Pacific Geotech
Consulting Geotechnical Engineers

GEOTECHNICAL REVIEW REPORT:

Proposed Wee Waa High School

105 to 107 Mitchell Street

Wee Waa

NSW Department of Education

October 2021

PG-6504

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Ref: PG-6504, 2021-10-14, GR VER 1
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21 October, 2021

NSW Department of Education
Email: Matthew.Arnett2@det.nsw.edu.au
Cc: Jeremy@ingineered.com.au; jdwyer@ethosurban.com

ATTN: MATT ARNETT

Dear Sir,

GEOTECHNICAL REVIEW – PROPOSED WEE WAA HIGH SCHOOL
105 TO 107 MITCHELL STREET, WEE WAA

Enclosed is a copy of our report for the above project dated October 2021. An electronic copy of the report has been issued.

Should you have any queries regarding this report, please do not hesitate to contact Peter Elkington at this office.

Yours faithfully,

P. ELKINGTON (RPEQ 7226)

For and on behalf of
PACIFIC GEOTECH PTY LTD

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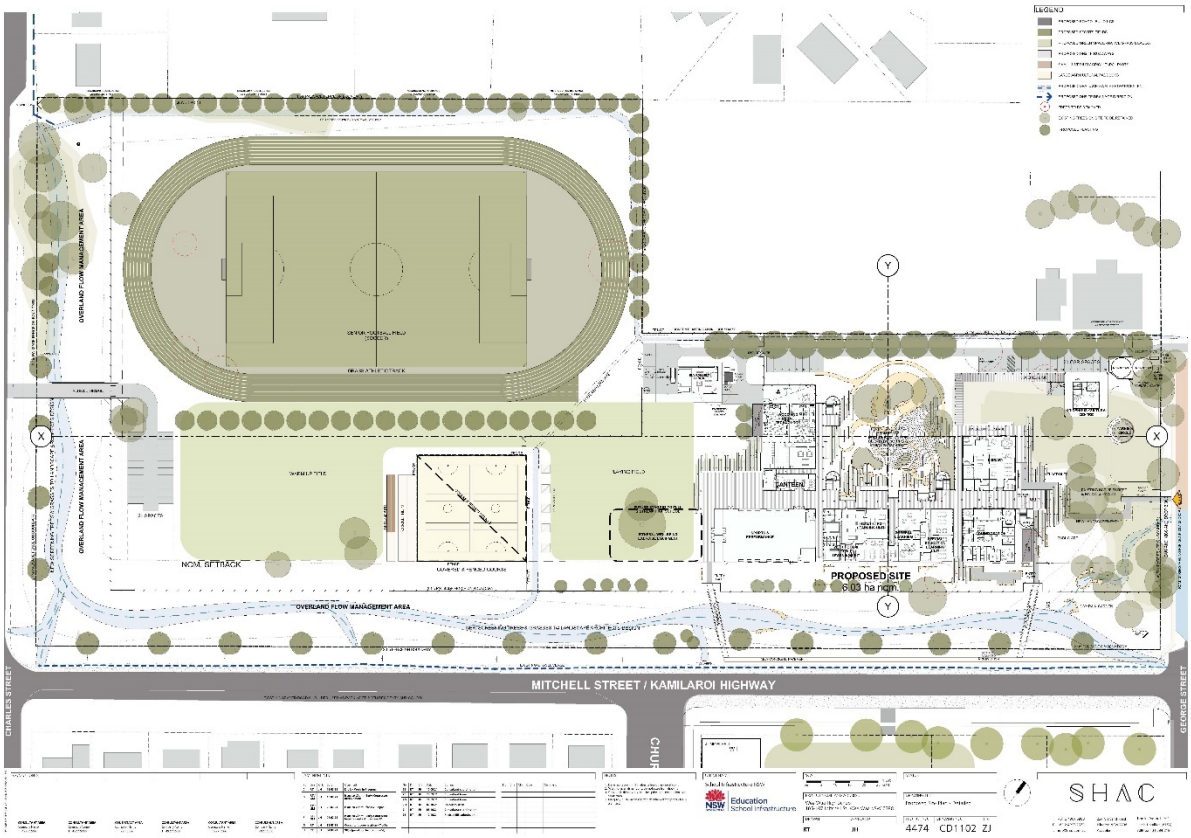
1.0 INTRODUCTION

This report contains the results of the review of the provided geotechnical investigation (Barnson geotechnical report reference 35754-GR02_A dated 24 May 2021) and provides advice and recommendations relating to the following:

- Foundation Recommendations including pile design parameters
- Characteristic ground surface movements
- Earthworks considerations
- Construction Considerations

Proposed Development

It is understood that the proposed development is to comprise the construction of a series of new school buildings. The buildings are to be constructed as high-set structures supported on steel posts, with a void between the structure and the ground surface level. Earthworks are expected to comprise a minor stripping operation (removal of topsoil etc.) followed by the placement of up to 700mm of fill to reprofile the site to improve drainage conditions. The filling will be undertaken with imported fill material. The proposed development is indicated below.



The proposed bulk earthworks are indicated below:

The Barnson geotechnical report for the site is appended.

2.0 EARTHWORKS AND SITE PREPARATION CONSIDERATIONS

Earthworks are expected to comprise of a minor cut to fill operation from front to rear, combined with an imported filling operation of up to 0.5m.

It is recommended that the following site preparation and earthworks procedures be carried out as part of the earthworks procedures during development.

- All earthworks operations should be carried out in general accordance with AS 3798-2007 "Guidelines on Earthworks for Commercial and Residential Developments".
- If significant rainfall events occur during the earthworks operation, significant difficulties could be experienced in trafficing the exposed surface.
- All topsoil (i.e. soil containing organic matter) and soils containing deleterious matter should be stripped from the construction area at the commencement of the earthworks operation. This is expected to be in the order of 0.3m, but could be locally deeper and could be confirmed at the time of stripping.

- The stripped surface should be proof rolled using a large vibrating roller of minimum weight of 12 tonnes, to identify areas of weak surficial soils and to compact the upper level material where trafficability is available following stripping.
- The natural soils are typically highly to extremely reactive and would generally not be suitable for reuse as structural fill around the building and under the proposed paths.
- Imported fill should be of fair to good quality with a minimum Soaked CBR value of 10%, a maximum Iss=0.5%, a maximum particle size of 75mm, a maximum Plasticity Index of 10%, a maximum Liquid Limit of 35% and a minimum 80% of material passing the 19mm sieve and 20% minimum passing 0.075mm sieve.
- All filling should be undertaken in layer thicknesses of approximately 250mm (or as appropriate for the compaction equipment being used). Fill should be compacted to a minimum dry density ratio of 95% Standard in accordance with AS1289 5.1.1.
- Appropriate engineering supervision of the filling operation and material should be maintained to optimise the final site classifications for the development.
- Field density testing should be carried out to check the standard of compaction achieved and the placement moisture content. The frequency and extent of testing should be as per guidelines in AS.3798-2007.
- All earthworks operations should be performed under Pacific Geotech's supervision, in general accordance with the requirements of AS3798 and should be certified as controlled fill by the testing authority.

