



Douglas Partners

Geotechnics | Environment | Groundwater

Report on
Geotechnical Investigation

Proposed New Public School
Fairley Street, Murrumbateman

Prepared for
Hansen Yuncken Pty Ltd

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Integrated Practical Solutions



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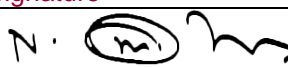

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Table of Contents

	Page
1. Introduction.....	1
2. Proposed Development.....	2
3. Site Description	2
4. Regional Geology.....	5
5. Field Work	5
5.1 Field Work Methods	5
5.2 Field Work Results	6
6. Laboratory Testing	7
7. Comments	9
7.1 Site Preparation and Earthworks	9
7.1.1 Stripping	9
7.1.2 Trafficability	9
7.1.3 Excavation Conditions	9
7.1.4 Excavation Batters	10
7.1.5 Reuse of Excavated Material	10
7.1.6 Filling Placement and Compaction	11
7.1.7 Site Drainage	11
7.2 Pavement Design Considerations	12
7.3 Site Classifications	12
7.4 Foundations	13
7.5 Soil Aggressivity.....	14
8. References	14
9. Limitations	14
Appendix A: About This Report	
Appendix B: Drawing 1 – Test Location Plan	
Appendix C: Explanatory Notes Test Pit Logs	
Appendix D: Results of Laboratory Testing	

Report on Geotechnical Investigation

Proposed New Public School

Fairley Street, Murrumbateman

1. Introduction

This Douglas Partners' report accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) in support of an application for a State Significant Development (SSD-11233241).

The development is for a new primary school located at 2 Fairley Street, Murrumbateman.

This report addresses the relevant Secretary's Environmental Assessment Requirements (SEARs), namely:

- Geotechnical Investigation and Reporting for the Environmental Impact Statement (EIS)

This report presents the results of a geotechnical investigation undertaken for the new primary school. The investigation was commissioned in an email dated 21 April 2021 by Paul Todhunter of Hansen Yuncken Pty Ltd and was undertaken in accordance with Douglas Partners' proposal 203624.00.P.001.Rev0 dated 5 May 2021.

It is understood that the proposed development of the site comprises the construction of a new primary school with three, 2 level structures (2 home base buildings and an admin/library building), a 1 level hall and canteen block, kiss and drop/carparking, sports courts and a play space.

It is understood that the report will be used to support the schematic design and detailed design phases, complete necessary due diligence and for inclusion in planning application submissions for the proposed development.

DP has also undertaken a contamination assessment with limited sampling which has been reported separately.

The aim of the investigation was to assess the subsurface soil and groundwater conditions across the site in order to provide the following:

- Broad assessment the subsurface conditions at the site relevant to the proposed development, including the presence and depth of fill, depth to groundwater, if encountered and any geotechnical constraints to development.
- Site classification in accordance with AS2870 for each building.
- Recommendations on suitable footing systems, including allowable bearing pressure for spread footings and parameters for pile design, estimates of total and differential settlements for spread and piled footings.
- Advice on concrete exposure classification from soil and water aggressivity, if any.
- Comment on the likely excavation characteristics of materials encountered as part of the site investigation and reuse of excavated materials as engineered fill.

- Advice for permanent and temporary batter slopes and retaining walls.
- Recommendations on earthworks and subgrade preparation methods including recommendations on the placement of engineered fill.
- Geotechnical advice on design subgrade CBR and suitability of existing pavement for incorporation into the proposed design.

The investigation included the drilling of 8 boreholes and excavation of 7 test pits and laboratory testing of selected samples. The details of the field work and laboratory testing are presented in this report, together with comments and recommendations on the items listed above.

This report must be read in conjunction with the notes entitled About this Report which are included in Appendix A.

2. Proposed Development

The proposed development is for construction and operation of a new primary school with Core 21 facilities in Murrumbateman that will accommodate up to 368 students.

The proposed development includes:

- A collection of 1-2 storey buildings containing 14 home base units, 2 special education learning units, hall, administration facilities and library.
- On-site parking lot with 40 spaces and kiss-and-ride area.
- Outdoor sports court and play area.
- Integrated landscaping, fencing and signage.

It is understood that the anticipated foundation loads (dead + live) are up to approximately 1800 kN.

3. Site Description

The site is located at 2 Fairley Street, Murrumbateman, in the local government area of Yass Valley Council. The site is formally described as Lot 302 DP1228766 (refer to Figure 1). The site is irregular in shape and has an area of 15,434.92m².

The site is located at the northern end of the Murrumbateman village, which is characterised by a mix of uses including low density residential and some commercial.

Immediately surrounding development includes a tourist hotel to the north across Fairley Street, Murrumbateman Library (located in the former Murrumbateman schoolhouse, a local heritage item) to the south, a medical centre and childcare centre to the west, and rural land and equestrian facilities to the east across Barton Highway. There is also a cycling and equestrian pathway to the south between the site and library.

The site contains an existing parking lot in its northern end and a driveway along its western boundary. There is also a mound of soil at the southern end of the site. The site is otherwise cleared and vacant.

The site is in a RU5 (village) zoning and is bounded by a hotel to the north, Barton highway to the east, a childcare centre to the west and an early childhood service centre to the south. At the time of investigation, the site had a moderately grassed stockpile about 2 - 4 m high, 40 m wide and 20 m deep to the south. The site is relatively flat, gently sloping from northwest to southeast with surface levels ranging approximately 566 m to 569 m Australian Height Datum (AHD). An approximate 1 m high fill batter was observed running along the eastern boundary.



Figure 1: Site Location

Figures 1 to 3 present the general conditions of the site at the time of investigation.



Figure 2: General conditions of the existing carpark, looking south/southwest.



Figure 3: General conditions of the site, looking south/southeast.



Figure 4: General conditions of the site, looking northeast.

4. Regional Geology

Reference to the Gunning 1: 100 000 geology map (Thomas, O.D. et. al. (2003) indicates the site is underlain by igneous rock of the Hawkins Volcanic unit, which typically comprises dacitic and rhyodacite rock, and beds of volcanoclastic rock such as tuff and tuffaceous sandstone.

5. Field Work

5.1 Field Work Methods

Field work for the investigation was undertaken in the period between 5 May 2021 and 6 May 2021 and comprised the drilling of 8 boreholes and excavation of 7 test pits. The test locations were nominated by the structural engineer for the project, Northrop Consulting Engineers Pty Ltd.

The approximate test locations are shown on Drawing 1 (Appendix B). The approximate test location coordinates provided on each log were determined on site using a hand-held GPS which is accurate only to about 3 – 5 m. The surface levels shown on the logs to Australian Height Datum (AHD) and coordinates to Map Grid of Australia (MGA, Zone 55) were interpolated using provided survey drawings and as such, are approximate only and not to be relied on.

Bores 1, 5, 6, and 8 were drilled using a Gemco 210B drill rig fitted with 110 mm diameter continuous flight augers to depths ranging between 8 m and 8.5 m. Standard penetration tests (SPT; AS1289 6.3.1:1997) were carried out at nominally 1.5 m test intervals to provide information on the strength of the overburden soils and samples for logging purposes. The SPT procedure is given in the notes in Appendix C and the penetration N values are shown on the borehole logs.

Bores 10 – 13 were drilled using a 3.5T CAT403C excavator fitted with a 300 mm solid flight auger to 1 m and extension rods to depths ranging from 2.5 m and 2.7 m. Pits 2, 3, 4, 7, 9, 14 and 15 were excavated using the same excavator fitted with a 300 mm wide bucket to depths ranging from 2.5 m to 3 m. It is noted that Pits 14 and 15 were excavated within a stockpile present in the south of the site. Dynamic cone penetrometer tests (AS 1289 6.3.2:1997) were also undertaken from the surface adjacent to each test location to provide an indication of the in-situ strength profile of the site soils.

The boreholes and test pits were logged on site by an experienced geotechnical engineer who collected regular disturbed and bulk samples of the soils to assist in strata identification and for laboratory testing.

5.2 Field Work Results

Details of the subsurface conditions encountered are presented in the bore hole and test pit logs included in Appendix C. The logs must be read in conjunction with the attached notes that define classification methods and terms used to describe the soils and rocks.

