Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Proposed South East Regional Hospital
1614 Tathra Road, Bega

Prepared for
Health Infrastructure

Project 78385.00
August 2012

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	78385.00	Document No.	1
Document title	Report on Geotechnical Investigation Proposed South East Regional Hospital		
Site address	1614 Tathra Road, Bega		
Report prepared for	Health Infrastructure		
File name	P:\78385 Bega\Report\78385 Bega		

Document status and review

Revision	Prepared by	Reviewed by	Date issued
0	K Schultz	G W McIntosh	20 August 2012

Distribution of copies

Revision	Electronic	Paper	Issued to
0	1	3	Nic Johnston, Johnstaff Projects Pty Ltd

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.

	Signature	Date
Author		20/8/2012
Reviewer	for G W McIntosh	20/8/12

Table of Contents

Report on Geotechnical Investigation
Proposed South East Regional Hospital
1614 Tathra Road, Bega

1. Introduction

This report presents the results of a geotechnical investigation undertaken at the site of the proposed South East Regional Hospital at 1614 Tathra Road, Bega. The work was commissioned by Johnstaff Projects Pty Ltd, project managers acting on behalf Health Infrastructure, developers for the project.

The construction of a 136 bed hospital is proposed which includes structures up to three storeys in height, basements, a helipad, car parking and access roads. Site investigation was undertaken to provide information on subsurface conditions for the design of excavations, earthworks, retaining walls, foundations and pavements.

The investigation comprised boreholes and test pits with in-situ testing and sampling of the subsurface strata, followed by groundwater monitoring, laboratory testing of selected samples, engineering analysis and reporting. Details of the work undertaken and the results obtained are given in the report, together with comments relating to design and construction practice.

An architectural concept plan and a survey plan showing the proposed layout and existing site levels were provided by the client for the investigation.

2. Site Description and Regional Geology

The site, known as 1614 Tathra Road, Bega is made up of Lots 1, 2 and 3 in DP 827161. It is an irregular rectangular shape with maximum plan dimensions of some 500 m by 400 m and an area of 18 ha. The site is bounded by Tathra Road to the west, by Boundary Road to the south and by open farmland to the north and east with the dry bank of the Bega River located about 200 m to the east.

Site levels generally fall from Tathra Road in the west towards the Bega River in the north and east at grades of about 1 in 10 with an overall difference in level estimated to be approximately 25 m from the highest part of the site to the lowest.

At the time of the investigation, the site was grassed farmland and used for grazing cattle with a few scattered trees noted (refer Photos 1 - 4 in Appendix A). Some outcropping rock and boulders were also present on the site surface (refer Photos 1, 2 and 4).

Reference to the 1:250 000 Bega – Mallacoota Geological Series Sheet (Ref 1) indicates that the site is underlain by Brogo Granodiorite of Early Devonian age. The investigation confirmed the geological mapping with granodiorite (granite type rock) encountered in all test pits and boreholes.

3. Field Work Methods

The field work program included the drilling of eight boreholes and the excavation of 21 test pits. The general locations and numbering of the field tests was provided by Johnstaff Projects Pty Ltd and are shown on Drawing 1 in Appendix A.

The boreholes were drilled using a specialised truck-mounted geotechnical drilling rig (Bores 10, 11. 14, 15, 17, 18, 21 and 22) to depths in the range of 3.8 - 12.2 m. In the overburden soils, the boreholes were initially drilled using 150 mm diameter spiral flight augers to depths of up to 1.0 m, then continued (with the exception of Bore 21) using rotary mud or water flush techniques. Sampling and testing was undertaken at nominal 1 m or 1.5 m intervals using thin walled steel tubes (U50) or standard penetration tests (SPT). On refusal of the auger or rotary equipment at depths in the range of 0.7 m to 8.9 m, the bores were cased then advanced using rotary coring techniques (NMLC, 50 mm core size) to the termination depths.

Standpipes were installed at two locations within the building footprint (Bores 15 and 17) to measure the groundwater levels and to allow permeability testing to be carried out. The permeability testing was carried out using the rising head method, with the bores bailed dry and then the incremental increase in water levels measured over time. The detailed results sheets are presented in Appendix A.

The test pits were excavated across the site using a backhoe fitted with a 600 mm wide bucket (Pits 1 - 9, 12, 13, 16, 19, 20, 23 - 29). The pits were excavated to depths in the range of 0.9 - 3.2 m and logged on site by a geotechnical engineer. Soil samples were collected to assist in strata identification and for laboratory testing. Dynamic cone penetrometer tests (AS 1289 6.3.2 – 1997) were carried out to depths of 1.2 m (where possible) to determine the penetration resistance of the near-surface soils.

Surface levels shown on the logs have been interpolated from a drawing provided by Johnstaff Projects Pty Ltd showing contours relative to the Australian Height Datum (AHD) and a contour interval of 1 m. As such, the levels must be considered as being indicative only. The MGA94 co-ordinates were determined in the field using a hand held global positioning system (GPS).

4. Field Work Results

The test pit and borehole logs are included in Appendix A, together with notes defining classification methods and descriptive terms.

4.1 Building Area

Within the building footprint, the boreholes encountered variable subsurface surface conditions that included organic topsoil to depths in the range of 0.2 - 0.6 m overlying layers of clay and sand to depths of 0.6 - 2.5 m then granodiorite, initially extremely low strength to depths of 0.6 - 8.9 m then generally increasing in strength with depth. The near surface soils were typically very weak to depths of up to 1 m. The drilling rig required towing to all the drill sites as it broke through the grassed, dry surface crust.

In Bores 10, 11, 18 and 21 the granodiorite become very low to high strength to depths in the range of 0.7 - 8.1 m. All bores were terminated in very high to extremely high strength granodiorite, except Bore 18 which was terminated in very low strength granodiorite at a depth of 11.6 m. In Bores 14, 15 and 18, very high to extremely high strength layers or tors (boulders) of granodiorite were encountered at depths in the range of 6.8 - 10.7 m before re-intersecting much weaker, weathered granodiorite rock.

Groundwater was observed during auger drilling of Bore 14 at a depth of 0.7 m. No free groundwater was observed in all other boreholes during auger drilling. Drilling fluids used for rotary coring precluded groundwater observations at depth. Two standpipes were installed in Bores 15 and 17 to monitor groundwater levels and allow permeability testing. Groundwater levels were measured in the standpipes on 4 July 2012 at depths of 8.2 m and 5.6 m (RL's 8.8 and 16.4) respectively.

Permeability testing in the standpipes indicates a hydraulic conductivity of 5.6×10^{-6} in Bore 15 and 1.5×10^{-6} in Bore 17.

4.2 Pavement and Landscaping Areas

Within the proposed pavement and landscaping areas, the test pits encountered variable subsurface surface conditions that included organic topsoil and topsoil filling to depths in the range of 0.2 - 0.6 m overlying layers of clay, sand and gravel to depths in the range of 0.7 - 2.4 m then granodiorite, initially extremely low strength, for remaining depths of excavation of 0.9 - 3.2 m.

The backhoe bucket refused on very low to high strength granodiorite in Pits 2, 3, 5, 8, 24 and 25 at depths in the range of 0.9 - 2.4 m.

Free groundwater seepage was observed in Pit 25 at a depth of 0.6 m, with the water level measured at 0.2 m depth after 15 minutes. No free groundwater was observed in the remaining test pits. It is noted that the pits were immediately backfilled following excavation, which precluded long term monitoring of groundwater levels in the pavement and landscaping areas.

5. Laboratory Testing

Selected samples recovered from the pits were tested in the laboratory to determine mechanical and chemical properties. The detailed laboratory test report sheets are given in Appendix B with a summary of the various test methods and results given below.

Samples were tested for measurement of field moisture content, plasticity index, linear shrinkage, compaction properties and California bearing ratio. Six CBR samples were compacted to (nominally) 100% dry density ratio (Standard compaction) at optimum moisture content and soaked for 4 days under surcharge loadings of 4.5 kg. The results are summarised in Table 1 (following page).

Table 1: Results Laboratory Testing

Pit/Bore No.	Depth (m)	W_F (%)	W_L (%)	PI (%)	LS (%)	OMC (%)	MDD (t/m^3)	CBR (%)	Material
1	0.5 – 0.6	18.1	-	-	-	17.4	1.75	10.0	Sandy Clay
3	0.6 – 0.7	29.5	-	-	-	26.6	1.53	3.0	Clay
5	0.9 – 1.0	15.6	39	22	10.5	-	-	-	Sandy Clay
6	0.5 – 0.6	21.3	-	-	-	18.5	1.73	9.0	Sandy Clay
7	0.5 – 0.6	21.7	-	-	-	19.8	1.68	4.0	Clay
8	0.6 – 0.6	25.8	77	51	19.0	-	-	-	Clay
17	1.0	18.2	39	18	10.0	-	-	-	Sandy Clay
18	0.5 – 0.8	26.8	-	-	-	-	-	-	Sandy Clay
23	0.6 – 0.7	27	-	-	-	22.6	1.57	3.5	Clay
25	1.4 – 1.5	32.3	66	35	15.0	-	-	-	Sandy Clay
28	0.5 – 0.6	24.6	-	-	-	21.5	1.62	5.0	Clay

Where W_F = Field moisture content; W_L = Liquid limit; PI = Plasticity index
LS = Linear shrinkage; OMC = Optimum moisture content; MDD = Maximum dry density
CBR = California bearing ratio

Shrink-swell tests were carried out on two clay samples recovered in thin walled steel tubes from Bores 14 and 18 with the shrink-swell index (I_{ss}) results of 0.7% and 1.3% per ΔpF respectively. The results of the plasticity index testing also indicate that the natural site soils are of medium to high plasticity and will therefore be highly susceptible to changes in volume with variations in soil moisture content.

The CBR test results are in the range of 3 - 10% and whilst the results are an accurate determination of a small, remoulded laboratory sample, it is considered that they overstate the in-situ strength (taking into account the nature of the clay soil). As such, some downgrading is considered appropriate for design purposes.

Four samples were also tested to determine the pH, chloride content and sulphate content. The results are summarised in Table 2.

Table 2: Results of Chemical (Aggressivity) Testing

Pit/Bore No.	Depth (m)	pH	Chloride (ppm)	Sulphate (ppm)	Material
2	0.5 – 0.6	6.1	7	39	Sandy Clay
4	1.6 – 1.7	6.5	3	14	Granite
15	2.5 – 2.6	6.2	60	6	Granite
17	1.0 – 1.5	5.5	49	71	Sandy Clay

The results indicate the natural soils which include sand layers on the site would have an exposure classification of **MILD** when assessed in accordance with AS 2159-2009 "Piling-Design and Installation" for concrete piles below the water table.

Screening tests for acid sulfate soils were carried out with reference made to ASSMAC (Ref 6) and QASSIT (Ref 7). Samples of natural site soils (a total of 10 samples) from the pits were tested in the DP laboratory for measurement of pH in water (pH_F) and pH after oxidation in hydrogen peroxide (pH_{FOX}) using a calibrated pH meter. The detailed results of the screening tests are given in Appendix B and discussed below.

The screening test results were assessed for the possible presence of actual acid sulfate soil (AASS) or potential acid sulfate soils (PASS) on the basis of the following guidance indicators specified in the NSW *Acid Sulfate Soils Assessment Guidelines* (1998), namely:

- $pH_F \leq 4$ strongly indicates oxidation has occurred in the past and that AASS are likely to be present;
- pH_F between 4 and 5.5 is neither positive or negative and requires additional testing;
- pH_{Fox} <3.5 (but preferably pH_{Fox} <3), plus preferably one of more of a pH_{Fox} reading at least one pH unit below the corresponding pH_F, a strong reaction with peroxide, change in soil colour from grey tones to brown tones or release of sulphurous gases, strongly indicates the presence of PASS.

No positive indicators of actual acid sulfate soils or potential acid sulfate soils were observed in the samples. Chromium suite testing was therefore not carried out. Further discussion on the implications of the testing is given in Section 7.6.

6. Proposed Development

It is understood that the construction of a 136 bed hospital is proposed which includes structures up to three storeys in height, single basements below most of the building footprint, a helipad, car parking and access roads. Whilst no detailed information is available on the building layout or design, it is expected that basement excavations will be some 3 - 4 m below the current site surface levels whilst balanced cut and fill bulk earthworks of up to 2 m will be required to re-profile the remainder of the site.

Building column loads could be in the order of 1000 - 2000 kN.

Access road pavements may need to accommodate some heavy road vehicles, although the anticipated traffic loading are not know at this stage. Car park areas are expected to be trafficked by light vehicles only.

All recommendations given in the following sections must be reviewed once the design layout has been finalised and the loads are known accurately.

7. Comments

7.1 Site Classification

Within the proposed building footprint, the depth of high plasticity clay soil indicates that undeveloped site will be classified as Class H1 when assessed in accordance with AS2870-2011 Residential Slabs and Footings.

Notwithstanding the classification, the scale and likely loads associated with the proposed development suggest that AS2870 will not be appropriate for use in designing the building footings. Footing design should be undertaken by a suitably qualified engineer using appropriate engineering principles which take into consideration the subsurface conditions and recommendations given in the following sections.

7.2 Excavation

The basement excavation will probably require cuts of up to 4 m in depth. The results of the boreholes indicate that the materials likely to be encountered will include topsoil and overburden soils to depths in the range of 0.6 - 2.5 m overlying granodiorite. Whilst in most of the boreholes the granodiorite was extremely weathered and extremely low strength to depths of 5.3 m or greater, in one borehole (Bore 21) very high strength to extremely high strength granodiorite was encountered at a depth of 0.7 m.

It is expected that the soil and extremely low strength granodiorite will be readily removed using conventional earthmoving equipment to at least the level of backhoe refusal shown on the test pit logs. Granodiorite of medium strength or stronger (up to and including extremely high strength) will require heavy rock breaking, rock grinding or ripping equipment. The rate of excavation of rock is dependent upon rock mass characteristics, primarily the spacing and orientation of jointing and rock strength, as well as the equipment used and skill of the operator. Excavation contractors should be advised to make their own judgement of the excavatability of the strata based on their experience, the equipment they propose to use and on inspection of the rock core.

7.2.1 Groundwater Inflow

The groundwater was measured in the standpipes at depths of 5.6 m and 8.2 m which are below the anticipated maximum excavation depth of 4 m. It is noted that groundwater levels can fluctuate with seasonal changes in rainfall and soil permeability.

