

GEOTECHNICAL INVESTIGATION AND PRELIMINARY CONTAMINATION ASSESSMENT PROPOSED ADDITIONS TO BLACKTOWN HOSPITAL BLACKTOWN, NSW

Health Infrastructure, NSW

GEOTLCOV24207AB-AB 10 May 2011



10 May 2011

Health Infrastructure, NSW C/- Robert Bird Group Level 5, 9 Castlereagh Street, Sydney, NSW 2000

Attention: Jason Langer

Dear Sir

RE: Geotechnical Investigation and Preliminary Contamination Assessment, Proposed Additions, Blacktown Hospital, NSW- Final Report

Coffey Geotechnics Pty Ltd (Coffey) is pleased to present the final report for the geotechnical investigation and contamination assessment undertaken for the proposed additions to Blacktown Hospital, NSW.

Should you have any queries or comments regarding this report please do not hesitate to contact Sara Somasundaram or the undersigned on (02) 9911 1000.

For and on behalf of Coffey Geotechnics Pty Ltd

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Peter Waddell Principal Engineer

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1 INTRODUCTION

This report presents the results of a geotechnical investigation and contamination assessment carried out by Coffey Geotechnics Pty Ltd (Coffey) on behalf of Health Infrastructure, NSW (the Principal) and Robert Bird Group (RBG, Principal's representative) for the proposed additions to Blacktown Hospital, NSW.

The Investigation was undertaken in general accordance with the scope of works presented in our initial proposal; reference GEOTLCOV24207AA-AA, dated 31 January 2011, and our revised proposal; reference GEOTLCOV24207AA-AB, dated 8 February 2011.

It is understood that the project is currently at an early planning stage and that the results of this investigation will be used to further refine the proposed development and to assist with civil/structural design.

The following documents were referred to by Coffey in preparation of this report:

- "Geotechnical Investigation Brief" document revision 3 Blacktown Hospital (RBG Job ref:10684 dated 19 January 2011)
- "Geotechnical Desktop Study for Proposed Redevelopment of Blacktown Hospital" (issued to the Principal) by Jeffery and Katauskas Pty Ltd on 2 November 2011).

Based on the above documents the proposed redevelopment is likely to comprise:

- Provision of access from Blacktown road and reconfiguration of internal accesses and entry/exit points.
- Construction of new hospital buildings on the southern side of the existing main hospital building (i.e. at the location of existing car parks). These buildings are expected to be up to 4 stories high and are to be undertaken in two stages.
- Construction of new multi-storey car parks to the south of proposed buildings.
- Demolition of some existing buildings at the location of proposed multi storey car parks
- A potential underground tunnel link between main hospital building and proposed building.

Coffey Understands that the Stage 1 and Stage 2 developments will comprise above ground structures only with no excavation of basements. It is noted from the brief supplied to us that the developments are likely to be founded on high level pad footings in rock and piles to stiff clay or rock. Raft foundations are mentioned as an option dependent upon subsurface conditions.

Proposed investigation locations were identified by RBG with basic layout drawings supplied to us as part of the brief.

The objectives of the geotechnical investigation are to assess subsurface conditions and to provide comments and recommendations on geotechnical aspects as set out in the brief

The environmental component of the work aims to provide a preliminary contamination assessment of the site.

2 SITE INFORMATION

2.1 Published Geology

The Penrith 1:100,000 Geological Sheet indicates that the sites are underlain by Bringelly Shale of the Wianamatta Group. The Bringelly Shale is described as shale, carbonaceous claystone, claystone, laminate, fine to medium grained lithic sandstone, rare coal and tuff.

2.2 Site description

The site is located at the Blacktown Hospital Campus located south of Blacktown Road occupying ground gently sloping down towards the north/northwest. The site is bound to the north and east by Blacktown Road and to the south by Bungarribee Road. The areas of proposed development are located to the south of the existing Main Hospital Building on an area currently occupied by car parks at grade as shown in Figure 1.

2.3 Hydrogeology

A search for registered groundwater bores within a 500m radius of the site was undertaken using the NSW Natural Resources Atlas (NSW-NRA, <u>http://nratlas.nsw.gov.au</u>) on 11 November 2010 as part of a Stage 1 Site Contamination Assessment (Coffey, 2010). Records for four registered groundwater bores were found. A summary of groundwater bores is presented below:

- One bore located approximately 500m northwest of the site is reported to be used for waste disposal purposes; and
- Three bores located approximately 400m northeast of the site are reported to be used for monitoring purposes.

Based on data provided in the groundwater bore search results, it is estimated that groundwater beneath the site would lie at a depth of between about 3m and 11m below ground surface (bgs) and is considered likely to flow in a broadly north and/or easterly direction.

2.4 Acid Sulfate Soils

Based on the published acid sulfate soils risk maps, the site is located in an area not known to contain acid sulfate soils.

2.5 Previous Investigations

2.5.1 Geotechnical Reports

Several geotechnical investigations have been undertaken by Jeffery and Katauskas Pty Ltd (J&K) at Blacktown Hospital pertaining to various previous developments. A summary of these previous works were presented in a Geotechnical Desktop Study Report authored by J&K (reference: 24416SBrpt dated 2 November 2010).

The Geotechnical Desk Study Report summarised the findings of geotechnical investigations undertaken for the following previous developments at the Blacktown Hospital Campus:

• Clinical School Building;

- Main Hospital Building;
- Birthing Centre Building; and
- Ambulance Station Building.

A total of 40 boreholes were drilled to varying depths within the Blacktown Hospital site, based on collation of this data, subsurface conditions were found to comprise areas of fill overlying residual silty clays of medium plasticity and stiff to hard consistencies, grading into weathered shale and sandstone rock.

The depth to the surface of the rock in the area of the proposed new development to the south of the existing Main Hospital Building was interpreted to be in the order of 2m to 6m depth.

The shale and sandstone was reported to be extremely weathered and extremely low strength on contact and improving with depth with many defects and extremely low strength bands throughout.

Groundwater was encountered in some of the boreholes and interpreted to occur mainly along the soil/rock interface and through joints in the rock.

2.5.2 Contamination Reports

Coffey Environments Pty Ltd previously undertook a Stage 1 Preliminary Site Contamination Assessment for the site (Ref: ENAURHOD04072AA-R01). The assessment included a site walkover and a review of available site history information.

Based on findings from the assessment, it was concluded that there is a low to medium likelihood of contamination existing on the portions of the site where the proposed development zones are located in Master Plan Option 3 (Woods Bagot, 2010) from past and present activities.

3 POTENTIAL CONTAMINATING ACTIVITIES & AREAS OF CONCERN

Based on information presented in the Stage 1 assessment, the areas of environmental concern (AEC) and contaminants of potential concern (COPC) with respect to the subject investigation area are listed in Table 3.1.

Area of Environmental Concern	Contaminants of Potential Concern
Historical 20,000L UST (location unknown)	TPH, BTEX, PAH and lead
Fill material	TPH, BTEX, PAH, metals, PCB, OCP, OPP and asbestos
Previous hospital footprint and demolition	Asbestos, lead, OCP and OPP

4 METHOD OF INVESTIGATION

4.1 Geotechnical Fieldwork

The fieldwork for this investigation was conducted between the 15 and 22 February 2011, and comprised the following:

- Twelve boreholes (BH1 to BH11) drilled using a truck mounted drilling rig; and
- Two test pits (TPB1 and TPB2) excavated using a Yanmar 5 tonne excavator.

Figure 1 shows the approximate borehole and test pit locations.

A Coffey Engineer or Geologist was present throughout the fieldwork to conduct;

- Geotechnical sampling and testing, record test results and log materials encountered;
- Environmental sampling/testing;
- Liaison with Principal's representatives and contractors;
- Implementation of the Site Specific Health, Safety and Environmental Management Plans.

4.1.1 Borehole Drilling

The boreholes were drilled using a Hydrapower Scout truck mounted drilling rig. Each borehole was advanced using solid flight augers with a tungsten carbide (TC) drill bit until refusal on rock at depths between 3.2m and 8.2m, with the exception of BH4a which was terminated at a refusal depth of 1.1m on concrete.

Standard Penetration Testing (SPT) was carried out at selected depth intervals to assess soil strength and obtain samples for logging purposes. Environmental samples were also collected at selected depth intervals in each borehole.

Following TC bit refusal on rock the boreholes were cored using a triple tube core barrel to a depth of about 10m.

Groundwater inflows and soil moisture observed during drilling in soil were recorded. Groundwater observations were not possible in the cored sections of the boreholes during drilling as water was used as a drilling fluid. All remaining boreholes were backfilled with cuttings to 0.1m below ground level, and the pavement repaired at surface with bitumen.

Borehole and test pit locations were marked on the site survey plan supplied by the client and approximate interpreted reduced levels noted on the logs.

4.1.2 Test Pitting

The test pits were excavated using a Yanmar 5 Tonne Excavator with a toothless 1800mm mud bucket attachment, until termination in weathered shale at depths of 2.4m and 3m respectively. Environmental samples and bulk samples were collected at selected depth intervals.

4.2 Geotechnical Laboratory Testing

Soil samples obtained during the investigation were taken to our NATA registered laboratory. The following tests were carried out on selected samples:

- Standard Compaction and 4 days soaked California Bearing Ratio (CBR)
- Atterberg Limits 4 point
- Moisture Content
- Soil Aggressivity for buried steel and concrete structures (ph, Sulphate and Chloride)

4.3 Environmental Laboratory Testing

Environmental samples were taken from the geotechnical boreholes. The geotechnical boreholes provided a broad coverage of the general investigation area and the areas of environmental concern.

A total of 20 primary soil samples were collected from the site and submitted for laboratory analysis for one or more of the following contaminants of potential concern:

- total petroleum hydrocarbons (TPH);
- benzene, toluene, ethylbenzene, total xylenes (BTEX);
- polycyclic aromatic hydrocarbons (PAH);
- organochloine pesticides (OCP);
- polychlorinated biphenyls (PCB);
- heavy metals; and
- asbestos.

Soil samples collected from a decontaminated split spoon sampler and were transferred to laboratory supplied sample containers for chemical analysis. Where samples were submitted for asbestos analysis, a portion of the soil sample was placed in a zip-lock bag for analysis. The sample containers/bags clearly identified the site details, sampling location and sample depth. The samples were transferred to an ice chilled cooler.

A portion of the sample was placed inside an additional sealed plastic bag for screening for the presence of volatile organic compounds (VOCs) using a Photoionisation Detector (PID) calibrated to 100ppm isobutylene calibration gas.

The PID readings, together with other field observations, were used to assess which samples should be analysed for volatile contaminants (BTEX and TPH C_6 - C_9). The field screening results are included on the borehole logs.

One intra-laboratory duplicate soil sample, one inter-laboratory duplicate soil sample, one wash blank, one trip blank and one trip spike were collected from the site during fieldwork for quality control/quality assurance (QA/QC) purposes and analysed for the contaminants of potential concern.

The samples were dispatched to NATA accredited laboratories (SGS Australia as the primary laboratory) under chain of custody control.

5 RESULTS OF INVESTIGATION

5.1 Subsurface Conditions

Engineering borehole logs from the current investigation are presented in Appendix A, together with Explanation Sheets defining the terms and symbols adopted in the borehole log preparation and photographs of the rock core recovered during the investigation.

The site is underlain be a variable thickness of fill overlying residual soils and shale or sandstone bedrock. In some locations relatively deep sand and gravel fill was encountered (BH5 and BH6). Such deep fill deposits may be associated with existing services or old infilled service trenches. In other locations clay fill was encountered which may be associated with levelling of the site during construction of the car parking area or backfilling associated with services trenches. At one borehole location (BH4a) concrete was encountered that may be associated with an old building footing or other buried structure.

Based on the information obtained from the boreholes, three cross sections have been drawn through the site and are presented in Figures 2, 3 and 4. Two geotechnical models have been developed, pertaining to developments immediately south of the Main Hospital Building (Table 5.1) and another for the area in the vicinity of existing Child Care Centre (Table 5.2).

TABLE 5.1: Interpreted Subsurface Conditions – Area South of Main Hospital Building (BH1 to	
BH11)	

Unit	Material / Origin	Depth to Top of Unit (m)	Thickness of Unit (m)	Top of Unit (mAHD)	Description
1	Fill	0	0.5 to 3.8	61.2 to 64.75	Variable deposits of Sand, Gravel and Clay
2	Residual Soil	0.5 to 3.8	0.1 to 4.2	57.8 to 61.3	Clay: medium and high plasticity, firm to hard, pale grey to reddish brown with ironstone gravels
3а	Class V and IV Shale and Class V and IV Sandstone	3.1 to 6.6	0.8 to 4.4	54.8 to 59.75	Shale with interbedded Sandstone: pale to dark grey and reddish brown, extremely to moderately weathered, very low to medium strength

Unit	Material / Origin	Depth to Top of Unit (m)	Thickness of Unit (m)	Top of Unit (mAHD)	Description
3b	Class III Shale and Class III Sandstone or better ⁽¹⁾	5.3 to >10m	Not Proven	<51.34 to 56.5	Shale with interbedded Sandstone: pale to dark grey, reddish brown, slightly weathered, medium to high strength

(1) Rock classified in accordance with Pells et al (1998) "Foundations on Sandstone and Shale in the Sydney Region" Aust. Geomech. Jnl, Dec 1998.

Unit	Material / Origin	Depth to Top of Unit (m)	Thickness of Unit (m)	Top of Unit (mAHD)	Description
1	Fill	0	0.6 to 1.6	56.85 to 57.3	Topsoil / Clay and Sandy Clay
2	Residual Soil	1.0 to 1.6	0.8	55.7 to 56.25	Clay: Medium and high plasticity, hard, pale grey to reddish brown with ironstone and shale gravel
3a	Class V Shale ⁽¹⁾	1.8 to 2.4	Not Proven	54.9 to 55.05	Shale: pale grey to reddish brown, extremely weathered, very low to low strength

(1) Rock classified in accordance with Pells et al (1998) "Foundations on Sandstone and Shale in the Sydney Region" Aust. Geomech. Jnl, Dec 1998.

The depths and layer thicknesses in Tables 5.1 and 5.2 are based on the subsurface conditions at the borehole locations and may not be representative of all areas of the site.

5.2 Laboratory Test Results

5.2.1 Geotechnical Testing

Soil samples were transported to our NATA registered laboratory for storage and testing. The following soil tests were carried out on soil samples obtained during the field work.

- Moisture Content tests
- Atterberg limit tests
- Shrink / Swell Tests
- pH, sulphate & chloride content tests
- California Bearing Ratio tests; and

In addition, axial and diametral point load index strength testing was carried out on the rock cores, with the test results presented on the individual borehole engineering logs in Appendix A and in Appendix B. Detailed laboratory test results are presented in Appendix B and a summary is presented in Table nos. 5.3 to 5.5, given below:

Borehole	Depth (m)	Sul	Soluble Sulfate	Sulfate Chloride	Moisture	Atterberg Limits		
No.	BGL	рН	(SO4 ²⁻) (mg/kg)	(Cl ⁻) (mg/kg)	Content (%)	LL (%)	PL (%)	PI (%)
BH1	2.0 – 2.45	10.1	90	430	19	-	-	-
BH1	2.55 – 2.90	-	-	-	20	51	18	33
BH2	2.0 – 2.50	-	-	-	17	50	20	30
BH3	5.0 – 5.45	9.7	380	940	16	-	-	-
BH4	2.0-2.45	-	-	-	20	46	16	30
BH5	2.0 – 2.45	11.0	250	30	9	-	-	-
BH6	2.0 – 2.45	9.0	270	30	8	-	-	-
BH9	2.0 - 2.45	-	-	-	19	47	16	31
BH9	3.5 – 3.95	6.4	250	260	14	45	19	26
BH10	2.0 - 2.45	7.0	190	180	9	-	-	-
BH10	3.0 - 3.45	-	-	-	18	59	18	41
BH11	0.5 – 0.95	6.9	580	40	14	-	-	-

TABLE 5.3: Summary of Moisture Content, Atterberg Limits and Soil Aggressivity Tests

Borehole No.	Depth	Maximum Dry Density	Optimum Moisture Content	4 day Soaked CBR %
TPB1	0.5-0.7	1.75	17.9	1
TPB2	1.5-1.7	1.82	15.5	1.5

TABLE 5.4: Summary of CBR Test Results

TABLE 5.5: Summary of Shrink Swell Test Results

Borehole No.	Depth	Swell on Saturation %	Shrink on Drying %	Shrink Swell Index I _{ss}
BH1	2.55-2.90	2	6.8	4.3

Based on laboratory test results as summarized in Table 5.3, the soils could be classified as "mildly aggressive to non aggressive" according to AS 2159-2009 for concrete and as "non aggressive" for steel.

5.3 Environmental Testing

5.3.1 Environmental Soil Assessment Criteria

For assessing whether the soil is contaminated, the criteria presented in the following references are generally the primary criteria used in NSW when setting acceptance criteria for chemical contaminants in soil:

- Guidelines for the NSW Auditor Scheme (Second Edition) (NSW DEC, 2006); and
- Guidelines for Assessing Service Station Sites (NSW EPA, 1994).

For assessing contamination levels in soil in urban settings, the *Guidelines for the NSW Site Auditor Scheme* (NSW DEC, 2006) present health based investigation levels (HILs) for different land uses (e.g. industrial/commercial, residential, recreational etc.). These HIL settings are, however, not generally applicable for hospital sites and there is currently no clear guidance as to the most appropriate guideline value for comparison purposes.

This notwithstanding, based on the understanding that the site is intended for ongoing hospital usage, Coffey has adopted a conservative approach and used the HIL for residential land use with gardens and accessible soils, and the provisional phytoxicity-based investigation levels, for preliminary screening of the soil.

NSW DEC (2006) guidelines do not provide levels for volatile petroleum hydrocarbon compounds. The *Guidelines for Assessing Service Station Sites* (NSW EPA, 1994) provide an indication of acceptable

levels for sensitive land use for petroleum hydrocarbons compounds. The NSW DECC has advised that these guidelines should also be used without multiplication for less sensitive land uses. For semi-volatile petroleum hydrocarbons (C16–C35 and >C35) investigation levels are provided in the NSW DEC (2006) Guidelines, however, these are based on the NEPC (1999) health-based investigation levels, which require the laboratory analysis to unequivocally differentiate between aromatic and aliphatic compounds. The relevant values in NSW EPA service station guidelines will be applied in the first instance as broad criteria to assess TPH concentrations. If TPH impacts are identified in soil, then aromatic/aliphatic investigation levels from NSW DEC (2006) may be utilised to assess the aromatic/aliphatic speciation of TPH if considered necessary.

Currently there are no set guidelines in NSW for the assessment of asbestos in soils. A criterion of "no asbestos detected" will be adopted as a screening level for assessing soil asbestos analytical results.

A summary of the adopted soil acceptance criteria is presented in Table 5.6.

Analyte	Health-based Investigation Levels (HILs) (mg/kg) ⁽¹⁾ HIL A	Sensitive Land Use (mg/kg) ⁽²⁾	Provisional Phytotoxicity-based Investigation Levels (mg/kg) ⁽¹⁾	Adopted Soil Assessment Criteria (mg/kg)
METALS / METALLO	IDS			
Arsenic (total)	100	-	20	20
Cadmium	20	-	3	3
Chromium (III)	12,000	-	400	400
Copper	1,000	-	100	100
Lead	300	-	600	300
Mercury (inorganic)	15	-	1	1
Nickel	600	-	60	60
Zinc	7,000	-	200	200
ORGANICS	L			
Total PAHs	20	-	-	20
Benzo(a)pyrene	1	-	-	1
Aldrin + Dieldrin	10	-	-	10
Chlordane	50	-	-	50
DDT+DDD+DDE	200	-	-	200
Heptachlor	10	-	-	10
Total PCB	10	-	-	10
TPH C ₆ -C ₉	-	65	-	65
TPH C ₁₀ -C ₄₀	-	1,000	-	1,000
Benzene	-	1	-	1

Table 5.6: Summar	y of Soil Contamination	Assessment Criteria
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Analyte	Health-based Investigation Levels (HILs) (mg/kg) ⁽¹⁾ HIL A	Sensitive Land Use (mg/kg) ⁽²⁾	Provisional Phytotoxicity-based Investigation Levels (mg/kg) ⁽¹⁾	Adopted Soil Assessment Criteria (mg/kg)
Toluene	-	50	-	1.4
Ethylbenzene	-	130	-	3.1
Xylenes	-	25	-	14
Asbestos	-	-		No Asbestos Detected

1. NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme (2nd Edition).

2. NSW EPA (1994) Guidelines for Assessing Service Station Sites.

5.3.2 Field Observations and Screening

No visual or olfactory evidence of significant contamination (i.e. odours or staining) was identified during field work.

Screening of soil samples collected from the site reported PID readings between 0.2ppm and 7.5ppm, which suggests a low potential for the presence of volatile hydrocarbons in these samples.

5.3.3 Analytical Results

The results of the laboratory analysis of the environmental soil samples collected from the site indicated the following:

- The samples analysed reported concentrations of TPH C₆-C₉ and BTEX less than the laboratory limit of reporting (LOR);
- The samples analysed reported concentrations of TPH C10-C36 less than the adopted assessment criteria;
- The samples analysed reported concentrations of PAH, OCP and PCB less than the laboratory LOR;
- The samples analysed reported concentrations of heavy metals less than the adopted healthbased assessment criteria, however samples BH1 (0.1-0.5), BH2 (0.1-0.3) and its duplicate DUP1, BH3(0.1-0.3), BH4 (0.1-0.3) and BH9 (0.1-0.3) reported nickel concentrations between 69mg/kg and 100mg/kg) which exceeds the phytoxicity investigation levels; and
- Asbestos was not detected in the samples analysed.

Detailed laboratory test results are presented in Appendix C.

5.3.4 Quality Assurance / Quality Control

Field and laboratory analytical results have been reviewed to assess their suitability for use for the purpose of this assessment. Based on the review, the data is considered suitable for the purpose of this assessment without qualification or adjustment.

The data validation report is attached in Appendix D.

6 DISCUSSION AND RECOMMENDATIONS

6.1 Excavation Conditions

6.1.1 Excavatability

Coffey is not aware of any proposed basement excavations. However, excavations into the hillside may be required depending on building levels and the potential underground tunnel link that is being considered would also require bulk excavation. Excavation in Units 1 and 2 should be possible using conventional earthmoving equipment such as tracked loaders and hydraulic excavators. During or following periods of high rainfall, groundwater may be encountered near the soil/rock interface and at higher levels in the soil profile.

Where excavations extend into the bedrock, it is expected that very low strength or fractured shale/sandstone should be able to be excavated using conventional earthmoving plant such as hydraulic excavators fitted with a rock bucket and dozers fitted with rippers. At depths where the rock is expected to be medium to high strength, ripping or the use of rock hammers and rock saws may be required.

Rock excavations can result in noise and vibrations that affect adjacent structures, particularly if hydraulic impact breakers are used. Selection of excavation plant will need to be carefully considered by the contractor as part of construction planning together with the preparation of a vibration monitoring plan if excavations are to be carried out in close proximity to existing structures. Rock saws may be required to reduce the lateral transmission of vibrations.

Excavation contractors should be required to consider the borehole logs and core photographs and make their own interpretation of the capacity and productivity of specific plant.

6.1.2 Bulk Excavation Support Requirements

We recommend temporary unsupported batter slopes of 2H:1V for excavations on Unit 1 and 1.5H:1V for excavations on Units 2 and 3a (provided excavation is above the groundwater table and surcharge loads are kept well clear of the crest of batters). If there is insufficient room to form temporary batters, or if excavations encounter groundwater, then retention system will be required. Further advice on retention systems is provided in Section 7.2. For permanent batters 2H:1V or flatter slopes are recommended.

As for Unit 3b (class III shale or better) vertical excavations should be practicable provided support is provided in the form of rock bolts, mesh and shotcrete, where required. An experienced geotechnical engineer or engineering geologist should be engaged to assess the rock faces after each 1.5m depth of excavation to assess support needs.

Where rock bolts are required to provide permanent support they should be galvanised and double encapsulated in grout and a polyethylene sheath. Proprietary systems such as "CT bolts" or equivalent have been accepted as having a design life of up to 100 years when double encapsulated.

6.1.3 Traffic on Soils

Field (SPT) and laboratory testings on Unit 1 and 2 soils indicate that a minimum 300mm thick working platform of road base may be needed where construction plants such are trucks are to travel above Unit

1 and Unit 2. Where heavy plants such as piling rigs or mobile cranes are to traffic the site, specific analysis of working platform requirements will be required to assess working platform thickness.

6.1.4 Groundwater

No groundwater inflow was observed during auger drilling up to depths ranging 3m to 7m, except in BH5, where ground water was observed at 1.8m below ground level in a sandy layer (likely to be localised due to events such as recent rains or leaking services.). Water level monitoring was not possible during rock coring as water was used as drilling fluid in the drilling process. Previous investigations report water observations in some boreholes at depths ranging between 2m to 3.7m and suggest that they are mainly along soil/rock interface and through joints in rock. It is anticipated that high groundwater levels would be limited to prolonged periods of high rainfall or localised events such as failures of service lines.

We do not anticipate major groundwater inflows during excavations however; ground water seepages are likely due to high rainfall events, local drainage conditions etc and provision should be made for pumping form sumps. The risk of the development causing adverse impacts on adjacent sites due to changes in groundwater is assessed as low.

6.2 Retention Systems

6.2.1 Possible Systems and Limitations

Though the site lies in a relatively elevated location with low permanent groundwater table levels, short term build up of hydrostatic pressures could occur during prolonged wet periods or due to broken services, hence the possibility of hydrostatic pressures that could extend to the ground surface should be considered in the design of retention systems.

Surcharges due to equipment, stockpiles or other loadings behind the wall should also be considered in the design.

Retention systems that could be considered include:

- Sheet Pile Walls;
- Soldier Pile Walls
- Contiguous Piled Walls.

Sheet piles driven to the weathered rock could provide temporary support for excavations. A cast insitu concrete wall would be required to provide a permanent retention system. Noise and vibration issues as well as drivability through residual soil (Unit 2) need to be considered.

Soldier pile walls using steel or bored piles with shotcrete infilled panels (laggings) could also be considered.

Contiguous piles could be adopted, however with such a system gaps between the piles may allow soil to fall into the excavation destabilising the ground behind the piles and risking undermining of adjacent structures. Careful construction procedures would be a required with allowance for progressive grouting of gaps between piles for this system to provide effective temporary and permanent support.

6.2.2 Design Parameters for Shoring and Earth Retaining Structures

For the design of retaining walls a triangular earth pressure distribution can be adopted to calculate earth pressures for relatively flexible shoring systems such as cantilevered walls or walls supported by a single row of props or anchors. The horizontal earth pressure profile may be calculated using the following formula:

$$p = K (\gamma' z + p_s)$$

where p = lateral earth pressure (kPa)

- K = earth pressure coefficient, to be selected depending considering the amount of movement that can be tolerated.
- γ' = effective unit weight (kN/m³)
- z = depth below top of excavation (m)
- H = height of excavation at base of excavation (m)
- ps = design uniform surcharge pressure at ground level

Flexible shoring systems such as cantilevered walls should be avoided where there is a risk of movements damaging structures or services adjacent to an excavation.

Design of braced shoring or permanent retaining structures walls, which are constrained at several levels, can be based on a trapezoidal earth pressure distribution. Where retention of a multi-layered material profile is required, modification of the distribution (including the definition of H) will be necessary.

Depth (m)	Horizontal Pressure (kPa)
0	K.p _s
0.25 H	K (0.8.γ [́] .H + p _s)
0.75 H	K (0.8.γ.H + p _s)
н	K.p _s

Table 7.1: Trapezoidal Pressure Distribution

In addition to lateral earth pressures and surcharge loads, consideration should be given to the possibility of a hydrostatic pressure due to build-up of water behind the wall (e.g. from broken services) unless permanent subsurface drainage can be provided.

