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Geotechnical Investigation Report

Prepared for Department of Education & Communities

Arthur Phillip High School and Parramatta Public School
Macquarie Street, Parramatta

Project Number: 1915
Report Number: 1915-GR-1-1
Report date: 31st July 2015
Attention: Mr Roland Marshall

We give you the right information to make the right decisions

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INTRODUCTION AND SCOPE

This report presents the findings of a geotechnical investigation undertaken by Alliance Geotechnical Pty Ltd (AG) of Arthur Phillip High School and Parramatta Public School at Macquarie Street, Parramatta. It is understood redevelopment of the schools is proposed and will involve demolition of the existing buildings with the exception of the heritage buildings and the construction of new buildings. The new Arthur Phillip High School buildings will comprise a fifteen plus storey block and low rise buildings along Macquarie Street, whilst the new Parramatta Public School building will comprise a four to six storey building.

Geotechnical investigation was undertaken to provide information for the design of the new building footings, lot classification, soil aggressivity for steel and concrete structures. The investigation was commissioned by the Department of Education and Communities.

The geotechnical investigation comprised the drilling of thirteen (13) machine drilled geotechnical boreholes with insitu testing and sampling, followed by laboratory testing, engineering analysis and reporting. The results of the assessment are presented herein together with comments on the encountered subsurface profile, suitable foundation systems and design parameters for structures and potential geotechnical constraints.

SITE DESCRIPTION AND REGIONAL GEOLOGY

The schools are currently in use and are located on either side of Macquarie Street, and are bounded by Charles Street to the east; Smith Street and Barrack Lane to the west; existing commercial buildings to the north; and the Lancer Barracks and Little Street to the south. The combined site has an irregular shape with major dimensions of approximately 250m by 215m. Ground surface levels across the site typically fall to the north east from around RL 14m AHD in the south western corner to RL 7m AHD in the north eastern corner of the site.

Reference to the Sydney 1:100,000 Geological Series Sheet 9130 (Edition 1) 1983 indicates that the site is underlain by Ashfield Shale of Triassic Age. The Ashfield Shale is described as comprising black to dark grey shale and laminite. Quaternary Alluvium is indicated in areas to the south and east of the site.

The boreholes confirmed the geological mapping with Ashfield Shale encountered in the cored boreholes. Quaternary Alluvium was also encountered in the boreholes in the north eastern corner of the site.

FIELDWORK

Methods

The field investigation was undertaken between 30 June and 8 July 2015 and comprised the drilling of thirteen (13) geotechnical boreholes using a truck mounted Envirodrill drilling rig operated by Total Drilling. The boreholes were drilled using 100mm solid flight augers fitted with a TC (Tungsten Carbide) drill bit. Rotary coring of the upper highly weathered bedrock was undertaken at BH12 to advance the borehole to the top of sound rock. Diamond coring of the bedrock was then undertaken in eight (8) of the boreholes (BH1, BH2, BH3, BH5, BH8, BH10, BH12 and BH13). The recovered rock core was boxed and logged on site and then returned to our office for core photography, point load and UCS testing. A geotechnical engineer from AG was on site full time and directed the insitu testing, sampling, tactile assessment and logging of the subsurface strata profile. The approximate borehole locations are shown on the Drawing 1915 provided in Appendix A.

The borehole co-ordinates and surface levels were obtained using a DGPS Rover and are tabulated in Appendix A. The surface levels are also recorded on the borehole logs.

Results

For details of the conditions encountered in the boreholes reference should be made to the borehole logs provided in Appendix A.

The general subsurface profile encountered at the borehole locations is summarised below:

- FILL – Encountered at all locations to depths of 0.3m (BH7, BH10, BH11 in pavement areas) to 1.5m (BH2 playing fields). Generally comprising sandy gravel in pavement areas (BH1, BH7, BH8, BH11, BH12 and BH13) and gravelly, silty and sandy clay elsewhere.
- ALLUVIUM – Encountered in BH3 and BH6 only to depths of 4.7m and 5.1m respectively. Comprising interbedded Silty Clay - firm and stiff, grey and brown; and Silty and Clayey Sand- loose and medium dense, grey and brown.
- RESIDUAL SOILS – Encountered in all boreholes except those with alluvium, to depths of 1.5m (BH5 and BH11) to 5.0m (BH2). Comprising Silty Clay – stiff to very stiff, grey, brown, orange brown and red brown, with SPT N values ranging from 12 to 36 with an average N value of 19.
- SHALE – the boreholes typically encountered a relatively deeply weathered profile in the cored boreholes except for those overlain by alluvium, with the thickness of extremely low to low strength bedrock ranging from 2.8m in BH1 to 5.8m in BH13. Where alluvium was encountered the highly weathered rock was relatively thin (0.8m thick in BH3). Below the deeply weathered extremely low to low strength profile, the shale was medium to high strength with some very high strength bands.

Groundwater

Groundwater observations during auger drilling are presented in Table 1. Note that the use of drilling fluids during coring and wash boring does not readily allow groundwater observations during drilling.

Table 1 - Groundwater Observations During Drilling

Borehole	Depth (m)	RL (m AHD)	Strata
BH2	1.7	5.9	Residual
BH3	1.7	5.0	Alluvium
BH6	3.6	3.3	Alluvium

LABORATORY TESTING

The following laboratory tests were undertaken:

Soil

- Particle Size Distribution (PSD) and Hydrometer: (6)
- Moisture Content: (6)
- Atterberg Limits and Linear Shrinkage: (6)
- Emerson Class Number: (6)
- Shrink Swell Index: (1)
- Soil Aggressivity: (10)

Rock

- Point Load Testing: (80)
- UCS: (12)

Soil Laboratory Test Results

The results of the soil laboratory tests are summarised presented in Table 2. The laboratory test certificates are presented in Appendix B.

Table 2 - Soil Laboratory Test Results

Borehole	Depth	Strata	Moisture Content (%)	Atterberg Limits + LS (%)					Emerson Class Number	Shrink Swell Index (% per pF)	PSD + Hydrometer	Soil Aggressivity
				FMC (%)	LL (%)	PL (%)	PI (%)	LS (%)				
BH1	1.5-2.5	Silty Clay, red brown	-	16.6	48	19	29	13.0	-	-	-	●
BH2	2.0	Silty Clay, brown	-	22.5	25	13	22	5.5	-	-	-	●
BH2	4.0	Silty Clay, grey and brown	17.7	-	-	-	-	-	2	-	●	-
BH3	1.0	Fill – silty clay	-	12.9	19	13	6	3.0	-	-	-	-
BH3	2.5	Clayey Sand, brown	-	-	-	-	-	-	-	-	-	●
BH5	0.5-1.0	Silty Clay, red brown	-	10.0	34	19	15	9.0	-	-	-	-
BH5	1.0	Silty Clay, red brown	12.1	-	-	-	-	-	1	-	●	-
BH5	1.5-1.8	Siltstone, red brown	-	10.6	35	20	15	7.0	-	-	-	●
BH6	1.0	Fill – Silty Clay, grey and brown	19.8	-	-	-	-	-	2	-	●	-
BH6	4.0	Clayey Sand, brown	-	-	-	-	-	-	-	-	-	●
BH9	1.0	Gravelly Clay, dark grey	15.4	-	-	-	-	-	1	-	●	-
BH9	U_{50} 1.5	Silty Clay, red brown and grey	-	-	-	-	-	-	-	2.4	-	-
BH9	1.5-1.9	Silty Clay, red brown and grey	-	18.6	43	22	21	9.0	-	-	-	●
BH9	2.5-3.0	Silty Clay, grey	-	-	-	-	-	-	-	-	-	●
BH10	1.0	Silty Clay, light grey and brown	-	-	-	-	-	-	-	-	-	●
BH10	1.45-1.6	Silty Clay, light grey and brown	19.7	-	-	-	-	-	3	-	●	●
BH12	1.5	Silty Clay, orange brown	-	-	-	-	-	-	-	-	-	●
BH12	3.0	Silty Clay, light grey	17.9	-	-	-	-	-	2	-	●	-

● Test Performed, results described further

The Atterberg Limit tests indicate that the test soils are in the range of low to medium plasticity, which is consistent with the logging.

The shrink swell test indicates that the soils are moderately reactive, and this information is relevant to the lot classification and design of residential type structures. Two tests were originally scheduled, however, one of the samples broke on extrusion rendering it unsuitable to be tested.

The Emerson Class Numbers 1, 2 and 3 indicate that the tested soils exhibit partial to complete dispersion, which indicates that the soils should be protected in surface exposures.

The PSD and Hydrometer test results confirm that the soils are predominantly silty clays, which is consistent with the logging.

Soil Aggressivity

Soil Samples collected during the field investigation were analysed for the following chemical parameters in accordance with the AS2870 – 2011 and AS2159 – 2009 for steel and concrete exposure classifications.

- pH;
- EC;
- Chloride;
- Sulphate; and
- Resistivity

Electrical Conductivity

Salt separates into positively and negatively charged ions when dissolved in water, the electrical conductivity of the water increases as the amount of salt increases. To test the electrical conductivity of soil one part of soil is mixed with 5 parts of water. The result is then multiplied by the soil texture conversion factor to give the final extract electrical conductivity (ECe) figure.

Table 3 – Electrical Conductivity Exposure Classification

Class	ECe (ds/m)	Effects	Exposure Classification for Concrete (AS 2870 – 2011 from Tables 5.1 & 5.3)
Non Saline	< 2	Salinity effects mostly negligible	A1 (min. F'c = 20 MPa)
Slightly Saline	2-4	Yields of very sensitive crops may be affected	A1 (min. F'c = 20 MPa)
Moderately Saline	4-8	Yields of many crops affected	A2 (min. F'c = 25 MPa)
Very Saline	8-16	Only tolerant crops yield Satisfactorily	B1 (min. F'c = 32 MPa)
Highly Saline	>16	Only a very few tolerant crops yield satisfactorily	B2 (min. F'c = 40MPa)

The EC result recorded by SGS was converted to extract electrical conductivity (EC_e; having units of dS/m), by multiplying it by the adopted soil texture conversion factor. For silty clay, a texture conversion factor of 8.5 was adopted (NSW Department of Primary Industries). The EC_e values (0.357 to 2.635) indicate that the examined site soils were variable in soluble salt content, with non-saline to slightly saline figures being recorded.

pH

Measures acidity or alkalinity of soil and is important in determining the aggressiveness of the soil to building materials.

Table 4 – pH Exposure Classification

Concrete Structure		Steel Structures	
pH	Classification	pH	Classification
>5	Non Aggressive	>4	Non Aggressive
4.5 – 5	Mild	3 – 4	Mild
4.0 – 4.5	Moderate	<3	Moderate
<4.0	Severe	-	-

Analysis of the acidity (pH) found the material had an acidity of 4.3 to 6.7 pH units (1:5 – Soil:Water) which is considered to be mildly aggressive to concrete however non aggressive to steel.

Chlorides and Sulphates

Chlorides and Sulphates are negatively charged ions (anions) which are corrosive to building material, particularly steel and concrete.

Table 5 – Chloride and Sulphate Exposure Classification

Concrete Structure		**Steel Structures**	
Sulphate (SO4) Units (mg/kg)	Classification	Chloride Units (mg/kg)	Classification
<5000	Non Aggressive	<20000	Non Aggressive
5000 –10000	Mild	20000-50000	Mild
10000 – 20000	Moderate	>50000	Moderate
>20000	Severe	-	-

Sample test results indicate that both the sulphate (5.9 to 350 mg/kg) and chloride (1.1 to 89 mg/kg) concentrations are within the non-aggressive range to both concrete and steel.

Resistivity

Resistivity values were calculated based on raw EC values. Resistivity values for the soil samples ranged from 3200 to 24000 ohm.cm. The soil resistivity values indicate that the soils are non aggressive to concrete and steel.

Based on the findings from this assessment it was concluded that:

- The excavated material is considered non saline to slightly saline.
- The excavated material is considered mildly aggressive to concrete however non aggressive to steel.

Rock Laboratory Test Results

The results of the soil laboratory tests are summarised presented in Table 6. The laboratory test certificates are presented in Appendix C.

Table 6 - Rock Laboratory Test Results

Borehole	Depth	Rock Type	UCS (MPa)	PL (MPa)	Rock Strength	Ratio UCS/PL
BH2	3.086-6.320	Shale	78	-	Very High	14.3
BH2	6.04	Shale	-	5.44	Very High	
BH2	7.800-7.988	Shale	76	-	Very High	32
BH2	7.61	Shale	-	2.36	High	25.8
BH2	8.04	Shale	-	2.95	High	
BH3	7.31-7.46	Shale	57	-	High	32
BH3	7.24	Shale	-	1.78	High	24.6
BH3	7.88	Shale	-	2.32	High	
BH3	9.24-9.51	Shale	72	-	High	36.9
BH3	9.19	Shale	-	1.95	High	
BH5	5.32-5.65	Shale	15	-	Medium	39.5
BH5	5.63	Shale	-	0.38	Medium	
BH5	7.69-7.88	Shale	27	-	High	14.4
BH5	7.88	Shale	-	1.88	High	
BH8	7.54-7.84	Shale	12	-	Medium	35.2
BH8	7.87	Shale	-	0.34	Medium	
BH8	9.54-9.71	Shale	17	-	Medium	11.0
BH8	9.79	Shale	-	1.54	High	
BH10	10.34-10.52	Shale	14	-	Medium	21.9
BH10	10.49	Shale	-	0.64	Medium	
BH13	11.16-11.32	Shale	19	-	Medium	10.3
BH13	11.20	Shale	-	1.85	High	
					Average	24.8

COMMENTS AND RECOMMENDATIONS

It is understood that the proposed development will involve the demolition of the existing non-heritage building and the construction of new multi-storey buildings. No basement or significant extents of cut or fill have been proposed.

It is noted that along Smith Street, in the vicinity of the heritage buildings, open playing fields are proposed and hence significant excavation or the use of deep foundations is not considered likely in that area.

At the other end of the site in the north eastern corner near Charles Street, firm and loose alluvium was encountered with the water table at 1.7m depth in BH3. If deep excavations were to be considered in this area, temporary dewatering or installation of cut off walls to rock and tanking of the structures would likely be required. Hence, deep excavations are not recommended in the eastern areas of the site that are or may be underlain by alluvium.

The construction of shallow excavations, involving the use of temporary and/or permanent batter slopes or low retaining walls may be required across the site.

Excavation Conditions

Any shallow excavations would likely be in clayey fill, stiff to very stiff silty clays and possibly extremely low strength siltstone / shale (for excavations in the south eastern corner). Fill and water charged alluvium would be expected in the north eastern corner of the site. The fill soils and extremely low strength rock are expected to be readily excavatable using conventional earthmoving equipment such as dozers, excavators or other mechanical plant.

The soil laboratory test results indicate that the site soils are liable to full or partial dispersion. It is therefore recommended that the soils be protected from erosion and dispersion during construction by covering them with a 100mm thick granular working platform. In the long term, otherwise unprotected soils should be covered with topsoil and vegetated.

Excavation Stability and Batter Slopes

Temporary batter slopes could be appropriate for excavations not encountering groundwater seepage and provided the excavations are set back sufficiently from the site boundaries. The recommended maximum slopes for excavated batters are presented in Table 7.

Table 7 - Recommended Maximum Batter Slopes

Unit	Maximum Batter Slope (H : V)	
	Permanent	Temporary
Stiff to very stiff clay / compacted cohesive fill to 2.5m maximum height	2.5 : 1*	1 : 1
Extremely Low Strength Rock	Inspection Required	1 : 1*

* All batter slopes should be inspected by an experienced geotechnical engineer

It must be noted that the above recommended batter slopes are only applicable for excavations where the battered or benched soils do not extend below the “zone of influence” of adjacent structures ie. a line drawn 45° down from the foundation level of adjacent neighbouring buildings and structures or features (including paths, fences, stairs etc). Where there is insufficient space for batter construction and excavations extend below this line then the proposed excavations must be retained prior to excavation and excavations should be supported by means of temporary or permanent retaining structures. These structures should be designed to withstand the applied lateral pressures of the subsurface soils layer, the existing surcharges in their zone of influence, and hydrostatic pressures due to possible water inflow or seepage.

Retaining Structures

It is anticipated that low retaining walls up to 2.5m could be considered. Suitable support should be designed for all boundary walls. These structures should be designed to withstand the applied lateral pressures of the subsurface soils layer, surcharges in their zone of influence, and hydrostatic pressures if appropriate, using a triangular pressure distribution using the following formula:

$$p_h = \gamma kH + qk$$

where specified:

- p_h = Horizontal pressure (kN/m^2)
- γ = Unit weight of soil (kN/m^3)
- k_a = Coefficient of earth pressure
- H = Retained height (m)
- q = Surcharge pressure on the high side of a retaining wall (kN/m^2)

For the design of flexible retaining structures, where some lateral movement is acceptable, an active lateral earth pressure coefficient is recommended (Ka). If it is critical to limit the horizontal deformation of a retaining of an earth pressure coefficient "at rest" should be considered (Ko). Recommended parameters for the design of earth retaining structures in the underlying sand layers are as follows in Table 8 below.

Table 8 – Preliminary Geotechnical Design Parameters for Retaining Walls

Paramaters	Stiff Clay (St-VSt)	Controlled Fill - cohesive	Extremely Low Strength Rock
Ka	0.4	0.4	0.4
Ko	0.58	0.58	0.58
Poisson Ratio (v)	0.3	0.3	0.3
Effective Cohesion c' (kPa)	2	0	25
Effective Internal Friction Angle (degrees)	25	25	25
Bulk Unit Weight (kN/m^3)	18	18	20

Shallow Foundations

The investigation has encountered filling, which was predominantly cohesive clay, across the site to depths of 0.3 – 1.5m. In the absence of compaction records or a detailed assessment demonstrating adequate compaction, moisture content and materials composition, the filling is considered uncontrolled and hence unsuitable for the support of structures. For parts of the site underlain by uncontrolled fill, the applicable lot classification would be Class P "Problem Site" in accordance with AS2870 "Residential Slabs and Footings".

Based on the results of the one shrink swell test result for the site, an indicative lot classification can be provided however, further testing would be required to confirm the classification at the specific locations. The indicative lot classification for where the natural soils are exposed is Class M "Moderately Reactive".

Shallow footings bearing in residual clays of stiff to very stiff consistency may be designed for a maximum allowable bearing pressure of 150kPa. Footings bearing in extremely low strength rock or stronger may be designed upon an allowable bearing pressure of 600kPa.

