8.37m		SANDSTONE: fine to coarse grained, pale grey with dark grey bands, bedded at 5-15°.	FR			P, 0°, PR, SM P, 0°, clay VN, PR, RF P, 0°, PR, RF P, 5°, PR, SM P, 10°, PR, RF
						8.81m		Hole Terminated at 8.81 m Target depth				
					155.8 154.8 153.8	9 10 11						



Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

GREEN
GEOTECHNICS

Project No: GG11529.001

Client: SINSW C/- SMEC

Date Cored: 29/05/2024

Geotechnical Investigation
New Primary School at Wilton Junction

CORE PHOTO - BH12

Box : 1 of 1

Borehole No.

BH13

Page 1 of 3

Engineering Log - Borehole

Project No.: GG11529.001

Client: SINSW C/- SMEC
Project Name: Geotechnical Investigation: Wilton Junction School
Hole Location: Wilton Junction School, Wilton
Hole Position: See Plan 286353.0 m E 6212292.5 m N MGA2020-56

Commenced: 30/5/2024
Completed: 30/5/2024
Logged By: JK
Checked By: MG

Drill Model and Mounting: Hanjin DB8
Hole Diameter: 105 mm
Inclination: -90°
Bearing:
RL Surface: 164.80 m
Datum: AHD
Operator: AC

Drilling Information								Soil Description					Observations
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T							0.20m		CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
				0.50m SPT 3,4,7 N=11 0.95m		163.8	1 1.00m		CI /CH	Silty CLAY: medium to high plasticity, red brown and orange brown with pale grey.	M	F to St St	RESIDUAL SOIL
							1.20m		CI	CLAY: medium plasticity, pale grey with orange brown.	M / D	VSt	
							1.80m			SHALE: pale grey with orange brown and dark grey, with clay seams and sandstone interbeds. Estimate very low strength (Class 5).	D		ROCK
						162.8	2			Continued on cored borehole sheet			
						161.8	3						
						160.8	4						
						159.8	5						

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

GREEN
GEOTECHNICS

Cored Borehole No.
BH13
Page 2 of 3

Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	30/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	30/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286353.0 m E 6212292.5 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	164.80 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information

Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)
					163.8	1
NMLC		100% Water Return	100	0	162.8	2
		100% Water Return	100	77	161.8	3
					160.8	4
					159.8	5
			100	90		

Rock Substance

Depth (m)	Material Description: rock type: grain characteristics, colour, structure, minor components	Weathering
1.80m	Continued from non-cored borehole sheet	
1.80m – 2.12m	SANDSTONE: fine grained, orange brown with pale grey, with shale interbeds, laminated at 0-10°.	MW
2.12m – 3.31m	SANDSTONE: fine grained, dark grey with pale grey and orange brown, with shale interbeds, laminated at 0-10°.	SW
3.31m – 5.11m	SANDSTONE: fine grained, pale grey with dark grey and orange brown bands, bedded at 0-10°.	SW
5.11m	SANDSTONE: fine grained, pale grey with dark grey bands, bedded at 0-10°.	FR

Strength: UCS=·$I_{s(50)}$ ● - Axial ○ - Diametral ■ - UCS; VL L M H VH EH

Average Defect Spacing (mm): 10 30 100 300 1000

Rock Mass Defects

Defect Description: thickness, type, inclination, planarity, roughness, coating/infilling

- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 3°, PR, SM
- P, 0°, clay VN, PR, SM
- CS
- P, 0°, clay VN, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- J, 80°, IR, RF
- P, 0°, PR, RF
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, RF
- P, 0°, clay VN, PR, RF
- CS
- DB
- P, 0°, PR, RF
- P, 0°, PR, SM
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 2°, clay VN, PR, RF
- P, 0°, PR, RF
- P, 0°, clay VN, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 2°, PR, SM
- P, 0°, PR, RF
- P, 0°, clay VN, PR, SM
- P, 0°, PR, SM
- P, 2°, PR, SM
- DB

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

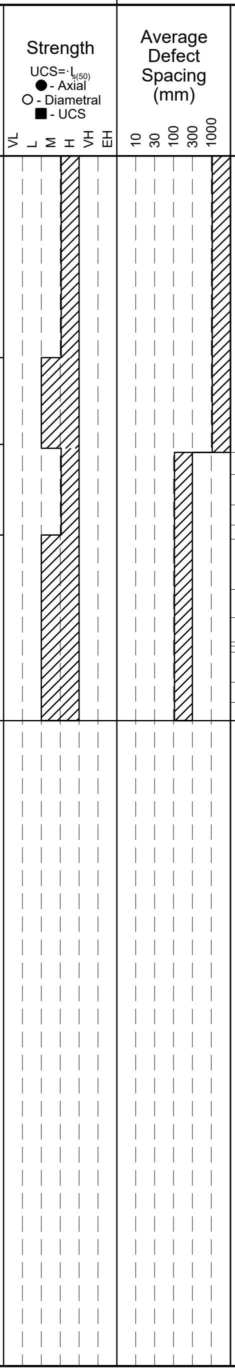
Engineering Log - Cored Borehole

Project No.: GG11529.001

Client: SINSW C/- SMEC
Project Name: Geotechnical Investigation: Wilton Junction School
Hole Location: Wilton Junction School, Wilton
Hole Position: See Plan 286353.0 m E 6212292.5 m N MGA2020-56

Commenced: 30/5/2024
Completed: 30/5/2024
Logged By: JK
Checked By: MG

Drill Model and Mounting: Hanjin DB8
Barrel Type and Length: Stepped Face 3 m
Inclination: -90°
Bearing:
RL Surface: 164.80 m
Datum: AHD
Operator: AC



Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
NMLC		100% Water Return	100	90			SANDSTONE: fine grained, pale grey with dark grey bands, bedded at 0-10° *(continued)*	FR	
					157.8	7	7.00m SANDSTONE: fine to coarse grained, pale grey and brown with dark grey bands, bedded at 0-10°.	SW	
							7.43m SANDSTONE: fine grained, pale grey with dark grey and orange brown bands, bedded at 0-10°.	FR	P, 0°, PR, RF P, 0°, PR, SM P, 0°, PR, SM P, 0°, PR, RF P, 0°, clay VN, PR, SM
					156.8	8	7.88m SANDSTONE: fine to coarse grained, pale grey with orange brown, red brown and dark grey bands, bedded at 5-15°.		P, 0°, PR, RF P, 0°, PR, SM P, 2°, PR, RF P, 0°, PR, SM P, 0°, PR, SM P, 2°, PR, SM P, 5°, PR, SM
					155.8	9	8.80m Hole Terminated at 8.80 m Target depth		
					154.8	10			
					153.8	11			

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
⊻ Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
▨ Core recovered (hatching indicates material)
☒ Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

GREEN GEOTECHNICS	Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **CORE PHOTO - BH13**	Box : 1 of 1
	Client: SINSW C/- SMEC		
	Date Cored: 30/05/2024		

GREEN
GEOTECHNICS

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	28/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	28/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286357.5 m E 6212264.4 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	166.20 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	AC

Method	Support	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T					0.20m	CI	TOPSOIL Silty CLAY: medium plasticity, dark brown.	M		TOPSOIL
		0.50m SPT 5,7,15 N=22 0.95m			0.80m	CI /CH	Silty CLAY: medium to high plasticity, orange brown with pale grey.	M	F to St St	RESIDUAL SOIL
				165.2	1 1.20m	CI	Silty CLAY: medium plasticity, pale grey with orange brown, trace of fine grained sand.	M / D	VSt	
					1.75m		SANDSTONE: fine to medium grained, orange brown with pale grey, with frequent clay seams. Estimate very low strength (Class 5).	D		ROCK
				164.2	2		Continued on cored borehole sheet			
				163.2	3					
				162.2	4					
				161.2	5					

Method
AS - Auger Screwing
ADV - Auger V Bit
ADT - Auger Tungsten Carbide Bit
RR - Rock Roller
WB - Washbore

Support
C - Casing

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test
PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
D - Dry
M - Moist
W - Wet
w - Moisture Content
PL - Plastic Limit
LL - Liquid Limit

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	28/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	28/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286357.5 m E 6212264.4 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	166.20 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information