Table 7.2 provides retaining wall design parameters:

Geotechnical Unit	Active Earth Pressure Coefficient (k_a^1)	At Rest Earth Pressure Coefficient (K ₀)	Passive Earth Pressure Coefficient K _p	Bulk Density (kN/m ³)	Drained Cohesion, c' (kPa) ³	Effective Friction, φ' (°)	Drained Elastic Modulus E'(MPa)
Unit 1	0.33	0.5	3.0	19	0	30	10
Unit 2	0.36	0.53	2.8	19	5	28	20
Unit 3a ²	0.33	0.5	3.0	22	10	30	120

Table 7.2: Earth Pressure Coefficients for Retaining Wall Design

Notes:

1. Assumes no wall friction

2. Values of better quality rock are variable and dependant on global effects of defects. Variability also occurs due to the in situ stress environment and geometry of the excavation. For design parameters, use should be made of the cohesion and friction angle parameters.

The earth pressure coefficients in Table 7.2 assume horizontal ground surface at the crest and toe of the retaining wall. If this is not the case then the coefficient should be modified or surcharges added, as necessary. Care will be required when compacting fill adjacent to retaining walls to avoid lateral pressures that exceed tabulated values.

Based on concept plan drawings, adjacent structures may be located within the nominal zone of influence of the excavation (a line extending at a gradient of 1H:1V upwards from the base of the proposed excavation). The excavation system will need to be designed to support the footing surcharge loads.

The amount of movement that will be experienced by a retaining wall will depend on various factors including the earth pressures that exist, groundwater conditions and the excavation and construction sequence, including the tensioning sequence of anchors. Detailed soil structure interaction analysis should be carried out if movement sensitive structures are located within close proximity to the retaining wall. In particular, if movement sensitive services are located close to the excavation the design should consider the need to limit movements. In such situations the earth pressures calculated using coefficients in Table 7.2 may need to be modified to assess the impact on predicted movements.

6.3 Foundation Options

There is a variable depth of fill across the site probably as a result of buried services, demolition of previous buildings and site levelling works during car park construction. We recommend piled foundations for multi storey building development where relatively high building loads and differential movement tolerances are tight, with the piles founded on bedrock.

For lightly loaded structures it may be possible to adopt shallow foundation such as a stiffened raft, however, additional investigations would be required as there is no well defined pattern to the distribution of fill. Unless records are available to confirm that fill has been placed and compacted to an engineering specification it should be treated as uncontrolled and should not be used to support

building loads. If assessed to be suitable for reuse, existing fill could be excavated and recompacted to form a foundation for raft slabs. Fill should be compacted to at least 98% Standard Compaction at moisture content within 2% of Standard Optimum Moisture Content.

6.3.1 Shrink Swell Potential

In areas where existing fill occurs a site classification of 'P' as defined in AS2870-2011 should be adopted. If the fill is excavated and recompacted it may be possible to found a raft slab on the fill. Reclassification of the site would depend on the nature and thickness of the compacted fill and should foundation recommendations should be developed based on AS2870-2011.

Where residual soils are relatively shallow and would form the bearing stratum for a raft a classification of other than 'P' could be adopted. Raft foundations could be adopted for buildings with similar scale and building loads to residential structures, based on the guidelines in AS2870-2011. Based on a shrink swell test on a sample of residual soil from BH1 sites underlain by residual soils can be classified as 'H1' as defined in AS2870-2011.

6.3.2 Pad Footings

For pad or strip footings bearing on stiff residual soil we recommend an allowable bearing pressure of 150kPa. However, pad footings on residual soil should only be adopted for structures that are not susceptible to damage from shrink swell movements. For pad footings founded on units 3a and 3b, <u>ultimate</u> bearing pressures of 2MPa and 10MPa are recommended, respectively. A geotechnical strength reduction factor ϕ_{g1} of 0.5 should be adopted. Settlements of these footings should be assessed adopting an elastic modulus of 100MPa and 500MPa for Units 3a and 3b, respectively.

A geotechnical engineer should observe pad footing excavations (and undertake dynamic cone penetration tests if founding layer is residual soil) to confirm that a competent bearing stratum exists.

6.3.3 Piled Foundations

Where a piled foundation is required the piles should penetrate the fill and residual soil layers and found within Unit 3a and 3b bedrock.

Open bored piles may be feasible but would require temporary liners when penetrating granular materials such as the sand fill encountered at some locations. In clay fill or clay residual soils open bored piles may still require temporary liners if groundwater seepage occurs as seepage will tend to soften the pile shaft if left open.

Continuous flight auger (CFA) piles should be practicable and do not require temporary casing. However, a high capacity CFA piling rig will be required to socket the piles into the bedrock if significant loads are to be carried in shaft adhesion or to take advantage of the parameters for the better quality Unit 3b rock. Advice should be sought from specialist CFA piling contractors regarding the length of socket in the Unit 3b that can be achieved with their piling rigs.

For the limit state design of piles the geotechnical parameters provided in Table 6.1, below, can be adopted.

Geotechnical Unit ⁽¹⁾	Ultimate End Bearing (MPa) ⁽²⁾	Ultimate Shaft Adhesion (kPa) ⁽³⁾	Elastic Modulus (MPa) ⁽⁴⁾
Unit 2 – Residual Soil	-	30	30
Unit 3a – Class IV and V Shale and Class V and IV Sandstone	3	100	100
Unit 3b – Class III Shale and Class III Sandstone	15 ⁵	500	500

Table 6.1: Recommended Limit State Design Parameters for Piles on Rock

(1) Rock classified in accordance with Pells et al (1998) "Foundations on Sandstone and Shale in the Sydney Region" Aust. Geomech. Jnl, Dec 1998.

- (2) Assumes a minimum embedment of at least 0.3m into the relevant bearing stratum.
- (3) Shaft adhesion should be ignored unless the pile has a minimum socket length of 3 pile diameters.
- (4) Serviceability should be assessed using the tabulated modulus value to check that settlements are within tolerable limits.
- (5) To adopt this value further assessment of rock quality will be required as discussed below.

We recommend a geotechnical strength reduction factor, Φ_g , of 0.7 for footings bearing on rock where a suitable program of verification is undertaken. If piles are required to resist uplift the shaft adhesion a Φ_g of 0.6 should be adopted and the values in Table 8 should be multiplied by 0.6 and a cone pull out check should be carried out assuming a cone angle of 70⁰.

Where ultimate end bearing pressures of greater than 6.5MPa are adopted we recommend that additional cored boreholes be drilled at column locations to assess the uniformity and quality of the bearing stratum. The number of additional boreholes will be dependent on the piling layout. Cores may be required at 25% to 50% of pile locations to assess provide adequate information for the assessment of rock quality to justify the upper end of the recommended ultimate end bearing values.

A geotechnical engineer should be engaged to review piling records to confirm that piles have penetrated to the appropriate rock class. Pile dynamic integrity testing should be carried out particularly, if CFA piles are adopted. At least 5% of all piles should be subjected to integrity testing.

The base of open bored piles and pad footings should be clean of loose debris and water. Continuous flight auger piles should be carefully controlled to avoid spoil falling off the auger and fouling the base of the pile.

6.4 Pavement Design

Laboratory testing of two bulk disturbed samples indicate the 4 day soaked CBR values to be 1% and 1.5% for plastic clays. Previous investigations report CBR values ranging between 0.5% and 3%.

Subgrade improvement in the form of excavation and replacement with better quality material or insitu improvement of the existing subgrade using lime stabilisation or similar techniques should be

undertaken to improve the subgrade conditions for pavements. With replacement or insitu improvement a target CBR of 5% could be achieved depending on the nature technique employed and the depth of treatment.

Where existing fill lies at subgrade level it should be excavated and recompacted, if suitable, or replaced with a good quality material. Fill that is to form the subgrade for pavements should be compacted to at least 100% Standard Compaction at moisture content within 2% of Standard Optimum Moisture Content. If existing fill is deeper than about 1m below final subgrade level it may be possible to leave the fill in place provided it is assessed to be suitable by a geotechnical engineer and proof rolled.

6.5 Earthquake Design

We recommend that the site be classified as Class C_e in accordance with the site sub-soil classes defined in AS1170.4-2007 Part 4, Earthquake Actions in Australia. In the event, the entire building footprint is excavated and founded on Unit 3b (i.e. class III shale / Class III Sandstone or better) then the site could be classified as B_e .

A hazard factor of 0.08 is suggested based on AS1170.4-2007. Liquefaction potential is considered to be low in view of the limited thicknesses of sandy deposits and low groundwater table level.

6.6 Environmental Assessment

The conclusions and recommendations presented below are based on the limited scope of works carried out on-site as part of the preliminary environmental assessment.

The results of the laboratory analysis indicate that concentrations of chemical contaminants within the subsurface are less than the adopted health-based assessment criteria and that no asbestos fibres were detected.

Based on the results of the limited environmental assessment, there is no evidence at the borehole locations to suggest contamination conditions exceeding human health criteria that may present significant limitations to the proposed hospital development. Although several samples reported concentrations of nickel exceeding the phytotoxicity investigation levels, these guidelines are generally used as a screening guide only and are typically subject to specific plant and soil types.

With respect to waste classification, the chemicals of potential concern analysed were generally detected below the General Solid Waste (CT1) criteria with the exception of a number of exceedances for nickel. For preliminary planning purposes, it appears that a majority of the fill and natural soils would likely meet the General Solid Waste criteria (for fill) and VENM classification (for natural soils), subject to further assessment including leachability testing based on the toxicity characteristics leaching procedure (TCLP).

Coffey notes that the Stage 1 assessment identified potential presence of USTs in the investigation area. Boreholes drilled during this investigation however did not provide any visual evidence of underground petroleum infrastructure. As such, there remains uncertainty in relation to the potential presence of USTs. Given the significant potential for contamination associated with USTs, we recommend further assessment of the potential presence of USTs, which may include undertaking a geophysical survey such as Ground Penetrating Radar.

It should be noted that environmental sampling conducted on-site was for the purposes of preliminary assessment at discrete locations to assist with initial development planning and should not be relied on for assessment of overall site suitability.

6.7 Construction Risk Register

A preliminary risk register(in format provided by the Client), identifying geotechnical and environmental construction risks is presented in Appendix E. It should be noted that the risk register is prepared based on information available at present and should be reviewed and updated during construction stages.

7 LIMITATIONS

The geotechnical model and recommendations in this report are based on a limited number of boreholes. The engineering logs describe subsurface conditions only at the specific borehole locations. Ground conditions can vary over relatively close distances and a geotechnical engineer should be engaged at the construction stage to assess whether site conditions are consistent with design assumptions.

The attached document entitled "Important Information about your Coffey Report" presents additional information about the uses and limitations of this report.

For and on behalf of Coffey Geotechnics Pty Ltd

Aladel

Peter Waddell
Principal Engineer



Important information about your Coffey Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give

preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.



Important information about your Coffey Report

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment.

Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

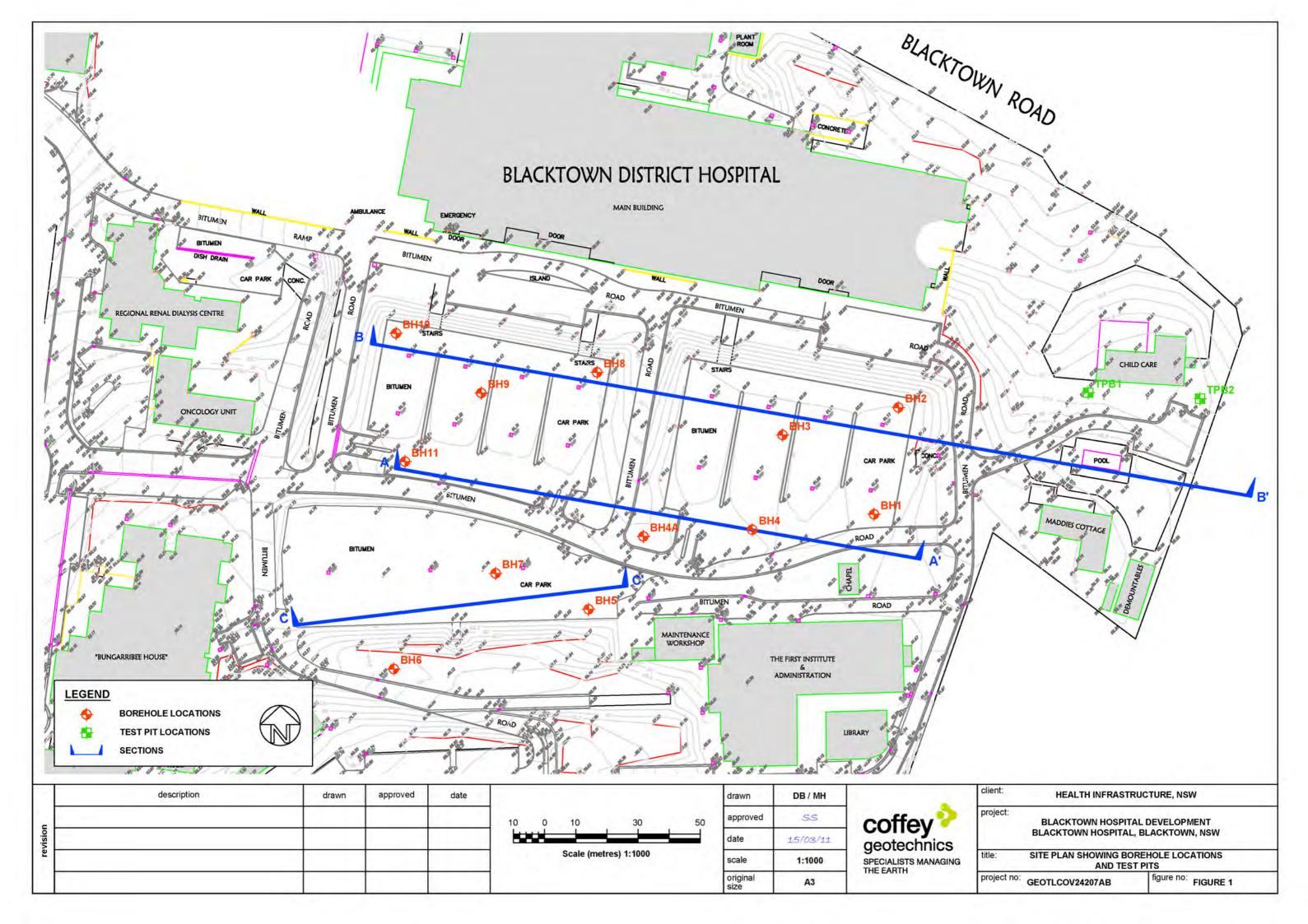
Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

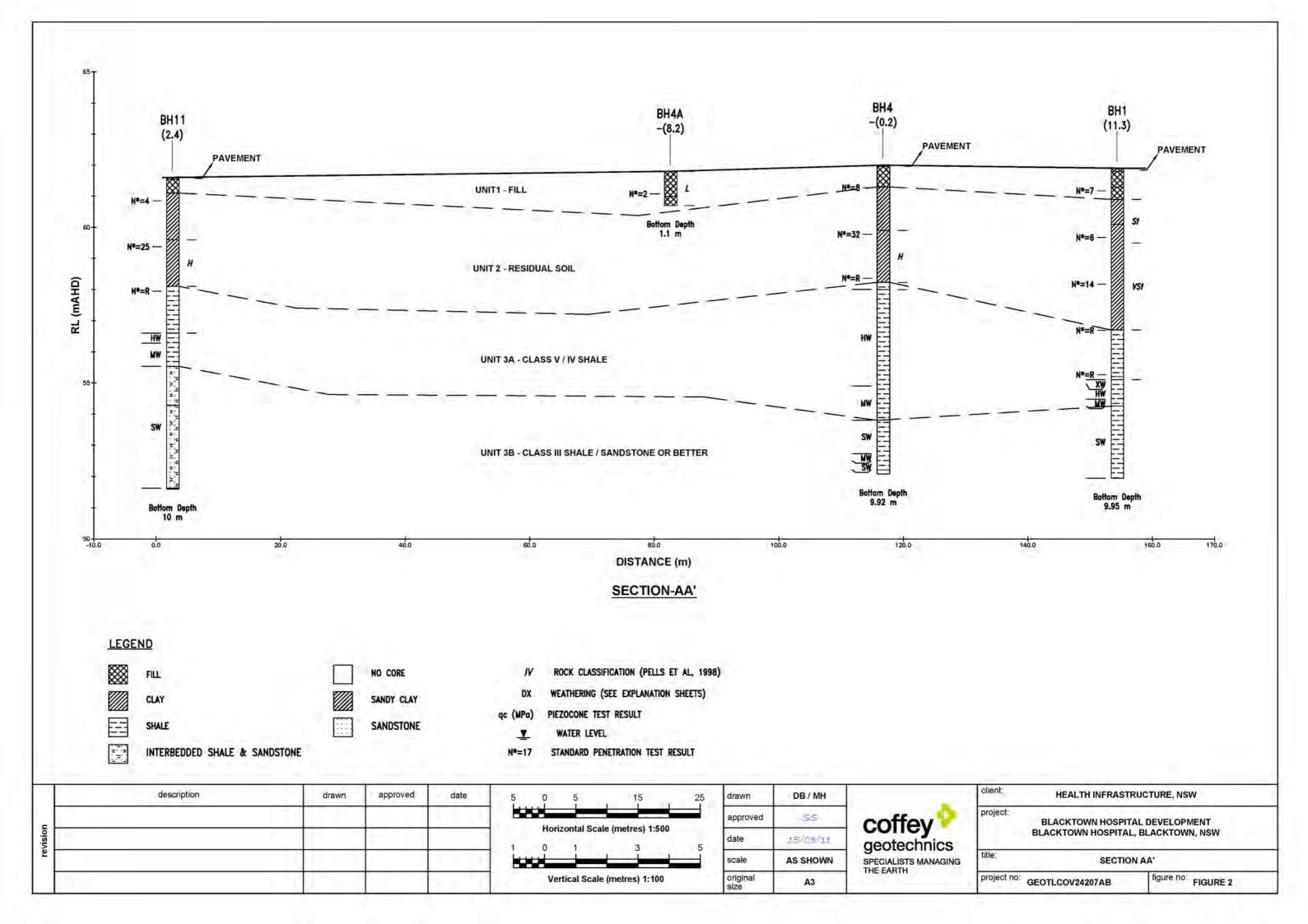
Responsibility

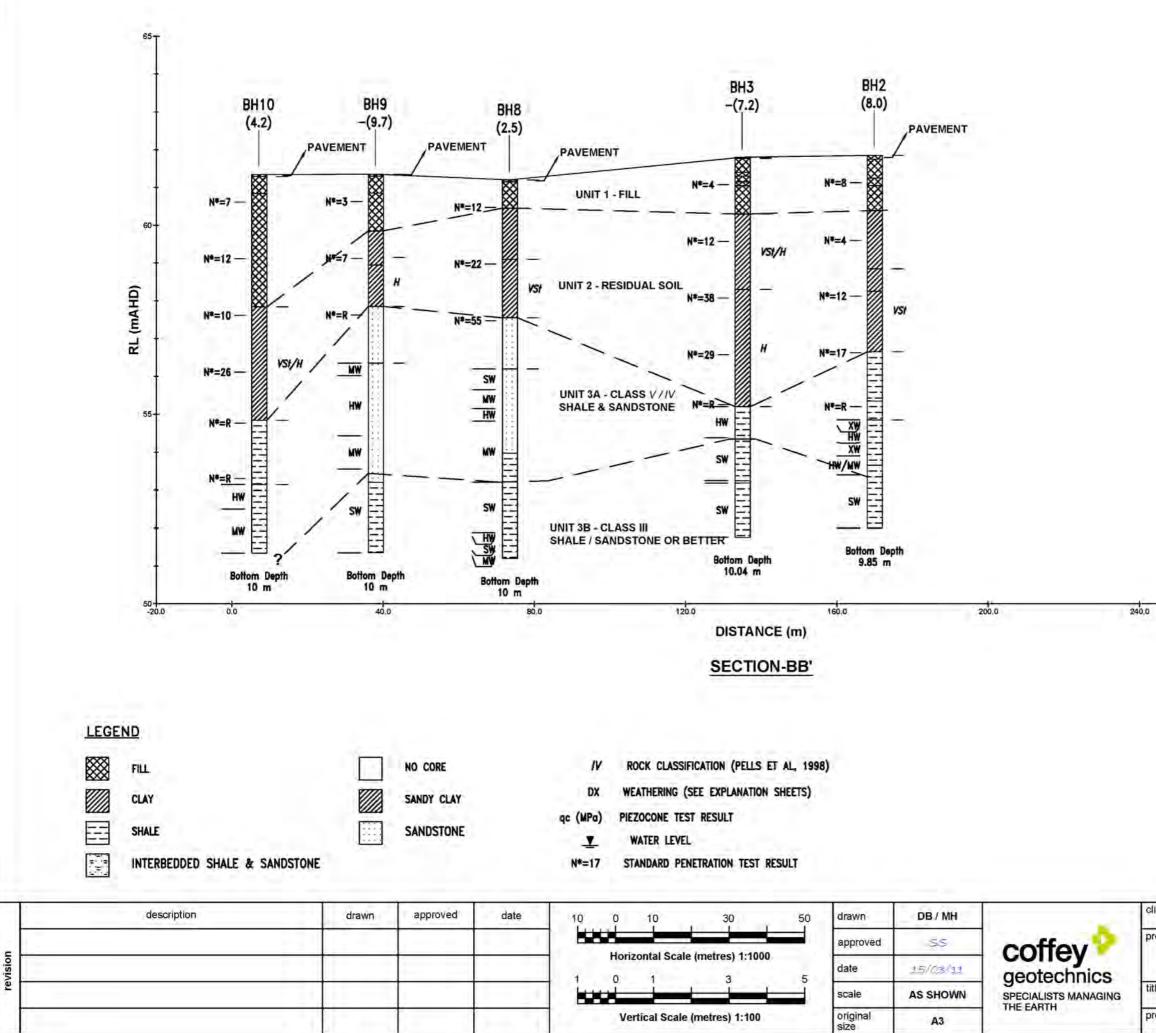
Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Figures



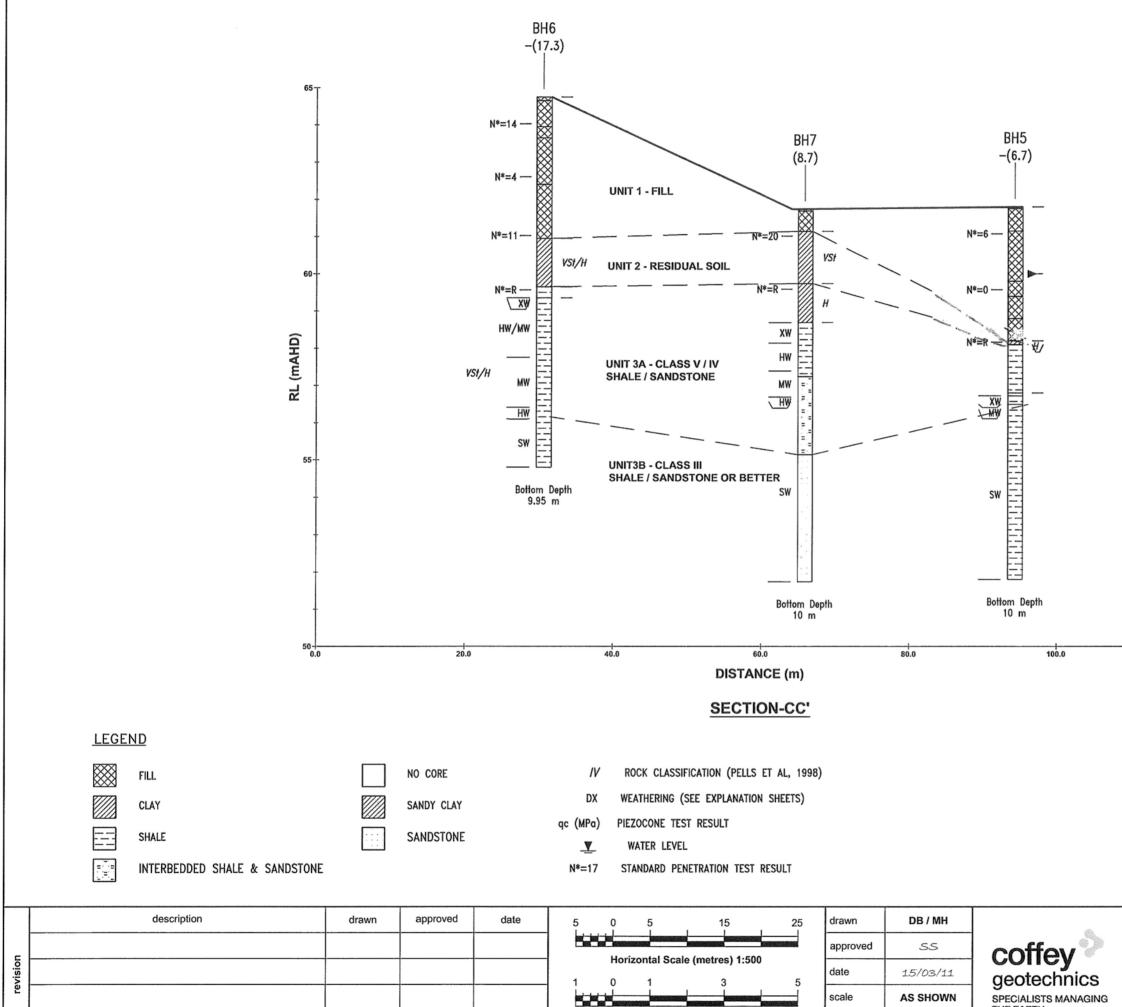




nt:	HEALTH INFRASTR	UCTURE, NSW
	HEALTH INFRASTR BLACKTOWN HOSPITA BLACKTOWN HOSPITAL	
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ent: oject: le: oject no:	BLACKTOWN HOSPITA BLACKTOWN HOSPITAL SECTION	AL DEVELOPMENT , BLACKTOWN, NSW

300.0

280.0



Vertical Scale (metres) 1:100

AS SHOWN original size

A3

SPECIALISTS MANAGING THE EARTH

client:	HEALTH INFRASTRUC	TURE, NSW	
project:	BLACKTOWN HOSPITAL DEVELOPMENT BLACKTOWN HOSPITAL, BLACKTOWN, NSW		
title:	SECTION C	C'	
project no:	GEOTLCOV24207AB	figure no: FIGURE 4	

120.0

Appendix A

Engineering Borehole Logs, Core Photographs and Explanation Sheets



Soil Description Explanation Sheet (1 of 2)

DEFINITION:

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

CLASSIFICATION SYMBOL & SOIL NAME

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

PARTICLE SIZE DESCRIPTIVE TERMS

NAME	SUBDIVISION	SIZE
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 μm to 2.36 mm
	medium	200 μm to 600 μm
	fine	75 μm to 200 μm

MOISTURE CONDITION

- Dry Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
- Moist Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
- Wet As for moist but with free water forming on hands when handled.

CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH S _U (kPa)	FIELD GUIDE
Very Soft	<12	A finger can be pushed well into the soil with little effort.
Soft	12 - 25	A finger can be pushed into the soil to about 25mm depth.
Firm	25 - 50	The soil can be indented about 5mm with the thumb, but not penetrated.
Stiff	50 - 100	The surface of the soil can be indented with the thumb, but not penetrated.
Very Stiff	100 - 200	The surface of the soil can be marked, but not indented with thumb pressure.
Hard	>200	The surface of the soil can be marked only with the thumbnail.
Friable	_	Crumbles or powders when scraped by thumbnail.

