Broken Hill Hospital Redevelopment

Results of Geotechnical Investigation

PSM4951-004R REV1 6 October 2023

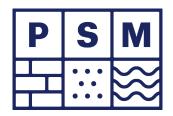


Table of Contents

1.	Intro	duction	4
2.	Supp	lied Documents	4
3.	Prop	osed Development	4
4.	Geot	echnical Investigation – February 2023	4
	4.1	Fieldwork	4
	4.2	Groundwater Monitoring Wells	5
	4.3	Laboratory testing	5
5.	Site	Conditions	9
	5.1	Geological Setting	9
	5.2	Surface Conditions	9
	5.3	Subsurface Conditions	10
	5.4	Groundwater	12
6.	Salin	ity and Aggressivity Assessment	13
	6.1	Soil Chemistry	
	6.2	Salinity Assessment	13
	1.1	Corrosivity / Aggressivity	13
7.	Geot	echnical Design Advice	14
	7.1	General	14
	7.2	Site preparation	14
	7.3	Site Classification	15
	7.4	Foundations	15
		7.4.1 Shallow Foundation	15
		7.4.2 Piles	
	7.5	Excavation	17
	7.6	Vibrations	
	7.7	Articulation	17
	1.2	Permanent and Temporary Batters	17
	1.3	Excavation and retention advice	
	7.8	Slabs	
	7.9	Earthquake Site Classification	
	7.10	Mine Subsidence	19
	7.11	Site Suitability for Stormwater Infiltration Systems	19
8.	Gene	eral	20



List of Tables

Table 1 – Summary of Salinity and Aggressivity Test results	8
Table 2 – Summary of inferred geotechnical units encountered in boreholes	11
Table 3 – Depth to top of inferred geotechnical units	12
Table 4 – Summary of groundwater observations	12
Table 5 – Salinity Classification	13
Table 7 - Batter Slope Angles	18

List of Figures

5)
5)
5)
5)
5)

List of Insets

Inset 1:	Broken Hill Geological Map (site location marked in red)	9
Inset 2:	Aerial image showing surface condition in proposed areas (outlined in red) for development	10

List of Appendices

- Appendix A Engineering Borehole Logs
- Appendix B Point Load Index Test Results
- Appendix C Piezometer Construction Records
- Appendix D CBR Test Results



1. Introduction

This report presents the results of a geotechnical investigation undertaken for the proposed development at Broken Hill Hospital, located at 176 Thomas Street, Broken Hill NSW (the Site). The purpose of the investigation was to understand the ground conditions within the areas proposed for development and provide geotechnical advice to assist the designers of the new proposed development.

PSM has previously provided a desktop geotechnical study of the Site, PSM4951-003L, dated 21 December 2022.

2. Supplied Documents

To assist us in the investigation, PSM were provided with the following documents:

- Broken Hill Acute Adult Mental Health Unit and Emergency Department Concept Design Options by STH (dated 12 December 2022)
- Broken Hill Acute Adult Mental Health Unit and Emergency Department Road Relocation Option by STH (dated 25 January 2023)
- Broken Hill Acute Adult Mental Health Unit and Emergency Department 'Stage 1' and 'Stage 2' REF Submission by STH (dated 18 August 2023)
- Detail Survey by Monteath & Powys (ref. 22/0418 REV3, dated 9 December 2022)

3. Proposed Development

Based on the documents above, PSM understands the following regarding the Site and proposed development:

- A new mental health unit (MHU), with an area of approximately 1000 m², will be developed across the existing hospital carpark.
- A new emergency department (ED), with an area of approximately 700 m², will be developed across the existing ambulance bay. The building will be connected to the existing imaging department.
- The MHU and ED will be single storey building, constructed at grade.
- New pavement areas will be developed to provide vehicle access and parking near the new MHU
- Existing services on site include underground drainage lines, gas, water, and sewer mains, and electric and telecommunications cables.

4. Geotechnical Investigation – February 2023

4.1 Fieldwork

The geotechnical investigation was completed over the course of five (5) days of fieldwork, from the 1st to 5th of February 2023. The works was undertaken under the fulltime supervision of a PSM Geotechnical Engineer, who undertook the following:

- Directing borehole drilling and piezometer installation
- Preparing field logs of material encountered in boreholes
- Collecting soil samples for laboratory testing.
- Conducting and directing field tests, including Standard Penetrometer Tests (SPTs) and Point Load Index tests
- Measuring water levels in the piezometers installed
- Reinstating pavements following the completion of boreholes

The works were also undertaken under the fulltime supervision of Rob Sharp and Andrew James of JBS&G.

Over the course of the fieldwork, five (5) boreholes were drilled to a depth of 12 m, using a track-mounted drill rig, and two (2) shallow test pits were dug using hand tools. Cores of bedrock were retrieved from the five boreholes using diamond coring techniques, and point load index testing was undertaken on the recovered rock cores at



approximately 1 m intervals. Appendix A presents the geotechnical borehole logs and core photographs. The depth of the holes was nominated by the Client.

Appendix B presents the results of the point load index tests.

Figure 1 presents a locality plan showing the locations of the boreholes and test pits. Figures 2 to 6 present a selection of photographs taken during fieldwork.

4.2 Groundwater Monitoring Wells

A standpipe piezometer was installed in BH01, BH03 and BH05 to allow ongoing monitoring of groundwater levels. The piezometers were developed by pumping water out and letting the water level recover.

Appendix C presents the piezometer construction records.

4.3 Laboratory testing

4.3.1 Geotechnical Testing

Three (3) bulk soil samples were recovered and sent to a geotechnical laboratory for the following testing:

- Three (3) California Bearing Ratio (CBR) tests were undertaken on 4 day soaked samples compacted to 98% SMDD at OMC with a 4.5 kg surcharge
- Three (3) Particle Size Distribution (PSD) tests
- Three (3) Atterberg Limit Tests

Tables 1, 2 and 3 present the laboratory test results. The laboratory reports for CBR, Atterberg Limits and PSD tests are included in Appendix D, E and F, respectively.



Table 1 - Summary of CBR Test results

Sample ID (Depth)	Material Description	Soaked CBR [%]	омс [%]	Standard Maximum Dry Density [t/m³]	Swell [%]
TP01 (0 – 0. 5 m)	Clayey Gravelly SAND	17 ^[1]	10.1	2.086	0.0
TP02 (0 – 0. 5 m)	Silty Sandy CLAY, trace Gravel	13 ^[2]	15.5	1.830	0.2
BH03 (0.2 – 0.7 m)	Silty SAND with Gravel	35 ^[2]	8.1	2.155	0.1

¹ At a penetration of 5.0 mm

² At a penetration of 2.5 mm

Table 2 - Summary of Atterberg Limit Test results

Sample ID (Depth)	Material Description	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
TP01 (0 – 0. 5 m)	Clayey Gravelly SAND	31	13	18
TP02 (0 – 0. 5 m)	Silty Sandy CLAY, trace Gravel	42	14	28
BH03 (0.2 – 0.7 m)	Silty SAND with Gravel	-	-	(Non-Plastic)

Table 3 - Summary of Particle Size Distribution Test Results

Sample ID (Depth)	% Passing 9.5 mm Sieve	% Passing 4.75 mm Sieve	% Passing 1.18 mm Sieve	% Passing 600 μm Sieve	% Passing 212 µm Sieve	% Passing 75 µm Sieve
TP01 (0 – 0. 5 m)	90	79	60	52	38	26
TP02 (0 – 0. 5 m)	96	93	82	76	60	46
BH03 (0.2 – 0.7 m)	91	86	71	65	49	33

4.3.2 Soil Chemistry Testing

Three (3) soil samples were recovered and sent to a NATA accredited analytical laboratory for the following testing:

- Cation Exchange Capacity (CEC) of calcium, magnesium, potassium and sodium
- Exchange sodium percentage
- Salinity (EC 1:5, one part soil to five parts water)
- Soil pH
- Chlorides

- Sulphates.
- Resistivity

Table 4 presents a summary of the results of the analytical soil testing undertaken. Laboratory test reports are included in Appendix D.



Table 4 – Summary of Salinity and Aggressivity Test results

Sample ID	Exchangeable Cations [meq/100g]			Exchange		Electrical	Sulfate	Chloride	Resistivity	Moisture		
(Depth)	Ca	Mg	к	Na	CEC	Sodium [%]	рН	Conductivity [µS/cm]	[mg/kg]	[mg/kg]	[ohm cm]	Content [%]
BH01 (0.3 – 0.5 m)	5.1	4.0	1.0	5.2	15.2	34.3	8.9	1190	1080	1240	840	11.9
BH03 (0.3 – 0.6 m)	2.1	0.9	0.2	0.7	4.0	17.6	9.1	434	330	260	2300	8.8
ED-B4 ¹ (0.3 – 0.5 m)	3.9	0.9	0.2	<0.2	5.0	<0.2	9.1	137	60	50	7300	7.5

³ ED-B4 is a JBS&G hand augered hole in the ED area

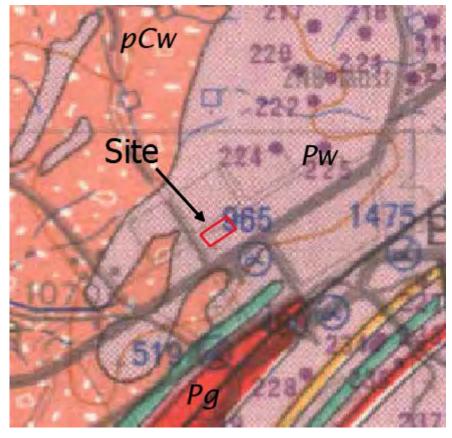


5. Site Conditions

5.1 Geological Setting

The Broken Hill 1:250,000 Geological Map (1970), shown in Inset 1, indicates that the site is underlain by:

• The Willyama Complex (*P_w*), which consists of sillimanite gneiss, and alusite-, chiastolite-, mica-, schist, phyllite, quartzite, sandstone, slate



Inset 1: Broken Hill Geological Map (site location marked in red)

5.2 Surface Conditions

The surface in the proposed area (refer Inset 2) for development of the MHU and ED consists of a combination of:

- Asphalt pavement (carpark, hospital internal road, ambulance bay)
- Concrete hardstand areas
- Landscaped areas with bushes and trees
- Existing hospital buildings
- Services (fire hydrant, light poles etc.)

Inset 2 is an aerial photograph showing the current conditions.







5.3 Subsurface Conditions

The subsurface conditions encountered across the site were generally consistent with our desktop study, comprising shallow FILL overlying NATURAL SOIL, overlying BEDROCK. Table 5 presents a summary of the material encountered. Table 6 presents the depth to the top of inferred geotechnical units at each borehole location.



Table 5 – Summary of inferred geotechnical units encountered in boreholes

Unit Name	Approximate Depth to the Top of Unit (m)	Description
PAVEMENT	0.0	Sealed pavement; 60 mm thick Subbase; Sandy GRAVEL; pale grey-brown, angular to sub-angular gravel, well graded, up to 30 mm; fine to coarse grained sand; moist; very dense
FILL	0.16 – 0.2	Gravelly SAND; grey/brown, fine to coarse grained, well graded; angular to subangular gravel, up to 60 mm; moist, medium dense to dense Silty SAND with clay: brown-red, fine to medium grained; medium plasticity clay; moist; dense
NATURAL SOIL	0.3 – 0.5	Gravelly CLAY with sand; red, medium plasticity, stiff to very stiff; angular to subangular gravel, up to 30 mm; fine to coarse grained sand; moist
BEDROCK A (VERY LOW AND LOW STRENGTH)	0.4 - 1.4	GNEISS; pale grey/grey/dark gey/brown/pale brown/pale orange, medium to coarse grained, layered, extremely to highly weathered, very low and low strength
BEDROCK B		GNEISS; pale grey/grey/dark gey/brown/pale brown/pale orange, medium to coarse grained, layered, moderately to slightly weathered, medium to very high strength
(MEDIUM STRENGTH OR GREATER)	0.8 – 2.6	QUARTZITE; pale grey/grey/dark gey/pale orange/pale green, fine to medium grained, crystalline, massive, moderately to slightly weathered, high to extremely high strength



Table 6 – Depth to top of inferred geotechnical units

	Approximate Depth to Top of Unit (m)									
BH ID	PAVEMENT	FILL	NATURAL SOIL	BEDROCK A	BEDROCK B	END OF HOLE				
BH01	0.0	N.E. ⁽¹⁾	0.3	1.4	2.3	12.0				
BH02	0.0	0.16	0.5	0.8	2.6	12.0				
BH03	0.0	0.2	N.E.	0.7	0.8	12.0				
BH04	0.0	0.2	N.E.	0.5	2.6	12.0				
BH05	0.0	N.E.	N.E.	0.4	2.0	12.0				

N.E. = Not Encountered

5.4 Groundwater

Table 7 presents the summary of groundwater measurements recorded during fieldwork. The measurements were recorded at the three (3) newly built standpipe piezometers at BH01, BH03 and BH05.

Given the proximity of the groundwater to the top of the BEDROCK B unit, it is possible that the measured groundwater represents an aquifer perched above the lower permeability unit. Such an aquifer would be expected to be sensitive to rainfall and the resulting water table could be expected to vary due to individual rainfall events and extended periods of dry or wet weather.

Table 7 – Summary of groundwater observations

Borehole	3 February 2	2023	4 February 2	2023	5 February 2023		
ID	Depth (m) below ground ⁽¹⁾	RL (m AHD) ⁽²⁾	Depth (m) below ground	RL (m AHD)	Depth (m) below ground	RL (m AHD)	
BH01	-	-	1.1	307.9	-	-	
BH03	2.0	307.0	1.8	307.2	-	-	
BH05	-	-	2.0	307.0	2.2	306.8	

Notes:

Measured by using water dipmeter.

2 RL calculated using approximated surface RL from LIDAR topographic data (Source: ELVIS)



6. Salinity and Aggressivity Assessment

6.1 Soil Chemistry

The salinity and aggressivity test results, summarised in Table 4 indicate the following:

- pH of the soil samples analysed was in the range of 8.9 to 9.1, with an average of 9.0.
- The 1:5 soil to water extraction and subsequent electrical conductivity (EC1:5) of the soil samples analysed to be in the range of 137 to 1190 μ S/cm
- Concentrations of soluble sulphate in samples analysed was in the range of 60 to 1080 mg/kg
- Concentrations of chlorides in samples analysed was in the range of 50 to 1240 mg/kg.
- Cation Exchange Capacity (CEC) in samples analysed was in the range 4.0 meq/100g to 15.2 meq/100g
- Exchangeable Sodium Percentage (ESP) in samples analysed was in the range of <0.2 % to 34.3 %.

6.2 Salinity Assessment

Site Investigations for Urban Salinity (DLWC 2002)¹ classify soil salinity based on electrical conductivity (EC_e) as per Richards (1954)². The method of conversion from EC_{1:5} to EC_e (electrical conductivity of saturated extract) is based on DLWC (2002) and given by EC_e = EC_{1:5} x M, where M is the multiplication factor based on "Soil Texture Group".

The "Soil Texture Group" of the samples tested has been assessed during our investigation. The salinity classification for the soil samples that were tested are presented in Table 8.

Table 8 – Salinity Classification

Sample ID (Depth)	EC _{1:5} [dS/m]	Soil Texture Group	М	EC₀ [dS/m]	Salinity Class
BH01 (0.3 – 0.5 m)	1.19	Medium clays	7	8.3	Very saline
BH03 (0.3 – 0.6 m)	0.43	Sands	17	7.3	Moderately saline
ED-B4 ¹ (0.3 – 0.5 m)	0.14	Sands	17	2.4	Slightly saline

ED-B4 is a JBS&G hand augered hole in the ED area

It is assessed that the soils on site are classified in a range from "slightly saline" to "very saline".

We have referred to Clause 4.8.2 of Australian Standard AS 3600:2018³ and note that the assessed soil electrical conductivity (EC_e) to fall on the boundary between "A2" and "B1" exposure classification.

6.3 Corrosivity / Aggressivity

Table 4.8.1 of AS 3600:2018 provides criteria for exposure classification for concrete in sulphate soils based on sulphates in soil and groundwater, and pH of soil. On the basis of the sulphate and pH testing completed we assess the exposure classification for concrete in sulphate soils to be "A1" for the natural soils and "A2" for the fill.

Similarly, Table 6.4.2(C) of Australian Standard AS 2159-2009⁴ provides criteria for exposure classification for concrete piles in soil, and here the exposure classification for concrete piles in soils is "Non-aggressive" for the natural soils and "Mild" for the fill.



¹ DLWC (2002) Site Investigations for Urban Salinity. Department of Land and Water Conservation, Sydney.

² Richards, L.A. (1954) Diagnosis and improvement of saline and alkali soils. Agricultural handbook 60. U.S. Dept. of Agriculture, Washington D.C., 160 p.

³ Standards Australia (2018) Concrete Structures, AS 3600:2018, Standards Australia, NSW.

⁴ Standards Australia (2009) Piling – Design and Installation, AS 2159-2009, Standards Australia, NSW.

7. Geotechnical Design Advice

7.1 General

The geotechnical design advice provided in the following sections has been prepared based on the expected subsurface conditions described in Section 5.3.

7.2 Site preparation

We understand earthworks is required to prepare the Site for development. For most areas, we expect fill/cuts to be minor (e.g. less than 0.5 m).

We consider the advice in the following sections adequate, assuming any earthworks is undertaken in accordance with a detailed earthworks specification that has been prepare in accordance with the guidelines in AS 3798-2007 "Guidelines on earthworks for commercial and residential developments". Such a specification will also need to comply with any specific council requirements.