Bored Pile Foundations

It is expected that the structural loads from the multi-storey buildings will be taken and the use of bored and cast insitu reinforced concrete piles are considered appropriate. The piles should be socketed within the medium to high strength Class III sandstone underlying the site. Recommended parameters for the design of piled foundations are provided in Table 9.

Table 9 - Recommended Parameters for the Design of Piled Foundations

Rock Strength	Bearing Pressure (kPa)		Shaft Adhesion (kPa)	
	SLS	ULS	SLS	ULS
Extremely Low to Very Low	600	3,000	20	75
Low Strength	1,200	6,000	75	150
Medium Strength	6,000	30,000	350	700

SLS – Serviceability Limit State
ULS – Ultimate Limit State

Expected settlements are <1% of the footing diameter at the SLS bearing pressures.

In the areas underlain by alluvium, in the north eastern corner of the site, it is expected that temporary casings installed down to and sealed into the top of the rock will be required to prevent side wall collapse and significant groundwater inflow.

Shaft adhesion should be reduced or ignored if the socket lengths are smeared or fail to satisfy the socket requirements. Concrete should be placed within 24 hours of excavation as the weathered bedrock may deteriorate rapidly upon exposure.

If part of the footing system is founded on rock it is strongly recommended that all footings be founded on the rock to reduce the potential for differential movements. All foundations should be inspected for the quality and material type including the base cleanliness by a geotechnical engineer prior to placement of concrete.

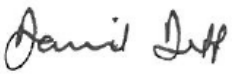
Groundwater Control

It is expected the seepage may occur within shallow excavations during periods of high rainfall during earthworks on the site. It is anticipated that such seepage can be easily controlled using sump-and-pump techniques, and should not adversely affect adjoining properties provided that sufficient drainage is implemented during and after earthworks. It should be noted that groundwater levels may fluctuate due to rainfalls and seasonal weather conditions and the conditions across the surrounding landscape. It is recommended potential seepage water levels be investigated if construction is undertaken during or following adverse weather.

Should you need any further information, please do not hesitate to contact us.

Regards,

Reviewed By,



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REFERENCES

References

- AS1726-1993 - Geotechnical Site Investigations
- The 1:100,000 NSW Department of Mines, Geological Map for Sydney

APPENDIX A

- Site Plan – Geotechnical Borehole Locations
- Explanatory Notes
- Borehole Logs
- Core Photographs

Borehole Co-ordinates and Levels

Borehole	Easting	Northing	Level (m AHD)
BH1	315568.571	6256533.243	9.735
BH2	315631.553	6256507.705	7.568
BH3	315677.928	6256494.505	6.678
BH4	315558.207	6256504.413	10.739
BH5	315625.083	6256470.690	7.812
BH6	315668.319	6256453.391	6.886
BH7	315637.142	6256424.862	10.202
BH8	315663.172	6256412.153	8.166
BH9	315633.394	6256383.191	11.080
BH10	315600.240	6256359.543	12.732
BH11	315660.554	6256374.616	9.146
BH12	315465.874	6256451.696	11.485
BH13	315517.413	6256400.255	12.955

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Geotechnical Borehole Locations

Not To Scale

Source: SIX Maps (www.maps.six.nsw.gov.au)

EXPLANATORY NOTES - DRILL & EXCAVATION LOGS

GENERAL

Information obtained from site investigations is recorded on log sheets. The "Cored Drill Hole Log" presents data from an operation where a core barrel has been used to recover material - commonly rock. The "Non-Core Drill Hole - Geological Log" presents data from an operation where coring has not been used and information is based on a combination of regular sampling and insitu testing. The material penetrated in non-core drilling is commonly soil but may include rock. The "Excavation - Geological Log" presents data and drawings from exposures of soil and rock resulting from excavtion of pits, trenches, etc.

The heading of the log sheets contains information on Project Identification, Hole or Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material substance description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The common depth scale is 8m per drill log sheet and about 3-5m for excavation logs sheets.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is inevitable in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures. Material description and classifications are based on SAA Site Investigation Code AS 1726 - 1993 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

DRILLING

Drilling & Casing

AS	Auger Screwing
AD/V	Auger Drilling with V-Bit
AD/T	Auger Drilling with TC Bit
WB	Wash-bore drilling
RR	Rock Roller
NMLC	NMLC core barrel
NQ	NQ core barrel
HMLC	HMLC core barrel
HQ	HQ core barrel

Drilling Fluid/Water

The drilling fluid used is identified and loss of return to the surface estimated as a percentage.

Drilling Penetration/Drill Depth

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

VE	Very Easy
E	Easy
F	Firm
H	Hard
VH	Very Hard

Groundwater Levels

Date of measurement is shown.

Standing water level measured in completed borehole

Level taken during or immediately after drilling

Samples/Tests

D	Disturbed
U	Undisturbed
C	Core Sample
SPT	Standard Penetration Test
N	Result of SPT (*sample taken)
VS	Vane Shear Test
IMP	Borehole Impression Device
PBT	Plate Bearing Test
PZ	Piezometer Installation
HP	Hand Penetrometer Test

EXCAVATION LOGS

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the "Structure and other Observations" column. The depth of the base of excavation (for the logged section) at the appropriate depth in the "Material Description" column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added.

MATERIAL DESCRIPTION - SOIL

Classification Symbol - In accordance with the Unified Classification System (AS 1726-1993, Appendix A, Table A1)

Material Description - In accordance with AS 1726-1993, Appendix A2.3

Moisture Condition

D	Dry, looks and feels dry
M	Moist, No free water on remoulding
W	Wet, free water on remoulding

Consistency - In accordance with AS 1726-1993, Appendix A2.5

VS	Very Soft	< 25kPa
S	Soft	25 - 50kPa
F	Firm	50 - 100kPa
St	Stiff	100 - 200kPa
VSt	Very Stiff	200 - 400kPa
H	Hard	≥ 400kPa

Strength figures quoted are the approximate range of Unconfined Compressive Strength for each class.

Density Index. (%) is estimated or is based on SPT results. Approximate N Value correlation is shown in right column.

VL	Very Loose	< 15%	0 - 4
L	Loose	15 - 35%	4 - 10
MD	Medium Dense	35 - 65%	10 - 30
D	Dense	65 - 85%	30 - 50
VD	Very Dense	> 85%	> 50

MATERIAL DESCRIPTION -ROCK

Material Description

Identification of rock type, composition and texture based on visual features in accordance with AS 1726-1993, Appendix A3.1-A3.3 and Tables A6a, A6b and A7.

Core Loss

Is shown at the bottom of the run unless otherwise indicated.

Bedding

Description	Spacing (mm)
Thinly Laminated	< 6
Laminated	6 - 20
Very Thinly Bedded	20 - 60
Thinly Bedded	60 - 200
Medium Bedded	200 - 600
Thickly Bedded	600 - 2000
Very Thickly Bedded	> 2000

Weathering - No distinction is made between weathering and alteration. Weathering classification assists in identification but does not imply engineering properties.

Fresh (F)	Rock substance unaffected by weathering
Slightly Weathered (SW)	Rock substance partly stained or discoloured. Colour and texture of fresh rock recognisable.
Moderately Weathered (MW)	Staining or discolouration extends throughout rock substance. Fresh rock colour not recognisable.
Highly Weathered (HW)	Stained or discoloured throughout. Signs of chemical or physical alteration. Rock texture retained.
Extremely Weathered (EW)	Rock texture evident but material has soil properties and can be remoulded.

Strength - The following terms are used to described rock strength:

Rock Strength Class	Abbreviation	Point Load Strength Index, Is(50) (MPa)
Extremely Low	EL	< 0.03
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	≥ 10

Strengths are estimated and where possible supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical estimated strength by using:

- ° Diametral Point Load Test
- • Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown.

MATERIALS STRUCTURE/FRACTURES

ROCK

Natural Fracture Spacing - A plot of average fracture spacing excluding defects known or suspected to be due to drilling, core boxing or testing. Closed or cemented joints, drilling breaks and handling breaks are not included in the Natural Fracture Spacing.

Visual Log - A diagrammatic plot of defects showing type, spacing and orientation in relation to core axis.

Defects	————	Defects open in-situ or clay sealed
	- - - - - - -	Defects closed in-situ
	.....	Breaks through rock substance

Additional Data - Description of individual defects by type, orientation, in-filling, shape and roughness in accordance with AS 1726-1993, Appendix A Table A10, notes and Figure A2.

Type	BP	Bedding Parting
	JT	Joint
	SM	Seam
	FZ	Fracture Zone
	SZ	Shear Zone
	VN	Vein
	FL	Foliation
	CL	Cleavage
	DL	Drill Lift
	HB	Handling break
	DB	Drilling break

Orientation - angle relative to the plane normal to the core axis.

Infilling	CN	Clean
	X	Carbonaceous
	Clay	Clay
	KT	Chlorite
	CA	Calcite
	Fe	Iron Oxide
	Qz	Quartz
	MS	Secondary Mineral
	MU	Unidentified Mineral
Shape	PR	Planar
	CU	Curved
	UN	Undulose
	ST	Stepped
	IR	Irregular
	DIS	Discontinuous
Roughness	POL	Polished
	SL	Slickensided
	S	Smooth
	RF	Rough
	VR	Very Rough

SOIL

Structures - Fissuring and other defects are described in accordance with AS 1726-1993, Appendix A2.6, using the terminology for rock defects.

Origin - Where practicable an assessment is provided of the probable origin of the soil, eg fill, topsoil, alluvium, colluvium, residual soil.

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BH No: BH01
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Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 1/7/15
Finished: 1/7/15
Borehole Size: 110mm Dia
Equipment: TD104
Logged: PC
RL Surface: 9.735
Bearing: ---
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering	9	0			Sandy GRAVEL, low plasticity, dark brown		M	L	Fill
			1		CL	Silty CLAY, low to medium plasticity, dark grey		M	St	Residual
		8	2		CL	Silty CLAY, low to medium plasticity, red-brown, trace of Ironstone gravel	SPT 4, 6, 8 N=14	M	St	
					CL	Increase in Ironstone Content		D	VSt	
		7	3		CL	Silty CLAY, low plasticity, grey and brown mottled, trace of Ironstone gravel, low 'TC' bit resistance	SPT 15, 15, 21 N=36	SM	Vst	
					CL	Silty CLAY, low to medium plasticity, trace of EW Siltstone		SM	VSt	
		6	4			SILTSTONE, light grey and brown, low strength, infrequent clay bands, trace of Ironstone gravel, low 'TC' bit resistance at 4.0m				Bed Rock
						Moderate 'TC' bit resistance	SPT 16, 22, R			
						High 'TC' bit resistance at 4.5m				
		5	5			Borehole BH01 continued as cored hole				
		4	6							
		3	7							
		2	8							
		1	9							

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BH No: BH01
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Job No:1915

Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 1/7/15
Finished: 1/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 9.735 **Bearing:** ---
Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
		9	1								
		8	2								
		7	3								
		6	4								
					Continued from non-cored borehole						
NMLC		5	5		SHALE, dark grey with orange and ligh grey laminations, extremely low strength	HW		A 0.05 A 0.07	0		4.6 4.8, FZ, EW HW zone 4.95, BP, HZ PR, CN, RF, OP 4.97, BP, HZ PR, CN, RF, OP 5.13, BP, HZ, PR, RF, OP 5.23, CS, HW zone, 20mm
		4	6					A 0.05 A 0.03			5.39, BP, HZ, PR, RF, OP 5.47, BP, HZ, PR, SO,CL 5.59, BP, HZ, PR, SO,CL 5.7, BP, HZ, PR, SO,CL 5.75, SM, HZ, CLAY, 10mm 5.8, SM, HZ, CLAY, 10mm 5.85, BP, HZ, PR, CN, CL 5.95, BP, HZ, PR, CN, CL 6.08, BP, HZ, PR, MS, OP 6.22-6.80, FZ, EW zone, IR + BP & SM
		3	7		SHALE, light grey and dark grey, extremely low strength	EW			10		
		2	8		SHALE, dark grey and orange, extremely low to very low strength	HW		A 0.1 A 0.2			6.85, JT, 30°, CN, CL, FE 6.9-7.0, JT, 90°, VT, ST, FE, RF, CL 7.08, JT, 5°, FE, RF, CL 7.21, BP, HZ, UN, FE, OP 7.23, BP, HZ, UN, FE, OP 7.25, BP, HZ, PR, CN, CL 7.28, BP, HZ, PR, CN, CL 7.31, BP, HZ, UN, RF, OP 7.35, BP, HZ, UN, RF, OP 7.40, JT, 30°, CU, FE, RF 7.51, BP, HZ, PR, FE, OP 7.65, CS, EW zone, 15mm 7.89, CS, EW zone, 10mm 7.92, BP, HZ, CU, CN, RF, CL 8.20, DB, HZ, UN, CN, RF, OP 8.22, JT, 45°, CN, CL 8.28, JT, 40°, FE, OP 8.35, BP, HZ, PR, CN, SO, CL 8.58, BP, HZ, PR, CN, SO, CL 8.72, CB, HZ, ST, MS, RF, OP 8.78, BP, HZ, PR, CN, RF, CL
		1			SHALE, dark grey, low to moderate strength	MW		A 0.53 A 0.72 A 1.12 A 1.3	53		
			9		BH01 terminated at 8.85m						

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Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School

Started: 2/7/15
Finished: 2/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 7.568 **Bearing:** ---

Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT						Gravelly CLAY, brown, with grass roots		SM		Topsoil
						SAND, light brown, coarse grained		W	L	Fill
		7				Silty CLAY, low to medium plasticity, brown, trace of sand		M	F	
			1			Silty CLAY, low plasticity, dark grey and black, some fine to coarse grained sand	SPT 0, 0, 0 N=0	W	L/S	
		6			CH	Silty CLAY, medium plasticity, brown and dark brown mottled		M	St	Residual
	Inflow at 1.7m		2							
		5			CH	Silty CLAY, medium to high plasticity, red-brown,	SPT 5, 7, 10 N=17	VM	VSt	
			3							
		4								
			4		CH	Silty CLAY, medium plasticity, grey and brown mottled, low 'TC' bit resistance	SPT 4, 6, 8 N=14	VM	VSt	
		3								
			5							
				× × × × × ×		SILTSTONE, very low to low strength, light grey, trace of clay bands, low to moderate 'TC' bit resistance				Bed Rock
						SILTSTONE, moderate strength, grey and light grey, moderate to high 'TC' bit resistance				
		2				Borehole BH02 continued as cored hole				
			6							
		1								
			7							
		0								
			8							
		-1								
			9							
		-2								
			10							
		-3								
			11							

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Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 2/7/15
Finished: 2/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 7.568 **Bearing:** ---
Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	Is(50) MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
		7	1								
		6	2								
		5	3								
		4	4								
		3	5								
					Continued from non-cored borehole						
NMLC		2	6		SHALE, dark grey with light grey laminations, low to medium strength, thinly laminated	MW		A 2.49 A 2.49 A 5.44	54		5.4-5.56, FZ, OP 5.59, BP, HZ, PR, CN, RF, CL 5.62, BP, HZ, PR, CN, RF, CL 5.67, JT, 30°, CU, CN, CL 5.72, BP, HZ, PR, CN, SO, CL 5.82, BP, HZ, PR, CN, RF, OP 6.08, BP, HZ, PR, CN, RF, OP
		1			SHALE, dark grey, high strength, with a very high strength band						6.41-6.47, JT, 50°, PR, CN, CL
		0	7		SHALE, dark grey, high strength, with some very high strength bands	SW		A 1.87 A 3.03 A 2.36 A 2.95	86		6.57, BP, HZ, PR, CN, RF, CL 6.58, BP, HZ, PR, CN, RF, CL 6.83, BP, HZ, PR, CN, SO, CL 6.91, BP, HZ, PR, MU, RF, OP 7.10, BP, HZ, PR, CN, SO, CL 7.22, BP, HZ, PR, CN, SO, CL 7.43, BP, HZ, UN, CN, RF, OP 7.60, BP, HZ, ST, MU, SO, CL 7.67, BP, HZ, PR, CN, SO, CL 7.80, BP, HZ, PR, CN, SO, CL 8.04, BP, HZ, PR, CN, SO, CL 8.08, BP, HZ, PR, CN, SO, CL
		-1	8								8.56, BP, HZ, PR, CN, SO, CL
			9					A 2.55 A 3.89	82		8.89, BP, HZ, PR, CN, SO, CL 9.06, BP, HZ, PR, CN, SO, CL 9.15, JT, 45°, PR, CN, SO, CL
		-2	10		BH02 terminated at 9.28m			A 2.89			
		-3	11								

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Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School

Started: 2/7/15
Finished: 2/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 6.678
Bearing: ---

Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT		6				Gravelly CLAY, brown, with grass roots		SM		Topsoil
						Gravelly CLAY, low plasticity, dark grey and black, trace of sand and medium to low graded angular gravel		M		Fill
						Silty CLAY, low plasticity, black, trace of gravel	SPT 4, 4, 6 N=10	M	F	
	Seepage at 1.7m ▼		2		CL	Silty CLAY, low to medium plasticity, grey and brown-grey		M	St	Alluvial
		4			SC	Clayey SAND, brown, fine to coarse grained sand, infrequent silty clay band	SPT 5, 7, 8 N=15	SM	MD	
	Water Inflow At 3.6m ▼		4		CL	Sandy CLAY, low to medium plasticity, grey and brown		VM W	St St	
		2			CL	Silty SAND, grey and light grey, fine to coarse grained sand,	SPT 4, 5, 10 N=15	W	L	
						SILTSTONE, extremely low to low strength, low 'TC' bit resistance				Bed Rock
						SILTSTONE, medium to high strength, moderate to high 'TC' bit resistance				
						Borehole BH03 continued as cored hole				
		0	6							
			8							
		-2								
			10							
		-4								
			12							
		-6								