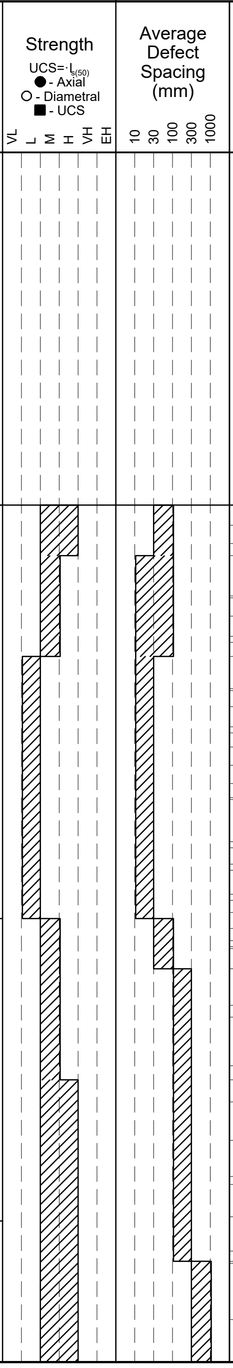
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)
					165.2	1
NMLC		100% Water Return	100	0	164.2	2
		100% Water Return	100	48	163.2	3
					162.2	4
					161.2	5
			100	85		

Rock Substance

Depth	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering
1.75m		Continued from non-cored borehole sheet	
	⁙	SANDSTONE: fine to medium grained, pale grey with orange brown, with frequent clay seams.	MW
3.80m	⁙	SANDSTONE: fine to medium grained, orange brown with pale grey, bedded at 0-10°.	SW
5.30m	⁙	SANDSTONE: fine to medium grained, pale grey with orange brown, bedded at 0-10°.	SW

Strength
UCS=·$I_{s(50)}$
● - Axial
○ - Diametral
■ - UCS

Average Defect Spacing (mm)



Rock Mass Defects

Defect Description
thickness, type, inclination, planarity, roughness, coating/infilling

- P, 0°, clay, IR, RF
- P, 0°, PR, RF
- J, 0 - 90°, clay, IR, RF, infill
- J, 0 - 90°, IR, RF, tight-open
- J, 45°, clay VN, IR, RF
- J, 85°, clay, IR, RF, infill
- J, 80°, clay, IR, RF, infill
- P, 2°, clay, PR, RF
- P, 3°, clay, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, RF
- J, 85°, clay, PR, RF
- clay, SM
- clay, SM
- clay, SM
- clay, SM
- clay, SM
- clay, SM
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 0°, PR, SM
- clay, SM
- P, 0°, PR, RF
- J, 90°, IR, RF
- DB
- P, 0°, IR, RF

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
⊻ Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
⁙ Core recovered (hatching indicates material)
☒ Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

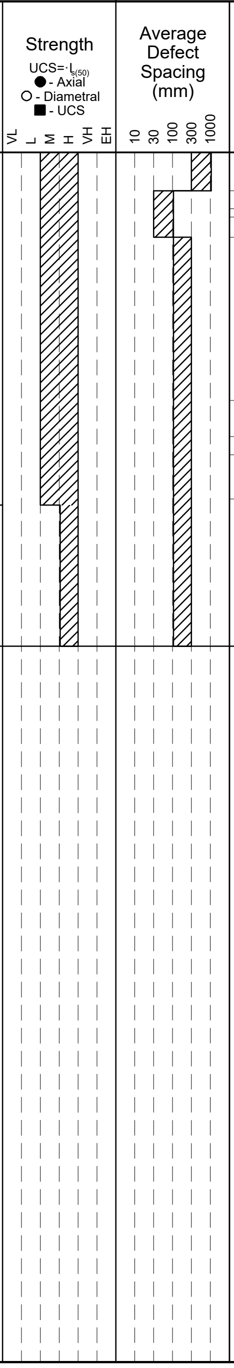
Strength
VL - Very Low
L - Low
M - Medium
H - High
VH - Very High
EH - Extremely High

Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	28/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	28/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286357.5 m E 6212264.4 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting: Hanjin DB8 Inclination: -90° RL Surface: 166.20 m
Barrel Type and Length: Stepped Face 3 m Bearing: Datum: AHD Operator: AC



Drilling Information							Rock Substance				Rock Mass Defects	
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength	Average Defect Spacing (mm)	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
NMLC		100% Water Return	100	85	159.2	7	7.75m	SANDSTONE: fine to medium grained, pale grey with orange brown, bedded at 0-10°*(continued)*	SW			P, 0°, PR, RF P, 3°, PR, SM P, 3°, PR, SM P, 0°, PR, SM P, 2°, PR, SM P, 0°, PR, SM HB P, 0°, clay VN, PR, RF
					158.2	8	8.45m	SANDSTONE: fine to coarse grained, mottled pale grey with dark grey, bedded at 5-15°.	FR			
					157.2 156.2 155.2	9 10 11		Hole Terminated at 8.45 m Target depth				

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

GREEN GEOTECHNICS	Project No: GG11529.001	Geotechnical Investigation New Primary School at Wilton Junction **CORE PHOTO - BH14**	Box : 1 of 1
	Client: SINSW C/- SMEC		
	Date Cored: 28/05/2024		

GREEN GEOTECHNICS

Borehole No.
BH15
Page 1 of 3

Engineering Log - Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	28/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	28/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286353.2 m E 6212235.0 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	167.00 m		
Hole Diameter:	105 mm	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information								Soil Description					Observations
Method	Support	Penetration	Groundwater Levels	Samples & Field Tests	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Structure and Additional Observations
AD/T									CI	TOPSOIL Silty CLAY: medium plasticity, dark brown. 0.30m	M		TOPSOIL
				0.50m					CI /CH	Silty CLAY: medium to high plasticity, orange brown with pale grey. 0.50m	M	F to St	RESIDUAL SOIL
				SPT 4,5,6 N=11 S10 at 0.60m 0.95m		166.0	1		CI /CH	Silty CLAY: medium to high plasticity, pale grey with orange brown, trace of ironstone/ sandstone gravel; (completely weathered sandstone. 1.20m	M M / D	St VSt	
										SANDSTONE: fine grained, orange brown with pale grey and red brown, with clay seams. Estimate very low strength (Class 5). 1.73m	D		ROCK
						165.0	2			Continued on cored borehole sheet			
						164.0	3						
						163.0	4						
						162.0	5						

Method
- AS - Auger Screwing
- ADV - Auger V Bit
- ADT - Auger Tungsten Carbide Bit
- RR - Rock Roller
- WB - Washbore

Support
- C - Casing

Penetration
No resistance ranging to refusal

Graphic Log/Core Loss
- Core recovered (hatching indicates material)
- Core loss

Water
- Level (Date)
- Inflow
- Partial Loss
- Complete Loss

Samples and Tests
- U - Undisturbed Sample
- D - Disturbed Sample
- SPT - Standard Penetration Test
- PP - Pocket Penetrometer

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Moisture Condition
- D - Dry
- M - Moist
- W - Wet
- w - Moisture Content
- PL - Plastic Limit
- LL - Liquid Limit

Consistency/Relative Density
- VS - Very Soft
- S - Soft
- F - Firm
- VSt - Very Stiff
- H - Hard
- Fr - Friable
- VL - Very Loose
- L - Loose
- MD - Medium Dense
- D - Dense
- VD - Very Dense