In our experience such a detailed specification should include:

- Requirements for stripping of vegetation, TOPSOIL.
- Requirements for proof rolling of the exposed surface particularly where it comprises FILL. The exposed subgrade surface should be proof rolled with a minimum 8 tonne smooth drum non-vibratory roller. A geotechnical engineer should witness the proof rolling and advise the number of passes for each section and identify "soft spots". Any "soft spots" identified should be excavated and replaced with approved material, with a maximum compacted layer thickness of 200 mm.
- Requirements for subgrade preparation. Where surfaces are required to support structures the exposed subgrade surface shall be scarified, and moisture conditioned to a depth of 150 mm and brought to moisture variation of between 2% dry and 2% wet.
- Definition of compaction and moisture variation requirements for new fill to be placed. Typically, we recommend that fill to be placed and compacted to a density ratio of between 98% and 102% (Standard) and moisture variation of between 2% dry and 2% wet.
- Requirements with regards to maximum layer thickness for new fill. Typically, we recommend a maximum compacted layer thicknesses of 200 mm. If larger earthmoving equipment is employed (e.g. 12t rollers or CAT825) the layer thicknesses could be increased to 300 mm.
- Testing requirements. We typically recommend that fill be placed in Lots that are defined as a single layer of ENGINEERED FILL consisting of uniform material which has undergone similar treatment and that each Lot be tested on "a none to fail basis", i.e., if any one test undertaken with a Lot fails, the whole of the Lot shall be reworked and retested. The minimum density testing frequency should be as per AS3798-2007 and as follows:
 - For Lots less than 30 m³ 1 test per Lot
 - For Lots between 30 m³ to 150 m³ 2 tests per Lot
 - For Lots greater than 150 m³ shall not be less than the greater of:
 - o 1 test per 500 m³ of material placed
 - o 3 tests per lot.

Fill placed in accordance with a specification developed in accordance with the above recommendations is referred to herein as ENGINEERED FILL.



7.3 Site Classification

It is understood that the proposed development comprises single storey buildings which may fall within the scope of Australian Standard AS2870-2011⁵ "Residential slabs and footings".

We advise the following:

- 1. In cut areas within the BEDROCK A or BEDROCK B unit, structures that are within the scope of AS2870-2011 be designed for a site classification of Class "A" in accordance with Table 2.1 of AS2870-2011.
- 2. In cut areas within the NATURAL SOIL unit, structures that are within the scope of AS2870-2011 be designed for a site classification of Class "M" in accordance with Table 2.1 of AS2870-2011.
- 3. In cut areas within the FILL unit or in new fill areas:
 - a. Where existing fill is present the fill cannot be currently considered as "controlled fill" and thus the site is classified as Class P in accordance with AS2870-2011.
- b. Where ENGINEERED FILL is placed in accordance with Section 7.2 of this report, the fill can then be considered "controlled fill" and the site can be reclassified from Class P to Class M (subject to confirmation of the source of the fill material).

The civil and structural engineers should consider likely heave / settlement due to the effect of climatic factors in their designs.

We recommend that all structures and services be detailed such that they preclude any local wetting up or drying out of the subgrade after initial equilibrium is reached following construction of the slab and that the subgrade be within Specification at the time of construction of the slab. We note that normal mounding or sagging away from the perimeter of covered areas will still occur and perimeters, or open joints, will still respond to environmental changes.

Careful consideration should be given to differential movements between new structures and existing structures due to reactivity. This is likely to be able to be addressed by means of carefully detailed articulation between the new and existing structures.

7.4 Foundations

7.4.1 Shallow Foundation

It is expected that the foundations used as part of any proposed development at the site would typically include strip, pad, or other shallow footings.

Pad footings can be proportioned on the basis of an allowable bearing pressure (ABP) for centric vertical loads provided in Table 9.

We note that an allowable bearing pressure (ABP) is not a soil property. It depends on many factors such as the size of the footings, the embedment depth, the load direction and eccentricity, the stiffness of the footing, the adopted factor of safety (FOS), as well as the soil properties. As footings get bigger or deeper the capacity increases rapidly, and as the load gains eccentricity or becomes inclined, the capacity reduces rapidly.

When assessing the settlement of the shallow footings, the designer needs to consider the additional ground settlement due to the total building load on both shallow and deeper units. The differential settlement due to the building load and differing founding conditions shall also be assessed. Foundation conditions at the proposed shallow pad footing should be inspected by a suitably qualified geotechnical engineer prior to the pouring of concrete.

The BEDROCK A and BEDROCK B parameters provided are for the weakest rock encountered in the two units. High and very high strength rock masses within BEDROCK B are present at shallow depths in places and at deeper depths at all borehole locations. Higher bearing capacities than those provided in Table 9 are achievable for these higher strength rock masses within BEDROCK B. If this is required, further advice should be sought from PSM.



⁵ Standards Australia (2011) Residential slabs and footings, AS 2870-2011, Standards Australia, NSW.

Table 9 - Foundation Parameters of the inferred Geotechnical Units

	Bulk unit weight	parameters		Ultimate bearing pressure under vertical	Allowable bearing pressure under vertical	Ultimate Shaft Adhesion	Elastic parameters		
	(kN/m ³)	c′ (kPa)	φ' (deg)	centric loading ² (kPa)	centric Ioading ³ (kPa)	(kPa)	Young's Modulus (MPa)	Poisson's Ratio	
ENGINEER ED FILL, NATURAL SOIL	18	0	30	300 ¹	100	N/A	10	0.3	
BEDROCK A	25	-	-	3000	1000	150	100	0.25	
BEDROCK B	25	-	-	20000	6000	800	500	0.2	

¹ Pad footings in soil units should have a minimum horizontal dimension of 1.0 m and a minimum embedment depth of 0.5 m.

² Ultimate bearing pressure values occur at large settlement (>5% of minimum footing dimensions)

³ Allowable bearing pressure to cause settlement of <1% of minimum footing dimension.

7.4.2 Piles

Piled foundations should be within the BEDROCK units.

Piles should be designed in accordance with the requirements in AS 2159 (2009), *Piling – Design and Installation*. The parameters provided in Table 9 may be adopted in the design of piles founded in the BEDROCK units.

The foundation designer should note the following with regards to the pile design:

- The ABP needs to be confirmed by a geotechnical engineer through pile inspections prior to pouring concrete. This is particularly important where BEDROCK B parameters are adopted.
- Under permanent load, the contribution of side adhesion for soil units should be ignored.
- Pile settlement can be checked using the recommended elastic parameters in Table 9.
- Where adjacent foundation details differ (e.g., pile and pad, differing loads or ground conditions), differential settlement should also be assessed.

With regards to the pile design, we recommend that:

- A basic geotechnical strength reduction factor, $\Phi_{gb} = 0.56$ (AS2159 CL. 4.3.2) be adopted for a high redundancy system for an assessed average risk rating (ARR) between 3.0 and 3.5. This should be reviewed to suit the specific design and appropriate pile testing proposed by the structural / pile designers in accordance with the requirements of AS2159
- It may be possible to increase the pile reduction factors, if the details of the proposed pile installation procedures indicate a high level of quality control with regards to concrete placement, base cleanliness, etc
- If a geotechnical strength reduction factor, $\Phi_g = 0.40$ is adopted then no pile testing will be required (AS2159 Clause 8.2.4 (b)).

Where the pile is sized using the allowable bearing capacity in Table 9. (i.e., assuming all the serviceability load is carried by the base), the settlement would be expected to be less than 1% of the pile diameter plus elastic shortening of the pile itself.



7.5 Excavation

We expect excavations will occur for the proposed development. In particular, for development of the proposed 'Stage 2' carpark, located north of the MHU.

Excavation of FILL and NATURAL units is expected to be achievable using conventional earth moving equipment (e.g., large dozers, excavators, ripper etc.). Excavation of BEDROCK units will require use of rock breaking equipment (impact hammers and rock saws). We note that some of the BEDROCK B unit is high and very high strength and excavation with rock saws and large impact hammers is likely to be very slow. Similarly, the construction of bored piles within the BEDROCK B unit would be expected to encounter very difficult drilling conditions with the use of coring tools likely to be required.

It is our experience that excavatability is heavily dependent on factors such as the experience of the operator, the plant used and the area available for excavation activities. Therefore, any earthworks contractor should satisfy themselves regarding excavatability of the material. As a minimum, the Contractor shall be provided with this report, they shall review the logs and point load test results and undertake a site inspection to visually assess the site conditions. We note that the logs record the depth of TC auger refusal.

7.6 Vibrations

Use of earthmoving and particularly rock breaking equipment can result in ground vibrations that can in turn damage neighbouring structures and assets.

It is the responsibility of the earthworks contractor to develop methodologies that do not result in damage to neighbouring structures and assets.

The methodology should include appropriate sizing of rock breaking equipment, use of saw cutting if required, dilapidation surveys of neighbouring structures, development of vibration limits at the site boundaries and monitoring procedures to minimise the risk of damage to neighbouring dwellings and assets.

The Contractor shall also consider the effect of potential work induced vibrations on equipment typically present within health infrastructure which are highly sensitive to vibrations Even when the operation and trafficking of a given plant or equipment is deemed unlikely to affect structures and assets, their impact on sensitive medical equipment, as well as their impact on hospital staff and patients, should be assessed.

7.7 Articulation

Particular attention shall be given to detailing the foundations and superstructure where a new building connects to an existing structure. It is likely that differential settlements due to loading and shrink swell movements will occur between existing and new structures and allowances shall be included in the design to cater for such movements.

It is our experience articulation between new and old structures will need to be provided to accommodate the potential for differential movements between the separate structures.

7.8 Permanent and Temporary Batters

The batter slope angles shown in Table 10 are recommended for the design of batters up to 3 m height and above the groundwater, subject to the following recommendations:

- All batters shall be protected from erosion
- Permanent batters shall be drained
- Temporary batters shall not be left unsupported for more than 2 months without further advice, and inspection by a geotechnical engineer should be undertaken following significant rain events
- No buildings, loads or services should be located within 1 batter height of the crest.

If the conditions above cannot be met, further advice should be sought.



Table 10 - Batter Slope Angles

Unit	Temporary	Permanent		
ENGINEERED FILL / NATURAL SOIL	1.5H: 1V	2.5H: 1V		
BEDROCK (subject to inspection)	Vertical	1H:1V		

The batters should be inspected by an experienced geotechnical engineer or engineering geologist during excavation to confirm the batter advice provided and assess the need for localised support.

Batters in the BEDROCK unit shall be inspected at regular intervals (less than 1.5 m) during excavation. The purpose of the inspection is to identify the presence of adversely oriented defects that may impact the stability of the batters. Where such features are observed, additional support in the form of rock bolts or anchors may be required.

Proper and suitable safe work method statements and OHS documents need to be developed for works to be undertaken in the vicinity of the crest and toe of batters.

7.9 Excavation and retention advice

Temporary or permanent cuts steeper than the recommended permanent batter slopes in Table 10 will need to be supported by some form of retaining structure.

The design of these structures should be based on the following geotechnical properties:

- Effective soil strength parameters for the soil units of:
 - c' = 0 kPa and phi' = 30°
- Surcharge loads behind the retention
- Water pressure (depending on the type of structure)
- A lateral pressure of 10 kPa for vertical cuts in the BEDROCK unit. This is to allow for blocks and rock wedges formed due to adverse defects that may exist within the unit.

Note that design of retention systems may be based on either Ka or Ko earth pressures. Design using active earth pressures provides the minimum lateral earth pressure that must be supported to avoid failure and requires a wall that can rotate or translate to allow the pressures to reduce to these values (vertical and lateral movements up to 2% of height may occur, typical movements will be much less).

Where the design is based on Ko pressures, construction should be carefully controlled to avoid unwanted effects. It should be noted that designing for Ko pressures do not, of themselves, ensure that movement does not occur. Movements are controlled by the construction method, especially sequence.

Both surface and sub-surface drainage needs to be designed and constructed properly to prevent pore water pressures from building up behind the retaining walls or appropriate water pressures must be included in the design.

Where excavations are proposed adjacent to neighbouring properties the effects of excavation induced ground movements on neighbouring properties shall be considered and appropriate retention systems designed to limit the movement to prevent damage to neighbouring properties.

The designers and builders of the retention system shall include consideration of ground deformation resulting from installation of the support and during temporary stages of the support installation. Where anchors or rock bolts are proposed to extend below neighbouring properties permits from other owners will need to be negotiated.

We recommend that once details of the proposed development are defined, further advice regarding the effects of the proposed excavation on neighbouring structures is sought from a suitably qualified geotechnical engineer.



7.10 Slabs

The design of slabs on ground can be based on:

- The subsurface conditions as described in Section 5.3,
- The site classification described in Section 7.3 and
- A subgrade with a long term Young's Modulus of 10 MPa.

We note that the environmental effects (e.g., drying or wetting up of the finished surface) affecting the land prior to development should be taken into account by the various designers of the proposed development.

7.11 Pavements

Three (3) CBR tests were undertaken on samples of fill. The results (refer Table 1) indicated a CBR of between 17% and 35%.

A CBR of 10% can be adopted for subgrade and fill formed in bulk earthworks placed in accordance with a PSM Specification.

Subgrade CBR for pavement design depends on the material at the finished subgrade levels.

We recommend that specific CBR testing be undertaken at subgrade level when pavement layouts are finalised. CBR testing shall be undertaken for any new imported material within the pavement subgrade (e.g., within 1 m below pavement).

Pavement shall be designed and constructed in accordance with the Council's requirements.

7.12 Earthquake Site Classification

We have reviewed AS1170.4-2007⁶ to determine the Hazard Design Factor (Z) and Site Sub-Soil Class for the Site. For earthquake provisions, we recommend the following for the proposed development:

- Site Sub-Soil Class = B_e (Rock)
- Hazard Design Factor (Z) = 0.03 (for Broken Hill).

7.13 Mine Subsidence

Consultation of the Mine Subsidence Advisory website indicates that the Site is not located within a Mine Subsidence District. On this basis we understand that the Site is not affected by mine Subsidence.

7.14 Site Suitability for Stormwater Infiltration Systems

Infiltration systems are systems designed to detain and retain stormwater to provide an opportunity for infiltration of stored water to the surrounding soils. The aim is to reduce stormwater volumes by retaining and infiltrating the water into the soil and the local groundwater.

Design guidelines for such systems indicate that these are not suitable where the ground conditions comprise clays overlying shallow bedrock. The presence of a water table near the surface also reduces the suitability of a site for this system.

On the above basis, we consider that the Site is unsuitable for an infiltration system as:

- The ground conditions comprise clay overlying shallow bedrock.
- A perched water table has been observed within 2 m of the existing ground surface.

⁶ Standards Australia (2007) Structural design actions – Part 4: Earthquake actions in Australia, AS 1170.4-2007, Standards Australia, NSW.



8. General

Should there be any queries, do not hesitate to contact the undersigned.

Yours Sincerely

Vanlae

HARLEY ZHENG GEOTECHNICAL ENGINEER

Dal Pello

DAVID PICCOLO PRINCIPAL



Brisbane

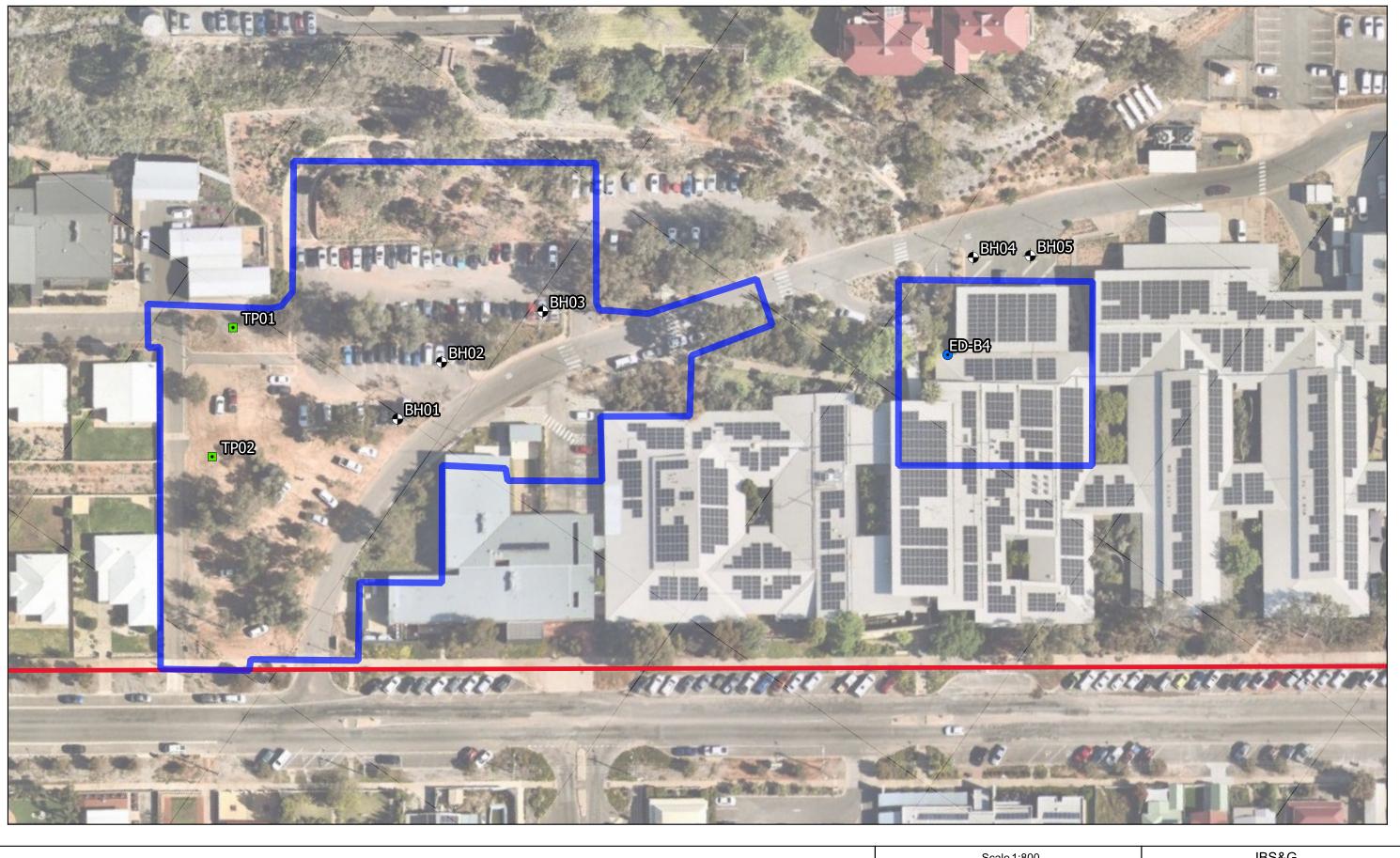
Level 6, 500 Queen Street Brisbane QLD 4000 +61 7 3220 8300