DENSITY OF GRANULAR SOILS

TERM	DENSITY INDEX (%)
Very loose	Less than 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	Greater than 85

MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%

SOIL STRUCTURE

	ZONING	CEMENTING			
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.		
Lenses	Discontinuous layers of lenticular shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.		
Pockets	Irregular inclusions of different material.				

GEOLOGICAL ORIGIN WEATHERED IN PLACE SOILS Extremely Structure and fabric of parent rock visible. weathered material								
Residual soil	Structure and fabric of parent rock not visible.							
TRANSPORTED SOILS								
Aeolian soil	Deposited by wind.							
Alluvial soil	Deposited by streams and rivers.							
Colluvial soil	Deposited on slopes (transported downslope by gravity).							
Fill	Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.							
Lacustrine soil	Deposited by lakes.							
Marine soil	Deposited in ocean basins, bays, beaches and estuaries.							

coffey **>**

Soil Description Explanation Sheet (2 of 2)

(Exclu	ding				ON PROCEDURE and basing fractions	-	USC	PRIMARY NAME
GRAINED SOILS % of material less than naller than 0.075 mm 0.075 mm particle is about the smallest particle visible to the naked eye)		GRAVELS More than half of coarse fraction is larger than 2.0 mm	CLEAN RAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.			GW	GRAVEL
			CLEAN GRAVELS (Little or no fines)	Predominantly one size or a range of sizes with more intermediate sizes missing.			GP	GRAVEL
	eye)	GRAVELS than half of is larger than	GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)			GM	SILTY GRAVEL
	e naked	More t fraction i		Plastic fines (for identification procedures see CL below)			GC	CLAYEY GRAVEL
	ble to th		CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate sizes missing		SW	SAND	
	icle visi	SANDS More than half of coarse fraction is smaller than 2.0 mm		Predominantly one size or a range of sizes with some intermediate sizes missing.			SP	SAND
	lest part		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).			SM	SILTY SAND
	the sma			Plastic fines (for identification procedures see CL below).			SC	CLAYEY SAND
	out		IDENTIFICAT	DENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.				
_ a	s ab		DRY STREN	GTH	DILATANCY	TOUGHNESS		
SOILS ial less th 0.075 mn	rticle i	SILTS & CLAYS Liquid limit less than 50	None to Low	1	Quick to slow	None	ML	SILT
FINE GRAINED SOILS More than 50% of material less than 63 mm is smaller than 0.075 mm (A 0.075 mm particle is at	nm pa	_TS & (_iquid ess tha	Medium to High		None	Medium	CL	CLAY
	.075 r	SII SI	Low to medi	um	Slow to very slow	Low	OL	ORGANIC SILT
	(A 0	_AYS mit tin 50	Low to medium		Slow to very slow	Low to medium	MH	SILT
		SILTS & CLAYS Liquid limit greater than 50	High		None	High	СН	CLAY
Mc 6	9 Ø	SILT Lik	Medium to High		None	Low to medium	OH	ORGANIC CLAY
HIGHLY SOILS	HIGHLY ORGANIC SOILS Readily identified by cr frequently by fibrous te			gy feel and	Pt	PEAT		
• Low pl	lastic	city – Liqu	uid Limit W _L les	s than	35%. • Medium plast	icity – W _L between 35%	6 and 50%.	· · · · · · · · · · · · · · · · · · ·

SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

COMMON DEFECTS IN SOIL					
TERM	DEFINITION	DIAGRAM	TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.		SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	AND STOLEN
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length.		TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.		TUBE CAST Roughly cylindrical elongated body of soi different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.		
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.		INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	



Rock Description Explanation Sheet (1 of 2)

The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993. DEFINITIONS: Rock substance, defect and mass are defined as follows: Rock Substance In engineering terms roch substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material, may be isotropic or anisotropic. Defect Discontinuity or break in the continuity of a substance or substances. Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or Mass more substances with one or more defects. SUBSTANCE DESCRIPTIVE TERMS: **ROCK SUBSTANCE STRENGTH TERMS** ROCK NAME Simple rock names are used rather than precise Term Abbrev- Point Load Field Guide Index, I_S50 (MPa) geological classification. iation PARTICLE SIZE Grain size terms for sandstone are: Coarse grained Mainly 0.6mm to 2mm Medium grained Mainly 0.2mm to 0.6mm Very Low VL Less than 0.1 Material crumbles under firm blows with sharp end of pick; Mainly 0.06mm (just visible) to 0.2mm Fine grained can be peeled with a knife: pieces up to 30mm thick can FABRIC Terms for layering of penetrative fabric (eg. bedding, be broken by finger pressure. cleavage etc.) are: Massive No layering or penetrative fabric. 0.1 to 0.3 Easily scored with a knife: Low L Indistinct Layering or fabric just visible. Little effect on properties. indentations 1mm to 3mm show with firm bows of a Distinct Layering or fabric is easily visible. Rock breaks more pick point; has a dull sound easily parallel to layering of fabric. under hammer. Pieces of core 150mm long by 50mm CLASSIFICATION OF WEATHERING PRODUCTS diameter may be broken by hand. Sharp edges of core Term Abbreviation Definition may be friable and break RS Soil derived from the weathering of rock; the during handling. Residual Soil mass structure and substance fabric are no longer evident; there is a large change in 0.3 to 1.0 volume but the soil has not been significantly Medium Μ Readily scored with a knife: a piece of core 150mm long by transported. . 50mm diameter can be broken by hand with difficulty. xw Material is weathered to such an extent that it Extremely has soil properties, ie, it either disintegrates or Weathered can be remoulded in water. Original rock fabric Material Hiah н 1 to 3 A piece of core 150mm long still visible. by 50mm can not be broken by hand but can be broken HW Rock strength is changed by weathering. The Highly by a pick with a single firm whole of the rock substance is discoloured, Weathered blow; rock rings under usually by iron staining or bleaching to the Rock extent that the colour of the original rock is not hammer recognisable. Some minerals are decomposed to clay minerals. Porosity may be increased by Very High VH 3 to 10 Hand specimen breaks after leaching or may be decreased due to the more than one blow of a deposition of minerals in pores pick; rock rings under Moderately MW The whole of the rock substance is discoloured, hammer. Weathered usually by iron staining or bleaching , to the extent that the colour of the fresh rock is no Rock Extremely EH More than 10 Specimen requires many longer recognisable. blows with geological pick to High Slightly Rock substance affected by weathering to the break; rock rings under SW extent that partial staining or partial hammer Weathered discolouration of the rock substance (usually by Rock limonite) has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the Notes on Rock Substance Strength: fresh rock substance. 1. In anisotropic rocks the field guide to strength applies to the strength perpendicular to the anisotropy. High strength anisotropic rocks may Rock substance unaffected by weathering. Fresh Rock FR break readily parallel to the planar anisotropy. The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein Notes on Weathering: 1. AS1726 suggests the term "Distinctly Weathered" (DW) to cover the range of makes it clear that materials in that strength range are soils in engineering terms. substance weathering conditions between XW and SW. For projects where it is not practical to delineate between HW and MW or it is judged that there is no 3. The unconfined compressive strength for isotropic rocks (and advantage in making such a distinction. DW may be used with the definition anisotropic rocks which fall across the planar anisotropy) is typically given in AS1726. 10 to 25 times the point load index (Is50). The ratio may vary for 2. Where physical and chemical changes were caused by hot gasses and liquids different rock types. Lower strength rocks often have lower ratios associated with igneous rocks, the term "altered" may be substituted for than higher strength rocks. "weathering" to give the abbreviations XA, HA, MA, SA and DA.



Rock Description Explanation Sheet (2 of 2)

ROCK MA		Diagram	Map Symbol	(Note 1)	DEFECT SHAPE Planar	TERMS The defect does not vary in orientation
Term	Definition					onentation
Parting	A surface or crack across which the rock has little or no tensile strength. Parallel or sub parallel to layering	<i></i>	20 Bed	ding	Curved	The defect has a gradual change in orientation
	(eg bedding) or a planar anisotropy in the rock substance (eg, cleavage).		20 Clear		Undulating	The defect has a wavy surfac
	May be open or closed.			(110(0 2)	Stepped	The defect has one or mor well defined steps
roc bu pa an	A surface or crack across which the rock has little or no tensile strength. but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance.				Irregular	The defect has many sharp changes of orientation
			×60	(Note 2)	Note: The assessment of defect shape is pa influenced by the scale of the observation	
	May be open or closed.				ROUGHNESS Slickensided	TERMS Grooved or striated surface usually polished
Sheared Zone Note 3)	Zone of rock substance with roughly parallel near planar, curved or				Polished	Shiny smooth surface
closely sp surfaces o the defect intersect t	undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of	A.	35	11 (11)	Smooth	Smooth to touch. Few or n surface irregularities
	the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.	11111			Rough	Many small surface irregularitie (amplitude generally less thar 1mm). Feels like fine to coars sand paper.
Sheared Surface Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.		40	10.200 10.200	Very Rough	Many large surface irregularities (amplitude generally more than 1mm) Feels like, or coarser than ve coarse sand paper.
Crushed Seam	Seam with roughly parallel almost planar boundaries, composed of				COATING TER Clean	MS No visible coating
(Note 3)	disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam has soil properties.	10 10 10	50 50		Stained	No visible coating but surfaces are discoloured
					Veneer	A visible coating of soil or mineral, too thin to measure may be patchy
nfilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries				t i s	A visible coating up to 1mi thick. Thicker soil material usually described using appropriate defect terms (e infilled seam). Thicker roc strength material is usuall described as a vein.
	formed by the migration of soil into an open cavity or joint, infilled seams less than 1mm thick may be described as veneer or coating on joint surface.		AL A	65		
Weathered Seam	Seam of soil substance, often with gradational boundaries. Formad by weathering of the rock substance in place.				BLOCK SHAPI Blocky	E TERMS Approximately equidimensional
		\$\$0\$X\$\$\$	JUL 32	DL DI	Tabular	Thickness much less than length or width
		Seam			Columnar	Height much greate than cross section

- 1. Usually borehole logs show the true dip of defects and face sketches and sections the apparent dip.
- 2. Partings and joints are not usually shown on the graphic log unless considered significant.
- 3. Sheared zones, sheared surfaces and crushed seams are faults in geological terms.



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E	ng	in	ee						ehole			Sheet Project	No:		1 of 3 GEOTLCOV24207AE
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	model		moui			power S	Scout -	Truck	Easting: 307226 slope:	-90°			R	.L. Su	urface: 61.9
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method	penetration	support	water	notes samples, tests, etc		depth	graphic log	classification symbol	material soil type: plasticity or particle characteristic	cs,	moisture condition	consistency/ density index	A pocket a penetro-		structure and additional observations
	123	© ⊽	3		RL	metres	5) XXXX	0.0	colour, secondary and minor components FILL: BITUMEN: Black.	δ.		σσ	30 g 9		AVEMENT
ADT				E+D		-			FILL: Gravelly SAND: Fine to coarse grained, brown, fine to medium gravel, angular, trace of the second sec	- — —] clav.	D			FĪ	LL 1-0.5m PID=1.2ppm
				SPT 20,5,2 N*=7	61				FILL: Gravelly SAND: Fine to coarse grained, brown, fine to medium gravel, angular, trace of e	pale					5-0.95m PID=1.6ppm
				D		<u>1</u> –		CL/CH	CLAY: Medium to high plasticity, brown, trace fine angular shale and fine subrounded ironston gravel.	of ne	D/M	VSt/St		R	ESIDUAL SOIL
					_60	2		CL	CLAY: Medium plasticity, pale grey/red brown, trace of fine rounded ironstone gravel and roots			VSt			
				SPT 1,2,4 N*=6	-	-						Н	×	2.	0-2.45m PID=1.1ppm
				U ₅₀	_59	3								*	
				SPT 2,5,9 N*=14	_58	 			Trace of fine grained sand at 3.50m.				*		· · ·
				SPT 4,15 N*=R	_57	5			SHALE: Extremely weathered, pale grey/red brown, ironstained, estimated low to be very low strength, remoulds to a gravelly clay.					Si	
				SPT 6	_56	6									-
				N*=R	_55	7	<u> </u>	<u>.</u>	SHALE: Highly weathered, dark grey/pale grey vironstained, estimated low to medium strength. Borehole BH1 continued as cored hole	у,					
metil AS AD RR W CT HA DT B V T *bits e.g.	hod shown I	au ro wa ca ha di bl bl V T(by sut	iger d Iler/tri ashbo ible to and au atube ank bi bit C bit	re ol ıger	M C per 1	ter 10/1/9	n no resista ranging to refusal 8 water e showr nflow	level	U _{s0} undisturbed sample 50mm diameter U ₆₃ undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample		ption inified	classifica			consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense

BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11



		U			y	900.00								Bo	orehole No.	BH1	1
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С	lien	t:		1	Heal	th Infrastructure									ate started:		.2011
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						wer Scout Truck	Easting		30722	26	s	lope:		-90°	-	L. Surface:	61.9
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,	,				graphic log core recovery	rock type; grain characteris	stics. colour,	ering ion		imate rength		s ₍₅₀₎ 1Pa	%	defect spacing	type,		anarity, roughness,
mothod	core-lift	water		depth	Iraphic ore re	structure, minor comp		weathering alteration		-		diam- etral axial		mm		coating, t	hickness
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			55	7		SHALE: Pale grey/red brown staining along defects, with so	n, iron	XW HW			0	0	Π	┪	Highly F	Clay filled, pp= ractured Zone	
Ž				-	<u> </u>	grained sandstone lamination 6.80 to 7.27m.										f	
				-			ļ	MW					99	╗║	Highly F	ractured Zone ractured Zone ractured Zone	e, 80mm
			54	-	ĒĒ	SHALE: Grey/dark grey, thin 0-5°.	ly bedded at	SW			D	A_		╺┹╖║	PT, 10m		
	netho) Jd	Γ	8	E	core-lift	water	<u> </u>			wea	20.23 athering	g			ct type	roughness
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F	AD RR		rolle	ger drilling er/tricone		barrel withdrawn	► wat				HW XW	/ hig / ext	ghly v ctreme	weathered ely weather	red SZ	sheared zone sheared surfac	SL slickensided
1			NM	w or blade ILC core		graphic log/core recovery		rtial drill fl mplete dr			DW	(cc		ly weathere MW and H		crushed seam	coating
	IQ, H	iq, pq) wire	eline core	1	core recovered - graphic symbols					VL	ength vei lov	ery lov	N	PL	planar curved	CN clean SN stained
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CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11



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dri	llin	g ir	oform	nation		erial substance material		i	1		1	ro	ock mas	s defe		efect descrip	tion	
method	core-lift	water	RL	depth metres	graphic log core recovery	rock type; grain characte structure, minor cor		weathering alteration	estim strer	ngth	Is ₍₅₀₎ MPa D- dian etral A- axia	, Ъ % ДС	defect spacing mm	9	type, inclin	ation, planari coating, thickr	ty, roughne	ess, general
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		mpur		-							D / 0.2 0	.3 64 64	┍┿┯┛		JT, 80°, PL, R	O, CN		; unle
		Gro		-							D /	.3	└┼┧╎╎		PT Highly Fractu 60mm	red Zone of N	/lultiple PT,	, s,
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CB NMI			NM	w or blade ILC core		graphic log/core recovery		artial drill f mplete d		SS	DW	distinc (cover	tly weathe s MW and	red	CS crush	ned seam	00041	
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CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11





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Ε	ng	in	ee						ehole			Sheet Project	No:		1 of 3 GEOTLCOV24207	AB
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Prir	ncipal	:									[Date co	omple	ted:	16.2.2011	
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	model diame		mour	0		power S	Scout	Fruck	Easting: 307233 slope:	-90°					urface: 61.85	
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method	penetration	support	water	notes samples, tests, etc	ы	depth	graphic log	classification symbol	material soil type: plasticity or particle characteri colour, secondary and minor compone		moisture condition	consistency/ density index	0 A pocket		structure and additional observations	
	123	° C	>		RL	metres		0 0	FILL: BITUMEN: Black.	ents.		00	8 6 9 8 7 9 8 9 9		AVEMENT	
ADT				E		-			FILL: Gravelly SAND: Fine to coarse, brow is fine to medium, angular, trace of clay.	n, gravel	D			Fi		
				SPT		-			FILL: Gravelly SAND: Fine to coarse, pale	brown					.5-0.7m PID=5.3ppm	
			-	6,5,3 N*=8	_61				FILL: CLAY: Medium to high plasticity, pale trace of ironstone gravel.	· /	<wp< th=""><th></th><th>*</th><th></th><th></th><th>-</th></wp<>		*			-
						-		CL/CH	CLAY: Medium to high plasticity, pale brow mottled red brown/pale grey, with some coar	n — — — — — — — — — — — — — — — — — — —		F/St		R	ESIDUAL SOIL	
					_60	2			grained sand, trace of fine angular ironstone							-
				SPT 1,2,2 N*=4		-							*	2.	0-2.2m PID=6.3ppm	-
					_59			CL	CLAY: Medium plasticity, brown/pale brown			VSt				-
			-	SPT	-	-			some fine ironstone gravel.			voi	*	3	5-3.7m PID=6.6ppm	-
				2,5,7 N*=12	_58	4		CL/CH	Sandy CLAY: Medium to high plasticity, pa trace of ironstone gravel and rootlets.	le grey,						_
						-										-
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			ł	SPT		5_								5.	0-5.2m PID=7.5ppm	-
				3,7,10 N*=17		_			SHALE: Extremely weathered, pale grey, es to be very low strength, remoulds to a gravel					S	HALE	
						-										-
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						-										-
				SPT	-	-			SHALE: Highly weathered, pale grey, estim							-
				12,22 N*=R	_55				be very low strength, iron stained.					6.	.5-6.8m PID=2.5ppm	1
					1	7			Borehole BH2 continued as cored hole				+ +	\parallel		-
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AS AR AR W CT HA DT B V T *bit e.g.	h od	au roi ka ca ha dia bla V TC	iger di ler/trid ashbo ble to ble to and au atube ank bi bit bit bit bit	re ol ıger	M C pe	ter 10/1/9	n no resista ranging to refusal 8 water e showr inflow	level	notes, samples, tests U ₅₀ undisturbed sample 50mm diameter U ₈₃ undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal		iption unified o	classificat			consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense	



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	Clie	nt:			Heal	th Infrastructure								Dat	e started:	15.2.201	11
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	method	water		depth	graphic log core recovery	rock type; grain character structure, minor com		weathering alteration		imated ength	Is ₍₅₀₎ MPa D- diam- etral	RQD %	defe spac mr	ing n	type, inclin		y, roughness,
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			_55	7		Continued from non-core	ed borehole										-
	NMLC		_54			SHALE: Pale grey mottled staining along defects.	red/brown, iron	XW HW XW				40			-XW, Clay filler -Highly Fractur PT, 0°, CU, RO Highly Fractur -PT, 0°, CU, RO -PT, 0°, CU, RO	red Zone, 330 O, SN red Zone, 270 O, SN D. SN)mm)mm
	meth DT AS AD RR CB NML NQ,		aug aug roll clav NM	ube ler screwi er drilling er/tricone v or blade LC core eline core	e bit	core-lift casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material no core recovered	ب wat ب wat ب wat ر ma ی ی (این ر این	1/98 wat date sho er inflow tial drill fl nplete dr er press geons) fo grval sho	wn uid los Il fluid ure tes r deptl	ss I loss st result	SW s MW m HW h ZW e DW c (strength VL v L li M m H h VL v VL v	resh slightly noder highly extrem distinc cover very lo ow nedium high very hi	m	eather red athered hered nd HV	d SZ shea SS shea CS crush	ng red zone red surface ned seam ar ad lating ped	roughness VR very rough RO rough SO smooth SL slickensided CN clean SN stained VN veneer CO coating

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

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(U)		ey	y	yeolec	111103					B	orehole	e No.	BH2		
	Ξı	างู	gi	ne	eri	ng	Log - Core	d Bore	eho	le				neet roject N	No:	3 of 3 GEOTL	COV2420	07AB
_	Clie						th Infrastructure						D	ate sta	rted:	15.2.20		
F	Prin	cip	al:										D	ate cor	npleted:	16.2.20 ⁻	11	
F	Proj	ect	:		E	Blac	ktown Hospital Deve	elopment					Lo	ogged	by:	VJ		
E	sore	eho	le l	_ocat	ion:	Blac	ktown District Hosp	ital Carpar	ĸ				С	hecked	l by:	SS		
d	rill r	nod	el &	mour	nting: Hy	drapov	ver Scout Truck	Eastir	ng: :	307233	slope):	-90°		R.L. Su	rface: 61	.85	
			nete		12: ation		Drilling fluid: erial substance	Northi	ing: (6260711	beari	ĭ	ck mas	e dofoc	datum:	Ał	HD	
┝		Ţ	,				material			estimate	d la		defect			efect descrip	otion	
	Liletion	core-III	water	RL	depth metres	graphic log core recovery	rock type; grain characteri structure, minor comp		weathering alteration	strengt	n MPa D-diam etral		spacing mm	3	c	ation, planarit coating, thickn		
L		_	_	RL	metres		-		HW/MV	2727 <u>3</u>		++	86868			Parting every		general
			Groundwater Not Monitored				SHALE: Pale grey/dark grey bedded at 0-5°, with some find sandstone laminations, pale g	e grained	sw	-	0.31 0.3 D A 0.28 0.3 D	┨┢)	fo	r 210mm)	ed Zone, 120		_
			water No	_53	9_						0.2 D A	40	j		T, 0°, RO T, 0-5°, RO			-
			Ground								0.2 0.6	<u>;4</u>	ł	`_л	T, 0°, RO T, 80-85°, RC T, 0°, PL	D, SN, 210mn	n	-
L	_	+	_	52	10		BH2 terminated at 9.85m				D 0.3							
																		-
				_51	-													-
					1 <u>1</u> -													
				50	-													-
				_00	1 <u>2</u>													
					_													-
				_49	13													
					-													-
				_48	14													-
					_													-
			-	_47	1 <u>5</u>													_
					_													-
				_46	16			1			weather	inc			i			_
	meti DT AS AD RR	100		aug	er screwi er drilling r/tricone		core-lift casing used barrel withdrawn	→ on	/1/98 wat date sho ater inflow	wn ,	FR SW MW HW XW	fresh slightly modera highly w extreme	weathered tely weath reathered ely weathe	ered red	SS shea	ng i red zone red surface	roughness VR very rou RO rough SO smooth SL slickens	, ,
	CB NML NQ,		PQ	NM	/ or blade _C core line core	זוט :	core recovered - graphic symbols			ill fluid loss	strengtl VL	(covers	y weathere MW and H		planarity PL plana CU curve	d	coating CN clean SN stained	
							no core recovered	55 (Iu	ater press geons) fo erval sho		III M H VH	medium high very hig extreme	h		UN undu ST stepp IR irregu	ed	VN veneer CO coating	





СОПЕ	эу 🍷 🖞	yeole		-	Borehol	le No.	BH3
Enginee	ring Log	g - Bor	ehole		Sheet Project	No:	1 of 3 GEOTLCOV24207AB
Client:	Health Infra	astructure			Date sta	arted:	16.2.2011
Principal:					Date co	mpleted:	16.2.2011
Project:	Blacktown	Hospital D	evelopment		Logged	by:	VJ
Borehole Location	Blacktown	District Ho	spital Carpark		Checke	d by:	SS
drill model and mount	ing: Hydrapowe	r Scout Truck	Easting: 307196 slope:	-90°		R.L. Su	urface: 61.8
hole diameter: drilling information	125 mm		Northing 6260702 bearing:			datum:	AHD
tration	notes samples,	graphic log classification symbol	material	ē e	consistency/ density index	pocket penetro- meter	structure and additional observations
9 1 1	tests, etc dept	8 파 graphic log classificatic symbol	soil type: plasticity or particle characteristi		onsist lensity	kPa	
120	RL metro	es 5 0 0 v	colour, secondary and minor component FILL: BITUMEN: Black.	IS. 20	00	€ 8 8 8 9 \P/	AVEMENT
	E + D SPT 1,2,2 N*=4 1		FILL: Sandy GRAVEL: Fine to medium, angu gravel, dark grey/brown, fine to coarse grained FILL: Gravelly SAND: Fine to medium sand, brown/grey, medium, angular gravel, trace of of FILL: CLAY: Low plasticity, brown/grey, trace medium gravel and roots. FILL: SAND: Medium to coarse sand, brown/grey/white, trace of fine angular gravel.	ular d sand. clay.	_	FI 0.	LL
	<u>E + D</u> 60	CL/CH	FILL: CLAY: Low to medium plasticity, brown brown/grey, with some fine angular gravel. CLAY: Medium to high plasticity, pale grey/re brown, with some fine angular ironstone grave	ed <wp< td=""><td>VSt/H</td><td></td><td>20-1.30m PID=1.8ppm ESIDUAL SOIL</td></wp<>	VSt/H		20-1.30m PID=1.8ppm ESIDUAL SOIL
	SPT 3,5,7 N*=12 _59		of sand and roots.			× 2. *	00-2.45m PID=1.9ppm
	SPT 7,14,24 N*=38		CLAY: Medium to high plasticity, pale grey m red brown, with some fine ironstone gravel.	ottled	н	*3.	- 50-3.95m PID=2.1ppm - - - - - - - -
	SPT 5,9,20 N*=29 _56566					*	
	<u>SPT</u> 20/90mm <u>N*=R</u> _55 _54 _54	-	Borehole BH3 continued as cored hole				-
method AS auger scr. AD auger dril RR roller/tricc W washbore CT cable tool B blank bit V V bit T T C bit *bit shown by suffix e.g.	er water water water ↓ 10/1 ↓	N nil Ig ion	notes, samples, tests Us0 undisturbed sample 50mm diameter Us1 undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal	classification sy soil description based on unified system D dry M moist W wet Wp plastic lim W_L liquid limit	l classificat		consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense



					y	J									В	oreho	le No.	BH3	
Ε	n	gi	ine	eri	ng	Log - Cored E	Bore	eho	le							heet roject	No:	2 of 3 GEO	TLCOV24207AE
Cli	ent	:		1	leal	th Infrastructure									D	ate st	arted:	16.2.2	
Pri	inci	pal:													D	ate co	mpleted:	16.2.2	2011
	ojeo	•		,	Blac	ktown Hospital Develop	ment									ogged	•	VJ	
						ktown District Hospital (ł								hecke	-	SS	
_						wer Scout Truck	Eastin		3071	96		slope:		_0	0°	песке	R.L. Su		61.8
		amet				Drilling fluid:	Northi	•	6260			bearin		-	-		datum:		AHD
d	rillir	ng ir	nform	ation		terial substance							rc	ock	mas	s defe	cts		
method	core-lift	water	RL	depth	graphic log core recovery	material rock type; grain characteristics, c structure, minor component		weathering alteration	st	timate rengtl ≥ ± 3	h	Is ₍₅₀₎ MPa D- diam- etral A- axial	RQD %	sp: r	efect acing mm		type, inclir	lefect des nation, plar coating, th	narity, roughness,
⊢		-								21;	> ш			ě ÷	m ÷ i				general
				-															-
				-															-
			_61	1															-
				_															
				-															-
			_60	-															-
				2_															-
				-															-
				-															-
			_59	3															-
				-															-
				-															-
			_58	-															-
				4															
				-															-
				-															-
			_57	5															-
				_															-
				-															-
			_56	-															-
				6															-
				-															-
0						Continued from non-cored bore SHALE: Pale brown/pale grey, dis		HW									PT, 0-5°, CU,	RO, SN	
NMLC			_55	7		bedded 0-5°, with some minor sand laminations.										<u>\</u> \F	PT, 0-5°, CU, PT, 0°, PL, R	D, SN	-
				_	<u> </u>	At 6.85m becoming grey/pale grey.					-	D A 0 0.06		₹		_/\·I	IT, 45°, CU, F Highly Fractu	red Zone,	
				-				SW				DA	60	<u>र</u>			Highly Fractu IT, 30°, RO, 9 PT, 0-5°, CU,	SN	SUMM -
			_54	-								0.170.12 				W +	Highly Fractu IT, PL, SO		20mm -
m	etho	d		8		core-lift	water					0.25 0.26 weatherin					PT, 0-5°, CU,		roughness
DT	Г		diat aug	ube er screwi	ng	casing used	T 10/	/1/98 wat date sho		el		FR fre SW sli	esh ightly	wea	there	ł	JT joint PT parti	ng	VR very rough RO rough
AE)		aug	er drilling er/tricone	, ,	barrel withdrawn	► wa					MW m HW hi	oder ghly	ately weatl	weath hered reathe	ered	SM sear SZ shea	n ired zone	SO smooth SL slickensided
CE			clav	v or blade LC core		graphic log/core recovery	→ par → cor	rtial drill f mplete dr				DW di	stinc	tly we	eather ather	ed	CS crus	red surface hed seam	
		Q, PG		line core		core recovered - graphic symbols						strength VL ve	ery lo				planarity PL plan		coating CN clean
						indicate material		iter press geons) fo			ult	L lo M m					CU curv UN undu ST step	Ilating	SN stained VN veneer CO coating
						no core recovered		erval sho				VH ve	ery hi	gh ely h	igh		IR irreg		oodaniy