GREEN
GEOTECHNICS

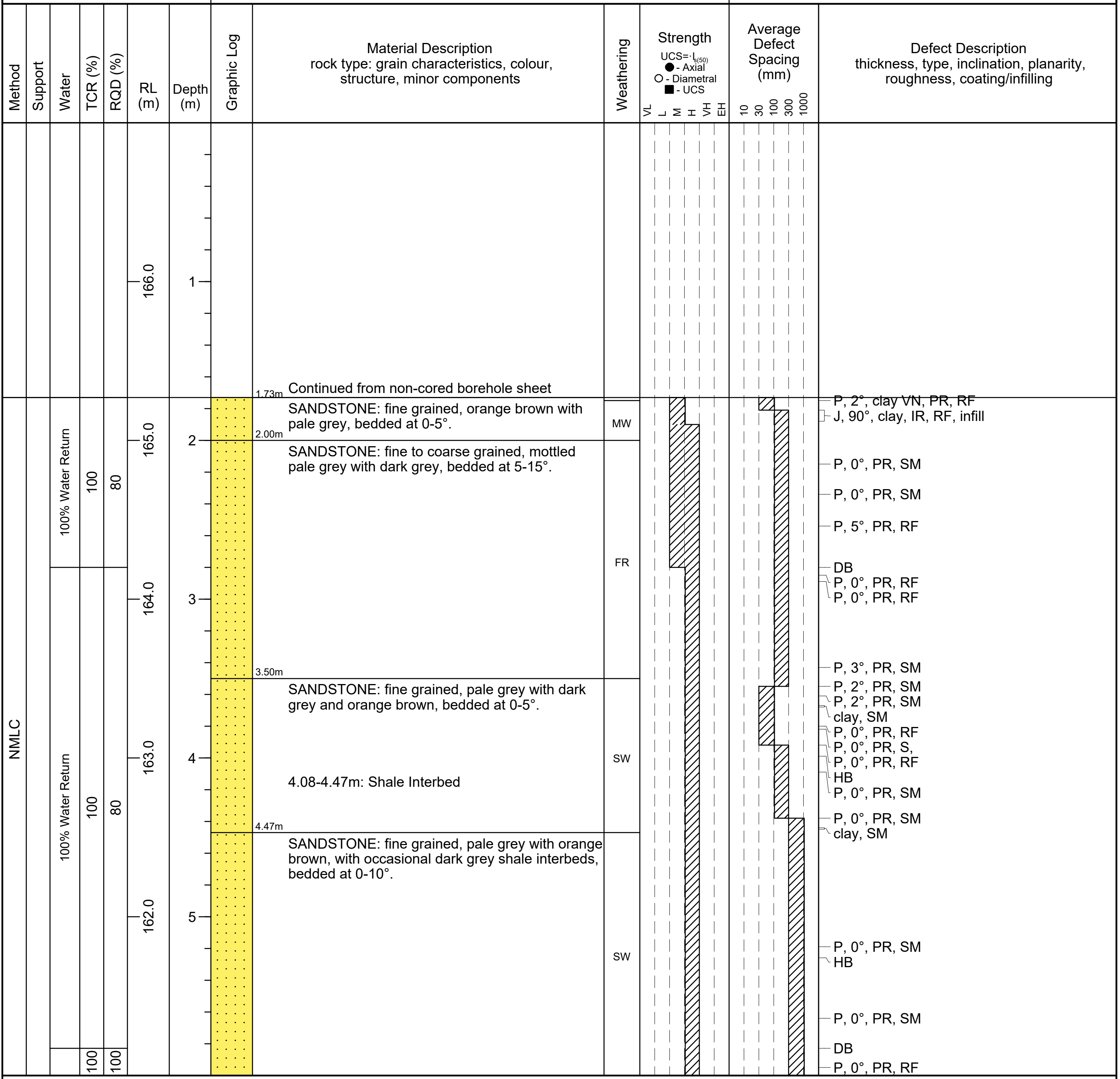
Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	28/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	28/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286353.2 m E 6212235.0 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	167.00 m		
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD	Operator:	AC

Drilling Information | **Rock Substance** | **Rock Mass Defects**



Material Description
rock type: grain characteristics, colour, structure, minor components

Depth (m)	Material Description	Weathering
1.73m	Continued from non-cored borehole sheet	
	SANDSTONE: fine grained, orange brown with pale grey, bedded at 0-5°.	MW
2.00m	SANDSTONE: fine to coarse grained, mottled pale grey with dark grey, bedded at 5-15°.	FR
3.50m	SANDSTONE: fine grained, pale grey with dark grey and orange brown, bedded at 0-5°. 4.08-4.47m: Shale Interbed	SW
4.47m	SANDSTONE: fine grained, pale grey with orange brown, with occasional dark grey shale interbeds, bedded at 0-10°.	SW

Defect Description
thickness, type, inclination, planarity, roughness, coating/infilling

- P, 2°, clay VN, PR, RF
- J, 90°, clay, IR, RF, infill
- P, 0°, PR, SM
- P, 0°, PR, SM
- P, 5°, PR, RF
- DB
- P, 0°, PR, RF
- P, 0°, PR, RF
- P, 3°, PR, SM
- P, 2°, PR, SM
- P, 2°, PR, SM
- clay, SM
- P, 0°, PR, RF
- P, 0°, PR, S,
- P, 0°, PR, RF
- HB
- P, 0°, PR, SM
- P, 0°, PR, SM
- clay, SM
- P, 0°, PR, SM
- HB
- P, 0°, PR, SM
- DB
- P, 0°, PR, RF

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
⊻ Level (Date)
▷ Inflow
◁ Partial Loss
◀ Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
▦ Core recovered (hatching indicates material)
☒ Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

GREEN GEOTECHNICS

Cored Borehole No.
BH15
Page 3 of 3

Engineering Log - Cored Borehole

Project No.: GG11529.001

Client:	SINSW C/- SMEC	Commenced:	28/5/2024
Project Name:	Geotechnical Investigation: Wilton Junction School	Completed:	28/5/2024
Hole Location:	Wilton Junction School, Wilton	Logged By:	JK
Hole Position:	See Plan 286353.2 m E 6212235.0 m N MGA2020-56	Checked By:	MG

Drill Model and Mounting:	Hanjin DB8	Inclination:	-90°	RL Surface:	167.00 m
Barrel Type and Length:	Stepped Face 3 m	Bearing:		Datum:	AHD Operator: AC

Drilling Information							Rock Substance				Rock Mass Defects	
Method	Support	Water	TCR (%)	RQD (%)	RL (m)	Depth (m)	Graphic Log	Material Description rock type: grain characteristics, colour, structure, minor components	Weathering	Strength UCS=I s(50) ● - Axial ○ - Diametral ■ - UCS VL L M H VH EH	Average Defect Spacing (mm) 10 30 100 300 1000	Defect Description thickness, type, inclination, planarity, roughness, coating/infilling
NMLC		100% Water Return	100	100	160.0 159.0	7 8	8.55m	SANDSTONE: fine grained, pale grey with orange brown, with occasional dark grey shale interbeds, bedded at 0-10°.*(continued)*	SW	H	300 1000	P, 0°, PR, RF P, 0°, PR, SM P, 2°, PR, SM
					158.0 157.0 156.0	9 10 11		Hole Terminated at 8.55 m Target depth				

Method
AS - Auger Screwing
WB - Washbore
HQ3 - HQ3 Core Barrel
NQ3 - NQ3 Core Barrel
NMLC - NMLC Core Barrel

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Support
T - Timbering

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Weathering
FR - Fresh
SW - Slightly Weathered
MW - Moderately Weathered
DW - Distinctly Weathered
HW - Highly Weathered
XW - Extremely Weathered
RS - Residual Soil

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

GREEN
GEOTECHNICS

Project No: GG11529.001

Client: SINSW C/- SMEC

Date Cored: 28/05/2024

Geotechnical Investigation
New Primary School at Wilton Junction

CORE PHOTO - BH15

Box : 1 of 1

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POINT LOAD STRENGTH INDEX

Project No: GG11529
Project Address: Wilton Junction Public School, Wilton
Client: SINSW C/- SMEC

Test Method: AS 4133.4.1
Test Date: 28/05/2024
Tested By: MG
Page: 1 of 4

Borehole No: BH8						Borehole No: BH9					
Date Drilled: 27/5/2024						Date Drilled: 27/5/2024					
Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture	Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture
2.61	D	**0.21**	SH	LA	M	4.27	D	**0.13**	SH	LA	D
	A	**0.32**	SH	LA	M		A	**0.42**	SH	LA	D
3.32	D	**0.17**	SH	LA	M	5.16	D	**0.92**	SS	BE	D
	A	**0.28**	SH	LA	M		A	**1.01**	SS	BE	D
4.21	D	**0.28**	SS	BE	D	6.42	D	**0.87**	SS	BE	D
	A	**0.39**	SS	BE	D		A	**0.96**	SS	BE	D
5.81	D	**1.07**	SS	BE	D	7.56	D	**1.21**	SS	BE	D
	A	**1.25**	SS	BE	D		A	**1.36**	SS	BE	D
6.42	D	**1.25**	SS	BE	D	8.27	D	**1.25**	SS	BE	D
	A	**1.37**	SS	BE	D		A	**1.41**	SS	BE	D
7.17	D	**1.54**	SS	BE	D						
	A	**1.86**	SS	BE	D						
8.43	D	**0.89**	SS	BE	D						
	A	**0.98**	SS	BE	D						