The results of permeability testing in the standpipes indicate that the hydraulic conductivity, K, of the strata likely to be exposed in the base of the excavation will be in the order of 10^{-5} - 10^{-6} m/s. Following rainfall, groundwater levels may rise and seepage into the open excavation may occur. Based on previous experience in similar geological conditions any groundwater inflows occurring during bulk excavation should be controllable by installing temporary drains and by pumping from suitably located collector sumps. In the long term, drainage should be provided behind the perimeter retaining walls and beneath underfloor slabs. As the natural fall of the site is towards the Bega River, it should be feasible to design a gravity discharge system.

7.3 Batter Slopes and Excavation Support

The soil and extremely low strength, extremely weathered granodiorite rock likely to be exposed in most of the walls of the excavation will not stand vertically over extended periods of time without support. As the proposed excavation will not be in close proximity to any other structures, it should be feasible to temporarily batter the sides of the excavation to facilitate construction of permanent retaining structures.

Suggested batter slopes for excavations up to 4 m in height are summarised in Table 3 below:

Table 3: Suggested Batter Slopes

Material	Safe Batter Slope (horizontal : vertical)	
	Short Term Temporary	Long Term Permanent
Controlled Filling	1:1	2:1
Sand and Clayey Sand	1.5:1	2:1
Clay and Granodiorite (extremely low strength)	1:1	2:1
Granodiorite (medium strength or greater)	Vertical	0.25:1

If permanent batter slopes in soil will be exposed to the weather, erosion protection, vegetation and maintenance will require flatter slopes of at least 3:1 (h:v) or preferably flatter. In medium strength or stronger granodiorite, vertical permanent batters may be feasible but will depend on jointing. Inspection and reassessment during construction will be required if this option is adopted. Additional site specific assessment will also be required if slopes exceed 4 m in height or vertical cuts are preferred.

Permanent retaining walls will probably be required for the final structure and it is suggested that the design be based on a triangular pressure distribution using the bulk densities and earth pressure coefficients set out Table 4 below.

Table 4: Suggested Retaining Structure Design Parameters

Material	Bulk Density (kN/m^3)	Earth Pressure Coefficients Permanent Support, K_a
Controlled Filling	20	0.4
Sand and Clayey Sand	20	0.5
Clay and Granodiorite (extremely low strength)	20	0.25
Granodiorite (medium strength or greater)	22	10 kPa

These parameters are applicable where the ground surface behind proposed retaining walls is near horizontal. Drainage should be provided behind the walls, or alternatively, full hydrostatic pressure allowed for in design. In this event, the unit weight of the retained soil can be reduced to the buoyant value.

7.4 Ground Vibrations

As the proposed development is to be located in a "greenfield" site and the basement excavation will be several hundred meters from the nearest structures, it is unlikely that ground vibrations will limit the construction works. If required, additional information can be provided specific to the final excavation methods to be adopted.

7.5 Reuse or Disposal of Excavated Material

It should be feasible to reuse most of the soil and rock materials likely to encountered during the earthworks construction and basement excavations.

Vegetation and organic topsoil should be suitable for reuse for landscaping and the near surface clay, sand and gravel should be suitable for general filling, particularly if moisture conditioned (wet or dried) and blended with the extremely weathered granodiorite. The higher strength granodiorite rock could be crushed for use as select fill.

Excavations for the basement will result in the creation of significant volumes of spoil that may need to be removed from site. Under the Protection of the Environment Operation Act (1997), the burden of proof that materials received by a landfill or fill site meet the environmental criteria for proposed land use rests on the waste/fill receiving site. It should be noted that some non-licensed fill sites, such as those operated by Councils or other bodies, may have their own special environmental criteria to be met before receiving any materials. Douglas Partners can assist excavation contractors in classifying materials and negotiating disposal, if required.

7.6 Site Preparation and Earthworks

It is suggested that site preparation and filling should incorporate:

- stripping and removal to stockpiles for landscaping of all vegetation, topsoil and organic-affected material (up to 0.6 m depth in the test pits and boreholes);
- excavation to design levels;
- rolling of the surfaces to receive filling with six passes of a minimum 12 tonne dead weight roller with a final test rolling accompanied by careful visual inspection to allow detection and treatment of soft or compressible zones;
- screening and sorting of the excavated material to remove oversize particles (greater than 100 mm in size). It may be possible to crush oversize granodiorite cobbles and boulders to make the material suitable for reuse as controlled filling;
- placement of the screened filling or approved granular fill in layers of not more than 300 mm loose thickness compacted to a dry density ratio of at least 98% relative to standard compaction (AS 1289 5.1.1) for most of the filling and to 100% for the top 1 m beneath the pavement areas. Moisture contents should be within 2% of optimum moisture content for standard compaction.

As described in Section 7.5, the existing site materials should be suitable for reuse if moisture conditioned and screened.

All fill placement beneath structures should be undertaken under Level 1 control as defined in AS 3798 Guidelines on Earthworks for Commercial and Residential Developments and Level 2 control beneath pavements.

Imported fill material, if required, must be approved for use prior to delivery on site and clays of high plasticity should be avoided if possible.

7.7 Footings

Following excavation and site preparation to achieve basement levels, subgrade conditions will probably include extremely weathered granodiorite at the western end of the site (Bores 11, 14, 17 and 21) to residual clays and eventually new controlled filling at the eastern end (Bores 10, 15, 18 and 22). Due to the likely structural loads and the preference from a settlement perspective for a uniform bearing stratum, it is recommended that all footings found within the underlying granodiorite rock.

Footings could comprise pad or strip footings founded in weathered granodiorite in the west of the site grading to bored piers to rock in the north of the site, where rock is, say, greater than 1.5 m below subgrade level.

Footings could be designed using the following parameters:

- Base bearing on extremely low strength rock 500 kPa
- Base bearing on medium strength or stronger rock 3,500 kPa
- Allowable shaft adhesion in extremely low strength rock 50 kPa
- Allowable shaft adhesion in medium strength or stronger rock 350 kPa

It is noted that the strength of the rock encountered in most of the boreholes does not appear to increase incrementally with depth with the core recovered generally abruptly increasing in strength as fresh material was encountered below the zone of weathering.

Based on the above parameters, a 1.5 m square pad footing founded on extremely low strength rock encountered in the boreholes at depths in the range 1.0 - 2.4 m would be required to support a working load of 1000 kN. A 0.5 m square pad footing founded on medium strength or stronger rock (encountered at depths in the range 0.6 - 11.1 m in the boreholes) would be required to support the same load.

Similarly, a 0.9 m diameter bored pier founded in extremely low strength rock would require a socket length of 2.9 m to support a working load of 1000 kN. It is noted that sockets within medium strength or stronger rock are likely to be difficult to construct with very slow penetration rates. As such, appropriately proportioned, end bearing pile groups could be considered, thus mitigating the need for excessive sockets.

Very high to extremely high strength bands/tors within the much weaker weathered profile (Bores 14, 15 and 18) and difficult or slow drilling, may necessitate the use of percussion drilling techniques or the relocation of some piers.

Also temporary or sacrificial liners may be required at some locations to control groundwater ingress and to facilitate satisfactory base cleaning. The work should be undertaken by contractors experienced in challenging ground conditions, with concrete poured immediately following base cleaning and inspection. Load capacity due to side adhesion must be ignored in those instances where liners are installed.

Auger grouted piles, also known as grout injected piles, could be considered as a lower risk (but possibly more expensive) alternate piling system, provided installation is undertaken by an experienced contractor. It is noted that in order to achieve sockets into medium strength rock, it would be necessary to employ a high torque boring rig for pier construction.

Footings should be inspected by a suitably qualified engineer prior to the placement of concrete to confirm the appropriateness of the bearing stratum for the adopted design pressures. Allowance should also be made for concrete placement within the footings following base cleaning and inspection.

7.8 Pavements

7.8.1 Design CBR

Based on the results of field investigation, laboratory testing, subgrade preparation as detailed in Section 7.7 and allowing for the variability in test results, it is suggested that a CBR value of 3% be adopted for pavement design purposes. These design assumptions should be reviewed before detailed design is carried out.

7.8.2 Pavement Thickness Design

Whilst details of the traffic spectrum and loads were not available at the time of reporting, based on previous experience preliminary pavement thickness design has been based on traffic loadings of 1.0×10^4 and 1.0×10^5 Equivalent Standard Axle (ESA) loads.

The pavement thickness designs given in Table 5 are based on the requirements of AUSTROADS (Ref 4) and the design parameters detailed above. The pavement material quality and compaction requirements are given in Table 6 (following page).

Table 5: Preliminary Pavement Thickness Design

Traffic Loading (ESA)	Design CBR (%)	Total Pavement Thickness (mm)	Pavement Profile (mm)		
			Wearing Course	Base Course	Subbase Course
1.0×10^4	3	325	40AC	100	185
1.0×10^5	3	385	40AC	100	245

The 40 mm thick wearing courses should typically comprise one layer of gap-graded AC10 or 25 mm gap-graded AC10 over 15 mm AC5. At the roundabouts, the wearing course should be 80 mm thick and comprise SBS polymer modified asphaltic concrete. It is noted that the at the roundabouts the asphalt thickness is assumed to not contribute to the structural strength of the pavement and the total the subbase thickness should be increased by 40 mm to 225 mm or 285 mm respectively.

The pavement should be placed and compacted in layers no thicker than 150 mm with control exercised over placement moisture contents. If layer thicknesses greater than 150 mm are proposed, it may be necessary to test the top and bottom of the layer to ensure that the minimum level of compaction has been achieved through the layer.

7.8.3 Materials and Compaction

The suggested minimum material quality and compaction requirements are given in Table 6.

The use of lower quality materials might be feasible providing an increased risk of reduced pavement life and/or higher maintenance costs are accepted. It is also suggested that advice be sought if lesser quality pavement materials are proposed.

Table 6: Pavement Material Quality and Compaction

Layer	Material Quality	Minimum Compaction
Wearing Course	To conform to Austroads	To conform to Austroads
Base Course	To conform to Austroads Soaked CBR ≥ 80%, PI ≤ 6%	Minimum dry density ratio of 98% Modified (AS 1289 Test 5.2.1)
Subbase Course	To conform to Austroads Soaked CBR ≥ 50%, PI ≤ 12%	Minimum dry density ratio of 95% Modified (AS 1289 Test 5.2.1)
Subgrade	-	Minimum dry density ratio of 100% Standard (AS 1289 Test 5.1.1)

Where PI = plasticity index

7.8.4 Drainage

Surface and subsurface drainage should be installed and maintained to protect the pavement and subgrade. The subsurface drains should be located at a minimum of 0.5 m depth below subgrade level and installed where appropriate (for example, on the upslope sides of the pavement). Guidelines on the arrangement of subsurface drainage are given on Page 20 of ARRB – SR41 (Ref 2). It should be noted that if the sub-base is of low permeability relative to the base layer, then the subsurface drain is required to intersect all pavement layers as shown in ARRB – SR41.

7.9 Acid Sulphate Soil

Review of NSW Acid Sulphate Soil Risk mapping indicates that the site is outside the area of any known occurrence of acid sulphate soils. The results of the screening testing undertaken confirm the likely absence of potential acid sulphate soils within the proposed development area therefore the production of an acid sulphate soil management plan (ASSMP) should not be required.

8. References

1. Bega – Mallacoota 1:250 000 Geological Series Sheet, Dept of Mineral Resources, (1995)
2. Australian Standard AS 2159 – 2009 Piling – Design and Installation.
3. AS 1170.4 – 2007 Structural Design Actions, Part 4: Earthquake Actions in Australia.
4. AUSTROADS, "Guide to Pavement Technology – Part 2: Pavement Structural Design", 2008.
5. A Structural Design Guide for Flexible Residential Street Pavements, Australian Road Research Board, Special Report No 41, (1989).
6. Acid Sulfate Soil Manual, ASSMAC (1998).
7. Dear SE, Moore NG, et al "Queensland Acid Sulfate Soil Technical Manual – Soil Management Guidelines" Dept of Natural Resources and Mines (2002).

9. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for the proposed South East Regional Hospital at 1614 Tathra Road, Bega in accordance with DP's proposal dated 3 May 2012 and acceptance received from Health Infrastructure dated 22 May 2012. The work was carried out under the Health Infrastructure Consultancy Agreement HI2271. This report is provided for the exclusive use of Health Infrastructure 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. 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 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 testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

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
Results of Field Work
Drawing 1
Photos 1 to 4

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.

Copyright

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.

Sampling Methods

Douglas Partners

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 in to 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

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.

Soil Descriptions

Douglas Partners

Description and Classification Methods

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

Soil Types

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

Type	Particle size (mm)
Boulder	>200
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 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx 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 $Is_{(50)}$

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 b leaching affects w hole of roc k substance and other signs of decomposition are evi dent. 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 su bstance has taken place
Slightly weathered	SW	Rock substance is slig htly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but stai ning 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 inc ludes 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 loner 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:

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

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 a bbreviations 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

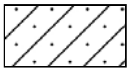
Soils


Topsoil

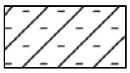

Peat


Clay

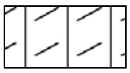

Silty clay

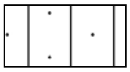

Sandy clay

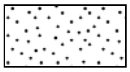

Gravelly clay

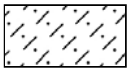

Shaly clay

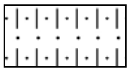

Silt


Clayey silt


Sandy silt


Sand

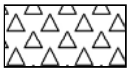

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

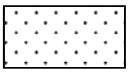

Talus

Sedimentary Rocks

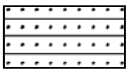

Boulder conglomerate

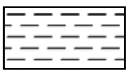

Conglomerate


Conglomeratic sandstone

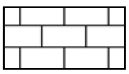

Sandstone


Siltstone


Laminite

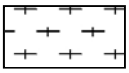

Mudstone, claystone, shale

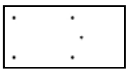

Coal


Limestone

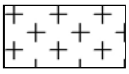
Metamorphic Rocks

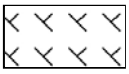

Slate, phyllite, schist

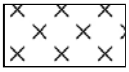

Gneiss


Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 20 AHD
EASTING: 755092
NORTHING: 5935941
DIP/AZIMUTH: 90°/--

PIT No: 1
PROJECT No: 78385
DATE: 27/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
20	0.2	TOPSOIL - dark grey brown, silty clay with some roots and rootlets							
	0.3	SANDY GRAVEL - dark brown, fine to coarse sandy, fine gravel with trace clay and silt, damp							
		SANDY CLAY - very stiff to hard, orange brown and grey brown, slightly gravelly (fine), fine to coarse sandy clay, damp		B	0.5		pp = 320-480		
					0.6				
19	1	- with clayey, coarse sandy, fine gravel and extremely low strength, extremely weathered, granodiorite seams below 1.0m		D	1.0				1
					1.1				
	1.4	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, brown and brown grey granodiorite with some slightly clayey to clayey, coarse sandy gravel seams		D	1.4				
					1.5				
18	2			D	2.0				2
					2.1				
				D	2.4				
					2.5				
				D	2.9				
17	3	3.0 Pit discontinued at 3.0m Limit of investigation			3.0				3