The succession of strata (not including pavement profile and stockpiles) is broadly summarised below:

TOPSOIL FILL: low plasticity, wet, firm, sandy Silt, trace rootles, only in Bore 1 to depth of 0.1 m.

FILL (ROADBASE): medium dense, well graded gravel underlying 35 mm to 55 mm thick surficial asphalt layer, to depths between 0.3 m – 0.4 m in Bores 1, 10 – 13.

FILL: generally low to medium plasticity, stiff to hard, moist, silty/sandy Clay, with varying amount of sand and gravel encountered in all test locations except in Bore 8 and 13, to depths of between 0 - 0.3 m and 0.2 – 1.0 m.

CLAYEY/SANDY/GRAVELLY SILT: generally low plasticity, moist, stiff to very stiff, clayey/sandy/gravelly silt, with varying amount of sand and gravel mixture in Bores 1, 10 and 13 and Pits 2 and 3, to depths of between 0.3 m – 1.2 m and 0.5 m – 1.4 m.

SILTY/SANDY/GRAVELLY CLAY & CLAY: generally low to high plasticity, moist to dry, stiff to hard, silty/sandy/gravelly clay and clay with varying amount of sand, ironstone nodules and gravel from depths of 0.5 m – 1.0 m to termination depths of 2.5 m – 2.7 m in Bores 10 – 13 and Pits 2 – 4 and 7; from 0.1 m – 1.4 m to 1.0 m – 6.5 m in Bore 1, 5, 6, 8, 13 and Pit 9.

DACITE: variably extremely low, extremely weathered dacite becoming low strength, highly weathered with depth, below depths of 1.0 m – 6.5 m to the termination depths of 2.5 m – 8.5 m.

No free groundwater was observed during the drilling/excavation of the boreholes/test pits. However, groundwater was found in some boreholes after some period as presented in Table 1 below:

Table 1: Groundwater Recordings

Bore	Groundwater Depth and Estimated Reduced Level		
	5/5/2021 – 6/5/2021		
	Depth (m)	RL (m)*	Time of Measurement
BH1	6.2m	559.8 m	1 hour after drilling
BH5	6.5 m - 6.7m	561.5 m - 561.3 m	1 hours after drilling
BH6	5.2 m	563.8 m	4 hours after drilling
BH8	5.0 m	564 m	2 hours after drilling

It is noted that the boreholes were backfilled within hours after drilling and test pits on the same day, precluding longer term monitoring of groundwater levels.

Groundwater conditions rarely remain constant and can change due to seasonal variations in rainfall and evapotranspiration, and also permeability and irrigation practices. For these reasons, it is noted that the moisture condition of the site soils may vary considerably between the time of the investigation and construction.

6. Laboratory Testing

Laboratory testing was performed on selected samples in DP's laboratory and comprised the following:

- Two Atterberg limits and linear shrinkage tests;
- Two California bearing ratio (CBR) tests; and
- One particle size distribution test.

A further four samples were tested by Envirolab Services Pty Ltd for chemical aggressiveness.

The results of the laboratory testing are provided in detail in the test report sheets in Appendix D and are summarised in Tables 2 to 5 below.

Table 2: Results of Plasticity Testing

Pit No.	Depth (m)	W _F (%)	W _L (%)	W _P (%)	PI (%)	LS (%)	Field Description
2	2.1	22.3	69	22	47	18.0	Clay
9	0.5	21.1	78	22	56	18.0	Clay

Where W_F = Moisture content W_L = Liquid limit W_P = plastic limit
 PI = Plasticity Index LS = Linear shrinkage

Table 3: Summary of Compaction & CBR Testing

Pit No.	Depth (m)	FMC (%)	OMC (%)	MDD (t/m ³)	CBR (%)	Swell (%)	Field Description
3	0.3 – 0.5	12.5	15.5	1.81	6.0	0.5	Sandy Clay
9	0.5 – 0.7	20.8	23.5	1.54	2.5	2.5	Clay

Where: FMC = Field moisture content MDD = Maximum dry density (standard)
 OMC = Optimum moisture content CBR = California bearing ratio

Table 4: Result of Particle Size Distribution Test

Pit No.	Sample Depth (m)	Percent Passing Sieve Size (%)				Material
		6.7 mm	2.36 mm	0.425 mm	0.075 mm	
2	2.1	100	100	94	87	Clay

Table 5: Results of Soil Aggressivity Testing

Pit / Bore No.	Depth (m)	Field Description	pH	Chloride (mg/kg)	Sulphate (mg/kg)	Electrical Conductivity (μS/cm)	Resistivity ⁽²⁾ (ohm.cm)
3	1.2	Sandy Clay	7.5	<10	20	42	23809
5	6.0	Dacite	9.3	<10	10	100	10000
6	1.8	Silty Clay	7.6	<10	<10	20	50000
8	4.5	Dacite	8.9	<10	<10	45	22222
Criteria for "Non-aggressive" Soil Conditions (low permeability soils or soils above the groundwater table) ⁽¹⁾			>5.5 (concrete) >5.0 (steel)	<5,000 (steel)	<5,000 (concrete)	-	>5,000 (steel)

Notes:

(1) In accordance with AS 2159:2009

(2) Resistivity (ohm.cm) is the inverse of Electrical Conductivity (S/cm)

7. Comments

7.1 Site Preparation and Earthworks

7.1.1 Stripping

Site preparation for the construction of road formations and controlled fill should include the removal of vegetation, uncontrolled fill, topsoil and other deleterious materials from the proposed construction areas. Based on the results of the investigation, a topsoil stripping depth of about 0.2 m is expected. Deeper excavations (such as in gullies) are likely to occur should localised deeper topsoils or unsuitable materials/fill be encountered, if inclement weather precedes construction or if the contractor adopts inappropriate stripping methods.

It is recommended that inspection of stripped surfaces be undertaken by a suitably qualified geotechnical engineer to assess the need for further removal of unsuitable material or of any other remedial measures.

7.1.2 Trafficability

Following periods of wet weather, the natural surface across the site is likely to be boggy and effectively untrafficable to all but tracked construction vehicles. Some measures that can be undertaken to reduce the impact of wet weather on the earthworks construction include:

- retain grass cover wherever possible;
- provide cut surfaces with a slight but even cross-gradient to assist surface drainage;
- “seal” exposed fill surfaces at the end of each workday by running over with a smooth-wheeled roller;
- armour temporary access roads with rockfill;
- form swale drains at upslope locations to help intercept surface and near-surface seepage water and to redirect it into existing drainage gullies or dams, or to sediment retention ponds.

7.1.3 Excavation Conditions

The investigation has indicated subsurface conditions generally comprising topsoils, fill, and natural soils of variable composition overlying weathered bedrock at variable depths.

The topsoil, fill, natural soils and extremely low to low strength bedrock could be expected to be removed using conventional earthmoving plant and as such no difficulties are anticipated. Large excavators with rock hammers, toothed buckets and/or rippers will be needed to remove low to medium strength (or greater) weathered rock in trenches and ripping with large dozers will be required for bulk excavations to the level of test pit refusal encountered in this investigation. The excavatability of the rock below test pit/borehole refusal depths will be largely dependent on the degree of fracturing and the dip of bedding within the rock mass. Low production rates must be envisaged particularly where shallow refusal was encountered.

Groundwater seepages into excavations likely to occur from the silty/sandy layers or through fractures in the bedrock after periods of rain and possibly in area of springs which cannot be detected until bulk earthworks. Seepage flows would readily be controllable by gravity draining to a collection sump or pond. Consideration should be given to installation of diversion drains across the site to minimise surface and subsurface water entering into the site.

7.1.4 Excavation Batters

For permanent excavations in topsoil, natural soils and weathered rock, maximum gradients of 3H:1V (horizontal: vertical) are recommended. In low to medium strength bedrock, maximum gradients of 1H:1V (horizontal: vertical) are recommended. To minimise surface erosion the batter should be protected with toe and spoon drains and vegetated as soon as possible after construction. For temporary excavations, maximum gradients of 1H:1V and 0.5H:1V are suggested for natural soils and low to medium strength rock respectively, subject to geotechnical inspection and assessment during excavation.

7.1.5 Reuse of Excavated Material

The upper sandy silt layer is considered to be unsuitable for engineering applications. These soils may be difficult to handle and compact and will require careful moisture control. The soils can be placed in the verge, in landscape mounds or other non-structural applications.