STRUCTURE
MA= MASSIVE
BE= BEDDED
LA= LAMINATED
CR= CRYSTALLINE

TEST TYPE
A= AXIAL
D= DIAMETRAL
I= IRREGULAR
C= CUBE

MOISTURE CONDITION
W= WET
M= MOIST
D= DRY

ROCK TYPE
SS= SANDSTONE
ST= SILTSTONE
SH= SHALE
YS= CLAYSTONE
IG= IGNEOUS

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POINT LOAD STRENGTH INDEX

Project No: GG11529
Project Address: Wilton Junction Public School, Wilton
Client: SINSW C/- SMEC

Test Method: AS 4133.4.1
Test Date: 30/05/2024
Tested By: MG
Page: 2 of 4

Borehole No: BH10						Borehole No: BH11					
Date Drilled: 87/5/2024						Date Drilled: 29/5/2024					
Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture	Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture
3.15	D	**0.75**	SS	BE	D	2.7	D	**0.7**	SH	LA	M
	A	**0.91**	SS	BE	D		A	**0.64**	SH	LA	M
4.55	D	**1.21**	SS	BE	D	3.41	D	**1.08**	SS	BE	D
	A	**1.17**	SS	BE	D		A	**1.14**	SS	BE	D
5.15	D	**0.87**	SS	BE	D	4.62	D	**1.01**	SS	BE	D
	A	**0.91**	SS	BE	D		A	**1.36**	SS	BE	D
6.77	D	**0.97**	SS	BE	D	5.17	D	**0.97**	SS	BE	D
	A	**1.15**	SS	BE	D		A	**1.21**	SS	BE	D
7.23	D	**1.08**	SS	BE	D	6.37	D	**0.84**	SS	BE	D
	A	**1.56**	SS	BE	D		A	**0.97**	SS	BE	D
8.45	D	**1.14**	SS	BE	D	7.31	D	**0.87**	SS	BE	D
	A	**1.08**	SS	BE	D		A	**1.11**	SS	BE	D

STRUCTURE
MA= MASSIVE
BE= BEDDED
LA= LAMINATED
CR= CRYSTALLINE

TEST TYPE
A= AXIAL
D= DIAMETRAL
I= IRREGULAR
C= CUBE

MOISTURE CONDITION
W= WET
M= MOIST
D= DRY

ROCK TYPE
SS= SANDSTONE
ST= SILTSTONE
SH= SHALE
YS= CLAYSTONE
IG= IGNEOUS

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POINT LOAD STRENGTH INDEX

Project No: GG11529
Project Address: Wilton Junction Public School, Wilton
Client: SINSW C/- SMEC

Test Method: AS 4133.4.1
Test Date: 30/05/2024
Tested By: MG
Page: 3 of 1

Borehole No: BH12						Borehole No: BH13					
Date Drilled: 29/5/2024						Date Drilled: 30/5/2024					
Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture	Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture
2.9	D	**0.18**	SH	LA	D	3.61	D	**0.98**	SS	LA	M
	A	**0.52**	SH	LA	D		A	**1.13**	SS	LA	M
3.81	D	**1.01**	SS	BE	D	4.42	D	**1.11**	SS	BE	D
	A	**1.14**	SS	BE	D		A	**1.19**	SS	BE	D
4.15	D	**0.96**	SS	BE	D	5.31	D	**0.98**	SS	BE	D
	A	**1.31**	SS	BE	D		A	**1.05**	SS	BE	D
5.81	D	**0.92**	SS	BE	D	6.5	D	**0.99**	SS	BE	D
	A	**0.98**	SS	BE	D		A	**0.94**	SS	BE	D
6.15	D	**1.11**	SS	BE	D	7.28	D	**1.11**	SS	BE	D
	A	**1.13**	SS	BE	D		A	**1.36**	SS	BE	D
7.23	D	**1.08**	SS	BE	D	8.08	D	**0.78**	SS	BE	D
	A	**1.11**	SS	BE	D		A	**0.97**	SS	BE	D
8.5	D	**0.89**	SS	BE	D						
	A	**0.91**	SS	BE	D						

STRUCTURE
MA= MASSIVE
BE= BEDDED
LA= LAMINATED
CR= CRYSTALLINE

TEST TYPE
A= AXIAL
D= DIAMETRAL
I= IRREGULAR
C= CUBE

MOISTURE CONDITION
W= WET
M= MOIST
D= DRY

ROCK TYPE
SS= SANDSTONE
ST= SILTSTONE
SH= SHALE
YS= CLAYSTONE
IG= IGNEOUS

POINT LOAD STRENGTH INDEX

Project No: GG11529
Project Address: Wilton Junction Public School, Wilton
Client: SINSW C/- SMEC

Test Method: AS 4133.4.1
Test Date: 30/05/2024
Tested By: MG
Page: 4 of 4

Borehole No: BH14 Date Drilled: 28/5/2024						Borehole No: BH15 Date Drilled: 28/5/2024					
Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture	Depth	Test Type	**Is(50) (Mpa)**	Rock Type	Rock Structure	Moisture
4.15	D	**0.75**	SS	BE	D	2.21	D	**0.87**	SS	BE	D
	A	**0.91**	SS	BE	D		A	**0.89**	SS	BE	D
5.4	D	**1.21**	SS	BE	D	3.06	D	**0.78**	SS	BE	D
	A	**1.17**	SS	BE	D		A	**0.82**	SS	BE	D
6.72	D	**0.87**	SS	BE	D	4.77	D	**1.12**	SS	BE	D
	A	**0.91**	SS	BE	D		A	**1.17**	SS	BE	D
7.92	D	**0.97**	SS	BE	D	5.51	D	**1.07**	SS	BE	D
	A	**1.15**	SS	BE	D		A	**1.22**	SS	BE	D
8.27	D	**1.08**	SS	BE	D	6.67	D	**0.98**	SS	BE	D
	A	**1.36**	SS	BE	D		A	**0.97**	SS	BE	D
						7.2	D	**1.01**	SS	BE	D
							A	**1.12**	SS	BE	D
						8.14	D	**0.99**	SS	BE	D
							A	**1.36**	SS	BE	D

STRUCTURE
MA= MASSIVE
BE= BEDDED
LA= LAMINATED
CR= CRYSTALLINE

TEST TYPE
A= AXIAL
D= DIAMETRAL
I= IRREGULAR
C= CUBE

MOISTURE CONDITION
W= WET
M= MOIST
D= DRY

ROCK TYPE
SS= SANDSTONE
ST= SILTSTONE
SH= SHALE
YS= CLAYSTONE
IG= IGNEOUS

Dynamic Cone Penetrometer Test Report

Project Number: GG11529.001
Site Address: Wilton Junction Public School
Test Date: 27/05/2024

Page: 1 of 2

Test Method: **AS1289.6.3.2**

Technician: JK

Test No	BH1	BH2	BH3	BH4	BH5	BH6
Starting Level	Surface Level	Surface Level	Surface Level	Surface Level	Surface Level	Surface Level
Depth (m)	Penetration Resistance (blows / 150mm)					
0.00 - 0.15	1	1	1	2	1	1
0.15 - 0.30	2	3	2	4	2	2
0.30 - 0.45	3	3	3	10	2	3
0.45 - 0.60	4	5	2	22	3	3
0.60 - 0.75	4	4	3	Refusal	4	3
0.75 - 0.90	10	6	4		4	3
0.90 - 1.05	16	7	8		5	7
1.05 - 1.20	22	12	10		6	14
1.20 - 1.35	Refusal	12	16		22	22
1.35 - 1.50		22	22		Refusal	Refusal
1.50 - 1.65		Discontinued	Refusal			
1.65 - 1.80						
1.80 - 1.95						
1.95 - 2.10						
2.10 - 2.25						
2.25 - 2.40						
2.40 - 2.55						
2.55 - 2.70						
2.70 - 2.85						
2.85 - 3.00						

Remarks: * Pre drilled prior to testing

Dynamic Cone Penetrometer Test Report

Project Number: GG11529.001
Site Address: Wilton Junction Public School
Test Date: 27/05/2024

Page: 2 of 2

Test Method: **AS1289.6.3.2**

Technician: JK

Test No	BH7					
Starting Level	Surface Level					
Depth (m)	Penetration Resistance (blows / 150mm)					
0.00 - 0.15	1					
0.15 - 0.30	2					
0.30 - 0.45	3					
0.45 - 0.60	3					
0.60 - 0.75	4					
0.75 - 0.90	6					
0.90 - 1.05	8					
1.05 - 1.20	9					
1.20 - 1.35	10					
1.35 - 1.50	22					
1.50 - 1.65	Refusal					
1.65 - 1.80						
1.80 - 1.95						
1.95 - 2.10						
2.10 - 2.25						
2.25 - 2.40						
2.40 - 2.55						
2.55 - 2.70						
2.70 - 2.85						
2.85 - 3.00						

Remarks: * Pre drilled prior to testing

SAMPLING & IN-SITU TESTING

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock. Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure. Undisturbed samples are taken by pushing a thin walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator.