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

-			.			geotechr	nice										
C	,	U		e	y	geoleciii	1103						Bo	orehole No	· E	BH3	
Ε	n	gi	ine	eri	ng	Log - Cored E	Bore	eho	le					neet oject No:		of 3 GEOTLCO	V24207AB
Clie		-				th Infrastructure								ate started:		6.2.2011	
Prii	nci	pal:											Da	ate comple	ted: 1	6.2.2011	
Pro		•		E	Blaci	ktown Hospital Develop	ment							gged by:		/J	
			Locat			ktown District Hospital (k						necked by:		S	
						ver Scout Truck	Eastin		307196		slope:		-90°	,	R.L. Surfa		
hole	e di	ame	ter:	12	5 mm	Drilling fluid:	Northi	ing:	6260702	2	bearin	g:		C	datum:	AHD	
dr	illiı	ng ii	nform	ation		erial substance material		i	i		1	rc	ock mass	defects	dofo	ct description	
					log overy			ng n	estim strer		Is ₍₅₀₎ MPa		defect spacing			•	
method	core-lift	water		depth	graphic log core recovery	rock type; grain characteristics, c structure, minor component		weathering alteration		0	D- diam- etral	RQD %	່ຫຫຼັ			on, planarity, ro ting, thickness	ughness,
	ō	wa	RL	metres	gra				z r k	тγп	A- axial	RC	300 300 3000 3000				general
NMLC		ored		_		SHALE: Pale brown/pale grey, dis bedded 0-5°, with some minor sand		SW					Ĺ	\\\Highly	; CU, SN, Fractured RO, CU	SO Zone, 40mm	-
z		Monit		-		laminations. (continued)					D A_	60		\JT, 45-	80°, PL. S RO, CU	O, 100mm	-
		Not	_53			NO CORE: 0.06m. SHALE: Grey/pale grey, distinctly	bedded	sw			0.43 0.5					Zone, 70mm	
		Groundwater Not Monitored		9		at 0°-5°, with some minor sandstone laminations.									, 75-80°, 1	Fmm	_
		ound		-							D A		5	► PT, 0°,	PL	Jillin	-
		Ģ		_							0.3 0.3		ון	-PT, 0°,	ST		
			_52	10							DA			-PT, 0°,	PI		-
				<u> </u>		BH3 terminated at 10.04m					_D A_ 0.2 0.2		₽	,.,			
				-													-
			_51	-													-
				11_													
				-													-
				-													-
			_50														
				12_													
				-													-
			_49	13													-
				_													
				-													-
			_48														-
				14													_
				-													-
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			_47	15													-
																	_
				-													-
			_46	-													-
	th -	d	Γ.ο	16	L,	core-lift	water				weatherin	a		 			
DT AS		a	diat	ube er screwi	og.	casing used	water	/1/98 wat date sho	ter level		FR fre	esh	weathered	defe JT PT	ect type joint parting		ughness very rough rough
AD RR			aug	er screwi er drilling er/tricone	ч	barrel withdrawn		ter inflow			MW m HW hi	oder: ghly	ately weathe weathered	ered SM SZ	seam sheared	zone SL	smooth
СВ			clav	v or blade	bit	graphic log/core recovery	- pa	rtial drill f		SS	DW di	stinct	ely weather tly weathere s MW and H	d CS	sheared crushed		
		Q, PG		line core		core recovered - graphic symbols		u		~-	strength	ery lo		PL	n arity planar	CN	
						indicate material			ure test r	esult	L lo M m	w ediur		CU UN ST	curved undulatir stepped	ng VN CC	veneer
						no core recovered		geons) fo erval sho			VH ve	gh ery hi ktrem	gh ely high	IR	irregular		Joaniy





concy	y	Borehole No.	BH4
Engineering Log	- Borehole	Sheet Project No:	1 of 3 GEOTLCOV24207AB
Client: Health Infras		Date started:	18.2.2011
Principal:		Date completed	: 18.2.2011
Project: Blacktown H	lospital Development	Logged by:	VJ
Borehole Location: Blacktown D		Checked by:	SS
drill model and mounting: Hydrapower		•	Surface: 62.0
hole diameter: 125 mm	Northing 6260672 bearing:	datu	m: AHD
drilling information	material substance		
Pour state in the	B0 Interview Interview In	's moisture condition consistency/ density index density index 200 v pocket 200 v meter	structure and additional observations
	FILL: BITUMEN: Black.		
	FILL: SAND: Fine grained sand, brown, with so fine gravel, trace of clay.	ome	FILL
SPT - 1,2,6	CH CLAY: High plasticity, pale grey, trace of ironst		0.5-0.6m PID=5.8ppm
N*=8_61 <u>1</u>	CH CLAY: High plasticity, pale grey, trace of ironstr gravel and rootlets.		
			-
			-
			-
60 <u>2</u> SPT	CL CLAY: Medium plasticity, pale grey/red brown,	_H	2.0-2.1m PID=0.7ppm
1,13,19 - N*=32 _	trace of ironstone gravel.		-
			-
59 3			-
			-
15 N*=R 58 4	SHALE: Extremely weathered, pale grey/red		SHALE
	brown, estimated to be very low strength, remou a gravelly clay.	Jilds to	
-	Borehole BH4 continued as cored hole		-
			-
_57 5			-
			-
			-
			-
			-
			-
			-
55 7	4		_
			-
			-
			-
method support AS auger screwing* M mud		classification symbols and soil description	consistency/density index VS very soft
AD auger drilling* C casing RR roller/tricone penetratio	D U ₆₃ undisturbed sample 63mm diameter b D disturbed sample 63mm diameter b	based on unified classification system	S soft F firm
W washbore 1 2 3 4 CT cable tool	no resistance N standard penetration test (SPT) ranging to N* SPT - sample recovered n	moisture	St stiff VSt very stiff
HA hand auger DT diatube water	Irrefusal Nc SPT with solid cone U V vane shear (kPa)	D dry M moist	H hard Fb friable
V V bit 📥 on dat	te shown Bs bulk sample	W wet Wp plastic limit W liquid limit	VL very loose L loose
	inflow R refusal outflow	W _L liquid limit	MD medium dense D dense VD verv dense



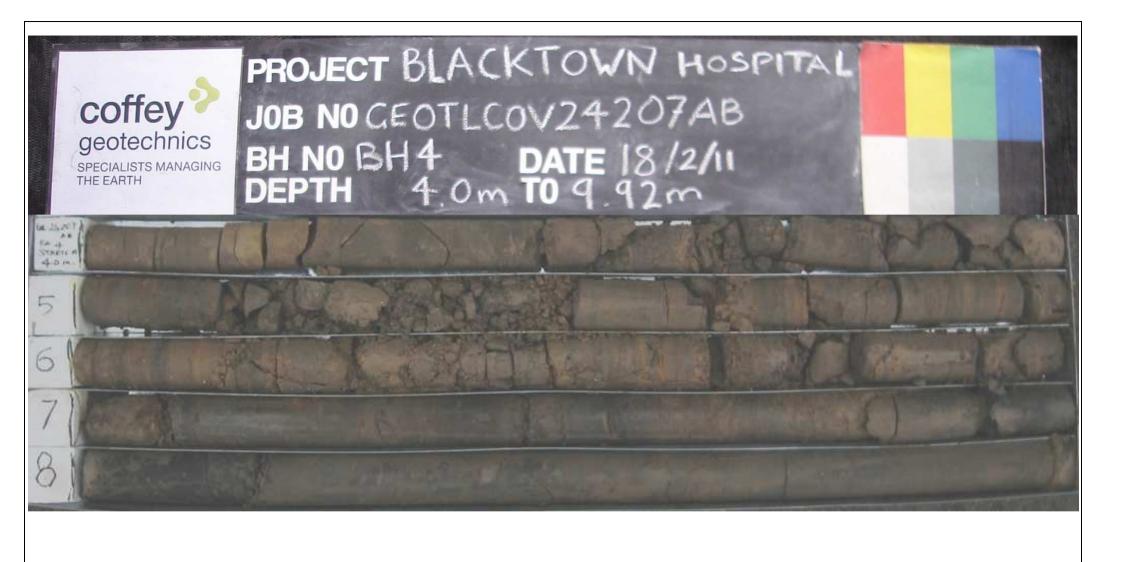
		U	/		y	3								Во	rehole No.	BH4	
F	Ξr	ıgi	ine	eri	ng	Log - Core	d Bore	eho	le						eet oject No:	2 of 3 GEOTLC	OV24207AB
С	Clien	/t:			Healt	th Infrastructure								Da	te started:	18.2.201	1
P	'rinc	ipal:	:											Da	te completed:	18.2.201	1
P	Proje	ect:		1	Blacl	ktown Hospital Deve	elopment							Lo	gged by:	VJ	
			Loca			ktown District Hosp	•	k							ecked by:	SS	
_						wer Scout Truck	Easting		30718	37	s	lope:		-90°	R.L. Su)
		liamet				Drilling fluid:	Northir	ng:	62606	572	b	earing:			datum:	AHD)
Ľ	llink	ng ir	nform	ation		terial substance material		 	+						defects d	efect description	on
	- _+			!	graphic log core recovery	rock type; grain characteri	istics colour.	≱ring ion		imateo ength		S ₍₅₀₎ IPa		defect spacing		ation, planarity,	
-othou	method core-lift	water		depth	raphic ore re	structure, minor comp		weathering alteration		_	. 6	diam- etral axial	ຼ	mm 88	C	coating, thicknes	SS
Ľ	- ō	3	RL	metres	δō			<i>5</i> ≤	: 	Σı≯	≞~°		Υ e	3000	particular		general
																	-
																	-
			61	1													_
			_01	-													
				_'													-
				-													-
			_60	2													
																	_
				7													-
			-0	3													_
			_59	-													
				_'													-
																	-
Ļ	, –	+	58	4		Continued from non-core SHALE: Grey/red brown, thir		HW		++-		\rightarrow					
		nitored				iron stained.	lly lanacc,								— PT, 0°, PL, SC — JT, 45°, PL, S	O, SN, 80mm	-
						-								┛	Highly Fractur	red Zone, 440m N	יm –
		Groundwater Not Mo	57	5	E	-									∖JT, 45-50°, IR	, 50mm	-
		ndwa	_0,	<u> </u>										η	-Highly Fractu	red Zone, 350m	 חות
		Grou									LD	۶ A_	8				-
				-								10.13		(−PT, IR, SN ∽PT, ST, IR		-
			_56	6							D 0.08	A 30.18 A]	PT, 0°, PL, SN		
						-						А 0.03	Γ	•	PT, 0°, PL JT, 75-80°, IR PT, 0°, PL, SN		-
				_											Highly Fractur JT, 90°, IR, 15	red Zone, 500m 50mm	וm _
	F	1	_55	7								A 0.09		ל	PT, 0°, PL, RC −JT, 60-70°, PL	., SN, 80mm	-
							ł	MW			LD	A_ 0.2		h	PT, 0°, IR, SN		-
						-						70	8	┛	— JT, 45-50°, PL — PT, 0°, IR, SN		-
															►PT, 0°, IR —JT, 85-90°, SC	D. 110mm	-
┝	metho	od bc	54	8	<u> </u>	core-lift	water				D wea	A_ athering	-	<u>+</u>]	SM, 20mm		roughness
	DT AS		aug	tube ger screwii		casing used		/1/98 wat date sho		ł	FR SW MV	/ sligh	ntly w	eathered	JT joint PT partir	ng	VR very rough RO rough
	AD RR		rolle	ger drilling er/tricone		barrel withdrawn	► wate				HW XW	/ high / extre	nly we emely	eathered / weathere	ed SZ shea	red zone red surface	SO smooth SL slickensided
I	CB NMLC		NM	w or blade ILC core		graphic log/core recovery	→ part → com	rtial drill f mplete dr			DW			weathered IW and HV		ned seam	coating
	IQ, H	iq, pc	2 wire	eline core		core recovered - graphic symbols					VL		low		PL plana CU curve	ar ed	CN clean SN stained
2						no core recovered	සු (lug	ter press geons) fo	or depth		t м Н	med high	1 I		UN undu ST stepp IR irregu	bed	VN veneer CO coating
							inte	erval sho	wn		VH		/ high emelv	/ high	in inego	Jidi	

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

coffey	geotechnics
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		U	/		y	90010							-	Bore	ehole No.	BH4	
ļ	Er	ıgi	ine	eri	ng	Log - Core	ed Bore	eho	le					She Proj	et ect No:	3 of 3 GEOTL	COV24207AB
-	Clien					th Infrastructure								-	e started:	18.2.20	
F	Princ	ipal:												Date	e completed:	18.2.20	11
F	Proje	ct:		I	Blaci	ktown Hospital De	velopment							Log	ged by:	VJ	
			Loca			ktown District Hos	-	rk						-	ecked by:	SS	
_						wer Scout Truck	Eastin		307187		slope):	-90°		-		2.0
		liamet				Drilling fluid:	North	ning:	626067	2	beari	ĭ			datur	n: Al	HD
F	drilli	ng ir	nform	nation		terial substance material			.		+	rc	1		lefects	defect descrip	otion
,	± q	<u>.</u>			graphic log core recovery	rock type; grain charact		weathering alteration	estim strer		Is ₍₅₀₎ MPa	%	defe spaci mm	ing	type, inc	lination, planari	ty, roughness,
	method core-lift	water	RL	depth metres	jraphi core ri	structure, minor co		veath alterat		т э	D- diam etral A- axial	R	300 300 300			coating, thickr	ness
		-		Illeues		SHALE: Grey/red brown,	thinly laminated,	MW	Z L K	±≶ū	-0 0.2	z	328	39	particular		general
	NMLC			-		iron stained. <i>(continued)</i>	·	SW	-		D A 10.2 0.3 D A	3			SM, 10mm -JT, 45°, PL,		-
				-		1					D A 0.2 0.3				—JT, 90°, PL,		-
			53	9							D A	78			— PT, 0-5°, PL	CNI	-
				-	Ē						0.2 U	2	┥┥			_, SN , SO, SN, 150m	m _
				-				MW					T		PT, 0°, IR, S	3N	-
				-				SW		Щ	D A 0.4 0.0 D A	<u>3</u>		Щ	NSM, 10mm PT, IR, SN		-
\vdash	+	+'	_52	10	┨──	NO CORE: 130mm. BH4 terminated at 9.92m		+		\vdash	0.1 0.	3		┿┽┥		., SN	
																	-
				-													-
				-	-												-
			_51	11													
				-	1												-
					-												-
			_50	12													-
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			_48	'													
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				-													-
			47	15													-
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																	-
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┢	metho	od	46	16	┸┯┥	core-lift	water				weather	ing			defect ty	/pe	roughness
	DT AS			itube ger screwi	ing	casing used		0/1/98 wat n date sho			SW	fresh slightly	y weathe	red	JT joir PT pa	nt Irting	VR very rough RO rough
	AD RR		rolle	ger drilling ler/tricone		barrel withdrawn		ater inflow			HW	highly	rately we weather nely weat	ed	SZ sh	am leared zone leared surface	SO smooth SL slickensided
	CB NMLC		NM	w or blade		graphic log/core recovery		artial drill f omplete dr			DW	distinc (cover:	tly weath s MW an	nered) CS cru	ushed seam	
	NQ, H	IQ, PQ	۷ wire	eline core	1	core recovered - graphic symbols						very lo	w			/ anar irved	coating CN clean SN stained
						indicate material		/ater press ugeons) fo		result	М	low mediui high	m		UN un ST ste	idulating epped	VN veneer CO coating
5								nterval sho			VH	very hi	igh nelv hiah	1	IR irre	egular	Ū

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11



BM		client: Health Infrastructu	re , NSW
SS		project: GEOTECHNICAL & ENVIRONMENTAL INVEST	
18/2/2011	coffey	GEOTECHNICAL & ENVIRONMENTAL INVEST	IGATION - BLACKTOWN
Not to scale	geotechnics	title: BOREHOLE PHOTOGRAPH-I	3H4: 4.00m – 9.92m
A4	SPECIALISTS MANAGING THE EARTH	project no: GEOTLCOV24207AB	Photo no: BH4 1 of 1

HOSPITAL

drawn approved

date scale original size



C		U			Ξy		2	,		onnoo	E	Boreho	le N	lo.		BH4A
Ε	n	g	in	e	ering	J L	.og	- E	Bor	ehole		Sheet Project	No			1 of 1 GEOTLCOV24207AB
Clie		_					nfras					Date st				16.2.2011
Pri	nci	pal									[Date co	omp	lete	ed:	16.2.2011
Pro					Blac	kto	wn H	lospi	ital D	evelopment		_oggeo				VJ
			Lo	catio				-		, spital Carpark		Checke	-			SS
drill	mo	odel	and	mou	nting:	Hydra	power	Scout .	Truck	Easting: 307152 slope: -90	0			R.	L. Su	rface: 61.8
		ame				125 m	m	i		Northing 6260670 bearing:				da	itum:	AHD
ar	-	<u> </u>	nto	rma		İ	1	mate		Ibstance		_ ×		6	1	
method		N penetration	support	water	notes samples, tests, etc	RL	depth metres		classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	k	300 b penetro- 400 meter		structure and additional observations
ADT			N		E		- 1			FILL: SAND: Fine to medium grained, grey, with some fine gravel and roots.	D	L			FIL	L 2-0.3m PID=3.8ppm
						1	-									-
					SPT 2,1,1	_61					_				0.5	5-0.6m PID = 7.1ppm
					N*=2		1	\otimes		FILL: GRAVEL: Fine to medium, angular, with some medium to coarse grained sand.					_	
										Borehole BH4A terminated at 1.1m					En	d on posible concrete foundation_
							-									-
						_60	2									-
							-									-
							-									-
						_59										-
							3_									
																-
						_58	-									-
						_50	4									-
							-									-
																-
						_57										-
							5_									
							_									-
						_56	-									-
							6									
							-									-
																-
						_55	-									-
							-									
							-									-
						_54										-
met	hoc					su	8 pport			notes, samples, tests classif	ication sy	mbols ar	 nd			consistency/density index
AS AD			a	uger d	crewing* Irilling*	М	mud casing	N	nil	U_{s0} undisturbed sample 50mm diameter soil de U ₆₃ undisturbed sample 63mm diameter based	scription on unified					VS very soft S soft
RR W			w	ller/tri ashbc	ore	ре 1	netratio	no resista	ance	D disturbed sample system N standard penetration test (SPT)					-	F firm St stiff
CT HA DT			h	able to and av atube	uger			ranging to refusal	D		dry					VSt very stiff H hard Fb friable
B V			bl	atube ank b bit		wa	ater 10/1/9 - on dat	8 water e showr	level	P pressuremeter W	moist wet plastic limit	t				Fb friable VL very loose L loose
т	sho	own b	Т	C bit			- water				liquid limit	-				MD medium dense D dense
e.g.				DT		-	water	outflow								VD very dense

BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11



	U		e	ÿ	•	5 C	Jec	JIE	CHHICS	-	Boreho	le No.	BH5
En	gi	ne	e	ring	L	og	- E	Bor	ehole		Sheet Project	No:	1 of 3 GEOTLCOV24207AB
Client	:			Heal	th li	nfras	truc	ture		I	Date st	arted:	17.2.2011
Princi	pal:									[Date co	ompleted	d: 17.2.2011
Projec	ct:			Blac	kto	vn H	ospi	tal D	evelopment	I	ogged	l by:	VJ
Boreh	ole l	Loca	tion:	Blac	kto	wn D	istri	ct Ho	spital Carpark	(Checke	ed by:	SS
drill mo			ountin			ower S	Scout 7	Fruck	Easting: 307134 slope: -90°			R.L	. Surface: 61.8
hole dia drillir		-	atio		25 m	n	mate	erial su	Northing 6260646 bearing:			datı	um: AHD
hethod	etration	support	Sa	notes amples, ests, etc	RL	depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	100 x pocket 200 d penetro- 400 meter	structure and additional observations
ADT -	23	С							FILL: BITUMEN: Black.	D		4 3 2 7	
A				E+D					FILL: SAND: Medium to coarse sand, grey, with some fine to medium gravel, trace of clay.				FILL 0.30-0.40m PID=1.8ppm
A				SPT 3,3,3 N*=6 E + D	_61	- 1_			FILL: SAND: Fine to medium sand, pale brown.	М	-		- - 1.00-1.10m PID=3.9ppm
ЧЧ				E+D		-							1.30-1.40m PID=4.2ppm _
ADT			-	SPT	_60	2			FILL: SAND: Fine to medium sand, pale brown.	W	-		_
				0,0,0 N*=0	_59	-			FILL: Clayey SAND: Fine to medium sand, grey, low to medium plasticity clay.				weight
						3			FILL: SAND: Fine to medium sand, pale brown.				-
				SPT 10 N*=R _/	_58	_ 		СГ/СН	CLAY: Medium to high plasticity, pale grey/grey, trace of fine ironstone gravel. SHALE: Extremely weathered, brown/pale brown/red brown, estimated to be very low strength,	_ D	Н		3.50-3.60m PID=4.9ppm RESIDUAL SOIL SHALE
					_57				remoulds to a gravelly clay.				-
						5			Borehole BH5 continued as cored hole				
					_56	6							-
					_55								-
						<u>7</u> 							
					_54								
method AS AD RR V RR V CT HA DT CT BB HA DT CT B HA DT CT B HA S S S S S S S S S S S S S S S S S S		auge roller wash cable hand diatu blank V bit TC b	tool augei be bit	ng* e	M C per	ter 10/1/98	n no resista anging to efusal 8 water 9 water 9 shown nflow	level		unified	classifica		consistency/density indexVSvery softSsoftFfirmStstiffVStvery stiffHhardFbfriableVLvery looseLlooseMDmedium denseDdenseVDvery dense

BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11



	C	U	′ .		y		3										Bo	orehole No.	BH5	
	Er	ıgi	ine	eri	ng	L	og - Cored	Bore	eho		e								of 3 GEOTLC	OV24207AB
-	Clien						nfrastructure	ji .									Da	•	17.2.2011	
	Princ	ipal:															Da	ate completed:	17.2.2011	!
	Proje			I	Blaci	ktov	wn Hospital Develo	opment											/J	
	•		Loca				wn District Hospita	-	rk										SS	
_							Scout Truck	Eastir		30	713	4		slope:		-ć	90°	R.L. Surfa		
L	hole d						ng fluid:	North	ing:	626	606	46		bearin	ig:	_		datum:	AHD	
F	drilli	ng ir	nform	nation	_	-	l substance material		1	+					ro	ck	mass	defects	ect descriptio	
					graphic log core recovery				l ing	1		mate engtl		Is ₍₅₀₎ MPa			efect acing		•	
	method core-lift	ter		depth	aphic re rec	r	rock type; grain characteristic structure, minor compon		weathering alteration					D- diam- etral	RQD %	r	mm ⁻		on, planarity, iting, thicknes	
L	e S	water	RL	metres	gre				we	۲	_ 2	ΣI	H H		RC	100 100	3000	particular		general
Ī				_						T					Γ		\top			
				_	'															4
			_61		<u> </u>															-
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				_	- I															-
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			_60	2	{ '															-
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				-	'															-
			_59		'															-
			_55	3	1 '															
				-	'															-
					1															-
			_58	-	'															-
				4	{ '															
					<u> </u> '															-
				-	'															-
			_57	5	1 '		Continued from non-cored b	borehole												-
ſ	NMLC			_	E		CORE: 0.08m ALE: Brown, thinly bedded,		xw		F	\square	┮			F	++	- Highly Fractured	Zone, 210m	
	ź			-		irons	ALE: Grey/dark grey, thinly I		/ MW SW	-)~~ -						┝┲		-PT		No. –
			_56			0-5°,	°, with some laminations of fin idstone, pale grey.	ne grained	000								i	— JT, 25-30°, PL, 2	:0mm	- CN
				6												曲	i	−JT, 0-5°, 10mm PT JT, 85-90°, PL, §	0 20mm	
				_													1	JT, 10-15°, PL, S		All defects are: PT, 0°-5°, PL, SO-RO, CN-SN
				-											70		r	PT PT, CU)°-5°,
l			_55			1								D A 0.130.19	Ī		[│		PT, 0
l				7_		1								D A 0.12 0.26	5	Ц		Highly Fractured	Zone, 220m	m, igi —
l				-										0.1 0.22						ects
l			-	-		-								A 0.3				DT		All de
L			_54	8		1											<u></u>	│ — PT │ ू PT		_
Γ	metho DT	d	diat	tube		core)/1/98 wa			I			esh			defect type JT joint	١	oughness /R very rough
	AS AD		aug	ger screwi ger drilling			casing used barrel withdrawn		n date she					MW m	noder	ately	thered weathe hered	ered PT parting SM seam SZ sheared	5	RO rough SO smooth SL slickensided
	RR CB		claw	er/tricone w or blade		grar	phic log/core recovery	→ pa	ater inflov artial drill	fluic				XW ex DW di	xtrem	nely w tly we	veather eathere	ed SS sheared d CS crushed	surface	Silckensided
	NMLC NQ, H			ILC core eline core	,		core recovered		omplete d	rill f	luid	loss		strength			/ and H	planarity		coating
5						E	- graphic symbols indicate material		ater press	sure	e tes	t resi	ult	L lo	ery lo ow nediu			PL planar CU curved UN undulati	5	CN clean SN stained /N veneer
							no core recovered		ugeons) fe terval sho			I		H hi	igh ery hi			ST stepped IR irregular	с Т	CO coating