After stripping and removal of topsoils and uncontrolled/stockpiled fill, it would be expected that most of the materials available from excavation on the site would be suitable for reuse as fill over the lower areas, provided time is available and weather conditions are suitable to adjust the moisture content to near optimum.

The weathered rock encountered in the test pits to the level of test pit refusal was logged as extremely low to low strength and can be removed with a backhoe or excavator. This material is considered suitable for reuse in all areas of controlled fill, embankment fill or possibly select fill subject to additional laboratory testing to confirm conformance to the specification.

As excavation proceeds below the level of pit refusal, it would be expected that cobble and boulder sized rock pieces would be removed, which would need to be crushed to a maximum particle size of 75 mm prior to use within fill areas. It is expected that minimal fines would be created during the crushing process and that blending with the overlying soil may be required to create a suitable fill material (i.e. well graded).

7.1.6 Filling Placement and Compaction

It is recommended that subgrade areas that are to support ground slabs and vehicular pavements should be prepared in accordance with the following general guidelines:

- Strip and excavate all existing fill, topsoil, roots, vegetation, moisture weakened soils and any other potentially deleterious materials (See Section 7.1.1).
- Obtain a preliminary inspection by a geotechnical engineer who should assess whether the exposed subgrade is suitable or whether further excavation or other treatment may be required;
- Tyne and homogenise the subgrade to at least 150 mm depth, adjust the moisture content of the mixed material to within about 2% Standard optimum moisture content (SOMC), and leave long enough or overnight to allow the soil to "cure".
- Roll the tynd, moisture conditioned surface with at least six passes of a minimum 12 tonne deadweight roller with a final test roll pass in the presence of a geotechnical engineer. The subgrade surface should not exhibit excessive deformation or springing under test roll.
- Areas of prepared subgrade that are found to deform significantly under test rolling should be either excavated and replaced with compacted approved fill or improved by other method as advised by the geotechnical engineer. Depth of over-excavation should not exceed 500 mm depth without further geotechnical advice.
- Place and compact new fill in horizontal layers up to 150 mm compacted thickness. In confined working areas or in situations where compaction may be difficult to achieve, thinner layers may be required. Uniformly moisture condition the fill material to within 2% of SOMC. Suggested compaction requirements for the fill are presented in Table 6.

Table 6: Suggested Compaction Requirements

Purpose	Minimum Dry Density Ratio
Heavy floor load support	98% Standard
Footing support	100% Standard
Pavements : > 500 mm below subgrade level	98% Standard
< 500 mm below subgrade level	100% Standard

Full time supervision of fill placement and compaction testing to a Level 1 standard, as defined in AS 3798:2007 is required where structural loads are supported on compacted fill. A Level 1 report should be prepared at the completion of the works stating that the fill has been satisfactorily constructed and capable of supporting building slabs and light weight footings.

7.1.7 Site Drainage

In undertaking earthworks operations on the site, it should be recognised that the drainage characteristics of the site may be significantly altered and that temporary and/or permanent measures may be required during and after construction to divert stormwater flow from the site. Unlined open spoon drains at least 0.5 m deep are expected to be effective in intercepting water from upslope areas entering the site. The need and location of subsoil drains can only be determined onsite during construction.

7.2 Pavement Design Considerations

Based on the results of the field investigation, laboratory testing and previous experience, Table 7 gives suggested design CBR values for the likely subgrade conditions.

Table 7: Design CBR Values

Subgrade Material	Design CBR (%)
Silty Clay	2.0
Weathered Bedrock	5.0

Note: (1) Following subgrade replacement as detailed below.

Subgrade replacement to a depth of approximately 300 mm using minimum CBR 15% material will be required where CBR values of less than 2% are exposed at subgrade level. In the event weathered rock is encountered prior to the base of the 300 mm over-excavation, the replacement depth may be reduced following inspection by a qualified geotechnical engineer.

It is recommended that fill of roadway embankments be undertaken using sandy clays/gravelly clays of low plasticity, clayey gravels or weathered rock.

All earthworks should be undertaken under close supervision and consultation with the geotechnical consultant in order to avoid any unnecessary over-excavation.

Prevailing weather conditions at the time of construction and the control that can be exercised over construction traffic will be critical in achieving satisfactory subgrade performance. If pavement construction does not immediately follow subgrade preparation (thus exposing the subgrade to weather and traffic), subgrade deterioration would be expected, thus requiring rectification. In conjunction with subgrade preparation procedures, consideration should also be given to installing temporary drainage systems prior to installation of the final works.

Surface and subsoil drainage should be installed and maintained to protect the pavement and subgrade. Subsoil drains should be located at a minimum of 0.5 m depth below subgrade level.

The standard of construction, the selection of materials and quality of workmanship for the roads should satisfy the requirements of the latest edition of the Local Council.

7.3 Site Classifications

In accordance with AS 2870 – 2011, the site could be classified as high range Class M (moderately reactive site) in areas of shallow rock (< 1m depth) to Class H1 (highly reactive). The majority of the site, however, would be equivalent to H1 conditions. It may be prudent to construct all structures based on a Class H1 system to avoid future possible issues with ground movements.

It is recommended that the site be reclassified/reassessed after earthworks involving cut and fill work has been completed.

7.4 Foundations

For the maximum 1800 kN likely structural load (dead + live) provided by Northrop, pad footings designed based on 150 kPa allowable bearing pressure would be more than 3 m by 3 m. At this size, pad footings would most likely be required to be thickened and become uneconomical. For the 2 storey structures and hall, it is recommended that the footings be founded within the weathered rock. The advantage of founding in rock would be the resulting minimal total and differential settlements. Other lightweight structures including single storey structures could be designed as waffle or raft type slabs founding on suitable natural soils or controlled fill.

For preliminary sizing of footings including any future retaining walls, allowable base bearing pressures for the various soil strata encountered including controlled filling are given below:

- Controlled Fill: 100 kPa
- Very stiff clayey soils: 150 kPa
- Extremely low to very low strength bedrock: 500 kPa
- Low strength bedrock: 1000 kPa
- Medium or greater strength bedrock (to be confirmed) 2500 kPa

Table 8 provides preliminary pile design parameters:

Table 8: Preliminary Geotechnical Parameters for Pile Design

Soil Stratum	E_v (MPa)	Ultimate Strength	
		End Bearing, $f_b^{(3),(4)}$ (kPa)	Shaft Adhesion, $f_s^{(1),(2)}$ (kPa)
Stiff to very stiff Clay	10	-	20
Very stiff to hard Clay	20	900	50
Very low to low strength dacite	100	3000	100

Notes to Table 8:

All pile end bearing parameters are based on pile penetration of at least four pile diameters or 3 m whichever is greater, below the ground surface.

- 1 Shaft adhesion parameters are only applicable where adequate socket roughness is achieved.
- 2 For calculation of tension or uplift capacity the shaft adhesion should be taken as 70% of the above shaft adhesion parameters.
- 3 Bearing pressure values assume a minimum embedment of one pile diameter into the relevant bearing stratum, with an overall length of at least four pile diameters.
- 4 Ultimate end bearing parameters mobilised at large settlements (i.e. > 5% of pile diameter).
- 5 Allowable end bearing parameters could experience settlements of less than 1% of the pile diameter.

Basic geotechnical strength reduction factor of 0.4 is recommended for the pile design, as this does not require no pile load testing after the pile installation.

All footing excavations should be inspected by a suitably qualified engineer prior to placement of reinforcing steel and pouring of concrete to confirm the design bearing pressures.

7.5 Soil Aggressivity

The soil aggressivity test results are included in Appendix D and are summarised in Table 5 in Section 6. The results indicate that based on the soils/rock the exposure classification for concrete and steel is *Non-Aggressive*.

8. References

- AS 1289.6.3.1. (2004). *Methods for testing soils for engineering purposes - Soil strength and consolidation tests - Determination of the penetration resistance of a soil - Standard penetration test (SPT)*. Reconfirmed 2016: Standards Australia.
- AS 1289.6.3.2. (1997). *Methods for testing soils for engineering purposes - Soil strength and consolidation tests - Determination of the penetration resistance of a soil - 9kg dynamic cone penetrometer test*. Reconfirmed 2013: Standards Australia.
- AS 2870. (2011). *Residential Slabs and Footings*. Standards Australia.
- AS 3798. (2007). *Guidelines on Earthworks for Commercial and Residential Developments*. Standards Australia.
- Thomas, O. (2003). *Gunning 1:100 000 Geological Sheet 8728*. Geological Survey of New South Wales, Maitland.