Sydney

G3-56 Delhi Road North Ryde NSW 2113 +61 2 9812 5000

Perth

Level 3 22 Delhi Street West Perth WA 6005 +61 8 9462 8400

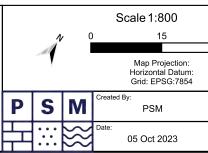


Legend

Approximate extent of hospital Lot

Approximate extent of proposed development area • Test Pits

- Boreholes \bullet
- Hand augered hole (JBS&G)



30 m	JBS&G Broken Hill Hospital Redevelopment 176 Thomas St, Broken Hill					
Revision:	Locality Plan					
Ā						
Paper Size: A3	PSM4951-004R	Figure 1				



Photo 1 - General photo of MHU area, looking west



Photo 2 - General photo of MHU area, looking east

	JBS&G				
	Broken Hill Ho	spital Upgrade			
PSM	176 Thomas St, Broken Hill SELECTED PHOTOS (1 OF 5)				
	PSM4951-004L	FIGURE 2			



Photo 3 - General photo of ED area, looking west



Photo 4 - General photo of ED area, looking north

	JBS	S&G			
	Broken Hill Ho	spital Upgrade			
PSM	176 Thomas St, Broken Hill				
	SELECTED PHOTOS (2 OF 5)				
	PSM4951-004L	FIGURE 3			



Photo 5 - General photo from fieldwork, showing drill rig set up at BH02



Photo 6 - General photo from fieldwork, showing a slab of pavement

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JBS&G Broken Hill Hospital Upgrade 176 Thomas St, Broken Hill

SELECTED PHOTOS (3 OF 5)

PSM4951-004L

FIGURE 4





Photo 8 - General photo from fieldwork, showing typical gravelly sand FILL encountered on site

	JBS	S&G
	Broken Hill Ho	spital Upgrade
PSM	176 Thomas	St, Broken Hill
	SELECTED PH	IOTOS (4 OF 5)
	PSM4951-004L	FIGURE 5



Photo 9 - General photo from fieldwork, showing typical gravelly CLAY soil encountered on site



Photo 10 - General photo from fieldwork, showing well installed at BH05

	JBS&G				
	Broken Hill Hospital Upgrade				
P S M	176 Thomas St, Broken Hill				
	SELECTED PHOTOS (5 OF 5)				
	PSM4951-004L	FIGURE 6			

Appendix A Engineering Borehole Logs



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Page 1 of 4

P F	Client: Projec Hole L Hole F	t Na .oca	tion:	Propos	Hill ed N	/HU	Area	-		20 Zone 54	Commence Complete Logged B Checked	d: y:)2/202)2/202	
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				ing Informat						Soil Descri						Observations
Method	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, beha particle characteristics of p component, colour, secondary o additional observation		Moisture Condition	Consistency / Relative Density	Ha Peneti U (k	and romete CS Pa)	r Structure, Zoning, Origin, Additional Observations
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		z	Not Encountered	3, 5, 6 N = 11		1 308.0	- 1					М	St to VSt			
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Page 2 of 4

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			ling Info	-			-		k Substance				Rock Mass Defects		
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Page 3 of 4

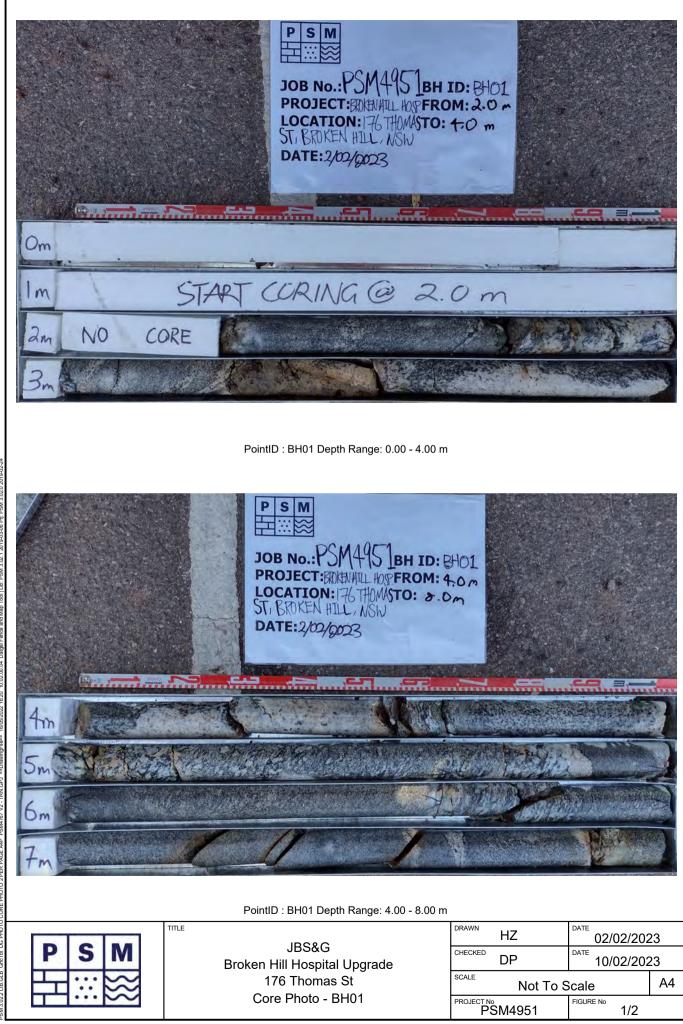
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Borehole ID

BH02

Page 1 of 4

Client: JBS&G Project Name: Broken Hill Hospital Upgr Hole Location: Proposed MHU Area Hole Position: 542905 m E 6465220 m I Drill Model and Mounting: Comacchio Geo S									n N MGA2020 Zone 54 Checked By:						2/202 2/202	
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Borehole ID

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Page 2 of 4

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Borehole ID

BH02

Page 3 of 4

F	Hole	ect Na	ation:	Bro Pro	opose	ed MH	IU Are	l Upgrade ea 20 m N MGA2020 Zone 54		Commen Complete Logged B Checked	ed: By:	03/02/2023 03/02/2023 HZ DP	
			el and M		0			Geo 305 Inclination:	-90°	RL Surfac		00 m	rator: MacCaa
	Sane		be and L Iing Info	-		HQ3	3 11	Bearing: Rock Su	bstance	Datum:	AHD		erator: MacGeo Rock Mass Defects
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain cha colour, fabric/texture, inclusion components, moisture, mineral comp	s or minor	>><>	Strength Is(50) • - Axial O - Diametral • • • • • • • • • • • • • • • • • •	Defect Spacing (mm) ନ୍ୟୁ _{ଜ ର} ରୁ ଚ୍ଚି	Defect Descriptions / Commen Description, alpha/beta, infilling or coating, shape, roughness, thickness, other
		84			302.0 303.0			GNEISS: medium to coarse grained, grey/orange-brown, layered.(continue	grey/dark ;d)				SM, 60°, CL, =15 mm FL, 0°, Fe & Clay, IR, RF SZ, 30°, RF, =300 mm JT, 60°, FE, PR, RF JT, 70°, FE, CU, RF JT, 60°, FE, CU, RF JT, 60°, FE, PR, RF JT, 60°, FE, UN, RF
HQ3	Not Encountered	94			301.0	- - - 8 - -		QUARTZITE: fine to medium grained grey/grey, crystalline, massive, comp	 , dark act.				—FL, 10°, FE, PR, RF —JT, 75°, FE, UN, RF
		91 100			300.0	- 9 - - -		GNEISS: medium to coarse grained, grey/orange-brown, layered.	 grey/dark				— JT, 60°, FE, CU, RF ¬ JT, 80°, FE, CU, RF ¬ JT, 70°, FE, ST, RF — FL, 0°, FE, IR, RF — JT, 60°, FE, PR, RF
	AD/ WB HQ: PQ; SP1 PT	/T-Aug /V-Aug 3-War 3-Win 3-Win 7-Star -Pus /T-Wa	ter pressure	' bit 63.5 mr 85.0 mr tration f	m)	Gra	> Inflo ☐ Parti ■ Com ohic L o Core indica	v XW - E HW - H HW - H HW - M M bal Loss MW - M plete Loss SW - S pg/Core Loss FR - F pg/Core Loss VL - V recovered (hatching L - L tes material) M - M H - er recovery VH - V	ength ery Low ow edium	FT - Faul SS - Shea SZ - Shea	ar Surface ar Zone ding parting m ed Seam t tact shed Zone ture Zone	Infilling/Coz CN - Clean SN - Stain VN - Veneer CO - Coatiny RF - Rock fr G - Gravel S - Sand Z - Silt CA - Calcite CL - Clay FE - Iron QZ - Quartz	SL - Slickensided POL - Polished S - Smooth agments VR - Very Rough Shape PR - Planar CU - Curved UN - Undulating ST - Stepped

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Borehole ID

BH02

Page 4 of 4

Ingi	nee	ring	Log	- C	ore	d Bo	orehole		Project N	lo.: F	SM4951	Fage 4 01 4
Clier Proje Hole Hole	ect Na Loca	ation:	Bro Pro	opose	ed MH	IU Are	l Upgrade a 20 m N MGA2020 Zone :	54	Commen Complete Logged E Checked	ed: C By: H)3/02/2023)3/02/2023 HZ)P	
		el and M						lination: -90°	RL Surfa	,		
		be and L		-	HQ3			aring:	Datum:	AHD		rator: MacGeo
	Drill	ling Info	ormat	ion			R	ock Substance			F	Rock Mass Defects
Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Des ROCK NAME: particle/g colour, fabric/texture, i components, moisture, miner	grain characteristics, inclusions or minor	Weathering ⁿ ≳ ≩ ≩ ⊗ ಱ	Strength Is(50) ● - Axial O - Diametral	Defect Spacing (mm)	Defect Descriptions / Commen Description, alpha/beta, infillin or coating, shape, roughness thickness, other
Not Encountered	91			298.0	- - - 11 -		GNEISS: medium to coarse grey/orange-brown, layered.					- JT, 80°, CU, RF - FL, 0°, PR, RF - FL, 0°, PR, RF - FL, 0°, PR, RF - JT, 45°, PR, RF - CZ, 0°, CL, =70 mm - SM, 0°, CL, =15 mm
				297.0	- - - - - -		Hole Terminated at 12.00 m Target depth					— JT, 20°, CU, RF
				 296.0	- - 13— -							
				 295.0	- - 14 — -							
AD/ WB HQ PQ SP PT	/T-Aug /V-Aug 3-Wa 3-Win 3-Win 3-Win T-Stat -Pus	eline core (eline core (ndard pene	/ bit 63.5 mr 85.0 mr tration f	n)		> Inflow ☐ Partia Comp Comp Core r indica		Weathering XW - Extremely Weathered MW - Highly Weathered MW - Slightly Weathered SW - Slightly Weathered FR - Fresh Strength VL - Yey Low L - Low M - Medium H - High VH - Very High EH - Extremely High	FT - Fau SS - She SZ - She	ar Surface ar Zone ding parting m led Seam it tact shed Zone n cture Zone	Image: Image Amplitude Image Amplitude Image Amplitude Image Amplitude <td>SL - Slickensided POL - Polished S - Smooth RF - Rough</td>	SL - Slickensided POL - Polished S - Smooth RF - Rough



P S M

6:20

JBS&G Broken Hill Hospital Upgrade 176 Thomas St Core Photo - BH02
 DRAWN
 HZ
 DATE
 03/02/2023

 CHECKED
 DP
 DATE
 10/02/2023

 SCALE
 Not To Scale
 A4

 PROJECT No
 PSM4951
 FIGURE No



PointID : BH02 Depth Range: 8.00 - 12.00 m

		HZ	DATE 03/02/202	23
P S M	JBS&G Broken Hill Hospital Upgrade	CHECKED	DATE 10/02/202	23
	176 Thomas St	SCALE Not To S	Scale	A4
	Core Photo - BH02	PROJECT № PSM4951	FIGURE No 2/2	

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Borehole ID

BH03

Page 1 of 4

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Н	lole L lole P	oca	tion:	Propos	ed N	/HU /	Area	-		20 Zone 54	Logged E Checked	By:		HZ DP		_02	•
	rill M lole D			0		macc 5 mm	hio Ge	eo 305	5	Inclination: -90° Bearing:	RL Surfa Datum:	ce:	30 AH	9.00 ID	m	O	perator: MacGeo
			Drill	ing Informati	on					Soil Descr	iption						Observations
	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description SOIL NAME: Plasticity, beh particle characteristics of component, colour, secondary additional observatio		Moisture Condition	Consistency / Relative Density	Pene L	JCS (Pa)	eter	Additional Observations
		z		SPT 0.50-0.65 m			-	0.00	GW SM-SC	SEALED PAVEMENT: 60 mm GRAVEL: to 30 mm, well graded grey. Silty SAND with clay: fine to med brown-red; clay medium plasticit	ium grained,	<u>м</u> м	VD D				0.00: PAVEMENT 0.06: ROADBASE 0.20: FILL
				15, refusal		308.0	1			GNEISS: brown-yellow/pale orar weathered, low strength Continued on cored borehole sh	/	D					
						307.0	- 2 -										
						306.0	3-										
						305.0	- - 4 - -										
N S P A	D/T - 1 D/V - 1 /B - 1 PT - 1 T - 1 S - 1	Was Stan Push Auge	er drill er drill hbore dard tube er scr	penetration test		netrat lo resis Re ng 76	stance efusal	•	$>$ Inflo \lhd Par	ater Samples a bw U - Undisturber tial Loss D - Disturbed P mplete Loss ES - Environmer TW - Thin Walled LB - Large Distu	l Sample ample enetration Test ital Sample		M	re Co. - Di - M - W	y oist	ion	Consistency/Relative Dens VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

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Borehole ID

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Page 2 of 4

e Loca e Posi Mode rel Typ Dril	lame: ation: sition: el and M /pe and L <i>lling Info</i>	Bro Pro 542 ountin ength	pose 2920 ig:	ed MH m E 6	IU Are	l Upgrade	Commenc Completed Logged By	d: 0	1/02/2023	
e Loca e Posi Mode rel Typ Dril	ation: sition: el and M vpe and L	Pro 542 ountin ength	pose 2920 ig:	ed MH m E 6	IU Are		•		1/02/2023	
e Posi Mode rel Ty Dril	ition: el and M vpe and L	542 ountin ength	2920 ng:	m E 6				~ L	ΙZ	
rel Ty Dril	/pe and L	ength	•	Como		40 m N MGA2020 Zone 54	Checked E		12)P	
Dril	-	-	:	Joing	acchic	Geo 305 Inclination: -90°	RL Surfac	e: 309.0	00 m	
	lling Info			HQ3	3 m	Bearing:	Datum:	AHD	Ope	erator: MacGeo
(%		rmau	on			Rock Substance			F	Rock Mass Defects
RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain characteristics, colour, fabric/texture, inclusions or minor components, moisture, mineral composition, alteratic		Strength Is(50) ● - Axial D - Diametral	Defect Spacing (mm)	Defect Descriptions / Comme Description, alpha/beta, infilli or coating, shape, roughness thickness, other
			308.0			Continued from non-cored borehole sheet GNEISS: medium to coarse grained, grey/dark grey/pale yellow, layered, significant amounts of healed sub-vertical fractures.				—JT, 80°, Fe & Clay, PR, RF → FL, 0°, FE, PR, RF → FL, 0°, FE, PR, RF
62			307.0	2		QUARIZITE: fine grained, pale grey/pale blue/dark grey, crystalline, massive, compact, significant amounts of healed sub-vertical fractures.				— JT, 80°, Fe & Clay, PR, RF — JT, 55°, RF, PR, RF
	_	_	306.0	3-						− JT, 85°, FE, ST, RF − CZ, 70°, RF, =60 mm
92			305.0	4		GNEISS: medium to coarse grained, grey/dark grey/pale green, layered. QUARTZITE: fine to medium grained, dark grey/pale green, crystalline, massive.				- FL, 0°, FE, PR, RF - FL, 0°, Fe & Clay, PR, RF - JT, 80°, FE, UN, RF
M	lethod				w w		Defect	Type		
0/T - Aug 0/V - Aug B - Wa Q3- Wir Q3- Wir Q3- Wir 2T- Sta	iger drilling T iger drilling V ashbore ireline core (f ireline core (f andard pene ish tube	' bit 63.5 mm 35.0 mm tration te	í)	<	 > Inflo ☐ Parti Inflo Com Core Indica 	w XW - Extremely Weathered al Loss HW - Highly Weathered al Loss MW - Moderately Weathered plete Loss FR - Fresh pg(Core Loss FR - Fresh percovered (hatching tes material) L - Low M - Medium H - High	FT - Fault SS - Shear BP - Beddi SM - Seam IS - Infillec JT - Joint CO - Conta CZ - Crush VN - Vein	Surface Zone ng parting d Seam ct ed Zone	CN - Clean SN - Stain VN - Veneer CO - Coating RF - Rock fr G - Gravel S - Sand Z - Silt CA - Calcite CL - Clay	SL - Slickensided POL - Polished S - Smooth agments VR - Rough VR - Very Rough Shape PR - Planar
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Page 3 of 4