3.0 POTENTIAL GROUND SURFACE MOVEMENTS

The final site classification for the site will be dependent upon the earthworks undertaken and the quality of the fill material on-site. In its current condition, potential ground surface movements in the order of 90mm to 120mm could be expected. This equates to Class E in accordance with AS2870 and could result in significant cost impediments to the foundations.

If the natural clays are utilised for the earthworks cut and fill, a further increase in the potential ground surface movements will result.

To maximise the potential ground surface movements, consideration could be given to adopting a surface layer of non-reactive material as outlined in Section 8.

4.0 GROUND SURFACE REDUCTION OPTIONS

If the upper level reactive clays are removed and suitably bridged, a reduction in the reactivity, and therefore site classification, of the site can be achieved. The

bridging can be achieved through the placement of lowly reactive imported select fill across the site, in order to reduce the expected ground surface movement.

Reduced potential ground surface movements (ys) to less than 60mm (Class H1) or 40mm (Class M) would result with 0.6m and 1.0m, respectively of controlled and suitable low plasticity clay fill, as specified in Section 6.0.

Additional comments relating to the successful reclassification of the site include:

- The site drainage must be carefully managed to ensure that all water is collected and directed into the stormwater systems and away from the structures.
- The base of all service trenches should be graded to fall away from the building.
- The replacement material must extend laterally beyond the buildings for at least 2m outside the structures.
- Supervision by Pacific Geotech of the earthworks operations is required to ensure satisfactory treatment of the site is achieved.
- The success of the measures is greatly dependent on sutiable site maintenance over the life of the development.

5.0 BUILDING FOUNDATIONS

5.1 Foundation Options

The site has been assessed to be equivalent to Class E, in accordance with AS 2870, with a potential ground surface movement of up to 120mm calculated.

It is understood that consideration is being given to adopting slab on ground structures for the paths and associated shade systems. These could be supported either on a piled foundation system with void former under the slab and the roofs cantilevered off the piled structure, or alternatively, consideration could be given to suitably articulating the slabs and roof structures, supporting the structure on the existing ground surface and allowing the structure to move with the moisture variation that is likely to occur.

Foundation systems that could be considered for the support of the classrooms could include:

1. Deep foundations (piers) with void former under the slabs, if a slab on ground is to be adopted.
2. Works to reduce potential ground surface movement, together with conventional raft type foundation systems.

Ground surface reduction could be achieved as outlined in Section 8.0, to reduce the classification to Class H1 or Class M.

Site specific site classifications should be undertaken following the completion of the bulk earthworks.

5.2 Deep Foundations

Screw piles, or possibly bored piers, founded a suitable depth below the zone of moisture variation could be considered for the support of the proposed structures.

The deep foundation system should consider the following:

- Compressional capacity
- Uplift/swell effects as a result of soil swell pressures

To remove the potential swell pressures on the footings, consideration could be given to adopting a void former such as "formavoid" under the footings and slabs. It is suggested a minimum thickness of 150mm of void former be utilised. A void should be provided by over-excavating the footing trenches and placing a 150mm 'Formavoid' (product name) or similar.

The deep foundation system should be designed in accordance with the recommendations of AS 2159-2009 'Piling - Design and Installation'.

The ultimate geotechnical strength ($R_{d,ug}$) of piles can be calculated using the unfactored, ultimate shaft adhesion and end bearing values given in Table 2. The $R_{d,ug}$ values given in Table 2 will need to be multiplied by a suitable geotechnical strength reduction factor ($ø_g$) to obtain the design geotechnical strength ($R_{d,g}$) of piles. In accordance with AS2159-2009, the $ø_g$ value must be determined by the designer, but based on the anticipated site, design and installation risk factors, a $ø_g$ value of 0.48 is recommended. Higher values may be applicable with suitable supervision.

If working stress methods are used in the pile design, the $R_{d,ug}$ values given in Table 2 will need to be divided by a factor of safety of 2.5 to caluculate the maximum single pile working load.

TABLE 1 ULTIMATE (UNFACTORED) PILE DESIGN PARAMETERS

Material	Ultimate Unfactored End Bearing* (kPa)		Ultimate Unfactored Shaft Adhesion* (kPa)
	<4D	>4D	
Controlled Fill and Stiff Clay	NR	NR	30
Hard clays	900	1200	40

Notes:
*Geotechnical strength reduction factor needs to be applied to these parameters.
1. NR – Not Recommended.
2. Skin friction in the upper 1.8m of the soil profile should be ignored.
3. Piers should found a minimum distance of 4.0m below the ground and suitably below the zone of moisture variation to resist the potential uplift from the reactive clays.

Construction Considerations

The bases of bored pile holes must be thoroughly cleaned of all loose soil and rock debris using a proper cleaning tool. The practice of adding water and spinning the auger is generally not acceptable.

Whilst no seepage was encountered in the boreholes during the investigation at this site, an allowance for the use of liners should be made. The groundwater seepages may be controllable by pumping. Shaft adhesion must be ignored for the portion of the pile that is permanently lined.

During construction, all bored piles must be inspected by a geotechnical engineer to confirm the geotechnical strength parameters presented in Table 2 and to check the capacity of the piles.

Uplift Considerations

The capacity of the piers to resist the uplift effects of from expansive clays should be assessed, as well as the compressional capacity of the piers.

The effect of swelling of the upper level soils can assess the following formula from AS2159-2009 3.3.2 (b)(i)(B):-

$$S_u = 1.5F_{es}$$

Where F_{es} is the uplift load generated by the swell pressure of the soils on the pier.

F_{es} can be calculated using

$$F_{es} = 0.15 * SP * A_{mv}$$

Where, SP = recommended Swell Pressure of soil (kPa)

A = surface area of pile in the zone of moisture variation (i.e. zone of moisture variation = 2.3m)

For design purposes, SP = 150kPa could be adopted for the site.

The uplift from the swell pressures should be offset by the site friction capacity of the pile below the zone of moisture variation.

The swell pressure effects on screw piles is significantly reduced when compared to bored piers.

6.0 SITE MANAGEMENT

To maintain the long term performance of the structure, good management of the soil conditions and the development is vital throughout the life of the development.

The following are some specific comments with respect to site management.