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Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 2/7/15
Finished: 2/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 6.678 **Bearing:** ---
Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
		6									
			2								
		4									
			4								
		2									
					Continued from non-cored borehole						
NMLC			6		SHALE, dark grey with light grey laminations, highly weathered, medium strength, thinly laminated to laminated	HW		A 0.53			5.5-5.66, FZ, EW-HW zone, IR, FE, OP
					SHALE, dark grey, moderately weathered, medium strength	MW		A 0.69	0		5.72, BP, HZ, PR, CN, SO, OP
		0			SHALE, dark grey, moderately weathered, high strength			A 1.41			5.78-5.8, CS, HZ, PR, CN, RF, OP
						SW		A 1.78	66		5.83, JT, 10°, PR, RF, OP
			8		SHALE, slightly weathered, high strength			A 2.32			5.85, BP, HZ, PR, CN, SO CL
								A 1.55	85		5.88, BP, HZ, PR, CN, SO CL
		-2									5.91, BP, HZ, PR, CN, SO CL
								A 2			5.95, BP, HZ, PR, CN, SO CL
								A 1.95	100		6.08-6.15, FZ, HW zone, IR
			10		BH03 terminated at 9.91m			A 1.17			6.20, SM, HZ, UN, 5mm
		-4									6.24, BP, HZ, PR, CN, SO, CL
											6.30, BP, HZ, PR, CN, SO, CL
			12								6.34, BP, HZ, PR, CN, SO, CL
											6.35, BP, HZ, PR, CN, SO, CL
		-6									6.47, BP, HZ, PR, CN, RF, OP
											6.54, BP, HZ, PR, CN, RF, OP
											6.62, BP, HZ, PR, CN, RF, OP
											6.67, BP, HZ, PR, CN, RF, OP
											6.69, BP, HZ, PR, CN, RF, OP
											6.73, CB, ST, HZ, CN, RF, CL
											6.76, CS, IR, CN, RF, OP
											6.81, BP, HZ, PR, CN, SO, CL
											6.91, BP, HZ, PR, CN, SO, CL
											7.11, BP, BP, UN, CN, RF, OP
											7.20, BP, HZ, PR, CN, SO, CL
											7.29, CS, HZ, 5mm
											7.64, BP, HZ, PR, CN, SO, CL
											7.96, BP, HZ, PR, CN, SO, CL
											8.10, BP, HZ, CU, CN, SO, CL
											8.3-8.33, CS/FZ, HW zone
											8.4-8.45, JT, 45°, PR, CN, CL
											9.07, BP, HZ, PR, CN, SO, OP
											9.24, BP, HZ, PR, CN, SO, CL
											9.50, BP, HZ, PR, CN, SO, CL
											9.60, BP, HZ, PR, CN, SO, CL
											9.77, BP, HZ, PR, CN, SO, CL

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Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 29/6/15
Finished: 29/6/15
Borehole Size: 110mm Dia
Equipment: TD104
Logged: PC
RL Surface: 10.739
Bearing: ---
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering					Silty CLAY, medium plasticity, grey and dark grey		M	F	Topsoil
		10				Sandy CLAY, low plasticity, light brown, fine to medium grained,		M		Fill
						Silty CLAY, medium plasticity, orange-brown, trace of fine to medium grained sand		M	F	Residual
			2		CH	Silty CLAY, medium to high plasticity, brown and grey mottled	SPT 3, 5, 7 N=12	M	St	
					CL	Silty CLAY, low to medium plasticity, brown and grey		D	St	
		8			CL	Gravelly CLAY, low plasticity, brown, trace of EW Siltstone, low 'TC' bit resistance		D	St	
						SILTSTONE, grey and brown, low strength, moderate 'TC' bit resistance				Bed Rock
			4			Some light grey clay bands, high 'TC' bit resistance				
						Borehole BH04 terminated at 4m				Borehole Refusal at 4.0m
		6								
			6							
		4								
			8							
		2								
			10							
		0								
			12							
		-2								

BOREHOLE / TEST PIT 1915 BOREHOLE LOGS.GPJ GINT STD AUSTRALIA.GDT 31/7/15

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Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 3/7/15
Finished: 3/7/15
Borehole Size: 110mm Dia
Equipment: TD104
Logged: PC
RL Surface: 7.812
Bearing: ---
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering					Gravelly CLAY, low plasticity, brown and dark brown, with grass roots		D	F	Topsoil
						Gravelly CLAY, low plasticity, light grey and brown, trace of silt		D	F	Fill
					CL	Silty CLAY, low plasticity, red-brown, some coarse grained gravel		D	St	Residual
					CL	Silty CLAY, grey with red-brown mottled, trace of Ironstone	SPT 6, 14, 16 N=30	M	VSt	
		6				SILTSTONE, red-brown, very low strength, low 'TC' bit resistance				Bed Rock
			2			SILTSTONE, grey and light grey, low strength, low 'TC' bit resistance				
		4				SILTSTONE, grey and dark grey, medium strength, moderate 'TC' bit resistance	SPT R			
			4			Moderate to high 'TC' bit resistance				
						SILTSTONE, dark grey, high strength, high 'TC' bit resistance				
						Borehole BH05 continued as cored hole				
		2	6							
		0	8							
		-2	10							
		-4	12							

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BH No: BH05
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Job No:1915

Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 3/7/15
Finished: 3/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 7.812 **Bearing:** ---
Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
		6	2								
		4	4		Continued from non-cored borehole						
NMLC		2	6		SHALE, dark grey with light grey laminations, very low to low strength, thinly laminated	EW		A 0.4	52		4.6-4.77, SM, HZ, CLAY + CS, EW zone 4.79, BP, HZ, PR, CN, RF, OP 4.87, BP, HZ,PR, CN, SO, OP 5.06, BP, HZ, PR, CN, SO, CL 5.27, SM, CLAY + CS, HZ, PR, 20mm
					SHALE, dark grey, moderately weathered, medium strength with high strength band	MW		A 0.74			
								A 0.38	52		5.64, BP, HZ, PR, CN, SO, CL 5.84, BP, HZ, PR, CN, RF, CL 5.93, SM, HZ, UN, MU, OP
								A 1.12			6.19, SM, CLAY, 5mm 6.30, BP, HZ, PR, CN, SO, CL 6.50, BP, HZ, PR, CN, SO, CL 6.56, BP, HZ, PR, CN, SO, CL 6.73, BP, HZ, CU, CN, RF, OP 6.78, BP, HZ, PR, CN, SO, CL
								A 0.63			
		0	8		SHALE, dark grey, moderate weathered, medium and high strength, thinly laminated			A 1.89	60		6.97, FZ, HW zone, 30mm 7.10, BP, HZ, PR, CN, RF, OP 7.12, JT, 45°, CU, CN, RF, CL 7.27, BP, HZ, PR, CN, SO, CL 7.39, BP, HZ, PR, CN, SO, CL 7.47, JT, 45°, PR, CN, SO, CL 7.69, BP, HZ, PR, CN, SO, CL
								A 1.88			
								A 0.71	14		7.88, BP, HZ, PR, CN, SO, CL 8.05, BP, HZ, PR, CN, SO, CL 8.11, BP, HZ, PR + CS, HZ, PR 2mm 8.13, BP, HZ, PR + CS, HZ, PR 2mm 8.18, SM, CLAY, 5mm
								A 1.14			
		-2	10		BH05 terminated at 8.78m						8.21, BP, HZ, PR, SO, OP 8.28, BP, HZ, PR, SO, CL 8.30, BP, HZ, PR, SO, CL 8.39, BP, HZ, PR, RF, OP 8.49, SM, CLAY, 10mm 8.54, CS, HZ, PR,5mm 8.59, BP, HZ PR, SO, CL 8.63, BP, HZ, UN, RF, CL 8.64, BP, HZ, UN, RF, CL 8.69, BP, HZ, PR, SO, CL
		-4	12								

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Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 2/7/15
Finished: 2/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 6.886
Bearing: ---
Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT		6				Gravelly CLAY, low plasticity, dark brown, trace of sand		M	L	Fill
						Clayey GRAVEL, black		VM	L	
					CL	Silty CLAY, low to medium plasticity, grey and brown-grey	SPT 0, 0, 2 N=2	W	F	
			2		CL	Silty CLAY, medium plasticity, light brown and orange mottled		M	F	Alluvial
					CL	Silty CLAY, medium plasticity, light brown, trace of fine grained sand		M	F	
		4			CL	Silty CLAY, low to medium plasticity, light grey and brown mottled, trace of Ironstone gravel and fine grained sand	SPT 4, 4, 7 N=11	M	St	
	▼		4		SC	Clayey SAND, brown, increase in sand content		W	L	
		2			SM	Silty SAND, brown, fine to coarse grained sand, low 'TC' bit resistance from 4.7	SPT 7, 7, 8 N=15	W	MD	
			6			SILTSTONE, light brown, low to medium strength, with high 'TC' bit resistance from 5.5m				Bed Rock
		0				Borehole BH06 terminated at 6m				Borehole Refused at 6.0m
			8							
		-2								
			10							
		-4								
			12							
		-6								

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BH No: BH07
Sheet: 1 of 1
Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 8/7/15
Finished: 8/7/15
Borehole Size: 110mm Dia

Equipment: TD104
Logged: PC
RL Surface: 10.202
Bearing: ---
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering	10				Asphalt pavement, bitumen		D	L	Fill
					CL	Gravelly SAND		M	F	Residual
						Silty CLAY, low to medium plasticity, brown and light grey mottled, some gravel bands at 0.8m				
						Silty CLAY, low plasticity, light grey with brown mottled, Ironstone Band at 1.45m	SPT 5, 7, 14 N=21	M	VSt	
		8	2			SILTSTONE, light brown and light grey, embedded with clay bands, extremely low strength, low to moderate 'TC' resistance				Bed Rock
						SILTSTONE, red-brown, low to medium strength, moderate 'TC' resistance High 'TC' resistance from 2.75m				
						Borehole BH07 terminated at 3m				Borehole Refused at 3.0m
		6	4							
		4	6							
		2	8							
		0	10							
		-2	12							

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BH No: BH08
PAGE 1 OF 2
Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 8/7/15
Finished: 8/7/15
Borehole Size: 110mm Dia
Equipment: TD104
Logged: PC
RL Surface: 8.167
Bearing: ---
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering	8				Asphalt pavement, bitumen				Fill
						Sandy GRAVEL, brown		M		
						Sandy CLAY, low plasticity, orange-brown and dark brown, trace of coarse grained gravel		M	F	
					CL	Silty CLAY, low to medium plasticity, light grey and red mottled, Ironstone band at 1.2m	SPT 3, 6, 7 N=13	M	St	Residual
		6	2		CL	Silty CLAY, low plasticity, light brown and light grey mottled, with frequent Ironstone band		M	St	
					CL	Silty CLAY, low plasticity, light grey and orange-brown mottled, Ironstone band at 2.6m, low 'TC' bit resistance	SPT 5, 7, 13 N=20	D	VSt	
						SILTSTONE, lightbrown and grey-brown, extremely low strength, moderate 'TC' bit resistance				Bed Rock
		4	4			SILTSTONE, grey and dark grey, low to medium strength, moderate to high 'TC' bit resistance, High 'TC' bit resistance from 4.0m				
		2	6			Borehole BH08 continued as cored hole				
		0	8							
		-2	10							
		-4	12							

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Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 8/7/15
Finished: 8/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 8.167 **Bearing:** ---
Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
		8									
			2								
		6									
			4								
		4			Continued from non-cored borehole						
NMLC					SHALE, grey and red-brown, very low strength, thinly laminated to laminated,	EW					
						HW					
			6		SHALE, dark grey, low strength, high strength band from 5.8m to 6.0m						
		2				MW					
						HW					
					SHALE, dark grey with light grey laminations, medium strength, high strength from 9.0m	MW/SW		A 0.27	0		4.90-5.00, FZ, OP 5.05, BP, HZ, PR, CLAY, SO, OP 5.22, SM, HZ, PR, CLAY, CL, 15mm 5.27, SM, HZ, PR, CLAY, CL, 10mm 5.29, JT, 30°, PR, CN, OP 5.30-5.43, EW-HW Band, FZ, SM, CLAY 5.53, SM, HZ, PR, CLAY, CL 5.59, FZ, EW Seam, 15mm 5.67, BP, HZ, PR, CLAY, SO, CL 5.74-5.80, EW-HW Seam, FZ 5.86-6.00, JT, 70°, UN, FE, SO, OP 6.05, BP, HZ, PR, CN, SO, CL 6.11, BP, HZ, PR, CN, SO, CL 6.16, BP, HZ, PR, CN, SO, CL 6.21, BP, HZ, PR, CN, SO, CL 6.25, BP, HZ, PR, CN, SO, CL 6.31, BP, 5°, PR, CLAY, RF, CL 6.41, BP, HZ, PR, CLAY, RF, CL + EW ZONE 6.48, JT, 45°, PR, CN, OP 6.53, BP, HZ, PR, CLAY, SO, CL 6.54, BP, HZ, PR, CN, SO, CL 7.22, BP, HZ, PR, CN, SO, CL 7.29, FZ, EW, 5mm 7.38, BP, HZ, PR, CN, SO, CL 7.57, SM, HZ, PR, CLAY, CL, 5mm 7.84, SM, HZ, PR, CLAY, CL, 5mm 7.87, BP, HZ, PR, CN, RF, CL 8.04, BP, HZ, UN, CN, RF, CL 8.11, BP, HZ, UN, CN, RF, OP 8.23, FZ, BPs, HZ, PR, CN, SO 8.37, BP, HZ, PR, CN, SO, CL 8.42, BP, HZ, CU, CN, RF, CL 8.51, BP, HZ, PR, CN, SO, CL 8.57, BP, HZ, PR, CN, SO, CL 8.71, BP, HZ, PR, CN, SO, CL 8.94, BP, HZ, PR, CLAY, RF, OP 9.09, BP, HZ, PR, CLAY, SO, CL 9.30, CS, HZ, PR, SO, CL, 3mm 9.52&9.53, BP, HZ, PR, CN, RF, CL 9.79, BP, HZ, PR, CN, SO, CL 9.81-9.87, FZ, IR, CN, OP 9.95, BP, HZ, PR, CN, SO, CL 10.08, BP, HZ, PR, CN, SO, CL 10.13, CS, HZ, PR, SO, CL, 3mm 10.16, BP, HZ, PR, CN, SO, CL 10.23, BP, HZ, PR, CN, SO, CL 10.30, BP, HZ, PR, CN, SO, CL 10.37, BP, HZ, PR, CN, SO, CL 10.44, BP, HZ, PR, CN, SO, CL 10.47, BP, HZ, PR, CN, SO, CL
								A 0.23			
								A 0.54			
								A 0.35	53		
								A 0.34			
			8					A 0.34			
		0						A 0.66	75		
								A 0.69			
								A 1.33			
			10					A 1.54	53		
		-2						A 1.57			
					BH08 terminated at 10.52m			A 1.29			
			12								
		-4									

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BH No: BH09
Sheet: 1 of 1
Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School

Started: 1/7/15
Finished: 1/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 11.080
Bearing: ---

Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering					Asphalt pavement, bitumen				
						Gravelly SAND, brown and yellow		M	MD	FIll
		10			CL	Gravelly CLAY, dark grey		M	F-St	Residual
					CH	Silty CLAY, medium to high plasticity, red-brown and grey mottled		M	St	
			2		CL	Silty CLAY, low to medium plasticity, light grey, trace of Ironstone gravel	SPT 5, 6, 8 N=14	M	St	
		8			CL	Silty CLAY, low plasticity, grey, trace of fine sand and gravel		M	St	
			4			SILTSTONE, red-brown, extremely low strength, with clay band, light grey and brown				Bed Rock
						SILTSTONE, red-brown, low strength, trace of Ironstone gravel, moderate 'TC' bit resistance, High 'TC' bit resistance from 4.5				
		6	6			Borehole BH09 terminated at 4.8m				Borehole Refused at 4.8m
		4	8							
		2	10							
		0	12							

BOREHOLE / TEST PIT 1915 BOREHOLE LOGS.GPJ GINT STD AUSTRALIA.GDT 31/7/15

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Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 7/7/15
Finished: 7/7/15
Borehole Size: 110mm Dia
Equipment: TD104
Logged: PC
RL Surface: 12.732
Bearing: ---
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering					Asphalt pavement, bitumen				
						Gravelly CLAY, dark grey		M	L	Fill
		12			CL	Silty CLAY, low to medium plasticity, dark grey, trace of fine gravel,		M	St	Residual
			2		CL	Silty CLAY, low plasticity, light grey and brown mottled, trace of extremely weathered coarse grained siltstone, Siltstone Boulder from 1.6m-2.7m	SPT 3, 6, 19 N=25	D	VSt	
		10			CL	Silty CLAY, medium plasticity, light grey and light brown mottled, with Siltstone bands and coarse grained gravel	SPT 12, 8, 11 N=19	M	VSt	
			4			SILTSTONE, dark grey, low strength, some clay bands, low to moderate 'TC' bit resistance				Bed Rock
		8				Borehole BH10 continued as cored hole				
			6							
		6								
			8							
		4								
			10							
		2								
			12							
		0								

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BH No: BH10
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Job No:1915

Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 7/7/15
Finished: 7/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 12.732 **Bearing:** ---
Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
		12									
			2								
		10									
			4								
					Continued from non-cored borehole						
NMLC		8			SHALE, dark grey with brown Iron indurated lamination, very low strength, low strength from 5.8m	HW		A 0.09	0		4.65, BP, HZ, IR, EW ROCK, VR 4.80, CB, 50°, ST, CN, RF 4.86, BP, 5°, PR, CN, RF 4.94, BP, PR, CN, RF 5.09, DB 5.22, BP, HZ, PR, FE, RF
			6					A 0.14	0		5.60, BPHZ, FE, PR, SO 5.69, BP, HZ, PR, CN, SO 5.80, FZ, 10mm 5.94, BP, HZ, PR, FE, SO 6.05, BP, HZ, CN,CU,SO 6.14, BP, 10°, IR/ST, CN, RF 6.18, BP, 10°, IR/ST, CN, RF 6.38, CB, 20°, PR, FE, RF 6.63, CB, ST, FE, RF 6.86, BP, PR, CN, SO
		6						A 0.06			
						EW					
						HW					7.38, JT, 45°, FE, PR, SO, CL 7.47, BP, 10°, CN, FE, SO 7.56, BP, HZ, PR, CN, SO
			8		Fragmented extremely weathered to highly weathered band			A 0.02	51		
								A 0.23			8.30-8.73, BP, HZ, PR, CN, SO
		4			SHALE, dark grey with light grey laminations, medium strength, thinly laminated	MW		A 0.55			
								A 0.43			9.19, BP, HZ, PR, CN, SO 9.28, BP, HZ, PR, CN, SO 9.46, BP, HZ, PR, CN, SO 9.55, BP, HZ, PR, CN, SO 9.77, BP, HZ, PR, CN, SO 9.85, BP, HZ, PR, CN, SO 9.92, DB 10.12, BP, HZ, ST, CN, SO 10.28, BP, HZ, PR, CN, RF, OP 10.30, BP, HZ, PR, CN, RF, OP 10.40, BP, HZ, PR, CN, SO 10.42, BP, HZ, PR, CN, SO 10.46, SM, HZ, PR, CLAY, 2mm 10.49, BP, HZ, CU, CN, SO 10.55, EW SM/FZ, 20mm 10.71, BP, HZ, PR, CN, SO 11.22, BP, HZ, PR, CN, SO 11.33, BP, HZ, PR, CN, SO 11.52, BP, 10°, PR, CLAY, SO @ 10 mm spacing 11.57, BP, 10°, PR, CLAY, SO @ 10 mm spacing
			10					A 0.38	65		
		2				SW		A 0.64			
								A 0.45			
								A 0.43			
								A 0.38			
CORED BOREHOLE			12		BH10 terminated at 11.7m						
		0									