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			ame: ation:			Hill Ho ed MH		l Upgrade		Complete Logged E)1/02/2023 HZ	
		Posi			•			a 40 m N MGA2020 Zone 54		Checked	-	чz DP	
0	Drill I	Mode	el and M	ounti	ng:	Coma	acchic	Geo 305 Inclinati	on: -90°	RL Surfa	ce: 309.	00 m	
			be and L			HQ3	3 m	Bearing	:	Datum:	AHD	Оре	rator: MacGeo
		Drill	ling Info	rmat	ion			Rock	Substance			F	ock Mass Defects
			р	ons)			ſ	Material Descript	ion		Strength Is(50)		Defect Descriptions / Commer
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL	Depth	Graphic Log	ROCK NAME: particle/grain colour, fabric/texture, inclus components, moisture, mineral co	characteristics, ions or minor	Weathering	• - Axial O - Diametral	Defect Spacing (mm)	Description, alpha/beta, infillin or coating, shape, roughness thickness, other
Ś	3	Ř	зё́т	3	(m)	(m)	~~	•	•	MW WW BW	╡」≥ェ⋚ਜ਼	1000 1000 1000 1000 1000 1000 1000 100	
		92			1 303.0	6	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	QUARTZITE: fine to medium grai green, crystalline, massive. <i>(conti</i>	ned, dark grey/pale <i>ued)</i>				FL, 5°, Z, PR, RF JT, 50°, FE, ST, RF JT, 50°, RF, ST, RF JT, 65°, FE, PR, RF SM, 70°, CL, =15 mm JT, 70°, FE, ST, RF JT, 70°, CN, PR, RF JT, 90°, CN, CU, RF
HQ3	Not Encountered				1 302.0	7							- JT, 60°, FE, UN, RF - JT, 60°, CL, PR, RF - JT, 70°, Fe & Clay, PR, S - JT, 60°, Fe & Clay, ST, RF ⁻ SM, 65°, CL, =5 mm - JT, 70°, Fe & Clay, PR, S
		66			1 300.0 301.0	-8 - - - 9 - - -	>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	GNEISS: medium to coarse grain	ed, grey/dark				− JT, 45°, FE, PR, RF − JT, 60°, CN, PR, RF − SM, 70°, Fe & Clay, =10 mm − CZ, 70°, RF, =20 mm
		94				-		grey/pale orange, layered.					┘ ─ JT, 80°, FE, PR, RF
			ethod				W	ater	Weathering		ct Type	Infilling/Coa	
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00			ter pressure nce with AS 1		7 Geoteo	chnical site	indica - No co	tes material) M H re recovery VH	 Medium High Very High Extremely High 	VN - Vei FZ - Fra	n cture Zone Iding Shear	CL - Clay FE - Iron QZ - Quartz X - Carbons	UN - Undulating ST - Stepped IR - Irregular

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Borehole ID

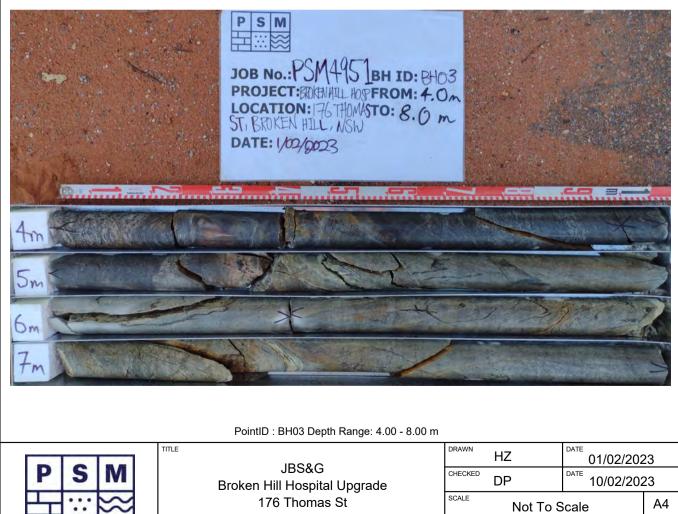
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Page 4 of 4

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	-		ame: ation:			ed MH		Upgrade a	Logged		IZ		
Н	ole	Posi	tion:	54	2920	m E 6	4652	40 m N MGA2020 Zone 54	Checked	d By: D)P		
			el and M be and L		-	Coma HQ3		Geo 305 Inclination:	-90° RL Surfa Datum:	ace: 309.0 AHD		erator: MacGeo	
				-		пQS	3 11	Bearing:			· ·		
		Driii	ing Info		ion			Rock Subst		Strength		Rock Mass Defects	
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Description ROCK NAME: particle/grain charact colour, fabric/texture, inclusions or components, moisture, mineral compositi	minor	Is(50) ● - Axial O - Diametral	Defect Spacing (mm)	Defect Descriptions / Comme Description, alpha/beta, infilli or coating, shape, roughness thickness, other	
201	Not Encountered	94			 298.0	- - - 11—		GNEISS: medium to coarse grained, gre grey/pale orange, layered.(continued)	y/dark			— JT, 70°, FE, PR, RF — JT, 75°, Fe & Clay, ST, RF — JT, 75°, FE, PR, RF	
					297.0	- - - - - -		Hole Terminated at 12.00 m Target depth				— JT, 75°, Z, PR, RF	
					296.0	- - 13— -							
					 295.0	- - 14 — -							
	AD/ WB HQ3 PQ3 SPT	T-Aug √-Aug - Was 3- Win 3- Win 5- Win	ethod ler drilling T ler drilling V shbore eline core (i ndard pene h tube	' bit 63.5 mr 85.0 mr	n)		> Inflov ☐ Partia ■ Com ■ Com		weathered FT - Fa Weathered SS Sh ately Weathered SZ Sh y Weathered SZ Sh y Weathered BP Be sM SK Sh y Weathered SN Se star Sh Sh ow CO CC	ear Surface ear Zone dding parting am illed Seam int	Iminipage Iminipage Iminipage Iminipage CN - Clean Stan SN - Stan Stan VN - Veneer CO - Coating RF - Rock fi G - Grave S - Sand Z - Sitt CA - Calcing CA - Calcing	SL - Slickensided POL - Polished S - Smooth g RF - Rough VR - Very Rough Shape PR - Planar	



PointID : BH03 Depth Range: 0.00 - 4.00 m



Core Photo - BH03

PROJECT № PSM4951

FIGURE No

1/2



PointID : BH03 Depth Range: 8.00 - 12.00 m

		HZ	DATE 01/02/202	23
PSM	JBS&G Broken Hill Hospital Upgrade	CHECKED DP	DATE 10/02/202	23
	176 Thomas St	SCALE Not To S	scale	A4
	Core Photo - BH03	PROJECT NO PSM4951	FIGURE № 2/2	
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Borehole ID

BH04

Page 1 of 4

Client: JBS&G Project Name: Broken Hill Hospita Hole Location: Proposed ED Area								pgrade Cor					:		02/2 02/2		
	ole Lo			•				m N N	1GA20	20 Zone 54	Logged By: Checked By:			HZ DP			
	rill Mo ole D			Mounting:		macc 5 mm	hio Ge	Geo 305 Inclination: -90° RL S Bearing: Date				ace:	30 AH	9.00 ID	m	Or	perator: MacGeo
Drilling Information						,				Soil Descr			7.0				Observations
Τ		-		.g							-		ity				
	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Descriptior SOIL NAME: Plasticity, beh particle characteristics of component, colour, secondary additional observatio	aviour or orimary components,	Moisture Condition	Consistency / Relative Density	H Pene ال ال 200 با	and trom JCS (Pa)	eter	
ł		z	Itered				_	000	GW	SEALED PAVEMENT: 60 mm Sandy GRAVEL: to 30 mm, well	graded,	м	VD				0.00: PAVEMENT 0.06: ROADBASE
			Not Encountered				_		SW	angular, pale grey-brown; sand r \coarse.	nedium to 	м	D				0.20: FILL
		z	Not E				_			Gravelly SAND: fine to coarse gr graded, brown/grey-brown; grave to 30 mm.		}	+				
										GNEISS: grey/orange/pale orang weathered, very low strength	ge, extremely						0.80: TC-bit refusal
						306.0 307.0 308.0	1										
A W	D/T - A D/V - A /B - \ PT - S T - F S - A	Auge Was Stan Push Auge	er drillii er drillii hbore dard p tube er scre	ng TC bit ng V bit enetration test wing s push tube 1.5		R	stance efusal		> Infl ⊲ Par	ater Samples a ow U - Undisturbed tial Loss SPT - Standard P nplete Loss ES - Environmer TW - Thin Walled LB - Large Distu	I Sample ample enetration Test ital Sample		M	re Co - Di - M ' - W	y oist	ion	Consistency/Relative Densive VS - Very soft S - Soft F - Firm St - Stiff VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense

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Borehole ID

BH04

Page 2 of 4

En	giı	nee	ering	Log) - C	ore	d Bo	orehole		Projec	t No.	:	PSM4	951	
С	lien	ıt:		JB	S&G					Comm Compl			04/02/ 04/02/		
	-		ame: ation:			ed ED		l Upgrade		Logge			04/02/ HZ	2023	
		Posi			•			10 m N MGA2020 Zone	54	Check	-		DP		
D	rill I	Mode	el and M	ounti	ng:	Coma	acchic	Geo 305 Inc	lination: -90°	RL Su	rface	: 309	9.00 m		
В	arre	el Typ	be and L	engtl	h:	HQ3	3 m	Ве	aring:	Datum	1:	AH	D	Ope	rator: MacGeo
		Drill	ling Info	rmat	ion			F	ock Substance					F	Rock Mass Defects
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material De ROCK NAME: particle/ colour, fabric/texture, components, moisture, mine	grain characteristics, inclusions or minor	Weather	ing O	Strength Is(50) ● - Axial - Diametra	Spa (m	fect acing im)	Defect Descriptions / Comme Description, alpha/beta, infilli or coating, shape, roughnes thickness, other
						-		Continued from non-cored l	porehole sheet						
					<u>8</u> .0		\mathbb{X}				i i		1 i i		
					1 308.0	-		GNEISS: medium grained, orange/grey/pale grey, laye rockmass, heavy iron staini	red, extremely fractured						− JT, 80°, Fe & Clay, PR, RF − SM, 60°, RF & CL, =40 mm
		22			1 307.0	- 2									SM, 70°, RF & CL, =10 mm [¬] JT, 70°, FE, PR, RF SM, 70°, RF & CL, =10 mm
0.00	Not Encountered	39			306.0	- - 3-									- JT, 70°, CL & S, PR, RF - CZ, 0°, RF & S, =100 mm - CZ, 0°, RF & CL, =30 mm - JT, 80°, RF & CL, UN, RF - FL, 10°, FE, UN, RF - CZ, 5°, RF & CL, =80 mm - JT, 70°, FE, CU, RF
		77			305.0			GNEISS: medium to coarse orange/brown/grey/pale gre	e grained, orange/pale y, layered.						- SM, 45°, RF & CL, =40 mm - JT, 70°, FE, IR, RF - SM, 60°, S & CL, =10 mm - JT, 60°, FE, CU, RF
			- 4h1				$\left[\right]$		14/2 - 4/						
	AD/ WB HQ3 PQ3 SPT PT	T-Aug V-Aug - Was 3- Win 3- Win 3- Win Γ- Star - Pus	ethod ger drilling T ger drilling V shbore eline core (f eline core (f ndard pene th tube	bit 63.5 mr 35.0 mr tration f	n)		> Inflo ☐ Parti ■ Com ■ Com ■ Core ■ indica		Weathering XW Extremely Weathered HW Highly Weathered MW Moderately Weathered WW Moderately Weathered FR Fresh Strength VL Very Low L Low M Medium H Hedium H High VH Very High	FT - SS - SZ - BP - SM - IS - CO - CZ - VN -	Shear	Surface Zone g parting Seam t d Zone	CN SN VN CO RF G S Z CA CL	ng/Coa - Clean - Stain - Veneer - Coating - Rock fr - Gravel - Sand - Silt - Calcite - Clay - Iron	SL - Slickensided POL - Polished S - Smooth RF - Rough

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Borehole ID

BH04

Page 3 of 4

	-							orehole		Project N		PSM4951	
	Clien				S&G		00014-	Upgrada		Commer		4/02/2023	
			ame: ation:			ed ED		Upgrade		Complete Logged I)4/02/2023 HZ	
		Posi			•			10 m N MGA2020 Zone 54		Checked	•)P	
C	Drill I	Mode	el and M	ounti	ng:	Coma	acchio	Geo 305 Inclination:	-90°	RL Surfa	ce: 309.0	00 m	
			be and L		•	HQ3		Bearing:	Datum:	AHD		rator: MacGeo	
		Drill	ling Info	ormat	ion			Rock Sul	ostance			F	Rock Mass Defects
			p	ons)			5	Material Description			Strength Is(50)		Defect Descriptions / Comme
_		(%	Samples and Field Tests	WPT (Lugeons)			Graphic Log	ROCK NAME: particle/grain char	acteristics,	Weathering	● - Axial 〇 - Diametral	Defect Spacing	Description, alpha/beta, infillir
Method	Water	RQD (%)	ampl eld T	PT (RL	Depth	raphi	colour, fabric/texture, inclusions components, moisture, mineral compo	or minor		0.1 0.3 3 10	(mm) ັ	or coating, shape, roughnes thickness, other
≥	3	Ř	ЗШ	3	(m)	(m)	U			X Y M S K	ᆿᄀᅙᅚᅀᆋ	<pre><20</pre> <pre><20</pre> <pre>1000</pre>	,
								GNEISS: medium to coarse grained, orange/brown/grey/pale grey, layered	orange/pale .(<i>continued</i>)				—JT, 80°, FE, UN, RF
							$\left(\right)$						
						-							
						_	$\left(\frac{1}{2}\right)$						─JT, 70°, FE, CU, RF ─JT, 80°, FE, UN, RF
		77											☐ JT, 60°, FE, UN, RF
						-							SM, 80°, CL, =4 mm SM, 80°, CL, =15 mm
					303.0	6-							— JT, 70°, FE, PR, RF — SM, 70°, RF & CL, =50 mm
					ň		$\left(\right)$						
						-							
						-	(:)						— JT, 80°, FE, PR, RF
													—JT, 35°, FE, PR, RF
						-							T, 80°, FE, PR, RF JT, 80°, FE, PR, RF
					302.0	7-							L ^I JT, 35°, FE, UN, RF
	ð				e N		$\left(\right)$						JT, 35°, FE, PR, RF FL, 5°, FE, PR, RF
	ntere	~											JT, 85°, FE, CU, RF
2	ncon	17				-							¹ JT, 70°, FE, UN, RF ¹ JT, 85°, Fe & Clay, CU, RF
	Not Encountered					-	$\left(\begin{array}{c} \cdot \cdot \cdot \\ \cdot $						¹ JT, 85°, FE, CU, RF
	z												
						-							
					301.0	8-	$\left(\right)$						
						_							— JT, 85°, FE, UN, RF
										<u>G</u> ii			51, 05 , 1 E, 0N, N
						-							- JT, 70°, FE, CU, RF
						-	$\left(\begin{array}{c} \cdot \cdot \cdot \\ \cdot \cdot \\ \cdot \end{array}\right)$,,,,,,
													—JT, 80°, FE, UN, RF
		94				-							
					300.0	9-							— FL, 20°, Fe & Clay, IR, RF
						_							
													—JT, 70°, FE, UN, RF
													—JT, 70°, FE, PR, RF
						-							— JT, 85°, FE, UN, RF
		93				_							
													JT, 75°, FE, CU, RF
		M	ethod	I	L	L	Wa		athering		ct Type	Infilling/Coa	ting Roughness
			ger drilling T ger drilling V				> Inflov	W HW - Hi	tremely Weathered ghly Weathered	FT - Fau SS - She	ult ear Surface	CN - Clean SN - Stain	SL - Slickensided POL - Polished
	WB	- Wa	shbore eline core (i		m)		Partia		oderately Weathered ightly Weathered		ding parting	VN - Veneer CO - Coating RF - Rock fra	RF - Rough
	PQ	3- Wir	eline core (ndard pene	85.0 mi	m)			Stre	ength		lled Seam	RF - Rock fra G - Gravel S - Sand	Shape
			sh tube				_ Core r	ecovered (hatching L - Lo	ery Low w edium	CO - Cor CZ - Cru	ntact ished Zone	Z - Silt CA - Calcite	PR - Planar CU - Curved
	WP	T-Wa	ter pressure	e test		\boxtimes		H - Hi			cture Zone	CL - Clay FE - Iron	UN - Undulating ST - Stepped
							e investiga	FH . F	tremely High		lding Shear ling Break	QZ - Quartz X - Carbon	IR - Irregular