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 16 AHD
EASTING: 755175
NORTHING: 5935977
DIP/AZIMUTH: 90°/--

PIT No: 2
PROJECT No: 78385
DATE: 27/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
16	0.0	TOPSOIL - dark grey, silty clay with some fine to medium sand, roots and rootlets							
	0.3	SANDY CLAY - stiff to very stiff, light orange brown, light brown and grey brown, slightly sandy to sandy (fine to coarse) clay with some fine gravel, damp		B	0.5 0.6		pp = 280-370		
	0.7	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, grey brown granodiorite		D	0.9 1.0				
15	1	- becoming very low strength, highly weathered below 1.2m		D	1.4 1.5				
14	2 2.0	Pit discontinued at 2.0m Very slow progress		D	1.9 2.0				
13	3								

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 12.5 AHD
EASTING: 755277
NORTHING: 5936005
DIP/AZIMUTH: 90°/--

PIT No: 3
PROJECT No: 78385
DATE: 27/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
12	0.0	TOPSOIL - dark grey brown, sandy clay to clayey, fine to medium sand with some roots and rootlets, damp to moist							
	0.6	CLAY - stiff, mottled grey and orange brown clay with some fine to medium sand, damp to moist		B	0.6 0.7		pp = 140 - 190		
	1	- becoming stiff to very stiff, slightly sandy to sandy (fine to coarse) clay with some fine gravel below 0.9m		D	1.0 1.1		pp = 170 - 280		1
11	1.3	SANDY GRAVEL - grey, brown grey green and light grey, slightly clayey, sandy (fine to coarse), fine gravel with some silt and trace extremely low strength, extremely weathered granodiorite seams		D	1.4 1.5				
	2			D	1.9 2.0				2
10	2.4	Pit discontinued at 2.4m Refusal on high strength granodiorite at 1.9m at southern end of pit, at 2.4m at northen end of pit							
	3								3

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 23.5 AHD
EASTING: 755152
NORTHING: 5935923
DIP/AZIMUTH: 90°/--

PIT No: 4
PROJECT No: 78385
DATE: 27/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
23	0.0	TOPSOIL - dark grey silty clay with some roots and rootlets, damp							
	0.3	CLAYEY SAND - medium dense, dark brown, slightly silty, clayey, fine to coarse sand with some fine gravel, damp		D	0.3 – 0.4				
	0.5	CLAY - dark orange brown and light orange brown clay with trace silt, damp							
	0.6	SANDY GRAVEL - brown and grey brown, slightly clayey, sandy (fine to coarse), fine gravel with trace silt and extremely low strength, extremely weathered granodiorite bands		D	0.6 – 0.7				
	1			D	1.0				1
	1.1	GRANODIORITE - extremely low strength, extremely weathered, brown grey granodiorite with some clayey gravel bands							
22		- with some very low strength, highly weathered bands at 1.6m		D	1.6 – 1.7				
	2								2
				D	2.4 – 2.5				
21	3			D	3.0				3
	3.1	Pit discontinued at 3.1m Limit of investigation			3.1				

RIG: JCB 4CX (600mm bucket)

LOGGED: BNG

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 18.5 AHD
EASTING: 755274
NORTHING: 5935915
DIP/AZIMUTH: 90°/--

PIT No: 5
PROJECT No: 78385
DATE: 27/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
18	0.4	TOPSOIL - drak grey black, slightly sandy (fine to medium), silty clay with some roots and rootlets, damp							
		CLAYEY SAND - grey, clayey, fine to coarse sand with trace rootlets, moist		D	0.5		pp = 150-290		
	0.7				0.6				
		CLAYEY SAND/SANDY CLAY - stiff to very stiff, light orange brown and light grey, clayey, fine to coarse sand to sandy clay with some fine to medium gravel (granodiorite), damp		D	0.9		pp = 180-280		
	1				1.0				1
17		- with some extremely low to very low strength, extremely weathered to highly weathered granodiorite seams below 1.3m							
	1.6	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, grey brown and light orange brown granodiorite with some clayey sand seams. Recovered as fine to coarse sand, fine to coarse gravel and trace cobbles		D	1.6 1.7				
				D	1.9 2.0				
	2								2
		- becoming very low strength below 2.1m							
	2.3	Pit discontinued at 2.3m							
16		Very slow progress in very low strength granodiorite							
	3								3

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 20 AHD
EASTING: 755417
NORTHING: 5935939
DIP/AZIMUTH: 90°/--

PIT No: 6
PROJECT No: 78385
DATE: 27/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
20	0.2	FILLING - dark brown grey, fine to coarse sandy clay with some fine gravel, roots and rootlets, damp (TOPSOIL)							
	0.3	TOPSOIL - dark grey, slightly sandy (fine to coarse) silty clay with some roots and rootlets, damp							
	0.5	SAND - medium dense to dense, dark brown, slightly silty, fine to coarse sand with some clay and fine gravel, moist							
		CLAYEY SAND/SANDY CLAY - very stiff to stiff, light orange brown, clayey, fine to coarse sand to sandy clay with some fine gravel and trace high strength granodiorite cobbles, damp to moist		B	0.5 0.6		pp = 180-250		>>
19	1	- with some clayey gravelly sand and extremely low strength, extremely weathered granodiorite bands below 0.9m		D	0.9 1.0				1
	1.3	GRANODIORITE - extremely low to very low, extremely to highly weathered, light brown orange granodiorite with trace clayey sandy gravel bands, Recovered as fine to coarse sand, fine to coarse gravel and trace cobbles		D	1.5 1.6				
18	2			D	1.9 2.0				2
				D	2.4 2.5				
				D	2.9				
17	3	3.0 Pit discontinued at 3.0m Limit of investigation			3.0				3

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 27 AHD
EASTING: 755226
NORTHING: 5935853
DIP/AZIMUTH: 90°/--

PIT No: 7
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
27		TOPSOIL - dark grey, silty clay with some sand, roots and rootlets, damp							
	0.3	SAND - brown, slightly silty, fine to coarse sand with some fine gravel, moist							
	0.4	CLAY - stiff to very stiff, light brown, orange brown and grey brown, slightly sandy (medium to coarse) to sandy clay with some fine gravel, damp		B	0.5 0.6		pp = 180-250		
	0.9	CLAYEY GRAVELLY SAND - light brown, orange brown and grey brown, clayey, gravelly (fine), medium to coarse sand, moist		D	0.9 1.0				
26	1								1
	1.2	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, brown granodiorite with some sandy clay seams		D	1.4 1.5				
				D	1.9 2.0				
25	2								2
				D	2.4 2.5				
		- with some low strength seams below 2.5m							
24	3								3
	3.0	Pit discontinued at 3.0m Limit of investigation							

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 21 AHD
EASTING: 755354
NORTHING: 5935881
DIP/AZIMUTH: 90°/--

PIT No: 8
PROJECT No: 78385
DATE: 27/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
21		TOPSOIL - dark grey, silty clay with some fine to medium sand, roots and rootlets, moist							
	0.4	SILTY SAND - light brown, silty, fine to coarse sand with trace fine gravel, moist							
	0.5	CLAY - firm to stiff, light orange brown and light grey clay with some fine to coarse sand and silt, damp to moist			0.5		pp = 120-210		
				D	0.6				
	0.7	SANDY CLAY - light orange brown and light grey, fine to coarse sandy clay with some fine gravel, moist							
	0.8	GRANODIORITE - very low to low strength, highly weathered, light brown grey granodiorite			0.8				
				D					
	0.9	Pit discontinued at 0.9m Refusal on low strength granodiorite			0.9				
20	1								1
19	2								2
18	3								3

RIG: JCB 4CX (600mm bucket)

LOGGED: BNG

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 31 AHD
EASTING: 755236
NORTHING: 5935806
DIP/AZIMUTH: 90°/--

PIT No: 9
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
31		TOPSOIL - dark grey, slightly sandy (fine to medium), silty clay with some roots and rootlets, damp							
	0.3	SAND - brown, slightly silty, fine to coarse sand with some fine gravel, moist							
	0.5	GRAVELLY SANDY CLAY / CLAYEY GRAVELLY SAND - firm to stiff, light brown, grey brown and orange brown, slightly gravelly (fine), medium to coarse sandy clay, damp to moist		B	0.5 0.6		pp = 80-180		
		- becoming very stiff to hard below 0.6m							
		- becoming slightly clayey, fine gravelly, medium to coarse sand below 0.9m		D	0.9 1.0				
30	1								1
		- with some seams of extremely low to very low strength, extremely to highly weathered, light brown granodiorite below 1.2m							
	1.4	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, light brown and grey brown granodiorite with some low strength and clayey gravel bands. Recovered as medium to coarse sand, fine to coarse gravel and trace cobbles		D	1.4 1.5				
				D	1.9 2.0				
29	2								2
				D	2.4 2.5				
				D	2.9				
28	3								3
	3.0	Pit discontinued at 3.0m Limit of investigation			3.0				

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 33 AHD
EASTING: 755234
NORTHING: 5935769
DIP/AZIMUTH: 90°/--

PIT No: 12
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
33		TOPSOIL - dark grey, slightly silty, slightly sandy (fine to medium) clay with some roots and rootlets, damp							
	0.3	SAND - light brown grey, slightly silty, slightly clayey, fine to coarse sand with some fine gravel, moist							
	0.4	CLAYEY GRAVELLY SAND - stiff to very stiff, mottled grey brown, grey and orange brown clayey, gravelly (fine), medium to coarse sand, moist		D	0.5		pp = 260-300		
				D	0.6				
	0.7	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, light brown and grey brown granodiorite. Recovered as medium to coarse sand, fine to coarse gravel and some cobbles		D	0.9				
32	1			D	1.0				1
				D	1.4				
					1.5				
31	2			D	2.0				2
					2.1				
		- with low strength bands below 2.5m		D	2.5				
					2.6				
				D	2.7				
	2.8	Pit discontinued at 2.8m Slow progres			2.8				
30	3								3

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 28.5 AHD
EASTING: 755290
NORTHING: 5935797
DIP/AZIMUTH: 90°/--

PIT No: 13
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
									5 10 15 20
	0.0	TOPSOIL - dark grey, slighlty sandy, slightly silty clay with some roots, rootlets and high strength granodiorite cobbles, damp							
	0.3	SAND - light brown grey, slightly silty, slightly clayey, fine to coarse sand with some fine gravel, moist							
28	0.5	CLAYEY SAND / SANDY CLAY - stiff to very stiff, mottled grey brown and orange brown, clayey, medium to coarse sand to sandy clay with some fine gravel and silt, damp		B	0.6 0.7		pp = 120-126		
		- with some high strength granodiorite cobbles and boulders below 0.8m in eastern end of pit		D	0.9				
	1	- with some extremely low to very low strength, extremely to highly weathered, light brown grey granodiorite seams below 0.9m			1.0				1
	1.2	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, light brown and grey brown granodiorite with trace low strength seams, high strength cobbles, boulders and clayey sand seams. Recovered as medium to coarse sand, fine to coarse gravel and some cobbles		D	1.4 1.5				
27		- with high strength boulder from 1.6 to 2.4m in western end of pit		D	1.9 2.0				
	2								2
				D	2.3				
	2.4	Pit discontinued at 2.4m Limit of investigation			2.4				
26									
	3								3

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 24.5 AHD
EASTING: 755371
NORTHING: 5935772
DIP/AZIMUTH: 90°/--

PIT No: 16
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
24	0.3	TOPSOIL - dark grey clay with some silt, sand, coarse gravel, cobbles (granodiorite), roots and rootlets, damp							
		SAND - light brown grey, slightly clayey, slightly silty, fine to coarse sand, moist		D	0.4				
	0.5	CLAYEY SAND / SANDY CLAY - firm, mottled grey brown, grey and orange brown, clayey, medium to coarse sand to sandy clay with trace fine gravel (granodiorite), damp			0.5				
	0.8	GRANODIORITE - very low strength, highly weathered, light brown and brown grey granodiorite with some extremely low strength, low strength and trace sandy clay seams. Recovered as medium to coarse sand, fine to coarse gravel and trace cobbles		D	0.9				
23	1				1.0				
				D	1.5				
					1.6				
	2			D	2.0				
					2.1				
22				D	2.4				
					2.5				
	2.8	Pit discontinued at 2.8m Slow progres							
	3								

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 30.5 AHD
EASTING: 755305
NORTHING: 5935718
DIP/AZIMUTH: 90°/--

PIT No: 19
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
30	0.0	TOPSOIL - dark grey, slightly sandy (fine to coarse) silty clay with some roots and rootlets, damp							
	0.3	SAND - light brown grey, slightly gravelly (fine granodiorite), slightly calyey, fine to coarse sand with some silt, moist to wet							
	0.4	CLAYEY GRAVELLY SAND / GRAVELLY SANDY CLAY - stiff to very stiff, mottled grey brown, grey and orange brown, clayey, gravelly (fine), medium to coarse sand to gravelly sandy clay, damp to moist		B	0.5 0.6		pp = 180-220		
29	1.0	GRANODIORITE - very low strength, highly weathered, light brown and brown granodiorite with some extremely low and low strength seams. Recovered as medium to coarse sand, fine to coarse gravel and some cobbles		D D D D D	1.0 1.1 1.5 1.6 2.0 2.1 2.4 2.5 2.9				
28	3.0	Pit discontinued at 3.0m Limit of investigation			3.0				

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 31.5 AHD
EASTING: 755290
NORTHING: 5935688
DIP/AZIMUTH: 90°/--

PIT No: 20
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
31	0.3	TOPSOIL - dark grey, silty clay with some sand, roots and rootlets, damp							
		SAND - medium dense, brown grey, medium to coarse sand with some silt and trace clay damp		D	0.5				
	0.7				0.6				
		CLAYEY SAND / SANDY CLAY - very stiff to hard, light orange brown and grey, clayey, coarse sand to coarse sandy clay with fine gravel, damp		D	0.9		pp = 250-400		
	1				1.0				1
	1.1	GRANODIORITE - extremely to very low strength, extremely to highly weathered, light brown grey granodiorite with trace clayey coarse sand seams. Recovered as medium to coarse sand, fine to coarse gravel with trace cobbles							
30		- becoming very low strength below 1.5m		D	1.5				
					1.6				
				D	1.9				
	2				2.0				2
		- with some low strength, highly weathered seams at 2.0m							
29				D	2.4				
					2.5				
				D	2.8				
	2.9				2.9				
		Pit discontinued at 2.9m Limit of investigation							
	3								3