- The ground surface around the perimeter of the buildings, walls and pavements should slope away from the structure and fall to the stormwater system. Water should not be allowed to pond adjacent to the buildings.
- Founding soils should not be allowed to become saturated.
- Service trenches under the buildings should be kept to a minimum. Saturation of the on-site material will result in an increase in potential ground surface movements.
- Footings should be poured immediately after excavation. If footings cannot be poured on the same day as excavation, a blinding layer of 50mm thickness is recommended.
- Trees, garden beds and other vegetation should be planted at a distance at least equivalent to one and a half times their mature height away from the structures. This will assist in minimising shrinkage movements in the expansive on-soils.

7.0 LIMITATIONS

We have prepared this report for the Proposed Wee Waa High School at 105 to 107 Mitchell Street, Wee Waa . The report is provided for the exclusive use of NSW Department of Education, for this project only and for the purposes outlined in the report. It should not be used by, or relied upon, for other projects on the same or different sites or by a third party. In preparing this report, we have relied upon information provided by the client or their agents.

The results are indicative of the subsurface conditions on site only at the specific testing locations. Subsurface conditions can change between test locations and the design and construction should take the spacing of the testing and testing methods adopted and the potential for variation between the test locations.

It is recommended that Pacific Geotech be engaged to provide advice and ensure the development is undertaken in accordance with the assumptions made in writing this report.

This is not to reduce the level of responsibility accepted by Pacific Geotech, but rather to ensure that the parties who may rely on the information contained in this report are aware of the responsibilities they assume in doing so.

P. ELKINGTON (RPEQ 7226)

For and on behalf of
PACIFIC GEOTECH PTY LTD

Enc. Barnson Geotechnical Report

Geotechnical Investigation Report

Assessment Site: "Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW

Client: NSW Department of Education

Address: 33-35 Bridge Street, Sydney NSW 2000

(Our Reference: 35754-GR02_B)

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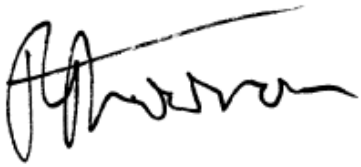
Disclaimer

This report has been prepared solely for NSW Department of Education in accordance with the scope provided by the client and for the purpose(s) as outlined throughout this report.

Barnson Pty Ltd accepts no liability or responsibility for or in respect of any use or reliance upon this report and its supporting material by anyone other than the client.

Project Name:	"Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW
Client:	NSW Department of Education
Project No.	35754
Report Reference	35754-GR02_B
Date:	24.05.2021
Revision:	Revision B.

Prepared by:	Reviewed by:
	
Gareth Williams Geotechnical Technician	Richard Noonan *BE(Hons) ME FIEAust CPEng NER* Director

1.0 INTRODUCTION

The following is a report on the geotechnical assessment of a site in accordance with AS1726-1993 “Geotechnical Site Investigations”.

The site investigation was carried out by Barnson Pty Ltd, on behalf of NSW Department of Education of Sydney NSW.

Plate 1 – Area of Investigation

NSW Department of Education is planning to develop new school buildings, pavement areas, sports ovals and relevant infrastructure at 105-107 Mitchell Street, Wee Waa NSW. The proposed site feature that is covered by this investigation are as follows.

- Proposed High School Building Footings

The investigation comprised of four (4) boreholes together with field mapping near the site. Details of the field work and laboratory testing are given in the report together with comments relevant to design and construction practice.

Reference is made to our initial geotechnical investigation report for this site (ref: 35754-GR01_A). This report details recommendations for pavement design.

1.1 Terminology

The methods used in this report to describe the soil profiles, including visual classification of material types encountered, are in accordance with Australian standard AS1726-1993 "Geotechnical Site Investigations".

1.2 Limitations

The geotechnical section of Barnson Pty Ltd has conducted this investigation and prepared this report in response to specific instructions from the client to whom this report is addressed. This report is intended for the sole use of the client, and only for the purpose which it is prepared. Any third party who relies on the report or any representation contained in it does so at their own risk.

1.3 Geotechnical Testing

Representative samples from the site were subjected to the following range of tests in accordance with relevant method of Australian Standard AS1289:

- Linear Shrinkage
- PH

NATA reports are attached in *Appendix D*.

2.0 SITE DESCRIPTION

2.1 General Site Description

The site is located in the centre of Wee Waa NSW. The surrounding land is mainly reserved for residential purposes.

The overall site is relativley flat. The block has an existing school and residential blocks surrounding the vicinity.

The site consists of moderate grass and weed cover with large trees scattered over the site. Reference is made to our initial geotechnical investigation report for this site (ref: 35754-GR01_A). The fieldwork conducted on 19th March 2021 was limited to hand excavation of boreholes due to the site being un-trafficable. The site contained ponding water from recent rains, which indicates the site's drainage is very poor.

Any trees noted to be within the building zone, should be removed and the excavation remaining should be backfilled with natural material and reinstated in layers to a minimum of 95% Standard Maximum Dry Density.

Plate 2 – General view of site facing Southwest.

Plate 3 – General view of site facing north.

Plate 4 – General view of site facing west.

Plate 5 – General view of borehole locations 1 and 3 facing northeast.

Plate 6 – General view of borehole location 4 northwest.

3.0 METHOD OF INVESTIGATION

On the 7th of May 2021, a geotechnical investigation was carried out at the site of the above-mentioned development. The field drilling was carried out by a geotechnical technician who logged the boreholes on site and undertook geological mapping of the nearby area.

A drilling rig with a 90mm auger and tungsten tip was used to excavate four (4) boreholes for the proposed new buildings to a depth of 4.0m within the proposed development areas. These are identified as boreholes 1 through 4.

Dynamic cone Penetrometer (DCP) testing was carried out to depths of 1.3m. At this depth, DCP refusal of 32 blows per 100mm was encountered.

3.1 GPS Co-Ordinates

The boreholes were drilled as close as possible to the anticipated location of the proposed structures. GPS Co-ordinates of these were recorded on site to enable plotting of the borehole locations. The following Table 1 shows these co-ordinates.

Table 1: GPS Co-Ordinates of Boreholes

Location	Longitude	Latitude	Proposed Structure
Borehole 1	149.441583	-30.222985	School Buildings
Borehole 2	149.441302	-30.222274	School Buildings
Borehole 3	149.441924	-30.222739	School Buildings
Borehole 4	149.441932	-30.222323	School Buildings

The boreholes were recorded on site with a Garmin Oregon 550 handheld GPS, using GDA94 Datum. The co-ordinates have an accuracy of +/- 5m. These locations are also shown on site plan in *Appendix B*.

The borehole logs of sub-surface profiles are attached in ***Appendix C***. Bulk samples (Ds <3kg) were sampled from all relevant boreholes and returned to the Laboratory where Linear Shrinkage and pH testing was performed to assist in the material classification.

4.0 GENERAL SUB-SURFACE CONDITIONS

4.1 Topsoil

Topsoil was encountered at all borehole locations. The topsoil encountered was sandy silt to a depth of 0.2m.