Large Diameter Augers

Boreholes can be drilled using a large diameter auger, typically up to 300 mm or larger in diameter mounted on a standard drilling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration.

Diamond Core Rock Drilling

A continuous core sample of can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter (NMLC). The borehole is advanced using a water or mud flush to lubricate the bit and removed cuttings.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1. The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable, and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as: 15, 30/40 mm.

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.

- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

SOIL DESCRIPTIONS

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle Size (mm)
Boulder >200	Boulder >200
Cobble 63 - 200	Cobble 63 - 200
Gravel 2.36 - 63	Gravel 2.36 - 63
Sand 0.075 - 2.36	Sand 0.075 - 2.36
Silt 0.002 - 0.075	Silt 0.002 - 0.075
Clay <0.002	Clay <0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle Size (mm)
Coarse Gravel	20 – 63
Medium Gravel	6 – 20
Fine Sand	2.36 – 6
Coarse Sand	0.6 – 2.36
Medium Sand	0.2 – 0.6
Fine Sand	0.075 – 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion
And	Specify
Adjective	20 - 35%
Slightly	12 - 20%
With some	5 - 12%
With a trace of	0 - 5%

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained Shear Strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	ST	50 - 100
Very stiff	VST	100 - 200
Hard	H	200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (DCP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N Value	CPT qc value (MPa)
Very loose	VL	<4	<2
Loose	L	4 - 10	2 -5
Medium Dense	MD	10-30	5-15
Dense	D	30-50	15-25
Very Dense	VD	>50	>25

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Fill - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

ROCK DESCRIPTIONS

Rock Strength

The Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

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

* Assumes a ration of 20:1 for UCS to $IS_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Residual Soil	RS	Soil developed on extremely weathered rock, the mass structure and substance fabric are no longer evident.
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable.
Distinctly Weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured usually by iron staining.
Moderately weathered	MW	Staining and discolouration of rock substance has taken place.
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.

Degree of Fracturing

The following classification applies to the spacing of natural fractures in core samples (bedding plane partings, joints and other defects, excluding drilling breaks

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured Core	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Unbroken Core lengths mostly > 1000 mm

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

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

Rock Quality Designation

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

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

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

ABBREVIATIONS

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
ADT	Auger Drill TC Bit
ADV	Auger Drill V Brit
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

Z	Water seep
V	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
S	Chemical sample
U50	Undisturbed tube sample (50mm)
W	Water sample
PP	Pocket Penetrometer (kPa)
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

C	Crushed Seam
DB	Drilling Break
DL	Drilling Lift
EW	Extremely Weathered Seam
HB	Handling Break
IS	Infilled Seam
J	Joint
MB	Mechanical Break
P	Parting
S	Sheared Surface
SS	Sheared Seam
SZ	Sheared Zone

Orientation

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

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cn	clean
ct	coating
sn	stained
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pr	planar
st	stepped
un	undulating

Roughness

po	polished
rf	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

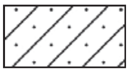
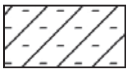
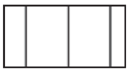
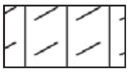
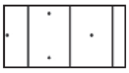
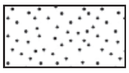
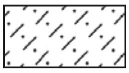
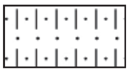
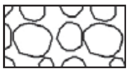
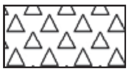
SYMBOLS

Graphic Symbols for Soil and Rock

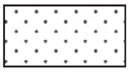
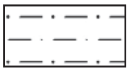
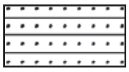
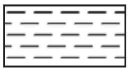
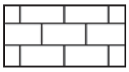
General

■	Asphalt
	Road base
	Concrete
	Filling

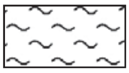
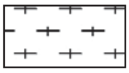
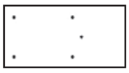
Soils

	Topsoil
	Peat
	Clay
	Silty clay
	Sandy clay
	Gravelly clay
	Shaly clay
	Silt
	Clayey silt
	Sandy silt
	Sand
	Clayey sand
	Silty sand
	Gravel
	Sandy gravel
	Cobbles, boulders
	Talus

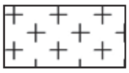
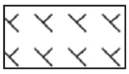
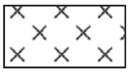
Sedimentary Rocks

	Boulder conglomerate
	Conglomerate
	Conglomeratic sandstone
	Sandstone
	Siltstone
	Laminite
	Mudstone, claystone, shale
■	Coal
	Limestone

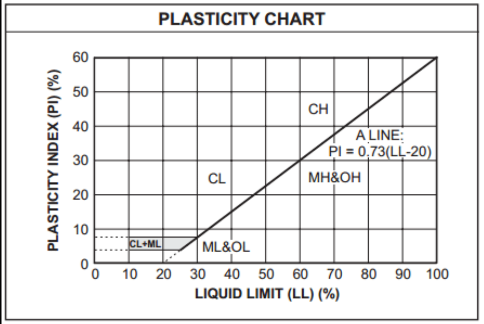
Metamorphic Rocks

	Slate, phyllite, schist
	Gneiss
	Quartzite

Igneous Rocks

	Granite
	Dolerite, basalt, andesite
	Dacite, epidote
	Tuff, breccia
	Porphyry

UNIFIED SOIL CLASSIFICATION TABLE

Field Identification Procedures (Excluding particles larger than 75um and basing fractions on estimated weights)							Group Symbols	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria			
Coarse-grained soils More than half of the material is large that 75um sieve size^b	The 75um sieve size is about the particle visible to the naked eye	Gravels More than half of the coarse fraction is larger than a 4mm sieve	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name: indicative approximate percentages of sand and gravel; maximum size; angularity; surface condition, and hardness of the coarse grains; local of geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty Sand*, gravelly; about 20% hard, angular gravel particles 12mm maximum size; rounded and subangular sand grains, coarse to fine, about 15% non-plastic fines low dry strength; well compacted and moist in place; alluvial sand; *(SM)*	Use grain size curve in identifying the fractions as given under field identification	Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than 75um sieve size) coarse grained soils are classified as follows Less than 5% GW, GP, SW, SP More than 12% GM, GC, SM, SC 5 to 12% Borderline cases requiring use of dual symbol	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
				Predominantly one size or range of sizes with some intermediate sizes missing			*GP*	Poorly graded gravels, grave-sand mixtures, little or no fines				Not meeting all graduation requirements for *GW*	
			Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)			*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures				Atterberg limits below "A" line or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are borderline cases of requiring use of dual symbols
				Plastic fines (for identification procedures see *CL* below)			*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures				Atterberg limits above "A" line with *PI* greater than 7	
		Sands More than half of the coarse fraction is smaller than a 4mm sieve	Clean sands (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			*SW*	Well graded sands, gravelly sands, little or no fines				$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
				Predominantly one size or range of sizes with some intermediate sizes missing			*SP*	Poorly graded sands, gravelly sands, little or no fines				Not meeting all graduation requirements for *SW*	
			Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)			*SM*	Silty sands, poorly graded sand-silt mixtures				Atterberg limits below "A" line or *PI* less than 5	Above "A" line with *PI* between 4 and 7 are borderline cases of requiring use of dual symbols
				Plastic fines (for identification procedures see *CL* below)			*SC*	Clayey sands, poorly graded sand-clay mixtures				Atterberg limits above "A" line with *PI* greater than 7	
Find-grained soils More than half of the material is smaller than 75um sieve size		Identification Procedures of Fractions Smaller than 380 um Sieve Size									 Plasticity Chart For laboratory classification of fine-grained soils		
		Silts and clays liquid limit less than 50		Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)							
				None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slit plasticity	Give typical name: indicative degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey Silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; *(ML)*				
				Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays					
				Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity					
		Silts and clays liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, clastic silts					
				High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays					
				Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity					
Highly Organic Soils				Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils					