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11



		U		C	y	900000								Bor	ehole No.	BH5	
E	Ξn	gi	ine	eri	ng	Log - Cored	Bore	eho	le					She Pro	eet ject No:	3 of 3 GEOT	LCOV24207AB
С	lien	t:		1	Healt	h Infrastructure								Dat	te started:	17.2.2	011
P	rinc	ipal:												Dat	te completed:	17.2.2	011
P	roje	ct:		l	Black	ktown Hospital Develo	pment							Log	ged by:	VJ	
В	orel	nole	Loca	tion:	Black	ktown District Hospita	I Carpa	rk						Ch	ecked by:	SS	
d	rill m	odel a	& mou	nting: Hy	drapov	ver Scout Truck	Easti	ng:	307134	Ļ	slop	e:	-90°			Surface:	61.8
		iame			-	Drilling fluid:	North	ning:	626064	ŀ6	bear	ĭ			datum	1:	AHD
ľ		ng II	ntorm	ation		erial substance material		1			1.		1		defects	defect desc	iption
Ι.	,				c log scove	rock type; grain characteristics	, colour,	ering		nated ngth	Is ₍₅₀₎ MPa	.0	defe spaci mr	ng	type, incli	ination, plana	arity, roughness,
hodtom	core-lift	water	RL	depth metres	graphic log core recovery	structure, minor compone		weathering alteration		т.	D- dian etra T A- axia	i Q	300 300			coating, thic	
		>	RL	metres		SHALE: Grey/dark grey, thinly b	edded at	SW	M L K	ΞŻi		<u>ــــــــــــــــــــــــــــــــــــ</u>	898	30,0	particular		general
				-		0-5°, with some laminations of fin sandstone, pale grey. (continued	e grained				0.2 0	.3	╡╡		\PT PT, 0°, IR PT		-
				-											— PT, 0°, IR		-
			_53	9							0.2 0 D /	۰ ۱					_
				_							D A	A					
				-							_0 0 D / 0.2 0	A			-PT		-
			_52	_								۱ ــ			-PT		-
⊢	-			10		BH5 terminated at 10m						┢					
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			51	11													_
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			_46	16													_
1	netho	d	diat	ube		core-lift)/1/98 wat			weathe FR	fresh			defect ty JT join	t	roughness VR very rough
2	AS AD		aug	er screwi er drilling		barrel withdrawn		n date sho ater inflow			SW MW HW	mode highly	y weathe rately we weather	ather ed	SZ she		RO rough SO smooth SL slickensided
	RR CB NMLC		clav	er/tricone v or blade LC core	e bit	graphic log/core recovery	- pa	artial drill f	luid loss		XW DW	extren	nely wea ctly weath rs MW ar	there nered	d SS she CS crut	ared surface shed seam	
		, Q, PC		LC core eline core		core recovered		omplete di	m nuía li	055	strengt VL			ia r¶V	PL plan	nar	coating CN clean
						- graphic symbols indicate material		ater press		result	L M	low mediu			CU cur UN und		SN stained VN veneer CO coating
						no core recovered		ugeons) fo terval sho			H VH EH	high very h extrer	igh nely high			gular	Coaung

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11



drawn	ВМ		client: Health Infrastructu	ire , NSW
approved	SS		project: GEOTECHNICAL & ENVIRONMENTAL INVEST	
date	17/2/2011	coffey	GEOTECHNICAL & ENVIRONMENTAL INVEST	IGATION - BLACKTOWN HOSPITAL
scale	Not to scale	geotechnics	title: BOREHOLE PHOTOGRAPH-E	3H5: 5.00m – 10.00m
original size	A4	SPECIALISTS MANAGING THE EARTH	project no: GEOTLCOV24207AB	Photo no: BH5 1 of 1



Engineering Log - Borehole Sheet 1 of 3 Project No: Client: Health Infrastructure Date started: 17.2.2011 Principal: Date completed: 17.2.2011 Project No: Blacktown Hospital Development Logged by: VJ Borehole Location: Blacktown District Hospital Carpark Checked by: SS Milling information Northing 6260628 bearing: -90° R.L. Surface: 64.75 Image: Structure 1 2 3 mm Northing 6260628 bearing: datum: AHD Image: Structure 1 2 3 mm Northing 6260628 bearing: datum: AHD Image: Structure 1 2 3 mm Northing 6260628 bearing: datum: AHD Image: Structure 1 2 3 mm Image: Structure soil type: plasticity or particle characteristics, clour, secondary and minor components. Image: Structure additional obs Image: Structure 1 2 3 mm Image: Structure Image: Structure Structure Structure Image: Structure Image: Structure Image: Structure Image: Structure Structure Structure Im	
Principal: Date completed: 17.2.2011 Project: Blacktown Hospital Development Logged by: VJ Borehole Location: Blacktown District Hospital Carpark Checked by: SS drill model and mounting: Hydrapower Scout Truck Easting: 307072 slope: -90° R.L. Surface: 64.75 hole diameter: 125 mm Northing 6260628 bearing: datum: AHD drilling information material substance material up in the state is solid type: plasticity or particle characteristics, colour, scoudry and minor components. KPa additional obs up in the state is is sets, etc. RL metres FILL: Gravely SAND: Fine to medium sand, brown/dark brown, trace of clay. D FILL: Gravely SAND: Fine to medium sand, brown/dark grey, fine gravel, dark grey, fine gravel, with some clay, trace of clay. 1.10-1.20m PID=5.0 0.50-0.60m PID=5.8 fill.: Gravely SAND: Fine to medium sand, brown/dark grey, fine gravel, with some clay, trace of clay. 1.10-1.20m PID=5.0	V24207AB
Project: Blacktown Hospital Development Logged by: VJ Borehole Location: Blacktown District Hospital Carpark Checked by: SS	
Borehole Location: Blacktown District Hospital Carpark Checked by: SS drill model and mounting: Hydrapower Scout Truck Easting: 307072 slope: -90° R.L. Surface: 64.75 hole diameter: 125 mm Northing 6260628 bearing: datum; AHD drilling information material substance material up to the state of the stat	
drill model and mounting: Hydrapower Scout Truck Easting: 307072 slope: -90° R.L. Surface: 64.75 hole diameter: 125 mm Northing 6260628 bearing: datum: AHD drilling information material substance material substance material substance 0 <t< th=""><th></th></t<>	
hole diameter: 125 mm Northing 6260628 bearing: datum: AHD drilling information material substance material substance material substance material substance 001 01 001 01 <th01< th=""> 01 01</th01<>	
drilling information material substance bit notes samples, tests, etc notes samples, tests, etc notes samples, tests, etc notes samples, tests, etc notes samples, tests, etc notes samples, tests, etc notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor components. notes soil type: plasticity or particle characteristics, colour, secondary and minor componen	
visca notes notes <th< th=""><th></th></th<>	
Image: Section of the section of th	
E + D FILL: GRAVEL: Coarse grained gravel, dark grey, with some medium to coarse sand, trace of clay. D FILL: 0.10-0.30m PID=3.2 SPT 2,5,9 -64 FILL: Clayey SAND: Fine to medium sand, brown/dark brown, trace of clay and grass cuttings at 0.8m. D 0.50-0.60m PID=5.8 FILL: Gravelly SAND: Fine to medium to coarse sand, trace of clay and grass cuttings at 0.8m. D 1.10-1.20m PID=5.0 FILL: Gravelly SAND: Fine gravel, with some clay, trace of roots. D 1.10-1.20m PID=5.0	
SPT 64 with some medium to coarse sand, trace of clay. 0.10-0.30m PID=3.2 N*=14 Image: Signal structure Image: Signal structure 0.50-0.60m PID=5.8 N*=14 Image: Signal structure Image: Signal structure 0.50-0.60m PID=5.8 Image: Signal structure Image: Signal structure Image: Signal structure 0.50-0.60m PID=5.8 Image: Signal structure Image: Signal structure Imag	
2,5,9 .64 N*=14 E + D FILL: Clayey SAND: Fine to medium sand, brown/dark brown, trace of clay and grass cuttings at 0.8m. FILL: Gravelly SAND: Medium to coarse sand, brown/dark grey, fine gravel, with some clay, trace of roots.	ppm _
Image: Nite of the second s	ppm _
E + D 0.8m. FILL: Gravelly SAND: Medium to coarse sand, brown/dark grey, fine gravel, with some clay, trace of roots. 1.10-1.20m PID=5.0	_
brown/dark grey, fine gravel, with some clay, trace of roots.	ppm _
	-
<u>SPT</u> <u>2</u>	_
1 2,2,2 - -	-
E + D Fill: SAND: Fine grained sand, pale brown. 2.35-2.45m PID=2.3	ppm –
	-
	-
	-
1,1,10 -61 - CL/CH CLAY: Medium to high plasticity, brown/dark	
4 brown, with some ironstone gravel.	-
	-
	-
	-
SPT 7,20 SHALE: Extremely weathered, grey, estimated to SHALE: SHALE	ppm
N*=R — be very low strength, remoulds to a clay. Borehole BH6 continued as cored hole I	
	-
	-
	-
	_
	-
	-
method support notes, samples, tests classification symbols and consistency/densit AS auger screwing* M M mud N nil U ₆₀ undisturbed sample 50mm diameter soil description VS very RR roller/tricone penetration D disturbed sample based on unified classification symbols and S soil description W washbore 1 2 3 4 no resistance D disturbed sample based on unified classification S soil CT cable tool 1 2 3 4 no resistance N standard penetration test (SPT) N* SPT - sample recovered N St stiff M madiaube water V vane shear (kPa) M moist Fb friab V V Vit V vane shear (kPa) M moist VL very T TC bit Ion/198 water level P pressuremeter W W We VL very T To bit Ion/198 water inflow R refusal R VD wet <	soft stiff



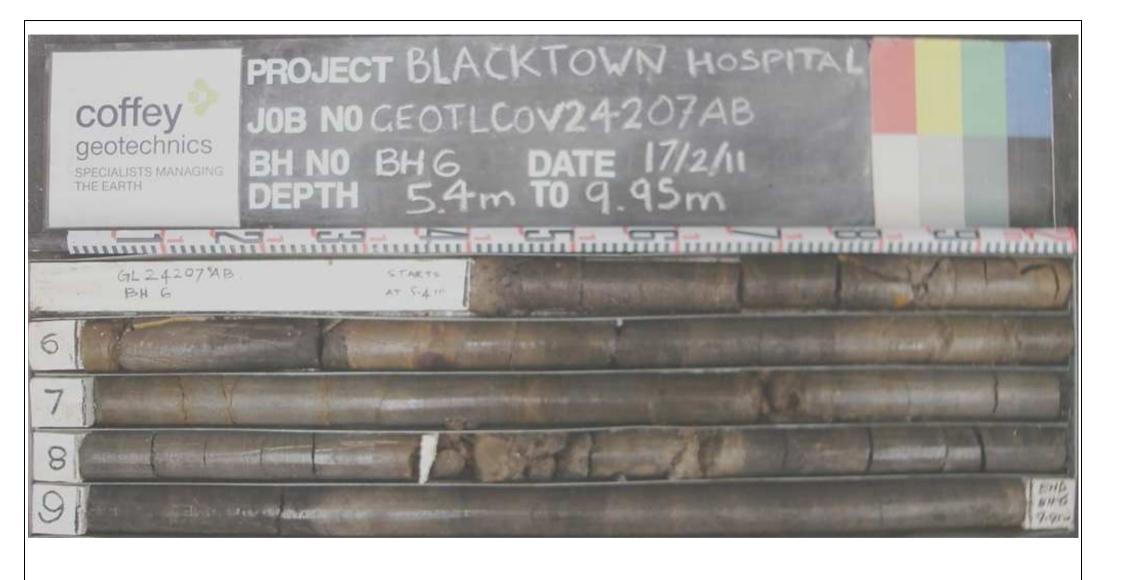
		U			y	3					Во	rehole No.	BH6	
ľ	Er	١g	ine	eri	ng	Log - Cored	Boreh	ole				eet oject No:	2 of 3 GEOTLCC	OV24207AB
-	Clier					th Infrastructure						te started:	17.2.2011	
F	rinc	cipal	:								Da	te completed:	17.2.2011	
	Proje			1	Blac	ktown Hospital Develo	oment					gged by:	VJ	
	•					ktown District Hospital	-					ecked by:	SS	
_						wer Scout Truck	Easting:	307072	slope:		-90°	R.L. Su		
L		diame				Drilling fluid:	Northing:	6260628	bearing	g:		datum:		
F	drill	ing i	inforn	nation		terial substance				ro	ck mass		-fact description	
.	method	water		depth	graphic log core recovery	material rock type; grain characteristics, structure, minor componen		estimated strength	MPa D- diam- etral	RQD %	defect spacing mm	type, inclin	lefect description ation, planarity, ro coating, thickness	oughness,
L	٤ ٤	Ň	RL	metres	; B		¥	<u>E</u> TACK	T A- axial	Å	3000 3000 3000	particular		general
			_64		· · · · · · · · · · · · · · · · · · ·									
			_62	2 3 										- - - - - - -
			_61		-									otherwise
				5	-	Continued from non-cored bo	arabala							s s noted
	NMLC	Groundwater Not Monitored	_59	- 6_ -		SHALE: Pale grey/pale brown m dark grey, indistinctly bedded at 0 some laminations of fine grained s iron staining along defects.	nottled XW 0-5°, with HW/M					PT, 80mm PT, 50mm Highly Fractu PT, 0°, IR, RC PT	red Zone, 40mm), SN	All defects are: PT, 0°5°, PL, RO-SO, SN-CN; unles s noted otherwise
		Groundwate	_58	- - 7_			MW	<u>_</u>	D A 0.03 0.17	20	╏	│ — JT, 5-10°, PL, │ 、 PT), SN), SN red Zone, 20mm	РТ, 0°-5°, РL, RC
	meth		_57			core-lift	water		D A 0 0.37 D A 0.12 0.19 weatherin			PT PT PT JT, 10-15°, PL PT, CU, SO, 5	SN	
0.000	DT AS AD RR CB NML0		au au rol cla NN	atube Iger screwi Iger drilling Iler/tricone aw or blade MLC core reline core	g e bit	casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material no core recovered	⊥ 10/1/98 w on date si water inflo partial dri complete water pre	low rill fluid loss e drill fluid loss essure test result s) for depth	FR free SW slip MW mig HW hig XW ex DW dis OW dis or strength VL ve L low M mig H hig VH ve	esh ightly odera ghly v stinctl overs ery lov w ediun gh ery hig	n	SZ shea SS shea CS crush N) planarity PL plana CU curve	ng R Pa S red sone Si red surface ned seam ar C ad S Ialating Vi ped C	sughness R very rough O rough O smooth L slickensided bating N N clean N stained N veneer O coating

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

coffey	geotechnics
--------	-------------

	J	U	/	C	y	• gooloo							Bo	orehole No.	BH6		
E	Ξn	ıgi	ine	eri	ng	Log - Corec	d Bore	ehe	le					neet oject No:	3 of 3 GEOTL	COV2420	07AB
-	lien					th Infrastructure								ate started:	17.2.201		
Ρ	rinci	ipal:											Da	ate completed:	17.2.201	11	
	roje			I	Blaci	ktown Hospital Deve	elopment						Lo	gged by:	VJ		
			Loca			ktown District Hospi	-	rk						necked by:	SS		
_						wer Scout Truck	Eastir		307072		slope):	-90°	,		.75	
		iamet				Drilling fluid:	Northi	ing: (6260628	1	beari	ĭ		datum	: AF	łD	
Ľ	lrilli İ	ng ir	hform	nation		terial substance material		+			1	ro	ock mass		defect descrip	tion	
method	core-lift	water	RL	depth metres	graphic log core recovery	rock type; grain characteris structure, minor comp		weathering alteration	estima streng	gth	Is ₍₅₀₎ MPa D- diam etral A- axial	R	defect spacing mm	type, inclir	nation, planarit coating, thickn	y, roughness, less	, general
C IMN			-			SHALE: Pale grey/pale brow dark grey, indistinctly bedded	vn mottled	MW			A	_	<u> </u>		area Zone, 30n		Cilorai
Z	<u> </u>			-		some laminations of fine grain iron staining along defects. (c	ned sandstone,	HW	-		0 0.	-	┢╌┨		L, RO, 20mm		
			_56	-			onundedj	SW	-				2,	Highly Fractu SM, 80mm, 0	ured Zone, 170 CLAY FILLED	mm	-
				9							D A	3	L L	-PT -PT			_
				-							D A 0.2 0.4 D A	4 ∞		-PT, 0°, IR, SC), CN		_
											0.1 0.5	5					-
			_55	-		-					D A						_
┢			<u> </u>	10		BH6 terminated at 9.95m		+			D A	4	╉				
				-													_
			_54	-													-
				11_													_
				-													_
				-													-
			_53														_
				12													
				_													-
				-													_
			_52	42													-
				13_													
				-	1												_
			51	-													-
			[⁻	14													
				-													-
				_													4
			_50	-													_
				15_	{												
																	-
			40	-													_
			_49	16			_										-
	netho	d	dia	tube	\square	core-lift	water	0/1/98 wat	ter level		weather FR	ing fresh	<u></u>	defect typ JT joint		roughness VR very rou	uah
	AS AD			ger screwi ger drilling		casing used	- on	n date sho	own		MW	moder	y weathered rately weathe	PT parti ered SM sear	ing m	RO rough SO smooth	
c	RR CB		clav	er/tricone w or blade		barrel withdrawn	-⊲ pa	ater inflow artial drill fl	fluid loss		XW DW	extrem distinc	weathered nely weathered tly weathered	ed SS shea d CS crus	ared zone ared surface shed seam	SL slickens	sided
	NMLC NQ, H	; IQ, PQ		ILC core eline core	,	graphic log/core recovery		omplete dr	rill fluid los	SS	strengt	(cover h	rs MW and H	W) planarity		coating	
						- graphic symbols indicate material		ater press	sure test re	esult	L	very lo low mediu		PL plan CU curv UN unde		CN clean SN stained VN veneer	
						no core recovered		ugeons) fo terval sho			H VH	high very h		ST step IR irreg	ped	CO coating	

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11



drawn	ВМ		client: Health Infrastructu	ire , NSW
approved	SS		project: GEOTECHNICAL & ENVIRONMENTAL INVEST	
date	17/2/2011	coffey	GEOTECHNICAL & ENVIRONMENTAL INVEST	IGATION - BLACKTOWN HOSFITAL
scale	Not to scale	geotechnics	title: BOREHOLE PHOTOGRAPH-	BH6: 5.40m – 9.95m
original size	A4	SPECIALISTS MANAGING THE EARTH	project no: GEOTLCOV24207AB	Photo no: BH6 1 of 1



C				y)				Boreho	ole No.		BH7	_
Ε	ng	jir	e	ering	j L	.og	- E	Bor	ehole		Sheet Project	t No:		1 of 3 GEOTLCOV24207A	В
Clie						nfras					Date s			17.2.2011	-
Prii	ncipa	l:									Date c	omplete	ed:	17.2.2011	
	oject:			Blac	kto	wn H	losn	ital D	evelopment		Logge	•		VJ	
		e Lo	catic				-		spital Carpark		Check			SS	
	mode					power			Easting: 307104 slope: -90)°			.L. Surfa	ace: 61.74	٦
	e diam				125 m	ım			Northing 6260658 bearing:			da	atum:	AHD	
dr	illing ç	info	rma	tion	1		mat		Ibstance	-i					┥
method	penetration	support	water	notes samples, tests, etc	RL	depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	ody pocket e dy penetro- meter		structure and additional observations	
ADT r	123					metres		0 0	FILL: BITUMEN: Black.	./ w		\$ 30 50 40 3 50 40	PAV		
A				E		-			FILL: CLAY: Medium plasticity, grey.				FILL		_
				SPT 1,5,15	_61	-		CL	CLAY: Medium plasticity, grey/pale brown, trace of ironstone gravel.	- Wp	VSt	- *	0.5-0 RES	0.6m PID=2.8ppm IDUAL SOIL	-
				N*=20	-	1									_
						-									
					60	-									-
						2				_					_
				SPT 14,32 N*=R		-		CL	CLAY: Medium plasticity, pale brown/dark brown mottled orange, trace of fine shale gravel.		Н		2.1-2	2.3m PID=2.1ppm	-
					1	-									
					_59	3									-
						<u> </u>			Borehole BH7 continued as cored hole					· · · · · · · · · · · · · · · · · · ·	=
						-	-								-
					_58	-									
						4									-
						-									
					_57	-									-
						5									_
						-									-
					-										
					_56	6	-								+
						-									_
						-									-
					_55	-									
						7_									-
						-									
					_54	-									-
mot	hod					8				fications				noistanov/danoity inday	
AS AD	hod			crewing* rilling*	М	mud casing	Ν	l nil	U ₅₀ undisturbed sample 50mm diameter soil de	escription	ymbols ar 1 d classifica		V: S		
RR W		ro	oller/tri ashbo	cone	ре	enetratio 2 3 4		2000	D disturbed sample system N standard penetration test (SPT)				F St	firm stiff	
CT HA		h	able to and au	uger			no resista ranging t refusal	ai ICE D	N* SPT - sample recovered moistu Nc SPT with solid cone D	dry			V: H	hard	
DT B V		b	iatube lank bi		wa	ater 10/1/9	8 water	level	P pressuremeter W	moist wet	ait		Ft VI	very loose	
т	shown	Т	bit C bit ffix			 on dat water 	e showi	I		plastic lin liquid lim			L M D		
e.a.			DT			water	outflow						v		1



E	n	g	ine	eri	ng	Log - Cored E	301	reho		9			_			heet roject	No:	2 of 3 GEOTI	LCOV2420)7AE
Clie	ent	:		I	leal	th Infrastructure									D	ate sta	arted:	17.2.20	011	
Prir	nci	pal:													D	ate co	mpleted:	17.2.20	011	
Pro	ojec	ct:		L	Blacl	ktown Hospital Develop	men	t							L	ogged	by:	VJ		
Bor	reh	ole	Loca	tion:	Black	ktown District Hospital	Carp	oark							С	hecke	d by:	SS		
						wer Scout Truck		isting:	307	104		slope:		-6	90°	-	,		61.74	
		ame				Drilling fluid:	No	orthing:	626	6065	8	bearir	ĭ				datum	:: <u> </u>	AHD	
dri	illir	ng ii	nform	nation		erial substance material			+-			1	r	ock	mas	s defe		defect descr	-tion	
ļ					graphic log core recovery	llidicitat		l ing		estim strei	nated	Is ₍₅₀₎ MPa			efect acing				•	
method	core-lift	water		depth	uphic re rec	rock type; grain characteristics, structure, minor componen		weathering		~		D- diam- etral	2D %		mm		type, incli	nation, plana coating, thicl	rity, roughness, kness	
ae	ç	wa	RL	metres	gra cor			we	۲	⊥≥	тЪ		RQD	30	- 300	parti	cular		g	jeneral
ļ	\square			-									Γ							_
ļ																				_
ļ			_61	_																-
				1																
																				-
ļ																				-
ļ			_60																	_
ļ				2_																
ļ				-																-
ļ				_																-
ļ			_59																	-
<u> </u>	\vdash			3		Continued from non-cored bord SHALE: Pale brown/dark grey mo	ottled	XW					\vdash			<u> </u>	T ON° IR F	RO, 120mm		
NMLC				-		orange brown, indistinctly bedded a ironstained.	at 0-5°,							┡╴		-J		0, 1201111		-
ļ		red	_58		<u> </u>	4		HW	-					1			T, ST, SO,	SN		-
ļ		Monitored		4											i		т			-
ļ		Vot M		_	<u> </u>	-									\	- F	Т			-
ļ		water Not						MW	-			D A	23		1				NS-N	-
ļ		mpur	_57	-		INTERLAMINATED SANDSTONE AND SHALE (40%): Fine to mediu	ùm í					D A			r	— F	•		0)
ļ		Ground		5		grained, sandstone, pale grey/dark thinly bedded at 5°.	grey,					0.120.3				`\F		SO SN	S	
ļ						-		HW SW				D A		Fr		🔨		ured Zone, 60	Dmm ^E	-
ļ				-								0.110.2 ² _D A			ł		T, 0°, IR, R		10,1	
	Ц		_56	-	ΞĘ.							0.28 0.38	3	Щ				ured Zone, 20	တ် က်က	-
				6								DA				-F	T, 0°, CU, 8	50, SN	are: F	_
				-	133	-						0.5 0.3			J	 _ F	T, 0°, CU, S	N CN	ects :	_
				-		CANDETONE. Find to modium ar	·ined					0.5 0.8]				'T, 0°, ST, S		All defects are: PT, 0°-10°; PL-IR, SO,	_
			_55			SANDSTONE: Fine to medium graph pale grey.	aineu,						87	۴ι			T, 80-85°, 8		4	
ļ										88		0.3 0.8 -D A- 0.4 1.4				\\F		RO. SN		-
												D.4 1.4 D A 0.4 1.6		¢	┪	🚬 F	'T, 0°, PL, F 'T, 0°, IR, R	O, CN		-
			_54									D A								-
				8								1.1 2	1_		5		T, 0°, PL, F T, 0°, IR, R			_
met DT		d	diat	tube	<u> </u>	core-lift	wate	er 10/1/98 wa	ater le	evel			esh				defect typ JT join		roughness VR very rou	ıah
AS AD			aug	jer screwi jer drilling		casing used	-▼	on date sh	own	0¥0.		SW s MW m	lightl	rately	there weath		PT par SM sea	ting m	RO rough SO smooth	•
RR CB			rolle	er/tricone w or blade		barrel withdrawn	1 -	water inflo partial drill		loss		XW e	xtren	nely v	hered /eathe eather		SS she	ared zone ared surface shed seam	SL slickens	ided
NM	1LC	Q, PC	NM	LC core		graphic log/core recovery		complete of			SS		cover		and /		planarity	shed seam	coating	
19-04	, 1	ωκ,ι	(51110 00.2		core recovered - graphic symbols	_					VL v	ery lo	w			PL plan CU cur	/ed	CN clean SN stained	
						no core recovered	25	water pres (lugeons)	for de		result	M n H h	nediu igh				ST step	lulating oped gular	VN veneer CO coating	
1								interval sh	own				ery h xtren		iah		IR Ine	gular		

BH7



		U		C	y	900000							Bo	orehole No.	Bl	47	
	Ξr	ŋ	ine	eri	ng	Log - Cored	Bore	ho	le				-	neet oject No:	3 c GE	of 3 E OTLCOV24207 A	B
C	lier	t:		1	Heal	th Infrastructure							Da	ate started:	17.	.2.2011	
F	rinc	ipal:											Da	ate complete	ed: 17 .	.2.2011	
F	Proje	ect:		l	Blac	ktown Hospital Devel	opment						Lo	ogged by:	VJ	1	
E	Bore	hole	Loca	tion:	Blac	ktown District Hospita	al Carpark	r					Cł	necked by:	SS	5	
_						ver Scout Truck	Easting		807104		slope:		-90°	-	.L. Surface	: 61.74	
		iame				Drilling fluid:	Northing	g: 6	6260658		bearir	ĭ.			atum:	AHD	
ŀ	drill	ing i	nform	ation		erial substance material	i					rc		defects	defect	description	_
	rrietriou core-lift	water	RL	depth metres	graphic log core recovery	rock type; grain characteristi structure, minor compor	cs, colour, nents	weathering alteration	estima streng ∽ _ ≥ ⊥	lth	Is ₍₅₀₎ MPa D- diam- etral A- axial	RQD %	defect spacing mm			planarity, roughness, g, thickness	rol
						SANDSTONE: Fine to medium		SW	ד⊼ר<	> ш	_D A_		, , , , , , , , , , , , , , , , , , ,		PL, RO, CN	gene	a
				-	· · · · ·	pale grey. (continued)					0.2 0.5 _D A_	87		— PT, 0°, F	PL, RO, CN		
			_53	-							0.4 0.6 D A			► PT, 0°, F	PL, RO, CN		_
		1		9							0.1 0.3 _D A			- PT, 0°, F	PL, RO, CN PL, RO, CN		_
				_							0.4 0.5			─PI, 0°, F	PL, RO, CN		
				-							_D A_	100					-
			_52	-							0.2 0.3						
╞	+			10		BH7 terminated at 10m					_D A_ 0.4_0.3	1					_
				-													
			_51	-													_
			_51	 11													-
				-													_
			_50	-													-
				12													
				-													_
				-													
			_49	-													_
				1 <u>3</u>													_
				_													
			48	-													_
				14													
				-													_
				-													-
			_47	-													1
				15_													
				-													-
			10	-													
			_46	16													-
	meth DT	od	diat			core-lift	water 10/1/	/98 wate	er level			esh		JT	ct type joint	roughness VR very rough	
	AS AD		aug	er screwi er drilling		casing used	- on da	ate sho	wn		MW n	noder	weathered ately weathered weathered	PT	parting seam	RO rough SO smooth	
	RR CB		clav	er/tricone v or blade	e bit	graphic log/core recovery	- partia		uid loss		XW e DW d	xtrem	ely weather tly weathere	ed SS ed CS	sheared zo sheared su crushed se	rface	
	NML(NQ, F	; IQ, PC		LC core line core		core recovered	- comp	plete dr	II fluid loss	5	(i strength	covers	s MW and H	IW) plana	arity	coating	
						- graphic symbols indicate material	wate	er press	ure test re:	sult	L lo	ery lo ow nediur		PL CU UN	planar curved undulating	CN clean SN stained VN veneer	
						no core recovered	윘 (luge	eons) fo val shov	r depth		H h VH v	igh ery hi		ST	stepped irregular	CO coating	