9. Limitations

Douglas Partners (DP) has prepared this report for this project at Fairley Street, Murrumbateman in accordance with DP's proposal 203624.00.P.001 dated 7 April 2021 and acceptance received from Paul Todhunter dated via email dated 21 April 2021. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Hansen Yuncken Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes

and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners



Introduction

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

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

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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

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

Groundwater

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

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix B

Drawing 1 – Test Location Plan

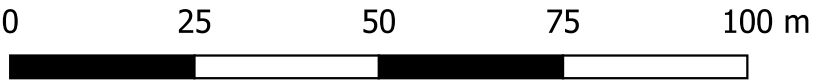




Site Location

Legend

- Borehole
- Test Pit
- Site Boundary

Drawing adapted from aerial imagery from Google Satellite dated 2019.
Test locations are approximate only to about 5m and were located using Handheld GPS.



 Douglas Partners Geotechnics Environment Groundwater	CLIENT: Hansen Yuncken Pty Ltd		TITLE: Test Location Plan Proposed New Public School Fairley Street, Murrumbateman		Project: 203624.00
	OFFICE: Canberra	DRAWN BY: TBO			DRAWING No: 1
	SCALE: 1:200 @ A3	DATE: 21.May.2021			REVISION: 0

Appendix C

Explanatory Notes
Test Pit Logs



Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

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

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

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

reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:
4,6,7
N=13
- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:
15, 30/40 mm

Sampling Methods

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.



Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

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

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

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

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

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

Cohesive Soils

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

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

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

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 - 5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

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

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

Transported soils may be further subdivided into:

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



Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

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

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

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

Rock Descriptions

Rock Quality Designation

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

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

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

Stratification Spacing

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

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

Symbols & Abbreviations

Douglas Partners



Introduction

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

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U ₅₀	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

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

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

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

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

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

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

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

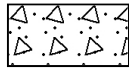
General



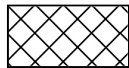
Asphalt



Road base



Concrete



Filling

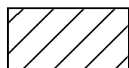
Soils



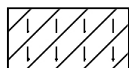
Topsoil



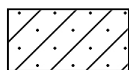
Peat



Clay



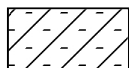
Silty clay



Sandy clay



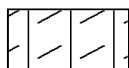
Gravelly clay



Shaly clay



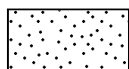
Silt



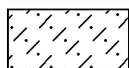
Clayey silt



Sandy silt



Sand



Clayey sand



Silty sand



Gravel



Sandy gravel



Cobbles, boulders



Talus

Sedimentary Rocks



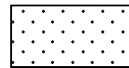
Boulder conglomerate



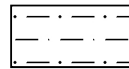
Conglomerate



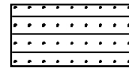
Conglomeratic sandstone



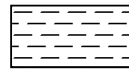
Sandstone



Siltstone



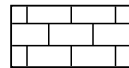
Laminite



Mudstone, claystone, shale

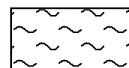


Coal

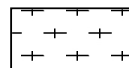


Limestone

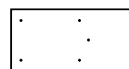
Metamorphic Rocks



Slate, phyllite, schist

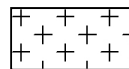


Gneiss

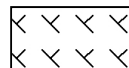


Quartzite

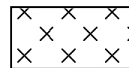
Igneous Rocks



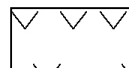
Granite



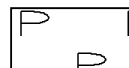
Dolerite, basalt, andesite



Dacite, epidote



Tuff, breccia



Porphyry

BOREHOLE LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 566 AHD
EASTING: 685367
NORTHING: 6128829
DIP/AZIMUTH: 90°/-

BORE No: 1
PROJECT No: 203624.00
DATE: 5-5-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
566	0.035	ASPHALT		A	0.2		PID = <1					
	0.35	FILL/GRAVEL (GW): fine to coarse grained up to 15mm size, dark grey, with silt, moist, medium dense, ROADBASE FILL		A	0.5		PID = <1					
				E			5,7,10					
				S			N = 17					
	1	FILL/Silty CLAY (CI): medium plasticity, brown mottled orange, trace fine to coarse grained sand and fine gravel, moist, w<PL, stiff to very stiff, FILL		E	0.95		PID = <1					
	1.2				1.0							
	1.4	Clayey SILT (ML): low plasticity, dark grey, with fine to coarse grained sand, trace fine gravel, moist, w<PL, very stiff, colluvium										
	2	Silty CLAY (CL/CI): low to medium plasticity, yellow-orange-brown, with fine to coarse grained sand and ironstone nodules, moist, w<PL, stiff to very stiff, residual		E	2.0		PID = <1					
				S			5,8,12					
					2.45		N = 20					
							pp = 110					
	3											
		-from 3.4m, w~PL, firm		A	3.3							
				S	3.5		pp = 110					
							3,3,4					
					3.95		N = 7					
	4											
		-from 4.5m, yellow-pale brown		A	4.7							
				S	5.0		pp = 400					
							5,12,17					
					5.45		N = 29					
	5.3	DACITE: fine to coarse grained, yellow-pale brown, dry, extremely low strength, extremely weathered										
	6	-from 6.2m, wet										
				S	6.5		7,14,25					
							N = 39					
					6.95							
	7			A	7.4							
	8.0	Bore discontinued at 8.0m -limit of excavation		S	8.0		4,25					
					8.45		refusal					
	9											

RIG: Gemco 210B

DRILLER: GE Drilling

LOGGED: TBO

CASING: N/A

TYPE OF BORING: Continuous flight auger to 8.0m

WATER OBSERVATIONS: Groundwater level at 6.2m, 1 hour after drilling

REMARKS: Location coordinates are in MGA94 Zone 55. Surface levels and coordinates are approximate only and must not be relied upon

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

SAMPLING & IN SITU TESTING LEGEND

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









Douglas Partners
 Geotechnics | Environment | Groundwater

BOREHOLE LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 568 AHD
EASTING: 685367
NORTHING: 6128778
DIP/AZIMUTH: 90°/-

BORE No: 5
PROJECT No: 203624.00
DATE: 6-5-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
568		FILL/Silty CLAY (CI): medium plasticity, brown, red-brown, with fine to coarse grained sand, trace fine to medium gravel to 30mm in size, moist to dry, w<PL, stiff to very stiff, FILL		E	0.1							
				E	0.5							
	0.7	Silty CLAY (CI): medium plasticity, red-brown, trace fine to coarse grained sand, and ironstone nodules, moist to dry, w<PL, very stiff, colluvium		S			6,9,9 N = 18					
				E	0.95							
	1			A	1.0							
				A	1.3							
	1.6	Silty CLAY (CI/CH): medium to high plasticity, yellow-brown mottled orange-grey, trace fine to coarse grained sand and ironstone nodules, moist to dry, w<PL, very stiff, colluvium		A	1.4							
				A	1.8							
	2			E	2.0							
	2.3	Silty CLAY (CI): medium plasticity, orange-brown mottled grey, with fine to coarse grained sand, trace fine gravel and weathered dacite, moist to dry, w<PL, very stiff to hard, residual		S			9,12,16 N = 28					
					2.45							
	3			A	3.1							
	3.0	Silty CLAY (CI): medium plasticity, yellow-brown, trace fine to coarse grained sand and weathered dacite, moist to dry, w<PL, very stiff to hard, residual		A								
				S	3.5							
	3.7	DACITE: fine to coarse grained, yellow-brown, dry to moist, very low to low strength, highly weathered, highly fractured, interbedded extremely weathered seams (drilled as medium plasticity sandy clay)			3.8		16,25/150 refusal					
	4											
	5			S	5.0							
				S	5.45		15,17,21 N = 38					
	6			A	6.0							
				S	6.5							
	7			S	6.95		9,14,18 N = 32					
				A	7.5							
	8			S	8.0							
	8.12	Bore discontinued at 8.12m -limit of excavation			8.12		15/120 refusal (bouncing)					
	9											