4.2 Alluvial Soils

Alluvial soils were encountered throughout the borehole locations. These comprised of slightly moist silty clay and slightly moist sandy silty clay to depths as shown in borelogs attached in *Appendix C*. The clays were noted to be of a high plasticity, which was confirmed through subsequent laboratory testing.

4.3 Regional Geology

Reference to the New South Wales 1:1,000,000 Geological Map indicates the surrounding area consists of *"Alluvial and riverine plain deposits of gravel, sand, silt and clay; claypans and outwash areas of black and red clayey silt and sand; coastal sand dunes and beach deposits".*

Rock was not encountered during this investigation.

4.4 Seismicity

Reference is made to AS1170.4-2007 as per clause 4.1.1 the sites sub-soil class is "C_e – Shallow Sub-soil".

4.5 Seasonal Surface Movement

From the laboratory test results, as shown in section 5, an estimated ground surface movement (Ys) was calculated in accordance with AS2870-2011 (using a change in suction at the soil surface $\Delta\mu$ = 1.5pF and a depth of design suction change, Hs = 4.0m) being:

Ys = 120-125mm

The site has mature trees scattered over the area which will cause abnormal soil moisture content and thus , it is our opinion that a Site Classification of 'P' should be adopted for the site in its present condition. The soil reactivity indicates a 'E-D' soil classification.

Reference is made to Appendix 'H' of AS2870-2011, which gives guidance on the design of footings on reactive clay soils with the effect of trees. The footing design engineer will need to calculate the tree induced differential centre heave mound height (y_m) based on the tree height and distance of the proposed buildings from the tree or group of trees. This value should be used to design a suitable footing design in accordance with section 4 of the code.

5.0 NATA LABORATORY TESTING

Disturbed samples were taken during the field investigation. Laboratory testing was carried out on selected samples of all different material types, with details of the sampling and testing shown below:

Soil Index Properties testing were carried out on samples to aid in classification of the soils encountered and to assist in determining design parameters.

5.1 Linear Shrinkage Testing (L.S)

The shrinkage results are summarised in the below table:

Table 2: Linear Shrinkage Results

Test Pit No.	Depth (m)	Proposed Structure	Linear Shrinkage (%)
Borehole 1	0.8	School Buildings	18.5
Borehole 1	2.0	School Buildings	16.5
Borehole 2	0.8	School Buildings	16.0
Borehole 2	2.0	School Buildings	15.5
Borehole 3	0.8	School Buildings	15.5
Borehole 3	2.0	School Buildings	15.5
Borehole 4	0.8	School Buildings	18.0
Borehole 4	2.0	School Buildings	16.5

The above test results confirm the material as high plasticity.

5.2 Acid Sulphates

Acidic ground conditions can be caused by dissolved "aggressive" carbon dioxide, pure and very soft waters, organic and mineral acids and bacterial activity. PH testing was conducted on the site samples to determine if any acidic conditions were present in the soils encountered.

Table 3: PH Testing Results

Borehole No.	Sample Depth (m)	Proposed Structure	pH	Exposure Classification
Borehole 1	0.8	School Buildings	8.30	A1
Borehole 2	0.8	School Buildings	8.20	A1
Borehole 3	0.8	School Buildings	8.50	A1
Borehole 4	0.8	School Buildings	8.20	A1

These results show the exposure classification as per Table 5.2 AS2870-2011. Groundwater was not encountered during this investigation.

6.0 SUB-SURFACE BEARING CAPACITIES

6.1 Bearing Capacities General

All the below soil strengths are applicable to the sites at the time of the investigation.

Elevation of moisture content will cause a marked decrease in bearing capacity with soil types listed. Refer to our initial report which found wet soft clay to depths of 600mm with design bearing capacity of 10-80 kPa.

Table 4: In-Situ Site Bearing Capacities

Test Pit No.	Soil Strata	Depth of Strata (m)	Ultimate Base Bearing Capacity (kPa)	Factored Limit State Ø = 0.52 (kPa)
Borehole 1	Stiff CLAY	0.2-0.4	150	80
Borehole 1	Very Stiff CLAY	0.4-0.6	300	156
Borehole 1	Hard CLAY	0.6-4.0	>500	>260
Borehole 2	Stiff CLAY	0.2-0.4	150	80
Borehole 2	Very Stiff CLAY	0.4-0.6	300	156
Borehole 2	Hard CLAY	0.6-4.0	>500	>260
Borehole 3	Stiff CLAY	0.2-0.4	150	80
Borehole 3	Very Stiff CLAY	0.4-0.6	300	156
Borehole 3	Hard CLAY	0.6-4.0	>500	>260
Borehole 4	Stiff CLAY	0.2-0.4	150	80
Borehole 4	Very Stiff CLAY	0.4-0.6	300	156
Borehole 4	Hard CLAY	0.6-4.0	>500	>260

A Geotechnical reduction factor of 0.52 has been applied to all listed ultimate bearing capacities (reference table 4.3.2 (i) AS2159-2009)

7.0 EARTHWORKS RECOMMENDATIONS

7.1 Excavations

Excavations within the natural clays will be achievable using conventional earthmoving equipment. The civil contractor should be responsible for selecting excavation equipment based on the proposed excavation depths and equipment capabilities.

The soft upper layers of topsoil and clay for a depth of 500mm should be stripped and removed from site or saved for use as landscaping soil. The subgrade should then be proof rolled in accordance with AS3798-2007. Local soft spots, failing the proof roll test, will need further excavation and removal of unsuitable soil.

7.2 General Construction Filling

All earthworks performed on site must be undertaken in a controlled manner, in accordance with a suitable earthwork's specification. Filling should be placed, compacted, inspected and tested in accordance with the Level 2 requirements of AS3798-2007.

The following conditions should also be satisfied:

- General filling must be compacted to a minimum dry density ratio of 98-100% relative to standard compaction at a moisture content of -2% to +2% of standard optimum moisture content.
- Filling should proceed in layers of 300mm maximum loose thicknesses.
- Layers of filling should be horizontal or benched to suit the surrounding topography.
- The existing subgrade can NOT be used as bulk fill, due to its extreme reactivity.

7.3 Site Construction Batters

7.3.1 Temporary batter slopes

In soil should be graded no steeper than 2 Horizontal (H) in 1 Vertical (V), and protected from erosion by re-directing any surface water flows from the batter face, revegetating etc.

7.3.2 Permanent batter slopes

Batter slopes in with clay should be no steeper than 4 Horizontal (H) in 1 Vertical (V) and protected from erosion. Alternatively, fill embankments may be retained with properly designed and constructed retaining walls. The natural soil is not suitable for backfilling against retaining walls.

8.0 DESIGN PARAMETERS DISCUSSIONS

8.1 School Building Foundations

All foundations for buildings that are similar in size and structure to large residential buildings should be designed with guidance from AS2870-2011 for the site classification provided in section 4.5.