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Borehole ID

BH04

Page 4 of 4

:: ct Na Loca	ame.	JB	S&G								
	anic.	Bro	oken	Hill Ho	ospita	l Upgrade		Commeno Complete		4/02/2023 4/02/2023	
Posit	tion:		•	ed ED		10 m N MGA2020 Zone 54		Logged B	-	IZ)P	
	l and M	-		-		Geo 305 Inclination	-90°	Checked RL Surfac	,		
	be and L		•	HQ3		Bearing:	-30	Datum:	AHD		rator: MacGeo
Drill	ing Info	ormati	ion			Rock Su	bstance			F	Rock Mass Defects
RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	colour, fabric/texture, inclusion	s or minor		Strength Is(50) ● - Axial O - Diametral	Defect Spacing (mm) ତି ର ରି ତି	Defect Descriptions / Comme Description, alpha/beta, infilli or coating, shape, roughnes thickness, other
93		-	1 298.0	- - 11 — -							- JT, 75°, FE, CU, RF JT, 75°, FE, PR, RF CZ, 60°, RF & CL, =60 mm - JT, 85°, Fe & Clay, UN, RF - FL, 45°, Fe, UN, RF - SM, 45°, Fe & Clay, =10 mm - JT, 70°, FE, PR, RF
			297.0	- <u>12</u>		Hole Terminated at 12.00 m Target depth					^L SM, 70°, Fe & Clay, =10 mm —CZ, 30°, RF & CL, =40 mm —JT, 70°, FE, CU, RF
		-	1 296.0	- 13							
		-	1 295.0	- - 14 -							
- Aug / - Aug - Was - Wire - Wire - Star	er drilling T er drilling V shbore eline core (i eline core (i ndard pene	/ bit 63.5 mn 85.0 mn	n)	<	> Inflo ☐ Parti 【 Com 【 Com _ Core	w XW - E HW - H HW - H al Loss MW - M plete Loss SW - S pg/Core Loss FR - F v VL - V recovered (hatching L - L	xtremely Weathered ighly Weathered loderately Weathered lightly Weathered resh ength ery Low ow	FT - Fault SS - Shea SZ - Shea BP - Bedd SM - Sean IS - Infille JT - Joint CO - Conta CZ - Crus	ir Surface ir Zone ling parting n ed Seam act	Infilling/Coa CN - Clean SN - Stain VN - Veneer CO - Coating RF - Rock fr G - Gravel S - Sand Z - Sitt CA - Calcite	SL - Slickensided POL - Polished S - Smooth agments VR - Rough Shape PR - Planar
	B3 B34 COD (%) - Auggaba - Source - Auggaba - Water -	(%) Pussibility (%) Base of the set of	(%) OD Pussible (%) OD Base of the second secon	So -So -So -S	(%) (%) <td>Image: Construction of the second s</td> <td>(a) (b) (b) (b) (c) (c)<td>Image: Set of the set o</td><td>Image: State of the state</td><td>Strength (stop) Strength (stop) (s) 000 (s) 0000 (s) 000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s</td><td>(9) ODU (9) ODU</td></td>	Image: Construction of the second s	(a) (b) (b) (b) (c) (c) <td>Image: Set of the set o</td> <td>Image: State of the state</td> <td>Strength (stop) Strength (stop) (s) 000 (s) 0000 (s) 000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s</td> <td>(9) ODU (9) ODU</td>	Image: Set of the set o	Image: State of the state	Strength (stop) Strength (stop) (s) 000 (s) 0000 (s) 000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s) 0000 (s	(9) ODU (9) ODU



PointID : BH04 Depth Range: 0.00 - 4.00 m



PointID : BH04 Depth Range: 4.00 - 8.00 m



TITLE

JBS&G Broken Hill Hospital Upgrade 176 Thomas St Core Photo - BH04

DRAWN	DATE	
HZ	04/02/202	23
CHECKED DP	DATE 10/02/202	23
SCALE Not To S	Scale	A4
PROJECT NO PSM4951	FIGURE No 1/2	



PointID : BH04 Depth Range: 8.00 - 12.00 m

		HZ	DATE 04/02/202	23
PSM	JBS&G Broken Hill Hospital Upgrade	CHECKED DP	DATE 10/02/2023	
	176 Thomas St	SCALE Not To S	scale	A4
	Core Photo - BH04	PROJECT № PSM4951	FIGURE No 2/2	

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Borehole ID

BH05

Page 1 of 4

P H	lient: rojec ole L ole P	t Na .oca	tion:	Propos	Hill ed E	D Ar	ea	-		20 Zone 54	Commer Complet Logged Checked	ed: By:			02/20 02/20		
	rill M ole D			-		maccl 5 mm	hio Ge	eo 305	5	Inclination: -90° Bearing:	RL Surfa Datum:	ace:	30 AH	9.00 I D		Oper	rator: MacGeo
			Drill	ing Informati	ion					Soil Descr	iption						Observations
2010	Penetration	Support	Water	Samples Tests Remarks	Recovery	RL (m)	RL Depth m) (m) C		Classification Symbol	Material Description SOIL NAME: Plasticity, beh particle characteristics of f component, colour, secondary additional observatio	aviour or primary components,	Moisture Condition	Consistency / Relative Density	Pene L (ł	and trome JCS (Pa)		Structure, Zoning, Origin, Additional Observations
		z	ered				-		GW	SEALED PAVEMENT: 60 mm Sandy GRAVEL: to 30 mm, well angular, grey-brown; sand fine to		м	D			0.	00: PAVEMENT 06: ROADBASE
		z	Not Encountered	SPT 0.50-0.59 m 15 (refusal)	ZZ		-			GNEISS: grey/pale brown, extrem weathered, very low strength		D to M					
ł						308.0	1-			Continued on cored borehole she	- <u></u>						1.00: TC-bit refusal
						306.0 307.0	2										
	 	Hetho Auge Auge Stan	o d er dril hbore dard	ling TC bit ling V bit e penetration test	Pe	0.200 0.200 <i>netrat</i> o resis	4		$>$ Inflo \lhd Par	ater Samples a by U - Undisturbed tial Loss D - Disturbed S nplete Loss ES - Environmer	Sample		M	re Co - Di - M - W	y oist	n	Consistency/Relative Dens VS - Very soft S - Soft F - Firm St - Stiff
	I - S -	Pusr Auge	r tude er scr	ewing us push tube 1.8		ng 76r				TW - Thin Walled LB - Large Distu							VSt - Very stiff H - Hard VL - Very loose L - Loose MD - Medium dense D - Dense VD - Very dense

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Borehole ID

BH05

Page 2 of 4

n	ngi	nee	ering	Log	J - C	ore	d Bo	orehole		Project	t No).:		PSM49	951										
	Clien				S&G					Comm				04/02/2											
	-		ame: ation:			Hill Ho ed ED		Upgrade		Compl Logge				04/02/2 HZ	2023										
		Posi						15 m N MGA2020 Zone 54		Check				DP											
D	Drill I	Mode	and M	ounti	ng:	Coma	acchio	Geo 305 Inclination	: -90°	RL Su	rfac	e:	309	.00 m											
В	Barre	el Typ	be and L	engt	h:	HQ3	3 m	Bearing:		Datum	:		AHE)	Ope	rator: MacGeo									
		Drill	ling Info	ormat	ion		Rock Substance									Rock Substance									Rock Mass Defects
			р	ons)			6	Material Description					ngth 50)			Defect Descriptions / Comme									
2		(%)	les ar Tests	(Luge			lic Log	ROCK NAME: particle/grain cha		Weatheri	ng		Axial ametral	Def Space	cing	Description, alpha/beta, infilli									
Mellion	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic I	colour, fabric/texture, inclusior components, moisture, mineral comp		WX AW MA NS	FR FR	⊠ L 5 0.3	т н н - ° б	(mi 3 8 8		or coating, shape, roughnes thickness, other									
						-					 														
						-																			
					308.0	-	\searrow	Continued from non-cored borehole	sheet																
						-		GNEISS: medium grained, pale grey orange, layered, extremely fractured	 /-brown/pale rockmass.																
						-																			
						-																			
					0	-										JT, 80°, Fe & Clay, PR, RF									
		6			307.0	2-	$\left(\left(\left$									— JT, 80°, Fe & Clay, PR, RF									
						-																			
						-										— JT, 80°, Fe & Clay, UN, RF									
	ered					-					i I					– JT, 80°, Fe & Clay, PR, RF									
	ncountered				0.0	-										JT, 90°, Fe & Clay, CU, RF									
	Not En				306	3-																			
						-										→ JT, 90°, Fe & Clay, CU, RF → SM, 80°, CL, =3 mm									
						-										└ JT, 70°, FE, CU, RF									
		21				-										- JT, 80°, Fe & Clay, PR, RF									
						-										—SM, 45°, CL, =5 mm									
					305.0	4-										— JT, 80°, FE, PR, RF									
						-										SM, 60°, RF & CL, =150 mr									
						-																			
		0				-																			
						-																			
	AD/	T - Auc	e thod Jer drilling T	C bit		2	Wa > Inflov	XW - 1	eathering Extremely Weathered	FT -	Fault	Тур			Clean	SL - Slickensided									
	AD/ WB	V-Aug - Wa	jer drilling V shbore	/ bit	~)	<	Parti	al Loss MW - I SW - SW - S	Highly Weathered Moderately Weathered Slightly Weathered	SS - SZ - BP -	Shear Beddi	[.] Zone ng part		VN CO -	Stain - Veneer Coating	g RF - Rough									
	PQ	3- Win	eline core (eline core (ndard pene	85.0 mr	m)			FR - I	⁻ resh rength	SM - IS - JT -	Seam Infille		-	RF - G - S -	Rock fra Gravel Sand	agments VR - Very Rough Shape									
	PT	- Pus	h tube				Core	ecovered (hatching L - I tes material) M - I	/ery Low ∟ow Medium	CO - CZ - VN -	Conta Crush		ie	Z - CA-	Silt Calcite Clay	PR - Planar									
	WP	∶ı-Wa	ter pressure	e test		chnical site	– No co	re recovery VH - VH	High /ery High Extremely High	FZ - BSH -	Fractu Beddi		ar	FE - QZ -		ST - Stepped IR - Irregular									

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Borehole ID

BH05

Page 3 of 4

Pro Ho	ble	ct Na	ame: ition: tion:	Bro Pro	opose	ed ED	Area	l Upgrade 15 m N MGA2020 Zone s	54		Commen Complete Logged E Checked	əd: By:	C F	94/02/2023 94/02/2023 1Z OP	
			el and M be and L		•	Coma HQ3			ination: -90° aring:		RL Surfa Datum:		309.(AHD)0 m Ope	erator: MacGeo
			ing Info	-		IIQU	0 III		ock Substance		Datam.	,			Rock Mass Defects
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Des ROCK NAME: particle/g colour, fabric/texture, ii components, moisture, miner	rain characteristics nclusions or minor	s, eration	Veathering ≹ ≩ ≩ & ⊮) al	Defect Spacing (mm) ଝି _{ଡି} ଝି ଛି ଛି	Defect Descriptions / Comn Description, alpha/beta, inf or coating, shape, roughn thickness, other
HQ3	Not Encountered	0 06			300.0 301.0 302.0 303.0			GNEISS: medium grained, p orange, layered, extremely fr rockmass.(continued)	actured	//pale					 SM, 60°, CL, =20 mm JT, 90°, Fe & Clay, UN, RI JT, 80°, Fe & Clay, ST, RF JT, 50°, FE, UN, RF JT, 40°, FE, PR, RF GZ, 20°, RF, =30 mm JT, 40°, FE, IR, RF FL, 0°, FE, IR, RF FL, 0°, FE, IR, RF GZ, 0°, RF, =20 mm FL, 15°, FE, IR, RF GZ, 0°, RF, =20 mm FL, 15°, FE, IR, RF GZ, 0°, RF, =20 mm SM, 30°, FE, UN, RF SM, 30°, CL, =15 mm JT, 80°, FE, UN, RF
	AD/\	T - Aug √ - Aug	e thod er drilling T er drilling V				· · · · · · · · · · · · · · · · · · ·		Weathering XW - Extremely Weat HW - Highly Weather HW - Highly Weather	ed	FT - Fau	ear Surface		I I I I	SL - Slickensided POL - Polished
	HQ3 PQ3 SPT PT	8- Wire 6- Wire 7- Star - Pus	shbore eline core (6 eline core (8 ndard penet h tube ter pressure	35.0 mr tration t	n)	-	Com Com Core	plete Loss og/Core Loss recovered (hatching tes material)	SW - Slightly Weathe FR - Fresh Strength VL - Very Low L - Low M - Medium H - High	red	SM - Sea IS - Infil JT - Joir CO - Cor	led Seam nt ntact shed Zone		CO - Coatin RF - Rock f G - Gravel S - Sand Z - Silt CA - Calcite CL - Clay FE - Iron	ragments VR - Very Rough Shape PR - Planar

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Borehole ID

BH05

Page 4 of 4

Ξn	gi	nee	ering	Log	- C	ore	d Bo	orehole		Project N	р.: I	PSM4951			
P H	lole	ect Na	ame: ation: tion:	Bro Pro	opose	ed ED	Area	l Upgrade 15 m N MGA2020 Zone 54		Commene Complete Logged B Checked	d: (y: I)4/02/2023)4/02/2023 HZ DP			
			el and M be and L		-	Coma HQ3		Geo 305 Inclinat Bearing		RL Surfac	e: 309. AHD	00 m	erator: MacGeo		
D	ane		ling Info	-			3 111		J. Substance	Datum.	And		Rock Mass Defects		
Method	Water	RQD (%)	Samples and Field Tests	WPT (Lugeons)	RL (m)	Depth (m)	Graphic Log	Material Descrip ROCK NAME: particle/grain colour, fabric/texture, inclu components, moisture, mineral co	tion characteristics, sions or minor		Strength Is(50) - Axial - Diametral	Defect Spacing (mm) _{ସି} ତ _{ଛି} ଛି ଛି	Defect Descriptions / Comment Description, alpha/beta, infilling or coating, shape, roughness, thickness, other		
COLL COLL	Not Encountered	87			 298.0	- - 11		GNEISS: medium to coarse graii grey/pale brown/pale orange, lay					 — SM, 70°, Fe & Clay, =15 mm — JT, 45°, FE, PR, RF ~ JT, 85°, FE, CU, RF ~ JT, 60°, Fe & Clay, PR, RF ~ JT, 85°, FE, CU, RF ~ JT, 80°, FE, PR, RF ~ JT, 45°, FE, UN, RF ~ JT, 45°, RF & FE, UN, RF ~ JT, 45°, RF & FE, UN, RF 		
					297.0	- - 12 - -		Hole Terminated at 12.00 m Target depth							
					296.0	- 13— -									
					 295.0	- - 14 - -									
	AD/ WB HQ3 PQ3 SPT PT	T-Aug V-Aug - Wa 3- Win 3- Win Γ- Star - Pus	ethod per drilling T per drilling V shbore eline core (eline core (ndard pene h tube ter pressure	/ bit 63.5 mr 85.0 mr tration t	n)	<	> Inflov ☐ Partia ■ Com Dhic Lo _ Core n indica	V HW al Loss MW	Weathering - Extremely Weathered - Highly Weathered - Moderately Weathered - Slightly Weathered - Fresh Strength - Very Low - Low - Medium - High - Very High	FT - Fault SS - Shea SZ - Shea	rr Surface rr Zone ling parting n d Seam act hed Zone ture Zone	Infilling/Coo CN - Clean SN - Stain VN - Venee CO - Coatin RF - Rock f G - Gravel S - Sand Z - Sitt CA - Calcite CL - Clay FE - Iron QZ - Quartz	SL - Slickensided POL - Polished g RF - Rough ragments VR - Very Rough Shape PR - Planar cU - Curved UN - Undulating ST - Stepped		





PointID : BH05 Depth Range: 8.00 - 12.00 m

JBS&G DATE 04/02/2023 Broken Hill Hospital Upgrade DP DATE 04/02/2023 SCALE Not To Scale A4					
P S DP DATE 10/02/2023 Broken Hill Hospital Upgrade 176 Thomas St SCALE Not To Scale A4			HZ		23
176 Inomas St Not To Scale A4	P S M		CHECKED DP	DATE 10/02/202	23
		-		Scale	A4
Core Photo - BH05 PROJECT № PSM4951 FIGURE № 2/2		Core Photo - BH05	PROJECT № PSM4951		

18.GLB Griefin DG PHOTO CORE PHOTO 2 PER PAGE A4P PSMATRY V2.-TRN GPJ -4 Gammergiles- 16165/2022 16:20. 10.02.00.04 Daggel Fores and Map. Tool LLb. PSM 3.02.12.19:43:46 Pg. PSM 3.02.20.201