RIG: Gemco 210B

DRILLER: GE Drilling

LOGGED: GM

CASING: N/A

TYPE OF BORING: Continuous flight auger to 8.12m

WATER OBSERVATIONS: Groundwater seepages approximately at 6.5-6.7m

REMARKS: Location coordinates are in MGA94 Zone 55. Surface levels and coordinates are approximate only and must not be relied upon

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

SAMPLING & IN SITU TESTING LEGEND

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



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BOREHOLE LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 569 AHD
EASTING: 685330
NORTHING: 6128770
DIP/AZIMUTH: 90°/-

BORE No: 6
PROJECT No: 203624.00
DATE: 6-5-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
569	0.3	FILL/Silty CLAY (CI): medium plasticity, brown, trace fine to coarse grained sand, fine to medium gravel, to 30mm in size, moist to dry, w<PL, very stiff to hard, FILL		E	0.1							
	0.3			A	0.3							
	0.5			E	0.5							
	0.8	Silty CLAY (CL/CI): low to medium plasticity, red-brown, trace fine to coarse grained sand, fine gravel and ironstone nodules to 10mm, moist to dry, w>PL, firm to stiff, colluvium		S			4,7,13 N = 20					
568	1.0	-from 0.6m, dry to moist, w<PL, hard		A	0.95							
	1.2			E	1.0							
	1.3	Silty CLAY (CI): medium plasticity, yellow-brown mottled orange, trace fine to coarse grained sand, moist to dry, w~PL, very stiff to hard, colluvium		A	1.3							
	1.5				1.5							
	1.8			A	1.8							
567	2.0	Silty CLAY (CH): high plasticity, yellow-brown mottled grey, trace fine to coarse grained sand and fine gravel to 5mm in size, moist to day, w<PL, very stiff, residual		E	2.0		4,7,11 N = 18					
	2.45			S	2.45							
	2.6				2.6							
	2.8	Silty CLAY (CI): medium plasticity, yellow-brown, brown, trace fine to coarse grained sand and weathered dacite, moist to dry, w<PL, very stiff to hard, residual		A	2.8							
566	3.0				3.0							
	3.2	Silty CLAY (CI): medium plasticity, pale yellow-brown, with fine to coarse grained sand, trace weathered dacite, dry to moist, w<PL, hard, extremely weathered dacite			3.2							
	3.5			S	3.5		11,26/130 refusal					
565	3.78				3.78							
	4.0				4.0							
564	5.0			S	5.0		15/90 refusal (bouncing)					
	5.09				5.09							
563	6.0				6.0							
	6.5	DACITE: fine to coarse grain, pale brown, dry to moist, low strength, highly weathered, highly fractured		A	6.5							
562	7.0				7.0							
	8.0				8.0							
561	8.5	Bore discontinued at 8.5m -limit of excavation			8.5							
560	9.0				9.0							

RIG: Gemco 210B

DRILLER: GE Drilling

LOGGED: GM

CASING: N/A

TYPE OF BORING: Continuous flight auger to 8.5m

WATER OBSERVATIONS: Groundwater level at 5.2m, 4 hours after drilling

REMARKS: Location coordinates are in MGA94 Zone 55. Surface levels and coordinates are approximate only and must not be relied upon

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

SAMPLING & IN SITU TESTING LEGEND

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



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BOREHOLE LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 569 AHD
EASTING: 685367
NORTHING: 6128747
DIP/AZIMUTH: 90°/-

BORE No: 8
PROJECT No: 203624.00
DATE: 6-5-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
569	0.1	TOPSOIL FILL/Sandy SILT (ML): low plasticity, brown, fine to medium grained sand, trace rootlets, wet, w>PL, firm, FILL		E	0.1							
	0.3			A	0.3							
	0.4			E	0.4							
	0.5	Silty CLAY (CL): low plasticity, red-brown, trace rootlets, moist, w>PL, firm to stiff, colluvium -from 0.3 to 0.5m, ironstone nodules		S	0.5		4,5,7 N = 12					
	0.95			E	0.95							
	1.0	Silty CLAY (CI/CH): medium to high plasticity, yellow-brown mottled red, trace fine to coarse grained sand and ironstone nodules, moist to dry, w~PL, very stiff, residual			1.0							
	1.6				1.6							
	1.7	DACITE: fine to coarse grained, brown, dry to moist, low strength, highly weathered, highly fractured		A	1.7							
	1.9			E	1.9							
	2.0	-from 1.9m to 2.3m, extremely weathered, drilled as medium plasticity silty clay with sand, trace weathered rock fragments		S	2.0		6,17,25/40 refusal					
	2.34				2.34							
	2.5	-from 2.3m, very low to low strength, highly weathered, highly fractured, trace extremely weathered seams/pockets		A	2.5							
	3.5			S	3.5		17,25/130 refusal					
	3.75				3.75							
	4.5			A	4.5							
	5.0			S	5.0		17,22,21 N = 43					
	5.45				5.45							
	6.5			S	6.5		25/130 refusal					
	6.63				6.63							
	8.0	Bore discontinued at 8.0m -limit of excavation										

RIG: Gemco 210B

DRILLER: GE Drilling

LOGGED: GM

CASING: N/A

TYPE OF BORING: Continuous flight auger to 8.0m

WATER OBSERVATIONS: Groundwater at 6.4m, groundwater level at about 5.0m 2 hours after drilling

REMARKS: Location coordinates are in MGA94 Zone 55. Surface levels and coordinates are approximate only and must not be relied upon

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

SAMPLING & IN SITU TESTING LEGEND

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



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BOREHOLE LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 566 AHD
EASTING: 685269
NORTHING: 6128667
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 203624.00
DATE: 6-5-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
566	0.035	ASPHALT		A	0.02							
		FILL/GRAVEL (GW): fine to coarse gravel up to 15mm, with silt, dark grey, moist, medium dense, ROADBASE FILL		A	0.1		PID = 1.7					
				E	0.3		PID = 1.4					
	0.4	FILL/Silty CLAY (CI/CH): medium to high plasticity, orange mottled brown, trace fine to coarse grained sand, moist, w<PL, stiff, FILL		A	0.5		PID = 2.7					
	0.6	Sandy SILT (ML): low plasticity, dark-grey, fine to coarse grained sand, with fine to medium gravel, moist, w<PL, stiff, colluvium		A	0.7							
	0.75	Silty CLAY (CL): low plasticity, yellow-orange brown, trace fine to coarse grained sand, moist, w<PL, stiff to very stiff, colluvium		A	1.0		PID < 1	1				
565	1			E	1.4							
	1.4	Silty CLAY (CI/CH): medium to high plasticity, yellow pale brown, with ironstone nodules, moist, w<PL, very stiff, residual		A	1.4							
				E	2.0		PID < 1	2				
564	2			A	2.5							
	2.7	Bore discontinued at 2.7m -limit of excavation										

RIG: CAT403C excavator

DRILLER: Bingley

LOGGED: TBO

CASING: N/A

TYPE OF BORING: Continuous flight auger to 1.0m, extension to 2.7m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Location coordinates are in MGA94 Zone 55. Surface levels and coordinates are approximate only and must not be relied upon

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

SAMPLING & IN SITU TESTING LEGEND

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



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BOREHOLE LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 567 AHD
EASTING: 685237
NORTHING: 6128680
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 203624.00
DATE: 6-5-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
567	0.055	ASPHALT		A	0.01							
		FILL/GRAVEL (GW): fine to coarse gravel up to 15mm, with silt, dark grey, moist, medium dense, ROADBASE FILL		E	0.1		PID = 1.5					
				A	0.3		PID < 1					
	0.4	FILL/Silty CLAY (CI): medium plasticity, orange-red mottled brown, trace fine to coarse grained sand, moist, w<PL, stiff, FILL		E	0.5		PID < 1					
				A	0.6							
	0.7	Silty CLAY (CI/CH): medium to high plasticity, yellow-orange brown, trace fine to coarse grained sand, moist, w<PL, stiff to very stiff, colluvium										
566	1			E	1.0		PID < 1	1				
	1.6	Gravelly CLAY (CL): low plasticity, pale brown-grey, fine to medium gravel, with fine to coarse grained sand and ironstone nodules, moist, w~PL, very stiff, colluvium		A	1.8							
	1.9	Silty CLAY (CH): high plasticity, yellow, trace fine gravel and ironstone nodules, moist, w<PL, very stiff to hard, residual		A	2.0		PID < 1	2				
565	2			E								
				A	2.5							
	2.6	Bore discontinued at 2.6m -limit of excavation										