Note:
1 Soils possessing characteristics of two groups are designated by combinations of group symbols (eg. GW-GC, well graded gravel-sand mixture with clay fines
2 Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity

APPENDIX B

LABORATORY TEST RESULTS

ASCT Illawarra
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Lab: 2/15 Miall Way, Albion Park Rail NSW 2527
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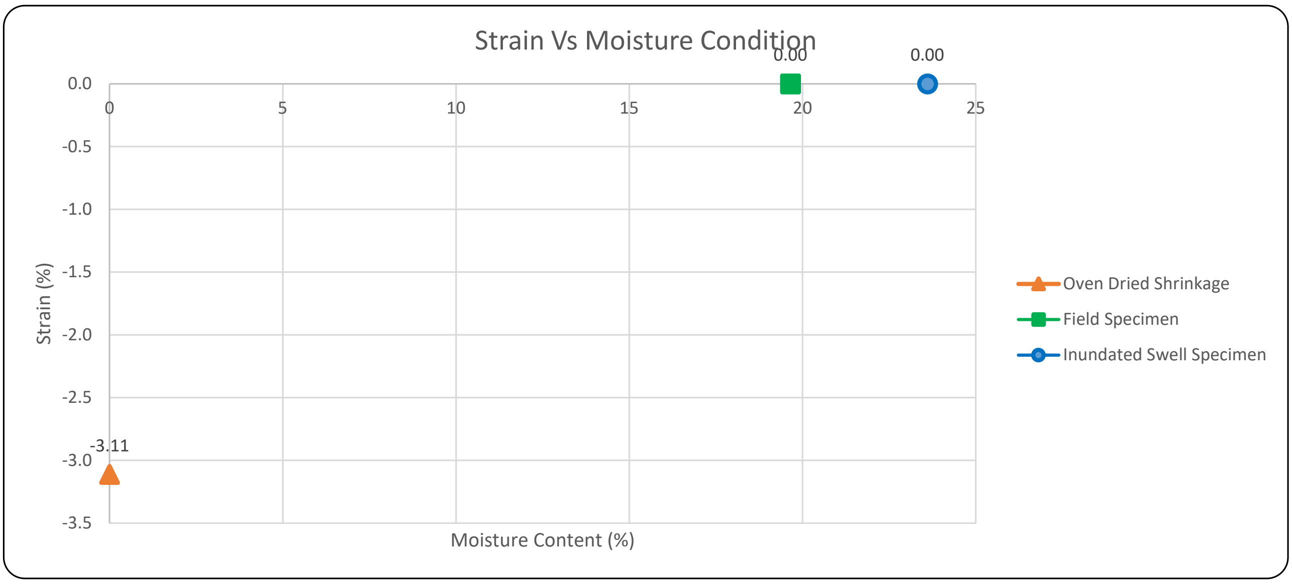
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

Report on Shrink / Swell Index of a Soil

Client:	ASCT Sydney South Laboratory	Report No:	**33-769-MQ**
Client Address:	Unit 10, 6 Gladstone Road, Castle Hill NSW 2154	Report Date:	12/06/2024
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	11 Greenbridge Dr, Wilton	Project No:	33
Material Used:	Insitu	Test Request/Order:	-
Material Description:	Silty CLAY	Lot Number:	GG11529
Lab Test Date/s:	Testing commenced 04/06/2024 and was completed 05/06/2024.	ITP/PCP Number:	-
Lot Comments:	-	Control Line:	-

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
24237	**27/05/2024**	**BH2**	**-**	**0.6 - 0.9**	**-**

Parameters	Units	Test Results	Soil Description
Shrinkage - Field Moisture Content	%	19.8	CH Silty CLAY red,brown
Swell - Field Moisture Content	%	19.5	
Swell - Inundated Moisture Content	%	23.6	
Inert Inclusions in the soil	%	0	
Extent of Soil Crumbling	-	None	
Extent of Soil Cracking	-	Minor	
Shrink-Swell Index	**%**	**1.7**	



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.7.1.1, Cl 4: (2003) Shrink Swell Index - Thin wall sampler (U50) AS 1289.7.1.1: (2003) Shrink Swell Index of a Soil	

NATA

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

Issued By:
P.Baltoski
Approved Signatory

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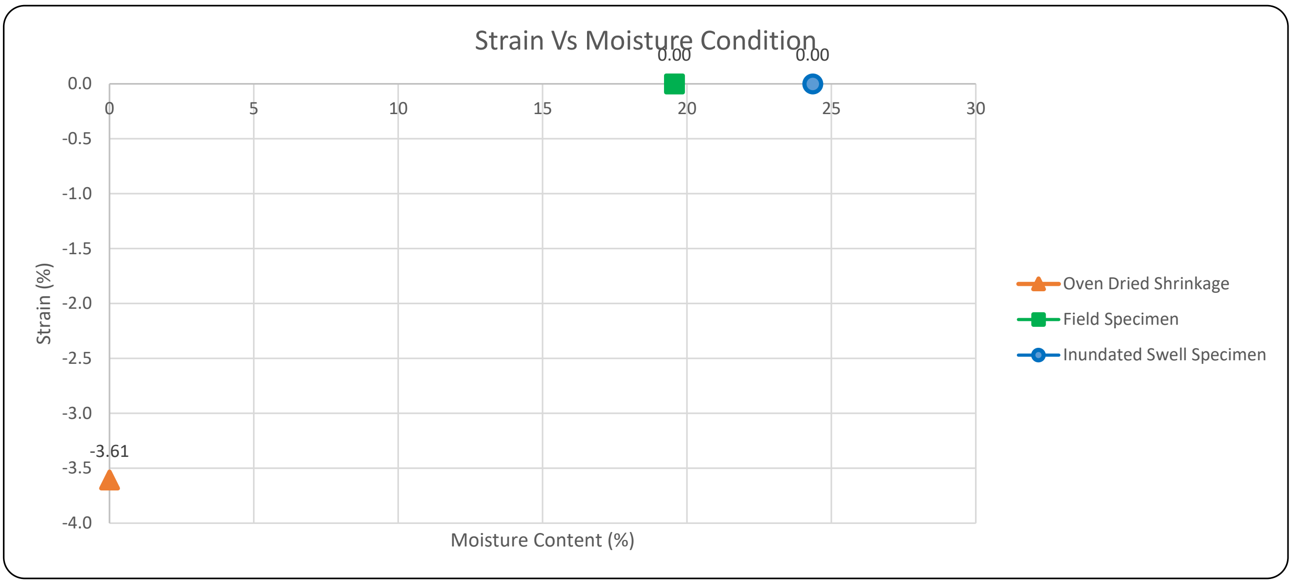
Report on Shrink / Swell Index of a Soil

Client:	ASCT Sydney South Laboratory	Report No:	**33-770-MQ**
Client Address:	Unit 10, 6 Gladstone Road, Castle Hill NSW 2154	Report Date:	12/06/2024
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	11 Greenbridge Dr, Wilton	Project No:	33
Material Used:	Insitu	Test Request/Order:	-
Material Description:	Silty CLAY	Lot Number:	GG11529
Lab Test Date/s:	Testing commenced 04/06/2024 and was completed 05/06/2024.	ITP/PCP Number:	-
Lot Comments:	-	Control Line:	-

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
24238	**27/05/2024**	**BH6**	**-**	**0.6 - 0.8**	**-**

Parameters	Units	Test Results	Soil Description
Shrinkage - Field Moisture Content	%	19.3	CH Silty CLAY red
Swell - Field Moisture Content	%	19.8	
Swell - Inundated Moisture Content	%	24.4	
Inert Inclusions in the soil	%	0	
Extent of Soil Crumbling	-	None	
Extent of Soil Cracking	-	Minor	
Shrink-Swell Index	**%**	**2.0**	