C				y		C)			_	Boreho	le No.	BH8
Ε	nc	iir	ne	erinc	۱L	oq	- E	Bor	ehole		Sheet Project	No:	1 of 3 GEOTLCOV24207AB
Clie			-		-	nfras					Date st		18.2.2011
	ncipa	d:										omplete	
	ject:			Blac	kto	wn H	losn	ital D	evelopment		Logged	•	VJ
			catio				-		ospital Carpark		Checke	-	SS
						power			Easting: 307137 slope: -90°		CHECKE		Surface: 61.2
	e diam				125 m				Northing 6260722 bearing:				um: AHD
dri	illing	info	rma	tion	-		mate		ubstance				
method	penetration	support	water	notes samples, tests, etc		depth	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	o dy pocket b dy penetro- meter	structure and additional observations
ADT n	12:	3 0°			RL _61	metres	, 0, XXXX	0 %	FILL: BITUMEN: Black.		00	400 300 400	
AL				E + D					FILL: SAND: Fine grained, brown, with some medium to coarse gravel, trace of clay.				FILL – – – – – – – – – – – – – – – – – –
				SPT	1	-							0.5-0.6m PID=6.7ppm
				4,5,7 N*=12	1	1		CL	CLAY: Medium plasticity, pale grey, with some fine to coarse ironstone gravel, trace of tree roots.	<wp< td=""><td>St/VSt</td><td></td><td></td></wp<>	St/VSt		
					_60	-							-
						-							-
													-
				SPT	59	2_			CLAY: Medium to high plasticity, pale grey/pale		VSt		2.0-2.1m PID=4.1ppm
				5,9,13 N*=22					brown mottled red/brown.		VSI		RESIDUAL SOIL –
						-							-
						3							-
					_58	-							-
				SPT	-	-							- 3.5-3.6m PID=4.7ppm _
				10,29,26 N*=55		_	· · · · ·	1	SANDSTONE: Extremely weathered, pale grey/pale brown, estimated to be very low strength,				SANDSTONE
					57	4_			remoulds to a sandy clay.				-
													-
						-							-
						5	· · · · ·						-
					_56	-			Borehole BH8 continued as cored hole				-
													-
						6							-
					_55								_
						-							-
						-							-
						7	-						_
					_54	-							-
													-
						8	-						-
met AS	hod	- I a	ugers	crewing*		ipport mud	N	ı I nil		cation sy	mbols an	d	consistency/density index VS very soft
AD RR		a r	uger o oller/tr	Irilling* icone	C pe	casing			U ₆₃ undisturbed sample 63mm diameter based of D disturbed sample system		classifica	tion	S soft F firm
W CT		c	vashbo able to	loc		234	no resista ranging te	ance	N standard penetration test (SPT) N* SPT - sample recovered moisture				St stiff VSt very stiff
HA DT		c	and a liatube		wa	ater	refusal		V vane shear (kPa) M n	lry noist			H hard Fb friable
B V T		١	lank b / bit C bit	IT	_	10/1/9 on dat	8 water e showr	level า	Bs bulk sample Wp p	vet Iastic lim quid limit			VL very loose L loose MD medium dense
	shown	by su				water	inflow outflow		E environmental sample W _L li R refusal				D dense VD very dense



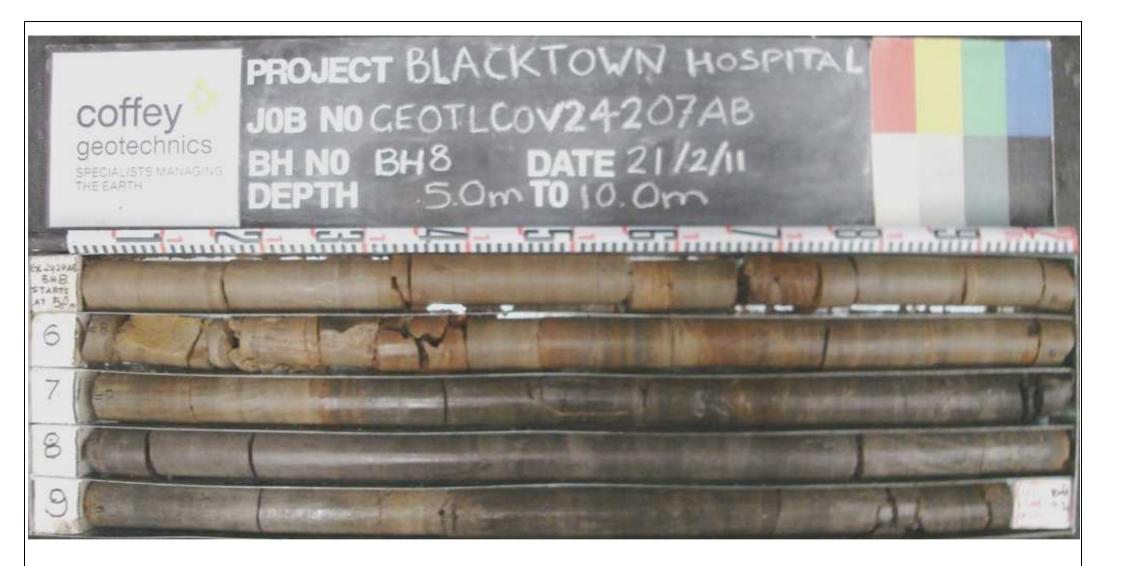
					y	3								Bo	orehole	No.	BH8		
Ε	in	gi	ine	eri	ng	Log - Cored E	3ore	•ho	le	ļ					neet oject N	No:	2 of 3 GEOT	LCOV24	207AB
-	ient					th Infrastructure									ate sta		18.2.2		
Pri	inci	pal:														npleted:	18.2.2	2011	
	ojec			I	Black	ktown Hospital Develop	ment								gged		VJ		
			l oca			ktown District Hospital (k							necked	-	SS		
_						ver Scout Truck	Easting		3071:	37		slope:		-90°		R.L. Su		61.2	
hol	le dia	amet	ter:	12		Drilling fluid:	Northin	0	6260 ⁻	722_	_	bearing				datum:		AHD	
dr	rillir	ng ir	nform	nation		erial substance					_		ro	ock mass	defec				
method	core-lift	water		depth	graphic log core recovery	material rock type; grain characteristics, c structure, minor component:		weathering alteration	st	timate	th	Is ₍₅₀₎ MPa D- diam- etral A- axial	RQD %	defect spacing mm		type, inclin	defect desc nation, plana coating, thic	arity, roughne	
Ľ	Ō	2	RL	metres	00			on ≤	- 4	ΣI	ΗЩ	A- aniai	8	30 300 3000 3000 3000	partic	ular			general
			_61			1													-
				-		1													_
				_															-
			_60		1	1													
			Γ	-		1													-
				_		1													_
				2															
			_59	-															-
																			-
				-															-
			_58	3															
				-															_
				_															-
				4															
		 	_57	-															<u>ں</u>
						Operations of from non-corod horr	Ia												ed otherwis
NMLC	+	red	_56	5		Continued from non-cored bore SANDSTONE : Fine to medium gra pale grey/red brown, ironstained.		SW	++		H	-	┢┤	┥╋	-P	T, CU			s note
≧Z		Groundwater Not Monitored		-		pale grey/red brown, nonstantes.						D A 0.87 0.31		┿╣║║		T, ST, SN, F	RO		les s
		l M		_		1	ŀ	MW	1					5	P'	T M, 0°, RO, V	/N		
		ater 1		6		1						DA 2.18 0.7			P.	Г			N
		Mpung	_55	-		1		HW					╽╏		P'	Г			All defects are: PT, 0°-10°, PL-IR, RO, SN-CN unles
		Gro				1	ļ	MW					62	Th	P	Т			- РГ-IR
												DA 0.170.22 DA				r, 90°, PL, 1	00mm		- 10°,
			54	7_		1						_D A_ 0.4 0.3 D A		<u> </u> \	P	T ighly Fractu	red Zone, 2	20mm	РТ, 0
				-		SHALE: Dark grey, with some fine grained sandstone laminations.						0.5 0.5 D A			P.	Ѓ Г			are:
				-	E	granied sandelene lana.e.e.e.						0.2 0.2				T, 0-5°, CU,	RO, SN		sfects
		 		8								A		▛Ш	P.	Г Г •			All de
DT		d		tube		core-lift		/1/98 wate		/el			esh			defect type JT joint		roughnes VR very	rough
AS AD	D		aug	ger screwinger drilling	a l	casing used	→ on c	date show				MW m HW hig	odera ghly v	v weathered ately weathe weathered	ered	PT partii SM sean SZ shea		RO roug SO smo SL slick	oth
RF CE	в		claw	er/tricone w or blade		graphic log/core recovery	- part	rtial drill fl	luid lo			XW ex DW dis	stinct	ely weather tly weathere	d	SS shea	ared surface hed seam	02 0	Bridiada
	MLC Q, HC	Q, PQ		ILC core eline core	J.	core recovered	- com	mplete dri	ill fluid	d loss		strength		s MW and H	W)	planarity PL plana	or	coating CN clea	in.
						- graphic symbols indicate material	wat	ter pressi	ure te	est res	ult	L lov	ery lov w iediun			CU curve UN undu	ed ulating	SN stair VN vene	ned eer
						no core recovered		geons) fo erval shov		th		VH ve	gh ery hig xtrem	gh Iely high		ST stepp IR irreg		CO coat	ing

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

GEO 5 5 lesue 3 Rev. 3

coffey	geotechnics	
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C		U		C	y	goot	00111100							Bor	rehole No.	BH8	3
E	n	gi	ine	eri	ng	Log - Co	red Bore	eho	le					She Pro	eet oject No:	3 of 3 GEO	3 0TLCOV24207AB
Cli	ent				Heal	th Infrastructure	9								te started:	18.2.	.2011
Pri	inci	pal:												Dat	te completed	d: 18.2.	.2011
Pre	ojec	ct:		1	Blac	ktown Hospital	Development							Loç	gged by:	VJ	
			Loca			ktown District H	-	rk						-	ecked by:	SS	
						wer Scout Truck	Easti		307137	7	slope):	-90		-	Surface:	61.2
		amet				Drilling fluid:	North	ning:	626072	22	bear	Ĭ	- alt n			um:	AHD
<u>u</u>	111	lg ii	Nom	nation	_	terial substance	erial	+	- antir	-tad			1		defects	defect des	scription
method	core-lift	water	RL	depth metres	graphic log core recovery	rock type; grain cha structure, mino		weathering alteration	stre	nated ength ≝ ≖ [⊥] ∃	Is ₍₅₀₎ MPa D- diam etral A- axial	- D	spa m	efect acing nm	type, in particular	nclination, pla coating, tl	anarity, roughness, hickness general
NMLC	+		_53	<u> </u>	<u> </u>	SHALE: Dark grey, w		SW			D A		- c + + +		WJI, 5-10;	CN, 20mm °, RO, SN, 30	
Ž	Π		Ē	-							D A		1]	JT, 10°, PI	Ľ, 100mm	-
				-											\ JT, 45°, PI	°, PL, SN, 90 L, SN, 50mm	1 I
				9	<u> </u>						D A	2		4	PT, 0°, IR	actured Zone	., 70mm –
			_52	-		-			_		D A 0.2 0.:	2 8			│	100mm	_
				-	<u> </u>			HW SW	-		D A			1			-
				10				MW	-		0.2 0.1 D A 0.2 0.1		╘┽╏	1	⊢ PT └ Highly Fra PT, 0°, CL	actured Zone J, IR, SN	e, 10mm —
	Π		_51	-		BH8 terminated at 10m	 N				10.2 0.					<u>, iit, Oit</u>	
				-													_
				-													-
				11	-												
			_50	-													-
				-	-												_
				12													-
			_49	-	1												-
				-													-
				-	1												-
			_48	1 <u>3</u>	{												
			_40 	-													-
				-	-												-
				14													-
			_47	-													_
				-	1												-
				-	-												_
			46	1 <u>5</u>	1												
			[-	1												-
				-													-
				16	<u> </u>						weather	ing					
DT AS		a		tube ger screwi	ina	core-lift		0/1/98 wat n date sho			FR	fresh	y weath	hered		: type joint parting	roughness VR very rough RO rough
AD)		aug	ger drilling er/tricone	g	barrel withdrawn		ater inflow			MW HW	moder highly	rately w	weather	ed SM s SZ s	seam sheared zone	SO smooth SL slickensided
CE			claw	w or blade ILC core		graphic log/core recover	N .	artial drill f omplete di			DW	distinc	ctly wea	athered and HW	CS of V)	sheared surfac crushed seam	
NC	ג, HC	Q, PQ) wire	eline core	1	core recovered - graphic symbols						very lo	wc			ʻity planar curved	coating CN clean SN stained
						indicate material	10 (1	ater press ugeons) fo			М	low mediu high	m		UN U ST s	undulating stepped	VN veneer CO coating
I								iterval sho				very h	nigh Delv bir	ab	IR i	irregular	



drawn	BM		client: Health Infrastructu	re , NSW
approved	SS		project: GEOTECHNICAL & ENVIRONMENTAL INVEST	
date	21/2/2011	coffey	GEOTECHNICAL & ENVIRONMENTAL INVEST	GATION - BLACKTOWN HOSFITAL
scale	Not to scale	geotechnics	title: BOREHOLE PHOTOGRAPH-B	H8: 5.00m – 10.00m
original size	A4	SPECIALISTS MANAGING THE EARTH	project no: GEOTLCOV24207AB	Photo no: BH8 1 of 1



		/		Ξy	-	5			CHIICS		Boreho	le No.	BH9
E	ng	in	ee						ehole		Sheet Project	No:	1 of 3 GEOTLCOV24207AB
Clie	ent:			Heal	th l	nfras	truc	ture			Date st	arted:	21.2.2011
Pri	ncipal	:									Date co	omplete	d: 21.2.2011
Pro	oject:			Blac	kto	wn H	lospi	tal D	evelopment		Logged	d by:	VJ
Bo	rehole	e Loo	catio	n: Blac	kto	wn D	istri	ct Ho	spital Carpark		Checke	ed by:	SS
drill	model	and	mour	nting: H	Iydra	power S	Scout -	Fruck	Easting: 307100 slope:	-90°		R.L	Surface: 61.35
	e diame illing i		mot		125 m	m	mat		Northing 6260716 bearing:			dat	ium: AHD
	-		mat		1		mau				<u> </u>	т Ģ	
method	5 Denetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	100 A pocket 200 A penetro- 400 meter	structure and additional observations
ADT		С		E+D		_			FILL: BITUMEN: Black. FILL: Gravelly SAND: Fine to medium grained	_/ D			
					_61	-			sand, dark grey, fine to coarse gravel. FILL: Sandy CLAY: Medium plasticity, pale brown				0.1-0.3m PID=0.9ppm _
				SPT 3,1,2				n, <wp< th=""><th></th><th></th><th>0.5-0.6m PID=3.4ppm</th></wp<>			0.5-0.6m PID=3.4ppm		
				N*=3	-	1							
					60	-						-	
					_00	-	\not		VSt				
								CL	CLAY: Medium plasticity, pale grey.				-
				SPT	-	2_							2.0-2.1m PID=4.1ppm
				1,2,5 N*=7	_59								
					1	_		CL	CLAY: Medium plasticity, pale grey/pale brown.				RESIDUAL SOIL
						3							-
					_58	_							-
				SPT 15		_	· · · · ·		SANDSTONE: Extremely weathered, fine to medium grained, pale brown/red brown, estimated	to			SANDSTONE 3.5-3.6m PID=5.4ppm
				N*=R		4	· · · · ·		be very low strength.				
					57	_	· · · · ·						-
					_57	-	· · · · · · · · · ·						-
							· · · · ·						
						5			Borehole BH9 continued as cored hole	_			
					_56	-							-
						6							4
						0_							-
					_55								
						_							-
						7							-
													-
					_54	-							-
met	thod				SU	8 pport			notes, samples, tests clas	sification s	wmbols ar		consistency/density index
GEO 5.3 Issue 3 Rev.2 T < a T H T & A B A C A T A A T A A T A A T A A A A A A A	shown l	au rol wa ca ha dia bla V TC	ger di ler/trid ashbo ble to ble to and au atube ank bi bit bit bit bit	re ol ıger	M C pe	mud casing netration 2 3 4 r ter 10/1/98	n no resista ranging to refusal 8 water e showr nflow	level	U ₅₀ undisturbed sample 50mm diameter soil U ₆₃ undisturbed sample 63mm diameter bas D disturbed sample syst N standard penetration test (SPT)	description ed on unifie	n d classifica		VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense



		U		C	y	3							Bo	orehole No.	BH9	
E	Er	g	ine	eri	ng	Log - Cored I	Boreho	olo	е					ieet oject No:	2 of 3 GEOTLCC)V24207AB
С	lien	t:		1	leal	th Infrastructure							Da	ate started:	21.2.2011	
Ρ	rinc	ipal:											Da	ate completed:	21.2.2011	
Ρ	roje	ct:		I	Blaci	ktown Hospital Develop	oment						Lo	gged by:	VJ	
			Loca			ktown District Hospital								necked by:	SS	
_						ver Scout Truck	Easting:	30	7100)	slope:		-90°	R.L. Su		
		iame			5 mm	Drilling fluid:	Northing:	62	6071	6	bearin	g:		datum:	AHD	
Ľ	lrilli	ng i	nform	ation		erial substance material	i				1	rc	ock mass		lefect descriptior	n
mothod	core-lift	water		depth	graphic log core recovery	rock type; grain characteristics, structure, minor componer		teration	stre	nated ngth	Is ₍₅₀₎ MPa D- diam- etral	RQD %	defect spacing mm	type, inclin	nation, planarity, ro coating, thickness	oughness,
	5 5	ŝ	RL	metres	ъS		Ň	۲ م	¦ _ ∑	т¥ц	A- axial	Ϋ́	30 300 3000 3000 3000	particular		general
			61	- - - 1 -												- - - - -
			_59													
				- 3_												- - -
			_58	-												-
			_57	4 - - - - - 5		Continued from non-cored bo	rehole									ed otherwise
		Groundwater Not Monitored	_56	-		SANDSTONE: Fine to medium gr pale brown/pale grey.					DA 0.36 0.91 DA 0.11 0.15			− PT − JT, ~90°, PL, − PT, 0°, PL, SN − Highly Fractu − HFZ, 30mm		s no
		Groundwater	_55	6 							D A 0.180.29 D A 4.9 4.89	2		PT Highly Fractu PT PT PT Highly Fractu	red Zone, 100mm red Zone, 330mm	
			_54	7 8			MV SV				D A 0.1 0.6 D A 0.2 0.1 D A 0.2 0.4			- PT - JT, 80-85°, PL - PT - PT - PT - PT - PT - PT - PT	., SN, 110mm	All defects are: PT, 0°-10°, PL-IR, RO, SN-CN unles
	neth DT ND ND R R B JMLC NQ, H		aug aug rolle clav NM	tube ger screwi ger drilling er/tricone w or blade LC core eline core	Ĩ	core-lift Image: casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material no core recovered	water ↓ 10/1/98 w on date s ↓ water infl ↓ partial dri ↓ complete water pre (lugeons) interval s	shown low ill fluic e drill f essure) for d	n d loss fluid le e test lepth	oss	SW sli MW m HW hiv XW ex- DW di (c strength VL ve L loo M m H hiv VH ve	esh ightly odera ghly dtrem stinct overs ery lo w ediur gh ery hi	n	ed SZ shea SS shea CS crush W) planarity PL plana CU curve	N VI ng R ¹ Ired sone SI ired surface hed seam ar C ed SI ilating VI ped C	A very rough R very rough O rough O smooth L slickensided Coating N clean N stained

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

coffey > ge	eotechnics
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	-	U		C	y	900100							-	Borehol	e No.	BH9	
E	Ξn	ıgi	ine	eri	ng	Log - Core	d Bore	ehe	le					Sheet Project I	No:	3 of 3 GEOT	LCOV24207AB
С	lien	t:			Healt	th Infrastructure								Date sta		21.2.20	011
Ρ	rinci	ipal:												Date co	mpleted:	21.2.20	011
Ρ	roje	ct:		I	Blacl	ktown Hospital Dev	elopment							Logged	by:	VJ	
			Loca			ktown District Hosp	-	'k						Checke	-	SS	
_						wer Scout Truck	Eastin		30710	0	slop	be:	-90°	-	R.L. Su		61.35
		iamet				Drilling fluid:	Northi	ing:	62607	16	bea	iring:			datum:	:	AHD
Ľ	Irilli	ng ir	1form	nation		terial substance material		+	1		1		ock ma	ss defeo		lefect descr	iption
method	core-lift	water		depth	graphic log core recovery	rock type; grain character structure, minor com		weathering alteration		nated ength	D- diar etra	m- 00	!	ng	type, inclir		rity, roughness,
		Ň	RL	metres					2 - 7	≤ ± ≯			300 300 300 300 300 300 300 300 300 300				general
CIMN			_53 _52	9 		SHALE: Grey/dark grey, thi	inly laminated.	SW			0.4 0 D 0.2 0 D 0.1 0 D 0.3 0 D 0.1 0	A-).4 A-).1 A).3 A-).4 A-).4 A-).4 A-).4 A-).4 A-).3 A-).4 A-).3 A-).3 A-).3 A-).3 A-).3 A-).3 A-).3 A-).3 A-).3 A-).4 A-).3 A-).4 A-).3 A-).5 A- A-).5 A- A-).5 A- A-).5 A- A- A-).5 A- A- A- A-).5 A- A- A-).5 A- A- A-).5 A- A-).5 A- A- A-).5 A- A- A-).5 A- A- A-).5 A- A- A- A- A- A- A- A- A- A-		P VP VP VP	T S, PL T T, 45°, IR ighly Fractu T T	L	_ Dmm
			-	-	-	BH9 terminated at 10m											_
			_51 _50 _49 _48 _48 _47 _46														
	netho DT SS D RR B IMLC IQ, H		aug aug rolle clav NMI	tube ger screwin ger drilling er/tricone w or blade ILC core eline core	e bit	core-lift casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material no core recovered	→ on → wa → ⊂ cor g2 (lug	/1/98 wat date sho ater inflow rtial drill f mplete dr ater press geons) fo erval sho	own / iluid los rill fluid sure tes or depth	s loss t result	weathd FR SW MW HW XW DW streng VL L M H H VH	fresh slight mode highly extre distin (cove th very low medi high very	ly weather erately weat y weather mely weat ctly weath ers MW and low um	ithered d nered ered	SS shea CS crust planarity PL plan CU curve	ng n ared zone ared surface hed seam ar ed Jlating ped	roughness VR very rough RO rough SO smooth SL slickensided coating CN clean SN stained VN veneer CO coating



Irawn	BM		client: Health Infrastructu	re , NSW
approved	SS		project: GEOTECHNICAL & ENVIRONMENTAL INVEST	
late	20/2/2011	coffey	GEOTECHNICAL & ENVIRONMENTAL INVEST	BATION - BEACKTOWN HOSFITAE
scale	Not to scale	geotechnics	title: BOREHOLE PHOTOGRAPH-B	H9: 5.00m – 10.00m
original size	A4	SPECIALISTS MANAGING THE EARTH	project no: GEOTLCOV24207AB	Photo no: BH9 1 of 1



Borehole No. **BH10 Engineering Log - Borehole** Sheet 1 of 3 GEOTLCOV24207AB Project No: Health Infrastructure 21.2.2011 Client: Date started: Principal: 21.2.2011 Date completed: Blacktown Hospital Development VJ Project: Logged by: Borehole Location: Blacktown District Hospital Carpark SS Checked by: drill model and mounting: Hydrapower Scout Truck Easting: 307072 slope: -90 R.L. Surface: 61.34 6260735 hole diameter: 125 mm Northing bearing: AHD datum drilling information material substance pocket penetro-meter classification symbol consistency/ density index notes penetratic material structure and g samples. moisture condition additional observations graphic I method support tests, etc water kPa soil type: plasticity or particle characteristics, depth metre RI 123 colour, secondary and minor components. FILL: BITUMEN: Black D ADT F + DFILL: SAND: Fine to medium grained sand, pale FILL 61 0.1-0.3m PID=2.7ppm brown, with some fine to coarse gravel, trace of clay. FILL: CLAY: Medium plasticity, brown, with some <Wp 0.5-0.6m PID=1.6ppm SPT 3,3,4 N*=7 fine to medium grained sand. 1 60 2 2.0-2.1m PID=6.3ppm SPT 3.7.5 59 N*=12 3 58 VSt/H RESIDUAL SOIL CL/CH CLAY: Medium to high plasticity, pale grey/red SPT brown, with some fine grained angular ironstone 3.5-3.6m PID=0.7ppm 4,5,5 N*=10 gravel. 4 _57 5 SPT 7,11,15 N*=26 _56 6 55 SHALE: Extremely weathered, dark grey/pale grey, SHALE SP 21 estimated to be very low strength, remoulds to a N*=R gravelly clay. 7 54 notes, samples, tests method support classification symbols and consistency/density index undisturbed sample 50mm diameter soil description AS auger screwing M mud N nil U₅₀ VS very soft AD auger drilling* С undisturbed sample 63mm diameter based on unified classification s casing U₆₃ soft RR W system roller/tricone D disturbed sample F firm enetration standard penetration test (SPT) washbore Ν St stiff anging to refuse СТ no re cable tool N' SPT - sample recovered moisture VSt very stiff hand auge HA SPT with solid cone Nc dry н hard D DT diatube v vane shear (kPa) Μ moist Fb friable wato В 10/1/98 water leve Р blank bit pressuremeter W wet VL very loose V plastic limit V bit Bs bulk sample Wp L loose on date shown Т TC bit environmental sample Ŵ liquid limit MD medium dense Е water inflow *bit shown by suffix R refusal D dense ADT water outflow VD e.q. very dense

BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

GEO 5.3 Issue 3 Rev.2



BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

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Ε	ną	giı	ne	ering	j L	og	- E	Bor	ehole					Sheet Project	No:		² of 3 GEOTLCOV24207AB
Clie	ent:			Hea	lth I	nfras	truc	ture					[Date st	arted	:	21.2.2011
Prir	ncip	al:											[Date co	omple	ted:	21.2.2011
Pro	ject	:		Blac	ckto	wn H	ospi	ital D	evelopment				L	oggeo	l by:		VJ
Bor	eho	le L	ocat	ion: Blac	ckto	wn D	istri	ct Ho	spital Carparl	k			(Checke	ed by:		SS
drill	drill model and mounting: Hydrapower Scout Truck Easting: 307072 slope: -90° R.L. Surface: 61.34																
hole	diar	metei	:		125 m	im			Northing 6260	735	bearing:					datum	:: AHD
dri	lling	g inf	orm	ation			mate	erial su	Ibstance								
Signature in the second								moisture condition	consistency/ density index	100 pocket	a	structure and additional observations					
				SPT 2 N*=R	_53				Borehole BH10 cont	tinued as cored	hole						-

Borehole No.