Appendix B Point Load Index Test Results



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POINT LOAD STRENGTH INDEX TEST RESULTS

lob No.	PSM4951																Sheet	1	of	3
Project	Broken Hill	Hospital	Upgrade																	
est Method	AS 4133.4.1-2 Determination		-		r engine	ering purpo	oses	-	Sampling Technique Storage History	HQ							Sampling Testing D			3 & 3/2/2023 3 & 3/2/2023
est Machine	GSA 6510-07	02							Moisture Condition	Natural							Tested By	v	ΗZ	
Calibration Date	27/10/2022								Loading Rate	< 30 sec	onds							•		
						Dia	amet	ral Te	-					Axial	Tes	ts				
Rock T	vpe	Location	Depth	D	L	P		s(50)		W	D	Р		I _s	1	s(50)				AS 1726:20
	51 · ·		(m)	(mm)	(mm)	(kN)		s(50) MPa)	Failure Mode	(mm)	(mm)	(kN)		's (MPa)		MPa)	Fai	lure N	lode	Strength Cl
Gneis	s	BH01	2.35	60	40	9.0		2.7	Parallel to foliation	60	40	9.6		3.1		3.3	Throug	ah sul	bstance	H / VH
Gneis		BH01	3.65	60	40	7.3		2.2	Parallel to foliation	60	55	7.7		1.8		2.1	-		oliation	H
Gneis	ss	BH01	4.25	60	40	10.4		3.1	Parallel to foliation					-						VH
Gneis	ss	BH01	5.67	60	35	1.7		0.5	Parallel to foliation	60	37	4.5		1.6		1.6	Throu	gh sul	bstance	M/H
Gneis	ss	BH01	6.60	60	41	12.5		3.8	Through substance	60	40	8.0		2.6		2.7			bstance	
Gneis	ss	BH01	7.50	60	40	12.9		3.9	Through substance	60	30	6.7		2.9		2.9	-	-	bstance	
Gneis	ss	BH01	8.05	60	38	2.6		0.8	Through substance	60	40	3.4		1.1		1.2	-	-	bstance	
Quartz	rite	BH01	9.20	60	40	15.1		4.6	Through substance	60	39	23.9)	8.0		8.3	-	-	bstance	
Quartz	rite	BH01	10.50	60	40	> 17.7	>	5.3	Bad break											≥ VH
Quartz	rite	BH01	11.80	60	35	6.6		2.0	Through substance	60	40	6.3		2.1		2.2	Throug	gh sul	bstance	Н
							0													
							0													
Gneis	ss	BH02	1.68	60	40	1.2	0	0.4	Parallel to foliation	60	40	> 1.2	>	0.4	>	0.4	Bad bi	reak		М
Gneis	ss	BH02	2.27	60	45	2.3	0	0.7	Through substance	60	45	0.3		0.1		0.1	Throug	gh sul	bstance	VL/N
Gneis	s	BH02	3.46	60	35	> 24.6	>	7.4	Bad break									-		≥ VH
Gneis	ss	BH02	4.70	60	35	13.0	0	3.9	Through substance	60	35	5.9		2.2		2.2	Throug	gh sul	bstance	H / VH
Gneis	ss	BH02	5.89	60	60	> 2.9	>	0.9	Bad break											≥ <i>M</i>
Gneis	ss	BH02	6.48	60	35	0.9	0	0.3	Parallel to foliation	60	35	2.7		1.0		1.0	Throug	gh sul	bstance	L/H
Quartz	tite	BH02	7.64	60	40	> 21.5	>	6.5	Bad break											≥ VH
Quartz	rite	BH02	8.33	60	150	> 22.7	>	6.8	Bad break											≥ VH
Gneis	ss	BH02	9.52	60	41	10.5	0	3.2	Parallel to foliation	60	36	16.9)	6.1		6.3	Throug	gh sul	bstance	VH
Gneis	ss	BH02	10.49	60	45	7.2	0	2.2	Through substance	60	45	> 8.7	>	2.5	>	2.7	Bad bi	reak		Н
Gneis	ss	BH02	11.54	60	36	6.8	0	2.1	Parallel to foliation	60	35	9.4		3.5		3.6	Throug	gh sul	bstance	H/VH
							0													
							0													
By:	HZ			Checke	al.)P									Date:		10/2/2	022

N:\PSM4951\Eng\gINT\[PSM4951 Point Load - Axial, Diametral.xlsx]Result Sheet (1 of 3)



POINT LOAD STRENGTH INDEX TEST RESULTS

Job No.	PSM4951																Sheet	2	of	3
Project	Broken Hil	l Hospital	Upgrade																	
est Method	AS 4133.4.1-	2007 Metho	ds of testing	g rocks fo	r engine	ering purp	oses	s -	Sampling Technique	HQ							Samplin	g Date	1/2/20	23 & 4/2/2023
	Determinatio	n of point loa	ad strength	index					Storage History								Testing	Date	1/2/20	23 & 4/2/2023
est Machine	GSA 6510-07	702							Moisture Condition	Natural							Tested I	Зу	ΗZ	
Calibration Date	27/10/2022								Loading Rate	< 30 seco	onds									
						D	iame	etral Te						Axia	Те	sts				
Rock T	vpe	Location	Depth	D	L	 P		I _{s(50)}		W	D	F	D	I _s		I _{s(50)}				AS 1726:20
) F -		(m)	(mm)	(mm)	(kN)		's(50) (MPa)	Failure Mode	(mm)	(mm)		N)	(MPa)		's(50) (MPa)	Fa	ailure	Mode	Strength Cla
Gneis	s	BH03	0.96	60	60	> 6.9	>	2.1	Bad break	60	、 ,		, 1.9 :		>		Alone	g defe	ct	≥ H
Gneis		BH03	1.30	60	50	> 3.0	>	0.9	Along defect									,		≥ <i>M</i>
Quartz	rite	BH03	2.05	60	40	> 15.2	>	4.6	Along defect											≥ VH
Quartz	rite	BH03	3.30	60	40	> 23.8	>	7.2	Bad break											≥ VH
Gneis	s	BH03	3.95	60	50	> 10.1	>	3.1	Bad break											≥ VH
Quartz	rite	BH03	4.40	60	40	> 5.6	>	1.7	Along defect											≥ <i>H</i>
Quartz	rite	BH03	5.15	60	40	> 3.6	>	1.1	Bad break											≥ <i>H</i>
Quartz	rite	BH03	6.45	60	35	10.8		3.2	Through substance	60	35	> 1	1.4 >	> 0.5	>	0.5	Along	g defe	ct	VH
Quartz	rite	BH03	7.95	60	70	> 6.7	>	2.0	Bad break											≥ <i>H</i>
Quartz	rite	BH03	8.50	60	35	7.3		2.2	Through substance	60	35	2	2.4	0.9		0.9	Along	g defe	ct	M/H
Gneis	s	BH03	9.70	60	80	> 4.5	>	1.4	Bad break											≥ <i>H</i>
Gneis	s	BH03	10.60	60	35	8.6		2.6	Through substance											н
Gneis	s	BH03	11.80	60	50	> 14.3	>	4.3	Bad break											≥VH
Gneis	ss	BH04	2.25	60	62	> 11.3	>	3.4	Bad break											≥ VH
Gneis	s	BH04	3.40	60	40	> 7.1	>	2.1	Along defect											≥ <i>H</i>
Gneis	s	BH04	4.05	60	45	> 5.9	>	1.8	Bad break											≥ <i>H</i>
Gneis	s	BH04	5.33	60	50	> 4.3	>	1.3	Bad break											≥ <i>H</i>
Gneis	ss	BH04	6.46	60	50	> 1.5	>	0.5	Bad break											≥ <i>M</i>
Gneis		BH04	8.38	60	50	> 1.1	>	0.3	Bad break											≥ <i>M</i>
Gneis	s	BH04	9.73	60	220	> 8.7	>	2.6	Bad break											≥ <i>H</i>
Gneis	s	BH04	10.95	60	60	> 2.5	>	0.7	Along defect											≥ <i>M</i>
Gneis	s	BH04	11.94	60	42	4.8		1.5	Parallel to foliation											Н
y:	HZ			Checke	d:			DP									Date:		10/2/	/2023

N:\PSM4951\Eng\gINT\[PSM4951 Point Load - Axial, Diametral.xlsx]Result Sheet (1 of 3)



POINT LOAD STRENGTH INDEX TEST RESULTS

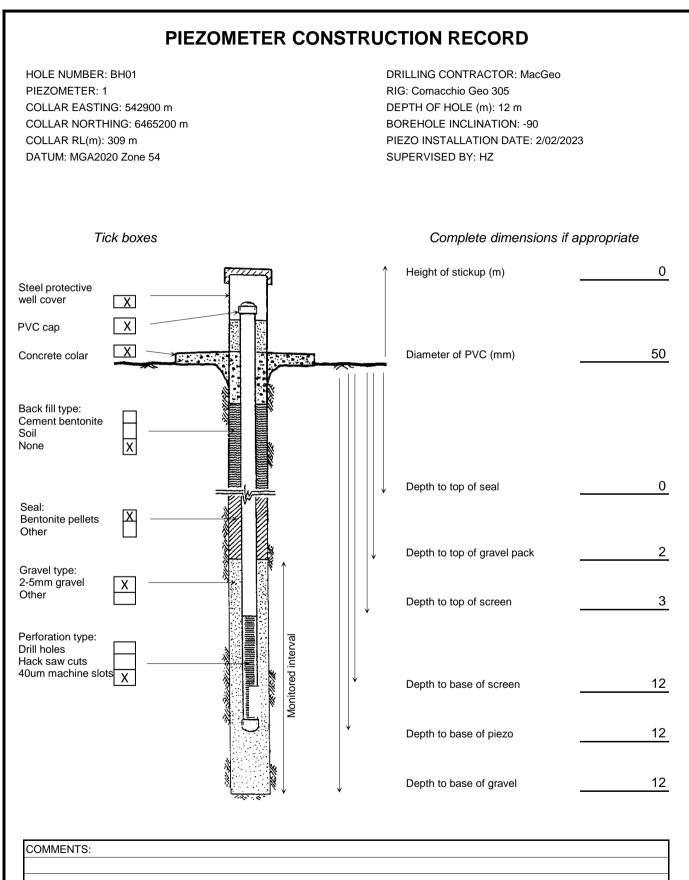
Job No.	PSM4951													Sheet	3	of	3
Project	Broken Hill Hospital	Upgrade															
est Method	AS 4133.4.1-2007 Metho Determination of point lo			r engine	ering purp	oses	; -	Sampling Technique Storage History	HQ					Sampling I Testing Da		4/2/2023 4/02/202	
est Machine	GSA 6510-0702							Moisture Condition	Natural					Tested By		HZ	
Calibration Date	27/10/2022							Loading Rate	< 30 sec	conds							
		Depth			D	iame	etral Te	ests				Axial	Tests				10 1700 00
Rock T	ype Location	(m)	D (mm)	L (mm)	P (kN)		l _{s(50)} (MPa)	Failure Mode	W (mm)	D (mm)	P (kN)	l _s (MPa)	I _{s(50)} (MPa)	Failu	ure M	lode	AS 1726:20 Strength Cla
Gneis	SS BH05	3.47	60	60	> 1.5		0.4	Along defect		()		, ,					≥ <i>M</i>
Gneis	SS BH05	4.54	60	60	> 0.6	>	0.2	Along defect									≥L
Gneis		5.20	60	50	> 0.5	>	0.2	Bad break									≥L
Gneis		6.51	60	70	> 4.5		1.3	Along defect									≥ H
Quartz		7.55	60	50	> 15.0		4.5	Bad break									≥ VH
Gneis		8.70	60	50	12.8		3.9	Through substance	60	42	5.8	1.8	1.9	Throug	h sub	stance	H/VH
Gneis		9.65	60	50	> 1.5		0.4	Along defect									≥ <i>M</i>
Gneis Gneis		10.20 11.80	60 60	60 50	> 2.8 > 5.6		0.9 1.7	Along defect Along defect									≥ M ≥ H
y:	HZ	1	Checke	d:			DP		1				1	Date:		10/2/20	23

Appendix C Piezometer Construction Records



JOB no.: PSM4951

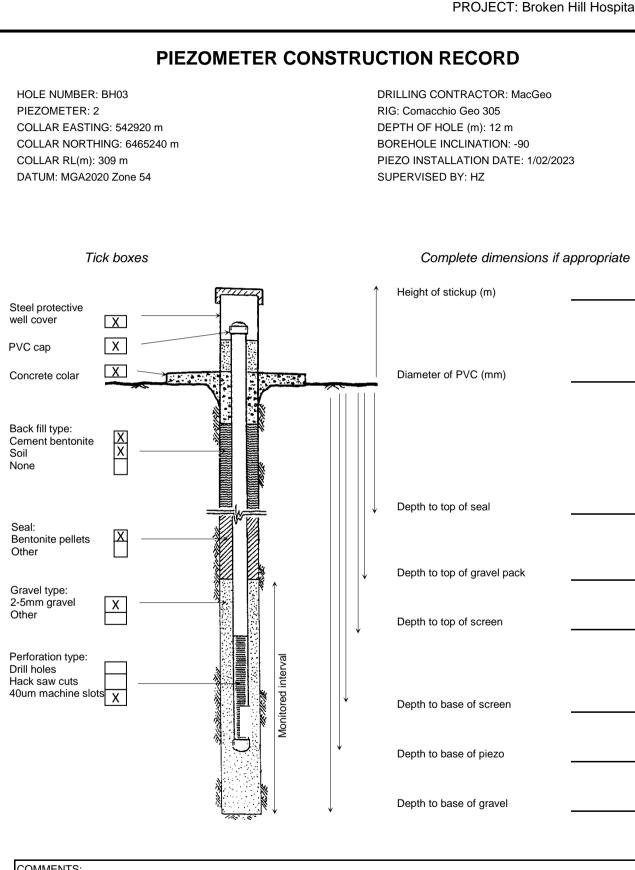
PROJECT: Broken Hill Hospital



PSM Engineering Consultants Rock - Soil - Water

JOB no.: PSM4951

PROJECT: Broken Hill Hospital

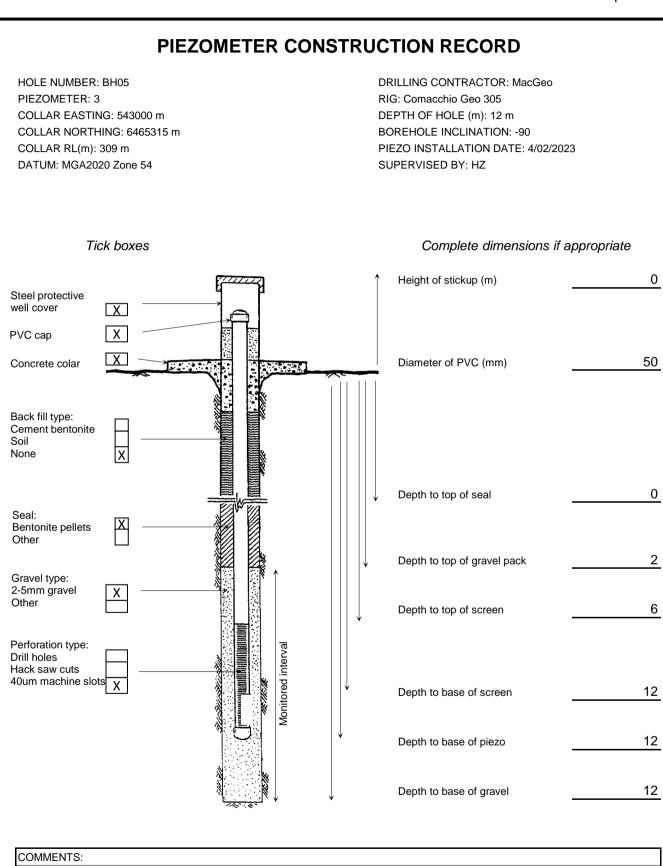


COMMENTS:



JOB no.: PSM4951

PROJECT: Broken Hill Hospital





Appendix D CBR Test Results



		CALIFO	ORNIA BE	ARING RATIO	REPOR	Т			
Clier	nt	PSM		Source	Sample 1 0.0-0	0.5m			
Addr	ess	g3, 56 Delhi Rd, North	Ryde, NSW, 2113	Sample Description	Clayey Gravelly SAND				
Proje	ect	Broken Hill Hospital Up	grade (PSM4951	Report No.	S83998-CBR	S83998-CBR			
Job I	No.	S23043-1		Sample No.	S83998				
Test	Procedure		RMS T117	California Bearing Ratio					
		 ✓ AS 1289.5.1.1 ☐ AS 1289.5.2.1 	RMS T111 RMS T112 RMS T112	Dry Density / Moisture Co Dry Density / Moisture Co	ntent Relationship -	Modified Compaction			
Sam	pling	AS 1289.2.1.1 Sampled by Client - results	RMS T120 apply to the sample as r	Moisture Content - Oven I eceived	Drying Method (Star	ndard Method) Date Sampled	Unknown		
	aration	Prepared in accordance wit	h the test method			Date Tested	13/03/2023		
	8								
	7								
	6								
	0								
	5								
()									
ad (kN)	4								
Load	3			Corrected 5.0					
	2		Corrected 2.5						
	1								
	1								
	0	Corrected Zero							
	0	1 2 3	4 5	6 7 8 Penetration (mm)	9 10	0 11	12 13		
P	reparation	& Specification		Density & Moisture		Achieved	Target		
R	etained on 1	19.0mm Sieve (%)	3	Lab Moisture Ratio - LMR	. (%)	98.5	100.0		
Μ	lethod of Est	tablishing Plasticity Level	Technician Assessment	Lab Density Ratio - LDR ((%)	98.5	98.0		
S	ample Curin	ng Time (hrs)	48 hrs	Dry Density - At Compact	ion (t/m³)	2.05	2.04		
С	ompaction H	Hammer Used	Standard	Dry Density - After Soakir	ng (t/m³)	2.05			
S	urcharge Ma	ass Applied (kg)	4.5	Specimen Swell (%)		0.0			
		aking (Days)	4	Moisture Content - At Cor		9.9			
	-	y Density - MDD (t/m ³)	2.09	Moisture Content - Top 30		10.7			
0	ptimum Moi	isture Content - OMC (%)	10.1	Moisture Content - Rema	inder (%)	10.6			
		Material CE	3R Value (%):	17 at a penetra	tion of 5.0	mm			
Note	S								
		A 10-14	150 47000		Authorised Sig	natory:			
	~	Accredited for compliance with ISO.	and/or measurements include	d	ins	2	1/02/2022		
		in this document are traceable to An This document shall not be reprodu Results relate only to the samples t	ced, except in full.			1	4/03/2023		
		NATA Accredited Laborat	ory Number: 14874		Chris Llo	yd	Date:		
G	CQUAR EOTEC	RIE				14 Carter	Geotechnical St NSW 2141		