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BH No: BH11
Sheet: 1 of 1
Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School

Started: 7/7/15
Finished: 7/7/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 9.146 **Bearing:** ---

Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering					Asphalt pavement, bitumen				
						Gravelly CLAY/ Clayey GRAVEL, brown,		M	MD	Fill
					CH	Silty CLAY, medium to high plasticity, dark grey and light brown, trace of gravel		M	F	Alluvial
		8			CH	Silty CLAY, medium plasticity, light grey and brown mottled, Ironstone band at 1.4m	SPT 3, 7, 10 N=17	M	Vst	Residual
			2			SILTSTONE, light grey and light brown, extremely low strength, low 'TC' bit resistance		D		Bedrock
						from 1.9m, light grey, medium strength, moderate 'TC' bit resistance		D		
						from 2.5m, medium to high strength, high 'TC' resistance				
		6				Borehole BH11 terminated at 2.9m				Borehole Refused at 2.9m
			4							
		4								
			6							
		2								
			8							
		0								
			10							
		-2								
			12							

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BH No: BH12
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Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School

Started: 30/6/15
Finished: 30/6/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 11.485
Bearing: ---

Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering					Asphalt pavement, bitumen				Fill
						Sandy GRAVEL, brown		M	MD	
						Gravelly CLAY, medium plasicity, dark grey		M	MD	
						Silty CLAY, medium plasticity, brown and dark grey mottled		M	F	
		10			CL	Silty CLAY, medium plasticity, orange-brown, trace of gravel	SPT 5, 5, 7 N=12	M	St	Residual
			2		CH	Silty CLAY, medium to high plasticity, red-brown and grey mottled		M	St	
		8	4		CL	Silty CLAY, low to medium plasticity, light grey with some brown bands, Ironstone band at 3.5m	SPT 6, 7, 16 N=23	M	VSt	
							SPT 20, 25, R			
WASH BORING		6	6			SILTSTONE, extremely low strength siltstone and shaly CLAY, siltstone boulder from 4.5-4.8m, siltstone boulder from 5.2-5.9m				Bed Rock
		4	8							
		2	10							
		0	12			Borehole BH12 continued as cored hole				

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Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School

Started: 30/6/15
Finished: 30/6/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 11.485 **Bearing:** ---

Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
		10	2								
		8	4								
		6	6								
		4	8								
		2	10		Continued from non-cored borehole						
NMLC		0	12		SHALE, light grey and dark grey laminations, medium to high strength and thinly laminated	HW MW		A 0.34 A 1.29 A 1.15 A 1.07 A 0.88 A 0.94	57 28		10-10.03, SM, HZ, CLAY, 30mm 10.12, BP, HZ, PR, CN, SO, CL 10.20, BP, HZ, PR, CN, SO, CL 10.25, BP, HZ, PR, CN, SO, CL 10.30, BP, HZ, PR, CN, SO, CL 10.32, BP, HZ, PR, CN, SO, CL 10.34-10.38, FZ, HW-EW zone, 35mm 10.53, BP, HZ, PR, CN, SO, OP 10.71-10.81, FZ, EW-HW zone 90mm 11.03, JT, 10°, PR, CN, SO, CL 11.12, BP, HZ, PR, CN, SO, CL 11.20, BP, HZ, PR, CN, SO, CL 11.28, BP, HZ, PR, CN, SO, CL 11.47, JT, 40°, PR, CN, RF, OP 11.51, BP, HZ, UN, CN, RF, CL 11.59, BP, HZ, UN, CN, RF, CL 11.68, JT, 20°, CU, CN, RF, CL 11.74, BP, HZ, PR, CN, SO,CL 11.77, JT, 45°, CU, CN, RF, CL 11.80, JT, 20°, CU, CN, RF, CL
					BH12 terminated at 12.42m						

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Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School

Started: 30/6/15
Finished: 30/6/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 11.485 **Bearing:** ---

Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength $Is_{(50)}$ MPa (EL VL L M H VH EH; D- diametral A- axial)	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
		-2	14							11.91, BP, HZ, PR, CN, SO, CL 12.00, JT, 30°, CU, CN, RF, OP 12.10, BP, HZ, PR, CN, SO, CL 12.13, BP, HZ, PR, CN, SO, CL 12.24, BP, HZ, PR, CN, SO, CL 12.32, BP, HZ, PR, CN, SO, CL 12.39, BP, HZ, PR, CLAY, SO, CL
		-4	16							
		-6	18							
		-8	20							
		-10	22							
		-12	24							
		-14	26							

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BH No: BH13
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Job No: 1915

Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School
Started: 30/6/15
Finished: 30/6/15
Borehole Size: 110mm Dia
Equipment: TD104
Logged: PC
RL Surface: 12.955
Bearing: ---
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/ Density Index	Additional Observations
ADT	NFGWO during augering					Asphalt pavement, bitumen				Bitumen
						Gravelly CLAY, brown and dark grey		D	L	FILL
		12			CL	Silty CLAY, low plasticity, orange-brown, trace of gravel		M	St	Residual
					CH	Silty CLAY, medium plasticity, orange-brown and grey mottled, trace of Ironstone		M	VSt	
			2				SPT 4, 8, 16 N=24			
		10				SANDSTONE/SILTSTONE, orange-brown, extremely low strength, embedded with clay bands				Bedrock
						Borehole BH13 continued as cored hole	SPT 11 /80mm Bouncing			
			4							
		8								
			6							
		6								
			8							
		4								
			10							
		2								
			12							
		0								

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Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School

Started: 30/6/15
Finished: 30/6/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 12.955 **Bearing:** ---

Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength (EL VL L M H VH EH)	$Is_{(50)}$ MPa D- diametral A- axial	RQD %	Defect Spacing mm (30 100 300 1000 3000)	Defect Description
		12									
			2								
		10			Continued from non-cored borehole						
NMLC					SILTSTONE, brown, very low strength, indistinctly bedded	HW		A 0.03			3.28, BP, HZ, PR, CLAY, RF, CL 3.42-3.47, JT, 45°, + CS PR, 45°, OP
					Coreloss-250mm						
			4		SILTSTONE, grey, very low strength, indistinctly bedded	EW			0		3.80-4.45, SM, IR, CLAY, OP
					Coreloss-100mm						
					SILTSTONE, grey, extremely low to very low strength,	HW		A 0.01			4.72, CB, 20°, UN, CN, RF, CL 4.93, BP, HZ, PR, CN, RF, OP
		8			Coreloss-120mm				0		
					SILTSTONE, grey, very low strength	HW		A 0.02			5.47, JT, 10°, CN, CL
											5.81, BP, HZ, PR, RF, OP
			6		SANDSTONE, red and yellow, low strength	MW			0		6.08-6.63, FZ, EW/HW zone, FE + CS, IR, FE
					SILTSTONE, light grey, extremely low strength and moderately weathered red Sandstone, indistinctly bedded						
					Coreloss-350mm						
		6			SANDSTONE, orange-brown and yellow, medium strength	HW		A 0.46	10		7.16, BP, HZ, PR, FE, CL 7.27, BP, HZ, PR, FE, CL
					SANDSTONE, red and grey, extremely low strength, with medium strength ironstone bands	EW		A 0.57			7.33-7.36, FZ, HW zone, FE, OP 7.42-8.42, series of BP + JT, 10-40mm, IR, FE, RF + FZ, EW zone
			8								
					SHALE, dark grey with light grey laminations, low strength, thinly laminated to laminated	HW		A 0.51			8.43, JT, 30°, PR, CL 8.55, BP, HZ, PR, CN, RF, CL 8.72, BP, HZ, PR, CN, RF, CL 8.75, BP, HZ, PR, CN, RF, CL 8.77, BP, HZ, PR, CN, RF, CL 8.79-8.91, FZ, EW/HW zone, IR, FE
		4							10		
								A 0.37			9.20, BP, HZ, PR, CLAY, RF, CL 9.31, BP, HZ, PR, CN, RF, OP 9.37, BP, HZ, PR, CN, RF, OP 9.59, BP, HZ, PR, CN, RF, OP
			10					A 0.48			9.64, BP, HZ, PR, FE, SO, CL
								A 0.83	22		9.80, BP, HZ, PR, FE, SO, CL 9.86, BP, HZ, PR, FE, SO, CL 9.90, BP, HZ, PR, FE, SO, CL
											10.10, JT, 10°, PR, FE, CL
		2						A 0.81			10.24, BP, HZ, PR, CN, SO, CL 10.32, BP, HZ, PR, CN, SO, CL 10.36, BP, HZ, PR, CN, SO, CL
					SHALE, dark grey with light grey laminations, high strength	MW		A 1.85	60		10.37, BP, HZ, PR, CN, SO, CL 10.38, BP, HZ, PR, CN, SO, CL 10.45, JT, 50°, UN, CN, RF, OP 10.53, BP, HZ, PR, CN, SO, CL 10.58, BP, HZ, PR, CN, SO, CL 10.77, BP, HZ, PR, CN, SO, CL
			12					A 1.01			10.85-10.89, JT, 45°, CN, SO, CL
					BH13 terminated at 11.93m			A 1.06			10.99, BP, HZ, PR, CN, SO, OP 11.21, BP, HZ, PR, CN, RF, OP 11.42, BP, HZ, PR, CN, RF, OP 11.62, BP, HZ, PR, CN, SO, CL 11.72, BP, HZ, PR, CN, SO, CL 11.81, BP, HZ, PR, CN, SO, CL
		0									

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Cored Borehole Log

Client: Department of Education
Project: Proposed Education Development
Location: Arthur Phillip High School & Parramatta Public School

Started: 30/6/15
Finished: 30/6/15
Borehole Size: 110mm Dia

Equipment: TD104
RL Surface: 12.955 **Bearing:** ---

Logged: PC
Checked: DFD

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength EL VL L M H VH EH — $Is_{(50)}$ MPa D- diam-etral A- axial	RQD %	Defect Spacing mm 30 100 300 1000 3000	Defect Description
										-11.89, BP, HZ, PR, CN, SO, CL
			14							
		-2								
			16							
		-4								
			18							
		-6								
			20							
		-8								
			22							
		-10								
			24							
		-12								
			26							

Arthur Phillip High School and Parramatta Public School

Geotechnical Investigation

BH1 - 4.6m to 8.8m

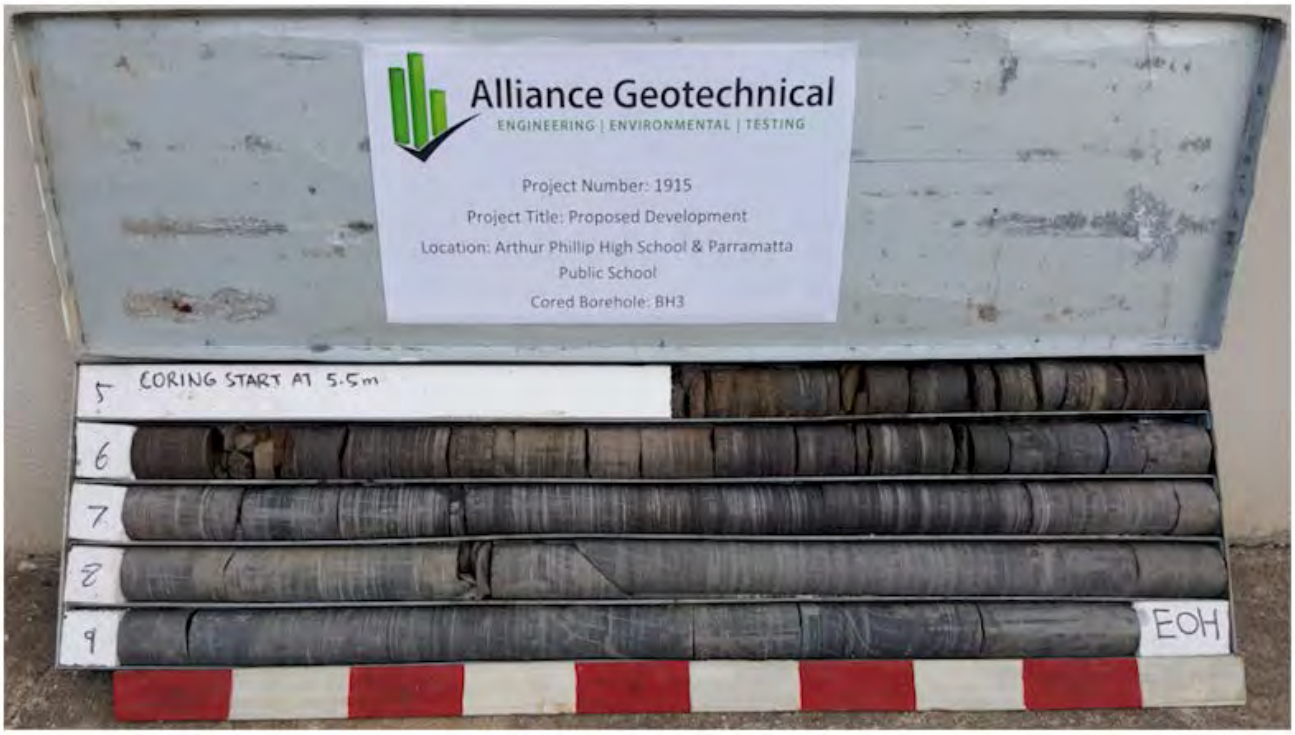
Arthur Phillip High School and Parramatta Public School

Geotechnical Investigation

BH2 - 5.4m to 9.2m

Arthur Phillip High School and Parramatta Public School

Geotechnical Investigation



BH3 – 5.5m to 10.0m

Arthur Phillip High School and Parramatta Public School

Geotechnical Investigation

BH5 - 4.6m to 8.8m

Arthur Phillip High School and Parramatta Public School

Geotechnical Investigation

BH8 - 4.7m to 9.0m

BH8 – 9.0m to 10.52m

Arthur Phillip High School and Parramatta Public School

Geotechnical Investigation

BH10 - 4.5m to 9.0m

BH10 – 9.0m to 11.68m

Arthur Phillip High School and Parramatta Public School

Geotechnical Investigation

BH12 – 10.0m to 12.42m

Arthur Phillip High School and Parramatta Public School

Geotechnical Investigation

BH13 – 3.1m to 8.0m

BH13 – 8.0m to 11.93m

APPENDIX B

Soil Laboratory Test Results

- Shrink Swell Index Test Report - Alliance Geotechnical 1915-ST-1-1
- Moisture Content - Alliance Geotechnical 1915-ST-1-2
- Plasticity Index Test Report - Alliance Geotechnical 1915-ST-1-3
- Plasticity Index Test Report - Alliance Geotechnical 1915-ST-1-4
- Plasticity Index Test Report - Alliance Geotechnical 1915-ST-1-5
- Plasticity Index Test Report - Alliance Geotechnical 1915-ST-1-6
- Plasticity Index Test Report - Alliance Geotechnical 1915-ST-1-7
- Plasticity Index Test Report - Alliance Geotechnical 1915-ST-1-8
- Emerson Class Number - Alliance Geotechnical 1915-ST-1-9
- Emerson Class Number - Alliance Geotechnical 1915-ST-1-10
- Emerson Class Number - Alliance Geotechnical 1915-ST-1-11
- Emerson Class Number - Alliance Geotechnical 1915-ST-1-12
- Emerson Class Number - Alliance Geotechnical 1915-ST-1-13
- Emerson Class Number - Alliance Geotechnical 1915-ST-1-14
- Particle Size Distribution – SGS 15-AC-1468
- Particle Size Distribution – SGS 15-AC-1469
- Particle Size Distribution – SGS 15-AC-1470
- Particle Size Distribution – SGS 15-AC-1471
- Particle Size Distribution – SGS 15-AC-1472
- Particle Size Distribution – SGS 15-AC-1473
- Analytical Report – SGS SE141392 R0

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Shrink Swell Index Test Report

Client Name:	Department of Education & Communities	Project Number:	1915
Client Address:	GPO Box 4037, Sydney NSW 2001	Report Number:	1915-ST-1-1
Project Name:	Arthur Phillip High School	Sample Number:	2549
Project Location:	Parramatta	Date Reported:	28/07/2015
Sample Source:	BH9 U50@ 1.5m	Date Sampled:	13/Jul/15
Sample Description:	CLAY: Grey	Date Tested:	21/Jul/15
Test Methods:	AS1289 7.1.1, 2.1.1	Sampled By:	Alliance
Sample Condition:	Moist		

Procedure	Units	Test Result
Shrink Sample - Initial Moisture Content:	%	17.4
Swell Sample - Initial Moisture Content:	%	17.4
Swell Sample - Final Moisture Content:	%	20.9
Swell Strain:	E_{SW}	3.1
Shrinkage Strain:	Esh	2.7

Shrink/Swell Index:	**I_{SS}**	**2.4**

Estimated % of inert inclusions in the sample	%	<5
Extent of soil crumbling during shrinkage:	%	N/A
Extent of cracking of the shrinkage specimen:	%	<1

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Approved Signatory

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Determination of Moisture Content of a Soil

Client:	Department of Education & Communities	Job No:	1915
Project:	Arthur Phillip High School	Report Date:	28/7/15
Project Location:	Parramatta	Report No:	1915-ST-1-2
Test Methods:	AS 1289.2.1.1		

Laboratory Number:	BH10	BH12	BH2	BH6
Sample Location:	1.45 – 1.6m	3.0m	4.0m	1.0m
Sampled By:	Alliance	Alliance	Alliance	Alliance
Date Sampled:	13/7/15	13/7/15	13/7/15	13/7/15
Material Description:	-	-	-	-
Moisture Content (%):	19.7	17.9	17.7	19.8

Laboratory Number:	BH9	BH5		
Sample Location:	1.0m	1.0m		
Sampled By:	Alliance	Alliance		
Date Sampled:	13/7/15	13/7/15		
Material Description:	-	-		
Moisture Content (%):	15.4	12.1		

Notes:

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Plasticity Index Test Report

Client Name:	Department of Education & Communities	Project Number:	1915
Client Address:	GPO Box 4037, Sydney NSW 2001	Report Number:	1915-ST-1-3
Project Name:	Arthur Phillip High School	Report Date:	28/7/15
Project Location:	Parramatta	Page Number:	1 of 1
Test Methods:	AS1289 ☒ 1.1 ☒ 2.1.1 ☐ 3.1.1 ☒ 3.1.2 ☒ 3.2.1 ☒ 3.3.1 ☒ 3.4.1		