It is anticipated the footings for the proposed school buildings will consist of either a stiffened raft slab supported by piers or a steel frame floor supported by piers. Raft slabs should be designed by engineering principles with guidance from AS2870-2011 for the site classification noted. It is recommended this raft slab be supported on bored concrete piers or steel screw in piers embedded a minimum depth of seasonal movement, Hs= 4.0m. The slab should be separated from the soil to limit the effects of ground swell, using a 150mm collapsible void former.

The design bearing capacity of piers founded at 4.0m can be taken as 450kPa. Design skin friction of the piers can be taken as 38kPa, with the top 1.2m not contributing due to shrinkage potential of the soil.

8.2 Foundations General

The possibility of other abnormal and localised moisture changes must be minimised by adherence to general design and site management practises. These recommendations assume that all footings will be founded in the natural soil or controlled fill, and that no topsoil or poor and uncompacted fill occurs beneath the footing beams or slab.

Finally, it must be emphasised that the recommended design approach accepts that minor aesthetic cracking may occur. The design philosophy is thus a compromise between economy and performance.

8.3 General Pavement Notes

All pavement areas are required to be sealed and well drained to prevent moisture affecting the sub-grade. All pavement areas should be removed of any other deleterious material then compacted to a minimum of 100% standard compaction. The pavement should be placed, compacted and tested in accordance with AS3798-2007.

9.0 CONCLUSION

The testing methods adopted are indicative of the site's sub-surface conditions to the depths excavated and to specific sampling and/or testing locations in this investigation, and only at the time the work was carried out.

The accuracy of geotechnical engineering advice provided in this report may be limited by unobserved variations in ground conditions across the site in areas between and beyond test locations and by any restrictions in the sampling and testing which was able to be carried out, as well as by the amount of data that could be collected given the project and site constraints.

These factors may lead to the possibility that actual ground conditions and materials behaviour observed at the test locations may differ from those which may be encountered elsewhere on the site.

If the sub-surface conditions are found to differ from those described in this report, we should be informed immediately to evaluate whether recommendations should be reviewed and amended if necessary.

Appendix A - General Notes

GEOTECHNICAL INVESTIGATION GENERAL NOTES

This report contains the results of a geotechnical investigation conducted for a specific purpose and client. The results should not be used by other parties, or for other purposes, as they may contain neither adequate nor appropriate information. The investigation does not cover contamination issues unless specifically required to do so by the client.

TEST HOLE LOGGING

The information on the test hole logs (boreholes, test pits, exposures etc.) is based on a visual and tactile assessment, except at the discrete locations where the test information is available (field and/or laboratory results). The borehole logs include both factual data and inferred information. Reference should be made to the relevant sheets for the explanation of logging procedures (Soil and Rock Descriptions, Core Log Sheet Notes etc.).

GROUNDWATER

Unless otherwise indicated, the water levels presented on the borehole logs are the levels of free water or seepage in the test hole recorded at the given time of measuring. The actual groundwater level may differ from this recorded level depending on material permeability's (i.e. depending on response time of the measuring instrument). Further, variations of this level could occur with time due to such effects as seasonal, environmental and tidal fluctuations or construction activities. Confirmation of groundwater levels, phreatic surfaces or piezo metric pressures can only be made by appropriate instrumentation techniques and monitoring programmes.

INTERPRETATION OF RESULTS

The discussion or recommendations contained within this report normally are based on a site evaluation from discrete borehole area. Generalised, idealised or inferred subsurface conditions (including any geotechnical cross-sections) have been assumed or prepared by interpolation and/or extrapolation of these data. As such these conditions are an interpretation and must be considered as a guide only.

CHANGE IN CONDITIONS

Local variations or anomalies in the generalised ground conditions do occur in the natural environment, particularly between discrete borehole locations. Additionally, certain design or construction procedures may have been assumed in assessing the soil-structure interaction behaviour of the site. Furthermore, conditions may change at the site from those encountered at the time of the geotechnical investigation through construction activities and constantly changing natural forces.

Any change in design, in construction methods, or in ground conditions as noted during construction, from those assumed or reported should be referred to this firm for appropriate assessment and comment.

GEOTECHNICAL VERIFICATION

Verification of the geotechnical assumptions and/or model is an integral part of the design process – investigation, construction verification and performance monitoring. Variability is a feature of the natural environment and, in many instances, verification of soil or rock quality, or foundation levels are required. There may be a requirement to extend foundation depths to modify a foundation system or to conduct monitoring because of this natural variability. Allowance for verification by geotechnical personnel accordingly should be recognised and programmed during construction.

FOUNDATIONS

Where referred to in the report, the soil or rock quality, or the recommendation depth of any foundation (piles, caissons footings etc.) is an engineering estimate. The estimate is influenced and perhaps limited, by the fieldwork method and testing carried out in connection with the site investigation, and other pertinent information as has been made available. The material quality and/or foundation depth remains, however, an estimate and therefore liable to variation. Foundation drawings, designs and specifications should provide for variations in the final depth, depending upon the ground conditions at each point of support, and allow for geotechnical verification.

REPRODUCTION OF REPORTS

Where it is desired to reproduce the information contained in our geotechnical report, or other technical information, for the inclusion in contract documents or engineering specification of the subject development, such reproductions should include at least all of the relevant test hole and test data, together with the appropriate standard description sheets and remarks made in the written report of a factual or descriptive nature.

ROCK

Rock Strength

Rock strength is a scale of strength, based on point load index testing, or field testing.