RIG: CAT403C excavator

DRILLER: Bingley

LOGGED: TBO

CASING: N/A

TYPE OF BORING: Continuous flight auger to 1.0m, extension to 2.6m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Location coordinates are in MGA94 Zone 55. Surface levels and coordinates are approximate only and must not be relied upon

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

SAMPLING & IN SITU TESTING LEGEND

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



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BOREHOLE LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 568 AHD
EASTING: 685200
NORTHING: 6128598
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 203624.00
DATE: 6-5-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
568	0.035	ASPHALT										
		FILL/GRAVEL (GW): fine to coarse gravel up to 15mm, dark grey, with silt, moist, medium dense, ROADBASE FILL		A	0.1		PID < 1					
				E	0.3		PID < 1					
	0.4	FILL/Silty CLAY (CL/CI): low to medium plasticity, red mottled brown, with fine gravel and fine to coarse grained sand, moist, w<PL, stiff to very stiff, FILL		E	0.5		PID < 1					
				A	0.6							
567	1.0	Silty CLAY (CH): high plasticity, yellow mottled red-brown, trace fine gravel and fine to coarse grained sand, moist, w<PL, very stiff, colluvium		E	1.0		PID < 1	1				
				A	1.1							
	1.5	Sandy CLAY (CL): low plasticity, pale brown-grey mottled yellow, fine to coarse grained sand, with fine to medium gravel, moist, w<PL, very stiff, colluvium		E	1.5		PID < 1					
				A	1.6							
566	1.8	Silty CLAY (CL/CI): low to medium plasticity, yellow mottled orange, trace fine gravel, fine to coarse grained sand and ironstone nodules, moist to dry, w<PL, very stiff to hard, residual		E	2.0		PID < 1	2				
				A	2.2							
	2.3	Silty CLAY (CH): high plasticity, yellow, trace fine gravel and ironstone nodules, moist, w<PL, very stiff to hard, residual										
	2.5	Bore discontinued at 2.5m -limit of excavation										

RIG: CAT403C excavator

DRILLER: Bingley

LOGGED: TBO

CASING: N/A

TYPE OF BORING: Continuous flight auger to 1.0m, extension to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Location coordinates are in MGA94 Zone 55. Surface levels and coordinates are approximate only and must not be relied upon

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

SAMPLING & IN SITU TESTING LEGEND

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

BOREHOLE LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 569 AHD
EASTING: 685201
NORTHING: 6128574
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 203624.00
DATE: 6-5-2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
569	0.035	ASPHALT										
		FILL/GRAVEL (GW): fine to coarse gravel up to 15mm, dark grey, with silt, moist, medium dense, ROADBASE FILL		E	0.1		PID = 2.5					
				A	0.2							
	0.3	Gravelly Sandy SILT (ML): low plasticity, brown-grey, fine to coarse grained sand, moist, stiff to very stiff, colluvium		E	0.3		PID < 1					
				A	0.4							
	0.5	Silty CLAY (CI/CH): medium to high plasticity, yellow mottled grey, moist, w<PL, very stiff, colluvium		E	0.5		PID < 1					
				A	0.7							
				B								
569	1			E	1.0		PID < 1	1				
	1.4	Silty CLAY (CI): medium plasticity, yellow mottled grey, moist, w<PL, very stiff, colluvium		A	1.6							
567	2	Sandy CLAY (CL): low plasticity, yellow, fine to coarse grained, with fine to medium gravel and ironstone nodules, dry, w<<PL, hard, residual		A	2.0		PID < 1	2				
	2.1	DACITE: fine to coarse grained, orange-yellow, dry, extremely low strength, extremely weathered		E								
	2.5	Bore discontinued at 2.5m -limit of excavation										

RIG: CAT403C excavator

DRILLER: Bingley

LOGGED: TBO

CASING: N/A

TYPE OF BORING: Continuous flight auger to 1.0m, extension to 2.5m

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Location coordinates are in MGA94 Zone 55. Surface levels and coordinates are approximate only and must not be relied upon

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

SAMPLING & IN SITU TESTING LEGEND

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



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TEST PIT LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 567 AHD
EASTING: 685348
NORTHING: 6128814

PIT No: 2
PROJECT No: 203624.00
DATE: 6/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
567	0.15	FILL/Silty CLAY (CI): medium plasticity, brown-red, with fine to coarse grained sand, trace fine gravel, moist, w<PL, stiff to very stiff, FILL		D	0.1		PID = <1					
		FILL/Sandy CLAY (CL): low plasticity, brown mottled orange, fine to coarse grained sand, with fine to coarse gravel and cobbles up to 70mm in size, dry, w<PL, hard, FILL		D	0.3							
	0.5	FILL/Silty CLAY (CL/CI): low to medium plasticity, orange-red mottled yellow, trace ironstone nodules, moist to dry, w<PL, very stiff, FILL		E	0.5		PID = <1					
				D	0.8							
566	1.0			E	1.0		PID = <1					
	1.2	Clayey SILT (ML): low plasticity, dark grey, dry, w<PL, very stiff to hard, colluvium, slight organic smell		D	1.3							
	1.45	Silty CLAY (CI): medium plasticity, yellow mottled orange, trace fine to coarse grained sand and fine gravel, dry to moist, w<PL, very stiff, residual		D	1.6							
	1.8	Silty CLAY (CH): high plasticity, orange mottled grey, trace ironstone nodules, moist, w<PL, very stiff to hard, residual		E	2.0		PID = <1					
565	2.0			D	2.1							
	2.5	Pit discontinued at 2.5m -limit of excavation										

RIG: CAT403C excavator fitted with a 300mm wide bucket

LOGGED: TBO

SURVEY DATUM: MGA94 Zone 55

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

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

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

TEST PIT LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 567 AHD
EASTING: 685380
NORTHING: 6128798

PIT No: 3
PROJECT No: 203624.00
DATE: 6/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
567	0.1	FILL/Silty CLAY (CI): medium plasticity, brown-red, with fine to coarse grained sand, trace fine gravel, moist, w<PL, stiff to very stiff, FILL		D	0.1							
	0.2	FILL/Sandy CLAY (CL): low plasticity, brown mottled orange, fine to coarse grained sand, with fine to coarse gravel and cobbles up to 70mm in size, dry, w<PL, hard, FILL		E	0.3							
	0.5			B D E	0.5							
	0.7	FILL/Sandy CLAY (CI): medium plasticity, orange, yellow-brown, fine to coarse grained, with fine to coarse gravel, trace cobbles up to 75mm in size, moist, W<PL, very stiff, FILL		D	0.7							
	0.8			D	0.8							
566	0.9	Clayey SILT (ML): low plasticity, dark grey, dry, w<PL, very stiff to hard, colluvium, slight organic smell		E	1.0							
	1.2			D	1.2							
	1.4	Silty CLAY (CL): low plasticity, red-orange, with fine to coarse grained sand, trace fine gravel, dry to moist, w<PL, hard, residual		D	1.6							
	1.8	Silty CLAY (CL): medium plasticity, yellow mottled orange, trace fine to coarse grained sand and fine gravel, moist to dry, w<PL, very stiff residual		E	2.0							
565	2.2			D	2.2							
	2.5	Pit discontinued at 2.5m -limit of excavation										

RIG: CAT403C excavator fitted with a 300mm wide bucket

LOGGED: TBO

SURVEY DATUM: MGA94 Zone 55

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

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

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

TEST PIT LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 568 AHD
EASTING: 685327
NORTHING: 6128795