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 27 AHD
EASTING: 755355
NORTHING: 5935706
DIP/AZIMUTH: 90°/--

PIT No: 23
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
27	0.0	TOPSOIL - dark grey, silty clay with some sand, roots and rootlets, moist							
	0.3	SILTY SAND - loose to medium dense, light brown grey, silty, fine to coarse sand with some fine gravel and clay, moist to wet							
	0.5	SANDY CLAY - firm to very stiff, mottled light orange brown and grey, slightly sandy to sandy (medium to coarse) clay with some fine gravel and trace rootlets, damp to moist		B	0.6 0.7		pp = 70-180		
	0.9	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, light orange brown and grey granodiorite with some seams of low strength granodiorite and trace clayey, medium to coarse sand seams		D	0.9 1.0				
26	1			D	1.5 1.6				
				D	1.9 2.0				
25	2			D	2.5 2.6				
24	3			D	3.1				
	3.2	Pit discontinued at 3.2m Limit of investigation			3.2				

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 23 AHD
EASTING: 755400
NORTHING: 5935703
DIP/AZIMUTH: 90°/--

PIT No: 24
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
23		TOPSOIL - dark grey brown, slightly sandy, slightly silty clay with roots and rootlets, damp							
	0.4								
	0.45	GRAVELLY SAND - light brown, gravelly (fine), fine to coarse sand with some silt and clay, moist							
		CLAY - firm to stiff, light brown mottled light orange brown and grey brown clay with some coarse sand and trace silt, damp		B	0.5		pp = 80-90		
					0.6				
		- becoming very stiff, slightly gravelly (fine granodiorite), slightly sandy (coarse) clay below 0.7m		D	0.7		pp = 220-250		
					0.8				
22	1.0	GRAVELLY SANDY CLAY - light brown mottled light orange brown and grey brown, gravelly (fine), sandy (coarse) clay with trace silt							
	1.3	GRANODIORITE - extremely to very low strength, extremely to highly weathered, light brown and grey brown granodiorite with trace low strength cobble sized pieces and seams of gravelly sandy clay. Recovered as medium to coarse sand, fine to medium gravel and trace cobbles		D	1.4				
					1.5				
21					1.9				
				D	2.0				
	2.3	Pit discontinued at 2.3m Refusal on medium strength granodiorite							
20									

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 16.5 AHD
EASTING: 755469
NORTHING: 5935717
DIP/AZIMUTH: 90°/--

PIT No: 25
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
16	0.0	TOPSOIL - dark grey clay with some sand and silt, moist							
		- with roots and rootlets to 0.5m							
	0.6	SAND - loose to medium dense, grey brown, medium to coarse sand with some silt and clay, moist to wet		D	0.7			▽	
	0.8	CLAYEY SAND / SANDY CLAY - firm to stiff, light brown, orange brown and grey brown, clayey fine to coarse sand to sandy clay with some silt, fine to medium gravel (granodiorite) and trace extremely low to very low strength, extremely to highly weathered, orange brown granodiorite seams, damp		B	0.8 0.9				
15	1	- becoming stiff below 1.4m		D	1.4 1.5		pp = 110-140		
		- becoming very stiff below 1.8m		D	1.8		pp = 250-400		
	1.9	Pit discontinued at 1.9m Refusal on medium to high strength granodiorite			1.9				
14	2								
	3								

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: Seepage from 0.6m. Pooling water 0.2m deep after 0.25hrs

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 27.5 AHD
EASTING: 755355
NORTHING: 5935622
DIP/AZIMUTH: 90°/--

PIT No: 26
PROJECT No: 78385
DATE: 25/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL - dark grey to black, slightly silty, fine to medium sandy clay with some roots							
	0.4	CLAYEY SANDY GRAVEL - firm to very stiff, light brown, grey brown and light orange brown, clayey, sandy (coarse), fine gravel, moist			0.5		pp = 200 - 220		
27				B	0.6				
		- becoming very stiff below 0.75m							
					0.9				
				D					
	1				1.0				1
	1.1	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, light brown orange granodiorite with some clayey, sandy (coarse), fine gravel seams. Recovered as fine to coarse sand, fine to medium gravel and some cobbles							
					1.4				
26				D					
		- with some very low to low strength, highly weathered seams between 1.1 and 2.0m			1.5				
					1.9				
				D					
	2				2.0				2
		- becoming extremely low strength, extremely weathered below 2.0m							
					2.4				
25				D					
					2.5				
					2.9				
				D					
	3				3.0				3
	3.0	Pit discontinued at 3.0m Limit of investigation							

RIG: JCB 4CX (600mm bucket)

LOGGED: BNG

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 23 AHD
EASTING: 755429
NORTHING: 5935642
DIP/AZIMUTH: 90°/--

PIT No: 27
PROJECT No: 78385
DATE: 25/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
23	0.0	TOPSOIL - dark grey to black, slightly silty, slightly sandy (fine to medium) clay with some roots, damp							
	0.3	SILTY CLAYEY SAND - medium dense, light brown orange, silty, clayey, fine to coarse sand to sandy clay, damp to moist		B	0.5		100 - 180		
	0.6	CLAYEY SAND - medium dense, mottled light orange brown and grey, clayey, fine to coarse sand with some silt, damp to moist			0.6				
22	1	- becoming very dense below 0.9m		D	0.9				1
	1.2	GRANODIORITE - extremely low strength, extremely weathered, light brown granodiorite with trace clayey, fine to coarse sand seams. Recovered as medium to coarse sand, fine to medium gravel and trace cobbles			1.0				
				D	1.5				
	1.7	GRANODIORITE - very low to low strength, highly weathered, grey brown granodiorite with some extremely low strength, extremely weathered seams and trace slightly clayey, fine to coarse sand seams			1.6				
21	2			D	1.9				2
					2.0				
				D	2.5				
					2.6				
				D	2.9				
20	3				3.0				3
	3.0	Pit discontinued at 3.0m Limit of investigation							

RIG: JCB 4CX (600mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 19 AHD
EASTING: 755479
NORTHING: 5935645
DIP/AZIMUTH: 90°/--

PIT No: 28
PROJECT No: 78385
DATE: 25/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
19	0.0	TOPSOIL - dark grey to black slightly sandy, slightly silty clay with roots and rootlets, damp							
	0.3	CLAYEY SILTY SAND - light brown, clayey, silty, fine to coarse sand with roots and rootlets, wet							
	0.5	CLAY - stiff to very stiff, mottled light orange brown and grey clay with some fine to medium sand, damp		B	0.5		pp = 140-160		
		- with some roots to 0.7m			0.6				
				D	0.9		pp = 160-290		
18	1				1.0				1
	1.2	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, light grey and light brown granodiorite. Recovered as medium to coarse sand, fine to medium gravel and trace cobbles.		D	1.4				
					1.5				
				D	1.9				
17	2				2.0				2
				D	2.4				
					2.5				
16	3								3
	3.0	Pit discontinued at 3.0m Limit of investigation							

RIG: JCB 4CX (600mm bucket)

LOGGED: BNG

SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

TEST PIT LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 23.5 AHD
EASTING: 755303
NORTHING: 5935548
DIP/AZIMUTH: 90°/--

PIT No: 29
PROJECT No: 78385
DATE: 25/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
23	0.5	TOPSOIL - dark grey black, clayey, silty, fine to medium sand with some roots and rootlets, damp							
		SILTY SAND - dense, grey brown and dark grey, slightly clayey, silty, fine to coarse sand, damp to moist		D	0.5 0.6				
	0.9	CLAYEY SAND - light grey and orange brown, slightly clayey to clayey fine to coarse sand, damp.		D	0.9 1.0		100 - 140		
22	1	- with some extremeley low to very low strength, extremely weathered to highly weathered granodiorite bands below 1.3m		D	1.4 1.5				
	2			D	1.9 2.0				
	2.1	GRANODIORITE - very low strength, grey and dark brown granodiorite		D	2.4 2.5				
21	2.9	Pit discontinued at 2.9m Limit of investigation							
	3								

RIG: JCB 4CX (300mm bucket)
LOGGED: BNG
SURVEY DATUM: MGA94

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

☐ 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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 18 AHD
EASTING: 755399
NORTHING: 5935883
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 78385
DATE: 4/7/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
18	0.00	TOPSOIL - dark grey brown, slightly silty, fine to medium sandy clay with some roots and rootlets, damp							A			
	0.55	SILTY SAND - grey brown, slightly silty to silty, fine to coarse sand with some clay, moist to wet							A			
17	1.0	SANDY CLAY / CLAYEY SAND - very stiff, light brown, orange brown and light grey, slightly silty, fine to coarse sandy clay to clayey sand with trace fine gravel, damp							A U S			14,16,10 N = 26
16	2											
	2.5	GRANODIORITE - extremely low strength, extremely weathered, light brown, grey brown and grey white granodiorite with clayey sand seams							S			11,16,23 N = 39
15	3											
14	4	- with some very low strength, highly weathered seams below 4.0m							S			23,16,25/110 refusal
13	5											
									S			15,25/110 refusal
12	6							Unless otherwise state, rock is fractured along, rough, planar, ironstained, sub horizontal joints.				
11	7											
	7.05	GRANODIORITE - very low strength, highly weathered, fractured, light brown to brown, medium to coarse grained granodiorite with extremely low to low strength, extremely to moderately weathered seams							C	100	0	PL(A) = 0.04
	7.73							7.67m: CORE LOSS: 60mm	C	70	0	
10	8								C	100	0	
	8.08	GRANODIORITE - very high to extremely high strength, fresh stained, slightly fractured, light grey mottled dark grey and white grey, medium to coarse grained granodiorite						8.07m: Joint, 20°, smooth, planar 8.37m: Joint, 0°, smooth 8.45m: Joint, 70°, smooth				PL(A) = 10.3
9	9								C	100	94	
												PL(A) = 9.6

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.25m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 7.05m, coring (NMLC) to 10.20m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 18 AHD
EASTING: 755399
NORTHING: 5935883
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 78385
DATE: 4/7/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.2	Bore discontinued at 10.2m Limit of investigation							C	100	94	

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.25m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 7.05m, coring (NMLC) to 10.20m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 22 AHD
EASTING: 755371
NORTHING: 5935828
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 78385
DATE: 3/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
22		TOPSOIL - dark brown clay with some roots, rootlets, silt and fine to medium sand, damp							A			
	0.35											
	0.5	SILTY SAND - brown, slightly clayey, silty, fine to coarse sand with trace fine gravel, moist							A			
21	1	CLAY - light brown and grey brown, slightly sandy (fine to coarse) clay with trace silt, damp							A			19,25/90 refusal
	1.15								S			
		GRANODIORITE - extremely low strength, extremely weathered, light brown mottled grey white granodiorite with clayey sand and very low strength, highly weathered seams										
20	2								S			10,25/70 refusal
19	3											
18	4							Unless otherwise stated rock is fractured along, rough, planar, ironstained sub horizontal joints	S			12,19,25/80 refusal
17	5											
	5.25	GRANODIORITE - medium to high strength, moderately to slightly weathered, slightly fractured, light brown and grey white, medium to coarse grained granodiorite							C	100	100	PL(A) = 0.5
	5.77											
16	6	GRANODIORITE - very high to extremely high strength, fresh stained, slightly fractured, grey mottled dark grey and white grey, medium to coarse grained granodiorite with extremely low to very low strength, extremely to highly weathered seams							C	100	100	PL(A) = 11.5
15	7	- becoming fresh stained and extremely high strength below 7.19m						7.02m: Joint, 0°, 40mm extremely to highly weathered 7.17m: Joint, 0°, 50mm extremely to highly weathered	C	100	90	PL(A) = 4.1
14	8											PL(A) = 10.9
	8.4	Bore discontinued at 8.4m Limit of investigation										
13	9											

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.2m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 5.25m, coring (NMLC) to 8.4m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 22.5 AHD
EASTING: 755389
NORTHING: 5935793
DIP/AZIMUTH: 90°/--

BORE No: 14
PROJECT No: 78385
DATE: 3/7/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low / Very Low / Low / Medium / High / Very High / Ex High		0.01 / 0.05 / 0.10 / 0.50 / 1.00	B - Bedding J - Joint S - Shear F - Fault				
22	0.3	TOPSOIL - dark grey brown, slightly silty, slightly sandy (fine to medium) clay with some roots and rootlets, damp to moist							A			
	0.6	CLAYEY SAND - grey brown, slightly clayey to clayey, fine to coarse sand, moist to wet							A			
21	1	SANDY CLAY/CLAYEY SAND - light orange brown mottled grey, fine to coarse sandy clay to clayey sand with some silt, damp - with some extremely low strength, extremely weathered seams below 1.0m							U A S			22,25/110 refusal
20	2								S			10,21,25/100 refusal
	2.9	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, white grey and light brown granodiorite										
19	3											
18	4								S			25/50 refusal
	5							Unless otherwise stated, rock is fractured along, rough, planar, ironstained, subhorizontal joints				
17	5.5	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, slightly fractured, brown to light brown, medium to coarse grained granodiorite							C	100	0	
								5.63m: J 0o, 40mm extremely weathered	C	100	0	
16	6							5.9m: J 0o, 30mm extremely weathered 5.95m: J 0o, 10mm extremely weathered 6.4m: J 0o, undulating 6.53m: J 0o, 30mm extremely weathered 6.65m: J 0o, 30mm extremely weathered	C	100	0	PL(A) = 0.04
	6.8	GRANODIORITE - high to very high strength, moderately weathered to fresh stained, slightly fractured, grey and brown, medium to coarse grained granodiorite - becoming very low to low strength with extremely low strength seams below 7.54m						7.2m: J 20o, 120mm highly fragmented 7.31m: J 40o 7.59m: J 80o, smooth, from 7.59 - 7.79m				PL(A) = 7.0 PL(A) = 1.8
15	7											
	8							7.98m: J 0o, 20mm extremely weathered 8.04m: J 0 - 10o undulating				PL(A) = 0.2
14	8.23							8.23m: CORE LOSS: 770mm	C	73	40	PL(A) = 6.8
	9											
	9.0							9.13m: J 250mm highly fragmented				
13	9.26	GRANODIORITE - very high strength, fresh stained, slightly fractured, light grey, medium to coarse grained granodiorite - becoming fresh below 9.53m						9.26m: J 80o, smooth, from 9.26 - 9.53m				
	9.75											