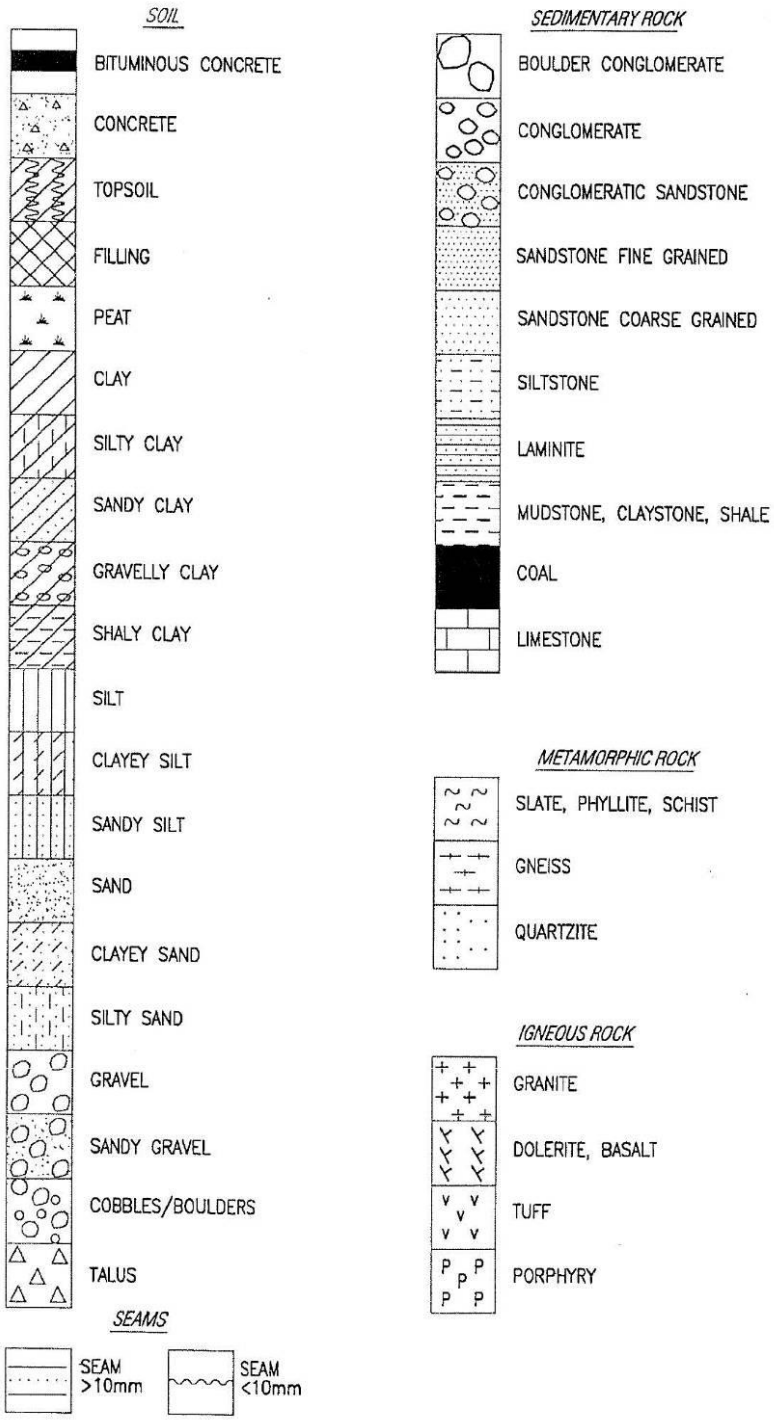
Term	Letter Symbol	Point load index (Mpa) Is (50)	Field guide to strength
Extremely low	EL	< 0.03	Easily remoulded by hand to a material with soil properties.
Very low	VL	0.03 – 0.1	Material crumbles under firm blows with sharp end of pick.
Low	L	0.1 – 0.3	Easily scored by knife, has dull sound under hammer.
Medium	M	0.3 – 1.0	Readily scored with knife, core pieces broken by hand with difficulty
High	H	1 – 3	Rock rings under hammer, core piece broken by pick only.
Very high	VH	3 – 10	Hand specimen breaks with pick after more than one blow.
Extremely high	EH	> 10	Hand specimen breaks with pick after several than one blow.

Rock Weathering

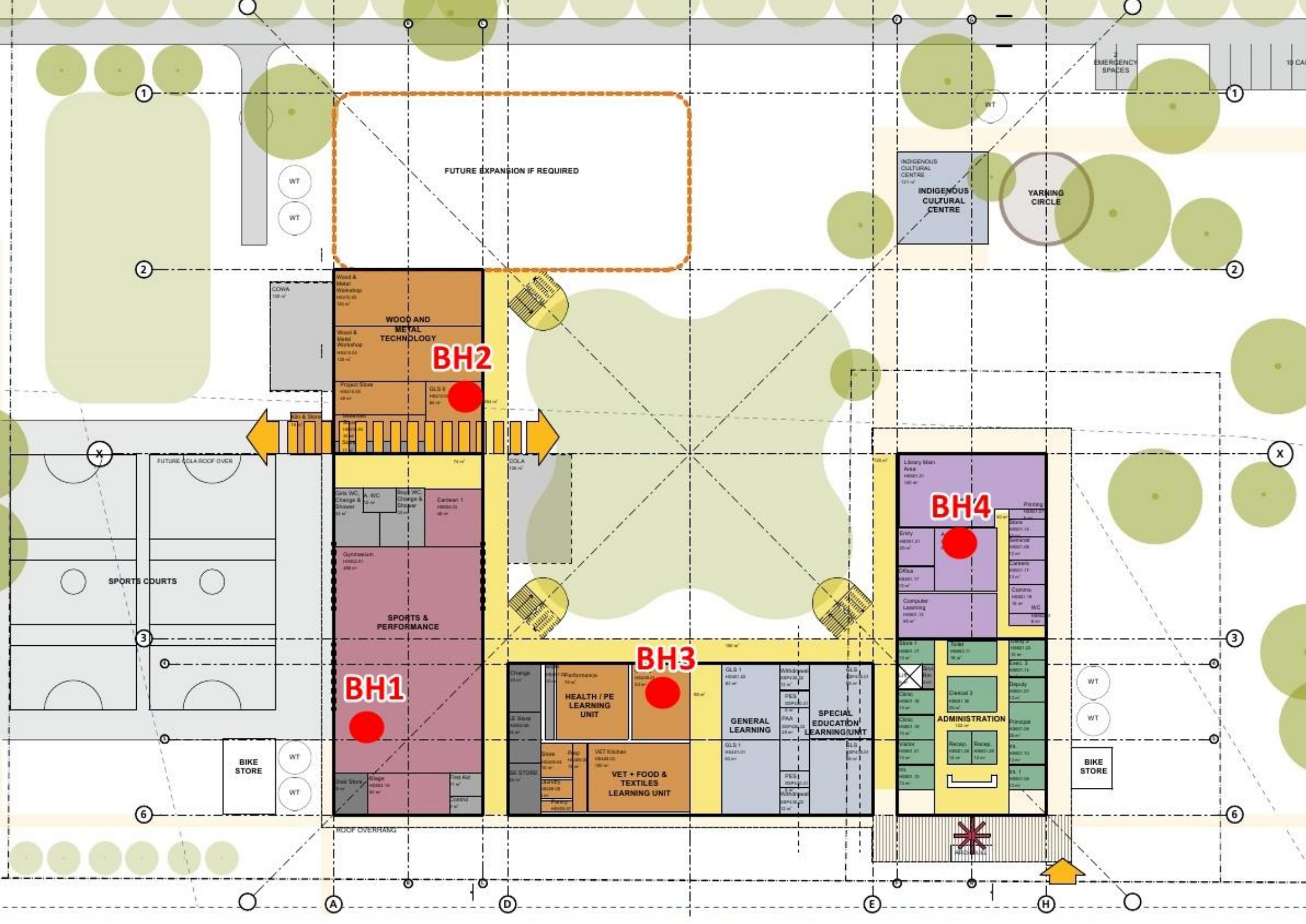
Rock weathering is the degree of rock weathering, determined in the field.