Sample Number:	2549
Sample Method Used:	-
Sample Identification:	BH1 1.5 – 2.5m
Date Sampled:	13/7/15
Sampled By:	Total Drilling
Material Description:	CLAY: red/brown
Preparation Method:	Dry Sieved
Sample History:	Oven Dried
Shrinkage Mould Length (mm):	250

Linear Shrinkage Observations:	-

Sample Moisture Content (%)	**16.6**
Liquid Limit (%)	**48**
Plastic Limit (%)	**19**
Linear Shrinkage (%)	**13.0**
Plastic Index (%)	**29**

Comments:	

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Plasticity Index Test Report

Client Name:	Department of Education & Communities	Project Number:	1915
Client Address:	GPO Box 4037, Sydney NSW 2001	Report Number:	1915-ST-1-4
Project Name:	Arthur Phillip High School	Report Date:	28/7/15
Project Location:	Parramatta	Page Number:	1 of 1
Test Methods:	AS1289 ☒ 1.1 ☒ 2.1.1 ☐ 3.1.1 ☒ 3.1.2 ☒ 3.2.1 ☒ 3.3.1 ☒ 3.4.1		

Sample Number:	2549
Sample Method Used:	-
Sample Identification:	BH2 SPT@2.0m
Date Sampled:	13/7/15
Sampled By:	Total Drilling
Material Description:	CLAY: Red/brown
Preparation Method:	Dry Sieved
Sample History:	Oven Dried
Shrinkage Mould Length (mm):	250

Linear Shrinkage Observations:	Curling

Sample Moisture Content (%)	**22.5**
Liquid Limit (%)	**25**
Plastic Limit (%)	**13**
Linear Shrinkage (%)	**5.5**
Plastic Index (%)	**22**

Comments:	

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Plasticity Index Test Report

Client Name:	Department of Education & Communities	Project Number:	1915
Client Address:	GPO Box 4037, Sydney NSW 2001	Report Number:	1915-ST-1-5
Project Name:	Arthur Phillip High School	Report Date:	28/7/15
Project Location:	Parramatta	Page Number:	1 of 1
Test Methods:	AS1289 ☒ 1.1 ☒ 2.1.1 ☐ 3.1.1 ☒ 3.1.2 ☒ 3.2.1 ☒ 3.3.1 ☒ 3.4.1		

Sample Number:	2549
Sample Method Used:	-
Sample Identification:	BH3 SPT@1.0m
Date Sampled:	13/7/15
Sampled By:	Total Drilling
Material Description:	CLAY: Black
Preparation Method:	Dry Sieved
Sample History:	Oven Dried
Shrinkage Mould Length (mm):	250

Linear Shrinkage Observations:	-

Sample Moisture Content (%)	**12.9**
Liquid Limit (%)	**19**
Plastic Limit (%)	**13**
Linear Shrinkage (%)	**3.0**
Plastic Index (%)	**6**

Comments:	

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Plasticity Index Test Report

Client Name:	Department of Education & Communities	Project Number:	1915
Client Address:	GPO Box 4037, Sydney NSW 2001	Report Number:	1915-ST-1-6
Project Name:	Arthur Phillip High School	Report Date:	28/7/15
Project Location:	Parramatta	Page Number:	1 of 1
Test Methods:	AS1289 ☒ 1.1 ☒ 2.1.1 ☐ 3.1.1 ☒ 3.1.2 ☒ 3.2.1 ☒ 3.3.1 ☒ 3.4.1		

Sample Number:	2549
Sample Method Used:	-
Sample Identification:	BH5 0.5 – 1.0m
Date Sampled:	13/7/15
Sampled By:	Total Drilling
Material Description:	CLAY: Red/Brown
Preparation Method:	Dry Sieved
Sample History:	Oven Dried
Shrinkage Mould Length (mm):	250

Linear Shrinkage Observations:	-

Sample Moisture Content (%)	**10.0**
Liquid Limit (%)	**34**
Plastic Limit (%)	**19**
Linear Shrinkage (%)	**9.0**
Plastic Index (%)	**15**

Comments:	

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Plasticity Index Test Report

Client Name:	Department of Education & Communities	Project Number:	1915
Client Address:	GPO Box 4037, Sydney NSW 2001	Report Number:	1915-ST-1-7
Project Name:	Arthur Phillip High School	Report Date:	28/7/15
Project Location:	Parramatta	Page Number:	1 of 1
Test Methods:	AS1289 ☒ 1.1 ☒ 2.1.1 ☐ 3.1.1 ☒ 3.1.2 ☒ 3.2.1 ☒ 3.3.1 ☒ 3.4.1		

Sample Number:	2549
Sample Method Used:	-
Sample Identification:	BH5 1.5 – 1.8m
Date Sampled:	13/7/15
Sampled By:	Total Drilling
Material Description:	SILTSTONE: Grey
Preparation Method:	Dry Sieved
Sample History:	Oven Dried
Shrinkage Mould Length (mm):	250

Linear Shrinkage Observations:	-

Sample Moisture Content (%)	**10.6**
Liquid Limit (%)	**35**
Plastic Limit (%)	**20**
Linear Shrinkage (%)	**7.0**
Plastic Index (%)	**15**

Comments:	

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Plasticity Index Test Report

Client Name:	Department of Education & Communities	Project Number:	1915
Client Address:	GPO Box 4037, Sydney NSW 2001	Report Number:	1915-ST-1-8
Project Name:	Arthur Phillip High School	Report Date:	28/7/15
Project Location:	Parramatta	Page Number:	1 of 1
Test Methods:	AS1289 ☒ 1.1 ☒ 2.1.1 ☐ 3.1.1 ☒ 3.1.2 ☒ 3.2.1 ☒ 3.3.1 ☒ 3.4.1		

Sample Number:	2549
Sample Method Used:	-
Sample Identification:	BH9 1.5 – 1.9m
Date Sampled:	13/7/15
Sampled By:	Total Drilling
Material Description:	CLAY: Red/brown
Preparation Method:	Dry Sieved
Sample History:	Oven Dried
Shrinkage Mould Length (mm):	250

Linear Shrinkage Observations:	-

Sample Moisture Content (%)	**18.6**
Liquid Limit (%)	**43**
Plastic Limit (%)	**22**
Linear Shrinkage (%)	**9.0**
Plastic Index (%)	**21**

Comments:	

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Determination of Emerson Class Number of a Soil

Client:	Department of Education & Communities	Job No: 1915
Project:	Arthur Phillip High School	Report Date: 28/7/15
Project Location:	Parramatta	Report Number: 1915-ST-1-9
Test Methods:	AS1141.3.8.1	

Sample Number:	BH2 SPT@4.0m
Sample Location:	BH2 SPT@4.0m
Sampled By:	Total Drilling
Source of Material:	-
Date Sampled:	13/7/15
Material Description:	CLAY: Grey
Water Type Used:	Distilled
Water Temperature:	17

Emerson Class Number:	**2**

Notes:

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Determination of Emerson Class Number of a Soil

Client:	Department of Education & Communities	Job No: 1915
Project:	Arthur Phillip High School	Report Date: 28/7/15
Project Location:	Parramatta	Report Number: 1915-ST-1-10
Test Methods:	AS1141.3.8.1	

Sample Number:	BH5 SPT@1.0m
Sample Location:	BH5 SPT@1.0m
Sampled By:	Total Drilling
Source of Material:	-
Date Sampled:	13/7/15
Material Description:	CLAY: White
Water Type Used:	Distilled
Water Temperature:	17

Emerson Class Number:	**1**

Notes:

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Determination of Emerson Class Number of a Soil

Client:	Department of Education & Communities	Job No: 1915
Project:	Arthur Phillip High School	Report Date: 28/7/15
Project Location:	Parramatta	Report Number: 1915-ST-1-11
Test Methods:	AS1141.3.8.1	

Sample Number:	BH6 SPT@1.0m
Sample Location:	BH6 SPT@1.0m
Sampled By:	Total Drilling
Source of Material:	-
Date Sampled:	13/7/15
Material Description:	CLAY: Brown
Water Type Used:	Distilled
Water Temperature:	17

Emerson Class Number:	**2**

Notes:

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Determination of Emerson Class Number of a Soil

Client:	Department of Education & Communities	Job No: 1915
Project:	Arthur Phillip High School	Report Date: 28/7/15
Project Location:	Parramatta	Report Number: 1915-ST-1-12
Test Methods:	AS1141.3.8.1	

Sample Number:	BH9 SPT@1.0m
Sample Location:	BH9 SPT@1.0m
Sampled By:	Total Drilling
Source of Material:	-
Date Sampled:	13/7/15
Material Description:	CLAY: Grey with yellow mottling
Water Type Used:	Distilled
Water Temperature:	17

Emerson Class Number:	**1**

Notes:

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Determination of Emerson Class Number of a Soil

Client:	Department of Education & Communities	Job No: 1915
Project:	Arthur Phillip High School	Report Date: 28/7/15
Project Location:	Parramatta	Report Number: 1915-ST-1-13
Test Methods:	AS1141.3.8.1	

Sample Number:	BH10 1.45 – 1.6m
Sample Location:	BH10 1.45 – 1.6m
Sampled By:	Total Drilling
Source of Material:	-
Date Sampled:	13/7/15
Material Description:	CLAY: Brown
Water Type Used:	Distilled
Water Temperature:	17

Emerson Class Number:	**3**

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Determination of Emerson Class Number of a Soil

Client:	Department of Education & Communities	Job No: 1915
Project:	Arthur Phillip High School	Report Date: 28/7/15
Project Location:	Parramatta	Report Number: 1915-ST-1-14
Test Methods:	AS1141.3.8.1	

Sample Number:	BH12 SPT@3.0m
Sample Location:	BH12 SPT@3.0m
Sampled By:	Total Drilling
Source of Material:	-
Date Sampled:	13/7/15
Material Description:	CLAY: Grey
Water Type Used:	Distilled
Water Temperature:	17

Emerson Class Number:	**2**

Notes:

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Approved Signatory: Simon Thomas

Alliance Geotechnical Pty Ltd | NATA Accreditation: 15100
Website: www.allgeo.com.au | Email: office@allgeo.com.au
Mobile: 0400 545 805 | Office Phone: (02) 9623 1588
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TEST CERTIFICATE

ABN 44 000 964 278
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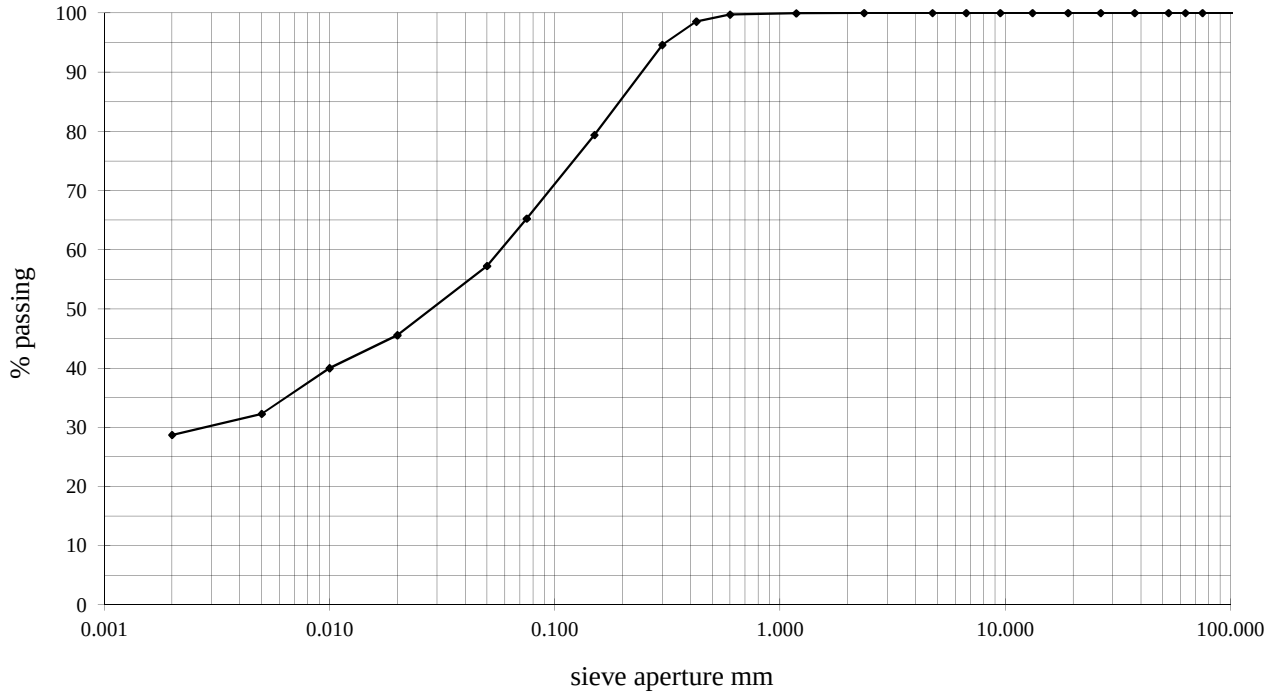
SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: **Alliance Geotechnical Pty Ltd**
Address: **Unit 3/ 155 Glendenning Road Glendenning NSW 2761**
Project: **Smith Street, Parramatta**
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 15-32-181
Sample Source: BH2 4.00m
Sampled By: Client
Lab Number: 15-AC-1468
Date Tested: 20/07/2015
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SANDY SILTY CLAY:Grey

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	
75.0		0.600	**100**
63.0		0.425	**99**
53.0		0.300	**95**
37.5		0.150	**79**
26.5		0.075	**65**
19.0		0.050	**57**
13.2		0.020	**46**
9.5		0.010	**40**
6.7		0.005	**32**
4.75		0.002	**29**
2.36			

Hydrometer Type: **ASTM 152H**
Dispersant Type: **Sodium Hexametaphosphate**
Pretreatment: **None**
Loss on Pretreatment: **None**
Remarks:

Approved Signatory: Aaron Lacey Date: 20/07/2015

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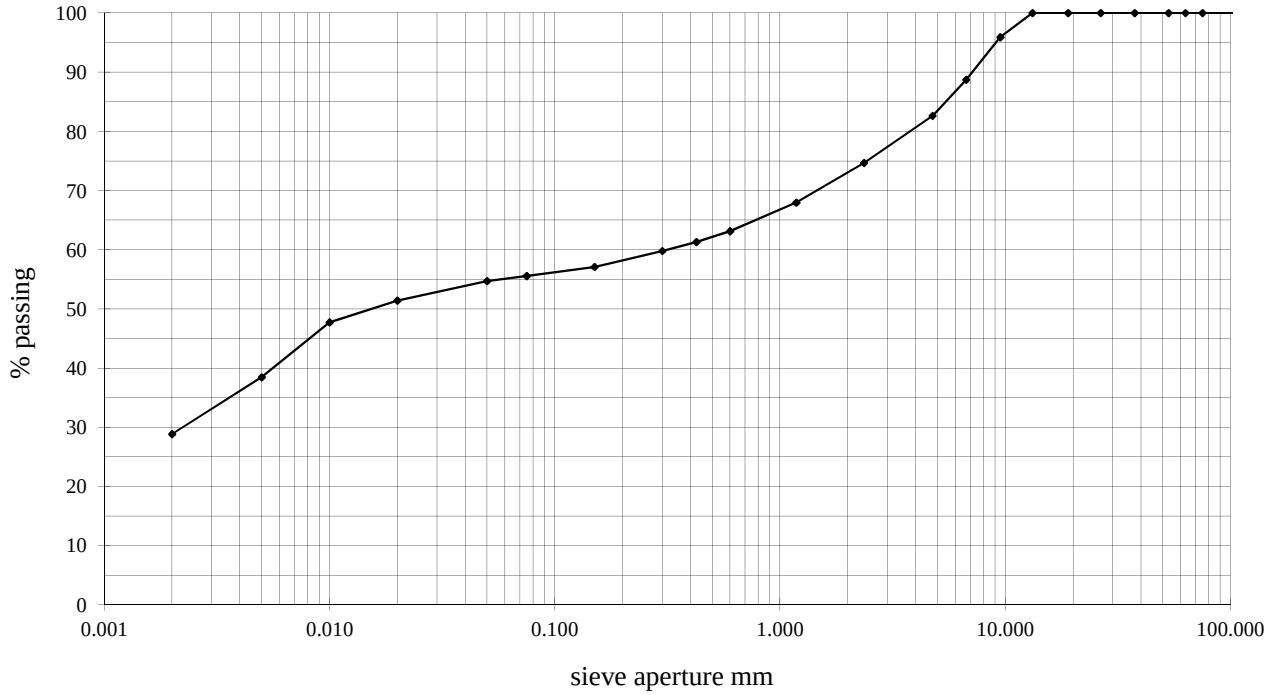
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: **Alliance Geotechnical Pty Ltd**
Address: **Unit 3/ 155 Glendenning Road Glendenning NSW 2761**
Project: **Smith Street, Parramatta**
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 15-32-181
Sample Source: BH5 1.00m
Sampled By: Client
Lab Number: 15-AC-1469
Date Tested: 16/07/2015
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY:Red-Brown/Grey

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**68**
75.0		0.600	**63**
63.0		0.425	**61**
53.0		0.300	**60**
37.5		0.150	**57**
26.5		0.075	**56**
19.0		0.050	**55**
13.2	**100**	0.020	**51**
9.5	**96**	0.010	**48**
6.7	**89**	0.005	**38**
4.75	**83**	0.002	**29**
2.36	**75**		

Hydrometer Type: **ASTM 152H**
Dispersant Type: **Sodium Hexametaphosphate**
Pretreatment: **None**
Loss on Pretreatment: **None**
Remarks:

Approved Signatory: Aaron Lacey Date: 20/07/2015

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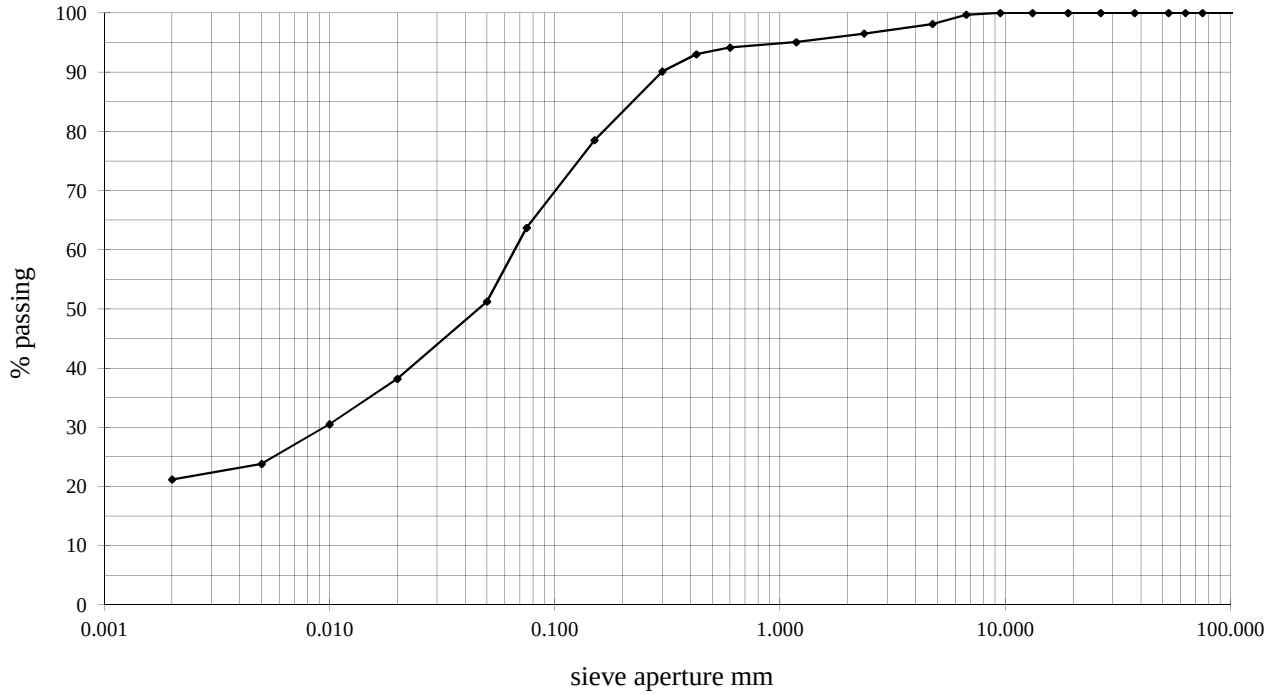
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: **Alliance Geotechnical Pty Ltd**
Address: **Unit 3/ 155 Glendenning Road Glendenning NSW 2761**
Project: **Smith Street, Parramatta**
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 15-32-181
Sample Source: BH6 1.00m
Sampled By: Client
Lab Number: 15-AC-1470
Date Tested: 15/07/2015
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SANDY SILTY CLAY:Grey

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**95**
75.0		0.600	**94**
63.0		0.425	**93**
53.0		0.300	**90**
37.5		0.150	**79**
26.5		0.075	**64**
19.0		0.050	**51**
13.2		0.020	**38**
9.5		0.010	**31**
6.7	**100**	0.005	**24**
4.75	**98**	0.002	**21**
2.36	**97**		

Hydrometer Type: **ASTM 152H**
Dispersant Type: **Sodium Hexametaphosphate**
Pretreatment: **None**
Loss on Pretreatment: **None**
Remarks:

Approved Signatory: Aaron Lacey Date: 20/07/2015

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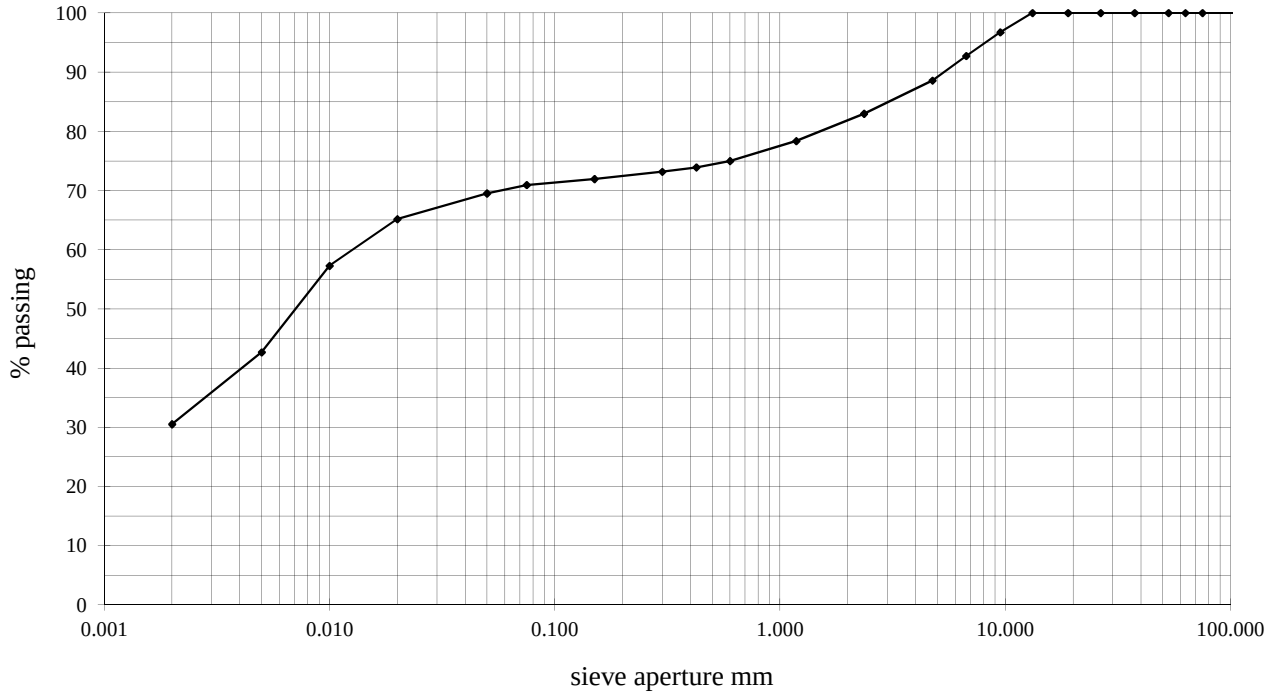
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: **Alliance Geotechnical Pty Ltd**
Address: **Unit 3/ 155 Glendenning Road Glendenning NSW 2761**
Project: **Smith Street, Parramatta**
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 15-32-181
Sample Source: BH9 1.00m
Sampled By: Client
Lab Number: 15-AC-1471
Date Tested: 16/07/2015
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY:Grey

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**78**
75.0		0.600	**75**
63.0		0.425	**74**
53.0		0.300	**73**
37.5		0.150	**72**
26.5		0.075	**71**
19.0		0.050	**70**
13.2	**100**	0.020	**65**
9.5	**97**	0.010	**57**
6.7	**93**	0.005	**43**
4.75	**89**	0.002	**31**
2.36	**83**		

Hydrometer Type: **ASTM 152H**
Dispersant Type: **Sodium Hexametaphosphate**
Pretreatment: **None**
Loss on Pretreatment: **None**
Remarks:

Approved Signatory: Aaron Lacey Date: 20/07/2015

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Alexandria NSW 2015
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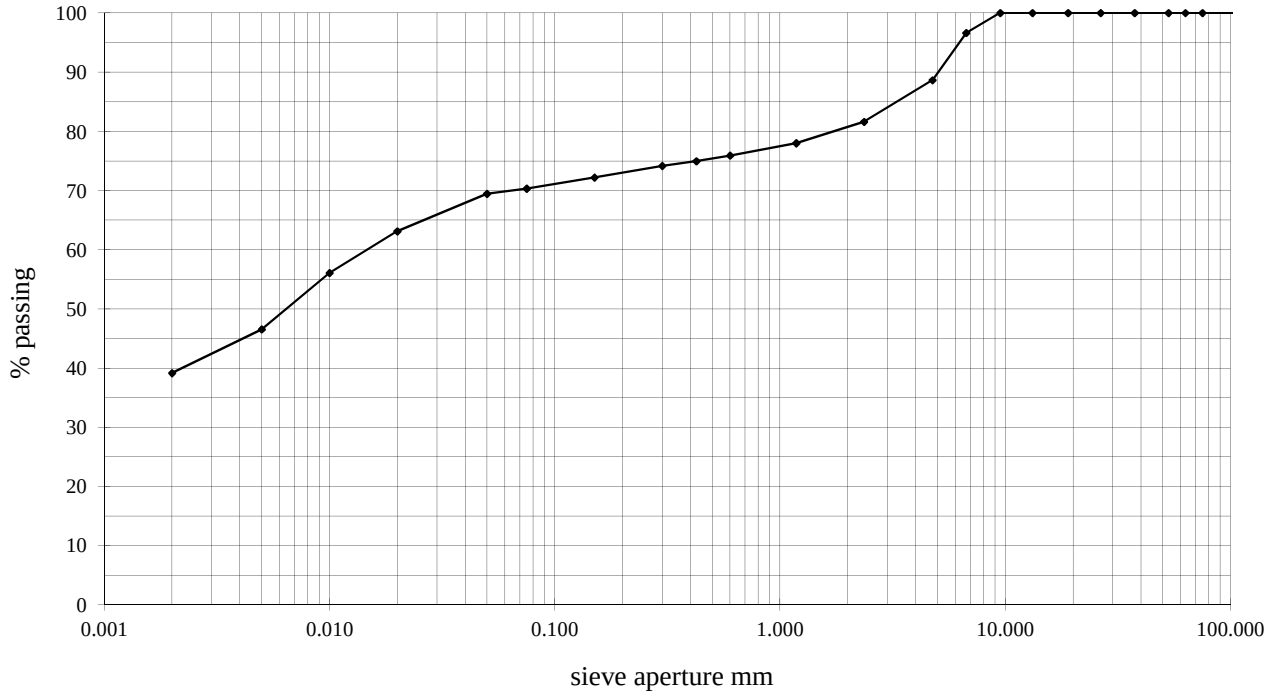
PARTICLE SIZE DISTRIBUTION

Client: **Alliance Geotechnical Pty Ltd**
Address: **Unit 3/ 155 Glendenning Road Glendenning NSW 2761**
Project: **Smith Street, Parramatta**
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 15-32-181
Sample Source: BH10 1.45-1.60m
Sampled By: Client
Lab Number: 15-AC-1472
Date Tested: 16/07/2015
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY:Brown

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**78**
75.0		0.600	**76**
63.0		0.425	**75**
53.0		0.300	**74**
37.5		0.150	**72**
26.5		0.075	**70**
19.0		0.050	**69**
13.2		0.020	**63**
9.5	**100**	0.010	**56**
6.7	**97**	0.005	**47**
4.75	**89**	0.002	**39**
2.36	**82**		

Hydrometer Type: **ASTM 152H**
Dispersant Type: **Sodium Hexametaphosphate**
Pretreatment: **None**
Loss on Pretreatment: **None**
Remarks:

Approved Signatory: Aaron Lacey **Date:** 17/07/2015

Accredited for Compliance with ISO/IEC 17025

TEST CERTIFICATE

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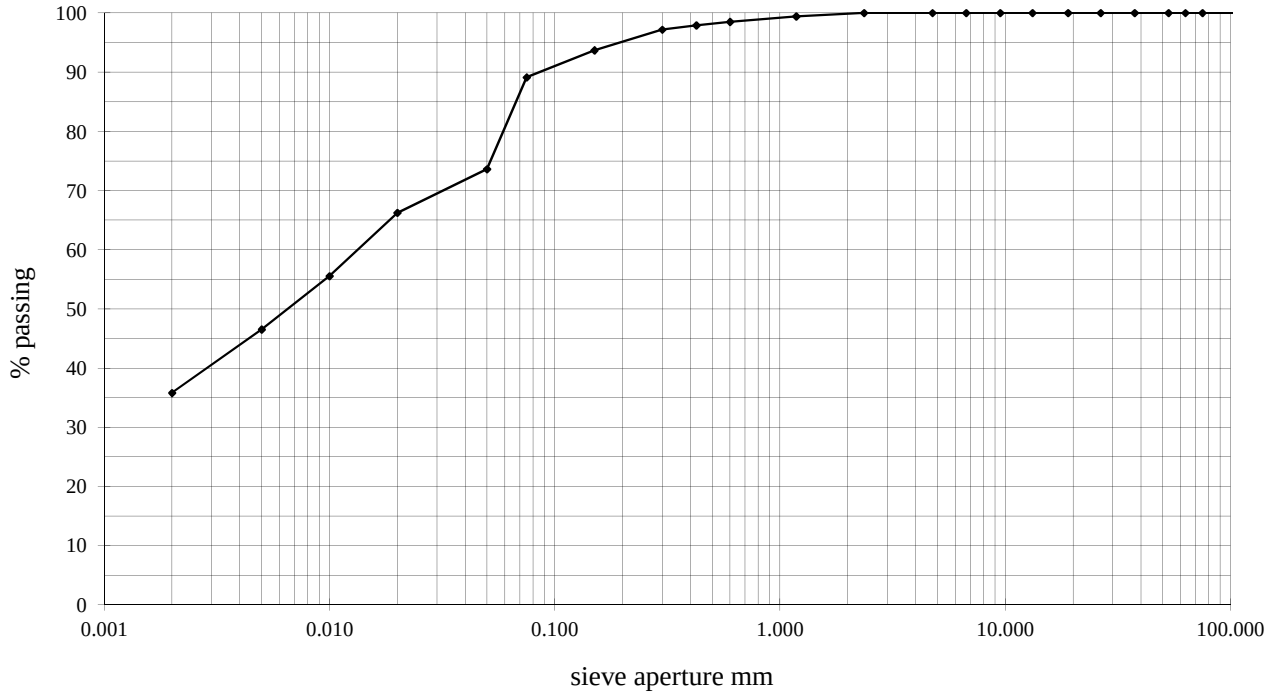
fax: +61 (0)2 8594 0499

SGS Australia Pty Ltd
Unit 15, 33 Maddox Street
(PO Box 6432)
Alexandria NSW 2015
Australia

PARTICLE SIZE DISTRIBUTION

Client: **Alliance Geotechnical Pty Ltd**
Address: **Unit 3/ 155 Glendenning Road Glendenning NSW 2761**
Project: **Smith Street, Parramatta**
Location:
Test Method: **AS 1289 3.6.1 / 3**
Job Number: 15-32-181
Sample Source: BH12 3.00m
Sampled By: Client
Lab Number: 15-AC-1473
Date Tested: 16/07/2015
Checked By: ME



Clay	Silt	Sand	Gravel

Sample Description: SILTY CLAY:Grey

Sieve Size (mm)	% Passing	Sieve Size (mm)	% Passing
150.0		1.18	**99**
75.0		0.600	**98**
63.0		0.425	**98**
53.0		0.300	**97**
37.5		0.150	**94**
26.5		0.075	**89**
19.0		0.050	**74**
13.2		0.020	**66**
9.5		0.010	**56**
6.7		0.005	**47**
4.75		0.002	**36**
2.36	**100**		

Hydrometer Type: **ASTM 152H**
Dispersant Type: **Sodium Hexametaphosphate**
Pretreatment: **None**
Loss on Pretreatment: **None**
Remarks:

Approved Signatory: Aaron Lacey **Date:** 17/07/2015

Accredited for Compliance with ISO/IEC 17025

Accreditation No. 2418

ANALYTICAL REPORT

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Paul Haslam	Manager	Huong Crawford
Client	Alliance Geotechnical Pty Ltd	Laboratory	SGS Alexandria Environmental
Address	Unit 4 / 22-24 Anne Street ST MARYS NSW 2760	Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	0407 551 455	Telephone	+61 2 8594 0400
Facsimile	02 9675 1888	Facsimile	+61 2 8594 0499
Email	office@allgeo.com.au	Email	au.environmental.sydney@sgs.com
Project	**1915 - Smith Street Parramatta**	SGS Reference	**SE141392 R0**
Order Number	(Not specified)	Report Number	0000116091
Samples	10	Date Reported	21 Jul 2015
Date Started	16 Jul 2015	Date Received	14 Jul 2015

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(4354).