BH10

	<u> </u>		23	°	>			metres		0 0	colour, secondary and minor components.	<u> </u>	00	2 %	184	Ŧ
				С		SPT										
						2 N*=R	_53	_			Borehole BH10 continued as cored hole					
								9_								
							_52									
								_								-
								10								
							_51	-								
								_								-
								1 <u>1</u>								
							_50	_								-
								_								
								1 <u>2</u>								-
							_49	_								-
1								-								
15.3.11								1 <u>3</u>								-
COFFEY.GDI							_48									-
COFE																
5.GPJ								14_								-
4207AE							47									
GEOILCOV24207AB.GPJ							_47	-								-
GEOIL								15								-
10LE								1 <u>5</u>								
BOREHOLE							_46	_								-
								_								
	met AS	hod				crewing*		16 pport mud	NI	nil		cation sy scription	 mbols an	d		consistency/density index VS very soft
2	AD RR			au		rilling*	C per	casing netratio				on unified	classifica	tion		S soft F firm
3 Rev	W CT			Wa Ca	ashbo able to	ire iol	12	2 3 1	no resista anging to refusal	nce	N standard penetration test (SPT) N* SPT - sample recovered moistu	re				St stiff VSt very stiff
Issue	HA DT			di	and au atube	-	wat	ter			NcSPT with solid coneDVvane shear (kPa)M	dry noist				H hard Fb friable
0 5.3	B V			V	ank bi bit	t	┸	10/1/9 on dat	8 water e shown	evel	Bs bulk sample Wp	vet plastic limi				VL very loose L loose
Form GEO 5.3 Issue 3 Rev.2	T *bit :	sho	wn b	y su				water i			E environmental sample W _L I R refusal	iquid limit				MD medium dense D dense
Ъ	e.g.			A	DT			water	JULIIOW		I					VD very dense

_			.			geotechr	aioo													
C		U		e	y	geoleciii	1103								В	orehol	e No.	BH10)	
Ε	n	gi	ine	eri	ng	Log - Cored E	Bore	eho	le)						neet roject l	No:	3 of 3 GEOT	LCOV	24207AB
Cli						th Infrastructure										ate sta		21.2.20		
Pri	nci	pal:													D	ate co	mpleted:	21.2.20	011	
Pro	oje	ct:		E	Black	ktown Hospital Develop	oment								Lo	ogged	by:	VJ		
			Loca			ktown District Hospital		k								hecke	-	SS		
						ver Scout Truck	Eastin		3070)72		slope:		-9			R.L. Su		61.34	
		ame				Drilling fluid:	Northi	ng:	6260)735		bearin	Ň	-			datum:	,	AHD	
dr	illiı	ng ii	nform	ation		erial substance material		1	1			i	ro	ock r	nas	s defeo		efect descr	ription	
method	core-lift	water		depth	graphic log core recovery	rock type; grain characteristics, structure, minor componen		weathering alteration	s	stimat treng	th	Is ₍₅₀₎ MPa D- diam- etral - A- axial	RQD %	spa n	efect acing nm	3	type, inclin	ation, plana coating, thic	arity, rough	nness,
Ľ	0	\$	RL	metres	50			σ≥	, , ,	JΣI	7 1		æ	98	1000	g partio	cular			general %
NINIC		Groundwater Not Monitored	_53 _52 _51 _50 _49 _48 _48 _47 _46			Continued from non-cored born SHALE: Grey/dark grey, thinly lan BH10 terminated at 10m		HW MW				D A 0 0.06 D A 0.05 0.17 D A 0.2 0.21 D A 0.36 0.17	26			\ P J V J V J V V P	T T T S, 20mm T, 0°, CU, SI T, 0°, ST, SN T, 0°, ST, SN F, 90°, CU, F F, 30-35°, PL	N, 160mm N, SN RO, SN ~90r ., SN, ~60m	nm	All defects are PT, 0-5 PL, RO, CN; unless noted otherwise
DT AS AD RR CB NN	AS auger screwing AD auger drilling RR roller/tricone barrel withdrawn				casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material	on wa	/1/98 wat date sho ter inflow rtial drill f mplete du ter press geons) fo erval sho	own v fluid I rill flu sure to or dep	oss id loss est res		SW si MW m HW h XW e DW d (c strength VL v L lc M m H h VH v	resh lightly nodera ighly v xtrem istinct covers	ately v weath ely we ly we MW MW w n gh	weath hered eathe athere and H	ered red ed	SS shea	ng red zone red surface ned seam ar ad lating ped	RO n SO s SL s coatin CN c SN s	ery rough ough mooth lickensided g lean tained eneer	

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

Form GEO 5.5 Issue 3 Rev. 3

geot	fey 🥍 🛛	IOB NO GEOTL	CKTOWN HOSE COV24207AB DATE 20/2/11 m TO 10.0m	PITAL
910	T AB TS AT 8.2m.	TERMINATI	ED AT 10.0m	
drawn	BM	JIERIMAIL		n Infrastructure , NSW
approved	SS	· · · · · ·	project:	TAL INVESTIGATION - BLACKTOWN HOSPITAL
date	20/2/2011	coffey		TAL INVESTIGATION - BLACKTOWN HOSPITAL
scale	Not to scale	geotechnics	title: BOREHOLE PHO	TOGRAPH–BH10: 8.20m – 10.00m
original size	A4	SPECIALISTS MANAGING THE EARTH	project no: GEOTLCOV24207AB	Photo no: BH10 1 of 1



COII	ey		ye		CHHICS		Boreho	le No.	BH11
Engine	ering	Lo	g - I	Bor	ehole		Sheet Project	No:	1 of 3 GEOTLCOV24207AB
Client:	Heal	th Infra	struc	ture			Date st	arted:	22.2.2011
Principal:							Date co	ompleted:	22.2.2011
Project:	Blac	ktown	Hosp	ital D	evelopment		Logged	l by:	VJ
Borehole Location	on: Blac	ktown	Distri	ct Ho	spital Carpark		Checke	ed by:	SS
drill model and mou	nting: H	lydrapowe	r Scout	Truck	Easting: 307075 slope:	-90°		R.L. S	Surface: 61.6
hole diameter:		25 mm	- i		Northing 6260694 bearing:			datum	n: AHD
drilling informa			mat		bstance			ų	
method 1 5 2 penetration support water	notes samples, tests, etc	dep RL metr	a ∓ graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture	consistency/ density index	100 x pocket 200 x pocket 300 b penetro- 400 meter	structure and additional observations
ADT C	E		-	*	FILL: BITUMEN: Black. FILL: SAND: Fine to medium grained sand, brow	D			
	_		-	×	with some fine to coarse gravel, trace of clay.			0	.1-0.3m PID=4.5ppm
	SPT 1,2,2 N*=4	_61		CL	CLAY: Medium plasticity, brown, with some fine to medium sand and fine gravel.	<u>o</u>	o VSt		OSSIBLE FILL
	SPT 4,9,16 N*=25	_59		CL	CLAY: Medium plasticity, pale grey/pale brown, with some ironstone gravel.		VSt/H		-
	SPT 9,8 N*=R	_58			SHALE: Extremely weathered, pale grey/pale brown/orange brown, estimated to be very low strength, remoulds to a gravelly clay.			S 3	
			_		Borehole BH11 continued as cored hole				-
		_56	- - - - - -						- - - -
		_55	-						
		_54	-						-
method AS auger s AD auger of RR roller/tri W washbo CT cable tri HA hand at DT diatube B blank b V V bit T TC bit "bit shown by suffix e.g.	cone pre pol uger	support M mud C casir penetra 1 2 3 water water 10/ on c	g ion	level	U _{s0} undisturbed sample 50mm diameter soi U _{s3} undisturbed sample 63mm diameter bas D disturbed sample sys N standard penetration test (SPT)		n d classifica nit		consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense

BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

Form GEO 5.3 Issue 3 Rev.2



	9	U			y	3								В	orehol	e No.	BH11	
ſ	Ξn	gi	ine	eri	ng	Log - Cored	Bore	ho	le						heet roject l	No.	2 of 3 GEOTL	.COV24207AB
-	Client					th Infrastructure									ate sta		22.2.20	
	Princi															mpleted:	22.2.20	
	Proje	•		1	Rlaci	ktown Hospital Develo	nment								ogged		VJ	
	•		Loca			ktown District Hospital	-	ŀ							hecked	-	SS	
_						wer Scout Truck	Easting		30707	75		slope:		-90°	I IEUNEN	R.L. Su		1.6
	ole di			• •		Drilling fluid:	Northir	ng:(62606	694		bearing	g:			datum:		HD
F	drilli	ng ir	nform	nation		erial substance material			<u> </u>		_		rc	ock mas	s defec		lefect descrip	tion
					log coven			ing n		imate engt		Is ₍₅₀₎ MPa		defect spacing				
- 40 d	method core-lift	water		depth	graphic log core recovery	rock type; grain characteristics structure, minor compone		weathering alteration		-		D- diam- etral	RQD %	mm			iation, planari coating, thickr	ity, roughness, ness
Ľ	<u> </u>	Ň	RL	metres	gr: C			we alt	: _ ;	ΣI	ΗЩ	A- axial	Я	+ 30 300 1000	partic	ular		general
				-	-								ſ					-
			_61	-									ĺ					-
					-								ſ					-
					1													
				-														-
			_60	-														-
				2	1													
				-														_
			_59	-														-
				-	-													-
				3														
				-	-													-
			_58	-														-
				4	1													
				-														- -
			_57	-														All defects are: PT, 0°-10°, PL-IR, RO, CN-SN; unle ss noted otherwise
				5		Continued from non-cored bo	orehole						ſ					ed otl
(;		ored		-	<u> </u>	SHALE: Pale grey/red brown, th bedded at 0-5°, with some lamina	ninly	HW						╤┛	—н	ighly Fractur	red Zone, 230	Jmm g _
	ź	Aonito	50	-		fine grained sandstone.		MW				D		╺┓	_J _P		7 SM, 20mm	nne –
		Not	_56	-	<u> </u>	-						0.11 A D 0.44 0.22		┛	_ P	т		S S S
		water		6			= (200()	0.11				DA		2	\\P J P	T, 90°, PL, SI	N, 30mm	, C
		Groundwater Not Monitored		-		INTERLAMINATED SANDSTONI AND SHALE (30%): Fine to med grained sandstone, pale grey mot	dium	SW				0.3 1.01				Ť		א – א –
		Ū	_55	_	=: =: :: .:	orange brown/dark grey, thinly be 0-5°, with some iron staining along	edded at						70	┙	\ Р		ı	, PL
				7			5							╶┓		T, 90°, IR, SN	N, ~130mm	0°-10
				-									ĺ	۱ <u>۲</u>		-		" PT,
			54	-	 	INTERLAMINATED SHALE (55% SANDSTONE (45%): Fine to me						D A 0.360.38		Ľ	<u>`</u> P		n	ts are
			_34	-		grained sandstone, pale grey to c thinly bedded at 0-5°.						D A 0.3 0.7				T, 0°, PL, SC T, 0°, PL, SC	D, SN	defec
┝	metho	d		8	2523	core-lift	water					D A weatherin	g			T, 0°, PL, SC defect type	D, CN	roughness
	DT AS			tube ger screwi	ing	casing used		/1/98 wat date sho		el		SW sli	esh ightly	weathered	d	JT joint PT partir	ng	VR very rough RO rough
	AD RR		rolle	ger drilling er/tricone		barrel withdrawn	► wat					HW hig	ghly	ately weath weathered iely weathe			n ared zone ared surface	SO smooth SL slickensided
l I	CB NMLC		NM	w or blade ILC core		graphic log/core recovery		rtial drill fl mplete dr				DW dis (ce	stinc	tly weather s MW and	ed	CS crush	hed seam	e e e time
	NQ, H	Q, PC	≀ wire	eline core		core recovered - graphic symbols					ſ	Strength VL ve	ery lo	w		planarity PL plana CU curve		coating CN clean SN stained
						indicate material no core recovered		ter press geons) fo			ult	M m H hig	ediur gh			ST stepp		VN veneer CO coating
							inte	erval sho	wn		-	VH ve	ery hi	gh		IR irregu	Jiar	

Borehole No.

CORED BOREHOLE GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

Form GEO 5.5 Issue 3 Rev. 3



)	U		C	y	900000						Bo	rehole No.	BH11	
E	In	gi	ine	eri	ng	Log - Core	d Bore	eho	le				eet oject No:	3 of 3 GEOTLC	OV24207AB
CI	ient	t:		1	Healt	th Infrastructure						Da	ite started:	22.2.201	1
Pr	inci	pal:										Da	te completed:	22.2.201	1
Pr	oje	ct:		I	Blacl	ktown Hospital Dev	elopment					Lo	gged by:	VJ	
			Loca			ktown District Hos	-	k					ecked by:	SS	
_						ver Scout Truck	Eastin		307075	slope:		-90°	R.L. Su		;
		ame				Drilling fluid:	Northi	ing: (6260694	bearin	ĭ	-	datum:	AHD)
d	rilli	ng i	nf or m	ation		erial substance material		1	1	1	ro	ck mass		efect descripti	on
method	core-lift	water		depth	graphic log core recovery	rock type; grain characte structure, minor com		weathering alteration	estimated strength	Is ₍₅₀₎ MPa D- diam- etral	RQD %	defect spacing mm	c	ation, planarity, coating, thicknes	
		8N B	RL	metres	gr C gr				, Z⊐∑⊐Z		Å	+ 30 100 1000 3000	particular		general
NMLC			_53 _52	- - 9 - - - - 10		INTERLAMINATED SHALE SANDSTONE (45%): Fine grained sandstone, pale gre thinly bedded at 0-5°. (contin	o medium y to dark grey,	SW		0.3 0.5 D A 0.4 0.8 D A 0.4 0.7 D A 0.2 0.3 D A 0.2 0.3 D A 0.2 0.3 D A 0.4 0.5 -D A 0.4 0.4	Ű		- PT, 0°, PL, SC - PT - Highly Fractur - PT - Highly Fractur - PT - PT - PT - PT	red Zone, 60mr	
			_51	- - - 1 <u>1</u> -		NO CORE: 0.03m BH11 terminated at 10m									- - - -
			_50	- - 1 <u>2</u> -											- - - - -
			_49 _48	- 1 <u>3</u> - -											- - - - -
			_47	14											- - - -
			_46	1 <u>5</u> - - 16											
D A A R C N	S D R B MLC		aug rolle clav NM	ube er screwi er drilling sr/tricone v or blade LC core sline core	e bit	core-lift casing used barrel withdrawn graphic log/core recovery core recovered - graphic symbols indicate material no core recovered	va Pa S (Iut S (Iut		wn / luid loss ill fluid loss ure test result yr depth	SW sli MW m HW hi XW ey DW di (c strength VL ve L lo M m H hi VH ve	esh ightly odera ghly v ktrem stinct overs ery lov ediur gh ediur gh	n	ed SZ shear SS shear d CS crush	ng red zone red surface ned seam ar ad lating ped	roughness VR very rough RO rough SO smooth SL slickensided Coating CN clean SN stained VN veneer CO coating

Form GEO 5.5 Issue 3 Rev. 3



drawn	BM		client: Health Infrastruc	ure , NSW
approved	SS		project: GEOTECHNICAL & ENVIRONMENTAL INVES	
date	22/2/2011	coffey		HIGHTON - BEACKTOWN HOSPITAL
scale	Not to scale	geotechnics	title: BOREHOLE PHOTOGRAPH-	BH11: 5.00m – 10.00m
original size	A4	SPECIALISTS MANAGING THE EARTH	project no: GEOTLCOV24207AB	Photo no: BH11 1 of 1



2.5

3.0

3.<u>5</u>

4.0

_54.5

_54.0

53.5

Bs

Engir	nee	ering	j L	og	- E	Exc	avation		Sheet Project	No:	1 of 1 GEOTLCOV24207AB
Client:		Hea	lth In	nfras	truc	ture			Date st	arted:	18.2.2011
Principal:									Date co	ompleted	t: 18.2.2011
Project:		Blac	ktov	vn H	lospi	ital D	evelopment		Logged	d by:	LJG
Test pit loca	ation:	Blac	ktov	vn D	istri	ct Ho	spital Carpark		Checke	ed by:	SS
equipment typ	e and	I model:	Yanma	r 5t Ex	cavato	or	Pit Orientation: Easting: 30	7294 m		R.L	Surface: 57.3
excavation dir			3.3m lo	ong ´	1.9m w			260716 r	n	datı	ım: AHD
excavation	info	rmation			mat	erial su	ubstance				
method 5 5 penetration	water	notes samples, tests, etc		depth netres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	¹⁰⁰ A pocket ²⁰⁰ A penetro- 400 meter	structure and additional observations
ш К	Groundwater Not Encountered	E + D Bs E + D Bs E	56.5	0. <u>5</u> 		CL/CH	FILL: Sandy CLAY: Low to medium plasticity, fine grained sand, with some roots. FILL: CLAY: Low to medium plasticity, brown, with some fine to medium roots, trace of gravel and sand. FILL: CLAY: Medium to high plasticity, pale grey/red brown, with some fine ironstone gravel, trace of sand, roots and terracotta pipe. CLAY: Medium to high plasticity, pale grey/red brown, with some fine ironstone gravel and fine angular shale gravel, trace of sand.	J <wp< td=""><td>VSt/H</td><td>· ×</td><td>TOPSOIL </td></wp<>	VSt/H	· ×	TOPSOIL

SHALE: Extremely weathered, pale grey mottled red brown, estimated to be very low strength,

SHALE: Highly weathered, pale grey mottled red brown, estimated to be low strength, remoulds to a gravelly clay. Test pit TPB1 terminated at 3m

remoulds to a gravelly clay.

Excavation No.

TPB1

SHALE

TESTPIT GEOTLCOV24207AB.GPJ COFFEY.GDT 15.3.11

Sketch

method support notes, samples, tests classification symbols and consistency/density index N X BH R very soft soft natural exposure S shoring N nil U_{50} undisturbed sample 50mm diameter soil description VS based on unified classification undisturbed sample 63mm diameter existing excavation U₆₃ s backhoe bucket D V disturbed sample system F firm Form GEO 5.2 Issue 3 Rev.2 penetration bulldozer blade vane shear (kPa) St stiff no resistance VSt Bs bulk sample very stiff ripper moisture ranging to refusal Е environmental sample excavator E R н D dry hard refusal М moist Fb friable wate water level w wet VL very loose Wp plastic limit on date shown L loose w. liquid limit MD medium dense water inflow D VD dense 4 water outflow very dense



										_			
CU			- y		C			0111105		E	Excava	tion No	D. TPB2
Engi	in	ee	ering	J L	og	- E	Exc	avation			Sheet Project	No:	1 of 1 GEOTLCOV24207AL
Client:			Hea	lth li	nfras	struc	ture			[Date st	arted:	18.2.2011
Principal:										[Date co	omplete	ed: 18.2.2011
Project:			Blac	kto	vn H	lospi	tal D	evelopment		L	oggeo	l by:	LJG
Fest pit lo	ocati	on:	Blac	kto	wn D) istri	ct Ho	spital Carpark		(Checke	ed by:	SS
quipment t						cavato		Pit Orientation: Easting:	3073	330 m		, R.	L. Surface: 56.85
xcavation	dime	ensio	ns: 2	2.8m lo	ong	1.7m w	ide	Northing:	6260	0714 m	1	da	atum: AHD
excavati	on i	nfor	mation			mat		ubstance					
method 5 penetration	support	water	notes samples, tests, etc	RL 1	depth netres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 A pocket 200 A penetro- 400 meter	
	N	red	E+D	-	_			FILL: Sandy CLAY: Low to medium plasticity, data brown, fine to medium grained sand, with some fin	rk e to <i>l</i>	<wp< td=""><td></td><td></td><td></td></wp<>			
		Encountered	E+D	56.5	0. <u>5</u>			Imedium roots. FILL: CLAY: Medium plasticity, brown, with some fine to medium roots, trace of fine gravel and fine	il				0.1-0.2m PID=0.2ppm DUP 2: 0.1-0.2m
	Bs _56.0 CL/CH CLAY: Medium to h with some fine round roots.						CLAY: Medium to high plasticity, brown/pale grey with some fine rounded ironstone, trace of sand ar	; — 1 id		VSt		RESIDUAL SOIL	
		mdw	E+D		1. <u>0</u>		CL/CH	CLAY: Medium to high plasticity, red brown/pale grey, with some fine ironstone gravel, trace of roots			Н		– 1.0-1.2m PID=4.5ppm
		Gro		_55.5	 1.5			grey, with some line indistone gravel, trace of rook	5.				Large root at 1.25m
			Bs	55.0	-								
					2. <u>0</u>			SHALE: Extremely weathered, pale grey/red brown, iron stained, estimated to be very low stren remoulds to a gravelly clay. At 1.80m becoming with some fine to medium ang					SHALE -
	\square		Bs	_54.5	2.5			shale gravel. Test pit TPB2 terminated at 2.4m					
				_54.0									
				_53.5	-								-
				_00.0	3. <u>5</u>								-
				_53.0	4.0								
Sketch													

								•	
	method		support	notes, s	amples, tests	clas	sification symbols and	consisten	cy/density index
	Ν	natural exposure	S shoring N nil	U ₅₀	undisturbed sample 50mm diameter	soil	description	VS	very soft
	Х	existing excavation		U ₆₃	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
.2	BH	backhoe bucket	penetration	D	disturbed sample	syst	em	F	firm
Re	В	bulldozer blade	1234	V	vane shear (kPa)			St	stiff
e	R	ripper	no resistance ranging to	Bs	bulk sample	moi	sture	VSt	very stiff
ene	E	excavator	refusal	E	environmental sample	D	dry	н	hard
ŝŝ			water	R	refusal	М	moist	Fb	friable
5.2			water level			W	wet	VL	very loose
			on date shown			Wp	plastic limit	L	loose
0E0						WL	liquid limit	MD	medium dense
ε			water inflow					D	dense
ЪО			- water outflow					VD	very dense

Appendix B

Geotechnical Laboratory Testing Results

	LOAD STRE	-		nod 4.1:H	Rock Stre	ength Tes	ts - Deter	mination of F	Point Load S	Strength Inde	x						Job No. Sheet		COV24207AB OF 11
	CLIENT:	Health Infrast	ructure NSW	/						GSA bench-m Lane Cove We		orage area				of Calibration: Calibrated By:			
	PROJECT:	GEOTLCOV2 Blacktown Ho							Tested By: Test Date: Checked:	23/2/2011						Sampled Date: age Location:		West indoor s	storage area
				ſ			Diame	tral test						Axial or I	rregular lu	Imp			
	ole No. / Test Depth (m)	Rock Description	Moisture Condition ⁽¹⁾ (N, D or S)	Length L	Diameter D (mm)	Load P (Gauge) (N)	l _s =(P/D ²) x 1000 (MPa)	Size Correctio <u>n</u> F=(D/50)^ ^{0.45}	I _{s(50)} (MPa)	Strength Class (Diametral)	Width W (core diameter) (mm)	Platen Separation D ⁽²⁾ (mm)	${\sf D}_{\sf e}^{\ 2}$	Load (Gauge) (kN)	I _s =(P/D _e ²) x 1000 (MPa)	Size Correction F=(D _e /50)^0.45	I _{s(50)} (MPa)	Strength Class (Axial)	Comments / Strength Classification
BH1	6.80	Shale	N	27.0	50.0	0	0.00	1.00	0.00	V. Low	50.0	27.0	1719	0.00	0.00	0.92	0.00	V. Low	BB
BH1	7.93	Shale	N	34.0	50.0	0.55	0.22	1.00	0.22	Low	50.0	34.0	2165	0.52	0.24	0.97	0.23	Low	
BH1	8.10	Shale	Ν	35.0	50.0	0.82	0.33	1.00	0.33	Medium	50.0	35.0	2228	0.89	0.40	0.97	0.39	Medium	
BH1	8.49	Shale	N	35.0	50.0	0.71	0.28	1.00	0.28	Low	50.0	35.0	2228	0.77	0.35	0.97	0.34	Medium	
BH1	8.87	Shale	Ν	37.0	50.0	0.74	0.30	1.00	0.3	Low	50.0	37.0	2355	0.53	0.23	0.99	0.2	Low	
BH1	9.0	Shale	N	29.0	50.0	0.41	0.16	1.00	0.2	Low	50.0	29.0	1846	0.56	0.30	0.93	0.3	Low	
BH1	9.44	Shale	N	44.0	50.0	0.74	0.30	1.00	0.3	Low	50.0	44.0	2801	0.87	0.31	1.03	0.3	Medium	
BH1	9.92	Shale	N	26.0	50.0	0.67	0.27	1.00	0.3	Low	50.0	26.0	1655	0.50	0.30	0.91	0.3	Low	
				-															
				1															

Is(50) MPa and Strength Classification

NOTES (1): N = Natural, D = Dry, S = Saturated (2): L > 0.5D, 0.3 < D/W < 1.0

< 0.1 Very Low 1-3 High 0.1 - 0.3 Low 3 - 10 Very High 0.3 - 1 Medium

$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		LOAD STRE			nod 4.1:H	Rock Stre	ength Tes	ts - Deter	mination of F	Point Load S	Strength Inde	x						Job No. Sheet		COV24207AB of 11
PROJECT: GEOTILC0024207AB Storage Location: Lane Cove West indoor storage and an and an and and and an and and an		CLIENT:	Health Infrast	ructure NSW	1					ing Locality:	Lane Cove W		orage area			(Calibrated By:			
Borehole No. / Test Depth (m)Moisture Condition ⁽¹⁾ Moisture DLoad DLase (Augue)Lase (Augue)Lase 										Test Date:	23/2/2011						•		West indoor s	storage area
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$								Diame	tral test						Axial or I	rregular lu	Imp			
BH2 8.01 Shale N 28.0 50.0 0.78 0.31 1.00 0.31 Medium 50.0 28.0 1783 0.58 0.33 0.93 0.30 Medium BH2 8.44 Shale N 31.0 50.0 0.69 0.28 1.00 0.28 Low 50.0 28.0 1783 0.61 0.34 0.93 0.32 Medium BH2 8.68 Shale N 30.0 50.0 0.49 0.20 1.00 0.20 Low 50.0 28.0 1783 0.61 0.34 0.93 0.32 Medium BH2 8.68 Shale N 30.0 50.0 0.49 0.20 1.00 0.20 Low 50.0 28.0 1783 0.61 0.34 0.93 0.32 Medium BH2 8.68 Shale N 30.0 50.0 0.49 0.20 1.00 0.20 Low 50.0 30.0 1910 1.30 0.68 0.94 0.64 Medium BH2 9.17 <td></td> <td></td> <td></td> <td>Condition⁽¹⁾</td> <td>(2)</td> <td>D</td> <td>(Gauge)</td> <td>x 1000</td> <td>Correction_</td> <td></td> <td>Class</td> <td>(core diameter)</td> <td>Separation D (2)</td> <td>${\sf D}_{\sf e}^{\ 2}$</td> <td>(Gauge)</td> <td>x 1000</td> <td>Correction</td> <td></td> <td>Class</td> <td>Comments / Strength Classification</td>				Condition ⁽¹⁾	(2)	D	(Gauge)	x 1000	Correction_		Class	(core diameter)	Separation D (2)	${\sf D}_{\sf e}^{\ 2}$	(Gauge)	x 1000	Correction		Class	Comments / Strength Classification
BH2 Shale N 30.0 50.0 0.49 0.20 1.00 0.20 Low Image: Constraint of the state of the s	BH2	8.01	Shale	N	()	. ,		· · /	1.00	. ,	i` í	. ,	. ,	1783	. ,	· · /	0.93	· · /	· · · ·	
BH2 9.17 Shale N 39.0 50.0 0.49 0.20 1.00 0.20 Low 50.0 30.0 1910 1.30 0.68 0.94 0.64 Medium	BH2	8.44	Shale	N	31.0	50.0	0.69	0.28	1.00	0.28	Low	50.0	28.0	1783	0.61	0.34	0.93	0.32	Medium	
	BH2	8.68	Shale	Ν	30.0	50.0	0.49	0.20	1.00	0.20	Low									JT/BB (diametral)
BH2 9.80 Shale N 27.0 50.0 0.63 0.25 1.00 0.3 Low 50.0 39.0 2483 I	BH2	9.17	Shale	Ν	39.0	50.0	0.49	0.20	1.00	0.20	Low	50.0	30.0	1910	1.30	0.68	0.94	0.64	Medium	
Image: state of the state o	BH2	9.80	Shale	N	27.0	50.0	0.63	0.25	1.00	0.3	Low	50.0	39.0	2483						BB
Image: state in the state i																				
Image: state of the state o																				
Image: Second second																				