Term	Letter Symbol	Definition
Residual soil	RS	Soil developed on extremely weathered rock.
Extremely weathered rock	XW	Soil is weathered to such an extent that it has soil properties, i.e., it disintegrates or can be remoulded in water.
Distinctly weathered rock	DW	Rock strength usually changed by weathering. The rock may be discoloured, usually by iron staining, porosity is increased.
Slightly weathered rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh rock	FR	Rock shows no sign of decomposition or staining.

GRAPHIC SYMBOLS FOR SOIL & ROCK



Appendix B – Site Plan with Borehole Locations


FUTURE EXPANSION IF REQUIRED
INDIGENOUS CULTURAL CENTRE
INDIGENOUS CULTURAL CENTRE
YARNING CIRCLE
WT
WT
WOOD AND METAL TECHNOLOGY
BH2
COWA
FUTURE COLA ROOF OVER
SPORTS COURTS
SPORTS & PERFORMANCE
BH1
COLA
BH3
HEALTH / PE LEARNING UNIT
GENERAL LEARNING
SPECIAL EDUCATION LEARNING UNIT
VET + FOOD & TEXTILES LEARNING UNIT
BH4
ADMINISTRATION
BIKE STORE
BIKE STORE
ROOF OVERHANG
WT
WT
WT
WT
1
2
3
6
X
A
D
E
H

Appendix C - Borehole Logs

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1/36 Darling Street
Dubbo, NSW 2830
Telephone: 1800 BARNSON

BOREHOLE NUMBER 1

CLIENT NSW Department of Education **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 35754 **PROJECT LOCATION** 105-107 Mitchell Street, Wee Waa NSW

DATE STARTED 7/5/21 **COMPLETED** 7/5/21 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Barnson **SLOPE** 90° **BEARING** ---

EQUIPMENT GT-10 Drill Rig **HOLE LOCATION** Borehole 1

HOLE SIZE 90mm **LOGGED BY** GW **CHECKED BY** NR

NOTES _____

Method	Samples	Depth (m)	Graphic Log	Classification Symbol	Material Description	Dynamic Cone Penetrometer Blows / 100mm	Additional Observations
Flight Auger & Tungsten Carbide (T.C) Bit		0			Sandy SILT: dark brown	0 4 8 12 16 20 24 2832	TOPSOIL
		0.2		CH	Silty CLAY: grey: slightly moist: stiff to hard: high plasticity	4 3 3 4 7 10 11 11 15 16 19 21	ALLUVIAL
	Disturbed Sample LS = 18.5%	0.5					
		1.0					
		1.3		CH	Sandy Silty CLAY: brown: slightly moist: hard: high plasticity	32	ALLUVIAL
	Disturbed Sample LS = 16.5%	1.5					
		2.0					
		2.5					
		3.0					
		3.5					
		4.0					

Borehole 1 terminated at 4m

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1/36 Darling Street
Dubbo, NSW 2830
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BOREHOLE NUMBER 2

CLIENT NSW Department of Education **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 35754 **PROJECT LOCATION** 105-107 Mitchell Street, Wee Waa NSW

DATE STARTED 7/5/21 **COMPLETED** 7/5/21 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Barnson **SLOPE** 90° **BEARING** ---

EQUIPMENT GT-10 Drill Rig **HOLE LOCATION** Borehole 2

HOLE SIZE 90mm **LOGGED BY** GW **CHECKED BY** NR

NOTES _____

Method	Samples	Depth (m)	Graphic Log	Classification Symbol	Material Description	Dynamic Cone Penetrometer Blows / 100mm	Additional Observations
Flight Auger & Tungsten Carbide (T.C) Bit		0			Sandy SILT: dark brown	0 3 4	TOPSOIL
		0.2		CH	Silty CLAY: grey: slightly moist: stiff to hard: high plasticity	4 4 6 9 10 11 14 16 19 23 32	ALLUVIAL
	Disturbed Sample LS = 16.0%	0.5					
		1.0					
		1.5					
		1.6		CH	Sandy Silty CLAY: brown: slightly moist: hard: high plasticity		ALLUVIAL
	Disturbed Sample LS = 15.5%	2.0					
		2.5					
		3.0					
		3.5					
		4.0					

Dynamic Cone Penetrometer Blows / 100mm: 0 4 8 12 16 20 24 28 32

Borehole 2 terminated at 4m

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Dubbo, NSW 2830
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BOREHOLE NUMBER 3

CLIENT NSW Department of Education **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 35754 **PROJECT LOCATION** 105-107 Mitchell Street, Wee Waa NSW

DATE STARTED 7/5/21 **COMPLETED** 7/5/21 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Barnson **SLOPE** 90° **BEARING** ---

EQUIPMENT GT-10 Drill Rig **HOLE LOCATION** Borehole 3

HOLE SIZE 90mm **LOGGED BY** GW **CHECKED BY** NR

NOTES _____

Method	Samples	Depth (m)	Graphic Log	Classification Symbol	Material Description	Dynamic Cone Penetrometer Blows / 100mm	Additional Observations
Flight Auger & Tungsten Carbide (T.C) Bit		0			Sandy SILT: dark brown	0 4 8 12 16 20 24 2832	TOPSOIL
		0.2		CH	Silty CLAY: grey: slightly moist: stiff to hard: high plasticity	0, 3, 4, 4, 4, 5, 10, 11, 12, 13, 14, 18, 24, 32	ALLUVIAL
	Disturbed Sample LS = 15.5%	0.5					
		1.0					
		1.3		CH	Sandy Silty CLAY: brown: slightly moist: hard: high plasticity		ALLUVIAL
	Disturbed Sample LS = 15.5%	1.5					
		2.0					
		2.5					
		3.0					
		3.5					
		4.0					

Borehole 3 terminated at 4m

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Dubbo, NSW 2830
Telephone: 1800 BARNSON

BOREHOLE NUMBER 4

CLIENT NSW Department of Education **PROJECT NAME** Geotechnical Investigation

PROJECT NUMBER 35754 **PROJECT LOCATION** 105-107 Mitchell Street, Wee Waa NSW

DATE STARTED 7/5/21 **COMPLETED** 7/5/21 **R.L. SURFACE** _____ **DATUM** _____

DRILLING CONTRACTOR Barnson **SLOPE** 90° **BEARING** ---

EQUIPMENT GT-10 Drill Rig **HOLE LOCATION** Borehole 4

HOLE SIZE 90mm **LOGGED BY** GW **CHECKED BY** NR

NOTES _____

Method	Samples	Depth (m)	Graphic Log	Classification Symbol	Material Description	Dynamic Cone Penetrometer Blows / 100mm	Additional Observations
Flight Auger & Tungsten Carbide (T.C) Bit		0			Sandy SILT: dark brown	0 3 3 4 4 5 11 14 18 19 22 24 28 32 (0 4 8 12 16 20 24 28 32)	TOPSOIL
		0.2		CH	Silty CLAY: grey: slightly moist: stiff to hard: high plasticity		ALLUVIAL
	Disturbed Sample LS = 18.0%	0.5					
		1.0					
		1.5					
		1.6		CH	Silty CLAY: brown: slightly moist: hard: high plasticity		ALLUVIAL
	Disturbed Sample LS = 16.5%	2.0					
		2.5					
		3.0					
		3.5					
		4.0					