PIT No: 4
PROJECT No: 203624.00
DATE: 6/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
568		FILL/Silty CLAY (CI): medium plasticity, brown-red, with fine to coarse grained sand, trace fine gravel, moist, w<PL, stiff to very stiff, FILL		E	0.1							
				D	0.2							
	0.45	FILL/Sandy CLAY (CL): low plasticity, pale brown mottled orange, fine to coarse grained sand, with fine to coarse gravel and cobbles up to 70mm in size, dry, w<PL, hard, FILL		D	0.5							
567	1.0	Silty CLAY (CI): medium plasticity, red mottled orange, trace fine to coarse grained sand and ironstone nodules, moist to dry, w<PL, very stiff, colluvium		D	1.0							
		-from 1.4m, pale brown, orange		D	1.5							
	1.75	Silty CLAY (CH): high plasticity, orange mottled grey, trace ironstone nodules, moist, w<PL, very stiff to hard, residual		D	1.7							
566	2.0			E	2.0							
	2.1	Gravelly CLAY (CL): low plasticity, pale brown-grey, fine to medium gravel, with fine to coarse sand and ironstone nodules, moist, w<PL, very stiff, residual		D	2.2							
	2.5	Pit discontinued at 2.5m -limit of excavation										

RIG: CAT403C excavator fitted with a 300mm wide bucket

LOGGED: TBO

SURVEY DATUM: MGA94 Zone 55

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

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

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

TEST PIT LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 568 AHD
EASTING: 685379
NORTHING: 6128761

PIT No: 7
PROJECT No: 203624.00
DATE: 6/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
568		FILL/Sandy CLAY (CL): low plasticity, brown mottled orange, fine to coarse grained sand, with fine to coarse gravel and cobbles up to 70mm in size, dry, w<PL, hard, FILL -from 0.2m, brown mottled red		D	0.1							
				E								
				D	0.3							
	0.4	Silty CLAY (CI): medium plasticity, red mottled orange, trace fine to coarse grained sand and ironstone nodules, moist to dry, w<PL, very stiff, colluvium		E	0.5							
				B								
				D	0.7							
567	1			E	1.0							
				D	1.2							
	1.4	Silty CLAY (CI): medium plasticity, yellow mottled orange, trace fine to coarse grained sand and fine gravel, dry to moist, w<PL, very stiff, residual		D	1.7							
566	2	Sandy CLAY (CL): low plasticity, yellow, fine to coarse grained, with fine to coarse gravel, and ironstone nodules, dry, w<PL, hard, residual		E	2.0							
				D	2.3							
	2.5	Pit discontinued at 2.5m -limit of excavation										

RIG: CAT403C excavator fitted with a 300mm wide bucket

LOGGED: TBO

SURVEY DATUM: MGA94 Zone 55

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

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



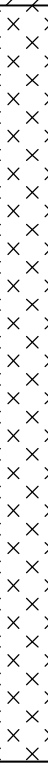
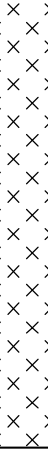
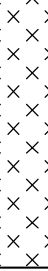
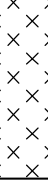
SAMPLING & IN SITU TESTING LEGEND					
A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket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

TEST PIT LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 570 AHD
EASTING: 685332
NORTHING: 6128728

PIT No: 9
PROJECT No: 203624.00
DATE: 6/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
570	0.0	FILL/Silty CLAY (CI): medium plasticity, brown-red, with fine to coarse grained sand, trace fine gravel, moist, w<PL, stiff to very stiff, FILL		D E	0.1							
	0.2	CLAY (CH): high plasticity, yellow orange mottled pale brown, trace ironstone, moist, w<PL, very stiff, residual		D E	0.5							
				B	0.7							
	1.0	DACITE: fine to coarse grained, orange-yellow, dry, extremely low strength, extremely weathered		E	1.0							
				D	1.2							
		-from 1.6m, very low strength, highly weathered										
569	2.0			E	2.0							
				D	2.2							
	2.5	Pit discontinued at 2.5m -limit of excavation										

RIG: CAT403C excavator fitted with a 300mm wide bucket

LOGGED: TBO

SURVEY DATUM: MGA94 Zone 55

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

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

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

TEST PIT LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 570 AHD
EASTING: 685352
NORTHING: 6128735

PIT No: 14
PROJECT No: 203624.00
DATE: 6/5/2021
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing				Water	Dynamic Penetrometer Test (blows per 150mm)			
				Type	Depth	Sample	Results & Comments		5	10	15	20
570	0.15	TOPSOIL FILL/Silty CLAY (CL): low plasticity, brown, with fine to coarse grained sand, fine to coarse gravel and rootlets, moist, stiff		E	0.1							
		FILL/Sandy SILT (ML): low plasticity, pale brown, fine to coarse grained sand, trace fine gravel, dry, w<<PL, hard, FILL										
				E	0.5							
569	1			D E	1.0							
	1.7	FILL/Clayey SILT (ML): low plasticity, dark grey, dry, w<PL, very stiff to hard, FILL, pungent smell										
568	2			D E	2.0							
	2.3	Silty CLAY (CI): medium plasticity, yellow mottled orange, trace fine to coarse grained sand and fine gravel, dry to moist, w<PL, very stiff, residual		D	2.3							
	2.4	Pit discontinued at 2.4m -limit of excavation										

RIG: CAT403C excavator fitted with a 300mm wide bucket

LOGGED: TBO

SURVEY DATUM: MGA94 Zone 55

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

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

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

TEST PIT LOG

CLIENT: Hansen Yuncken Pty Ltd
PROJECT: Proposed New Public School
LOCATION: Fairley Street, Murrumbateman

SURFACE LEVEL: 570 AHD
EASTING: 685365
NORTHING: 6128736

PIT No: 15
PROJECT No: 203624.00
DATE: 6/5/2021
SHEET 1 OF 1

[illegible]

Pit discontinued at 3.0m- limit of excavation

RIG: CAT403C excavator fitted with a 300mm wide bucket

LOGGED: TBO

SURVEY DATUM: MGA94 Zone 55

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface levels and coordinates are approximate only and must not be relied upon

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

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



Douglas Partners
Geotechnics | Environment | Groundwater

Appendix D

Results of Laboratory Testing

Material Test Report

Report Number: 203624.00-1
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: CBR Results Added.
Date Issued: 20/05/2021
Client: Hansen Yuncken Pty Ltd
 Building 1, Alexandria NSW 2015
Contact: Paul Todhunter
Project Number: 203624.00
Project Name: Proposed New Public School
Project Location: Fairley Street, Murrumbateman NSW
Work Request: 5907
Sample Number: GU-5907A
Date Sampled: 07/05/2021
Dates Tested: 11/05/2021 - 18/05/2021
Sampling Method: Sampled by Engineering Department
 The results apply to the sample as received
Sample Location: Pit 3 , Depth: 0.3-0.5
Material: Sandy Clay



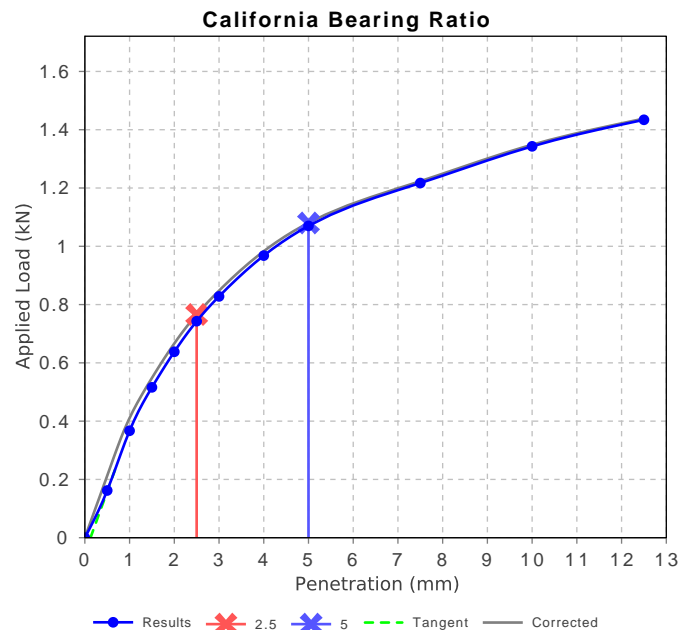
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brachlan Harris