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.2m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 5.5m, coring (NMLC) to 9.75m

WATER OBSERVATIONS: Initial depth at 0.7m

REMARKS:

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 22.5 AHD
EASTING: 755389
NORTHING: 5935793
DIP/AZIMUTH: 90°/--

BORE No: 14
PROJECT No: 78385
DATE: 3/7/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		Bore discontinued at 9.75m Limit of investigation										

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.2m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 5.5m, coring (NMLC) to 9.75m

WATER OBSERVATIONS: Initial depth at 0.7m

REMARKS:

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 17 AHD
EASTING: 755429
NORTHING: 5935845
DIP/AZIMUTH: 90°/--

BORE No: 15
PROJECT No: 78385
DATE: 27/6/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		B - Bedding J - Joint S - Shear F - Fault	EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00					
17	0.4	TOPSOIL - dark grey brown, slightly silty clay with some sand, roots and rootlets, damp							A			
	0.55	SAND - dark grey brown, slightly clayey, slightly silty, fine to coarse sand, moist							A			
16	1	CLAYEY SAND/SANDY CLAY - light brown and grey, slightly silty, clayey, fine to coarse sand to sandy clay with trace fine gravel (granodiorite), damp							A			
	1.3	- with some extremely low strength, extremerly weathered granodiorite seams below 1.0m							S			1,9,25/130 refusal
15	2	GRANODIORITE - extremely low to very low strength, extremely to highly weathered, light brown to brown granodiorite with some seams of slightly clayey to clayey sand with some fine gravel							S			25/120 refusal
14	3											
13	4								S			21,25/120 refusal
12	5											
									S			25/70 refusal
11	6											
10	7	- with some low strength seams below 7.0m							S			25/25 refusal
9	8							Unless otherwise stated, rock is fractured along rough, planar, ironstained subhorizontal joints				
8	8.85											
	8.96	MICRO GRANODIORITE - very high strength, fresh stained, unbroken, grey, fine to medium grained micro granodiorite						8.97m: Bedding, 30°				PL(A) = 7.1
								9.25m: Joint, 30°				
		GRANODIORITE - very high strength, fresh stained, fractured to slightly fractured, grey mottled light white grey, medium to coarse						9.35m: Joint, 30mm highly weathered	C	88	69	
	9.79							9.79m: Joint, 0-30°				

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.25m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 8.85m, coring (NMLC) to 12.15m

WATER OBSERVATIONS: Groundwater observed at 8.15m on 4/7/2012

REMARKS: Piezo installed. Solid casing to 1.0m, screen to 12.0m. Gravel Backfill to 0.6m, bentonite to 1.3m, sand to 12.0m

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 17 AHD
EASTING: 755429
NORTHING: 5935845
DIP/AZIMUTH: 90°/--

BORE No: 15
PROJECT No: 78385
DATE: 27/6/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	10.15	grained granodiorite with some extremely low to very low strength, extremely to highly weathered seams						10m: CORE LOSS: 150mm	C	88	69	
		GRANODIORITE - extremely low to low strength, extremely to moderately weathered, fractured, brown mottled light brown, medium to coarse grained granodiorite with some high strength, slightly weathered seams						10.41m: Joint, 0-10°, 5mm highly weathered 10.61m: Joint, 30°, highly weathered 10.79m: Joint, 50°, smooth, planar, 3mm sand infill	C	100	0	PL(A) = 0.05
	11.73	GRANODIORITE - very high to extremely high strength, slightly weathered to freshly stained, slightly fractured, light grey to grey, medium to coarse grained granodiorite						10.98m: Joint, 0°, 20mm sand, extremely weathered 11.29m: Joint, 30°, smooth 11.71m: Joint, 0-20°, smooth 12.1m: Joint, 40°, smooth	C	100	72	PL(A) = 2.0 PL(A) = 10.0
	12.15	Bore discontinued at 12.15m Limit of investigation										

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.25m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 8.85m, coring (NMLC) to 12.15m

WATER OBSERVATIONS: Groundwater observed at 8.15m on 4/7/2012

REMARKS: Piezo installed. Solid casing to 1.0m, screen to 12.0m. Gravel Backfill to 0.6m, bentonite to 1.3m, sand to 12.0m

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 22 AHD
EASTING: 755409
NORTHING: 5935770
DIP/AZIMUTH: 90°/--

BORE No: 17
PROJECT No: 78385
DATE: 27/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		B - Bedding J - Joint S - Shear F - Fault	EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00					
22	0.3	TOPSOIL - dark grey brown, slightly sandy (fine to medium) clay with some silt, roots and rootlets, damp to moist							A			
	0.5	SAND - grey brown, slightly clayey, slightly silty, fine to coarse sand with some fine gravel (granodiorite), moist							A			
21	1	SANDY CLAY / CLAYEY SAND - light brown orange, fine to coarse sandy clay to clayey sand, damp - becoming stiff, clayey, fine to coarse sand with some silt below 1.0m							A S			4,6,9 N = 15
20	2	2.0 GRANODIORITE - extremely low to very low strength, extremely to highly weathered, light brown to brown granodiorite							S			25/140 refusal
19	3											
18	4								S			25/110 refusal
17	5	- becoming low strength, highly to moderately weathered below 4.75m										
16	6								S			25/60 refusal
	6.65	- with extremely low to very low strength, extremely to highly weathered seams below 6.3m										
15	7	GRANODIORITE - very high to extremely high strength, fresh, unbroken, mottled white grey and grey, medium to coarse grained granodiorite										PL(A) = 10.6
14	8								C	100	100	PL(A) = 9.0
13	9											
	9.65	Bore discontinued at 9.65m Limit of investigation										

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.3m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (water) to 6.65m, coring (NMLC) to 9.65m

WATER OBSERVATIONS: Groundwater observed at 5.6m on 4/7/2012

REMARKS: Piezo installed. Solid casing to 1.4m, screen to 9.65m. Gravel backfill to 0.6m, bentonite to 1.4m, sand to 9.65m

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 17 AHD
EASTING: 755457
NORTHING: 5935801
DIP/AZIMUTH: 90°/--

BORE No: 18
PROJECT No: 78385
DATE: 28/6/2012
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
17	0.2	TOPSOIL - dark brown grey clay with some silt, fine to medium sand, roots and rootlets, damp			A			
	0.5	SAND - brown, slightly clayey, fine to coarse sand with trace fine gravel and silt, moist			A U			
16	1.0	SANDY CLAY - light brown to grey brown, slightly sandy to sandy (fine to coarse) clay with trace fine gravel, damp			A S			18,25/110 refusal
		GRANODIORITE - extremely low strength, extremely weathered, light brown to brown granodiorite,						
15	2	- becoming very low strength, highly weathered below 2.5m			S			19,23,25/110 refusal
14	3			Unless otherwise stated, rock is fractured along rough, planar sub horizontal joints				
13	4				S			25/20 refusal
	4.15	- becoming low strength, highly to moderately weathered below 4.0m						
		GRANODIORITE - very low strength, highly weathered, fractured, brown and light brown, medium to coarse grained granodiorite with extremely low to very low strength, extremely to highly weathered seams		4.36m: Joint, 60°	C	96	0	PL(A) = 0.04
12	5			5m: Joint, 160mm fragmented, extremely weathered				
	5.22			5.16m: CORE LOSS: 60mm 5.31m: Joint, 30°	C	96	0	PL(A) = 0.05
11	6			5.66m: Joint, 30°, smooth	C	100	0	
	6.31			6.1m: Joint, 50mm fragmented, extremely weathered	C	60	0	
	6.59			6.15m: CORE LOSS: 160mm	C	68	0	
10	7			6.45m: Joint, 60mm fragmented, extremely weathered 6.51m: CORE LOSS: 80mm	C	100	0	PL(A) = 0.02
	7.45			6.68m: Joint, 30mm, extremely weathered	C	57	0	
	7.74			6.77m: Joint, 50mm, fragmented	C	77	0	
9	8			7.3m: CORE LOSS: 150mm 7.58m: Joint, 70mm fragmented, extremely weathered 7.66m: CORE LOSS: 80mm	C	94	0	PL(A) = 0.07
8	9			7.77m: Joint, 0°, highly weathered 7.97m: Joint, 80mm extremely to highly weathered	C	76	0	PL(A) = 0.06
	9.04			7.99m: CORE LOSS: 40mm	C	74	0	
	9.89			8.82m: Joint, 0-30°,				

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.25m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 4.15m, coring (NMLC) to 11.6m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 17 AHD
EASTING: 755457
NORTHING: 5935801
DIP/AZIMUTH: 90°/--

BORE No: 18
PROJECT No: 78385
DATE: 28/6/2012
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
6	11	- with high to very high strength, freshly stained to slightly weathered seams between 10.68m and 11.10m						rough, planar, 20mm fragmented 8.84m: CORE LOSS: 200mm 9.09m: Joint, 40°, smooth, ironstained 9.37m: Joint, 30° 9.59m: Joint, 0°, 20mm highly weathered 9.63m: CORE LOSS: 260mm 9.94m: Joint, 80mm fragmented 10.09m: Joint, 30° 10.23m: Joint, 30mm highly weathered 10.55m: Joint, 0°, 20mm extremely weathered 10.68m: Joint, 50° 11m: Joint, 0° ironstained 11.1m: Joint, 80°, smooth, ironstained 11.44m: Joint, 0°, 10mm extremely weathered 11.59m: Joint, 50°	C	74	0	PL(A) = 1.6
									C	100	63	
	11.6	Bore discontinued at 11.6m Limit of investigation										
5	12											
4	13											
3	14											
2	15											
1	16											
0	17											
-1	18											
-2	19											

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.25m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 4.15m, coring (NMLC) to 11.6m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 20.5 AHD
EASTING: 755433
NORTHING: 5935735
DIP/AZIMUTH: 90°/--

BORE No: 21
PROJECT No: 78385
DATE: 26/6/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
20	0.45	TOPSOIL - dark grey brown, slightly sandy, silty clay with some roots and rootlets, damp							A			
	0.6	SAND - dark brown grey, slightly silty, slightly clayey, fine to coarse sand with some fine gravel, moist							A			
	0.65	GRANODIORITE - very low to low strength, highly to moderately weathered, orange brown granodiorite							C			PL(A) = 10.0
19	1							1.06m: Joint, 10°, rough, planar, ironstained 1.25m: Joint, 0°, rough, planar, ironstained				
		GRANODIORITE - very high to extremely high strength, fresh stained becoming fresh, slightly fractured, mottled light grey white to dark grey, medium to coarse grained granodiorite							C	100	100	
18	2											PL(A) = 9.5
17	3								C	100	100	
	3.8	Bore discontinued at 3.8m Limit of investigation										
16	4											
	5											
15	6											
14	7											
13	8											
12	9											
11												

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 0.65m

TYPE OF BORING: SFA (TC bit) to 0.65m, coring (NMLC) to 3.80m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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_x	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 I Environment I Groundwater

BOREHOLE LOG

CLIENT: Health Infrastructure
PROJECT: Proposed South East Regional Hospital
LOCATION: 1614 Tathra Road, Bega

SURFACE LEVEL: 16.5 AHD
EASTING: 755472
NORTHING: 5935754
DIP/AZIMUTH: 90°/--

BORE No: 22
PROJECT No: 78385
DATE: 2/7/2012
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
16	0.35	TOPSOIL - dark brown clay with some silt, roots, rootlets and trace sand, damp							A			
	0.5	SILTY CLAYEY SAND - light brown silty, clayey, fine to coarse sand with some fine gravel, moist							A			
15	1.2	SANDY CLAY - light brown to grey brown, slightly sandy to sandy (fine to coarse) clay with some fine gravel, damp							U			
		GRANODIORITE - extremely low strength, extremely weathered, light brown to brown granodiorite with some very low strength, highly weathered and clayey sand seams							A			
14									S			8,23,25/90 refusal
13									S			19,25/90 refusal
12								Unless otherwise stated, rock is fractured along, rough, planar, ironstained, sub horizontal joints	S			25/120 refusal
11		- becoming low strength, highly to moderately weathered below 5.2m							S			25/20 refusal
	5.6	GRANODIORITE - very high strength, slightly weathered becoming fresh stained, slightly fractured, light grey and light brown grey, medium to coarse grained granodiorite with extremely low to low strength, extremely to moderately weathered seams						5.74m: Joint, 50° 5.87m: Joint, 30° 6m: Joint, 0 - 40°, 80mm extremely to highly weathered 6.31m: Joint, 60°	C	100	82	PL(A) = 3.3
10									C	100	85	PL(A) = 7.7
9		- extremely high strength, fresh stained, light grey mottled white grey granodiorite below 6.78m						6.7m: Joint, 10°, smooth 6.75m: Joint, 0-10°, 60mm extremely to highly weathered	C	100	100	PL(A) = 11.0
8									C	100	100	
	8.45	Bore discontinued at 8.45m Limit of investigation										

RIG: Scout 2 **DRILLER:** Simons **LOGGED:** BNG **CASING:** HW to 1.2m

TYPE OF BORING: SFA (TC bit) to 1.0m, rotary (mud) to 5.60m, coring (NMLC) to 8.45m

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

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_x	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 I Environment I Groundwater

Douglas Partners
Geotechnics | Environment | Groundwater

1/1 Luso Road
Unanderra NSW 2526

Phone: (02) 4271 1836
Fax: (02) 4271 1897

PERMEABILITY TEST REPORT

Client:	Health Infrastructure	*Project No:*	78385
Project:	Proposed South East Regional Hospital	*Date:*	28-Jul-12
Location:	1614 Tathra Road, Bega	*Tested by:*	BNG

Test Location — **Test No.** 1

Description: BH15 — *Easting:* 755429 *m*

Material type: various (see log) — *Northing* 5935845 *m*

Condition of ground surface before test: damp to moist — *Surface Level:* 17 *m AHD*