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.7.1.1, Cl 4: (2003) Shrink Swell Index - Thin wall sampler (U50) AS 1289.7.1.1: (2003) Shrink Swell Index of a Soil	

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NATA Accreditation number: 20656

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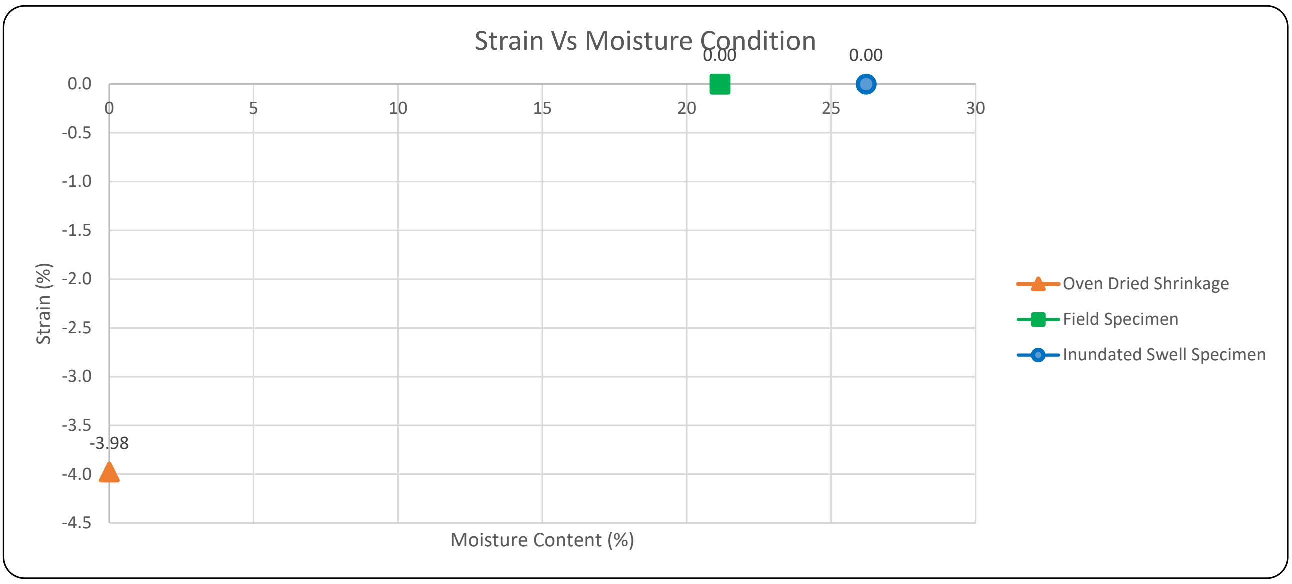
Report on Shrink / Swell Index of a Soil

Client:	ASCT Sydney South Laboratory	Report No:	**33-771-MQ**
Client Address:	Unit 10, 6 Gladstone Road, Castle Hill NSW 2154	Report Date:	12/06/2024
Project:	Geotechnical Testing	Report Page:	Page 1 of 1
Works Component:	11 Greenbridge Dr, Wilton	Project No:	33
Material Used:	Insitu	Test Request/Order:	-
Material Description:	Silty CLAY	Lot Number:	GG11529
Lab Test Date/s:	Testing commenced 04/06/2024 and was completed 05/06/2024.	ITP/PCP Number:	-
Lot Comments:	-	Control Line:	-

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
24239	**27/05/2024**	**BH7**	**-**	**0.6 - 0.8**	**-**

Parameters	Units	Test Results	Soil Description
Shrinkage - Field Moisture Content	%	21.1	CH Silty CLAY red
Swell - Field Moisture Content	%	21.2	
Swell - Inundated Moisture Content	%	26.2	
Inert Inclusions in the soil	%	0	
Extent of Soil Crumbling	-	None	
Extent of Soil Cracking	-	Minor	
Shrink-Swell Index	**%**	**2.2**	



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.7.1.1, Cl 4: (2003) Shrink Swell Index - Thin wall sampler (U50) AS 1289.7.1.1: (2003) Shrink Swell Index of a Soil	

NATA

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NATA Accreditation number: 20656

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A.B.N. 92 328 384 368

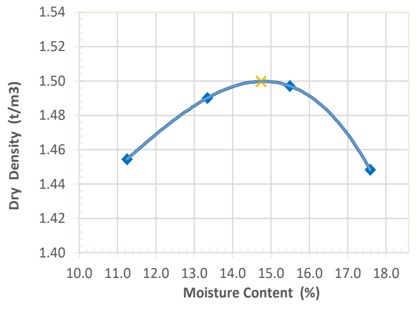
Report on AS CBR and MDD

Client:	Green Geotechnics Pty Ltd	Report No:	**241-606-CBR**
Client Address:	Po Box 3244, Rouse Hill, NSW, 2155	Report Date:	13/06/2024
Project:	Material Testing	Report Page:	Page 1 of 1
Works Component:	11 Greenbridge Dr, Wilton	Project No:	241
Material Used(Source):	Insitu	Test Request/Order:	**GG11529**
Material Description:	Silty Clay	Lot Number:	GG11529
Lot Boundaries:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 01/06/2024 to 13/06/2024	Control Line:	N/A

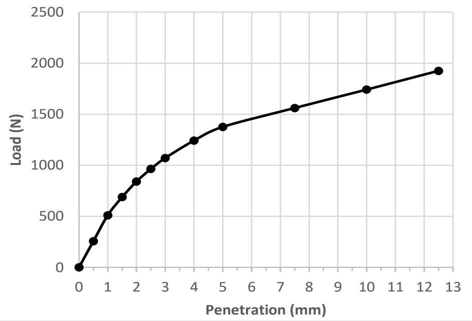
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
44016	**27/05/2024**	**N/A**	**N/A**	**BH4**	**0.4-1.1**

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 = 73 hrs	CBR = 170 hrs	
Soil Particle Density	t/m3	2.67		Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.500		Standard compactive effort
Optimum Moisture Content (OMC)	%	14.7		
Field/Prep Moisture Content	%	Field %	Prep 18.3 %	Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 14.6 %	LMR = 99.0%	Specified LMR = 100%
Compaction Dry Density	t/m3	Achieved 1.5 t/m3	LDR = 100.0%	Specified LDR = 100%
Surcharge Load	kg	4.5		
Period of Soaking	Days	Soaked - 4 Days		Dry Density (after soaking) = 1.49 t/m3.
Specimen Swell	%	0.5		
Moisture Content - Top 30mm	%	21.2		After Penetration
Moisture Content - Remaining	%	18.2		After Penetration

Dry Density Vs Moisture Content



Load-Penetration Curve



Material CBR Value (%)

7

California Bearing Ratios

$CBR_{2.5}$ = 7

$CBR_{5.0}$ = 7

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)

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

Report Remarks & Endorsement

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NATA Accreditation number: 20078

Issued By:
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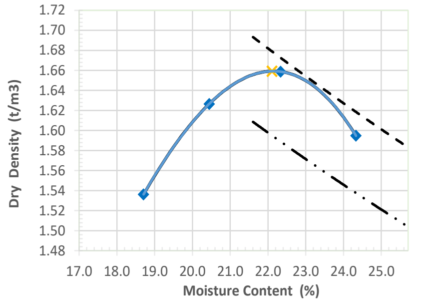
Report on AS CBR and MDD

Client:	Green Geotechnics Pty Ltd	Report No:	**241-607-CBR**
Client Address:	Po Box 3244, Rouse Hill, NSW, 2155	Report Date:	12/06/2024
Project:	Material Testing	Report Page:	Page 1 of 1
Works Component:	11 Greenbridge Dr, Wilton	Project No:	241
Material Used(Source):	Insitu	Test Request/Order:	**GG11529**
Material Description:	Silty Clay	Lot Number:	GG11529
Lot Boundaries:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 01/06/2024 to 12/06/2024	Control Line:	N/A