Borehole 4 terminated at 4m

Appendix D – NATA Laboratory Reports

Material Test Report

Barnson Pty Ltd
Dubbo Laboratory
16 L Yarrandale Road Dubbo NSW 2830
Phone: 1300 BARNSON
Email: jeremy@barnson.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Jeremy Wiatkowski
Geotechnical Technician
NATA Accredited Laboratory Number: 9605

Report Number: **35754-2**
Issue Number: 1
Date Issued: 12/05/2021
Client: NSW Department of Education
33-35 Bridge Street , Sydney NSW 2000
Contact: Ben Reddacliff
Project Number: 35754
Project Name: Geotechnical Investigation
Project Location: "Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW
Work Request: 4743
Sample Number: D21-4743A
Date Sampled: 07/05/2021
Dates Tested: 07/05/2021 - 12/05/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **Borehole 1, Depth: 800mm**
Material: Grey Silty CLAY

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	18.5		
Cracking Crumbling Curling	Curling		

Material Test Report

Report Number: 35754-2
Issue Number: 1
Date Issued: 12/05/2021
Client: NSW Department of Education
33-35 Bridge Street , Sydney NSW 2000
Contact: Ben Reddacliff
Project Number: 35754
Project Name: Geotechnical Investigation
Project Location: "Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW
Work Request: 4743
Sample Number: D21-4743B
Date Sampled: 07/05/2021
Dates Tested: 07/05/2021 - 12/05/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **Borehole 1, Depth: 2.0m**
Material: Brown Sandy Silty CLAY

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WORLD RECOGNISED ACCREDITATION

Approved Signatory: Jeremy Wiatkowski
Geotechnical Technician
NATA Accredited Laboratory Number: 9605

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	16.5		
Cracking Crumbling Curling	Curling		

Material Test Report

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Approved Signatory: Jeremy Wiatkowski
Geotechnical Technician

NATA Accredited Laboratory Number: 9605

Report Number: **35754-2**
Issue Number: 1
Date Issued: 12/05/2021
Client: NSW Department of Education
33-35 Bridge Street , Sydney NSW 2000
Contact: Ben Reddacliff
Project Number: 35754
Project Name: Geotechnical Investigation
Project Location: "Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW
Work Request: 4743
Sample Number: D21-4743C
Date Sampled: 07/05/2021
Dates Tested: 07/05/2021 - 12/05/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **Borehole 2, Depth: 800mm**
Material: Grey Silty CLAY

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	16.0		
Cracking Crumbling Curling	Curling		

Material Test Report

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Approved Signatory: Jeremy Wiatkowski
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NATA Accredited Laboratory Number: 9605

Report Number: **35754-2**
Issue Number: 1
Date Issued: 12/05/2021
Client: NSW Department of Education
33-35 Bridge Street , Sydney NSW 2000
Contact: Ben Reddacliff
Project Number: 35754
Project Name: Geotechnical Investigation
Project Location: "Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW
Work Request: 4743
Sample Number: D21-4743D
Date Sampled: 07/05/2021
Dates Tested: 07/05/2021 - 12/05/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **Borehole 2, Depth: 2.0m**
Material: Brown Sandy Silty CLAY

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	15.5		
Cracking Crumbling Curling	Curling		

Material Test Report

Report Number: 35754-2
Issue Number: 1
Date Issued: 12/05/2021
Client: NSW Department of Education
33-35 Bridge Street , Sydney NSW 2000
Contact: Ben Reddacliff
Project Number: 35754
Project Name: Geotechnical Investigation
Project Location: "Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW
Work Request: 4743
Sample Number: D21-4743E
Date Sampled: 07/05/2021
Dates Tested: 07/05/2021 - 12/05/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **Borehole 3, Depth: 800mm**
Material: Grey Silty CLAY

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Approved Signatory: Jeremy Wiatkowski
Geotechnical Technician
NATA Accredited Laboratory Number: 9605

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	15.5		
Cracking Crumbling Curling	Curling		

Material Test Report

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NATA Accredited Laboratory Number: 9605

Report Number: **35754-2**
Issue Number: 1
Date Issued: 12/05/2021
Client: NSW Department of Education
33-35 Bridge Street , Sydney NSW 2000
Contact: Ben Reddacliff
Project Number: 35754
Project Name: Geotechnical Investigation
Project Location: "Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW
Work Request: 4743
Sample Number: D21-4743F
Date Sampled: 07/05/2021
Dates Tested: 07/05/2021 - 12/05/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **Borehole 3, Depth: 2.0m**
Material: Brown Sandy Silty CLAY

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	15.5		
Cracking Crumbling Curling	Curling		

Material Test Report

Report Number: 35754-2
Issue Number: 1
Date Issued: 12/05/2021
Client: NSW Department of Education
33-35 Bridge Street , Sydney NSW 2000
Contact: Ben Reddacliff
Project Number: 35754
Project Name: Geotechnical Investigation
Project Location: "Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW
Work Request: 4743
Sample Number: D21-4743G
Date Sampled: 07/05/2021
Dates Tested: 07/05/2021 - 12/05/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **Borehole 4, Depth: 800mm**
Material: Grey Silty CLAY

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Approved Signatory: Jeremy Wiatkowski
Geotechnical Technician
NATA Accredited Laboratory Number: 9605

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	18.0		
Cracking Crumbling Curling	Curling		

Material Test Report

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Geotechnical Technician
NATA Accredited Laboratory Number: 9605

Report Number: **35754-2**
Issue Number: 1
Date Issued: 12/05/2021
Client: NSW Department of Education
33-35 Bridge Street , Sydney NSW 2000
Contact: Ben Reddacliff
Project Number: 35754
Project Name: Geotechnical Investigation
Project Location: "Wee Waa High School" 105-107 Mitchell Street, Wee Waa NSW
Work Request: 4743
Sample Number: D21-4743H
Date Sampled: 07/05/2021
Dates Tested: 07/05/2021 - 12/05/2021
Sampling Method: AS 1289.1.2.1 6.5.3 - Power auger drilling
Sample Location: **Borehole 4, Depth: 2.0m**
Material: Brown Silty CLAY

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	16.5		
Cracking Crumbling Curling	Curling		