Assistant Laboratory Manager

Laboratory Accreditation Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	6.0		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.81		
Optimum Moisture Content (%)	15.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	98.5		
Dry Density after Soaking (t/m ³)	1.80		
Field Moisture Content (%)	12.5		
Moisture Content at Placement (%)	15.4		
Moisture Content Top 30mm (%)	17.3		
Moisture Content Rest of Sample (%)	17.0		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	71.2		
Swell (%)	0.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		
Moisture Content (AS 1289 2.1.1)			
Moisture Content (%)		12.5	



Material Test Report

Report Number: 203624.00-1
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: CBR Results Added.
Date Issued: 20/05/2021
Client: Hansen Yuncken Pty Ltd
 Building 1, Alexandria NSW 2015
Contact: Paul Todhunter
Project Number: 203624.00
Project Name: Proposed New Public School
Project Location: Fairley Street, Murrumbateman NSW
Work Request: 5907
Sample Number: GU-5907B
Date Sampled: 07/05/2021
Dates Tested: 11/05/2021 - 18/05/2021
Sampling Method: Sampled by Engineering Department
 The results apply to the sample as received
Sample Location: Pit 9 , Depth: 0.5-0.7
Material: Clay



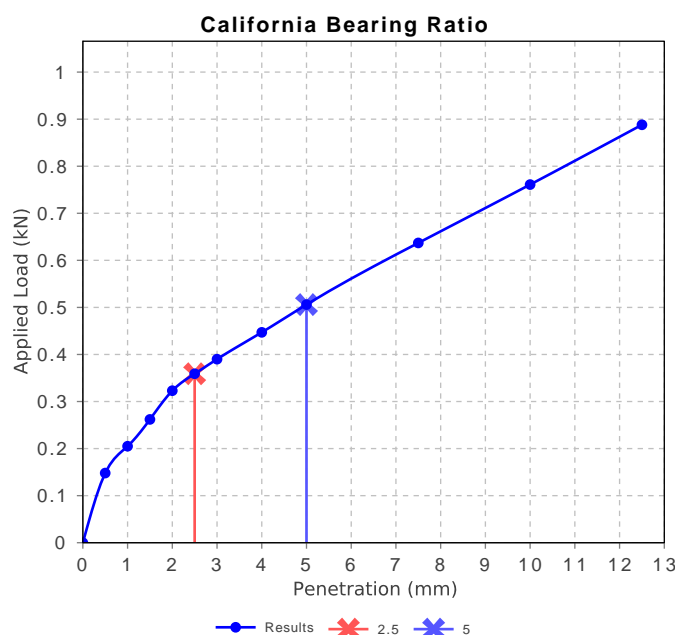
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brachlan Harris

Assistant Laboratory Manager

Laboratory Accreditation Number: 828

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	2.5		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m ³)	1.54		
Optimum Moisture Content (%)	23.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.5		
Dry Density after Soaking (t/m ³)	1.50		
Field Moisture Content (%)	20.8		
Moisture Content at Placement (%)	23.6		
Moisture Content Top 30mm (%)	30.9		
Moisture Content Rest of Sample (%)	27.1		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	70.5		
Swell (%)	2.5		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		
Moisture Content (AS 1289 2.1.1)			
Moisture Content (%)		20.8	



Material Test Report

Report Number: 203624.00-1
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: CBR Results Added.
Date Issued: 20/05/2021
Client: Hansen Yuncken Pty Ltd
Building 1, Alexandria NSW 2015
Contact: Paul Todhunter
Project Number: 203624.00
Project Name: Proposed New Public School
Project Location: Fairley Street, Murrumbateman NSW
Work Request: 5907
Sample Number: GU-5907C
Date Sampled: 07/05/2021
Dates Tested: 11/05/2021 - 17/05/2021
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: Pit 9 , Depth: 0.5
Material: Clay



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brachlan Harris
Assistant Laboratory Manager
Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	78		
Plastic Limit (%)	22		
Plasticity Index (%)	56		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	18.0		
Cracking Crumbling Curling	Curling		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	21.1

Material Test Report

Report Number: 203624.00-1
Issue Number: 2 - This version supersedes all previous issues
Reissue Reason: CBR Results Added.
Date Issued: 20/05/2021
Client: Hansen Yuncken Pty Ltd
Building 1, Alexandria NSW 2015
Contact: Paul Todhunter
Project Number: 203624.00
Project Name: Proposed New Public School
Project Location: Fairley Street, Murrumbateman NSW
Work Request: 5907
Sample Number: GU-5907D
Date Sampled: 07/05/2021
Dates Tested: 11/05/2021 - 17/05/2021
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: Pit 2 , Depth: 2.1
Material: Sandy Clay



Accredited for compliance with ISO/IEC 17025 - Testing

Brachlan Harris

Approved Signatory: Brachlan Harris

Assistant Laboratory Manager

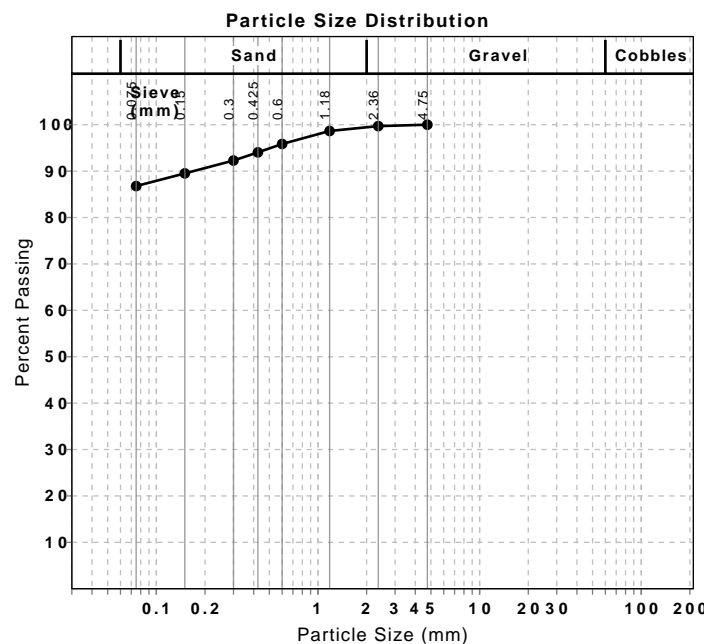
Laboratory Accreditation Number: 828

Particle Size Distribution (AS1289 3.6.1)				
Sieve	Passed %	Passing Limits	Retained %	Retained Limits
4.75 mm	100		0	
2.36 mm	100		0	
1.18 mm	99		1	
0.6 mm	96		3	
0.425 mm	94		2	
0.3 mm	92		2	
0.15 mm	90		3	
0.075 mm	87		3	

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)			Min	Max
Sample History	Oven Dried			
Preparation Method	Dry Sieve			
Liquid Limit (%)	69			
Plastic Limit (%)	22			
Plasticity Index (%)	47			

Linear Shrinkage (AS1289 3.4.1)			Min	Max
Moisture Condition Determined By	AS 1289.3.1.1			
Linear Shrinkage (%)	18.0			
Cracking Crumbling Curling	Curling			

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	22.3



CERTIFICATE OF ANALYSIS 268781

Client Details

Client	Douglas Partners Canberra
Attention	Sasi Sasiharan
Address	Unit 2, 73 Sheppard St., HUME, ACT, 2620

Sample Details

Your Reference	<u>203624.00, Hume</u>
Number of Samples	4 soil
Date samples received	12/05/2021
Date completed instructions received	12/05/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	19/05/2021
Date of Issue	18/05/2021
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. Tests not covered by NATA are denoted with *	

Results Approved By

Diego Bigolin, Team Leader, Inorganics

Authorised By



Nancy Zhang, Laboratory Manager

Soil Aggressivity					
Our Reference		268781-1	268781-2	268781-3	268781-4
Your Reference	UNITS	TP3/1.2m	BH6/1.8-2.0m	BH8/4.5m	BH5/6.0m
Type of sample		soil	soil	soil	soil
pH 1:5 soil:water	pH Units	7.5	7.6	8.9	9.3
Electrical Conductivity 1:5 soil:water	µS/cm	42	20	45	100
Chloride, Cl 1:5 soil:water	mg/kg	<10	<10	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	20	<10	<10	10

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.

QUALITY CONTROL: Soil Aggressivity					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	268781-3
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	7.5	7.4	1	99	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	42	46	9	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	<10	<10	0	95	82
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	20	20	0	96	78

Result Definitions

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

Quality Control Definitions

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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