1	DRY D	DENS	TY/	OF	PTI	MU	M	MO	IS	τu	RE	СС	DN	TE	ENT	R	EP	OR	Т	
Client	PSM	PSM					Source Sample 1 0.0-0.5m													
Address	g3, 56 De	lhi Rd, Nor	ih Ryde,	NSW,	, 2113					mple scrip										
Project	Broken Hi	ill Hospital	Jpgrade	(PSM	4951				Re	port l	No	S83	S83998-MDD							
Job No	S23043-1								Sa	mple	No	S83	S83998							
Test Procedu Sampling Preparation	Ire	0		2.1.1 results ince wi y D(Moist s apply ith the ensi ensi num D	ure Co to the st test me ity/l ity/l 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ntent - sample ethod Moi	stur stur isture ((t/m ³) nt (%) e (%)	eived e Co		d (Star	ndard I	Vetho		ate Sa ate Te	-	d		nown 3/2023	
						С	uring	Time					94 hi	rs						
Notes				Liqui	id Lim	nit Det	ermin	ation			Te	chnici	an As	ssess	sment					

	According for compliance with ICO/IEC 17025 Testing	Authorised Signatory:	
NATA	Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. This document shall not be reproduced, except in full. Results relate only to the samples tested.	(je	14/03/2023
	NATA Accredited Laboratory Number: 14874	Chris Lloyd	Date:
MACQUA GEOŢEC			Macquarie Geotechnical 14 Carter St Lidcombe NSW 2141

	CALIFO	ORNIA BE	ARING RATIO	REPOR	Т			
Client	PSM		Source	Source Sample 2 0.0-0.5m				
Address	g3, 56 Delhi Rd, North	Ryde, NSW, 2113	Sample Description	Silty Sandy CL	Silty Sandy CLAY, trace of Gravel			
Project	Broken Hill Hospital Up	ograde (PSM4951	Report No.	S83999-CBR				
Job No.	S23043-1		Sample No.	S83999				
Test Procedure	✓ AS 1289.6.1.1	RMS T117	California Bearing Ratio					
	 ✓ AS 1289.5.1.1 ☐ AS 1289.5.2.1 	RMS T111 RMS T112	Dry Density / Moisture Co Dry Density / Moisture Co	-	-			
	AS 1289.2.1.1	— П RMS T120	Moisture Content - Oven	-	idard Method)			
Sampling Preparation	Sampled by Client - results Prepared in accordance with		received		Date Sampled Date Tested	Unknown 13/03/2023		
						10/00/2020		
4								
3.5								
3								
2.5								
2 2								
Load								
1.5								
1								
•	¢							
0.5								
0 0	1 2 3	4 5	6 7 8 Penetration (mm)	9 10) 11	12 13		
Preparation &	Specification		Density & Moisture		Achieved	Target		
-	.0mm Sieve (%)	1	Lab Moisture Ratio - LMF	R (%)	100.5	100.0		
Method of Estal	blishing Plasticity Level	Technician Assessment	Lab Density Ratio - LDR	(%)	98.0	98.0		
Sample Curing	Time (hrs)	48 hrs	Dry Density - At Compac	tion (t/m³)	1.79	1.79		
Compaction Ha	ammer Used	Standard	Dry Density - After Soaki	ng (t/m³)	1.79			
Surcharge Mas	s Applied (kg)	4.5	Specimen Swell (%)		0.2			
Period of Soaki	ng (Days)	4	Moisture Content - At Con	mpaction (%)	15.7			
Maximum Dry D	Density - MDD (t/m³)	1.83	Moisture Content - Top 3	0mm (%)	17.4			
Optimum Moist	ure Content - OMC (%)	15.6	Moisture Content - Rema	inder (%)	17.0			
	Material Cl	BR Value (%):	13 at a penetra	tion of 2.5	mm			
Notes								
		150 47005 T I		Authorised Sig	natory:			
NATA	Accredited for compliance with ISC The results of the tests, calibrations in this document are traceable to A This document shall not be reprodu Results relate only to the samples	and/or measurements include ustralian/national standards. uced, except in full.	d	aje	2	4/03/2023		
	NATA Accredited Laborat			Chris Lloy	/d	Date:		
MACQUAR	IE				Macquarie 14 Carter	e Geotechnical		

ſ	DRY DENSITY / OPTIMUM M	OISTURE	CONTENT REPO	ORT	
Client	PSM	Source	Sample 2 0.0-0.5m		
Address	g3, 56 Delhi Rd, North Ryde, NSW, 2113	Sample Description	Silty Sandy CLAY, trace of Grav	el	
Project	Broken Hill Hospital Upgrade (PSM4951	Report No	S83999-MDD		
Job No	S23043-1	Sample No	S83999		
Test Procedur Sampling Preparation	AS1289.2.1.1 Moisture Content - Over Sampled by Client - results apply to the sample as Prepared in accordance with the test method Dry Density/Moist 1.84 1.82 1.80 1.76 1.74 1.72 1.72 1.72 1.72 1.72 1.72 1.74 0 Maximum Dry Density (t/m Optimum Moisture Content (6 Oversize Retained on 19mm sieve (6)	n Drying Method (Star received	Date Sampled Date Tested Relationship 17 18 19 1.830 15.6 10 1.0 0.0 0 0	Unknown 6/03/2023	
	Curing Tin		94 hrs echnician Assessment		
Notes	Liquid Limit Determinatio]	

		Authorized Signatory	
NATA	Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. This document shall not be reproduced, except in full. Results relate only to the samples tested.	Authorised Signatory:	14/03/2023
	NATA Accredited Laboratory Number: 14874	Chris Lloyd	Date:
MACQUAI GEOŢEC			Macquarie Geotechnical 14 Carter St Lidcombe NSW 2141

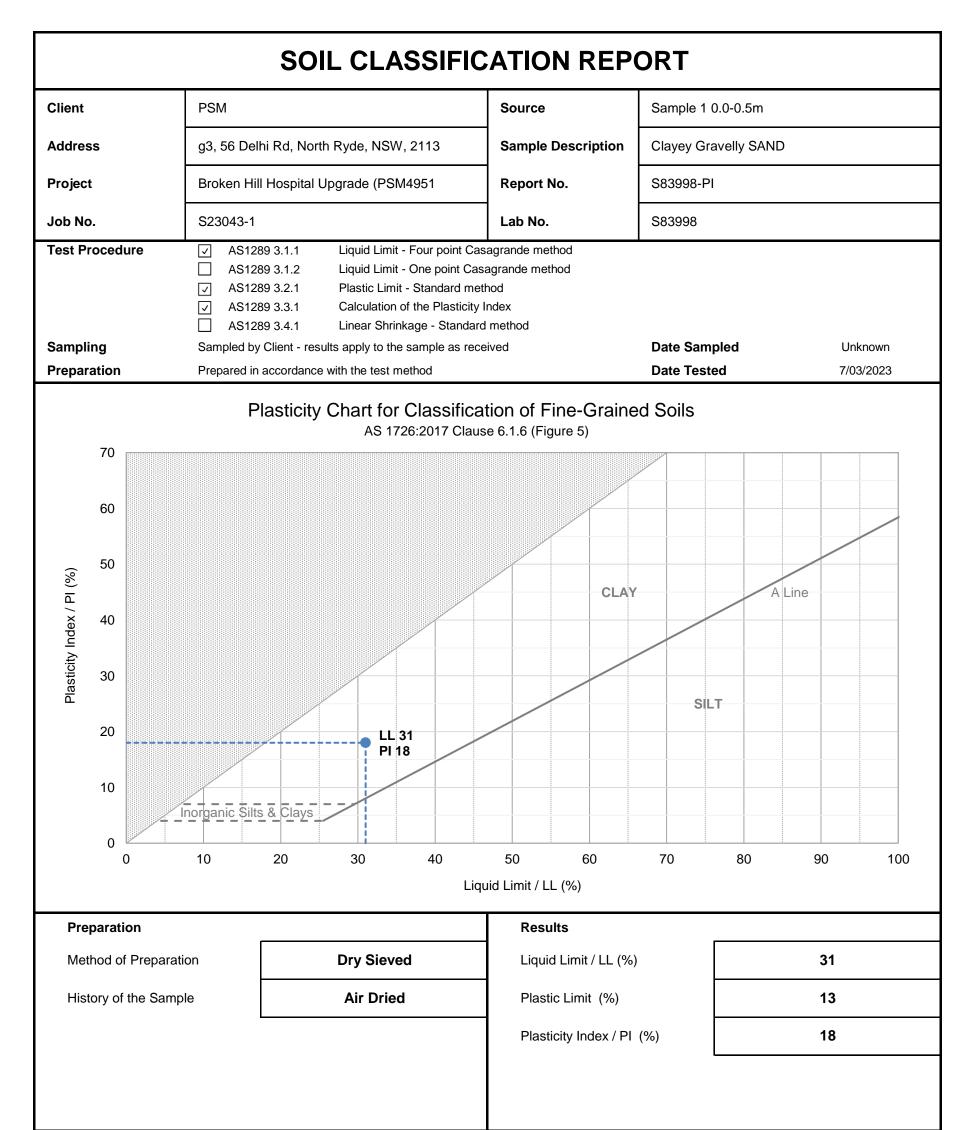
	CALIFO	ORNIA BEA	RING RATIO	REPOR	т		
Client	PSM		Source	Sample 3 (BH0	03) 0.20-0.80m		
Address	g3, 56 Delhi Rd, North	Ryde, NSW, 2113	Sample Description	Silty SAND with Gravel			
Project	Broken Hill Hospital Up	grade (PSM4951	Report No.	S84000-CBR			
Job No.	S23043-1		Sample No.	S84000			
Test Procedure	 ✓ AS 1289.6.1.1 ✓ AS 1289.5.1.1 ✓ AS 1289.5.2.1 	 RMS T117 RMS T111 RMS T112 	California Bearing Ratio Dry Density / Moisture Col Dry Density / Moisture Col		-		
Sampling	AS 1289.2.1.1 Sampled by Client - results	RMS T120	Moisture Content - Oven I	Drying Method (Star	ndard Method) Date Sampled	Unknown	
Preparation	Prepared in accordance wit				Date Tested	13/03/2023	
14							
12							
10							
2 8			prrected 5.0				
9 (kN)							
U LO							
4	Corre	cted 2.5					
•	0						
2	0						
	Ø						
0 Cori 0	rected Żero 1 2 3	4 5	6 7 8 Penetration (mm)	9 10) 11	12 13	
Preparation &	Specification		Density & Moisture		Achieved	Target	
-	.0mm Sieve (%)	1	Lab Moisture Ratio - LMR	(%)	99.5	100.0	
	blishing Plasticity Level	Technician	Lab Density Ratio - LDR (98.0	98.0	
Sample Curing		Assessment 49 hrs	Dry Density - At Compact		2.11	2.11	
Compaction Ha		Standard	Dry Density - After Soakir		2.11		
Surcharge Mas	s Applied (kg)	4.5	Specimen Swell (%)		0.1		
Period of Soaki	ng (Days)	4	Moisture Content - At Cor	npaction (%)	8.1		
Maximum Dry D	Density - MDD (t/m³)	2.16	Moisture Content - Top 30)mm (%)	9.7		
Optimum Moiste	ure Content - OMC (%)	8.1	Moisture Content - Remai	nder (%)	9.6		
	Material CE	BR Value (%):	35 at a penetrat	tion of 2.5	mm		
Notes							
		JEO 47005 . T		Authorised Sig	natory:		
NATA	Accredited for compliance with ISO. The results of the tests, calibrations in this document are traceable to Ar This document shall not be reprodu Results relate only to the samples t	and/or measurements included ustralian/national standards. ced, except in full.		inje	2 14	4/03/2023	
	NATA Accredited Laborat			Chris Lloy	yd	Date:	
MACQUARI GEOŢECH	E				Macquarie 14 Carter S Lidcombe N		

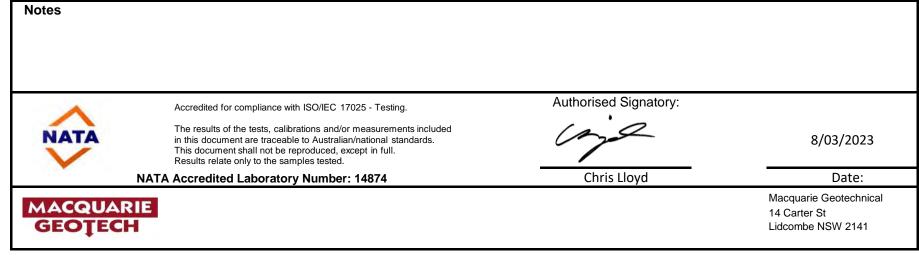
I	DRY DENSITY / OPTIMUM MC	ISTURE	CONTENT REP	ORT	
Client	PSM	Source	Sample 3 (BH03) 0.20-0.80m Silty SAND with Gravel S84000-MDD		
Address	g3, 56 Delhi Rd, North Ryde, NSW, 2113	Sample Description			
Project	Broken Hill Hospital Upgrade (PSM4951	Report No			
Job No	S23043-1	Sample No	S84000		
Test Procedu Sampling Preparation	AS1289.2.1.1 Moisture Content - Oven I Sampled by Client - results apply to the sample as red Prepared in accordance with the test method	Drying Method (Star eived	ndard Method) Date Sampled Date Tested	Unknown 6/03/2023	
	Oversize Retained on 37.5mm sieve (%)		0.0	-	
	Curing Time		68 hrs	1	
	Liquid Limit Determination	Te	chnician Assessment]	
Notes					

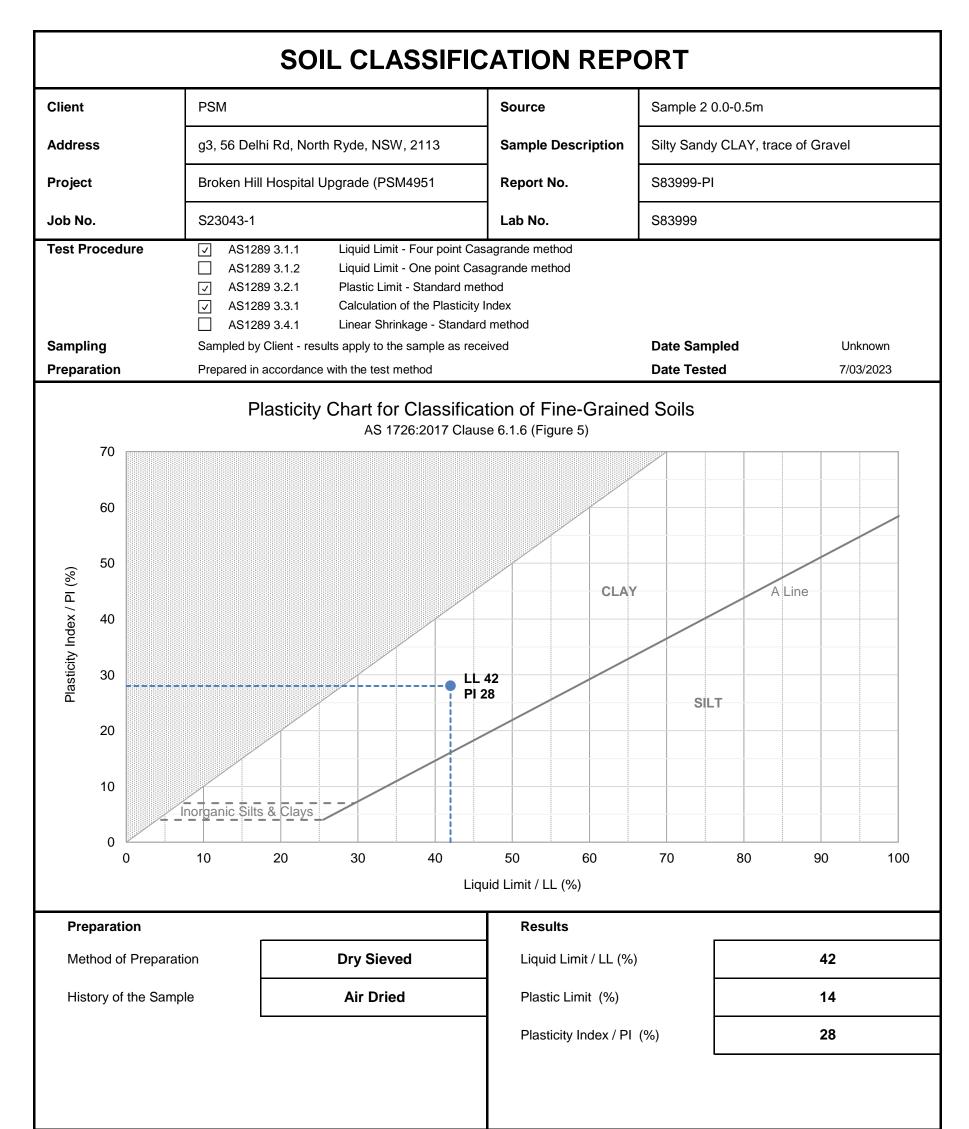
	According for compliance with ISO/IEC 17025 Testing	Authorised Signatory:	
NATA	Accredited for compliance with ISO/IEC 17025 - Testing. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. This document shall not be reproduced, except in full. Results relate only to the samples tested.	(je	14/03/2023
	NATA Accredited Laboratory Number: 14874	Chris Lloyd	Date:
MACQUA GEOŢEC			Macquarie Geotechnical 14 Carter St Lidcombe NSW 2141