Weather during test: Fine

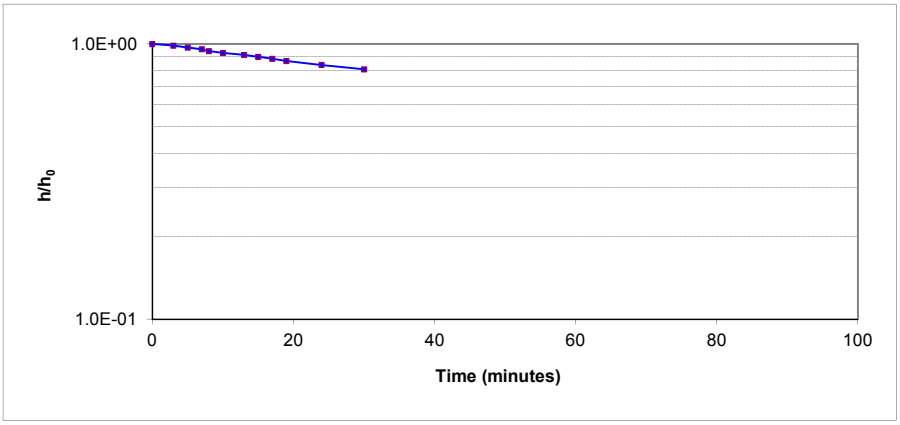
Details of Installation

Bore/Casing

Diameter of Well Casing:	0.05 *m*	Length of Well Screen:	10.7 *m*
Diameter of Well Screen:	0.1 *m*	Length of Gravel Interval:	10.7 *m*

Test Results

Elaspe Time (mins)	Depth to Water (m)	Change in Water Level (m)	h/h_0
Static	8.15		
0	11.55	3.4	1
3	11.50	3.35	0.99
5	11.45	3.3	0.97
7	11.40	3.25	0.96
8	11.35	3.2	0.94
10	11.30	3.15	0.93
13	11.25	3.1	0.91
15	11.20	3.05	0.90
17	11.15	3	0.88
19	11.10	2.95	0.87
24	11.00	2.85	0.84
30	10.90	2.75	0.81
		T_0 =	58.0



Hydraulic Conductivity - Over total duration of test

K = 9.38E-08 m/min where (L/R>8): $K = r^2/\ln(L_e/R)/2L_eT_0$

K = 5.63E-06 m/sec *ref. Horslev 1951*

Checked by:	BNG

Douglas Partners
Geotechnics / Environment / Groundwater

1/1 Luso Road
Unanderra NSW 2526

Phone: (02) 4271 1836
Fax: (02) 4271 1897

PERMEABILITY TEST REPORT

Client:	Health Infrastructure	*Project No:*	78385
Project:	Proposed South East Regional Hospital	*Date:*	28-Jul-12
Location:	1614 Tathra Road, Bega	*Tested by:*	BNG

Test Location — **Test No.** 1

Description: BH17 — *Easting:* 755409 *m*
Material type: various (see log) — *Northing* 5935770 *m*
Condition of ground surface before test: damp to moist — *Surface Level:* 22 *m AHD*
Weather during test: Fine

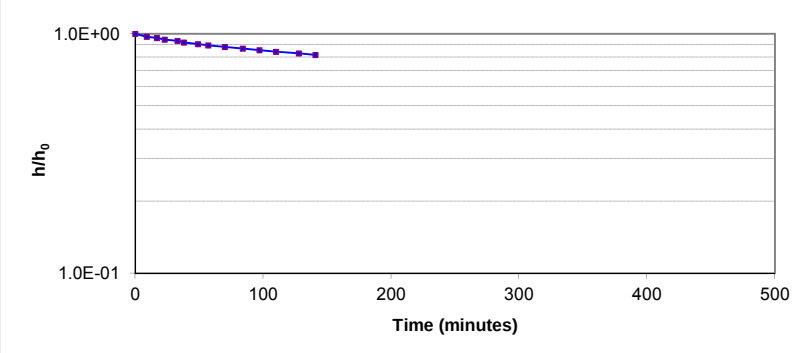
Details of Installation

Bore/Casing

Diameter of Well Casing:	0.05 *m*	Length of Well Screen:	8.25 *m*
Diameter of Well Screen:	0.1 *m*	Length of Gravel Interval:	8.25 *m*

Test Results

Elaspe Time (mins)	Depth to Water (m)	Change in Water Level (m)	h/h_0
Static	5.60		
0	9.40	3.8	1
9	9.30	3.7	0.97
17	9.25	3.65	0.96
23	9.20	3.6	0.95
33	9.15	3.55	0.93
38	9.10	3.5	0.92
49	9.05	3.45	0.91
57	9.00	3.4	0.89
70	8.95	3.35	0.88
84	8.90	3.3	0.87
97	8.85	3.25	0.86
110	8.80	3.2	0.84
128	8.75	3.15	0.83
141	8.70	3.1	0.82
		T_0 =	289.8

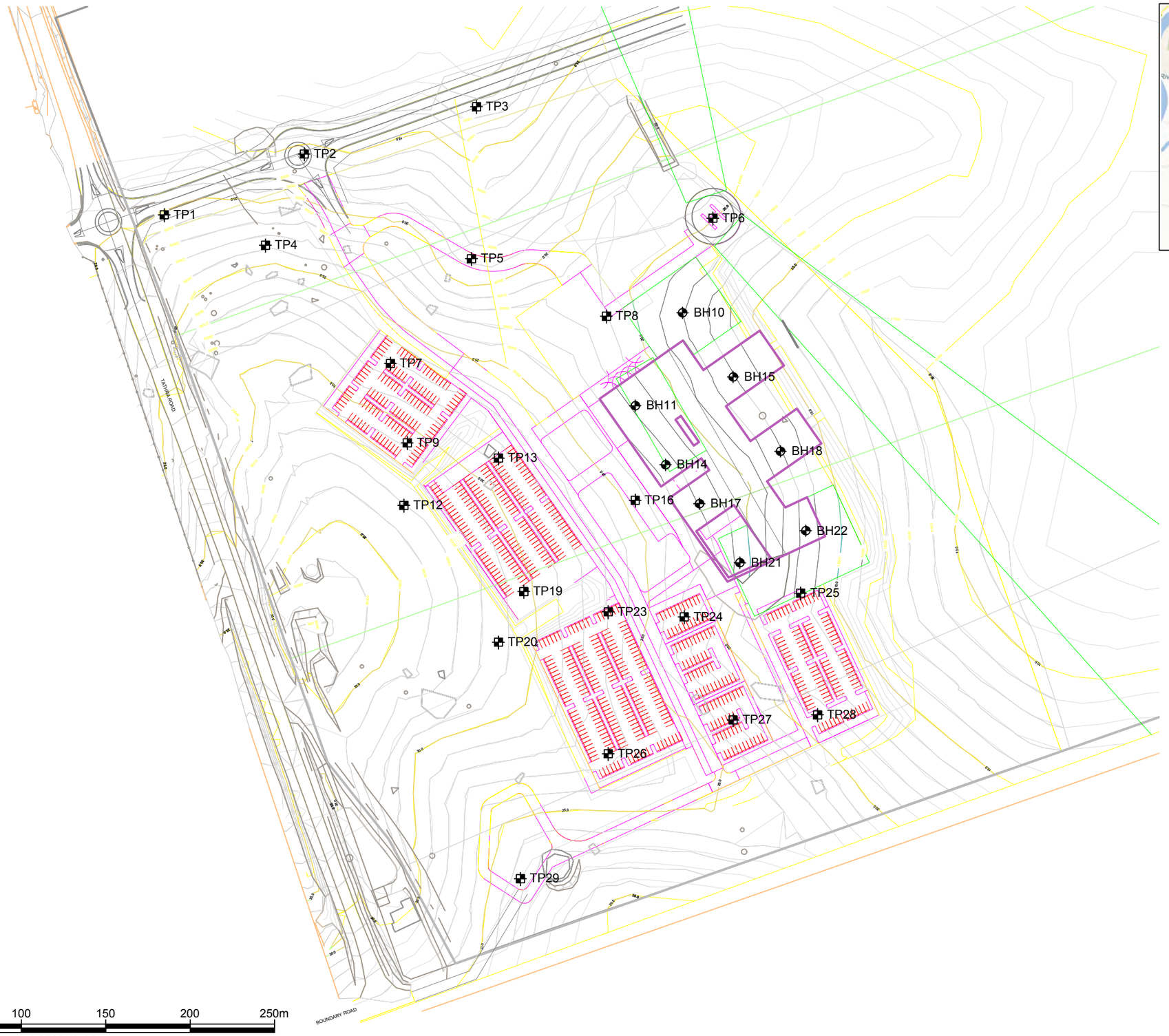


Hydraulic Conductivity - Over total duration of test

K = 2.56E-08 m/min where (L/R>8): $K = r^2/\ln(L_e/R)/2L_eT_0$

K = 1.54E-06 m/sec *ref. Horslev 1951*

Checked by:	BNG



Locality Plan

0 10 20 30 40 60 80 100 150 200 250m

1:2500 @ A3

NOTE: Base drawing from BVN Architecture (Drawing: Masterplan SK_101)

LEGEND

- Test Pit Location
- Borehole Location
- Proposed Hospital

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Health Infrastructure		TITLE: **Test Locations**	PROJECT No: 78385
OFFICE: Wollongong	DRAWN BY: BNG	**Proposed South East Regional Hospital**	DRAWING No: 1
SCALE: 1:2500 @ A3	DATE: 5/07/12	**1614 Tathra Road, Bega**	REVISION: A

MGA

Photo 1 – View south overlooking old stone quarry near TP2

Photo 2 – View north in between TP7 and TP4

Douglas Partners Geotechnics / Environment / Groundwater	Project No 78385	Site Photographs
	Date: July 2012	Proposed South East Regional Hospital, 1614 Tathra Road, Bega Client: Health Infrastructure

Photo 3 – View south. Drilling rig at BH15

Photo 4 – View east near BH21

Douglas Partners Geotechnics / Environment / Groundwater	Project No 78385	Site Photographs
	Date: July 2012	Proposed South East Regional Hospital, 1614 Tathra Road, Bega Client: Health Infrastructure

Appendix B

Results of Laboratory Testing

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of Shrink-Swell Index Determination

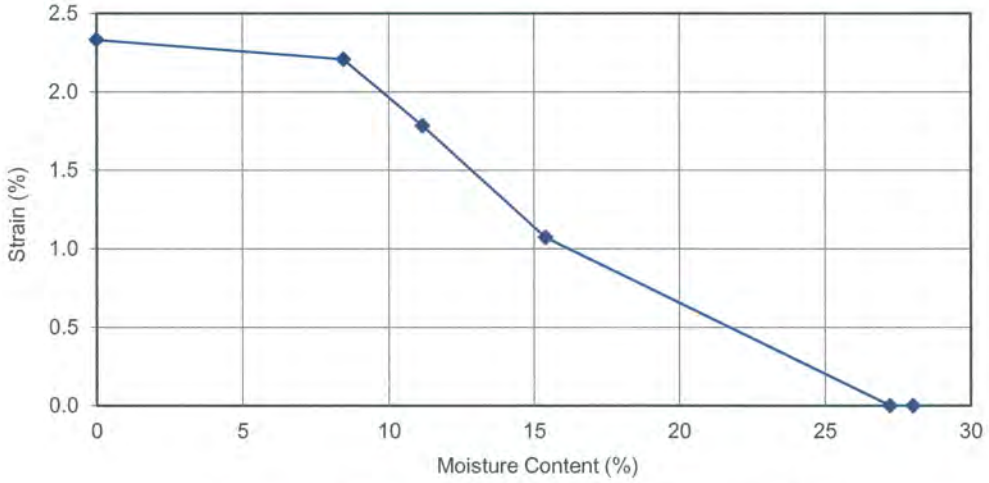
Client :	Health Infrastructure	**Project No. :**	78385.00
		Report No. :	UL12-102H
Project :	Proposed South East Regional Hospital	**Report Date :**	11/07/2012
		Date Sampled :	25/06/2012
Location :	1614 Tathra Road, Bega	**Date of Test:**	3/07/2012
Test Location :	BH18		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	2.2 %
Shrinkage - oven dried	2.3 %
Significant inert inclusions	3.0 %
Extent of cracking	UC
Extent of soil crumbling	0.0 %
Moisture content of core	27.2 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	210 kPa
Pocket penetrometer reading at final moisture content	190 kPa
Initial Moisture Content	26.8 %
Final Moisture Content	28.0 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 1.3% per Δ pF

Description: Brown sandy clay

Test Method(s): AS 1289.7.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled by Wollongong Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks: -

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested:	AM
Checked:	DE

Dave Evans
Laboratory Manager

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of Shrink-Swell Index Determination

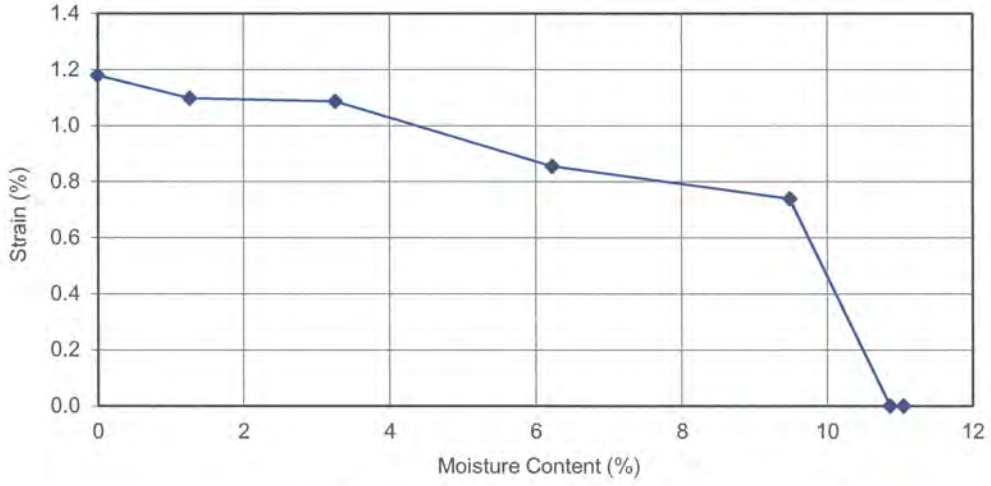
Client :	Health Infrastructure	**Project No. :**	78385.00
		Report No. :	UL12-108
Project :	Proposed South East Regional Hospital	**Report Date :**	17/07/2012
		Date Sampled :	3/07/2012
Location :	Bega	**Date of Test:**	9/07/2012
Test Location :	BH14		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	1.1 %
Shrinkage - oven dried	1.2 %
Significant inert inclusions	3.0 %
Extent of cracking	SC
Extent of soil crumbling	3.0 %
Moisture content of core	10.9 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	50 kPa
Pocket penetrometer reading at final moisture content	130 kPa
Initial Moisture Content	11.6 %
Final Moisture Content	11.0 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 0.7% per Δ pF

Description: Light brown clayey sand

Test Method(s): AS 1289.7.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled by Wollongong Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks: -

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested:	AM
Checked:	DE

Dave Evans
Laboratory Manager

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Results of Moisture Content, Plasticity and Linear Shrinkage Tests