SIGNATORIES

Andy Sutton
Senior Organic Chemist

Dong Liang
Metals/Inorganics Team Leader

Parameter	Units	LOR	Sample Number: SE141392.001 Sample Matrix: Soil Sample Date: 14 Jul 2015 Sample Name: BH1 1.5m-2.5m	SE141392.002 Soil 14 Jul 2015 BH2 2.0m	SE141392.003 Soil 14 Jul 2015 BH9 2.5m-3.0m	SE141392.004 Soil 14 Jul 2015 BH10 1.0m
pH in soil (1:2) Method: AN101 Tested: 21/7/2015						
pH (1:2)	pH Units	-	**4.7**	**5.7**	**4.6**	**4.3**
Conductivity (1:2) in soil Method: AN106 Tested: 21/7/2015						
Conductivity (1:2) @25 C*	µS/cm	1	**150**	**94**	**310**	**90**
Resistivity (1:2)*	ohm cm	-	**6500**	**11000**	**3200**	**11000**
Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography Method: AN245 Tested: 15/7/2015						
Chloride	mg/kg	0.25	**39**	**6.7**	**89**	**4.5**
Sulphate	mg/kg	0.5	**60**	**43**	**95**	**71**
Moisture Content Method: AN002 Tested: 16/7/2015						
% Moisture	%w/w	0.5	**15.9**	**22.4**	**13.9**	**17.3**

Parameter	Units	LOR	Sample Number: SE141392.005 Sample Matrix: Soil Sample Date: 14 Jul 2015 Sample Name: BH6 4.0m	Sample Number: SE141392.006 Sample Matrix: Soil Sample Date: 14 Jul 2015 Sample Name: BH3 2.5m	Sample Number: SE141392.007 Sample Matrix: Soil Sample Date: 14 Jul 2015 Sample Name: BH9 1.5m-1.9m	Sample Number: SE141392.008 Sample Matrix: Soil Sample Date: 14 Jul 2015 Sample Name: BH12 1.5m
pH in soil (1:2) Method: AN101 Tested: 21/7/2015						
pH (1:2)	pH Units	-	**6.4**	**6.7**	**5.0**	**4.8**
Conductivity (1:2) in soil Method: AN106 Tested: 21/7/2015						
Conductivity (1:2) @25 C*	µS/cm	1	**55**	**42**	**110**	**200**
Resistivity (1:2)*	ohm cm	-	**18000**	**24000**	**9300**	**5100**
Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography Method: AN245 Tested: 15/7/2015						
Chloride	mg/kg	0.25	**4.4**	**1.1**	**3.9**	**39**
Sulphate	mg/kg	0.5	**14**	**5.9**	**7.1**	**350**
Moisture Content Method: AN002 Tested: 16/7/2015						
% Moisture	%w/w	0.5	**13.6**	**11.5**	**18.8**	**22.5**

Parameter	Units	LOR	Sample Number: SE141392.009 Sample Matrix: Soil Sample Date: 14 Jul 2015 Sample Name: BH10 1.45m-1.6m	Sample Number: SE141392.010 Sample Matrix: Soil Sample Date: 14 Jul 2015 Sample Name: BH5 1.5-1.8m
pH in soil (1:2) Method: AN101 Tested: 21/7/2015				
pH (1:2)	pH Units	-	**4.4**	**4.9**
Conductivity (1:2) in soil Method: AN106 Tested: 21/7/2015				
Conductivity (1:2) @25 C*	µS/cm	1	**110**	**220**
Resistivity (1:2)*	ohm cm	-	**9300**	**4600**
Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography Method: AN245 Tested: 15/7/2015				
Chloride	mg/kg	0.25	**3.7**	**32**
Sulphate	mg/kg	0.5	**74**	**100**
Moisture Content Method: AN002 Tested: 16/7/2015				
% Moisture	%w/w	0.5	**15.2**	**9.7**

QC SUMMARY

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Conductivity (1:2) in soil Method: ME-(AU)-[ENV]AN106

Parameter	QC Reference	Units	LOR	DUP %RPD
Conductivity (1:2) @25 C*	LB081405	µS/cm	1	1 - 2%
Resistivity (1:2)*	LB081405	ohm cm	-	1 - 2%

Moisture Content Method: ME-(AU)-[ENV]AN002

Parameter	QC Reference	Units	LOR	DUP %RPD
% Moisture	LB081139	%w/w	0.5	0 - 2%

pH in soil (1:2) Method: ME-(AU)-[ENV]AN101

Parameter	QC Reference	Units	LOR	DUP %RPD
pH (1:2)	LB081404	pH Units	-	0 - 2%

Soluble Anions in Soil from 1:2 DI Extract by Ion Chromatography Method: ME-(AU)-[ENV]AN245

Parameter	QC Reference	Units	LOR	MB	LCS %Recovery
Chloride	LB081084	mg/kg	0.25	<0.25	99%
Sulphate	LB081084	mg/kg	0.5	<0.5	100%

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN101	pH in Soil Sludge Sediment and Water: pH is measured electrometrically using a combination electrode and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:2 and the pH determined and reported on the extract after 1 hour extraction (pH 1:2) or after 1 hour extraction and overnight aging (pH (1:2) aged). Reference APHA 4500-H+.
AN106	Conductivity : Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:2 and the EC determined and reported on the extract basis after the 1 hour extraction (EC(1:2)) or after the 1 hour extraction and overnight aging (EC(1:2) aged). Reference APHA 2520 B. Resistivity of the extract is reported on the extract basis and is the reciprocal of conductivity. Salinity and TDS can be calculated from the extract conductivity and is reported back to the soil basis.
AN245	Anions by Ion Chromatography: A water sample or extract is injected into an eluent stream that passes through the ion chromatographic system where the anions of interest ie Br, Cl, NO2, NO3 and SO4 are separated on their relative affinities for the active sites on the column packing material. Changes to the conductivity and the UV-visible absorbance of the eluent enable identification and quantitation of the anions based on their retention time and peak height or area. APHA 4110 B

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
		QFL	QC result is below the lower tolerance
**	Indicative data, theoretical holding time exceeded.	-	The sample was not analysed for this analyte
^	Performed by outside laboratory.	NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: http://www.sgs.com.au/~/media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf

APPENDIX C

Rock Laboratory Test Results

- Point load Strength Index Test Results – Alliance Geotechnical
- UCS Test Results – Resource Laboratories 15-0058

Test Report - Point Load Strength Index – Core Sample

Client Name:	Department of Education	Report Number:	1915-GR-1-1
Project Name:	Proposed Education Development	Sample Date:	12/07/2015
Project Location:	Arthur Phillip High School & Parramatta Public School	Sampled By:	PC
Project Number:	1915	Sample Method:	NMLC Core
Testing Device:	45-D0550/E - Digital, 55kN capacity	Test Date:	17/07/2015
Test Method:	AS 4133.4.1—2007	Sample History:	Unsoaked

Borehole BH1

Sample Number	Sample Depth (m)	Lithology	Failure Type	Test Orientation (Diametric/Axial)	Platen Point		Point Load Strength Is (MPa)	Point Load Strength **Is (50) (MPa)**	Rock Strength Class
					DIAM (mm)	Height (mm)			
1	4.88	HW Shale	FOB	Axial	50	50	0.05	**0.05**	Very Low
2	5.08	HW Shale	PF	Axial	50	48	0.07	**0.07**	Very Low
3	5.71	HW Shale	FOB	Axial	50	46	0.04	**0.05**	Very Low
4	6.03	HW Shale	FOB	Axial	50	47	0.03	**0.03**	Very Low
5	7.08	HW Shale	PF	Axial	50	38	0.10	**0.10**	Very Low
6	7.26	HW Shale	PF	Axial	50	35	0.20	**0.20**	Low
7	7.83	HW Shale	FI/FOB	Axial	50	48	0.50	**0.53**	Medium
8	8.00	HW Shale	FOB	Axial	50	48	0.69	**0.72**	Medium
9	8.31	HW Shale	FOB	Axial	50	48	1.07	**1.12**	High
10	8.72	HW Shale	FOB	Axial	50	42	1.28	**1.30**	High

Borehole BH2

Sample Number	Sample Depth (m)	Lithology	Failure Type	Test Orientation (Diametric/Axial)	Platen Point		Point Load Strength Is (MPa)	Point Load Strength **Is (50) (MPa)**	Rock Strength Class
					DIAM (mm)	Height (mm)			
1	8.61	HW Shale	FOB	Axial	50	35	2.57	**2.49**	High
2	5.77	HW Shale	FOB	Axial	50	43	2.43	**2.49**	High
3	6.04	HW Shale	FI/FOB	Axial	50	39	5.45	**5.44**	Very High
4	6.83	HW Shale	FOB	Axial	50	42	1.84	**1.87**	High
5	7.17	HW Shale	FOB	Axial	50	49	2.87	**3.03**	Very High
6	7.61	HW Shale	FOB	Axial	50	49	2.23	**2.36**	High
7	8.04	HW Shale	FOB	Axial	50	46	2.84	**2.95**	High
8	8.79	HW Shale	FOB	Axial	50	39	2.56	**2.55**	High
9	9.00	HW Shale	FOB	Axial	50	35	4.01	**3.89**	Very High
10	9.24	HW Shale	FOB	Axial	50	37	2.93	**2.89**	High

Borehole BH3

Sample Number	Sample Depth (m)	Lithology	Failure Type	Test Orientation (Diametric/Axial)	Platen Point		Point Load Strength Is (MPa)	Point Load Strength **Is (50) (MPa)**	Rock Strength Class
					DIAM (mm)	Height (mm)			
1	5.65	EW Shale	FI/FOB	Axial	50	44	0.51	**0.53**	Medium
2	6.23	HW Shale	FI/PF	Axial	50	50	0.65	**0.69**	Medium
3	6.85	HW Shale	FOB	Axial	50	43	1.38	**1.41**	High
4	7.24	MW Shale	FOB/EPF	Axial	50	49	1.68	**1.78**	High
5	7.88	MW Shale	FOB	Axial	50	40	2.31	**2.32**	High
6	8.09	MW Shale	FOB	Axial	50	49	1.47	**1.55**	High
7	8.80	MW Shale	FOB	Axial	50	50	1.88	**2.00**	High
8	9.19	MW Shale	FOB	Axial	50	49	1.84	**1.95**	High
9	9.87	MW Shale	FOB	Axial	50	48	1.11	**1.17**	High

Borehole BH5

Sample Number	Sample Depth (m)	Lithology	Failure Type	Test Orientation (Diametric/Axial)	Platen Point		Point Load Strength Is (MPa)	Point Load Strength **Is (50) (MPa)**	Rock Strength Class
					DIAM (mm)	Height (mm)			
1	4.82	EW Shale	FOB	Axial	50	42	0.40	**0.40**	Medium
2	5.00	HW Shale	FOB	Axial	50	46	0.71	**0.74**	Medium
3	5.63	HW Shale	FOB	Axial	50	42	0.38	**0.38**	Medium
4	6.19	HW Shale	FOB	Axial	50	44	1.09	**1.12**	High
5	6.73	HW Shale	FOB	Axial	50	46	0.60	**0.63**	Medium
6	7.05	HW Shale	FOB	Axial	50	40	1.88	**1.89**	High
7	7.88	HW Shale	FOB	Axial	50	40	1.87	**1.88**	High
8	8.00	HW Shale	FOB	Axial	50	49	0.67	**0.71**	Medium
9	8.54	HW Shale	FOB	Axial	50	50	1.07	**1.14**	High

Borehole BH8

Sample Number	Sample Depth (m)	Lithology	Failure Type	Test Orientation (Diametric/Axial)	Platen Point		Point Load Strength Is (MPa)	Point Load Strength **Is (50) (MPa)**	Rock Strength Class
					DIAM (mm)	Height (mm)			
1	5.05	HW Shale	FOB	Axial	50	43	0.26	**0.27**	Low
2	5.70	HW Shale	PF	Axial	50	49	0.21	**0.23**	Low
3	6.31	HW Shale	EPF	Axial	50	46	0.52	**0.54**	Medium
4	6.71	HW Shale	FOB	Axial	50	34	0.36	**0.35**	Medium
5	7.06	HW Shale	PF	Axial	50	42	0.34	**0.34**	Medium
6	7.87	HW Shale	PF	Axial	50	50	0.32	**0.34**	Medium
7	8.00	HW Shale	FOB	Axial	50	43	0.65	**0.66**	Medium
8	8.95	HW Shale	FOB	Axial	50	44	0.68	**0.69**	Medium
9	9.19	HW Shale	FOB	Axial	50	49	1.26	**1.33**	High

10	9.79	HW Shale	FOB/EPF	Axial	50	50	1.45	**1.54**	High
11	10.09	HW Shale	FOB/EPF	Axial		35	1.62	**1.57**	High
12	10.72	HW Shale	FOB	Axial		48	1.23	**1.29**	High

Borehole BH10

Sample Number	Sample Depth (m)	Lithology	Failure Type	Test Orientation (Diametric/Axial)	Platen Point		Point Load Strength Is (MPa)	Point Load Strength **Is (50) (MPa)**	Rock Strength Class
					DIAM (mm)	Height (mm)			
1	4.94	HW Shale	PF	Axial	50	50	0.08	**0.09**	Very Low
2	5.94	HW Shale	PF	Axial	50	49	0.13	**0.14**	Low
3	6.87	HW Shale	FOB	Axial	50	50	0.06	**0.06**	Low
4	7.69	HW Shale	FOB	Axial	50	49	0.02	**0.02**	Extremely Low
5	8.22	HW Shale	FOB	Axial	50	49	0.22	**0.23**	Low
6	8.93	HW Shale	FOB	Axial	50	50	0.52	**0.55**	Medium
7	9.19	HW Shale	PF	Axial	50	50	0.41	**0.43**	Medium
8	9.81	HW Shale	PF	Axial	50	45	0.36	**0.38**	Medium
9	10.49	HW Shale	PF	Axial	50	48	0.61	**0.64**	Medium
10	10.78	HW Shale	FOB/PF	Axial	50	47	0.43	**0.45**	Medium
11	11.09	HW Shale	FOB	Axial	50	48	0.41	**0.43**	Medium
12	11.64	HW Shale	FOB	Axial	50	47	0.36	**0.38**	Medium

Borehole BH12

Sample Number	Sample Depth (m)	Lithology	Failure Type	Test Orientation (Diametric/Axial)	Platen Point		Point Load Strength Is (MPa)	Point Load Strength **Is (50) (MPa)**	Rock Strength Class
					DIAM (mm)	Height (mm)			
1	10.17	EW Shale	FI	Axial	50	39	0.34	**0.34**	Medium
2	10.54	HW Shale	FOB	Axial	50	48	1.23	**1.29**	High
3	11.07	HW Shale	FOB/FI	Axial	50	46	1.11	**1.15**	High
4	11.68	HW Shale	FOB/FI	Axial	50	50	1.00	**1.07**	High
5	12.09	HW Shale	FOB	Axial	50	44	0.85	**0.88**	Medium
6	12.32	HW Shale	FOB	Axial	50	37	0.95	**0.94**	Medium

Borehole BH13

Sample Number	Sample Depth (m)	Lithology	Failure Type	Test Orientation (Diametric/Axial)	Platen Point		Point Load Strength Is (MPa)	Point Load Strength **Is (50) (MPa)**	Rock Strength Class
					DIAM (mm)	Height (mm)			
1	3.37	HW Siltstone	FOB	Axial	50	48	0.03	**0.03**	Very Low
2	4.50	HW Siltstone	FOB	Axial	50	50	0.01	**0.01**	Extremely Low
3	5.25	HW Siltstone	FOB	Axial	50	50	0.02	**0.02**	Extremely Low
4	7.26	HW Siltstone	PF	Axial	50	50	0.43	**0.46**	Extremely Low
5	7.62	HW Siltstone	PF	Axial	50	50	0.54	**0.57**	Medium
6	8.54	HW Shale	FOB	Axial	50	48	0.49	**0.51**	Medium

7	9.27	HW Shale	FI	Axial	50	43	0.37	**0.37**	Medium
8	9.85	HW Shale	FI	Axial	50	44	0.47	**0.48**	Medium
9	10.19	HW Shale	FI	Axial	50	50	0.78	**0.83**	Medium
10	10.76	HW Shale	FOB	Axial	50	47	0.78	**0.81**	Medium
11	11.20	HW Shale	FOB	Axial	50	43	1.81	**1.85**	High
12	11.81	HW Shale	FOB	Axial	50	49	0.96	**1.01**	High
13	11.75	HW Shale	FOB	Axial	50	41	1.05	**1.06**	High

Failure Type:
TS – Testing Stopped
FOB/NWP – Fracture of specimen oblique to bedding not influenced by weak planes.
EPF – Existing Plane Fracture.
FI – Fracture influenced by existing plane, vein, micro fracture.
PF – Partial fracture or chip only.

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Test Report

Customer: Alliance Geotechnical Pty Ltd
Project: Parramatta - 1915
Location: Parramatta

Job number: 15-0058
Report number: 1
Page: 1 of 9

Uniaxial Compressive Strength of Rock Core

Sampling method: Samples tested as received
Test method(s): AS 4133.1.1.1, 4.2.2

	Results			
Laboratory sample no.	6502	6503	6504	6505
Customer sample no.	BH2	BH2	BH3	BH3
Sample depth	6.086-6.320m	7.800-7.988m	7.31-7.46m	9.24-9.51m
Date sampled	02/07/2015	02/07/2015	02/07/2015	02/07/2015
Date tested	28/07/2015	28/07/2015	24/07/2015	24/07/2015
Lithological description	SHALE	SHALE	SHALE	SHALE
Storage history, curing and environment	Sealed, dry, moisture condition as received	Sealed, dry, moisture condition as received	Sealed, moist, moisture condition as received	Sealed, moist, moisture condition as received
Type of test machine used	Matest 1500kN - Grade A	Matest 1500kN - Grade A	Matest 1500kN - Grade A	Matest 1500kN - Grade A
Description of failure	Tensile dominated	Tensile dominated	Tensile dominated	Tensile dominated
Specimen average length (mm)	148.1	154.1	145.2	105.1
Specimen average diameter (mm)	51.8	51.6	51.8	51.8
Moisture content at time of test (%)	1.1	1.2	1.4	1.3
Test duration (mins)	38	30	11	12
Rate of displacement (mm/min)	<0.1	<0.1	<0.1	<0.1
Uniaxial Compressive Strength (MPa)	**78**	**76**	**57**	**72**

Notes: Where the measured strength using this method exceeds 50 MPa this method may result in a measured strength that is less than the strength obtained in test method AS 4133.4.2.1. 6505 length to diameter ratio 2.0

Approved Signatory:  E. Maldonado **Date:** 29/07/2015

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Test Report

Customer: Alliance Geotechnical Pty Ltd
Project: Parramatta - 1915
Location: Parramatta

Job number: 15-0058
Report number: 1

Uniaxial Compressive Strength of Rock Core

Sampling method: Samples tested as received
Test method(s): AS 4133.1.1.1, 4.2.2

	Results			
Laboratory sample no.	6506	6507	6508	6509
Customer sample no.	BH5	BH5	BH8	BH8
Sample depth	5.32-5.65m	7.69-7.88m	7.54-7.84m	9.54-9.71m
Date sampled	03/07/2015	03/07/2015	08/07/2015	08/07/2015
Date tested	24/07/2015	24/07/2015	24/07/2015	24/07/2015
Lithological description	SHALE	SHALE	SHALE	SHALE
Storage history, curing and environment	Sealed, moist, moisture condition as received	Sealed, moist, moisture condition as received	Sealed, moist, moisture condition as received	Sealed, moist, moisture condition as received
Type of test machine used	Matest 1500kN - Grade A	Matest 1500kN - Grade A	Matest 1500kN - Grade A	Matest 1500kN - Grade A
Description of failure	Tensile dominated	Tensile dominated	Tensile dominated	Tensile dominated
Specimen average length (mm)	152.3	154.7	137.0	132.3
Specimen average diameter (mm)	51.7	51.7	51.8	51.6
Moisture content at time of test (%)	2.9	2.1	3.1	2.6
Test duration (mins)	5	8	5	6
Rate of displacement (mm/min)	<0.1	<0.1	<0.1	<0.1
Uniaxial Compressive Strength (MPa)	**15**	**27**	**12**	**17**

Notes:

Approved Signatory:  E. Maldonado **Date:** 29/07/2015

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Test Report

Customer: Alliance Geotechnical Pty Ltd
Project: Parramatta - 1915
Location: Parramatta

Job number: 15-0058
Report number: 1

Uniaxial Compressive Strength of Rock Core

Sampling method: Samples tested as received
Test method(s): AS 4133.1.1.1, 4.2.2

	Results			
Laboratory sample no.	6510	6511		
Customer sample no.	BH10	BH13		
Sample depth	10.34-10.52m	11.16-11.32m		
Date sampled	07/07/2015	30/06/2015		
Date tested	24/07/2015	24/07/2015		
Lithological description	SHALE	SHALE		
Storage history, curing and environment	Sealed, moist, moisture condition as received	Sealed, moist, moisture condition as received		
Type of test machine used	Matest 1500kN - Grade A	Matest 1500kN - Grade A		
Description of failure	Tensile dominated	Tensile dominated		
Specimen average length (mm)	141.1	112.7		
Specimen average diameter (mm)	51.8	51.7		
Moisture content at time of test (%)	3.1	2.6		
Test duration (mins)	5	10		
Rate of displacement (mm/min)	<0.1	<0.1		
Uniaxial Compressive Strength (MPa)	**14**	**19**		

Notes: 6511 length to diameter ratio 2.2.