Is(50) MPa and Strength Classification

 (1): N = Natural, D = Dry, S = Saturated
 < 0.1</td>
 Very Low

 (2): L > 0.5D, 0.3 < D/W < 1.0</td>
 0.1 - 0.3
 Low

 0.3 - 1
 Medium

1 - 3 High 3 - 10 Very High

		AS4133.4.1	-1993 Meth	od 4.1:F	Rock Stre	ngth Tes	ts - Deter	mination of F	Point Load S	Strength Inde	x						Job No. Sheet		COV24207AB of 11
	CLIENT:	Health Infrasti	ructure NSW	1					ing Locality:	GSA bench-m Lane Cove We		orage area			(of Calibration: Calibrated By:			
		GEOTLCOV2							Tested By: Test Date: Checked:	23/2/2011						Sampled Date: age Location:		West indoor	storage area
LC	OCATION:	Blacktown Ho	spital	1					oncokeu.										
Borehole I Depth		Rock Description	Moisture Condition ⁽¹⁾ (N, D or S)	(2)	Diameter D	Load P (Gauge)	I _s =(P/D ²) x 1000	Size Correction F=(D/50)^0.45	I _{s(50)} (MPa)	Strength Class	Width W (core diameter)	Platen Separation D ⁽²⁾	D _e ²	Load (Gauge)	rregular lu I _s =(P/D _e ²) x 1000 (MPa)	Size Correction F=(D _e /50)^0.45	I _{s(50)} (MPa)	Strength Class	Comments / Strength Classification
BH3	7.16	Shale	N	(mm) 35.0	(mm) 50.0	(N) 0	(MPa)	1.00	(MPa) 0.00	(Diametral)	(mm) 50.0	(mm) 35.0	2228	(kN) 0.14	(IVIPa) 0.06	0.97	(IMPa) 0.06	(Axial) V. Low	BB
BH3	7.60	Shale	N	36.0	50.0	0.42	0.00	1.00	0.17	Low	50.0	36.0	2292	0.28	0.12	0.98	0.12	Low	BB
BH3	7.80	Shale	N	30.0	50.0	0.63	0.25	1.00	0.25	Low	50.0	30.0	1910	0.52	0.27	0.94	0.26	Low	
BH3	8.51	Shale	N	35.0	50.0	1.07	0.43	1.00	0.43	Medium	50.0	35.0	2228	1.14	0.51	0.97	0.50	Medium	
BH3	9.96	Shale	N	40.0	50.0	0.41	0.16	1.00	0.2	Low	50.0	40.0	2546	0.55	0.22	1.00	0.2	Low	BB
BH3	9.39	Shale	N	30.0	50.0	0.64	0.26	1.00	0.3	Low	50.0	30.0	1910	0.71	0.37	0.94	0.3	Medium	
BH3	9.97	Shale	N	35.0	50.0	0.46	0.18	1.00	0.2	Low	50.0	35.0	2228	0.64	0.29	0.97	0.3	Low	

Is(50) MPa and Strength Classification

(1): N = Natural, D = Dry, S = Saturated (2): L > 0.5D, 0.3 < D/W < 1.0

< 0.1 Very Low 1 - 3 High 0.1 - 0.3 Low 3 - 10 Very High 0.3 - 1 Medium

	LOAD STRE			nod 4.1:H	Rock Stre	ength Tes	sts - Deter	mination of F	Point Load S	Strength Inde	x						Job No. Sheet		COV24207AB of 11
	CLIENT:	Health Infrast	ructure NSW	1					ting Locality:	GSA bench-m Lane Cove We		orage area			(of Calibration: Calibrated By:			
	PROJECT:	GEOTLCOV2	4207AB						Tested By: Test Date:							Sampled Date: age Location:		West indoor	storage area
	LOCATION:	Blacktown Ho	spital						Checked:										
							Diame	tral test						Axial or I	rregular lu	ımp			
	ole No. / Test Depth (m)	Rock Description	Moisture Condition ⁽¹⁾ (N, D or S)	Length L	Diameter D (mm)	Load P (Gauge) (N)	I _s =(P/D ²) x 1000 (MPa)	Size Correctio <u>n</u> F=(D/50)^ ^{0.45}	I _{s(50)} (MPa)	Strength Class (Diametral)	Width W (core diameter) (mm)	Platen Separation D ⁽²⁾ (mm)	${\sf D}_{\!\!\!\!\theta}^{\ 2}$	Load (Gauge) (kN)	I _s =(P/D _e ²) x 1000 (MPa)	Size Correction F=(D _e /50)^0.45	I _{s(50)} (MPa)	Strength Class (Axial)	Comments / Strength Classification
BH4	5.54	Shale	N	34.0	50.0	0.53	0.21	1.00	0.21	(Diametral)	50.0	34.0	2165	0.30	0.14	0.97	0.13	(Axiai)	
BH4	5.93	Shale	N	28.0	50.0	0.2	0.08	1.00	0.08	V. Low	50.0	28.0	1783	0.35	0.20	0.93	0.18	Low	BB
BH4	6.09	Shale	N	28.0	50.0	0	0.00	1.00	0.00	V. Low	50.0	28.0	1783	0.06	0.03	0.93	0.03	V. Low	BB
BH4	6.87	Shale	N	36.0	50.0	0.24	0.10	1.00	0.10	V. Low	50.0	36.0	2292	0.22	0.10	0.98	0.09	V. Low	BB
BH4	7.11	Shale	Ν	36.0	50.0	0.13	0.05	1.00	0.1	V. Low	50.0	36.0	2292	0.44	0.19	0.98	0.2	Low	BB
BH4	7.93	Shale	Ν	35.0	50.0	0	0.00	1.00	0.0	V. Low	50.0	35.0	2228	0.49	0.22	0.97	0.2	Low	BB
BH4	8.00	Shale	N	40.0	50.0	0.61	0.24	1.00	0.2	Low	50.0	40.0	2546	0.72	0.28	1.00	0.3	Low	
BH4	8.27	Shale	N	27.0	50.0	0.55	0.22	1.00	0.2	Low	50.0	27.0	1719	0.53	0.31	0.92	0.3	Low	
BH4	8.94	Shale	N	30.0	50.0	0.55	0.22	1.00	0.2	Low	50.0	30.0	1910	0.06	0.03	0.94	0.0	V. Low	
BH4	9.58	Shale	N	35.0	50.0	0.88	0.35	1.00	0.4	Medium	50.0	35.0	2228	1.47	0.66	0.97	0.6	Medium	
BH4	9.71	Shale	N	42.0	50.0	0.13	0.05	1.00	0.1	V. Low	50.0	42.0	2674	0.78	0.29	1.02	0.3	Low	BB
				-															
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i																			

Is(50) MPa and Strength Classification

(1): N = Natural, D = Dry, S = Saturated (2): L > 0.5D, 0.3 < D/W < 1.0

< 0.1 Very Low 1 - 3 High 0.1 - 0.3 Low 3 - 10 Very High 0.3 - 1 Medium

> 10 Extreamly High

Pointload Calc Sheet.xlsx

	LOAD STRE	-		nod 4.1:H	Rock Stre	ength Tes	ts - Deter	mination of F	Point Load S	Strength Inde	x						Job No. Sheet		COV24207AB of 11
	CLIENT:	Health Infrast	ructure NSW	1					ing Locality:	GSA bench-m Lane Cove W		orage area			(of Calibration: Calibrated By:			
		GEOTLCOV2 Blacktown Ho							Tested By: Test Date: Checked:	23/2/2011						Sampled Date: age Location:		West indoor s	storage area
							Diame	tral test						Axial or I	rregular lu	Imp			
	ole No. / Test Depth (m)	Moisture Condition ⁽¹⁾ (N, D or S)	Length L	Diameter D (mm)	Load P (Gauge) (N)	l _s =(P/D ²) x 1000 (MPa)	Size Correctio <u>n</u> F=(D/50)^ ^{0.45}	I _{s(50)} (MPa)	Strength Class (Diametral)	Width W (core diameter) (mm)	Platen Separation D ⁽²⁾ (mm)	${\sf D}_{\sf e}^{\ 2}$	Load (Gauge) (kN)	I _s =(P/D _e ²) x 1000 (MPa)	Size Correction F=(D _e /50)^0.45	I _{s(50)} (MPa)	Strength Class (Axial)	Comments / Strength Classification	
BH5	6.77	Shale	N	35.0	50.0	0.33	0.13	1.00	0.13	Low	50.0	35.0	2228	0.44	0.20	0.97	0.19	Low	BB
BH5	6.80	Shale	N								50.0	30.0	1910	0.52	0.27	0.94	0.26	Low	
BH5	7.07	Shale	N	28.0	50.0	0.31	0.12	1.00	0.12	Low	50.0	28.0	1783	0.42	0.24	0.93	0.22	Low	BB
BH5	7.29	Shale	N	26.0	50.0	0.25	0.10	1.00	0.10	V. Low	50.0	26.0	1655	0.55	0.33	0.91	0.30	Medium	
BH5	8.0	Shale	N	35.0	50.0	0.58	0.23	1.00	0.2	Low	50.0	35.0	2228	0.64	0.29	0.97	0.3	Low	
BH5	8.7	Shale	Ν	26.0	50.0	0.53	0.21	1.00	0.2	Low	50.0	26.0	1655	0.67	0.40	0.91	0.4	Medium	BB
BH5	8.97	Shale	Ν	30.0	50.0	0.6	0.24	1.00	0.2	Low	50.0	30.0	1910	0.72	0.38	0.94	0.4	Medium	
BH5	9.07	Shale	Ν	26.0	50.0	0.08	0.03	1.00	0.0	V. Low	50.0	26.0	1655	0.50	0.30	0.91	0.3	Low	
BH5	9.68	Shale	N	30.0	50.0	0.47	0.19	1.00	0.2	Low	50.0	30.0	1910	0.61	0.32	0.94	0.3	Medium	
BH5	9.34	Shale	N	38.0	50.0	0.58	0.23	1.00	0.2	Low	50.0	358.0	22791	0.72	0.03	1.64	0.1	V. Low	BB

Is(50) MPa and Strength Classification

NOTES (1): N = Natural, D = Dry, S = Saturated (2): L > 0.5D, 0.3 < D/W < 1.0

< 0.1 Very Low 1-3 High 0.1 - 0.3 Low 3 - 10 Very High 0.3 - 1 Medium

	LOAD STRE			nod 4.1:F	Rock Stre	ength Tes	sts - Deter	mination of F	Point Load S	Strength Inde	x						Job No. Sheet		COV24207AB of 11
	CLIENT:	Health Infrast	ructure NSW	1					ting Locality:	GSA bench-m Lane Cove We		orage area			(of Calibration: Calibrated By:			
	PROJECT:	GEOTLCOV2	4207AB						Tested By: Test Date:							Sampled Date: age Location:		West indoor s	storage area
	LOCATION:	Blacktown Ho	spital						Checked:										
							Diame	tral test					1	Axial or I	rregular lu	ımp			
	ole No. / Test Depth (m)	Rock Description	Moisture Condition ⁽¹⁾ (N, D or S)	(2)	Diameter D	Load P (Gauge)	I _s =(P/D ²) x 1000	Size Correctio <u>n</u> F=(D/50)^ ^{0.45}	I _{s(50)}	Strength Class	Width W (core diameter)	Platen Separation D ⁽²⁾	${\sf D}_{\sf e}^{\;2}$	Load (Gauge)	I _s =(P/D _e ²) x 1000	Size Correction F=(D _e /50)^0.45	I _{s(50)}	Strength Class	Comments / Strength Classification
BH6	6.41	Shale	N	(mm) 32.0	(mm) 50.0	(N) 0.08	(MPa) 0.03	1.00	(MPa) 0.03	(Diametral)	(mm) 50.0	(mm) 32.0	2037	(kN) 0.36	(MPa) 0.18	0.95	(MPa) 0.17	(Axial)	BB
BH6	7.15	Shale	N	27.0	50.0	0.08	0.03	1.00	0.03	V. Low	50.0	27.0	1719	0.36	0.18	0.95	0.00	V. Low	DD
BH6	7.13	Shale	N	31.0	50.0	0	0.00	1.00	0.00	V. Low	50.0	31.0	1974	0.00	0.00	0.92	0.00	Medium	
BH6	7.90	Shale	N	33.0	50.0	0.31	0.12	1.00	0.12	Low	50.0	33.0	2101	0.41	0.20	0.96	0.19	Low	
BH6	8.04	Shale	N	31.0	50.0	0	0.00	1.00	0.0	V. Low	50.0	31.0	1974	0.52	0.26	0.95	0.2	Low	
BH6	8.86	Shale	N	34.0	50.0	0.06	0.02	1.00	0.0	V. Low	50.0	34.0	2165	0.56	0.26	0.97	0.3	Low	
BH6	8.96	Shale	N	30.0	50.0	0.39	0.16	1.00	0.2	Low	50.0	30.0	1910	0.72	0.38	0.94	0.4	Medium	
BH6	9.12	Shale	N	36.0	50.0	0.27	0.11	1.00	0.1	Low	50.0	36.0	2292	1.10	0.48	0.98	0.5	Medium	
BH6	9.72	Shale	N	36.0	50.0	1.24	0.50	1.00	0.5	Medium	50.0	36.0	2292	1.10	0.48	0.98	0.5	Medium	
BH6	9.92	Shale	Ν	29.0	50.0	1.16	0.46	1.00	0.5	Medium	50.0	29.0	1846	0.72	0.39	0.93	0.4	Medium	
														_					

Is(50) MPa and Strength Classification

(1): N = Natural, D = Dry, S = Saturated (2): L > 0.5D, 0.3 < D/W < 1.0

< 0.1 Very Low 1 - 3 High 0.1 - 0.3 Low 3 - 10 Very High 0.3 - 1 Medium

	LOAD STRE	-		od 4.1:F	Rock Stre	ength Tes	sts - Deter	mination of F	Point Load S	Strength Inde	x						Job No. Sheet		COV24207AB of 11
	CLIENT:	Health Infrast	ructure NSW	1					ting Locality:	GSA bench-m Lane Cove We		orage area			(of Calibration: Calibrated By:			
	PROJECT:	GEOTLCOV2	4207AB						Tested By: Test Date:							Sampled Date: age Location:		West indoor s	storage area
	LOCATION:	Blacktown Ho	ospital						Checked:						0101	uge Looution.			lorage area
							Diame	tral test						Axial or I	rregular lu	ımp			
	oole No. / Test Depth (m)	Rock Description	Moisture Condition ⁽¹⁾ (N, D or S)	Length L	D	Load P (Gauge)	I _s =(P/D ²) x 1000	Size Correctio <u>n</u> F=(D/50)^ ^{0.45}	I _{s(50)}	Strength Class	Width W (core diameter)	Platen Separation D ⁽²⁾	D _e ²	Load (Gauge)	I _s =(P/D _e ²) x 1000	Size Correction F=(D _e /50)^0.45	I _{s(50)}	Strength Class	Comments / Strength Classification
BH7	4.4	Shale	N	(mm) 36.0	(mm) 50.0	(N) 0.69	(MPa) 0.28	1.00	(MPa) 0.28	(Diametral)	(mm) 50.0	(mm) 36.0	2292	(kN)	(u)	0.98	(MPa)	(Axial) Medium	
BH7 BH7	4.4	Shale	N N	30.0	50.0	0.69	0.28	1.00	0.28	Low Low	50.0	30.0	1910	0.71	0.49	0.98	0.48	Medium	
BH7	5.27	Shale	N	30.0	50.0	0.3	0.12	1.00	0.12	Low	50.0	30.0	1910	0.49	0.37	0.94	0.35	Low	BB
BH7	5.60	Shale	N	40.0	50.0	0.27	0.11	1.00	0.11	Low	50.0	40.0	2546	0.49	0.20	1.00	0.24	Medium	
BH7	6.17	Sandstone	N	34.0	50.0	1.3	0.52	1.00	0.5	Medium	50.0	34.0	2165	0.75	0.35	0.97	0.30	Medium	
BH7	6.38	Sandstone	N	35.0	50.0	1.35	0.54	1.00	0.5	Medium	50.0	35.0	2228	1.79	0.80	0.97	0.8	Medium	
BH7	6.87	Sandstone	N	40.0	50.0	0.86	0.34	1.00	0.3	Medium	50.0	40.0	2546	1.98	0.78	1.00	0.8	Medium	BB
BH7	7.05	Sandstone	N	35.0	50.0	0.94	0.38	1.00	0.4	Medium	50.0	35.0	2228	3.14	1.41	0.97	1.4	High	BB
BH7	7.22	Sandstone	N	35.0	50.0	1.11	0.44	1.00	0.4	Medium	50.0	35.0	2228	3.64	1.63	0.97	1.6	High	
BH7	7.76	Sandstone	N	35.0	50.0	2.76	1.10	1.00	1.1	High	50.0	35.0	2228	4.47	2.01	0.97	2.0	High	
BH7	8.07	Sandstone	N	35.0	50.0	0.61	0.24	1.00	0.2	Low	50.0	35.0	2228	1.10	0.49	0.97	0.5	Medium	
BH7	8.45	Sandstone	Ν	27.0	50.0	1.11	0.44	1.00	0.4	Medium	50.0	27.0	1719	1.11	0.65	0.92	0.6	Medium	BB
BH7	8.70	Sandstone	Ν	30.0	50.0	0.30	0.12	1.00	0.1	Low	50.0	30.0	1910	0.63	0.33	0.94	0.3	Medium	BB
BH7	9.01	Sandstone	Ν	30.0	50.0	0.89	0.36	1.00	0.4	Medium	50.0	30.0	1910	1.10	0.58	0.94	0.5	Medium	
BH7	9.53	Sandstone	Ν	36.0	50.0	0.53	0.21	1.00	0.2	Low	50.0	36.0	2292	0.63	0.27	0.98	0.3	Low	
BH7	9.90	Sandstone	Ν	35.0	50.0	1.05	0.42	1.00	0.4	Medium	50.0	35.0	2228	1.14	0.51	0.97	0.5	Medium	

Is(50) MPa and Strength Classification

(1): N = Natural, D = Dry, S = Saturated (2): L > 0.5D, 0.3 < D/W < 1.0

< 0.1 Very Low 1 - 3 High 0.1 - 0.3 Low 3 - 10 Very High 0.3 - 1 Medium

	LOAD STRE			nod 4.1:F	Rock Stre	ength Tes	sts - Deter	mination of F	Point Load S	Strength Inde	x						Job No. Sheet		COV24207AB of 11
	CLIENT:	Health Infrast	ructure NSW	,					ting Locality:	GSA bench-m Lane Cove W		orage area			(of Calibration: Calibrated By:			
	PROJECT:	GEOTLCOV2	4207AB						Tested By: Test Date:							Sampled Date: age Location:		West indoor	storage area
	LOCATION:	Blacktown Ho	spital						Checked:										
							Diame	tral test						Axial or I	rregular lu	ımp			
	ole No. / Test Depth (m)	Rock Description	Moisture Condition ⁽¹⁾ (N, D or S)	(2)	Diameter D	Load P (Gauge)	I _s =(P/D ²) x 1000	Size Correctio <u>n</u> F=(D/50)^ ^{0.45}	I _{s(50)}	Strength Class	Width W (core diameter)	Platen Separation D (2)	D _e ²	Load (Gauge)	I _s =(P/D _e ²) x 1000	Size Correction F=(D _e /50)^0.45	I _{s(50)}	Strength Class	Comments / Strength Classification
		0.1		(mm)	(mm)	(N)	(MPa)		(MPa)	(Diametral)	(mm)	(mm)	1010	(kN)	(MPa)		(1411 0)	(Axial)	
BH8	5.30	Sandstone	N	30.0	50.0	0.78	0.31	1.00	0.31	Medium	50.0	30.0	1910	1.77	0.93	0.94	0.87	Medium	
BH8	5.86	Sandstone	N	30.0	50.0	1.74	0.70	1.00	0.70	Medium	50.0	30.0	1910	4.16	2.18	0.94	2.05	High	
BH8	6.43	Sandstone	N	35.0	50.0	1.13	0.45	1.00	0.45	Medium	50.0	35.0	2228	0.67	0.30	0.97	0.29	Low	BB
BH8	6.70	Sandstone	N	38.0	50.0	0.56	0.22	1.00	0.22	Low	50.0	38.0	2419	0.41	0.17	0.99	0.17	Low	вв
BH8 BH8	6.93 7.07	Sandstone Sandstone	N N	32.0 26.0	50.0 50.0	0.85	0.34	1.00	0.3	Medium Medium	50.0 50.0	32.0 26.0	2037 1655	0.86	0.42	0.95	0.4	Medium Medium	
BH8 BH8	7.89	Sandstone	N N	26.0	50.0	0.09	0.45	1.00	0.5	V. Low	50.0	26.0	1655	0.93	0.56	0.91	0.5	weatum	
BH8	7.89	Shale	N	20.0	50.0	0.09	0.04	1.00	0.0	Low	50.0	26.0	1655	0.38	0.23	0.91	0.2	Low	
BH8	8.14	Shale	N	30.0	50.0	0.47	0.19	1.00	0.2	Medium	50.0	30.0	1910	0.58	0.23	0.91	0.2	Medium	
BH8	8.44	Shale	N	35.0	50.0	0.80	0.32	1.00	0.3	Low	50.0	35.0	2228	0.78	0.32	0.94	0.3	Medium	
BH8	8.87	Shale	N	34.0	50.0	0.50	0.20	1.00	0.2	Low	50.0	34.0	2165	0.70	0.33	0.97	0.3	Medium	
BH8	9.15	Shale	N	30.0	50.0	0.60	0.24	1.00	0.2	Low	50.0	30.0	1910	0.50	0.26	0.94	0.2	Low	
BH8	9.66	Shale	N	35.0	50.0	0.17	0.07	1.00	0.1	V. Low	50.0	35.0	2228	0.39	0.18	0.97	0.2	Low	BB
BH8	9.62	Shale	N	30.0	50.0	0.52	0.21	1.00	0.2	Low	50.0	30.0	1910	0.50	0.26	0.94	0.2	Low	

Is(50) MPa and Strength Classification

(1): N = Natural, D = Dry, S = Saturated (2): L > 0.5D, 0.3 < D/W < 1.0

< 0.1 Very Low 1 - 3 High 0.1 - 0.3 Low 3 - 10 Very High 0.3 - 1 Medium

	LOAD STRE	-		nod 4.1:I	Rock Stre	ength Tes	sts - Deter	mination of F	Point Load S	Strength Inde	x						Job No. Sheet		COV24207AB of 11
	CLIENT:	Health Infrast	ructure NSW	1						GSA bench-m Lane Cove W		01000 0100				of Calibration: Calibrated By:			
	PROJECT:	GEOTLCOV2 Blacktown Ho						1650	Tested By: Test Date: Checked:	BM 23/2/2011		orage area			s	Sampled Date: age Location:	20/2/2011	e West indoor	storage area
							Diame	tral test						Axial or I	rregular lu	ımp			
	Depth (m) Description (N, D or S)				Diameter D (mm)	Load P (Gauge) (N)	I _s =(P/D ²) x 1000 (MPa)	Size Correctio <u>n</u> F=(D/50)^0.45	I _{s(50)} (MPa)	Strength Class (Diametral)	Width W (core diameter) (mm)	Platen Separation D ⁽²⁾ (mm)	${\sf D_e}^2$	Load (Gauge) (kN)	I _s =(P/D _e ²) x 1000 (MPa)	Size Correction F=(D _e /50)^ ^{0.45}	I _{s(50)} (MPa)	Strength Class (Axial)	Comments / Strength Classification
BH9	5.24	Sandstone	N	(mm) 31.0	50.0	0.89	0.36	1.00	0.36	Medium	50.0	31.0	1974	1.90	0.96	0.95	0.91	Medium	
BH9	5.50	Sandstone	N	32.0	50.0	0.28	0.11	1.00	0.11	Low	50.0	32.0	2037	0.31	0.15	0.95	0.15	Low	BB
BH9	6.28	Sandstone	N	31.0	50.0	0.46	0.18	1.00	0.18	Low	50.0	31.0	1974	0.60	0.30	0.95	0.29	Low	BB
BH9	6.43	Sandstone	N	27.0	50.0	12.25	4.90	1.00	4.90	V. High	50.0	27.0	1719	9.15	5.32	0.92	4.89	V. High	
BH9	7.30	Sandstone	N	34.0	50.0	0.31	0.12	1.00	0.1	Low	50.0	34.0	2165	1.35	0.62	0.97	0.6	Medium	
BH9	7.55	Sandstone	N	35.0	50.0	0.39	0.16	1.00	0.2	Low	50.0	35.0	2228	0.17	0.08	0.97	0.1	V. Low	
BH9	7.85	Sandstone	N	31.0	50.0	0.53	0.21	1.00	0.2	Low	50.0	31.0	1974	0.89	0.45	0.95	0.4	Medium	
BH9	8.02	Sandstone	N	32.0	50.0	0.93	0.37	1.00	0.4	Medium	50.0	32.0	2037	0.78	0.38	0.95	0.4	Medium	BB
BH9	8.28	Shale	Ν	27.0	50.0	0.06	0.02	1.00	0.0	V. Low	50.0	27.0	1719	0.28	0.16	0.92	0.1	Low	BB
BH9	8.46	Shale	Ν	28.0	50.0	0.61	0.24	1.00	0.2	Low	50.0	28.0	1783	0.61	0.34	0.93	0.3	Medium	BB
BH9	8.97	Sha;e	N	30.0	50.0	0.31	0.12	1.00	0.1	Low	50.0	30.0	1910	0.89	0.47	0.94	0.4	Medium	
BH9	9.17	Shale	N	31.0	50.0	0.67	0.27	1.00	0.3	Low	50.0	31.0	1974	0.89	0.45	0.95	0.4	Medium	
BH9	9.46	Shale	N	34.0	50.0	0.27	0.11	1.00	0.1	Low	50.0	34.0	2165	0.64	0.30	0.97	0.3	Low	BB
BH9	9.77	Shale	N	34.0	50.0	0.38	0.15	1.00	0.2	Low	50.0	34.0	2165	1.08	0.50	0.97	0.5	Medium	L
																			L

Is(50) MPa and Strength Classification

NOTES (1): N = Natural, D = Dry, S = Saturated (2): L > 0.5D, 0.3 < D/W < 1.0

< 0.1 Very Low 1-3 High 0.1 - 0.3 Low 3 - 10 Very High 0.3 - 1 Medium