Client: Health Infrastructure

Project: Proposed South East Regional Hospital

Location: 1614 Tathra Road, Bega

Project No: 78385.00
Report No: UL12-102G
Report Date: 11/07/2012

Date Sampled: 25/06/2012
Date of Test: 06/07/2012
Page: 1 of 1

Test Location	Depth (m)	Description	Code	W_F %	W_L %	W_P %	PI %	*LS %
TP5	0.9 – 1.0	Orange grey sandy clay	2,3,5	15.6	39	17	22	10.5
TP8	0.5 – 0.6	Yellow orange clay	2,3,5	25.8	77	26	51	19.0
TP25	1.4 – 1.5	Orange grey clay	2,3,5	32.3	66	31	35	15.0
BH17	1.0	Brown sandy clay	2,3,5	18.2	39	21	18	10.0

Legend:
W_F Field Moisture Content
W_L Liquid limit
W_P Plastic limit
PI Plasticity index
LS Linear shrinkage from liquid limit condition (Mould length125mm)

Test Methods:
Moisture Content: AS 1289 2.1.1
Liquid Limit: AS 1289 3.1.2
Plastic Limit: AS 1289 3.2.1
Plasticity Index: AS 1289 3.3.1
Linear Shrinkage: AS 1289 3.4.1

Code:
Sample history for plasticity tests
1. Air dried
2. Low temperature (<50°C) oven dried
3. Oven (105°C) dried
4. Unknown

Method of preparation for plasticity tests
5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

Sampling Methods: Sampled By Wollongong Engineering Department

Remarks: -

NATA Accredited Laboratory Number: 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025
ACCREDITED FOR TECHNICAL COMPETENCE

Tested: AM
Checked: DE

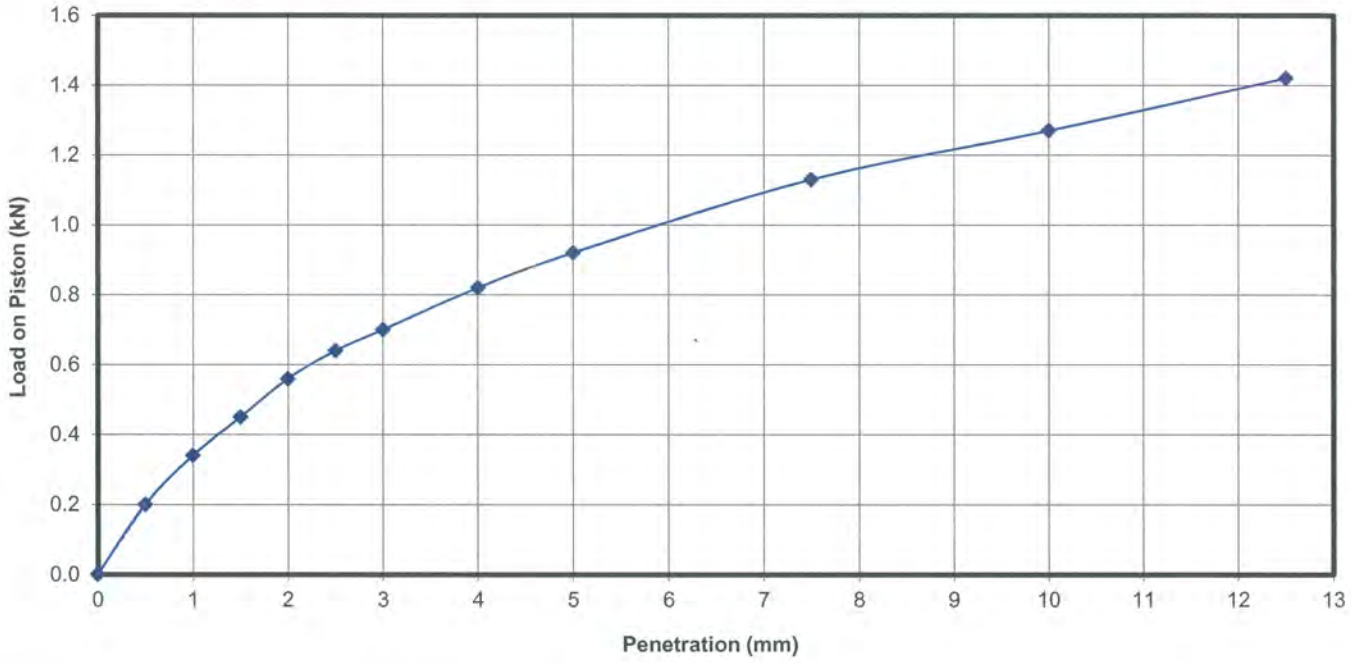
Dave Evans
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of California Bearing Ratio Test

Client :	Health Infrastructure	**Project No. :**	78385
		Report No. :	UL12-102F
Project :	Proposed South East Regional Hospital	**Report Date :**	11/07/2012
		Date Sampled :	25/06/2012
Location :	1614 Tathra Road, Bega	**Date of Test:**	9/07/2012
Test Location :	TP28		
Depth / Layer :	0.5 - 0.6m	**Page:**	1 of 1



Description: Brown silty clay

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled By Wollongong Engineering Department **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.9%
MOISTURE RATIO: 100% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		21.6	1.62
After soaking		23.5	1.61
After test	Top 30mm of sample	23.7	-
	Remainder of sample	22.0	-
Field values		24.6	-
Standard Compaction		21.5	1.62

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**5.0**
	5.0 mm	**4.5**

NATA Accredited Laboratory Number: 828

This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested:	MS
Checked:	DE

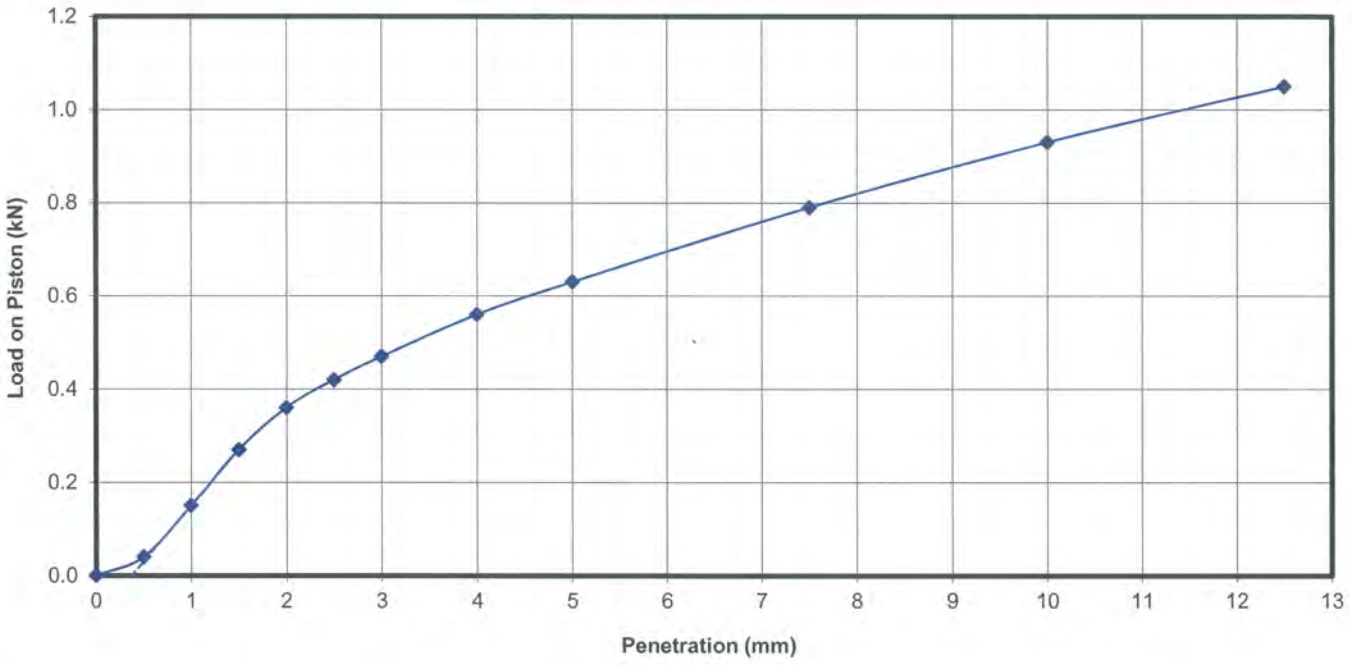
David Evans
Laboratory Manager

Douglas Partners
Geotechnics | Environment | Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of California Bearing Ratio Test

Client :	Health Infrastructure	**Project No. :**	78385
		Report No. :	UL12-102E
Project :	Proposed South East Regional Hospital	**Report Date :**	11/07/2012
		Date Sampled :	25/06/2012
Location :	1614 Tathra Road, Bega	**Date of Test:**	9/07/2012
Test Location :	TP23		
Depth / Layer :	0.6 - 0.7m	**Page:**	1 of 1



Description: Brown silty clay

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled By Wollongong Engineering Department **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 1.6%
MOISTURE RATIO: 101% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		22.8	1.57
After soaking		25.7	1.54
After test	Top 30mm of sample	26.9	-
	Remainder of sample	25.4	-
Field values		27.0	-
Standard Compaction		22.6	1.57

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**3.5**
	5.0 mm	**3.5**

NATA Accredited Laboratory Number: 828

This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested:	MS
Checked:	DE

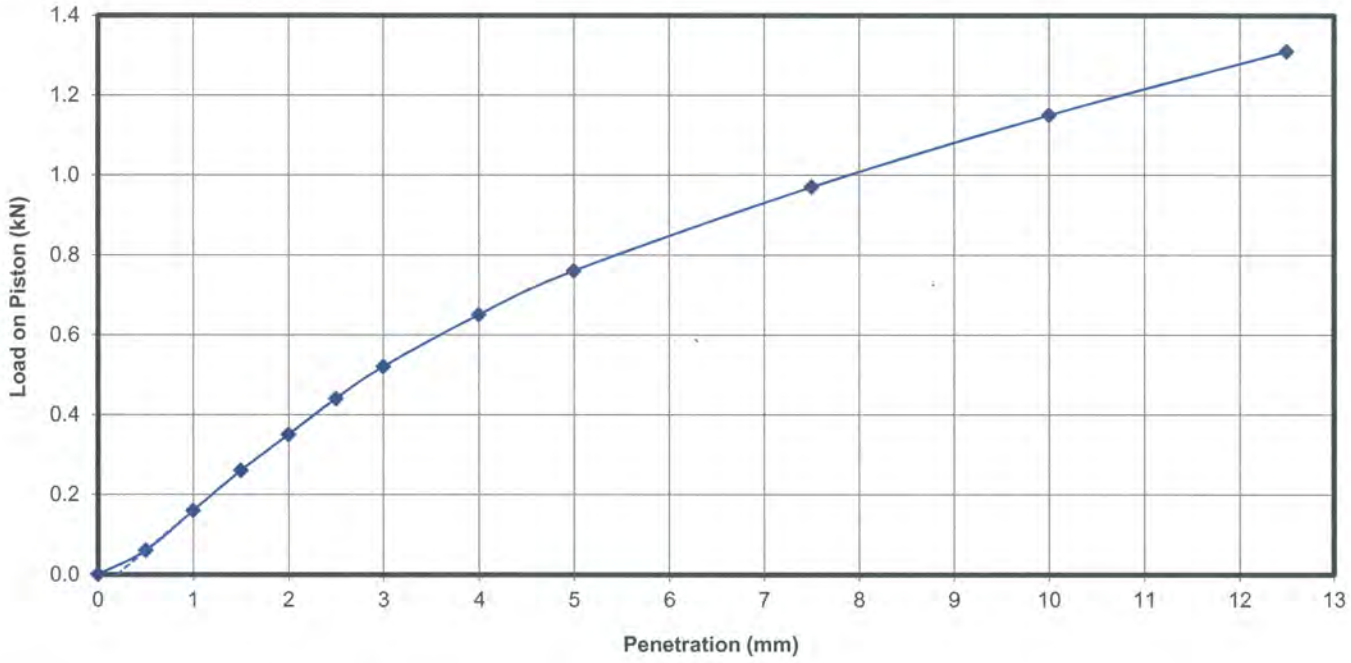
David Evans
Laboratory Manager

Douglas Partners
Geotechnics I Environment I Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of California Bearing Ratio Test

Client :	Health Infrastructure	**Project No. :**	78385
		Report No. :	UL12-102D
Project :	Proposed South East Regional Hospital	**Report Date :**	11/07/2012
		Date Sampled :	25/06/2012
Location :	1614 Tathra Road, Bega	**Date of Test:**	9/07/2012
Test Location :	TP7		
Depth / Layer :	0.5 - 0.6m	**Page:**	1 of 1



Description: Brown silty clay

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled By Wollongong Engineering Department **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 1.4%
MOISTURE RATIO: 98% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		19.3	1.68
After soaking		21.7	1.66
After test	Top 30mm of sample	23.5	-
	Remainder of sample	20.8	-
Field values		21.7	-
Standard Compaction		19.8	1.68

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**3.5**
	5.0 mm	**4.0**

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number: 828

This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested:	MS
Checked:	DE

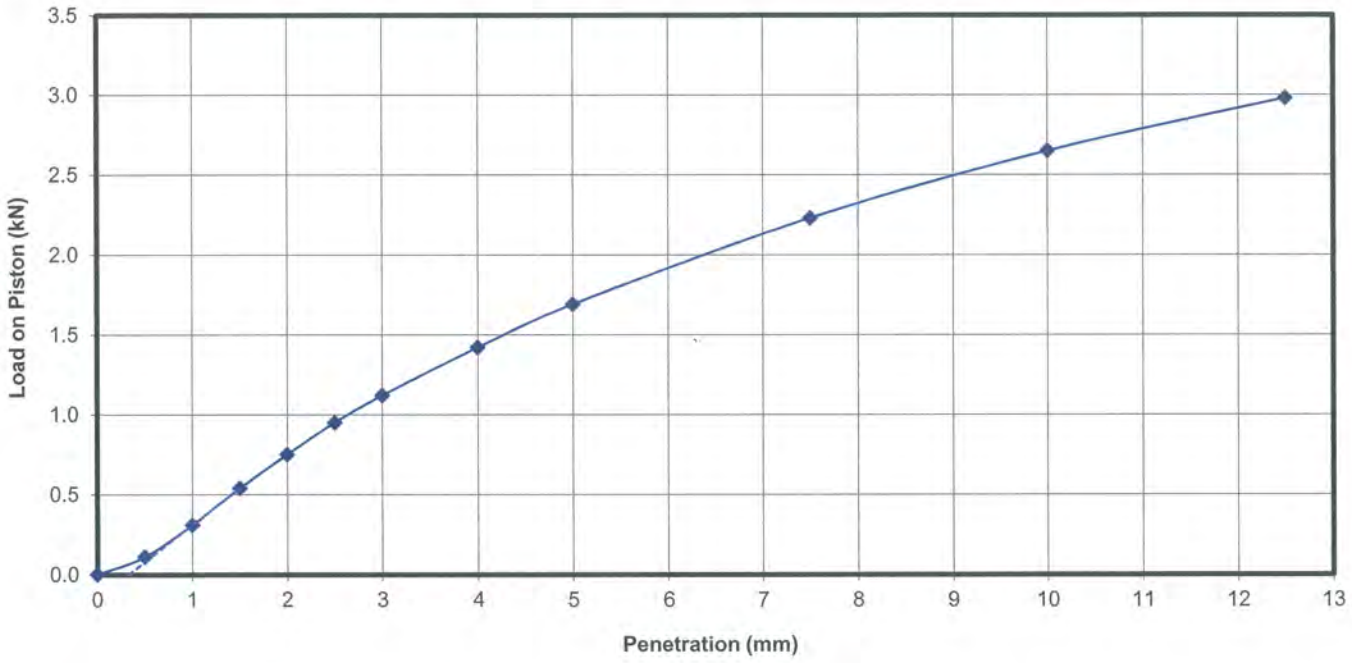
David Evans
Laboratory Manager

Douglas Partners
Geotechnics / Environment / Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of California Bearing Ratio Test