Approved Signatory: E. Maldonado **Date:** 29/07/2015

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Test Report

Customer: Alliance Geotechnical Pty Ltd
Project: Parramatta - 1915
Location: Parramatta

Job number: 15-0058
Report number: 1

Uniaxial Compressive Strength of Rock Core

Specimen prior to testing

Laboratory sample no. 6502

Laboratory sample no. 6503

Laboratory sample no. 6504

Laboratory sample no. 6505

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Test Report

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Location: Parramatta

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Uniaxial Compressive Strength of Rock Core

Specimen prior to testing

Laboratory sample no. 6506

Laboratory sample no. 6507

Laboratory sample no. 6508

Laboratory sample no. 6509

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Test Report

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Project: Parramatta - 1915
Location: Parramatta

Job number: 15-0058
Report number: 1

Uniaxial Compressive Strength of Rock Core

Specimen prior to testing

Laboratory sample no. 6510

Laboratory sample no. 6511

Laboratory sample no.

Laboratory sample no.

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Test Report

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Project: Parramatta - 1915
Location: Parramatta

Job number: 15-0058
Report number: 1

Uniaxial Compressive Strength of Rock Core

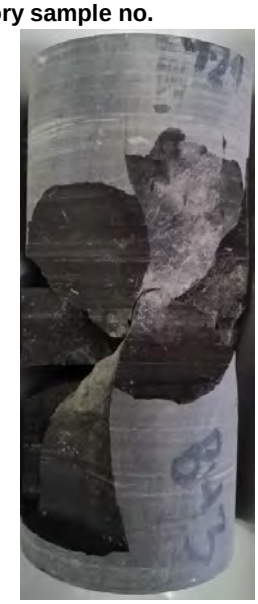
Specimen after failure

Laboratory sample no. 6502

Laboratory sample no. 6503

Laboratory sample no. 6504

Laboratory sample no. 6505



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Test Report

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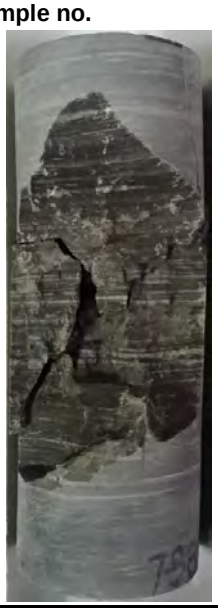
Job number: 15-0058
Report number: 1

Uniaxial Compressive Strength of Rock Core

Specimen after failure

Laboratory sample no. 6506

Laboratory sample no. 6507



Laboratory sample no. 6508

Laboratory sample no. 6509

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Test Report

Customer: Alliance Geotechnical Pty Ltd
Project: Parramatta - 1915
Location: Parramatta

Job number: 15-0058
Report number: 1

Uniaxial Compressive Strength of Rock Core

Specimen after failure

Laboratory sample no. 6510

Laboratory sample no. 6511

Laboratory sample no.

Laboratory sample no.

Manage the earth, eliminate the risk

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Addendum to Geotechnical Investigation Report

Prepared for Department of Education & Communities

Arthur Phillip High School and Parramatta Public School
Macquarie Street, Parramatta

Project Number: 1915
Report Number: 1915-GR-1-2
Report date: 2nd September 2015
Attention: Mr Roland Marshall

We give you the right information to make the right decisions

Alliance Geotechnical Pty Ltd - Phone: 02 9675 1777 - Web: www.allgeo.com.au

TABLE OF CONTENTS

ATTACHMENTS **Drawing 1915-GR-2A**
Geological Sections A-A, B-B and C-C

ADDENDUM INTRODUCTION AND SCOPE

This addendum is to be read in conjunction with the Alliance Geotechnical (AG) Geotechnical Investigation Report Number: 1915-GR-1-2 dated 31st July 2015. The purpose of this addendum is to provide additional comments and information for a possible single basement to be located within the site, with the actual basement location yet to be determined.

SINGLE BASEMENT

For a single basement, it is anticipated that the excavation depths would be approximately 3m, however, the actual basement location, extent and depths have yet to be determined.

There are several possible locations where a single basement could be located:

- In the north western corner of the site, adjacent to Barracks Lane on the northern side of Macquarie Street, under the proposed future playing field;
- In the south western corner of the site, under future open areas and playing fields to the south of the heritage buildings which are to remain;
- In the south eastern corner of the site, under the proposed new low rise Parramatta Public School; or
- In the north eastern corner of the site, under the proposed high rise Arthur Phillip High School;
- In between or a combination of the above.

With respect to excavation, in our earlier report it was noted that: "*in the north eastern corner near Charles Street, firm and loose alluvium was encountered with the water table at 1.7m depth in BH3. If deep excavations were to be considered in this area, temporary dewatering or installation of cut off walls to rock and tanking of the structures would likely be required. Hence, deep excavations are not recommended in the eastern areas of the site that are or may be underlain by alluvium.*"

When the location, extent and levels of the basement have been determined, the drilling of additional boreholes and installation of standpipe piezometers may be advisable to provide additional subsurface information for design and to confirm groundwater levels.

COMMENTS

North western corner of the site

In the north western corner of the site, based on the borehole information, a 3m deep basement excavation would encounter residual soils with bedrock near the base of the excavation to 0.6m below the base of the excavation. Groundwater was not encountered in the boreholes (BH1 and BH4) whilst augering to depths of 4m and 4.6m.

South western corner of the site

In the south western corner of the site, based on the borehole information, a 3m deep basement excavation would encounter residual soils with bedrock near the base of the excavation to 1.5m below the base of the excavation. Groundwater was not encountered in the boreholes (BH12 and BH13) whilst augering to depths of 6m and 3.1m.

South eastern corner of the site

In the south eastern corner of the site, based on the borehole information, a 3m deep basement excavation would encounter residual soils and up to 1.5m of bedrock in some sections, with bedrock up to 0.8m below the base of the excavation in other sections. Groundwater was not encountered in the boreholes (BH7 to BH11) whilst augering to depths of between 2.9m and 4.8m.

North eastern corner of the site

In the north eastern corner of the site, based on the borehole information, a 3m deep basement excavation would encounter firm and loose alluvium with bedrock about 2m below the base of the excavation.

Groundwater seepage was encountered in the boreholes (BH2, BH3 and BH6) at depths ranging from 1.7m to 3.6m.

Based on these conditions, it is considered that excavation conditions may generally be similar across the site with the exception of the north eastern corner of the site.

Geological sections have been produced and these are attached together with Drawing 1915-2-1A which shows the section locations.

Excavation Conditions

Excavations to approximately 3m depth would be in clayey fill, stiff to very stiff silty clays and possibly extremely low strength siltstone / shale, or medium to high strength siltstone (for excavations in the south eastern corner). Fill and water charged alluvium would be expected in the north eastern corner of the site.

The fill, residual soils and extremely low strength rock are expected to be readily excavatable using conventional earthmoving equipment such as dozers, excavators or other mechanical plant. The medium to high strength siltstone would likely require heavy ripping and/or the use of hydraulic hammers.

The alluvium north eastern corner of the site would be readily excavated using conventional earthmoving equipment, however, trafficability under the excavation plant may be marginal, particularly close to or below the levels of groundwater and groundwater seepage.

The soil laboratory test results indicate that the site soils are prone to full or partial dispersion. It is therefore recommended that the soils be protected from erosion and dispersion during construction by covering them with a 100mm thick granular working platform. In the long term, otherwise unprotected soils should be covered with topsoil and vegetated.

Excavation Stability and Batter Slopes

As was noted in our earlier report for shallow excavations, temporary batter slopes could be appropriate for excavations not encountering groundwater seepage and provided the excavations are set back sufficiently from the site boundaries. The recommended maximum slopes for excavated batters are presented in Table 7 of our earlier report, together with limitations and assumptions on the adoption of such batter slopes.

Batter slopes in soft and loose alluvium close to or below the level of groundwater and groundwater seepage would be potentially unstable, even at reasonably shallow batter slopes. For an excavation in such alluvium in the north eastern corner of the site, specific assessment and stability analysis would be recommended, taking into account the proximity of adjacent structures to the excavation and their foundation types and levels. It would be anticipated that some dewatering spears and/or sumps may be required to enable the excavation of batter slopes in such materials. Alternatively, a cut off wall could be constructed by installing sheet piling or a secant pile wall taken into the top of the weathered rock.

Retaining Structures

It is anticipated that cantilever retaining walls could be considered as for the shallow excavations described in the earlier report.

Recommended parameters for the design of earth retaining structures were provided in Table 8 of the main report. Additional parameters are provided in Table AD1 for the alluvial soils.

Consideration may be given to the incorporation of cantilever piles socketed into the underlying bedrock. For a basement excavation in the north eastern corner of the site in alluvium, secant piles may be adopted to cut off groundwater inflow and provide lateral restraint. It is recommended also that consideration be given to at least partial tanking of any basements in the north eastern corner of the site.

Table AD1 – Preliminary Geotechnical Design Parameters for Retaining Walls

Parameters	Soft and Loose Alluvium
Ka	0.4
Ko	0.6
Poisson Ratio (v)	0.4
Effective Cohesion c' (kPa)	0
Effective Internal Friction Angle (degrees)	25
Bulk Unit Weight (kN/m^3)	17

For the design of cantilever piles socketed into rock, computer modelling using either Wallap or Plaxis or similar is recommended to optimise the designs and accurately model the soil layers, resulting movements as well as shear forces and moments in the structures.

Rock Parameters

It is expected that the structural loads from the multi-storey buildings will be taken into the underlying rock stratum, and the use of bored and cast insitu reinforced concrete piles are considered appropriate. The piles should be socketed within the medium to high strength Class III sandstone underlying the site. Recommended parameters for the computer modelling and design of piled foundations are provided in Table AD2.

Table AD2 - Recommended Parameters for the Design of Piled Foundations

Rock Strength	Density kN/m^3	c' kPa	Phi' Degrees	v'	E' MPa
Extremely Low to Very Low	23	25	28	0.25	50
Low Strength	24	50	28	0.25	200
Medium Strength	25	100	31	0.25	700

Should you need any further information, please do not hesitate to contact us.

Regards,

Reviewed By,

David Duff BE(Hons) MEngSc MIEAust CPEng
Principal Geotechnical Engineer
Alliance Geotechnical Pty Ltd

Thomas Dale BE (Civil) Hon.
Geotechnical Engineer
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Geotechnical Borehole and Geological Section Locations

Not To Scale

N

Source: SIX Maps (www.maps.six.nsw.gov.au)

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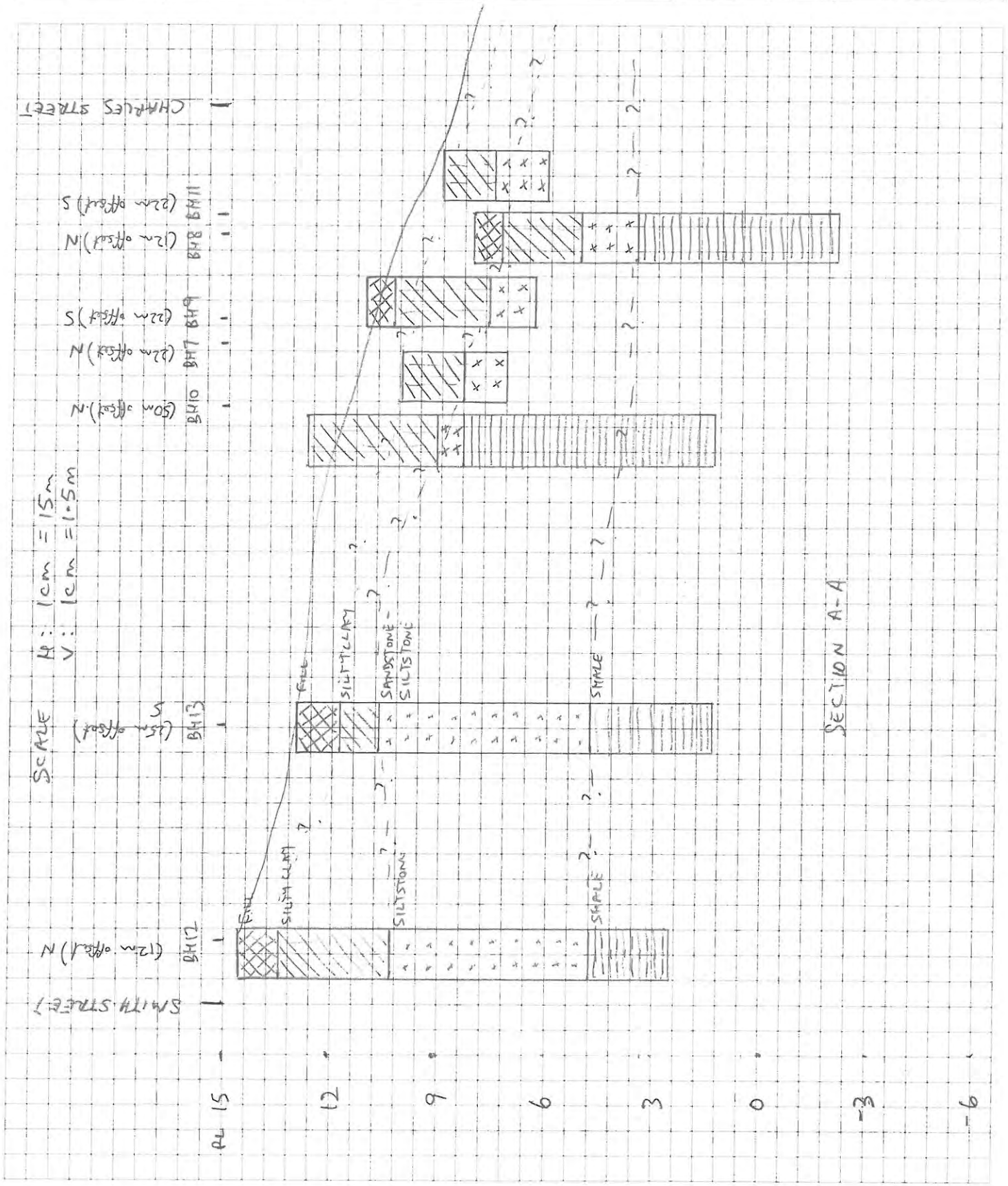
Client Name:	DEC	Project Number:	1915	Date:	2/9/15	Sheet 1 of 3
Project Name:	PARRAMATTA SCHOOLS			Calculated By:		DCD



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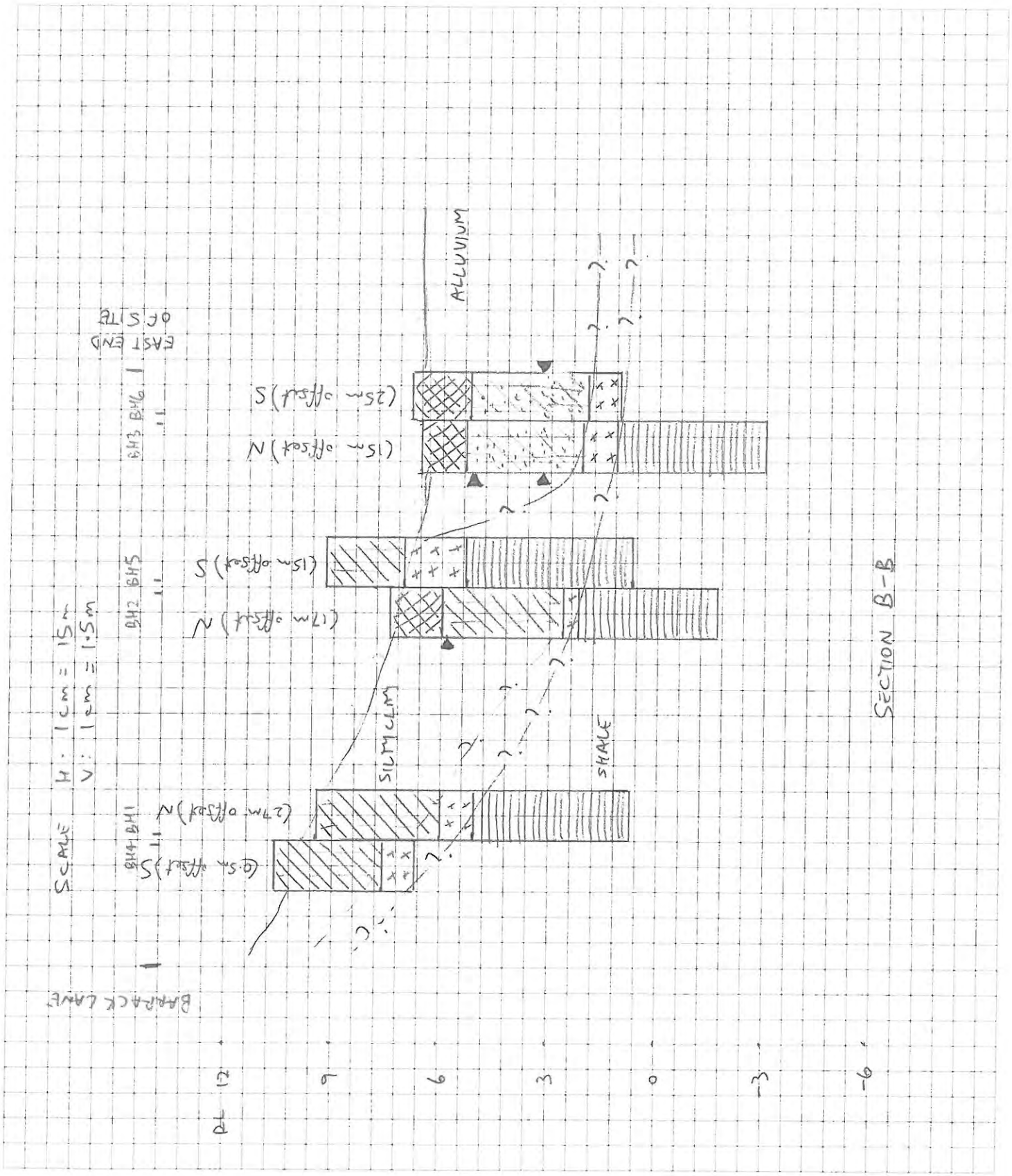
Client Name:	DEC	Project Number:	1915	Date:	2/9/15	Sheet 2 of 3
Project Name:	PARRAMATTA SCHOOLS			Calculated By:		DFD



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