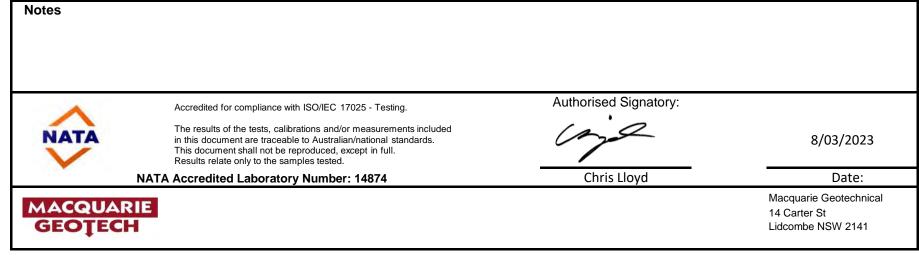
Appendix E Atterberg Limit Test Results

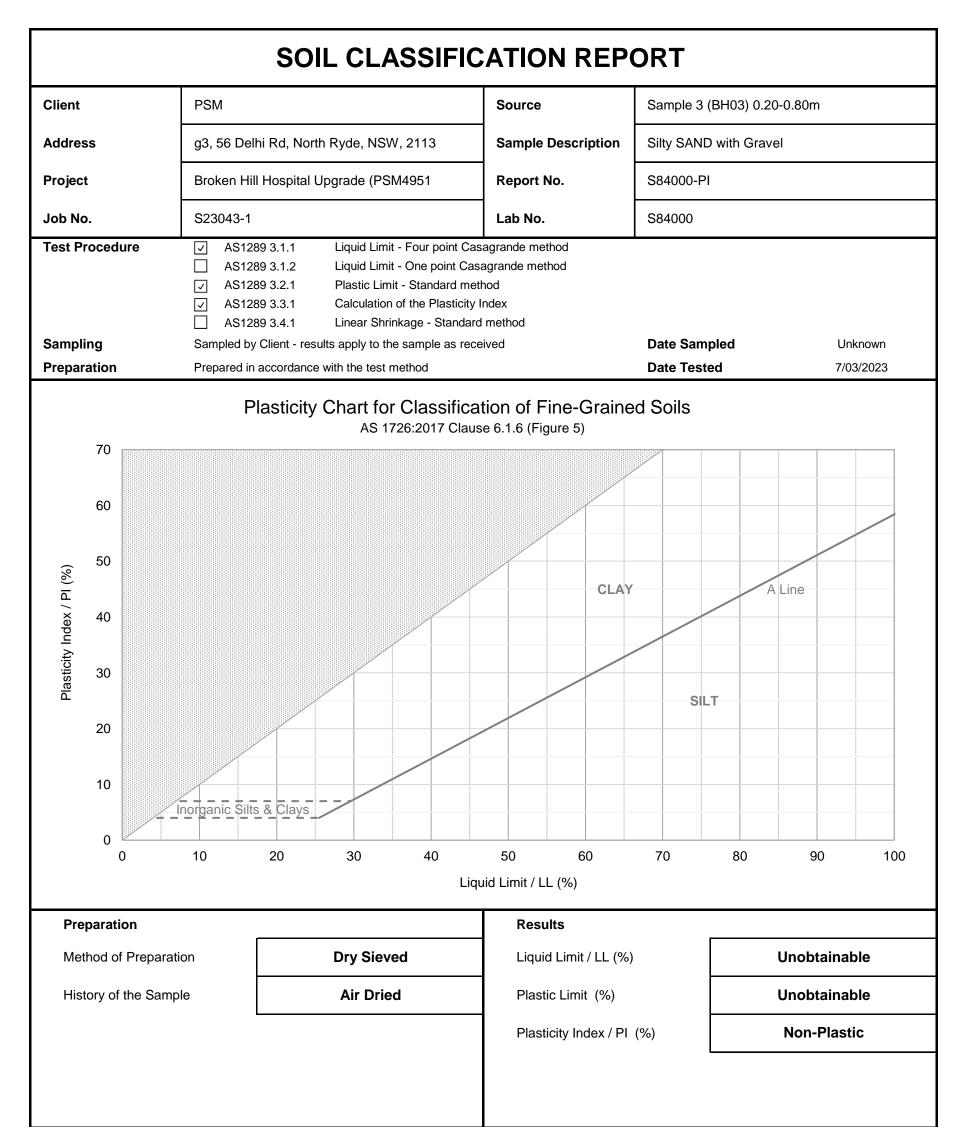


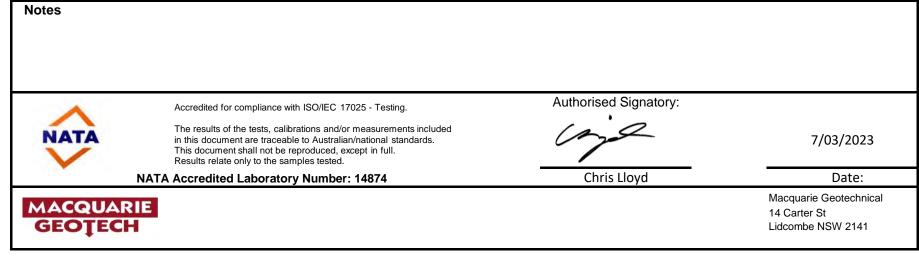






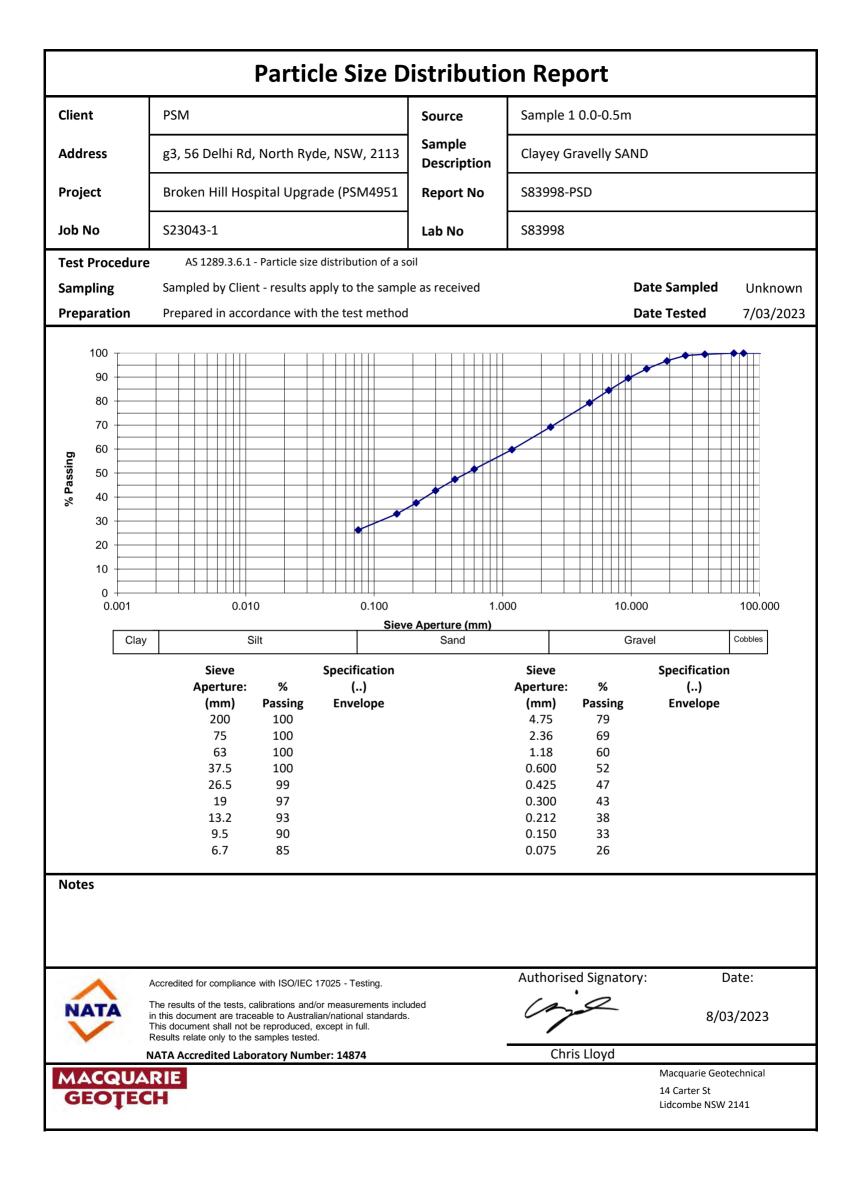


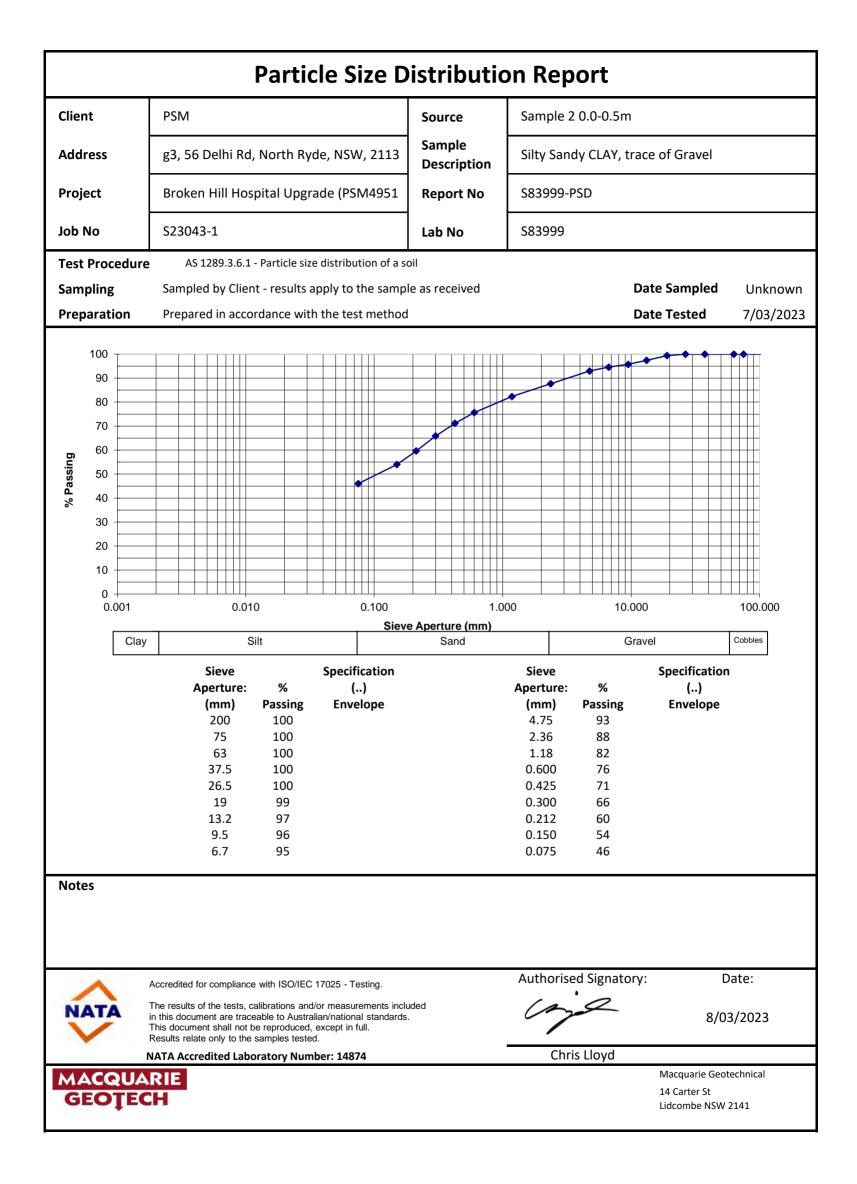


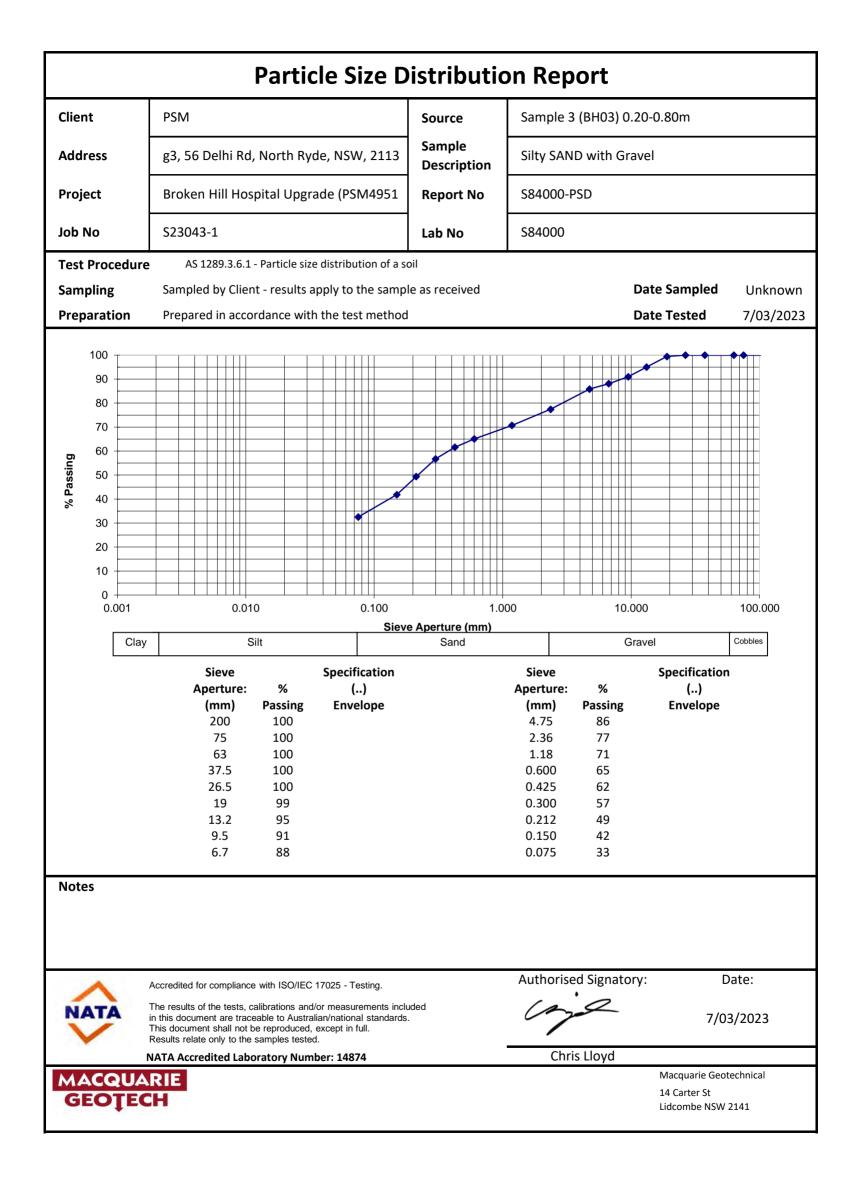


Appendix F Particle Size Distribution Test Results









Appendix G Salinity and Aggressivity Test Results





CERTIFICATE OF ANALYSIS

Work Order	: ES2303962	Page	: 1 of 3	
		-		
Client	: PELLS SULLIVAN MEYNINK T/A PSM Admin PTY LTD	Laboratory	Environmental Division Sydney	
Contact	: HARLEY ZHENG	Contact	: Customer Services ES	
Address	: G3, 56 DELHI ROAD	Address : 277-289 Woodpark Road Smithfield NSW Australia 2164		
	NORTH RYDE NSW, AUSTRALIA 2113			
Telephone	:	Telephone	: +61-2-8784 8555	
Project	: PSM4951	Date Samples Received	: 08-Feb-2023 11:20	
Order number	:	Date Analysis Commenced	: 08-Feb-2023	
C-O-C number	:	Issue Date	: 13-Feb-2023 15:45	
Sampler	:		NATA	
Site	:			
Quote number	: EN/333		Accreditation No. 825	
No. of samples received	: 3		Accredited for compliance with	
No. of samples analysed	: 3		ISO/IEC 17025 - Testing	

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

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



General Comments

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

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

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

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

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

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

Key: CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

* = This result is computed from individual analyte detections at or above the level of reporting

ø = ALS is not NATA accredited for these tests.

~ = Indicates an estimated value.

- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- ED007 and ED008: When Exchangeable AI is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCI Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + AI3+).

Page : 3 of 3 Work Order : ES2303962 Client : PELLS SULLIVAN MEYNINK T/A PSM Admin PTY LTD Project : PSM4951



Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH01	BH03	ED-B4	
Sampling date / time			02-Feb-2023 00:00	01-Feb-2023 00:00	04-Feb-2023 00:00	 	
Compound	CAS Number	LOR	Unit	ES2303962-001	ES2303962-002	ES2303962-003	
				Result	Result	Result	
EA002: pH 1:5 (Soils)							
pH Value		0.1	pH Unit	8.9	9.1	9.1	
EA010: Conductivity (1:5)							
Electrical Conductivity @ 25°C		1	µS/cm	1190	434	137	
EA055: Moisture Content (Dried @ 10)5-110°C)						
Moisture Content		1.0	%	11.9	8.8	7.5	
EA080: Resistivity							
Resistivity at 25°C		1	ohm cm	840	2300	7300	
ED006: Exchangeable Cations on Alk	aline Soils						
Exchangeable Calcium		0.2	meq/100g	5.1	2.1	3.9	
Exchangeable Magnesium		0.2	meq/100g	4.0	0.9	0.9	
Exchangeable Potassium		0.2	meq/100g	1.0	0.2	0.2	
Exchangeable Sodium		0.2	meq/100g	5.2	0.7	<0.2	
Cation Exchange Capacity		0.2	meq/100g	15.2	4.0	5.0	
Exchangeable Sodium Percent		0.2	%	34.3	17.6	<0.2	
ED040S : Soluble Sulfate by ICPAES							
Sulfate as SO4 2-	14808-79-8	10	mg/kg	1080	330	60	
ED045G: Chloride by Discrete Analys	ser						
Chloride	16887-00-6	10	mg/kg	1240	260	50	