Client :	Health Infrastructure	**Project No. :**	78385
		Report No. :	UL12-102C
Project :	Proposed South East Regional Hospital	**Report Date :**	11/07/2012
		Date Sampled :	25/06/2012
Location :	1614 Tathra Road, Bega	**Date of Test:**	9/07/2012
Test Location :	TP6		
Depth / Layer :	0.5 - 0.6m	**Page:**	1 of 1



Description: Brown sandy clay

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled By Wollongong Engineering Department **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.3%
MOISTURE RATIO: 101% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		18.6	1.73
After soaking		20.3	1.72
After test	Top 30mm of sample	19.8	-
	Remainder of sample	18.9	-
Field values		21.3	-
Standard Compaction		18.5	1.73

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**8**
	5.0 mm	**9**

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number: 828

This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested:	MS
Checked:	DE

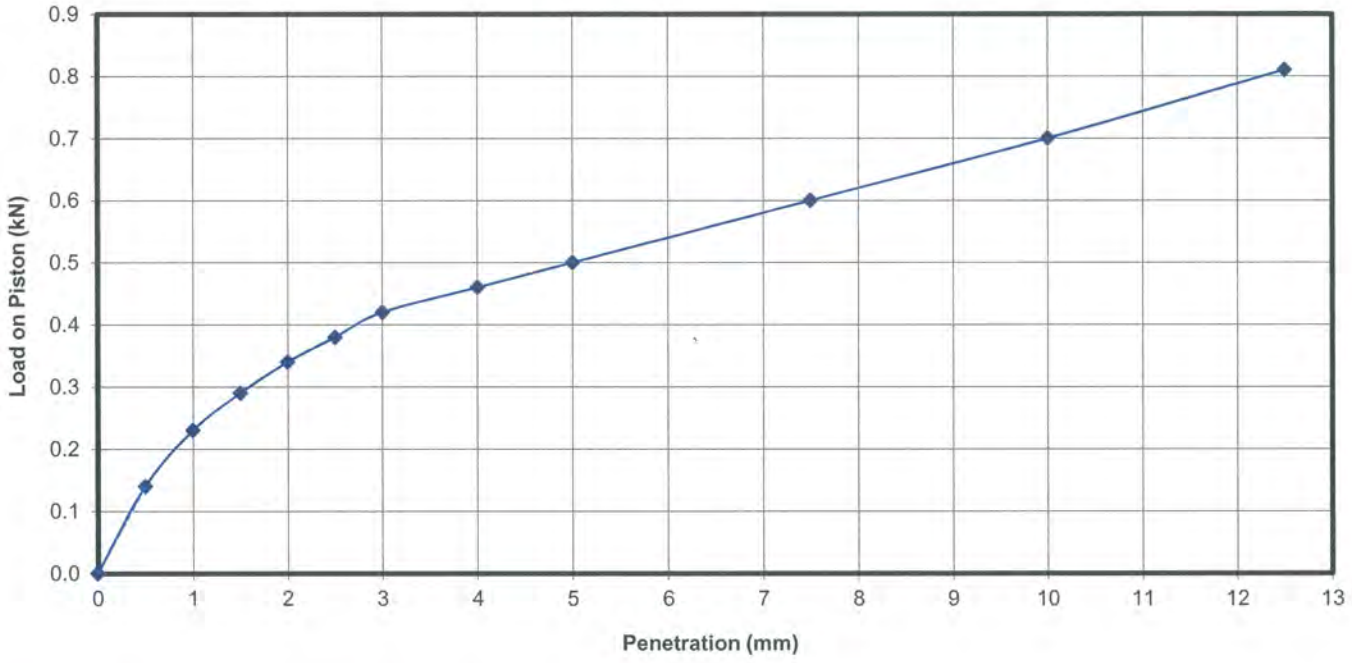
David Evans
Laboratory Manager

Douglas Partners
Geotechnics I Environment I Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of California Bearing Ratio Test

Client :	Health Infrastructure	**Project No. :**	78385
		Report No. :	UL12-102B
Project :	Proposed South East Regional Hospital	**Report Date :**	11/07/2012
		Date Sampled :	25/06/2012
Location :	1614 Tathra Road, Bega	**Date of Test:**	9/07/2012
Test Location :	TP3		
Depth / Layer :	0.6 - 0.7m	**Page:**	1 of 1



Description: Grey orange clay

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled By Wollongong Engineering Department

Percentage > 19mm: 0.0%

LEVEL OF COMPACTION: 100% of STD MDD
MOISTURE RATIO: 99% of STD OMC
SURCHARGE: 4.5 kg
SOAKING PERIOD: 4 days
SWELL: 1.9%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		26.4	1.54
After soaking		31.6	1.51
After test	Top 30mm of sample	31.1	-
	Remainder of sample	27.4	-
Field values		29.5	-
Standard Compaction		26.6	1.53

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**3.0**
	5.0 mm	**2.5**

NATA Accredited Laboratory Number: 828

This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested:	MS
Checked:	DE

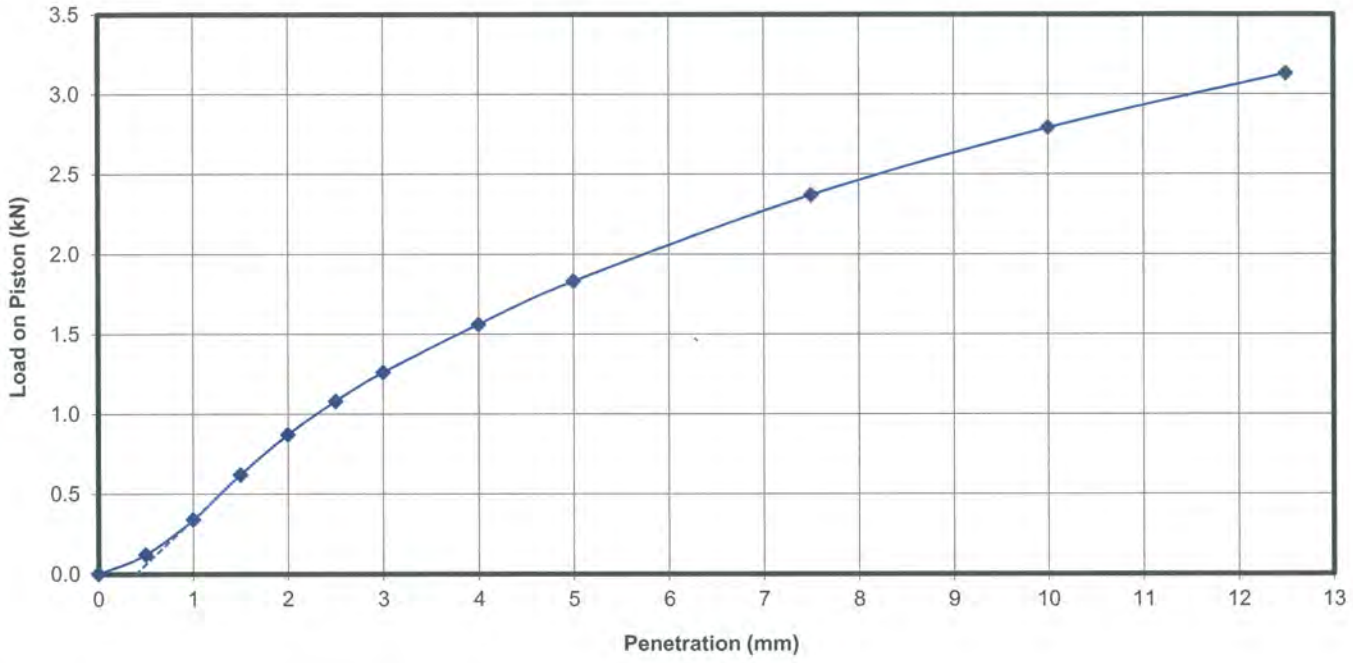
David Evans
Laboratory Manager

Douglas Partners
Geotechnics I Environment I Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
Unit 1, 1 Luso Drive
PO Box 486
Unanderra NSW 2526
Phone (02) 4271 1836
Fax (02) 4271 1897

Result of California Bearing Ratio Test

Client :	Health Infrastructure	**Project No. :**	78385
		Report No. :	UL12-102A
Project :	Proposed South East Regional Hospital	**Report Date :**	11/07/2012
		Date Sampled :	25/06/2012
Location :	1614 Tathra Road, Bega	**Date of Test:**	9/07/2012
Test Location :	TP1		
Depth / Layer :	0.5 - 0.6m	**Page:**	1 of 1



Description: Brown sandy clay

Test Method(s): AS 1289.6.1.1, AS 1289.2.1.1

Sampling Method(s): Sampled By Wollongong Engineering Department **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.8%
MOISTURE RATIO: 99% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		17.2	1.75
After soaking		19.3	1.74
After test	Top 30mm of sample	20.6	-
	Remainder of sample	18.8	-
Field values		18.1	-
Standard Compaction		17.4	1.75

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**9**
	5.0 mm	**10**

NATA Accredited Laboratory Number: 828

This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Tested:	MS
Checked:	DE

David Evans
Laboratory Manager

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 75705

Client:
Douglas Partners Unanderra
Unit 1, 1 Luso Drive
Unanderra
NSW 2526

Attention: Konrad Schultz

Sample log in details:

Your Reference:	**78385.00, Proposed SE Regional Hospital**
No. of samples:	4 Soils
Date samples received / completed instructions received	05/07/2012 / 05/07/2012

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

Report Details:

Date results requested by: / Issue Date:	11/07/12 / 11/07/12
Date of Preliminary Report:	Not issued

NATA accreditation number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. **Tests not covered by NATA are denoted with *.**

Results Approved By:

Nick Sarlamis
Inorganics Supervisor

Miscellaneous Inorg - soil					
Our Reference:	UNITS	75705-1	75705-2	75705-3	75705-4
Your Reference	----------	TP2	TP4	BH17	BH15
Depth	----------	0.5-0.6	1.6-1.7	1.0-1.45	2.5-2.62
Date Sampled		27/06/2012	27/06/2012	28/06/2012	28/06/2012
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	10/07/2012	10/07/2012	10/07/2012	10/07/2012
Date analysed	-	10/07/2012	10/07/2012	10/07/2012	10/07/2012
pH 1:5 soil:water	pH Units	6.1	6.5	5.5	6.2
Chloride, Cl 1:5 soil:water	mg/kg	7	3	49	60
Sulphate, SO4 1:5 soil:water	mg/kg	39	14	71	6

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA 21st ED, 4500-H+.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 21st ED, 4110 -B.

QUALITY CONTROL Miscellaneous Inorg - soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base ll Duplicate ll %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			10/07/2012	75705-1	10/07/2012 || 10/07/2012	LCS-1	10/07/2012
Date analysed	-			10/07/2012	75705-1	10/07/2012 || 10/07/2012	LCS-1	10/07/2012
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	75705-1	6.1 || 6.1 || RPD: 0	LCS-1	100%
Chloride, Cl 1:5 soil:water	mg/kg	2	Inorg-081	<2	75705-1	7 || 6 || RPD: 15	LCS-1	110%
Sulphate, SO4 1:5 soil:water	mg/kg	2	Inorg-081	<2	75705-1	39 || 43 || RPD: 10	LCS-1	99%

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

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.

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 batched of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes and LCS: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

Douglas Partners
Geotechnics | Environment | Groundwater

RESULTS OF ACID SULFATE SCREENING TESTS

Client: Health Infrastructure

Project: Proposed South East Regional Hospital

Project Location: 1614 Tathra Road, Bega

Project No: 78385

pH Meter: ☐ TPS with Ionode IJ46/WP80 pH/Temp. Electrode
☑ PH Scan 2

Calibration Buffer: ☑ pH4
☑ pH7
☑ pH10

Sample Location	Depth (m)	pH_F (in distilled water)	pH_{FOX} (oxidised in H_sO_s)			Strength of Reaction	Soil Description
		Date: 3/7/12	Date: 3/7/12	Date:	Date:	(1,2,3,4)*	
		Time: 11:22am	Time: 11:45am	Time:	Time:	F **	
TP3	1.0 – 1.1	5.6	6.3			1	Clay
TP4	1.0 – 1.1	6.0	6.5			1	Sandy clay
TP6	0.9 – 1.0	6.5	6.7			1	Clayey sand/Sandy clay
TP7	0.9 – 1.0	6.1	5.5			1	Clayey gravelly sand
TP12	0.5 – 0.6	6.3	5.9			1	Clayey gravelly sand
TP16	0.4 – 0.5	6.4	5.5			1	Sand
TP20	0.9 – 1.0	5.4	5.0			1	Clay
TP25	1.8 – 1.9	6.2	5.8			1	Clayey sand/Sandy clay
TP27	0.9 – 1.0	6.2	5.6			1	Clayey sand
TP29	1.9 – 2.0	5.9	5.5			1	Clayey sand

Legend: * *1 denotes no or slight effervescence*
2 denotes moderate effervescence
3 denotes vigorous effervescence
4 denotes "volcano" ie. very vigorous effervescence, gas evolution and heat
** F after reaction number indicates a bubbling/frothy reaction (organics)

Operator: BNG

Date: 3 July 12