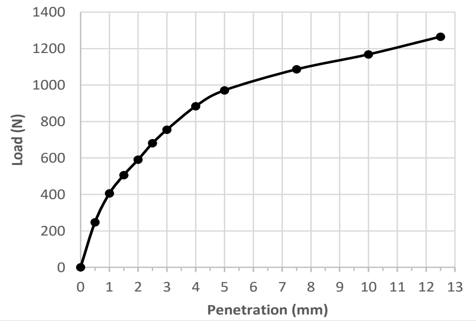
Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
44017	**27/05/2024**	**N/A**	**N/A**	**BH7**	**0.6-0.8**

Parameters	Units	Test Results		Information
Pretreatment Regime	--	No Pretreatment		
Portion Retained on AS Sieve	%	3% on 19mm		Retained material excluded from CBR
Material Plasticity (Liquid Limit)	--	Low (Less than 35%)		By Technician's Assessment
Sample Curing Time	hrs	MDD = 45 hrs	CBR = 147 hrs	
Soil Particle Density	t/m3	2.67		Estimated value only**
Maximum Dry Density (MDD)	t/m3	1.659		Standard compactive effort
Optimum Moisture Content (OMC)	%	22.1		
Field/Prep Moisture Content	%	Field %	Prep 22.6 %	Passing 19.0mm portion
Compaction Moisture Content	%	Achieved 21.9 %	LMR = 99.0%	Specified LMR = 100%
Compaction Dry Density	t/m3	Achieved 1.65 t/m3	LDR = 99.5%	Specified LDR = 100%
Surcharge Load	kg	4.5		
Period of Soaking	Days	Soaked - 4 Days		Dry Density (after soaking) = 1.65 t/m3.
Specimen Swell	%	0.0		
Moisture Content - Top 30mm	%	24.0		After Penetration
Moisture Content - Remaining	%	22.9		After Penetration

Dry Density Vs Moisture Content



Load-Penetration Curve



Material CBR Value (%)

5.0

California Bearing Ratios

CBR $_{2.5}$ = 5.0

CBR $_{5.0}$ = 5.0

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)

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

Report Remarks & Endorsement

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NATA Accreditation number: 20078

Issued By:
A.Clout
Approved Signatory

CERTIFICATE OF ANALYSIS

Work Order : **ES2417715**
Client : **GREEN GEOTECHNICS PTY LTD**
Contact : MR MATTHEW GREEN
Address : PO BOX 3244
ROUSE HILL 2155
Telephone : ----
Project : GG 11529
Order number : ----
C-O-C number : ----
Sampler : JL
Site : ----
Quote number : EN/222
No. of samples received : 12
No. of samples analysed : 12

Page : 1 of 5
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 29-May-2024 16:55
Date Analysis Commenced : 31-May-2024
Issue Date : 04-Jun-2024 17:27

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

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

General Comments

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

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

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

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

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

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

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

- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Sample ID*	**GG11529/S1**	**GG11529/S2**	**GG11529/S3**	**GG11529/S4**	**GG11529/S5**
			Sampling date / time	27-May-2024 00:00	27-May-2024 00:00	27-May-2024 00:00	27-May-2024 00:00	27-May-2024 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2417715-001**	**ES2417715-002**	**ES2417715-003**	**ES2417715-004**	**ES2417715-005**
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.2**	**5.5**	**5.8**	**5.6**	**5.9**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**31**	**110**	**34**	**75**	**51**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**20.1**	**8.3**	**17.8**	**11.4**	**22.4**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**30**	**60**	<10	**40**	**90**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	**30**	**100**	**20**	**60**	<10

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Sample ID*	**GG11529/S6**	**GG11529/S7**	**GG11529/S8**	**GG11529/S9**	**GG11529/S10**
			Sampling date / time	27-May-2024 00:00	27-May-2024 00:00	27-May-2024 00:00	27-May-2024 00:00	27-May-2024 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2417715-006**	**ES2417715-007**	**ES2417715-008**	**ES2417715-009**	**ES2417715-010**
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**5.8**	**6.5**	**6.2**	**5.6**	**5.8**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**48**	**34**	**49**	**58**	**32**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**20.0**	**21.2**	**19.0**	**16.2**	**18.9**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**60**	**50**	**20**	**40**	**50**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	**40**	**10**	**70**	**150**	<10

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

			Sample ID	**GG11529/S11**	**GG11529/S12**	**----**	**----**	**----**
			Sampling date / time	27-May-2024 00:00	27-May-2024 00:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**ES2417715-011**	**ES2417715-012**	**--------**	**--------**	**--------**
				Result	Result	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**6.0**	**6.1**	**----**	**----**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**35**	**23**	**----**	**----**	**----**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**21.4**	**17.3**	**----**	**----**	**----**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**60**	**30**	**----**	**----**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	**10**	**----**	**----**	**----**

APPENDIX C

CSIRO GUIDELINE

Foundation Maintenance and Footing Performance:

A Homeowner's Guide

BTF 18
replaces
Information
Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth
Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation
Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

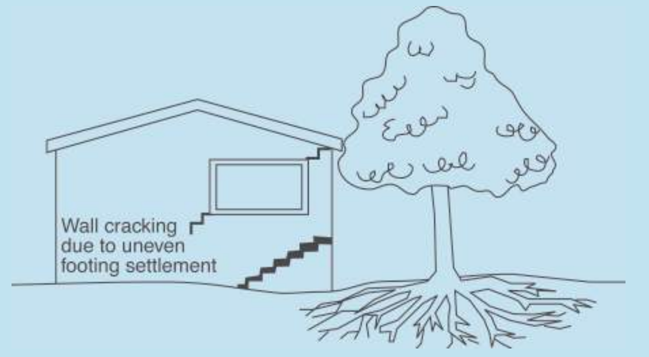
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay
Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage



As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots
In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself
Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures
Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures
Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures
Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing
Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation’s ability to support footings or even gain entry to the subfloor area.

Ground drainage
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

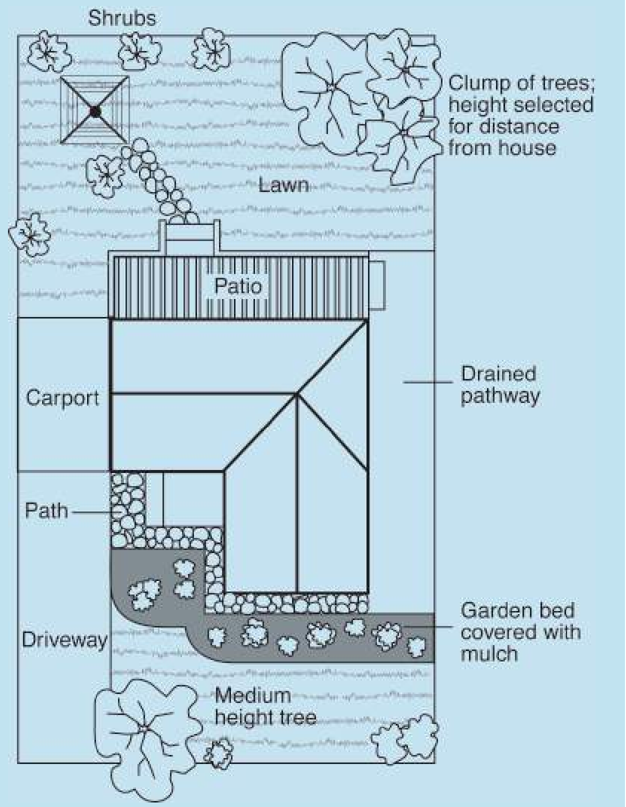
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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APPENDIX B

MINE SUBSIDENCE GUIDELINE 8

Surface Development Guideline 8

nsw.gov.au/departments-and-agencies/subsidence-advisory/subsidence-advisory-publications/surface-development-guideline-8 Printed: 15 January 2024

This page explains the requirements for building on a property in a Mine Subsidence District that has been assigned Guideline 8, it does not include proposed subdivisions.

On this page

Guideline 8 applies to properties that are not undermined, and future mining is not likely. These properties are assessed as not being at risk from mine subsidence.

Allowable residential construction

Guideline 8 does not apply restrictions on development for these properties.

Who can assess whether development complies with Guideline 8

Applications for proposed development that complies with this Guideline can be assessed by Subsidence Advisory, the relevant council or a registered certifier as defined in the **Environmental Planning and Assessment Act 1979 (https://www.legislation.nsw.gov.au/view/html/inforce/current/act-1979-203)**.

Disclaimer

Please note that Subsidence Advisory’s Surface Development Guidelines are subject to change.